

APPENDIX F

CVRD SEWAGE MASTER PLAN RECENT EVOLUTION OF REGULATORY FRAMEWORK

DAYTON & KNIGHT MEMORANDUM

MEMORANDUM

TO:

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FROM:

Dayton & Knight Ltd.

DATE:

October 3, 2008

RE:

CVRD Sewerage Master Plan Update Study

Recent Evolution of Regulatory Framework

1.0 DISCHARGES TO SURFACE WATER

Current regulatory criteria for treated wastewater discharges to surface waters are based on existing provincial regulations, which are set out in the Municipal Sewage Regulation (MSR) of the Environmental Management Act. Impending federal regulations for wastewater discharges are expected to be enacted in the near future. In addition, the B.C. Ministry of Environment intends to review and possibly revise the MSR.

Recent (2007) amendments to the MSR mere mainly matters of clarification and editing. A wide range of potential review and amendment items has been identified for the upcoming MSR review, including harmonization of the MSR with the new federal regulations and with the recently amended Ministry of Health Sewerage System Regulation, which applies to smaller wastewater discharges to ground disposal (see Section 2.0 of this Memorandum). The MSR review will consist of a five-step process, namely scoping, publication of a Policy Intentions Paper for Consultation, consultation with stakeholders and the general public, drafting of revisions for review by the Minister and Lieutenant Governor-in-Council, and implementation. The schedule for conducting the MSR review is not known at this time.

Information regarding the existing provincial regulations and the impending federal regulations for discharges of treated wastewater to surface water is summarized below.

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1.1 Provincial Regulations and Guidelines

The Municipal Sewage Regulation (MSR) administered by the Ministry of Environment (MOE) applies to all discharges to surface water and to discharges to ground in excess of 22.75 m³/d (MOE, 1999). The effluent criteria for discharges of treated wastewater to surface waters (based on the MSR) are summarized in Table 1-1. For the discharge from existing CVRD WWTP, the criteria for open marine waters are applicable.

TABLE 1-1
EFFLUENT REQUIREMENTS FOR DISCHARGES TO SURFACE WATERS

		Effluent Criteria for Discharges to Surface Waters ¹							
	Maxi	mum Daily Flo	w 50 m ³ /d or g	reater	Max	imum Daily Flo	ow less than 50	m³/d	
Parameter		Streams, Rivers & Marine Estuaries			Streams, Rivers & Estuaries		Marine		
	Dilution 40:1 ²	Dilution 10:1 ²	Open Marine Waters	Embayed Marine Waters	Dilution 40:1 ²	Dilution 10:1 ²	Open Marine Waters	Embayed Marine Waters	
Treatment Requirement	Secondary	High Quality Secondary	Secondary	Secondary	Secondary	High Quality Secondary	Primary	Secondary	
BOD ₅ (milligrams/litre)	45	10	45	45	45	10	130	45	
TSS (milligrams/litre)	45	10	45	45	45	10	130	45	
pН	6.0-9.0	6.9-9.0	6.0-9.0	6.0-9.0					
Disinfection	see ³	see ³	see ³	see ³	see ³	see ³	see ³	see ³	
Total Phosphorus (mg P/L)	1.04	1.04	**	-44					
Orthophosphate (mg P/L)	0.54	0.54				-	22		
Ammonia	see ⁵	see ⁵	see ⁵	see ⁵		**			

Effluent quality standards for all receiving water discharges are based on the use of an outfall which provides a combination of depth and distance to produce a minimum 10:1 initial dilution within the mixing zone.

Table 1-2 shows the allowable concentrations of microbiological indicators in accordance with the Ministry of Environment Water Quality Guidelines (British Columbia Approved Water Quality Guidelines, 2006 Edition) for recreational use and for the protection of shellfish waters.

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Dilutions less than 100:1 will require an environmental impact study to determine if effluent quality needs to be better than tabulated. Where the dilution ratio is below 40:1 and the receiving stream is used for recreational or domestic water extraction within the influence of the discharge, discharge will not be permitted unless an environmental impact study shows that the discharge is acceptable and no other solutions are available.

For discharges to recreational use waters, fecal coliform < 200 MPN/100 mL. Where domestic water extraction occurs within 300 m of a discharge, fecal coliform < 2.2 MPN/100 mL with no sample exceeding 14 MPN/100 mL. Where chlorine is used, dechlorination will be required. Wherever possible alternate forms of disinfection to chlorine should be implemented.

The total and orthophosphate criteria may be waived if it can be shown from an environmental impact study that receiving waters would not be subject to an undesirable degree of increased biological activity because of the phosphorus addition. Alternatively, an environmental impact study may show that lower effluent concentrations than are tabulated are necessary, or that a mass load criteria may be needed.

The allowable effluent ammonia concentrations at the "end of pipe" must be determined from a back calculation from the edge of the initial dilution zone. The back calculation must consider the ambient temperature and pH characteristics of the receiving water and known water quality guidelines.

TABLE 1-2
WATER QUALITY GUIDELINES FOR MICROBIOLOGICAL INDICATORS

	Number of Organisms per 100 mL								
Indicator Organism	Aquatic life – shel	lfish harvesting 1	Recreation, secondary contact, crustacean harvesting	Recreation, primary contact					
	90 th percentile	median	geometric mean ²	geometric mean ²					
Escherichia coli	< 43	< 14	< 385	< 77					
Enterococci	< 11	< 4	< 100	< 20					
Fecal coliforms	< 43	< 14	none applicable	< 200					

Measured outside the initial dilution zone.

The following toxicity standards are based on the MSR, Part 4 Standards for Effluent Reuse and Discharges to the Environment.

9 (1) A person must not discharge effluent, unless

- (a) the discharge passes a 96 hour LC50 bioassay test as defined by Environment Canada's Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout, Reference Method, EPS 1/RM/13, or
- (b) if the discharge fails a bioassay test described in paragraph (a), the discharge passes a test conducted as a follow up according to requirements set out in Schedule 6 of the MSR.

(2) Subsection (1) does not apply if

- i. the discharge is to ground,
- the discharge quality meets a maximum BOD₅ not exceeding 10 mg/L and a maximum TSS not exceeding 10 mg/L,
- iii. the discharge does not exceed a maximum daily flow of 5,000 m³/d and the discharger demonstrates to the satisfaction of a director that the discharge does not adversely affect the receiving environment,
- iv. the discharge is to open marine waters,

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The geometric mean is a type of mean or average, which indicates the central tendency or typical value of set of numbers. The n numbers are multiplied and then the nth root of the resulting product is taken, where n = count of numbers in the set.

- v. the discharge is diluted such that at the outside boundary of the initial dilution zone the dilution ratio exceeds 100:1 and the discharger demonstrates to the satisfaction of a director that the discharge does not adversely affect the receiving environment,
- vi. reclaimed water is being provided or used in accordance with this regulation, or
- vii. the discharger demonstrates to the satisfaction of a director that the discharge does not adversely affect the receiving environment.
- (3) If subsection (1) applies, a person must not discharge effluent unless the discharge is monitored for toxicity in accordance with the requirements of Schedule 6, Table 3 in the MSR.

1.2 Federal Regulations and Guidelines

The Canadian Council of Ministers of the Environment (CCME) is developing a Canada-wide Strategy for the Management of Municipal Wastewater Effluent. As discussed at the beginning of Section 1.0, the B.C. Ministry of Environment intends to review the Municipal Sewage Regulation (MSR) with a view to harmonizing the provincial MSR with the CCME strategy. The CCME strategy focuses on effluents released from wastewater treatment systems and overflows from sewer collection systems. National performance standards will be regulated under the Fisheries Act and in provincial and territorial regulatory instruments. The following discharge levels are expected to be defined in the federal regulations:

BOD₅ maximum effluent average discharge level 25 mg/L

TSS maximum effluent average discharge level 25 mg/L

residual chlorine maximum 0.02 mg/L

acute toxicity include specific requirements and timelines to identify and

reduce toxicity in cases of acute toxicity test failure

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ammonia

include specific requirements if acute toxicity test failure is due to ammonia that would authorize discharge of ammonia in effluent based on receiving environment considerations.

Monitoring of the environment and timelines to achieve effluent discharge levels are based on risk while considering elements such as sensitivity of the receiving environment, size and composition of the effluent release. In the long-term, the wastewater effluent discharge levels require wastewater treatment systems equivalent in performance to secondary treatment with advanced treatment if required.

The strategy also includes source control measures to preventing the entry of pollutants into the wastewater system (see Section 5.0 of this Memorandum). An action plan for wastewater systems on how to manage overflows from the combined sewers and how to achieve the effluent discharge levels within a 30 year timeline would be required.

1.3 Combined Sewer and Sanitary Sewer Overflows

Requirements for control of combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) are set out in the MSR, Schedule 1, Parts 15 and 16, respectively. The requirements are that an SSO (or CSO) shall not be allowed to occur during storm or snow melt events with less than a 5-year return period.

1.4 Control of Inflow and Infiltration

The B.C. Municipal Sewage Regulation (MSR) specifies that, where the maximum daily flow at treatment facilities exceeds two times the average dry weather flow during storm or snowmelt events with less than a 5-year return period, inflow and infiltration (I&I) to the collection system is deemed excessive and specified actions must be taken to reduce I&I must be taken.

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1.5 Pumping Stations

The B.C. Municipal Sewage Regulation (MSR) includes the following design standards for wastewater pumping stations:

- minimum of 2 pumps with each pump capable of pumping peak design flows;
- for larger stations with multiple pumps, the station must have sufficient capacity to pump peak design flows with the largest pump out of service;
- for two-pump stations, a receptacle for a portable generator must be provided;
- for multiple-pump stations, an on-site generator must be provided; and
- provision must be made so that standby power is activated prior to the hydraulic capacity of the pump station being exceeded.

1.6 Canadian Shellfish Sanitation Program

The federal, provincial and municipal governments are currently engaged in an initiative to strengthen the Canadian Shellfish Sanitation Program (CSSP), which will result in enhanced food safety for consumers of shellfish harvested from areas that may be affected by failures of wastewater treatment plants. Where operational failures of wastewater treatment plants can occur and potentially contaminate nearby harvest areas, it is critical that timely and effective response measures are in place to prevent any affected shellfish from reaching domestic and international companies.

The CSSP partners are developing an implementation protocol with the following key elements:

- the development of area-specific "management plans," which will outline collective responsibilities and a process for timely failure detection, notification, and response; and
- ii) enhanced food safety controls by shellfish processing plants.



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The protocol will be implemented in a step-wise, area-by-area manner across Canada. Eight harvest areas, including three in British Columbia (around the Ladysmith, Crofton and Chemainus wastewater treatment plants), are scheduled for implementation before the end of 2008 as the first phase of the initiative.

1.7 Summary of Surface Discharge Criteria

As described in the preceding sections, minimum standards for secondary treatment are set out in provincial and (impending) federal legislation. The provincial regulation will be reviewed and possibly revised in the near future. For the purpose of this study, the provincial and federal standards for secondary treatment (whichever is the more stringent) are proposed as a minimum for discharges to surface water. Disinfection to meet the recreational and shellfish standards set out in the Provincial Municipal Sewage Regulation, the British Columbia Approved Water Quality Guidelines (criteria), and the Canadian Shellfish Sanitation Program may also be necessary, depending on the location of the outfall discharge. Advanced treatment such as effluent filtration and/or nutrient removal may also be required if discharges to sensitive receiving waters (e.g., streams, embayed marine waters) is contemplated.

2.0 DISCHARGES TO LAND

Disposal of treated wastewater effluent to land is normally accomplished by the use of a network of buried, perforated pipes (commonly referred to as drain fields, disposal fields, or tile fields) that allow the effluent to seep into the surrounding soil. This type of system is designated "onsite", since wastewater is treated and disposed of within individual lots or parcels. The level of treatment required prior to ground disposal depends on the nature of the site and on the sensitivity of the receiving environment (e.g., the potential for groundwater contamination). Treatment systems vary in complexity from simple septic tanks to small off-the-shelf treatment facilities (commonly called "package plants").



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2.1 Ground Disposal Systems Regulated under the Health Act

Ground disposal systems with design flows of less than 22.75 m³/d (i.e., single home systems and community systems servicing up to about 50 or 60 homes) are administered by local Health Authorities under the Health Act. In 2005 the Sewerage System Regulation (SSR) replaced the old Sewage Disposal Regulation. The SSR requires that "authorized" (properly qualified and certified) persons certify that certain actions have been done or will be done in accordance with "standard practice", where standard practice is defined to mean "a method of constructing and maintaining a sewerage system that will ensure that the sewerage system does not cause, or contribute to, a health hazard." This differs from the former approach under the Sewage Disposal Regulation, in that the new SSR transfers responsibly for certification of systems design and construction to industry, where the Ministry of Health was responsible for monitoring and enforcement under the old regulation.

The SSR refers to the the Sewerage System Standard Practice Manual (SPM) recently published by the Ministry of Health. The SPM contains guidelines to be followed by authorized persons for design, installation, operation and maintenance of ground disposal systems that are administered under the Health Act. The SPM, first introduced in 2005 as V1, is periodically updated and revised by the B.C. Onsite Sewage Association (BCOSSA) Technical Review Committee for the Ministry of Health. The most recent version of the SPM (V2) was published in 2007. Alternative forms of standard practice other than those set out in the SPM can be undertaken to meet the requirements of the SSR, provided that the alternative practices are certified by authorized persons.

The old Sewage Disposal Regulation set out requirements for ground disposal based on soil percolation rates and total length of drain pipe; an area for a standby (redundant) disposal field was also required. The new Sewerage System Regulation is based on an evaluation of soil characteristics and soil hydraulic conductivity as well as soil percolation rate, to determine the allowable soil hydraulic loading rate, (i.e., infiltration trench bottom area), rather than on drain pipe length; in addition, the soil linear loading



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rate (i.e., movement of effluent away from the discharge area) must be evaluated under the new regulation. No standby disposal field is required under the new Regulation. Treatment standards are set out in the SPM, with the level of treatment required depending on site constraints. Monitoring of system performance and system maintenance requirements are identified in the SPM, where this was absent from the old Sewage Disposal Regulation.

2.2 Ground Disposal Systems Regulated under the Environmental Management Act

The Municipal Sewage Regulation (MSR) of the Environmental Management Act applies to discharges to ground that are equal to or greater than 22.75 m³/d. The effluent class definitions for ground disposal systems according to the MSR are shown in Table 2-1. The minimum drainage pipe length for the designated effluent classes are shown in Table 2-2. As discussed above, the requirements for ground disposal systems set out in the MSR are based on soil percolation rate and are similar to the standards that were contained in the old Sewage Disposal Regulation (now replaced by the new Sewerage System Regulation). Similar to the old Sewage Disposal Regulation, the MSR requires that two disposal fields, each capable of handling the design flow, be installed and that a standby area for a third field be set aside. The impending review of the MSR may result in revision of the ground disposal requirements that are more closely aligned with those in the new sewage system regulation.

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TABLE 2-1 EFFLUENT CLASS DEFINITION¹

		Effluent Quality Parameters (maximum values) ²						
Effluent Class	Description	BOD ₅ (mg/L)	TSS (mg/L)	Fecal Coliform (number of fecal coliform organisms/100 mL)	Turbidity (NTU)	Nitrogen (mg/L)		
Α	High quality secondary (drinking water well within 300 m)	10	10	median 2.2 any sample 14	average 2 any sample 5	nitrate-N 10 total N 20		
В	high quality secondary	10	10	3	N/A	N/A		
С	secondary	45	45 ⁵	N/A ⁴	N/A ⁴	N/A ⁴		
D	typical septic tank	N/A ⁴	N/A ⁴	N/A ⁴	N/A ⁴	N/A ⁴		

- from B.C. Municipal Sewage Regulation (1999), Schedule 4.
- ² continuous effluent quality monitoring required for Class A and Class B.
- A fecal coliform limit of 400/100 mL applies to discharges designed to meet the requirements of Row 2 to Table 5-5.
- N/A means not applicable.
- for lagoon systems the maximum TSS level must not exceed 60 mg/L.

TABLE 2-2 MINIMUM DRAINAGE PIPE LENGTH¹

	Number	Number of metres of drainage pipe for each 10 m ³ /d of Maximum Daily Flow for percolation rates shown						
Percolation rate; minutes/25 mm	2 ^{2,3}	5 ²	10	15	20 ⁴	25 ⁴	30 ⁴	
Effluent Class Prior to Application: A, B or C	50	75	100	110	120	135	150	
Effluent Class prior to Application: D	120	215	280	320	360	400	430	

- from B.C. Municipal Sewage Regulation (1999), Schedule 4.
- for discharges equal to or greater than 37 m³/d only, if the soils are well drained and if the depth to groundwater including any groundwater mounding effect is greater than 1.0 m below the bottom of the drainage trench, a qualified professional may design the ground disposal system with deeper narrower trenches and the drainage pipe length may be reduced to a value equal to the product of Table 5-4 pipe length and a factor of 1/H^{0.5} or 0.8 (whichever factor is greater), where H is the drainage trench depth below pipe invert in metres.
- percolation rates less than 2 minutes per 25 mm are too fast for adequate renovation and drainfields will not be permitted, unless hydrogeological studies show that local groundwater quality can be met at the property boundary. For discharges of less than 37 m³/d only, use of AMERICAN SOCIETY OF TESTING MATERIALS C33 sand mounding or AMERICAN SOCIETY OF TESTING MATERIALS C33 sand-filled trenches to reduce percolation is permitted if Class B or A effluent is discharged by pressure distribution.
- percolation rates more than 20 minutes per 25 mm require the construction to be supervised by a qualified professional to have been carried out in a manner which has not reduced the trench wall permeability unless, for discharges less than 37 m³/d only, the native undisturbed permeable soil depth exceeds 1.35 m.

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2.3 Ministry of Community Services Requirements

The Ministry of Community Services requires that local governments meet the following requirements in order to be eligible for infrastructure funding assistance for wastewater projects from the Province:

- enact a bylaw which applies to all areas within the boundaries under jurisdiction of the applicant that requires community sewer service to all new lots of less than one hectare; or
- an approved (by Minister of Environment) Liquid Waste Management Plan (LWMP) for decentralized wastewater the LWMP must address on-site sewage in a sustainable fashion, with the understanding that on-site sewage systems will be considered as permanent infrastructure the LWMP must be supported by appropriate bylaws (OCPs, zoning, subdivision standards, etc.), and at a minimum, the LWMP will address:
 - where the recipient is proposing development of new properties that will not receive community sewer, and the cumulative hydraulic loading from onsite sewage disposal systems can be safely and sustainably handled by the overall soils environment,
 - a community plan for the management and maintenance of onsite septic systems,
 - a biosolids management plan, and
 - a septage collection plan.

3.0 RECLAIMED WATER

Historically in British Columbia, and generally throughout North America, the emphasis in wastewater management in the past has been to provide sufficient treatment to allow disposal of



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effluent in order to protect public health and the environment. With the exception of some arid southern states in the U.S., the emphasis has been on disposal of effluent to water or to land. Treated wastewater is now being looked upon as a resource that should be beneficially reused where feasible. This evolving approach contrasts with wastewater disposal practices that currently prevail. An appropriate level of treatment and monitoring for various reuse applications is important for protection of public health and the receiving environment. With effective source control programs coupled with adequate and reliable treatment, effluent can be beneficially reused. Treatment plants designed for water reuse are more appropriately classified as water reclamation plants.

Standards for the use of reclaimed effluent in British Columbia were adopted in July 1999, and are administered by the Ministry of Environment (MOE) under the standards set out in the Municipal Sewage Regulation (MSR). The MSR standards for water reuse in British Columbia dictate that effluent used as reclaimed water must meet either of the two requirements described in Table 3-1, depending on the use of the reclaimed water. Environmental impact studies are required for both categories of reclaimed water. Use of reclaimed water must be authorized in writing by the local Health Authority having jurisdiction.

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TABLE 3-1 RECLAIMED WATER CATEGORY AND PERMITTED USES

RECLAIMED WATER CATEGO	
Unrestricted Public Access Category	Restricted Public Access Category
EFFLUENT QUALITY REQUIREMENTS	EFFUENT QUALITY REQUIREMENTS
6≥pH≤9	$6 \ge pH \le 9$
$BOD_5 \le 10$ milligrams/litre	BOD ₅ ≤ 45 milligrams/litre
Turbidity ≤ 2 NTU	TSS ≤ 45 milligrams/litre TSS
Fecal coliforms ≤ 2.2/100 millilitres	Fecal coliforms ≤ 200/100 millilitres
URBAN	AGRICULTURAL
- Parks	 Commercially processed food crops
- Playgrounds	- Fodder, Fibre
- Cemeteries	- Pasture
- Golf Courses	- Silviculture
- Road Rights-of-Way	- Nurseries
- School Grounds	- Sod Farms
- Residential Lawns	 Spring Frost Protection
- Greenbelts	- Chemical Spray
- Vehicle and Driveway Washing	 Trickle Drip Irrigation of Orchards and
- Landscaping around Buildings	Vineyards
- Toilet Flushing	
- Outside Landscape Fountains	
- Outside Fire Protection	
- Street Cleaning	
AGRICULTURAL	URBAN/RECREATIONAL
- Aquaculture	- Landscape Impoundments
- Food Crops Eaten Raw	- Landscape Waterfalls
- Orchards and Vineyard	- Snow Making not for skiing or
- Pasture (no lag time for animal grazing)	snowboarding
- Frost Protection, Crop Cooling and	- Golf Courses (providing health and
Chemical Spraying on crops eaten raw	environmental issues resolved to
- Seed crops	manager's satisfaction)
•	 remote areas of parks, school grounds
	during vacation period (providing health
	and environmental issues resolved to
	manager's satisfaction)
RECREATIONAL	CONSTRUCTION
- Stream Augmentation	- Soil Compaction
- Impoundments for Boating and Fishing	- Dust Control
- Snow Making for skiing and snowboarding	- Aggregate Washing
	- Making Concrete
	- Equipment Washdown
	INDUSTRIAL
	- Cooling Towers
	- Process Water
	- Stack Scrubbing
	- Boiler Feed
	ENVIRONMENTAL
	- Wetlands
	11 Chang

According to the MSR, the use of reclaimed water requires the following:

- provide in addition to seasonal storage an alternative method of disposing of the reclaimed water or satisfy the manager that no such alternative is required to assure public health protection and treatment reliability.
- in the absence of seasonal storage, the provision of at least 20 days emergency storage (the storage volume may be reduced to 2 days if multiple treatment units are used);
- the system for conveying reclaimed water must incorporate safeguards to prevent cross connection with the potable water system;
- authorization in writing by the local health authority or the establishment of a local service
 area under which a municipality, or a private corporation under contract to a municipality,
 assumes responsibility for the system;
- the provision of user information when Unrestricted Public Access Category uses are proposed;
- where frequent worker contact with reclaimed water occurs, disinfection must achieve a fecal coliform level of <14/100 millilitres;
- the reclaimed water provider must demonstrate that reclaimed water does not contain pathogens or parasites at levels which are a concern to local health authorities;
- reclaimed water must be clean, odourless, non-irritating to skin and eyes, and must contain
 no substances that are toxic on ingestion;
- where available, agricultural (crop) limits must govern criteria for metals;
- high nutrient levels may adversely affect some crops during certain growth stages,
 consequently crop limits and season must govern nutrient application; and
- the reclaimed water provider must obtain monitoring results, and confirm that water quality requirements are met, prior to distribution.

According to definitions contained in the MSR, water-carried wastes from liquid or non-liquid culinary purposes, washing, cleansing, laundering, food processing or ice production (i.e., grey water) are classified as domestic sewage, regardless of whether or not toilet wastes (black water) are included. As such, the MSR standards for use of reclaimed sewage effluent apply to treated



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and recycled grey water as well as to reclaimed sewage. According to the MSR, water reuse projects must be approved in consultation with the Ministry of Health (MOH). The MOH has allowed demonstration projects for grey water recycling (e.g., CK Choi Building and Quayside Village in North Vancouver). These projects required special permission from health authorities. Procedures and facilities must be in place to ensure that systems will be monitored and operated properly, so that it can be demonstrated that there is no danger to the public health. Each demonstration project is carefully considered on a case-by-case basis, before receiving approval.

4.0 SOURCE CONTROL

Regulation of waste discharges to sanitary sewers is essential for the protection of public health and the environment. These discharges may enter the system via service connections from buildings, or from pumper truck discharges at treatment facilities (e.g. septage and trucked liquid waste from private businesses). Toxic and hazardous materials that enter the sanitary system pose a risk to sewerage system workers, to the general public, to the collection and treatment works, and to the receiving environment. Toxic and hazardous materials in wastewater can upset biological treatment processes, heavy metals can accumulate in sediments and wastewater treatment plant residuals (biosolids), and waterborne contaminants can be discharged to surface waters; the result can be a negative impact on the environment from both liquid and solids discharges. Source control of trace metals is particularly important if the biosolids generated at wastewater treatment plants are to be used as a soil amendment/fertilizer now or in the future, since the use of biosolids in B.C. is restricted by the Provincial Organic Matter Recycling Regulation (OMRR) according to trace metals content and other factors.

Source controls can be implemented through either a regulatory or an educational approach, or a combination of the two. The regulatory approach is typically focused on non-domestic (i.e., commercial, industrial, and institutional) discharges through sewer use bylaws, also referred to as source control bylaws. A source control approach that includes a significant educational component is likely to be more effective than one of strict policing and enforcement. However, it must be emphasized that it is essential to prevent unauthorized discharges of industrial, toxic, and/or dangerous wastes to the wastewater collection and treatment system. Responsibilities for



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inspection and enforcement of source control regulations should be clearly defined.

A bylaw regulating discharges to the sanitary sewer collection system is an essential component of a source control program. The Canadian Council of Ministers of the Environment (CCME) recently developed a Model National Sewer Use Bylaw. The national study reviewed existing provincial sewer use bylaws, completed an analysis of potential contaminants and parameters to be covered in the CCME Model Bylaw, and provided recommendations for federal, provincial, and territorial governments to develop and implement effective sewer use bylaws. Forty-one substances and physical parameters were recommended for inclusion in the bylaw. Hazardous substances are typically prohibited and therefore do not require concentration limits. The Supplemental List contains substances that are of potential concern for environmental release or human health, and can be implemented in the municipal bylaw depending on existing industries in the community. The focus of the CCME for the Model Sewer Use Bylaw is on wastewater; however, prohibited substances for stormwater are to be identified and best management practices to protect stormwater quality (construction erosion, sediment control, outdoor storage of materials) are required.

Many communities require a Waste Discharge Permit for Restricted Wastes, High Volume Discharges, Stormwater or Cooling Waste. A Permit typically will apply to non-domestic discharges from the industrial, commercial and institutional (ICI) sectors. Waste Discharge Permits typically include the following:

- limits and restriction on the quantity, frequency and nature of the discharge; and
- requirements of the Permit holder (discharger) to:
 - construct the pre-treatment works if needed to meet the specified discharge limits,
 - monitor the discharge and provide reports to District, and
 - operate and maintain the pre-treatment and monitoring facilities.

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APPENDIX G

FIELD RECONNAISSANCE REPORTS

Sheet	11 of 18						
Route Option Number	1.1	1.1					
Route Description	SRW - Pu	SRW - Pump Station to Back Rd. via ALR					
MCSL Drawing Reference #	S-11	THE STATE OF THE S	Section of Control States and Co				
Section Number							
From (Upstream)	Back Road	d					
To (Downstream)	Pump Stat	tion via Se	ction 4				
Restoration Requirements	Yes	No	Measure				
Green Field	Yes						
Paved Road	N/A	N/A					
Gravelled/Chip Sealed Road	N/A	N/A					
Pavement Condition	N/A	N/A					
Curbs	N/A	N/A					
Sidewalk	N/A	N/A					
Overhead Power	N/A	N/A					
Constructability	Yes	No	Comment				
Traffic Volumes	None						
Appropriate Staging Areas							
Geotechnical Considerations							
Site Access							
Comments							
Additional Comments	Apparent I	Disadvanta	ages - Very flat farmland, climbing at Back Road				







Sheet	12 of 18					
Route Option Number	1.2	1.2				
Route Description	SRW - Ba	SRW - Back Rd. to Sheraton Rd.				
MCSL Drawing Reference #	S-11		Account Country			
Section Number						
From (Upstream)	Section 8	& 9				
To (Downstream)	Back Road	d				
Restoration Requirements	Yes	No	Measure			
Green Field						
Paved Road			Crossing at Back Road			
Gravelled/Chip Sealed Road	N/A	N/A				
Pavement Condition	N/A	N/A				
Curbs	N/A	N/A				
Sidewalk	N/A	N/A				
Overhead Power	N/A	N/A				
Constructability	Yes	No	Comment			
Traffic Volumes	Ave.		At Back Road only			
Appropriate Staging Areas						
Geotechnical Considerations						
Site Access	Poor					
Comments						
Additional Comments		Advantages - St acier View Lodg	teep uphill to Back Road and above Back Road. No houses le			





Sheet	13 of 18					
Route Option Number	1.3	1.3				
Route Description	Sheraton	Sheraton Rd S.R.W. to McDonald Rd.				
MCSL Drawing Reference #	S-11	S-11				
Section Number	111					
From (Upstream)	Sheraton	Sheraton Road				
To (Downstream)	Section 8	& 9 at Glad	cier View Lodge			
Restoration Requirements	Yes					
Green Field			Open Hilly			
Paved Road	N/A	N/A				
Gravelled/Chip Sealed Road	N/A	N/A				
Pavement Condition	N/A	N/A				
Curbs	N/A	N/A				
Sidewalk	N/A	N/A				
Overhead Power	N/A	N/A				
Constructability	Yes	No	Comment			
Traffic Volumes	N/A	N/A				
Appropriate Staging Areas	N/A	N/A				
Geotechnical Considerations	N/A	N/A				
Site Access	N/A	N/A				
Comments						
Additional Comments		Advantage Disadvantag	es - Open with trees es - Hilly			



Date: Dec 4, 2008

Sheet	14 of 18					
Route Option Number	1.4	1.4				
Route Description	McDonald	McDonald Rd Sheraton Rd. to Inverclyde Way extension				
MCSL Drawing Reference #	S-11					
Section Number						
From (Upstream)	MacDonal	d Road				
To (Downstream)	Sheridan					
Restoration Requirements	Yes	No	Measure			
Green Field						
Paved Road		V	Paved walkway			
Gravelled/Chip Sealed Road						
Pavement Condition	Good					
Curbs		V				
Sidewalk			Pathway paved			
Overhead Power	12	1				
Constructability	Yes	No	Comment			
Traffic Volumes	N/A	N/A				
Appropriate Staging Areas	N/A	N/A				
Geotechnical Considerations	N/A	N/A				
Site Access	N/A	N/A				
Comments						
Additional Comments	Apparent Road	Disadvantages	0.5m waterline along Sheridan climbing toward Macdonald			







Da	-	Dag 4	. 2008

Sheet	15 of 18	15 of 18					
Route Option Number	1.5	1.5					
Route Description	Future Mo	Future McDonald Rd. extension - Inverclyde Way extension to Aspen Rd.					
MCSL Drawing Reference #	S-11						
Section Number							
From (Upstream)	Hector Ro	ad via Ma	cdonald				
To (Downstream)	Sheridan I	Road					
Restoration Requirements	Yes	No	Measure				
Green Field							
Paved Road	\ \						
Gravelled/Chip Sealed Road							
Pavement Condition	O.k.						
Curbs		V					
Sidewalk		V					
Overhead Power	N						
Constructability	Yes	No	Comment				
Traffic Volumes	Light		Along MacDonald only				
Appropriate Staging Areas							
Geotechnical Considerations		T. F.					
Site Access							
Comments							
Additional Comments			es - Paved from Sheridan Road to Guthrie, Paved from Guthrie or. Through bush the rest of the way				





Sheet	16 of 18						
Route Option Number	1.6	1.6					
Route Description	Aspen Ro	Aspen Road - Future McDonald Rd. Extension to Idiens Way					
MCSL Drawing Reference #	S-11						
Section Number							
From (Upstream)	Aspen Ro	Aspen Road					
To (Downstream)	Hector Ro	ad via Plan 6	60685				
Restoration Requirements	Yes						
Green Field	N/A	N/A					
Paved Road	N/A	N/A					
Gravelled/Chip Sealed Road	N/A	N/A					
Pavement Condition	N/A	N/A					
Curbs	N/A	N/A					
Sidewalk	N/A	N/A					
Overhead Power	N/A	N/A					
Constructability	Yes	No	Comment				
Traffic Volumes							
Appropriate Staging Areas							
Geotechnical Considerations							
Site Access							
Comments							
Additional Comments							

Sheet	17 of 18		
Route Option Number	1.7		
Route Description	Idiens Wa	y - Aspen F	Rd. to Ex. Sanitary
MCSL Drawing Reference #	S-11		
Section Number			
From (Upstream)	Idiens Wa	y	
To (Downstream)	Along Asp	en	
Restoration Requirements	Yes	No	Measure
Green Field			
Paved Road			
Gravelled/Chip Sealed Road			
Pavement Condition			
Curbs			
Sidewalk			
Overhead Power			
Constructability	Yes	No	Comment
Traffic Volumes			
Appropriate Staging Areas			
Geotechnical Considerations			
Site Access			
Comments			
Additional Comments			





Date:	Dec 4	2008
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Date: Dec 4, 2008	T		
Sheet	18 of 18		
Route Option Number	1.8		
Route Description	S-11		
MCSL Drawing Reference #			
Section Number			
From (Upstream)		y connectio	
To (Downstream)	Idiens Wa	y at Aspen	
Restoration Requirements	Yes	No	Measure
Green Field			
Paved Road	\ \		
Gravelled/Chip Sealed Road			
Pavement Condition	Good		
Curbs		V	
Sidewalk		V	
Overhead Power	1		
Constructability	Yes	No	Comment
Traffic Volumes	Light		
Appropriate Staging Areas			
Geotechnical Considerations			Open Residential
Site Access	O.k.		
Comments			
Additional Comments	Apparent	Disadvanta	ges - Crosses jet fuel pipeline, high traffic, possible utility conflict
		Ţ	



APPENDIX H

COST ESTIMATE SUMMARY SHEETS

 Urban
 Rural
 Urban
 Rural

 376
 376
 600
 806
 GRAVITY Urban Rund Urban Rural Courtenay PS Q= 2.3 Size (mm) 900 900 1290 1200 500 Rurai Jame St. PS Q= 0.4 Unit Rate 500 450 700 850 750 1000 903 CFB PS Q= 3.1 FORCEMAIN Urban Rural Urban Urban Rural Urban Rural Urben Rural Docalddie PS Q= 0.4 300/375 500 500 500 500 750 750 1000 750 900 1200 Size (mm) 1200 1100 1200 Southern PS Q= 1.16 Unit Rate

				Gravi	ty Sewers			Presi	sute Sewers				Total Estimated
Route Option lumber	Pipe Section Reference Number	Description	Length	Disenseter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Construction Costs (no contingencies, engineering)
	0	New Courtenay River Pump Station									20,000,000		29,000,0
	1	Courtenay PS to Back Rd, through Section 9					1,200	1200	1450	1,740,000			1,740,0
	2	Plan 35005, from Back Rd to Sheraton Rd.				-	690	1200	1450	1,000,500			1,000,5
	3	Sheraton Rd, from Plan 35008 to McDonald Rd				-	750	1200	1450	1,067,500			1,597,5
E .	4	McDenald Rd, from Sheraton Rd to Hector Rd					800	1200	1450	1,160,000			1,160,6
P P	5	Through Plan 60685 to Aspen Rid	150	1200	900	135,000							135,00
McDonald/ld	6	Aspen Rd to idens Way	400	1200		400,000				-			400,00
Qu.	7	Idiens Way to Connection Point	60	1200	-	54,000					- 4		64,00
	ð	South leg of the Greenwood trunk to Pritchard Rd.	2,350	1200	-	2,115,000				-			2,115,00
Servicing Route 1 -	9	Knight Rd, Pritchard to CFB gravity sewer	1,100	1200		990,000				-			190,00
20	10	ReiRe existing CFB gravity sewer	2.250	1200	900	2,025,000							2,025,00
light.	-11	Upgrade CFB pump station									5,000,000		5,000,00
Sec	12	Twin CFB torcersan				-	1,500	1200	1450	2,320,000			2,220,00
Area	13	Upgrade Jane St Plump Station									1,000,600		1,000,00
Core A	. 14	Forcemain section, per CH2MHLL forcemain relocation report (Croteau and Laze)	-				680	375	650	572,000			572,60
	15	Forcemain section, per CHQMHILL forcemain relocation report (Jane st to Crollesu pump station)					380	375	650	247,000			247.00
	16	Gravity section, per CH2MHILL forcemain relocation report	1,160	600	500	696,000	-	31.0	-	247,000			696,00
	17	Inverted sighon, per CH2MHILL forcemain relocation report	940	600		564,000							564.00
		Total				6,979,000				8,127,000	26,000,000		\$ 41,106,00
													1.4
	-	Ships Point Rd, from Tozer Rd to Hwy 19A					1,230	300	550	676,500			676,50
V .		Hwy 19A, from Ships Point Rd to Old Yake Rd.					1,730	300		951,500			951,50
Point / Area		Hwy 19A, from Old Yake Rd to the Tsable River					1,920	300	-	1,056,000			1,056,00
2							1,180	300		649,000			549,00
2		Hwy 19A, from the Tsable River to Buckly Bely Rd.					2,840	300		1,562,000			
SHIPS	-	Hwy 19A, from Buckly Bay Rd to Brean Rd Hwy 19A, from Brean Rd to Seymour St (Terminus of Route 1)					3,150	300	550	1,732,500			1,562,00
40		Total				-		-		6,627,500			1 6,627,50
	_	100								4714631114			1.4
-	- 1	Charles and their features to the Senter Co.					1,790	500	750	1,342,500			1,342,60
		Highway 19A, from Seymour St to Jonés St					1,520	500		1,140,000			1,140,00
		Highway 19A, from Jones St to Van West Logging Rd.					2,590	500	750	1,942,500			1,942,50
	-	Highway 19A, from Van West Loggin Rd. to Inventess Rd		_			1,140	500	750	855,000			
9		Highway 19A, from inverness Rd. to Herondole Rd.					1,900	500					855,00
OMEZNIO		Highway 19A, from Herondale Rd to Gartley Rd.					1,900	500	/30	1,425,000			1,425,00
5		Highway 19A, from Gartley Rd. to Royston Rd future Pump station					1,650	500	750	1,237,500			1,237,50
		New Pump Station, Hwy 19A & Rotston Rd									9,000,000		9,000,00
		Highway 19A, from Royston Rd future Pump Station to Courtenay					5 600	700	900	5.040.000			5,040,00
	-	Pump Station Total	-			-	2.000	700	900	12.982.500	9,000,000	-	\$ 21,992,50
_		Total				-				12,342,300	9,040,000	_	1 21,992,59
_			-			1					3,000,000		3,000,00
3	2.1	Purry Station at Constructed Welland Treatment Facility				- 1	1,100	375	550	605,000	3,000,000		
er e	2.2	CWTF to Inland Island Hwy	1.000	-	400	1,140,000	1,100	913	330	902,000			606,00
Cumb	23	Ruyston Rd, Inland Island Hwy to BC Hydro RGW Ruyston Rd, BC Hydro RGW to Hwy 19A	1,900	500 500		1,710,000							1,140,00
0	4.9	Total	2,000	United	-	2.850,000	-			605,000	3,900,000		5 6,456,09
		1004	-			Lastina	_			010,000	2,344,444		1
c		Paralisia Parala Disma Challan					- 1				2,500,000		2,500,00
Morth		Sanatoga Beach Pump Station	-				9,450	300	550	5,197,500	2,500,000		5,197,50
Areas		Staratoga Bearch to Kitty Coleman					2,432	344	-	5,500,300			5.197.59
*		Villa Palinana Britisa District									4,000,000	-	4,000,00
Outlying		Kithy Coleman Pulnip Station Kithy Coleman to Greenwood trunk					13.630	375	550	7.496.500	4,044,000		7,496,50
Ont		Field Total					10,000	37.0	-	12,694,000	6,500,000		5 19,194,00
		2008								12,224,444	*,********		1. 16.1600
900			7000										
5.5		William Co.	4900	VARIOUS	800	2,940,000							2,940,00
Como		Grøenwood frunk (North)		- CONTRACTOR OF THE PARTY OF TH									

Courtenay PS Q= 23 Jane St. PS Q= 0.4 CFB PS Q= 0.8 Deciddle PS Q= 2.7

Southern PS Q= 1.10

GRAVITY	Urban	Rural	Urban	Rural	Urban	Rural	Linten	Runs
Size (mm)	375	375	600	600	900	500	1200	1200
Unit Rate	500	450	700	600	850	750	1000	900
FORCEMAIN	Urban	Rural	Urban	Roral .	Urban	Rural	Urban	Rura
Size (mm)	37%	375	500	500	900	900	1200	1200
Unit Rate	650	550	900	750	1200	1100	1600	1450

				Gravi	ty Sowers			Pres	sure Sewers				
Route Option Number	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimated Construction Costs
	0	New Courtenay River Pump Station	1								17,000,000		17,900.
	1	Dyker Rd. from Courtenay PS to Comus Ave at Rodello St.	-			4	3,330	1200	1600	5,328,000			5,328
Y.	2	Rodello St. from Cornox Ave to Beaufort Ave.					80	1200	1600	128,000			128
Til.	3	Beaufort Ave, from Rodello St to Ellis St.					725	1200	1600	1,160,000			1,160
Na.	4	Beaufort Ave, from Ellis St. to Stuart St.				-	790	1200	1600	1,264,000			1,264
2	5	Stewart St, from Beautorf St, to Comor Ave.				4	80	1200	1600	128,000			122.
-	8	Comax Ave, from Stewert to end of Comax Ave.				-	610	1200	1600	976,000			976
2	7	End of Cornox Ave to Croteau				-	220	1200	1600	352,000			352
No.	8	New pump station at Docaddle and Croteau Rds.				-					17,000,000		17,000
Area Serviding Route 2 - Beaufurt Ave	9	Forcemain section, per CH2MHILL forcemain relocation report (Choteau and Lazo)					860	1200	1450	1,276,000			1,276,
	10	Forcemain section, per CH2MHILL forcemain relocation report (Jane at to Croleau pump station)					380	375	650	247,000			
Core	11	Gravity section, per CH2MHILL forcemain rejocation report	1,160	1200	900	1,044,000	300	2(4	0.00	297,5000			247.
	12	Invested signion, per CH2MHILL forcemen relocation report	940	1200		846,000							1,044,
	12	Total				1,250,000				10,859,600	34,000,000		5 46,749)
										10,000,000	24,000,000		1 49,749)
		Ships Point Rd, from Toper Rd to Hew 19A					1,230	300	550	676,500			676.5
<		Hwy 19A, from Ships Point Rd to Did Yake Rd.					1,730	300	-	961,500			551,
Area		Hwy 19A, from Old Yake Rd to the Tsable River					1,920	300	-	1,056,000			1,056,0
Point,		Hwy 19A, from the Tsable River to Buckly Bay Rd.					1,180	300	550	549,000			
		Hwy 19A, from Buckly Bay Rd to Brean Rd					2,840	300	550	1,562,000			549,I
Bryps		Hwy 19A, from Brean Rd to Seymour St (Terminus of Roule 1)					3,150	300	550	1,732,500		_	1,732,1
60.	-	Total		-				-	-	5,627,500			1 6,627,5
_		1100					-			4,541,000			1 5,027,3
							1,790	500	790	1,342,500			
		Highway 19A, from Seymour St to Jones St						500	- CIVIS 12				1,342.5
		Highway 19A, from Jones SI to Van West Logging Rd.	-				1,520		750	1,140,000			1,140,0
		Highway 19A, from Van West Loggin Rid, to Inverness Rid.					2,590	500	750	1,942,500			1,942,5
9		Highway 19A, from Inverness Rd. to Herondale Rd.					1,140	500	750	855,000		_	855,0
UBIDARID		Highway 19A, from Herondale Rd to Gartley Rd.					1,900	500	750	1,425,000			1,425,0
en ne	11	Highway 19A, from Gartley Rd. to Royston Ad Noure Pump station					1,650	500	750	1,237,500	7 000 000		1,237,5
		New Pump Station, Hey 19A & Rotaton Rid Highway 19A, from Royaton Rd future Pump Station to Courtenay	-								7,000,000		7,000.0
		Pump Station					5,600	700	600	3,360,000			3,360,0
		Total				-				11,302,500	7,800,000		\$ 12,302,5
72	21	Pump Station at Constructed Welland Trealment Facility				-				-	3,000,000		3,000,0
Hand	22	CWTF to Irsiend Island Hey				-	1,100	375	550	605,000,00			605,0
Cumber	23	Royston Rd, Inland Island Hwy to BC Hydro RUW	1,900	600		855,000							855,8
3	2.4	Royaton Rd, BC Hydro ROW to Hwy 19A	2,850	600	450.00	1.282,500	-		-	-			1,282,5
		Total			-	2,137,590				605,000	3,000,000		\$ 5,742,5
			-	_			-	_					
North		Saratoga Beach Pump Station			_		-		-		2,500,000		2,500,0
2 80		Saratoga Seach to Kiffy Coleman					9,450	300	550	5,197,500			5,197,6
Aveas				_			-		-		0.100.02001		
J'rg		Kitty Coleman Pump Station			-		13,630	375	550	7.496.500	4,000,000		4,000,0
Cutiying		Kitly Coleman to Greenwood trunk		-	-		13,630	3/3	330	12,694,600	6,500,000		7,495,5
-		Total			_	1	_	_	_	12,594,000	5,500,000		1 19,194,0
_			- Count	T to a second	(Aure)	***************************************							
		Greenwood hunk (North)	4,900		600	2,940,000			-				2,940,0
×		South leg of the Greenwood trunk to Pritchard Rd.	2,350	375		1,057,500			-				1,057,5
20		Kinight Rid, Prochard to CFB grantly server	1,100	375		495,000			-	-			495,0
9		ReiRe existing CFB gravity sever	2.250	1200	900	2,025,000	-		-	-	portion in		2,025,0
B Comox		Harmonia APR as one station									2,500,000		2,500,0
CFB Con		Upgrade CFB pump station											
CFB Cen		Truly CFB forcemain Total				6,517,500	1,600	1200	1450	2,320,000	2,500,000		2,329,0 \$ 11,337,5

Courtenay PS Q= 2.3

Jane St. PS Q= 0.4

CFB PS Q= 3.1 Doolkdie PS Q= 0

Southern PS Q= 1.16

GRAVITY	Urban	Rural	Urtum	Rural	Urben	Rural	Urban	Runs
Size (mm)	375	375	600	600	900	500	1200	1200
Lint Rate	500	450	700	600	850	750	1000	900
FORCEMAIN	Urban	Foural	Grban	Runi	Urban	Rural	Urban	Rura
Size (mm)	375	375	500	500	500	900	1200	1200
Unit Rate	650	550	900	750	1200	1100	1600	1450

Route 3

				Gravi	ty Sewers			Presi	sure Sewers				
Route Option Lumber	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes.	Total Estimated Construction Costs
	0	New Courtenay River Pump Station									20,000,000		20,000,0
	t	Comox Rd, from Courteray PS to HWY 19A					1,500	1200	1450	2,175,000			2,176,0
	2	HWY 19A, from Comox Rd. to Headquarters Rd.				- 1	850	1200		1,360,000			1,360,0
	3	Headquarters Rd, from HWY 19A to Vanier Dr.					1,480	1200	1450	2,145,000			2,146,0
. 1		Vanier Dr., from Headquarters Rd. to HWY 19A					1,160	1200		1,682,000			1,632,0
E													300,000
Hook	5	Veteran's Memorial Parkway, from HWY 19A to DD 12675-N (Block 71)					670	1200	100000	971,500			571,5
Raute 3 - Block	8	Through DD 12676-N to Block 71				-	1,570	1200	1450	1,696,500			1,696,5
2	- 7	Through Block 71 to Greenwood trunk				- 4	1,350	1200	1450	1,957,500			1,957,5
B.		Greenwood trunk (north)	5,600	1200	900	5,040,000							5,040,00
Berviolng	9	Relike existing CFB gravity sewer	2,250	1200	900	2,025,000							2,025,0
2	10	Upgrade CFS pump station									5,000,000		5,000,0
9	31	Twin CFB forcemain				-	1,600	1200	1450	2,320,000			2.720.00
Azoa	12	Upgrade Jane St Pump Station			-						1,000,000		1,000,00
Core		Forcemain section, per CH2MHILL, forcemain relocation report (Croteau and Lazo)					880	375	650	572,000			672.00
		Forcemain section, per CH2MHILL forcemain relocation report (Jane st to Croteau pimp station)					380	375	650	247,000			247.0
1		Gravity section, per CH2MHILL forcemain relocation report	1,160	600	600	595,000					100		696,0
	16	Inverted sighon, per CH2MHILL forcemain relocation report	940	600		564,000							564.00
	- 1	Total				8,325,000				15,127,500	28,000,600		\$ 49,452,50
*		Snips Point Rd, from Toder Rd to Hwy 19A					1,230	300	550	676,500			676,50
		Hwy 1SA, from Ships Point Rd to Clid Yake Rd.					1,735	300	550	951,500			951,60
Point / Area		Hwy 19A, from Old Yake Rd to the Tsable Hiver					1,920	300	550	1,056,000			1,056,00
5		Hwy 19A, from the Tsable River to Buckly Bay Rd.					1,580	300		649,000			649,00
4		Hey 1SA, from Buckly Bay Rd to Brean Rd					2,840	300		1,562,000			1,662,00
SPATE		Hwy 19A, from Bresn Rd to Seymour St (Terminus of Route 1)					3,150	300		1,732,500			1,732,60
		Total				-				6,527,500			\$ 6,627,50
										1000000	- 4		1,4
		Highway 19A, from Saymour St to Jones St					1,790	500	750	1,342,500			1,342,50
- 1		Highway 19A, from Jones St to Van West Logging Rd.					1,520	500	750	1,140,000			1,140,00
1		Highway 19A, from Van West Loggin Rd. to inverness Rd.					2,590	500		1,942,500			1,942,50
		Highway 19A, from Inverness Rd. to Herondale Rd.					1,140	500		855,000			855,00
8							1,900	500		1,425,000			
UBIDIRID		Highway 19A, from Herondale Rd to Gartley Rd.					1,000		1.00	1,423,500			1,425,00
5		Highway 19A, from Gartley Rd, to Royston Rd future Pump station					1,650	500	750	1,237,500			1,237,50
1		New Pump Station, Hay 19A & Rolaton Hid					1	-			9,000,000		8,000,00
1	-	Highway 19A, from Royston Rd future Plamp Station to Courteray									4,000,000		3,000,00
		Pump Station					5,500	700	500	2,600,000			2,800,00
		Total				-				10,742,500	9,050,000		\$ 19,742,50
_					_		-	-				_	
y	21	Fump Station at Constructed Welland Treatment Facility			-	-			-	*	3,000,000		3,600,00
12	2.2	CWTF to Inland Island Hey				-	1,100	375	550	605,000			\$05,00
2		Royston Rd, Inland Island Hwy to BC Hydro ROW	1,900	600	600	1,140,000							1,140,00
8	24	Royaton Rd, BC Hydre ROW to Hwy 19A	2,850	800	500	1,710,000							1,710,00
		Total				2,850,000				695,269	3,000,000		\$ 6,455,00
4 1	- 1	Sarafoga Beach Pump Station									2,600,000		2,600,00
Nov							9,450	300	550	5,197,500	2,000,000		5,197,50
Areas North		Saratoga Beach to Kitty Coleman					0,430	- 300	-	4,101,300			3,137,800
2			-		-						4.000.000		7444
2		Kithy Coleman Pump Station			-		13,630	375	550	7,496,500	4,000,000		4,000,00
Outlying /	-	Kitty Coleman to Greenwood trunk			-		18,030	.5/5	200	12,694,000	6,500,000	-	7,496,60
		Total	_			-1				12,034,000	9,999,000		\$ 19,194,00
~ 1		Greenwood Irunk (south)	2,350	375	450	1,057,500							1,067,50
		Knight Rd, Priichard to CFB gravity sewer	1,100	375		495,000				1.2			495,000
H100													-
Comox		Total				1,652,650							\$ 1,562,6

Countersy PS G= 2.3
Jace St PS G= 0.4
CPB PS G= 0.6
Docaldde PS G= 0
Southern PS Q= 1.16

GRAVITY	Urban	Runal	Urban	Rural	Unbest	Rural	Urban	Rural
Size (mm)	378	375	205	600	900	906	1250	1200
Und Rate	205	18	700	200	980	750	1000	906
FORCEMAIN	Urban	Rural	Urban	Pural	Urban	Rural	Urban	Rust
Sizze (men)	375	375	200	909	900	300	1200	1203
Unit Rate	999	550	006	750	1200	1100	1600	1460

-	The second second	-				1		-				
Reference	Cesculpano	rendan	Contracted	Unit Rate	Total Cost	rengin	Olameter	Linit Rate	Total Cost	Pump Station Costs	Notes	Total Extended Construction Costs
New	New Couchangy River Pump Station							i		20,000,000		29,000,000
000						(700	1200	1450	2.465,000			2,485,000
McDe						006	1200	1600	1,440,000			1,440,000
9	Guilture Rd. from McDonaid Rd to Anderbor Rd.					1,100	1200	1600	1,780,000			1,740,000
S	Gultivie Rd., from Anderton Rd to Prilichand Rd.					1,270	1200	1800	2 632 600			2,032,006
Guth	Guthria Rd from Pritorard Rd to Steen Dr.					250	(200	1600	800,000			490,000
Germ	Guinnie Rd., Irons Streets Dr.ta Becklon Dr.	1,270			1,079,500							1,079,500
Beck	Becklan Dr., from Guthrie Rd to Gandner Way	220			167,000				4			107,000
Gand	siner Way, from Beckton to CHOMHILL Route	8	900	980	357,000		Ī					367,000
STATE OF	nyethe Signan	800			900,000		Ī					000'000
Per Cpg	Upgrade Jame St Pump Station. Presentan section, per CH2MFILL forceman relocation report (Critheau and Lazo).					98)S	8	000 750	00000001		1,050,000
Fere	errain section, per CHZMHILL forcemain relocation report (Jane st.								-			DAYAN .
9	to Croteau pump station)					390	375	280	309,000			209,802
Gran	Grantly section, per CH2MHILL forcemain relocation report	1,160	1200	800	1,044,000	I	Ī		-1			1,044,000
	men speciel, per concernat, recommen recommen reposit	240		П	4,113,500			H	1,790,000	21,688,900		\$ 33,903,500
55	Share Point Rd, from Tozer Rd to Hwy 19A					1,230	300	988	676,500			805'929
HONOL	Heay 15A, from Shaps Point Rd to Cita Yake Rd.					1,730	300	880	505.150			351,506
ě.	Hery 154, from Old Yake Rd to the Taable River					000	300	000	1,056,000			1,056,000
1	THEY CON, TION THE LEADER PLYNE IS DESCRIPTION FOR			İ		NA C	200	200	1 587 700			949,000
H.	Have 194, from Settin Rd to Seymour St. (Terminus of Rocks 1)					3,150	300	98	1,732,500			1,732,600
Ц	Total								6,627,500	ė		\$ 6,627,500
3	Committee Committee College Committee College					4.700	No.	2002	out of the			***************************************
1	Harbaran (SA from Jones Of to Use Wast I province Bri					1 500	0.05	100	1 140 000			1,44,590
9 69	Hopman 194, from Van West Loose Rd to Inverness Rd					2590	200	1 12	1942500			1,142,200
Har	Signwary 19A, from Investress R.d. to Herondale R.d.					1,140	200	750	865,000			355,000
20	Highway 194, from Herondale Rd to Gardey Rd.					1,900	200	750	1,425,000			1,425,000
Han	Highway 194, from Gartley Rd to Roysten Rd Mure Purro station					1,650	900	25	1,237,500			1,237,500
New	Pump Station, Hwy 194, & Robston Rid									9000000		3,500,000
ž č	Highway 194, Irom Royshon Ka Mure Pump Station to Counteray Pump Station					5,600	800	1100	6,150,000			6,150,000
Ц	Tetal								14,102,500	900'000'6		\$ 23,192,500
8	Parte Station at Constituting Welland Treatment Facility								1	3,000,000		3.080.080
NO.						1,100	375	550	605,000			BIS AND
Roys	Royaton Rd, intend taland Hwy to BC Hydro ROW	1,900	000	900	1,140,000	Ī						1,540,000
Roys	ton Rd, &C Hydro ROW to Hwy 19A, Total	2,650	68		2,850,000				808,000	3,000,000		1,710,000
								-		500 0000 0		
Sara	Saration Beach Purity Cities Continue Beach to Kitle Polemen					9.60	300	099	5 197 500	230,000		Z,500,000
N N	NOTIV Coleman Puring Station					15.630	300	000	7.456.500	4,000,000		4,000,000
					,			H	12.654,000	6,500,000		\$ 15,154,000
8	Germand trunk (Nach)	4,900	VARIOUS	909	2,940,000		Ī					2,340,306
Sou	South teg of the Greenwood trunk to Pritchard Rid.	2,350	375	8	1,057,500							1,067,500
7,570	Knight Hd, Prilichard to CFB gravily sewer	1,100	375	8	495,000	Ī	1	1				495,000
Refl	ReRe existing CFS gravity sewer	2280	1300	000	2025,000		Ī			2400000		2,025,000
1	Twin CFB hotelmain					1,600	1200	1450	2,320,000			2,320,600
ļ						-						

Countenay PS G= 23 Jane St PS G= 0.4 GPB PS G= 0.4 Dooledie PS G= 2.7 Southern PS G= 1.16

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Soute Option Number				Colarity bes	Steets		1	Pressure Se	re Sewers				
	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimated Construction Costs
	o	New Coultersiv River Pump Station					ı				20,000,000		26,600,030
		Courtenay PS to IR, along Dyke Rd.				3	2,050	1300	1450	2,972,500			2,972,500
	~	Through IR, Dake Rd to Robb Rd					900	1200	1450	725,000			725,000
рн		Robb Rd, from IR to Condor St.	arm.	OW.	*****	000000	220	1200	1600	352,000			352,500
ddg		DOOR TO SOUTH CANADA OL TO ANTICE AND ANTICE ANTICE AND ANTICE ANTICE AND ANTICE AND ANTICE AND ANTICE AND ANTICE AND ANTICE AND ANT	(380	one:	1000	1 380,000	İ	Ī					000'008
H - G	1 15	Principale Rd, from Rabb Rd to Balmani Ave.	480	1200	10001	700/007							456,000
eluasi	2	Balmons Ave. Storn Pritothard St to Croteau, to Croteau pump station.	960	1200	1000	960,000							889,000
Dujoja	M										27,000,000		and and the
ing vo		Fertenain section, per CHZMHILI forcemain relocation report (Ottissus					98	93.63	256+	(338,000)			1000
iV aio		Foremen section, per CHZMHILL tonormain relocation report (Jane st					1		1	200 000			Decree of the second
0	T		1,160	1200	800	1,044,000	2	9	200	00000			1 644 600
	12	Inverted signor, per CHCMHILL forcemain relocation report	98	1200	900	345,000							246,000
		Total	8	94		\$,420,000				5,534,500	37,000,000		1 47,354,530
		Steins Paint Rd from Taxes Rd to Haw 1934					1,230	280	288	576 500	Ī		600 975
Ass		HWY 194, from Shops Point Rd to Old Yake Rd.					1,730	280	250	951,500			851.500
ny/		Hwy 19A, from Old Yake Rd to the Tsable Rives					1,920	300	2005	1,056,000			1,056,000
NHO C		Hwy 194, from the Tsable River to Buckly Bay Rd.					1,180	300	988	649,000			649,000
sda		Hwy 19A, from Buckly Bay Rd to Brean Rd					2845	300	280	1,562,000			1,562,030
46		Hwy 1994, from Brean Rd to Seymout St. (Terminus of Raule 1)	1	1	-		3,150	800	280	1,732,500			1,732,550
1		100			1	-				8,527,500			5, 6,627,500
		Highway 19A, Itom Seymour St to Johns St		-1			1,780	650	750	1,342,500			5342,500
		John		7			1,520	059	750	1,140,000			1,140,000
							2,550	989	82	1,342,500			1,942,500
a					1		1,140	99	18	855,000			856,000
NO)		Highway 194, from Herondale Rd to Garney Rd.			1		1,800	300	8	1,42,000			1,425,000
en							1,650	900	750	1,237,500	Control State of		1,237,500
		Highway 194, from Poyeton Fid future Pump Station to Countersy.									No.		2,000,000
							5,500	7007	900	3,360,000			3,350,000
		Total				J				11,302,500	9,000,000		\$ 20,302,500
	3.4	Dume Colon of Creativeted Walland Transment Earlifts			-		-	ľ	-		3,000,000		4 000 000
pue	Г	CWTF to Inland leand Him					1,100	375	13	000,569			495,000
hedi	23		1900	800	9009	1,140,000							1,140,000
cni		PO RICHW to Hwy 19A	2800	909	2009	1,750,000							1,710,000
		Total			-	2,850,080				435,500	3,000,000,0		\$ 6,345,00
4			-	1	-	-	-	1	-		and and a		
naM		Sendon Bash to Ville Delenan					0.00	300	8	1250 500	William Y		4 363 636
140		consistent to the constant			-								-
ıy Bu											4,000,000		4,000,000
Man		truk			-		13,630	375	480	6,133,500			6,133,6
0		Total	1				T			18,386,000	8,508,000		4 16,886,000
		Grenwood Irank, (Moth)	4,900	VARIOUS	88	2340,000	ı						2,940,000
ж		South leg of the Greenwood trunk to Pritchard Rd.	2350	375	9	1,067,500	1		1				1,057,500
MIGO		Knight Rd, Pritchard to GFB gravity severy	1,100	375	3 8	485,000	T	Ī	t				496,000
na:		Herbite expling Or 5 gravity acreer	707	1400	200	2000000	T	T	Ī		2 500 000		2.625.909
,		Twin CFB forcemain				*	1,600	1200	1450	2320,000			2,329,600
		Total				6,517,530			44	2,326,000 \$	\$ 2,630,000		11,337,500

Courtenay PS Q= 1.13 Jane St. PS Q= 0.4 CFB PS Q= 1.93 Doddddle PS Q= 1.56 Gouthern PS Q= 1.16

OIL I										
GRAVITY	Urban	Rural	Urban	Rural	Urban	Rional	Urban	Rural	Urban	Runal
Size (mm)	375	375	500	600			900	900	1200	1200
Link Rate	500	450	700	600			850	750	1000	900
FORCEMAIN	Lirben	Rural	Urban	Runal	Lirban	Rural	Urban	Rural	Urban	Rural
Size (mm)	300/375	300/375	500	500	750	750	906	900	1290	1200
Unit Rate	650	550	900	750	1000	900	1200	1100	1600	1450

Route				-	Sewers			7.111	ure Sewers				1
Option Number	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimated Construction Cost
	0	New Courteray River Pump Station									17,000,000		17,00
	1	Courtenay PS to Back Rd, through Section 9					1,200	750	500	1,060,000			1,08
	2	Plan 35008, from Black Rid to Sheraton Rid.				-	590	750	900	621,000			62
	3	Sheraton Rit, from Plan 35008 to McDonald Rit.					750	750		675,000			67
2	4	McDonald Rd. from Sheraton Rd to Hector Rd				-	600	750	900	720,000			72
Roule 1 - McDanald/ldiens	- 5	Through Plan 60685 to Aspen Rd.	150		-	112500							11
Na.	- 6	Aspen Rd to Idiens Way	400			300000			-	-			30
OQ.	1	Idens Way to Connection Point	60			45,000				-			4
2	- 6	South leg of the Greenwood trunk to Pritchard Rd	2,350		-	1.762.500							1,76
4	9	Knight Rd, Pritchard to CFB gravity sevier	1,100			825,000	-						82
Ro	10	ReRe existing CF8 gravity sewer	2,250	1200	1450	3,262,500	_					_	3,26
Servicing	11	Upgrade CFB pump atation									5,000,000		5,00
2	12	Twin CFB forcemain					1,500	1200	1450	2,320,000			2,32
u5	13	Upgrade John St Pump Station									1,000,000		1,00
Core Area	14	Forcemain section, per CH2MHILL forcemain relocation report (Croteau and Lazo)					880	900	1100	968,000			96
ă	15	Forcemain section, per CH2MHILL forcemain relocation report (Jame at to Crolleau sump station)					380	900	1100	418,000			41
	17	Gravity section, per CH2MHILL forcemain relocation report Inverted signan, per CH2MHILL forcemain relocation report	1,160	1200		1,044,000							1,04
		Total				8,197,500				6,802,000	23,000,000		\$ 37,99
-													
<	-	Ships Point Rd, from Tozer Rd to Hwy 19A					1.230	300	550	576,500			676
Ares /		Hwy 19A, from Ships Point Rd to Old Yake Rd.					1,730	300	550	361,500			95
4		Hay 19A, from Old Yake Rd to the Tsable River					1,920	300	550	1,056,000			1,05
Point /		Hwy 19A, from the Tsable River to Buckly Bay Rd.					1,180	300	550	549,000			64
g.		Hwy 19A, from Buckly Bay Rd to Brean Rd					2.840	300	550	1,562,000			1,56
SHips		Hwy 19A, from Sirean Rd to Seymour St (Terminus of Route 1)					3,150	300	550	1,732,500			1,73
		Total				-				6,627,500	,		\$ 6,62
		Highway 19A, from Seymour St to Jones St					1,790	500	750	1,342,500			1,342
		Highway 19A, from Jones St to Van West Logging Rd.					1,520	500		1,140,000			1,14
		Highway 19A, from Van West Loggin Rd. to inverness Rd.					2.590	500		1,942,500			1,94
0		Highway 19A, from Inventess Rd. to Herondale Rd.					1,140	500		855,000			85
UBICARID		Highway 19A, from Herondale Rd to Gartley Rd.					1,900	500		1,425,000			1,42
UBIC		Highway 19A, from Gartier Rd to Royston Rd future Pump station					1,650	500	750	1,237,500			1,23
		New Pump Station, Hwy 19A & Rotation Rd					1,000			1,207,000	9,000,000		9,00
		Submarine Crossing to Jane Street					4 550	900	1500	6.825.000	2,000,000		6,82
		Total								14,767,500	9,000,000,0		\$ 23,767
		a and the second second							1	T	3,000,000		3,000
2	21	Pump Station at Constructed Welland Treatment Facility CWTF to inland Island Hwy					7,100	375	550	605,000,00	5,140,140		605
2	23	Royston Rd. Inland leland Hey to BC Hydro ROW	1,900	600	600	1,140,000		010					1,140
5	24	Royaton Rd, BC Hydro ROW to Hey 19A	2.850	500		1,710,000							1,710
0		Total				2,850,000				605,000	3,000,000		\$ 6,455
E							-		-		2,500,000		T
Herb		Saratoga Beach Pump Station					9.450	300	560	5.197.500	2,500,000		2,500
Areas		Sanatoga Beach to Kilty Coleman					240	300	550	3.191.300			5,197
		Vite Calance Diseas States									4,000,000		4,000
ying		Kitty Coleman Pump Station Kitty Coleman to Greenwood trunk					13,530	375	550	7,496,500	9,000,000		7,496
8	7-4	Total					1,7,000			12,694,000	6,500,000		\$ 19,154
. 8						- 1							
Comox		Greenwood trunk (North)	4900	VARIOUS	600	2940000							\$ 2,940

1.13	0.4	E.D	2.89
outenay PS Ga	Jape St. PS Qn	CFB PS G=	Societie PS On

GRAVITY	Urban	Ruesi	Urban	Rund	Urban	Rumal	Urban	Russ	Littan	Rusal
Size (mm)	375	375	203	800			300	900	1260	1200
Unit Rate	900	450	700	600			098	750	1000	300
FORCEMAIN	Uttan	Rural	Urban	Rural	Unbarr	Russi	Urban	Runal	Urban	Rusal
Signe (mm)	300/075	306/375	500	900	750	750	906	900	1200	1200
Linit Rate	099	250	900	750	1000	2006	1200	1100	1800	1,650

Part Part	H												
Part Control Contr		Descrip	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Rotes	Total Estimated Construction Cos
Particle Particle	0	+-									17 000 000		47.600
Particular Art Part	+	nor Aue at Redello					3300		300	2,967,000			20 0
Section of the control of the cont							200		1000	2000			
Section Control Cont	2 8	Reauthof Just from Rodale St to File St					77		1000	756.000			
Decided for the following that the following that the following that the following that the following that the following that the following that the following that the following that the following the following that the following the following that the following the following that the following the followin	4	Beautist Ave. from Ells St to Stuat St.					790		1000	790,000			26
Control Advanced Legister Le	141	Stemant St. from Beautiont St. to Cornor Ave.					90		1000	80,000			
Section of the control of the cont	w	Commit Ave. from Stemant to end of Compa Ave.					610		1000	610,000			10
Figure 1974 Control of March 2014 Control of Mar	1						220		1000	220,000			72
Contact and Active Contact Contact and Ac	90	roles									17,000,000		17,00
Section Proceedings Processing Proce	¢	forcernain relocation					0.9		1480	1,776,000			
Chart of Colors Lance of C		forcemain relocation											
Section of Control o	10							300	1100	418,000			14
Secretaria (Control of Control	: 5	40.3	1,180			1,044.00	0.0						1,00
Spiece Field Rule from File being 19th	4					1,830,000				7,195,000	34,000,000		43(
March Color Colo													
Fig. Section Control		Shars Point Rd, from Tozer Rd to Hay 1956,					1230	300	099	676,500			676
Fig. 16 for 10 km star files from the Table file file file file file file file fi		Hay 19A, from Ships Point Rd to Old Yake Rd					1730		250	961,500			98
Weight from the latest of the control of the cont							1,920		250	1,056,000			1,05
Variable Variable	-						1,180	300	8 8	000 649 000			3
February 19th Fore Sermon's St to Leven St Leven St Lev		They 19A, from Breas Rd to Seymour St (Terminus of Route 1)					3,150	300	999	1,732,500			1,78
Value Valu		Total				*				6,627,500	*		\$ 5,627
Higher Hold Note Note State State Note Note State State Note Note State		The second secon								11107-10215			
Pagement Mark Family Pagement Page		Highway 19A, from Sermour St to Jones St					1,790	300	2	1,342,500			1,342
Educative Holes for the control of Holes and Holes 1,140 500 750 1,525.00 1,205.00 1,525.00 1,		West Logging Kd					1,520	200	8 1	1,140,000			1.14
Figure 19 Figu		Herondale Rd.					1,140	8	8	865.00			100
Horaver 16th Hora							1,300	200	82	1,425,000			1,42
Number of Station Hair 19th & Robation All Stations Understand to James Station Total 4,550 900 1550 9,000 000 \$ 200 000							1,650	200	730	1 237 500			122
Submanine Cristation bline Street Total		Mew Pump Station, Hwy 194 & Rotston Rd									9,000,000		9.00
Purple Station of County-side Weight of Teach Purple Station of County-side Weight of Teach Purple Station of County-side Weight of Teach Purple Station of County-side Weight of Teach Purple Station of Station		Submarine Crossing to Jane Street			1		4,550	300	1500	6,825,000			6,82
Perror State on the Constructived Webort Treatment Freility 1,500 600 1,1440,000 1,1		Total								14,767,500	000'000'6		\$ 23,767
Prints State of the ROW 1,500 500 500 1,140,000 1,140,									-				
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Statistical Bases University Coloreste Colores	77		. 000	ľ		4 440 000		000	8	NO.			08
Semitory Black Plane Station Total 2,459,000 5,450 500 5,497,500	2.4	5 2	2,850			1719,000							173
Treat 4 200 VAR-DULIS 600 2,250,000 5,107,500						2,850,000				805,000			
13,600 300 5197500 13,600 300 5197500 13,600 300 5197500 13,600 300 5197500 13,600 300 51,600 51,600 51,600 51,600 51,600		Seratoca Beach Pumo Station							-		2,500,000		250
13,500 215 550 7,456,500 4,500,000 5,560,5		Saratoga Beach to Kitty Coleman					9,450	300	920	5,197,500			6,19
Total 1,550 215 550 7,466,500 5,560,000 5,500,000		SCPs Coleman Pump Station							ľ		4 000 000		400
Total 1.2554,000 5.250,0		man to Greenwood trunk					13,630		299	7,496,500			7,49
A 2001 VARBOURS 600 2,240,000 A 2001 375 450 1,007,500 A 2000 2,250,000 A 2000 000 2,250,000		Total								12,694,000	8,500,000		19,19
Autoria 2.250 3/75 450 1,567,500		Greenwood trunk, (North)	4900	VARIOUS		2,940,000							254
######################################			2350	375		1,067,50		Ī					1,05
2,255 1,200 900 2,005,000 2,590,000 2,590,000 1,200,000		Knight Rd. Prichard to CFB gravity sewer	1,100	375		495,000			1				48
Total 6,597.500 1500 2000 2,000,000 8		Raffie existing CFB gravity sewer	2,250	1200		2,025,000		Ī			of Edit Annual Co.		2,92
Total 6,437,500 1,200,000 2,200,000 8		Uograde CFB purpo station Takin CFB forcemain					1600	800	750	1,230,000	2500000		1.20
and the same of th						4 547 500				* 300.000	2 600 000		

	1020				200								
DEB DE ON 1 OF		500 mm	900	973	200	009	Ī	ı	200	98	1200	1200	
Dockdde PS.Q= 156		FORCEMAIN	Urban	Runti	Urban	Rusi	Urban	Rural	Urban	Rural	Urban	Paral	
Southern P.S. Ow 116		Sires (marris)	350000	1001174	con	con	750	200	200	2000	1000	-	
Deciment of		Oct sand	650	550	300	750	1000	900	1200	1100	1800	1200	
												3	
				Gravity	Sewers			Pressure	Severs				
Route Option Number	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimates Construction Co.
	0	New Courterary River Plump Station							ŀ		17.020.000		17.00
		Comax Rd, from Courternay PS to HMY 19A					1,500	750	1000	1,500,000			1.50
	2	HAVY 1SA, from Commr.Rd. to Headquarters Rd.					950	8	1000	850,000			828
	m ,	Headquarters Rd, from HWY 19A to Varier Dr.					1,480	000	006	1,332,000			1,33
12	ď	Variet Lif. from Headquarters Ad. to HWY 194. Veleran's Memorial Parkway from HWY 164 to DD 17676-N (Block					20	8	9	1,044,000			104
koaj	0	719					670	750	006	803 000		H	
3+8	10	Through DD 12875-N to Block 71			İ		1,170	200	000	1,053,000	1		1.05
eyno	10	Industrial plock (1) to undermood funds Greenwood funds	2,600		006	5 O4D 000	1,200	8	200	1,215,000			2,0
M Dui	6	ReRe austing CFB gravity severi	2250	(200	86	2,025,000							202
DINIB	10	Upgrade CFB pums station							1		5,000,000		5.00
S 801	11	Twith CPB for pentralin			t		1,600	1200	1450	2.335,000			2,32
N 810:	12	sau Rds			1			1	1		17,000,000		17,00
0	22	Forceman sector, per CHZMHILL torcertain relocation report (Crideau and Lazo)			1		989	006	1100	988,000			96
	**	Forcestain section, per CHOMHILL forcestain relocation report (Jame st to Crokeau tumo station)					380	006	1100	418.000			4
	155	Gravity section, per CHZMHILL forceman relocation report	1,160	1200	006	1,044,000							1.6
	16	GLL forcemen relocation report	98	1200	300	845,000		1	1				2
		1013				8,955,000				11,303,000	19,000,000		8
٧		Ships Point Rd, from Tozer RJ to Hwy 19A					1230	300	999	676,500			(3
1002		Hay 19A, from Ships Point Rd to Old Yake Rd.			1		1,730	300	280	361.500			36
A) In		Have 1956, from Clid Yake Rid to the Toolie River					1 300	300	086	1,056,000			1,05
0,j s		Have 154 from Buside Bay Rd to Brean Rd					2840	30	095	1562 000			7 3
fius		eminus of Route 1)				7	3,150	300	999	1,732,500			1,7
		Total							-	6,627,500	7		9'9
		Highest 19A, from Seymour St to Jones St					1,790	200	750	1,342,500			135
		Highway 19A, from Jones St to Van West Lopping Rd.					1,520	200	750	1,140,000			1,34
		Highway 19A, from Van West Logon Rd, to Inverness Rd.					2,590	800	780	1942500			1,94
anu		Highway 19A, from Inverness Rd to Necondare Rd. Highway 19A, from Herbridgle Rd to Getfery Rd.					1,900	200	8 8	1,425,000			1,42
нагі		Homes, 19A form Gardey Re to Rosson Refeare Pump salon					1,650	200	952	1,237,500			1,1
		New Pump Station, Hwy 19A & Rotston Rid									9,000,000		Ø'8
		Submatine Grossing to Jane Sired					4,300	800	1500	14,767,500	8,000,000		\$ 23,76
	lſ		'n						-				
pue	27	Pump Station at Constructed Wetland Treatment Facility				T	1 100	302	000	O CONCOR	3,000,000		3,00
hedn		Royston Rd. Inland Island Hwy to BC Hydro ROW	1,900	009	9009	1,140,000				0			10
Cun		Royston Rd, BC Hydra ROW to Hwy 15A	2,850	900	600	1,710,000				o			1,71
		Total		1		2,350,000		1	1	000'509	3,000,000		23
thoM		Seratoos Beach Pump Station				Ī	0.400	000	Copy	2 487 800	2500,000		2.50
SERV		Off acces breath to many contracts						3		ON THE REAL PROPERTY.			81.0
/ Ծայհյա		Kithy Coleman Purito Station Kithy Coleman to Greenwood trunk					13,630	200	955	7,496,500	4,000,000		1,49
0		Total								12,694,000	6,500,000		\$ 19,15
X01		South leg of the Greenwood trunk to Princhard Rd	2.350	375	89	1,057,500	T	H	+	78			1,05
Coll		Knight Rd, Pritchard to CFB gravity sower	1,100	302	450	435,000				-			43
1000		Total				1 5.52 500			-				37.

Counteray PS Cl= 113
Jane SI, PS Cl= Cl4
CFB PS Cl= Cl8
Dockidde PS Cl= 156
Southern PS Cl= 116

OPTION 1A - ROUTE 4 Unbennown Pic Cor 113 State from 1 175 Unbennown Pic Cor 113 175 Unbennown Pic Cor 113 175 Unbennown Pic Cor 113 175	175 275 500 500 500 100 100 100 100 100 100 10	Uhben Rusi 175 375 570 500 650 100 100 100 100 100 100 100 100 100 1	Uhan Russ Udan 275 375 660 500 650 700 4M Udan Russ Udan 3000775 3000775 500	Urban Rumi Urban Rumi Urban Ur	275 278 650 650 100mm 100mm	Urban Rumi Urban Rumi Urban Rumi Urban R	Libbon Razel Urbon Rural Urbon Rural Urbon Rural Urbon Rural Urbon Rural Urbon 860 860 SSO 650 770 600 600 860 860 NAN Urbon 850 860 860 106an 106an AMN 1000 600 760 750 750 800	Libber Rural Utber Rural Albert Rural <
Uhban 275 500 500 Uhbah 300175		875 850 850 Rusi 3000378	Runt Urbon 575 660 700 Runt Urbon 700075 660	Runsi Urben Runsi 2315 6500 6	Rumin Urbann Rumin Urbann 375 \$20 \$59 457 700 \$60 Rumin Urbann Burnin Urbann 300175 560 500 756	Rural U-bonn Rural U-bonn Rural 375 550 560 560 6x5 770 6x0 Rural 780x1 560 750 Rural 300x75 560 560 750 750	Russi Urban Russi Utban Russi Utban 575 660 690 800 800 657 700 600 800 800 Russi Urban Russi Urban Urban 300x77 550 500 750 800	Runs Urban Runs Urban Runs Urban Runs 375 620 600 600 900 900 650 700 600 900 750 Runs Urban Runs 104m Runs 300775 560 750 600 900
	Rura 575 650 Rura 300075	H	Urben 650 700 700 Urben 560	Uclean Runsi 850 \$60 700 \$60 Uclean Runsi 560 \$60 100 \$60	Uctown Rustle Urbonn \$50 \$59 700 \$60 Urbann Rustle Urbann 250 \$60 \$60 750 \$60	Undew Rural Urban Rusal	Ubbers Runsi Ubbers Runsi Ubbers 660 660 660 860 700 660 860 Ubbers Runsi Ubbers 860 860 750 750 860	Uclean Rural Utben Rural Utben Rural 660 660 660 800 800 700 660 750 750 Urban Rural Ubben Rural 850 750 750 850 750 800

Description New Countering Flows Pump Station Countering FS to McDonald at Back Rit McDonald Rd, from Back Rd to Guilton Guilman Rd, from McDonald Rd to Anderd Guilman Rd, from McDonald Rd to Anderd				-					Ī			
	6	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Uott Rate	Total Cost	Pump Stallon Costs	Notes	Tetal Estimated Construction Costs
										17,000,000		17,000,000
wid Rd, from Back Rd to Gulfrine Rd, from McDonald Rd to Anda	Rd. Brough ALR					1,700		006	1,530,000			1,530,000
a Rid, from McDonald Rid to Anda	trie Rif.					900		200	812,000			810,000
Coffeein Od from Landonton Do to Delichard Do	Anderton Rid.					1,700	082	1000	1,100,000			1,100,000
Camping Dd from Dribbhard Dd in Span D	-Ch					280	1	, troop	260,000			120,000
Gulbrie Hd. from Skeen Dir to Becaco Dir	20	1,270	906		1,079,500							1.078.500
Beckton Dr. from Guthrie Rd to Gardner Wey	er West	220	900	850	137,000							187,000
Sardner Way, from Beckton to CHZMI-	MHILL Route	420	800		357,000							357,000
	Croterau Rids.							1		17,000,000		17,000,000
Forcement section, per CHZMHILL for: Croteau and Lazo)	forcemain relocation report					980	006	1100	368,000			968,000
forcemain section, per CH2MHILL for	cersain relocation report					200	-	****	210.000			
	emain refocation record	1150	1200		1,044,000	707	*	0000	418,000			1,044,000
	report	DAS.	1200	300	846,000							
	Tota				3,513,500			1	6,346,000	34,600,000		\$ 43,859,500
Shice Point Rd, from Tozer Rd to Hwy 19A	19.4					1,230	300	980	676,500			676.500
Hay 19A, from Shos Pant Rd to Ok Yake Rd	Yake Rd					1,730	300	980	961,500			951.500
Hwy 15A, from Old Yake Rd to the Tsal	sable Rivar					1 920	300	550	1,056,000			1,656,000
riev 194, from the Tsable River to Buc	cody Bay Rd					1,180	300	950	649,000			645,000
Hary 19A, from Buckly Bay Rd to Brean Rd						2840	300	990	1,562,000			1,562,000
19A, from Brean Rid to Seymour S	Roste 1					(A)	300	88	1,732,500			
	Total								8,627,500			\$ 6,627,500
Highway 19A, from Seymour St to Jone	ones St					1,790	Soo	750	1,342,500			1,342,500
fighway 19A, from Jones St to Van Wi	West Logging Rd.					1 520	5005	750	1,140,000			1,140,000
	Ad to invernees Rd.					2590	300	750	1,942,500			1,942,500
Sphery 19A, from inverness Rd to He	Herondale Rd.					1,140	300	750	365,000			855,000
	Garden Rd					1,900	200	750	1,425,000			1,425,000
lehmay 18A, from Garbey Rd. to Royston Rd future Pump station	ston Rd future Pump station					1,650	200	750	1,237,500			1,237,500
New Purp Station, Hwy 19A & Rotstor	ston Rd									000'000'6		9,000,000
Submarine Crossing to Jane Street						6,550	800	1500	6,825,000			6,825,000
	Total				2				14,767,500	900'000's		\$ 21,767,500
Plane Station at Constructed Welland	nd Treatment Facility				100			-	1	3,000,000		3,000,000
					4	1,100	375	550	900000			605,009
Royston Rd, Insert Intand Hay to BC Hydro ROW	Hydro ROW	1,900	009	009	1,140,000				•			1,140,000
aton Rd, BC Hydro ROW to Hwy 15A	Total	2,850	800	88	2.850.000			-	900 509	3 000 000		1,710,000
Santiogs Beach Pump Station										2,500,000		2,500,009
Saratiogs Beach to Kitty Doleman						6 6	300	8	5,197,500			6,197,500
oman Pump Slab						And proper	and)	-	and the s	4,000,000		4,600,000
Comman to Greenwood trunk	Total					10,000	0,5	200	12,694,000	6,500,000		3 19,194,000
			-		and on the							
		4,900	VARIOUS	900	2940,000							2,940,000
South ing of the Greenwood trunk to Pri Kniese Rd. Deletions in CFR county see	Princhard Rd.	1,100	200	8 8	495,000			-				1,037,500
Re/Re existing CFB pravity seem		2250	1200	900	2,025,000							2,925,000
Upgrade CFB comp station										2500,000		2,500,000
CAD Incenses				1	-	1,600	200	130	1,230,000			1,299,990
	Total				B,217,000		1	1	1,COULDON	lacurage?		10,217,590

OPTION 1A - ROUTE 5

Counternay PS G= 2.3 Jame St. PS G= 0.4 CFB PS Q= 0.48 Docidde PS G= 2.7

GRAVITY	Ultan	Rhand	Urban.	Rund	Utten	Rural	Urban	Rural
Size (mm)	375	375	909	009	900	900	1200	1200
Unit Rate	909	950	700	9009	920	750	1000	800
FORCEMAIN	Urban	Rural	Urban	Rural	Uther	Ruse	Listan	Rural
Scre (m)	3000375	300/375	909	800	906	900	1200	1200
Unit Rate	650	550	300	280	1200	1100	2600	1450

1	٠		T.						-				
Company 20 bits of sections (Section State Sta	Pipe Secti Reference Number	Descript	Length	Diameter	Unde Rade	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimated Construction Costs
Comment 2 by the first include 2 by the	0	-									17 000 000		17,000,000
Properties Pro		Courtenay PS to R. alone Drive Rd					2060	12001	(450	2,872,500			2 679 6
Select Ref. (see, Centrol S. B. Montrol A. B. Montrol S. B. Montrol A. B. Montrol S. B. Montrol A. B. Montrol S. B. B. B. B. B. B. B. B. B. B. B. B. B.	2	Through IR. Divise Rd to Roob Rd					200	1200	1650	725 000			725.000
Section 12 Sec	49	Robb Rd from IR to Condor St.				,	002	1200	1600	352,000			359 000
Section Comparison Compar	7	Robb Rd from Conder St to Anderbon Ave	800	1200	1000	900,000				-			000,000
Decided 15th 15th 15th 15th 15th 15th 15th 15th		Stable Rid from Andlaton Aus to Protector Rd	0823	1200	1000	1 380 000							0,000
	16	Deschared Got from Dobb DA to Referent Dos	987	1300	1000	000,000							000,000,1
Page 1970 Page		fo Crotseu							İ				400
Section Commence	1		099	1200	1000	860,000		Ī		,			000'098
Contained below of Contained B	00	roleau Rds							1		17,000,000		17,000,000
Common Methods of Colifornia Common Workshop on World Common Methods on World Common Methods Colifornia Common Methods Colifornia Common Methods Colifornia Common Methods Colifornia Co	di	усетай н					880	1200	1450	1276 000			1 276 000
Chart Notice State of Content Interest to Content and State of Contend and State of Content and State of Content and State of Content		1.8											
Contract State Cont	10	(Jane st to Croteau sump station)					380	375	288	209,000			209,000
State to be the first file that the file to the file	#	UMU.	1,180	1200	900	1,044,000			1				1,044,000
Section Columnic Res Description Columnic Res Columnic R	12	entain resocation report	340	1200	900	5,429,000			İ	5,534,500	34,000,000		\$ 44,954,500
Figure 1966 Part 1964 Pa													
Fig. 19, Action Part Par		Ships Point Rd. from Tozer Rd to Haw 19A.					1230	300	988	676,500			676,500
Here Table from the Section of the Table from the Table Ta	1	Hirry 19A, from Ships Point Rd to Old Yake Rd			Ī		1,730	300	88	981500			951,500
Hear Table Notes the Enderson Branch State		Hay 19A, from Old Yake Rd to the Tsable River					1 320	300	98	1,056,000			1,056,000
Heavy 15th from filed bits Riche Riche Riches 1 Total Heavy 15th from filed bits Riche Riches Riches 1 Total Heavy 15th from filed bits Riches Richts Riches Richts Richts Riches Riches Riches Rich		Hwy 19A, from the Teable River to Buckly Bay Rd.	Ī				1,180	300	250	649,000			649,000
Holemany 19th North Service at State Levine ST Total 1,500 1,5			Ī			I	2840	300	98	1,562,000			1,562,000
Hebrana 19th feet Sterrout St to Jeroes St 1 Hebrana 19th feet St to Van West Loogin Rd is Inversed Rd. Hebrana 19th feet Van West Loogin Rd is Inversed Rd. Hebrana 19th feet Van West Loogin Rd is Inversed Rd. Hebrana 19th feet Van West Loogin Rd is Inversed Rd. Hebrana 19th feet Van West Loogin Rd is Inversed Rd. Hebrana 19th feet Van West Loogin Rd is Inversed Rd. Hebrana 19th feet Van West Loogin Rd is Inversed Rd. Hebrana 19th feet Van West Loogin Rd is Inversed Rd. Hebrana 19th feet Van West Van Rd Inversed Rd. Hebrana 19th feet Van West Van Rd Inversed Rd. Hebrana 19th feet Van Van West Van Rd Inversed Rd. Hebrana 19th feet Van Van West Van Rd Inversed Rd. Hebrana 19th feet Van Van West Van Rd Inversed Rd. Hebrana 19th feet Van Van West Van Rd Inversed Rd. Hebrana 19th feet Van Van West Van Rd Inversed Rd. Hebrana 19th feet Van Van West Van Rd Inversed Rd. Hebrana 19th feet Van Van West Van Rd Inversed Rd. Hebrana 19th feet Van Van Van Van Van Van Van Van Van Van		occupation or noons o					97390		200	6.627.500			1,732,500
Houseany 19A, Non-Sermous St to Alones St Houseany 19A, Non-Sermous St to Alones St Houseany 19A, Non-Sermous St to Alones St Houseany 19A, Non-Sermous St to Alones St Houseany 19A, Non-Sermous St to Alones St Houseany 19A, Non-Sermous St to Alones St Housean 19A, Non-New Notes County Notes In Proceedings of the Processing St to Alones St t													
Housey 19th from Sector Rt in browning Rd		Hochway 19A, from Seymour St to Jones St.					1,790	2009	750	1,342,500			1,342,500
Herizere 19th Forn New West Loom Rid to Inversels Rid. Herizere 19th Vern Members Rid. Herizere 19th Vern Rid. Herizere 19th Vern Rid. Herizere 19th Vern Rid. Herizere 19th Vern Rid. Herizere 19th Vern Rid. Herizere 19th Ver		Highway 19A, from Jones St to Van West Losaing Rid.					1,520	200	750	1,140,000			1,140,000
Hughwar 19th from thefereas R4 to felterorinin R4 that intervation R4 than intervation		Rd. to inversess					2590	920	730	1,942,500			1,942,504
Highway 19th from Neurotide Rid to Gerifan Rid							1,140	200	730	955,000			855,000
Highway 15A, then Garlier Rd. in Roution Rd. filture Pump station 1500 500 770 1207-500		Highway 19A, from Herondale Rid to Garlley Rid					1,300	900	750	1,425,000			1,425,000
Name of Parts Station Horizontal Total Total 4,550 300 1,500 6,425,000 Submanive Chesking to dainer Street Total 1,500 600 1,140,000 1,175,200 1,175,200 CMYTE bishord laboral files with the RDM to Horizont Treatment Facility 1,500 600 1,140,000 1,140,000 465,000 Reption Rd, 8ct Hydro RDM to Hery 15A Total 2,250 600 1,140,000 375 465,000 Reption Rd, 8ct Hydro RDM to Hery 15A Total 2,250 600 1,140,000 375 465,000 Seatilities Beach Parie Station Seatilities Beach to With Collection Total 2,250 600 300 4,250,500 Seatilities of Beach Parie Station Total 2,250,000 300 455,000 455,000 Seatilities of Beach Parie Station Total 2,250,000 2,250,000 300 455,000 Seatilities of Beach Collection Total 2,250 455,000 300 455,000 Seatilities of Beach Collection Total 455,000 300 2,250,000		Hishway 19A, from Gardey Rd, to Royston Rd fisure Pump station					1,650	2005	750	1,237,500			1,237,500
Submervise Circlescing to James Street Total Total 1,500 1,5		New Pump Station. Hwy 19A & Rotston Rd									9,000,000		9,000,000
Purps Station at Constituted Welter Tinestreet Facility CWIT is shared leaven from the Constituted Welter Tinestreet Facility 1,500 600 1,1140,000 1,140,0		marine Crossing to Jane Street					4,550	900	1,500	6,825,000			6,825,000
Purpo Station at Constructed Weland Treatment Facility 1,500 600 1,140,000 375 459 600 600 1,140,000 1,140,0		Total								14,767,500	8,000,000		1 23,767,500
Surface Beach Parts Station Surface Beach Parts Station Associated Beach Parts Station Asso	2.5	Treath			Ī	4					3,000,000		3,000,000
Region Rd, third bland liver to BC Hydra ROW b. Hay 19th 1,500 600 1,1140,000 1,140,	22	CMTF to Inland Island Hwy				4	1,100	375	150	495,000			485,000
Surface Beach Pure Staten Total 2,000	23		1,900	9009		1,140,000							1,146,000
Tetal 1.00 VARIOUS 800 2.0450 300 450 4.020.500 1.00 1.00 1.00 1.00 1.00 1.00 1.00	57	13V	2007	3	1	2 845 600		T		205,000	7 000 000		1,710,00
Total To					1					-	analismatic		
9-450 300 450 4,282,600 1,200 1,50		Saratoga Beach Pump Station							4		2,500,000		2,560,000
Treed		Saratoga Beach to Kittly Coleman					9,450	300	450	4,252,500			4.252.500
Total													
Tetal 15000 VARIOUS 800 2.240,000 1500 1500 1500 1500 1500 1500 1500		erran Pump Sta					100 63	1	400	2000000	4,000,000		4,000,000
A 5500 VARROUS 600 2.546,000 A 5250 375 450,000 2.500 1,200 300 2,005,000 - 1,600 1,200 300 2,005,000 - 1,600 1,400 2,200,000		FIRST SO LATES MODES STATES			1		Paris.	-	3	on ver you	6.600.000		6,155,20
4,900 VARBOUS 800 2.540,000 Princhesi R.B. 2,350 375 465 1,657,500 - Princhesi R.B. 1,100 375 450,000 - - 2,250 1,200 300 2,005,000 - - 1,600 1,450 2,200,000										O CONTRACTOR OF THE PARTY OF TH	Tanahanahan Indonesia		al alaman
Principal Public 2350 375 450 1457.500		Geenwood trunk. (North)	4,900	VARIOUS	009	2540,000							2,940,000
Yeemer 1,100 375 450 455,000			2,350	375	450	1,067,500				1			1,057,500
2,500 1,200 300 2,005,000		20	1,100	375	150	495,000			1				465,000
1,600 1,200 1,450 2,320,000		Refine existing CFB grantly sever	2250	1200	900	2,025,000			1		OT ALTO		2,025,000
Social Social Social		Usprade CFB pump station					1 600	4 200	1,450	2330,000	2,500,000		2,500,000
Total					1	E 657 500	Control of the Contro	-		2 325 000	4 624 564		boolester.

OPTION 2 - ROUTE 1

Courtenay PS Q= 1.13 Jane St. PS Q= 0.4 CFB PS Q= 1.51 Dooldde PS Q= 1.56

Southern PS Q= 1.16

V 1 III 1										
GRAVITY	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Size (mm)	375	375	600	600			900	900	1200	1200
Unit Rate	500	450	700	600			850	750	1000	900
FORCEMAIN	Urban	Rural	Urban	Rural	Urban	Rusi	Urban	Rural	Litten	Rural
Size (mm)	375	375	500	500	750	750	900	900	1200	1200
Unit Rate	650	550	900	750	1000	900	1200	1100	1600	1450

				Gravity	Sewers			Pressu	re Sewers				
Route Option lumber	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Clameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimate Construction Co
	. 0	New Courtenay River Pump Station									17,000,000		17,000,
	1	Courtenay PS to Back Rd, through Section 9					1,200	750	900	1,080,000			1,080,
	2	Plan 35006, from Back Rd to Sheraton Rd.					690	750	900	621,000			621,
	3	Sheraton Rd, from Plan 35008 to McDonald Rd.				-	750	750	900	675,000			675,
e u	4	McDonald Rd, from Sheraton Rd to Hector Rd					800	750	900	720,000			720,
dylde	5	Through Plan 60685 to Aspen Rd.	150	900	750	112,500							112,
	6	Aspen Rd to Idlens Way	400	900		300,000							300,
McDone	7	Idiens Way to Connection Point	60	900		45,000							45/
	. 8	South leg of the Greenwood trunk to Pritchard Rd.	2,350	900		1,762,500							1,762
Route 1	9	Knight Rd, Pritchard to CFB gravity sewer	1,100	1,200	-	990,000		0 = 1					990,
Roc	10	Re/Re existing CFB gravity sewer	2.250	1,200		3.262.500							3,262
9	11	Upgrade CFB pump station			7.50						5,000,000		5,000,
Servicing	12	Two CFB forcemain					1,600	900	1,100	1,760,000	0,000,000		1,760,
an m	13	Upgrade Jane St Pump Station							1,100	11.100,000	1,000,000		1,000,0
Core Area	14	Forcemain section, per CH2MHLL forcemain relocation report (Croteau and Lazo)					880	375	550	484,000	7,000,040		484,0
2	15	Forcemain section, per CH2MHILL forcemain relocation report (Jane st to Croteau pump station)					380	375		209,000			209,
	16	Gravity section, per CH2MHILL forcemain relocation report.	1,160	600	600	696,000				-			696,
	17	Inverted siphon, per CH2MHILL forcemain relocation report	940	600	600	564,000							564,8
		Total				7,732,500				5,549,000	23,000,000		\$ 36,281,
		Ships Point Rid, from Tozer Rid to Hwy 19A					1,230	300	550	676,500			678,1
<							1,730	300					The second
Point / Area		Hwy 19A, from Ships Point Rd to Old Yake Rd.				-		-		951,500			951,5
2		Hwy 19A, from Old Yake Rd to the Tsable River					1,920	300		1,056,000			1,056,0
Polr		Hwy 19A, from the Tsable River to Buckly Bay Rd.					1,180	300		649,000			649,0
Ships	-	Hwy 19A, from Buckly Bay Rd to Brean Rd			-		2,840	300		1,562,000			1,562,0
to to		Hwy 19A, from Brean Rd to Seymour St (Terminus of Route 1) Total					3,150	300	550	1,732,500 6,627,500			\$ 6,627,5
										53-50 (1113)	-	-	1
		Highway 1SA, from Seymour St to Jones St					1,790	500	750	1,342,500	J. Link		1,342,6
		Highway 19A, from Jones St to Van West Logging Rd.					1,520	500	750	1,140,000			1,140,0
0		Highway 19A, from Van West Loggin Rd. to Inverness Rd.					2,590	500	750	1,942,500			1,942,5
UBID/R:D		Highway 19A, from Inverness Rd. to Herondale Rd.					1,140	500	750	855,000			855,0
185		Highway 19A, from Herondale Rd to Gartley Rd.			-		1,900	500	750	1,425,000			1,425,0
		Highway 19A, from Gertley Rd. to Southern Treatment Plant (assumed to be at the intersection of Royston Rd and Hwy 19A					1,650	500	750	1,237,500			1,237,
_		Total								7,942,500	- 1		\$ 7,942,
. 1	21	Pump Station at Constructed Welland Treatment Facility				- 1					3,000,000		3,000,0
land	2.2	CWTF to thland Island Hwy					1,100	375	550	605,800			605,0
pe	2.3	Royston Rd, Inland Island Hwy to BC Hydro ROW	1,900	800	600	1,140,000							1,140,0
Cum	2.4	Royston Rd, BC Hydro ROW to Hwy 19A	2,850	600		1,710,000							1,710,0
-		Total				2,850,000				605,000	3,000,000		\$ 8,455,0
5													1
as North													
g Areas													
Outlying													
O		Total									1		
Сотой													
CFB		Greenwood trunk (North)	4900	VARIOUS	60.0	2,940,000		_					\$ 2,940,
Ö	3	Greenwood trunk. (North)	4900	VARIOUS	500	2,940,000	_						\$

OPTION 2 - ROUTE 2

Courtenay PS Q= 1.13 Jane St PS Q= 0.4 CFB PS Q= 0.48 Doctiddle PS Q= 1.53

Southern PS Q= 1,16

011										
GRAVITY	Urban	Rural	Urban	Rural	Lirban	Rural	Urban	Rural	Urban	Rural
Size (mm)	375	375	600	600			900	900	1200	1200
Linit Rate	500	450	700	600			850	750	1000	900
FORCEMAIN	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Sze (mm)	375	375	500	500	750	750	900	900	1200	1200
Unit Rate	650	550	900	750	1000	900	1200	1100	1600	1450

				Gravity	Sewers			Pressu	re Sewers				
Route Option lumber	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimate Construction Co
	0	New Courtenay River Pump Station									17,000,000		17,000,0
	1	Dyke Rd, from Courtenay PS to Comox Ave at Redelic St.				-	3,330	750	900	2,997,000			2,997,0
Ave	2	Rodello St, from Comax Ave to Beaufort Ave.					60	750	1,000	80,000			80,0
Beaufort	3	Beautort Ave, from Rodelio St to Ellis St.				14	725	750	1,000	725,000			725,0
8	A	Beaufort Ave, from Ellis St. to Stuart St.				-	790	750	1,000	790,000			790,0
Ń	5	Stewart St, from Beaufort St. to Comox Ave.					80	750	1,000	80,000			80,0
	6	Comax Aire, from Stewart to end of Comax Aire.			5-1	-	610	750	1,000	610,000			610,0
Route	7	End of Comox Ave to Croteau				-	220	750	1,000	220,000			220,0
guio	8	New pump station at Dociddle and Croteau Rds.						-			17,000,000		17,000,0
Serv	9	Forcertain section, per CH2MHILL forcemain relocation report (Croteau and Laze)					880	900	1,100	968,000			968,0
re Area	10	Forcemain section, per CH2MHILL forcemain relocation report (Jame st to Croteau pump station)				-	380	375	550	209,000			209,
000	17	Gravity section, per CH2MHILL forcemain relocation report	1,160	1,200	900	1,044,600							1,044,0
	12	Inverted siphon, per CH2MHILL forcemain relocation report	940	1,200	900	846,000							846,0
		Total				1,890,000				6,679,000	34,000,000		\$ 42,569,0
		MORE TO SERVICE THE SERVICE TH			_		7001	- 32		- T			
<		Ships Point Rd, from Tozer Rd to Hwy 19A					1,230	250		676,500			676,5
Area		Hwy 19A, from Ships Point Rd to Old Yake Rd.					1,730	250	-	951,500			951,5
3		Hwy 19A, from Old Yake Rd to the Tsable River					1,920	300		1,056,000			1,056,0
Paint		Hwy 18A, from the Tsable River to Buckly Bay Rd.					1,180	300	550	649,000			649,0
Ships		Hwy 19A, from Buckly Bay Rd to Brean Rd					2,840	300		1,562,000			1,562,0
5		Hwy 19A, from Brean Rd to Seymour St (Terminus of Route 1)					3,150	300	550	1,732,500			1,732,5
		Total								6,627,500	-		\$ 6,627,5
_			-				1,790	450	750				_
		Highway 19A, from Seymour St to Jones St				-				1,342,500			1,242,5
		Highway 19A, from Jones St to Van West Logging Rd.				-	1,520	450	750	1,140,000			1,140,0
UBIDIRED	_	Highway 19A, from Van West Loggin Rd. to Inverness Rd.				-	2,580	450		1,942,500			1,942,5
9		Highway 19A, from inverness Rd. to Herondale Rd.				-	1,140	450		855,000			855,0
3		Highway 19A, from Herondale Rd to Gartley Rd.				-	1,900	500	750	1,425,000			1,425,0
		Highway 19A, from Garbey Rd, to Southern Treatment Plant (assumed to be at the intersection of Royaton Rd and Hwy 19A					1,650	500	750	1,237,500			1,237,5
		Total				*				7,942,500			\$ 7,942,5
70'	2.1	Pump Station at Constructed Welland Treatment Facility				-				-	3,000,000		3,000,
9	2.2	CWTF to Inland Island Hwy		- 1			1,100	375	550	605,000			605,
de de	2.3	Royston Rd, Inland Island Hwy to BC Hydro ROW	1,900	600	600	1,140,000				+			1,140,
Ser.	24	Royston Rd, BC Hydro ROW to Hwy 19A	2,850	600	600	1,710,000				-			1,710,
		Total				2,850,000				605,000	3,000,000		\$ 6,455,6
6													1
North	-												
Aross													
									-				
Outhing		Total				-				*			
													_
		Greenwood trunk (North)	4,900	-	600	2,940,000		-			-		2,940,
×		South leg of the Greenwood trunk to Pritchard Rd.	2,350	375	450	1,057,500				-	-		1,057,
Come		Knight Rd, Pritchard to CFB gravity sewer	1,100	375	450	495,000		-	_	-			495,
0		Re/Re existing CFB gravity sewer	2,250	1,200	900	2,025,000		_		-	- 1		2,025,
		Upgrade CFB pump station					-				2,500,000		2,500,0
CFB		Twin CFB forcemain				*	1,600	500	750	1,200,000			1,200,
CFE						Substitute Western					10x 12x mm - 12x m		
CFB		Total				6,517,500				1,200,000	2,600,000		10,217.

OPTION 2-ROUTE 3

Courtenay PS Q= 1.13

Jane St PS Q= 0.4

CFS PS Q= 1.61

Dockiddle PS Q= 0

Southern PS Q= 1.16

TL J										
GRAVITY	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Size (mm)	375	375	600	600			900	900	1200	1200
Unit Rate	500	450	700	600			850	750	1000	900
FORCEMAIN	Urben	Rural	Urban	Rural	Urban	Rural	Urban	Rosal	Urban	Rural
Size (mm)	375	375	500	500	750	750	900	960	1200	1200
Unit Rate	650	550	900	750	1000	900	1200	1100	1600	1450

1 Comoxi 2 http://www.initiation.com/initiation.com			Gravit	Sewers			Pressu	re Sewers				
1 Cornex 2 HAVY 19 3 Headqu 4 Variet C 5 Veterari 5 Through 6 Through 7 Through 9 ReRe e 10 Upgrade 11 Two CF 12 Upgrade 13 Two CF 14 Croteau 15 Gravity e 16 through 16 through 17 Two CF 18 Two CF 19 Have	e Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimated Construction Cos
2 HWY 19 3 Headqu 4 Vaniet C 5 Vetarani 6 Through 6 Through 7 Through 8 Greenet 9 ReiRa e 10 Upgrade 11 Upgrade 12 Upgrade 13 Twin CF 14 Croteau 15 Gravity a 16 muinted 17 Through 18 Hey 194 19 Hey	New Courtenay River Pump Station									17,000,000		17,000,00
3 Headquilder Vanier B Vaterani 4 Vanier B Veterani 5 Veterani 6 Through 7 Through 7 Through 9 ReiRe e 10 Upgrade 11 Upgrade 11 Upgrade 11 Upgrade 11 Upgrade 11 Upgrade 11 Upgrade 11 Upgrade 12 Upgrade 14 Facerni 14 Croteau 15 Grantly 16 meethed 16 meethed 16 meethed 16 Meet	Comox Rd, from Courtenay PS to HWV 19A				12	1,500	.750	1,000	1,500,000			1,500,00
4 Vanier II 5 Vetaran's 5 Vetaran's 6 Through 7 Through 9 ReiRe e 10 Upgrade 11 Two CP 12 Upgrade 13 Two CP 14 Croesau 15 Granty e 16 twerted Vessylvanier in the common co	HWY 19A, from Comox Rd. to Headquarters Rd.				-	850	750	1,000	850,000			850,00
S Vetarani Through	Headquarters Rd, from HWY 19A to Varier Dr.				- 4	1,480	750	900	1,332,000			1,332,00
Ships Pt Shi	Vanier Dr., from Headquarters Rd. to HWY 19A					1,160	750	900	1,044,000			1,044,00
9 ReiRa e 10 Upgrade 11 Twin CF 12 Upgrade 13 Twin CF 14 Upgrade 15 Granty a 16 towarted 16 towarted 16 towarted 17 Granty a 18 Hey 194 194 Hey 194 195 Hey 194 19						522		-	199000			
9 ReiRa e 10 Upgrade 11 Twin CF 12 Upgrade 13 Twin CF 14 Upgrade 15 Granty a 16 towarted 16 towarted 16 towarted 17 Granty a 18 Hey 194 194 Hey 194 195 Hey 194 19	Veteran's Memorial Parkway, from HWY 19A to DD 12576-N (Block /1)				-	1,170	750 750	900	903,000			603,00
9 ReiRa e 10 Upgrade 11 Twin CF 12 Upgrade 13 Twin CF 14 Upgrade 15 Granty a 16 towarted 16 towarted 16 towarted 17 Granty a 18 Hey 194 194 Hey 194 195 Hey 194 19	Through DD 12676-N to Block 71				-	1,350	750	900	1,053,000			1,053,00
9 ReiRa e 10 Upgrade 11 Twin CF 12 Upgrade 13 Twin CF 14 Upgrade 15 Granty a 16 towarted 16 towarted 16 towarted 17 Granty a 18 Hey 194 194 Hey 194 195 Hey 194 19	Through Block 71 to Greenwood trunk	5,600	1,200	900	5,040,000	1,330	/50	900	1,215,000		_	1,215,00
Shop Process 13 Faccami and Lab Faccami 14 Croteau 15 Granty 4 16 Inverted Ships Pr 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14ghway 14ghwa	Greenwood trunk	2,250			2,025,000				- 1			5,040,00
Shop Process 13 Faccami and Lab Faccami 14 Croteau 15 Granty 4 16 Inverted Ships Pr 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14wy 154 14ghway 14ghwa	RelRa existing CFB gravity sewer	2,230	1,200	300	2,029,000				-	0.500.000		2,025,00
Shop Process 13 Faccami and Lab Faccami 14 Croteau 15 Granty 16 mounted 16 mounted 18 Ships Pr 18 19 19 19 19 19 19 19 19 19 19 19 19 19	Upgrade CFB pump station Two-CFB forcemain			-		1,600	1,200	1,450		2,500,000		2,500,000
Shop Process 13 Faccami and Lab Faccami 14 Croteau 15 Granty 16 mounted 16 mounted 18 Ships Pr 18 19 19 19 19 19 19 19 19 19 19 19 19 19					-	1,600	1,200	1,400	2,320,600			2,320,000
Ships Pr Shi	Upgrade Jane Street Pump Station Forcemain section, per CH2MHILL forcemain relocation report (Croteau and Land)					880	375	550	484,000	1,000,000		1,000,00
Ships Pic Ships Pic Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Hwy 194 Highway	Forcemain section, per CH2MHILL forcemain relocation report (Jane st to Croteau plane station)					380	375	550	209,000			209,00
Ships Pt Ships Pt Hey 194 H	Gravity section, per CH2MHILL forcemain relocation report	1,160	600	600	696,000				-			696,00
Hey 194 Hey 19	inverted sphon, per CH2MHILL forcemain relocation report	940	600	600	564,000				*			564,00
Hey 194 Hey 19	Total				8,325,000				10,510,000	29,500,000		\$ 39,435,000
Hey 194 Hey 19							-					
Hey 154 Hey 15	Ships Point Rd, from Tozer Rd to Hwy 19A					1,230		-	676,500			676,50
Hey 154 Hey 15	Hwy 19A, from Ships Point Rd to Old Yake Rd.					1,730	250		951,500			951,50
Hey 154 Hey 154 Hey 154 Hey 154 Highway Highwa	Hwy 19A, from Old Yake Rd to the Tsable River				_	1,920	300	550	1,056,000			1,056,00
Hey 154 Hey 154 Hey 154 Hey 154 Highway Highwa	Hwy 19A, from the Tsable River to Buckly Bsy Rd			-		1,180	300	-	649,000			649,000
DECOME PORT	Hwy 19A, from Buckly Bay Rd to Brean Rd					2,840	300	550	1,562,000			1,562,000
DE COMPT IN THE PROPERTY OF TH	Hwy 19A, from Brean Rd to Seymour St (Terminus of Route 1) Total					3,150	300	550	1,732,500 6,627,500		_	1,732,500
DE COMPT IN THE PROPERTY OF TH	1000								0,027,000			1 8,027,390
DE Highway Highway Highway Highway Highway De at the second De Sec	Highway 19A, from Seymour St to Jones St					1,790	450	750	1,342,500			1,342,50
DE Highway Highway Highway Highway Highway De at the second De Sec	Highway 19A, from Jones St to Van West Logging Rd.					1,520	450	750	1,140,000			1,140,000
Highway Highwa	Highway 19A, from Van West Loggin Rd. to Inverness Rd.					2,590	450	750	1,942,500			1,942,500
Pump St 22 CWFF to 2.3 Royston 2.4 Royston	Highway 19A, from inverness Rd. to Herondale Rd.					1,140	450		855,000			855,000
Pump St 22 CWFF to 2.3 Reyston 2.4 Reyston	Highway 19A, from Herondale Rd to Gartley Rd.					1,900	500	100	1,425,000			1,425,000
22 CWTF to 2.3 Reyston 2.4 Royston	Highway 19A, from Gartley Rd. to Southern Treatment Plant (assumed to be at the intersection of Royston Rd and Hwy 19A					1,650	500		1,237,500			1,237,500
22 CWTF to 23 Reyston 2.4 Royston	Total				4				7,942,500			\$ 7,942,50
22 CWTF to 23 Reyston 2.4 Royston		-										1
2.3 Royston 2.4 Royston	Pump Station at Constructed Wedland Treatment Facility					220			*	3,000,000		3,000,00
2.4 Royston	CWTF to Inland Island Hwy	1112	1000	-		1,100	375	550	605,000			605,00
No.	Royston Rd, Inland Island Hwy to BC Hydro ROW	1,900	600		1,140,000			-				1,140,00
Outlying Areas North	Royston Rd, BC Hydro ROW to Hwy 19A. Total	2,850	600	600	1,710,000	_		-	605,000	3,000,000		1,710,00
Outlying Areas North	1968				2,000,000				505,000	3,000,000		19 6,430,000
Outlying Areas No					- 1		3					
Outlying Area												
/ Buylano												
Vano												
O I												
	Total		_		Y		-		*	•		1
v	South leg of the Greenwood brunk to Pritchard Rd.	2,350	375	450	1,057,500				7.2			1,057,50
	Knight Rd. Pritchard to CFS gravity sewer	1,100			495,000							495,00
0 0	Total	- 2/3		- 1	1,552,500							\$ 1,552,500

OPTION 2 - ROUTE 4

Courtenay PS Q= 1.13

Jame St. PS Q= 0.4

CFB PS Q= 0.48

Docliddle PS Q= 0

Southern PS Q= 1.16

OIL 4										
GRAVITY	Urban	Rural	Urban	Runal	Urban	Rural	Urban	Rural	Urban	Rural
Size (mm)	375	375	600	600			900	900	1200	1200
Unit Rate	500	450	700	600			850	750	1000	900
FORCEMAIN	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Size (mm)	375	375	500	500	750	750	900	900	1200	1200
Unit Rate	650	550	900	750	1000	900	1200	1100	1600	1450

				Gravity	Sewers			Pressu	ure Sewers				
Route Option Number	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimate Construction Co
	.0.	New Courlenay River Pump Station									17,000,000		17,000,0
	1	Courteray PS to McDonald at Back Rd, through ALR				+	1,700	750	900	1,530,000			1,530,0
	2	McDonald Rd, from Back Rd to Guthrie Rd.					900	750	900	810,000			810,0
20	3	Guthrie Rd, from McDonald Rd to Anderton Rd.					1,100	750	1,000	1,100,000			1,100,0
Pue	4	Guthrie Rd, from Anderton Rd to Pritchard Rd.				-	1,270	750	1,000	1,270,000			1,270,0
Quen	S	Guthrie Rd from Pritchard Rd to Skeen Dr.				-	250	750	1,000	250,000			250,0
	6	Guthrie Rd, from Skeen Dr to Beckton Dr.	1,270	900	850	1,079,500				-			1,079,5
Route 6	7	Seckton Dr. from Guthrie Rd to Gardner Way	220	900	850	187,000				-			187,0
8	8	Gardner Way, from Beckton to CH2MHILL Route	420	900	850	357,000				-			357,0
Servicing	9	Upgrade Jane Street Pump Station	_			-				-	1,000,000		1,000,0
Arna Ser	10	Forcemain section, per CH2MHSLL forcemain relocation report (Groteau and Lazo)				-	880	375	550	484,000			484,0
4	-11	Forcemain section, per CH2MHILL forcemain relocation report (Jane st to Croteau pump station)					380	375	550	209.000			209,0
Core	12.	Gravity section, per CH2MHILL forcemain relocation report	1,160	600	600	696,000		2.0		200,000			696,0
	13	Inverted sighan, per CH2MHLL forcemain relocation report	940	600		564,000				(4)			564,0
		Total				2,883,500				5,653,000	18,000,000		\$ 26,536,5
<		Ships Point Rd, from Tozer Rd to Hwy 19A		_		-	1,230	250	550	676,500			576,5
Area		Hwy 19A, from Ships Point Rd to Old Yake Rd.			-	-	1,730	250	550	951,500			951,5
4	_	Hwy 19A, from Old Yake Rd to the Tsable River			_		1,920	300	550	1,056,000			1,055,0
Point)		Hwy 19A, from the Tsable River to Buckly Bay Rd.				-	1,180	300	550	649,000			649,0
Ships		Hwy 19A, from Buckly Bay Rd to Brean Rd					2,840	300	550	1,562,000			1,562,0
20		Hwy 19A, from Brean Rd to Seymour St (Terminus of Route 1)			-		3,150	300	550	1,732,500			1,732,5
_	_	Total			-	-				6,627,500	*		\$ 6,627,5
		Highway 19A, from Seymour St to Jones St					1,790	450	750	1,342,500			1,342,50
		Highway 19A, from Jones St to Van West Logging Rd.					1,520	450	750	1,140,000			1,140,0
		Highway 19A, from Van West Laggin Rd. to Inverness Rd.					2,590	450	750	1,942,500			1,942,5
JUL 1		Highway 19A, from inverness Rd, to Herondale Rd.					1,140	450	750	855,000			855,0
UBIDARIO		Highway 19A, from Herondale Rd to Gartley Rd					1,900	500	750	1,425,000			1,425,0
-		Highway 19A, from Gartley Rd. to Southern Treatment Plant (assumed to be at the intersection of Royston Rd and Hwy 19A					1,650	500	750	1,237,500			1,237,5
		Total				7		-		7,942,600			\$ 7,942,5
_		6 20 10 1 10 10 10 10 10 10 10 10 10 10 10						-				_	1 222
5	21	Pump Station at Constructed Wetland Treatment Facility					1,100	375	375	412,500	3,000,000		3,000,0
oerte	23	CWTF to Inland Island Hwy Reyston Rd, Inland Island Hwy to BC Hydro ROW	1,900	600	600	1,140,000	1,100	310	3/3	412,500			412,5
Oumberland	2.4	Royston Rd, BC Hydro ROW to Hey 19A	2,850	600	800	1,710,000							1,140,0
0	24	Total	2,000		000	2,850,000				412,500	3,000,000		\$ 6,262,5
North								_					
Areas 1						-							-
Are									-			_	-
Bul					-			-					-
Outhing		Total									-		
		Greenwood tunk (North)	4,900		600	2,940,000							2,940,0
×		South leg of the Greenwood trunk to Pritchard Rd.	2,350	375	450	1,057,500				, =			1,057,5
Como		Knight Rd, Pritchard to CFB gravity sever	1,100	375	450	495,000				-			495,0
CFBC		Re/Re existing CFB gravity sewer	2,250	1,200	900	2,025,000				14			2,025,0
75		Upgrade CFB pump station					4.000	200	600	200,000	2,500,000		2,500,0
-		Twin CFB forcemain				*	1,600	500	500	600,000			800,0
		Total				6,517,500		1	- 1	800,000	2,500,000		\$ 9,817,5

OPTION 2 - ROUTE 5

Courtenay PS Q= 1.13 Jane St PS Q= 0.4 CFB PS Q= 0.5 Dodddde PS Q= 1.56 Southern PS Q= 1.16

0120										
GRAVITY	Urban	Rural	Urban	Rural	Urban	Rutal	Urban	Rural	Urban	Rural
Size (mm)	375	375	600	600			900	900	1200	1200
Unit Rate	500	450	700	600			850	750	1000	900
FORCEMAIN	Urban	Rural	Urban.	Runal	Urban	Rural	Urban	Rural	Urban	Rural
Size (mm)	37.5	375	500	500	750	750	900	900	1200	1200
Unit Rate	653	550	900	750	1000	900	1200	1100	1600	1450

				Gravit	Sowers			Pressu	re Sewers				
Route Option lumber	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs		otal Estimate Instruction Co
	6	New Courtenay River Pump Station									17,000,000		17,000,0
	1	Courtenay PS to IR, along Dyke Rd					2,050	750	900	1,845,000			1,845,0
	2	Through IR, Dyke Rd to Robb Rd.				:+	500	750	900	450,000			450,0
20	3	Rubb Rd, from IR to Condor St.					220	750	1,000	220,000			220,0
Robb	-4	Robb Rd, from Condor St. to Anderton Ave.	800	900	850	680,000							680,0
	- 5	Robb Rd, from Anderton Ave to Pritchard Rd.	1,380	900	850	1,173,000				-			1,173,0
5	5	Prichard Rd, from Robb Rd to Balmoral Ave.	490	900	850	416,500							416,5
Route			2.1										
D.		Balmoral Ave, from Pritchard St to Croteau, to Croteau pump station.	860	900	850	731,000		_		- 4			731,0
Service	8	New pump station at Docliddle and Croteau Rds.									17,000,000		17,000,0
	9	Forcemain section, per CH2MHILL forcemain relocation report (Croteau and Lazo)				-	880	900	1,100	968,000			968,0
Area		Forcemain section, per CH2MHILL forcemain relocation report (Jane st to				-	0.0	300	1,169	300,000			394,01
Corp	10	Croteau purno station)					380	900	1,100	415,000			418,00
0	11	Grawty section, per CH2MHILL forcemain relocation report	1,160	1,200	900	1,044,000		-					1,044,00
	12	Inverted siphon, per CHZMHILL forcemain relocation report	940	1,200	900	846,000				%			846,0
		Total				4,890,500				3,901,000	34,000,000	\$	42,791,5
<	1	Ships Point Rd, from Tazer Rd to Hwy 19A					1,230	250	550	676,500			676,50
Area/	1 5	Hwy 19A, from Ships Point Rd to Old Yake Rd.					1,730	250	550	951,500			951,50
		Hwy 19A, from Old Yake Rd to the Tsable River					1,920		550	1,056,000			1,056,00
aint/		Hwy 19A, from the Tsable River to Buckly Bay Rd.					1,180		550	649,000			649,00
ps p		Hwy 19A, from Buckly Bay Rd to Brean Rd					2.840	300	550	1,562,000			1,562,00
Ship		Hwy 19A, from Brean Rd to Seymour St (Terminus of Route 1)					3,150		550	1,732,500			1,732,5
92		Total				- 1				6,627,500			6,627,50
										.,,		1.	alast lab
		Highway 19A, from Seymour St to Jones St					1,790	450	750	1,342,500			1,342,50
		Highway 19A, from Jones St to Van West Logging Rd.					1,520	450	750	1,140,000			1,140,00
8		Highway 19A, from Van West Loggin Rd. to Inverness Rd.					2,590		750	1,942,500			1,942,50
JBIO/RID	1	Highway 19A, from inverness Rd. to Herondale Rd.					1,145	450	750	855,000			855,00
5		Highway 19A, from Herandale Rd to Gartley Rd.					1,900	500	750	1,425,000			1,425,00
	1	Highway 19A, from Gartley Rd. to Royston Rd future Pump station					1,650	500	750	1,237,500			1,237,50
		Total				-				7,942,500	-	3	7,942,50
10	2.1	Pump Station at Constructed Wetland Treatment Facility				-					3,000,000		3,000,0
e l	2.2	CWTF to Inland Island Hwy					1,100	375	550	605,000			605,0
ag.		Royston Rd, Inland Island Hwy to BC Hydro ROW	1,900	600	600	1,140,000							1,140,0
8	24	Royston Rid, BC Hydro ROW to Hwy 19A	2,850	600	500	1,710,000							1,710,0
		Total				2,850,000				505,000	3,000,000	\$	6,455,00
2 1				-					- 1-	- 1			_
North												-	
50.													
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ying													
Dutying		Total				-				-			
		Greenwood trunk (North)	4,900	VARIOUS	600	2,940,000							2,940,0
		South leg of the Greenwood trunk to Pritchard Rd.	2,350	375	450	1,057,500							1,057,5
omo		Knight Rd, Pritchard to CFB gravity sewer	1,100	375	450	495,000							495,0
8 Con		Relike existing CFB gravity sewer	2,250	1,200	900	2,025,000				-			2,025,0
CFB		Upgrade CFB pump station									2,500,000		2,500,00
		Twin CFB forcemain					1,600	1,200	1,450	2,320,000			2,320,00
		Total				6,517,500				2,320,000	2,500,000	S	11,337,50

OPTION 2A - ROUTE 1

7117	OF HON ZA - ROOTE	Ole 1											
		GRAVITY	Urban	Rura	Urban	Rumi	Urban	Rural	Urban	Rural	Urban	Rural	
tenay PS D= 1.13		Size (mm)	375	375	009	009			900	800	1200	1200	
e St. PS O		Unit Rate	300	989	200	9009			98	750	1000	006	
CFB PS Q= 1.61		FORCEMAIN	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rusi	Urban	Rusk	
Mode PS Q= 1.56	1.56	Size (mm)	375	175	2005	500	750	750	900	906	1200	1200	
harri PS Q= 1.16	1.16	Unit Rate	580	980	006	750	1000	300	1200	1100	1600	1450	3.0
				Gravity	Gravity Sewers			Pressu	Pressure Sewers				
Route Option Number	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Dameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimated Construction Costs
	0	New Couriency River Pump Station									17,000,000		17,000,000
		Courtenay PS to Back Rd, through Section 9				*	1,200	750	300	1,050,000			1,080,000
	.2	Plan 35008, from Back Rd to Sharaton Rd.				f	999	750	300	621,000			621,000
	6	Shieraton Rd, from Plan 36006 to McDonaid Rd.				•	750	750	800	875,000			675,000
sue	*	McDonald Rd, from Shanaton Rd to Hector Rd				,	900	750	900	720,000			720,000
ipi/P	57	Through Plan 60665 to Aspen Rid	150	006	750	112,500							112,500
lano	10	Aspen His to identi Way	400	8	082	300,000			Ī				350,000
GoM		Idens Way to Connection Point	2	8	05)	25,000			T	9			45,000
1-1	0 0	NAME OF THE AMERICAN PARTY OF THE PROPERTY OF THE PARTY O	4 100	1300	000	000,000			İ	,			1,762,500
eyno	0.	RARA addition CPB crash's teasure	2250	1,200	1.450	3,380,500							200,000
og Oc	11	Lograde CFB sumo station									\$ 000,000		5,000,000
(O)A	12	Twin CrB forcemain					1,600	900	1,100	1,780,000			1.750,000
16S E	52	Upgrade Jane St Pump Station									1,000,000		1,500,000
evA e	2	Forcemen section, per CP-QMHSL Sectionary relocation report (Oroteau and Lazo)					980	100	989	464 000			484 000
DOI		Forcemain section, per CH2MHILL forcemain relocation report (Jaine et to Crotasu											
	15					•	380	375	255	209,000			209,000
	16	Gravity section, per CHZMHILL tecemain relocation report	1,160	009	000	000'969		Ī		1			000'949
		Total				7,732,500				\$ 549 000	23.000.000		36 281 600
		Ships Point Rd, from Tozer Rd to Hey 19A					1,230	300	989	676,500			676,500
/ 00		Hwy 194, from Ships Point Rd to Old Yake Rd					1,730	300	986	961,500			951,500
WI		Hwy 194, from Old Yake Rid to the Tsable River					1,920	300	880	1,056,000			1,056,000
luine		Hwy 19A, from the Tasble River to Buckly Bay Rd.					1,180	300	980	649,000			849,000
sdj.		Hwy 199, from Buckly Bay Rd to Bream Rd			Ī		2,840	300	250	1,562,000			1,562,000
19		arus of Route 1)			1		3,350	300	288	1,722,500			
		1618			l					6,627,500			\$ 6,627,500
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0		creenwood gunk (value)	and a	2000000	200	None Common							AND THE PERSON NAMED IN

OPTION 2A - ROUTE 2

Counterup PS Q= 1.13
Jane SL PS Q= 0.4
CFB PS Q= 0.48
Declidate PS Q= 1.55
Southern PS Q= 1.16

GRAVITY	Urban	Rural	Urban	Rural	Urban	Hursi	Urban	Rural	Urban	Rural
Sign (mec)	37.6	375	009	009			900	900	1200	1200
Unit Rate	009	480	200	900			980	750	1000	006
FORCEMAIN	Urban	Rural	Uttan	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Size (min)	37.5	375	005	200	750	750	900	900	1200	1200
Unit Rate	989	989	900	750	1000	006	1200	1100	1800	1450

OPTION 2A - ROUTE 3

Countroy PS G= 113

Jers St. PS G= 0.4

Stockers

CR PS Q= 1.61

Stockers

Cookidate PS G= 0

Stockers PS G= 0

Stockers

Stockers

Stockers

Stockers

Stockers

Stockers

Stockers

Stockers

Stockers

SRAVITY	Lirban	Rural	Ueban	Rural	Urban	Rural	Urban	Rural	Urban	Stand
(mm)	375	375	009	909			900	900	1,200	1,200
Jett Rate	900	480	700	9009			950	750	1,000	900
FORCEMAIN	Litters	Rural	Urban	Rusi	Urban	Rural	Urban	Russ	Urban	Rural
(zo (mm)	375		800	200	750		900	9006	1,200	1,200
Unit Rates	089	260		750		800	1,290	1,100	1,600	1,450

				Gravity Se	Sewers	П		Press	ure Sewers				
Route Option Number	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimated Construction Costs
	0	New Courtenay Rivar Pump Station									17,000,000		17.000,000
		Comos Rd from Courteway PS to HWY 19A				•	1,500	750	1,000	1,500,000			1,500,060
	çu.	HWY 19A, from Cornax Rd. to Headquarters Rd.				.v.	860	750	1,000	850,000			850,000
	n	Headquarters Rid, from HWY 19A to Vanier Dr.				ik.	1,460	750	008	1,332,000			1,332,000
12	4	Varier Dr., from Headquarters Rd. to HWY 18A				*	1,160	357	008	1,044,000			1,044,000
уоо	50	Veteran's Menoral Parkway, from HWY 19A to DD 12675-N (Block 71)				*	670	18	98	603,000			603,000
10 - 1	10	Through DD 12575 N to Blook 71				*	1.170	25	006	1,053,000			1,053,000
e on	7	Through Block 71 to Greenwood trunk		100000		5	1,350	25	000	1,215,000			1,215,000
Ман	100	Greenwood trunk	2,600	1,200	300	5,540,000				-			5,040,000
Bujo	os.	RwiNe existing CFB grantly sewer	2,250	1,200	8	2,025,000				,			2,025,000
MAK	10	Upgrade CFB pump shaton									2,500,000		2,500,000
ig W	11	Twin CFB forceman				56	1,600	1,200	1,450	2,320,000			2,320,000
ezy	12	Upgrade Jane Street Pump Station				*					1,000,000		1,000,000
Gore	17	Fernamen saction, one CH2MHII forcemain relocation report (Croteau and Lazo)				4	960	522	099	254.000			404 000
		Forcemen section, per CH2MHILL forcemen relocation report (Jame st to Crotesu								1			200/204
	4.	pump station)				,	380	375	980	209,000			209,600
	15	man relocation	1,160	600	909	696,000				,			000'969
	16	Inverted sphon, per CH2MHILL forceman relocation report	340	800	909	384,000			1				
		ero.				ona'ere's				10,610,000	20,260,000		\$ 39,435,000
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naking													
0		Total				×			1		*		
XNU FI		South log of the Greenwood trunk to Philiphard Rd.	2,350	375	089	1,057,500							1,057,500
CE Cen				375	900	480,000			1				495,000
		1013				1,332,340							1,552,500
i i		· · · · · · · · · · · · · · · · · · ·				\$ 277.500°				10,610,000	400/0000		1 61.000.000
		A Controlled State of the Cont											

Ulban Rund Ulban Nu. 1,200 800 Rural 500 750 OPTION 2A - ROUTE 4
Courtway PS CH 1.13
Java St. PS CH 0.4
Java St. PS CH 0.4
June Rase
Dooldse PS CH 0.4
Southern PS CH 1.16
June Rase
June Rase
June Rase

				-									
Route Option Number	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimated Construction Costs
	a	New Courtecay River Pump Station									17,000,000		17,006,008
	+	Counterray PS to McDonald at Back Rd, through ALR				3	1,700		006	1,530,000			1,530,000
	2	McDonaid Rd, from Back Rd to Guthris Rd.				-1	98		800	310,000			310,000
ры	69	Guthrie Rd, from McDonald Rd to Anderton Rd.				1	1,100	25	1,000	1,100,000			1,100,000
oixb	4	Guthore Rd, from Anderton Rd to Pritchard Rd				*	1,270		1,000	1,270,000			1,270,000
ng -	so.	Gultrie Rd from Pritchard Rd to Steen Dr.				4	280		1,000	250,000			250,000
h es	0 1	Gulfrie Rd, from Skeen Or to Becklon Dr.	1,270		880	1,078,500				*			1,079,500
you	7	Decitor Lt, from Guffine Hd to Gardner Way	77	36		187,000			Ī				187,000
Bull	0	Gardner way, from section to Challenia, Rouse	450			2000/000				3.	1 444 444		357,000
plyte		control during places and a second during places							T		000,000,1		1,000,000
e any	10	Forcemen section, per CHOMPRL forcemen relocation report (Crotesu and Lato) Forcemen section, se CHOMPRL forcemen relocation renort (Jame 41 to Crotesu				1	989	375	088	484,000			484,000
8305	n	pump station)					380	375	989	209,000			209,800
0	12	Gravity section, per CH2MHILL forceman relocation report	1,160	800	009	696,000			Ī				000'969
	13	Inverted signion, per CHZMHILL forcement reaccebon report Total				2,833,500			Ī	5,653,000	18.000.000		\$ 26,536,500
North Cumberland UBIONRID Ships Point /		Total											
Sping Arens													
vio.		Total											
		Greenwood trunk (North)	4,900	VARIO		2,940,000							2,940,000
, 30		South leg of the Greenwood trunk to Prochard Rd.	2,350		057	1,067,500				,			1,057,500
amo;		Knight Rd. Pritchard to CFB gravity sewer	1,100			486,000			Ì				495,000
o Ba		ReRe acciting CFB grantly sewer	2250	1,200	1,200	2,700,000			T		on and one		2,700,000
0		Upgrade CFB pump station Twin CFB forcemain					1,600	300	200	800,000	7,300,000		2,500,000
		Total				7,152,500				200,000	2,500,000		\$ 10,492,500

OPTION 2A - ROUTE 5

Courtenay PS G= 1.13
Jane St. PS G= 0.4
CFB PS G= 0.8
Dockiddle PS G= 1.58
Southern PS G= 1.16

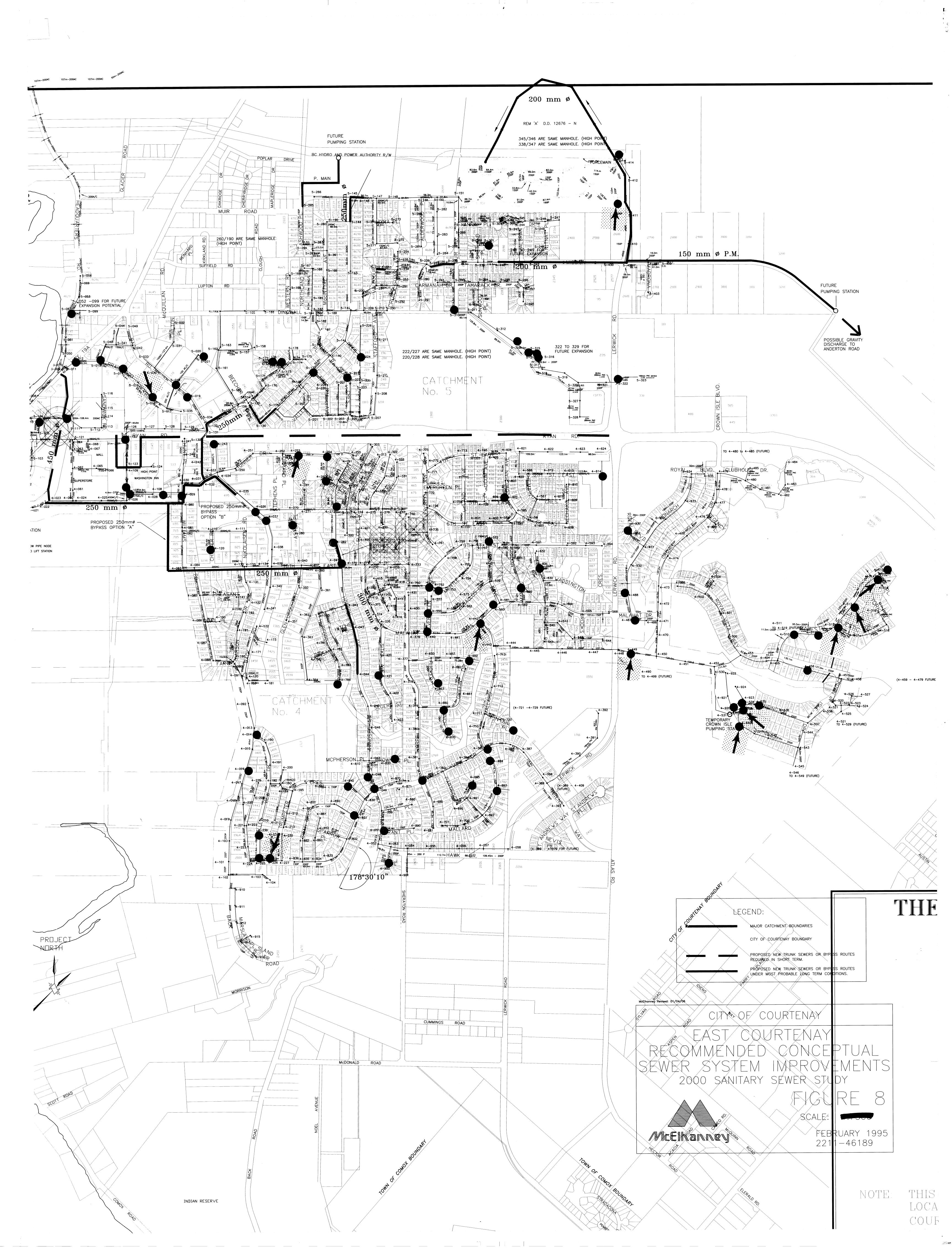
7123										
GRAVITY	Urban	Rural	Urban	Rural	Urban	Rurai	Urban	Rural	Urban	Rural
Size (mm)	375	375	600	600			900	900	1,200	1,200
Unit Rate	500	450	700	800			850	750	1,000	900
FORCEMAIN	Urban	Rural	Urban	Rural	Liriban	Rural	Urban	Rural	Urban	Rural
Size (mm)	375	375	500	500	750	750	900	900	1,200	1,200
Unit Rate	650	550	900	750	1.000	900	1.200	1,100	1.600	1.450

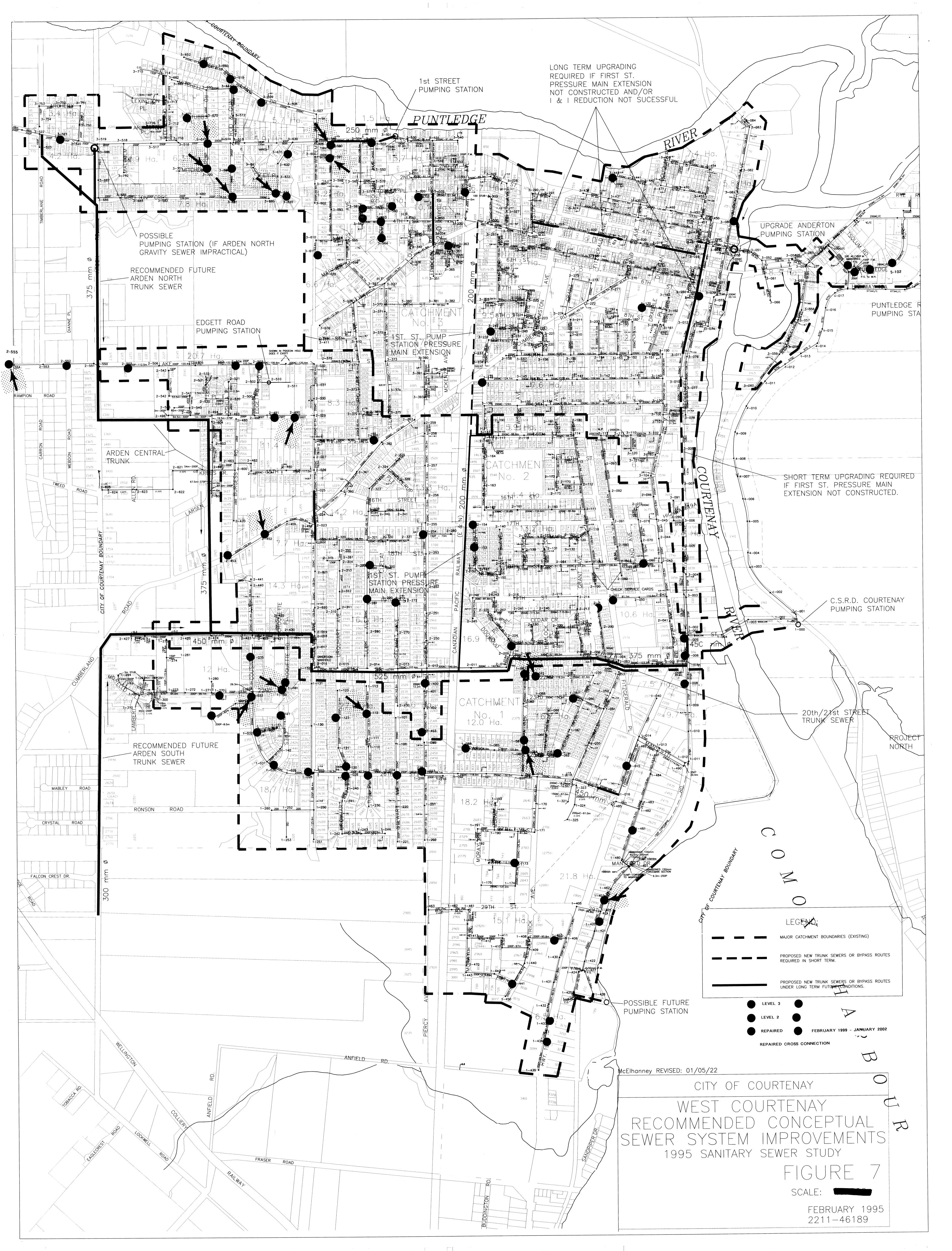
				Gravit	y Sewers			Press	ure Sewers				
Route Option sumber	Pipe Section Reference Number	Description	Length	Diameter	Unit Rate	Total Cost	Length	Diameter	Unit Rate	Total Cost	Pump Station Costs	Notes	Total Estimate Construction Co
	0	New Courtenay River Pump Station									17,000,000		17,000,0
		Courteray PS to IR, along Dyke Rd.				+	2,050	750	900	1,845,900			1,845.
	2	Through IR, Dyke Rd to Robb Rd.				-	500	750	900	450,000			450,
	3	Robb Rd, from IR to Condor St.				-	220	750	1,000	220,000			220,
	4	Robb Rd, from Condor St. to Anderton Ave.	800	900	850	680,000				-			680,
2	5	Robb Rd, from Anderton Ave to Pritchard Rd.	1,380	900	850	1,173,000							1,173,0
do	6	Prichard Rd, from Robb Rd to Selmoral Ave	490	900	850	416,500							416,
~	7	Balmoral Ave, from Pritchard St to Croteau, to Croteau pump station.	860	900	850	731,000				-			731,
g us	ā	New pump station at Dooliddle and Croteau Rds.									17,000,000		17,090,8
Option 5 - Robb Rd	9	Forcemain section, per CH2MHILL forcemain relocation report (Croteau and Lazo)				4	880	900	1,100	968,000			968,
	100	Forcemain section, per CH2MHILL forcemain relocation report (Jane st to Croteau					202	22.2	5.44				
		pump station)					380	900	1,100	418,000			418,0
		Gravity section, per CH2MHLL forcemain relocation report	1,160	1,200		1,044,000				-			1,044,0
	12	Inverted siphon, per CH2MHILL forcemain relocation report	940	1.200	900	846,000 4,890,500				+	41.00		846,0
		Total				4,890,500				3,901,000	34,000,000		\$ 42,791
V 98													
int / Ar			-										
Ships Point / Area													
io.		Total				- 1				-	-		5
						-							
0													
UBID/RID													
2													
		Total			-	-				+	-		1
rland													
Cumberland													
		Total									-		\$
£ 0													
2 200													
Outlying Areas North													
5		Total				1					-		6
		Greenwood trunk (North)	4,900	VARIOUS	600	2,940,000							2,940
		South leg of the Greenwood trunk to Pritchard Rd.	2,350	375	450	1,057,500				+			1,057
Comox		Knight Rd, Pritchard to CFB gravity sewer	1,100	375	450	495,000				-			495.
Co		Re/Re-existing CFB gravity sewer	2.250	1,200	900	2,025,000				_			2,025
CFB		Upgrade CFB pump station		1,2.44		-					2,500,000		2,500
-		Twin CFB forcemain				-	1,600	1,200	1,450	2,320,000			2,320,
		Total				5,517,500				2,320,000	2,500,000		\$ 11,337,



APPENDIX I

CITY OF COURTENAY I&I REDUCTION MAPPING







APPENDIX J

TOWN OF COMOX I&I REDUCTION LETTER



TOWN OF COMOX

File No.: 0360-20

5200-01

January 14, 2008

VIA FAX 334-4388

Mr. Graeme Faris
Director of Environmental Services
Comox-Strathcona Regional District,
600 Comox Road
Courtenay, B.C.
V9N 3P6

Dear Mr. Faris:

RE: TOWN OF COMOX INFLOW AND INFILTRATION PROGRAM

The following is a brief summary of the actions taken to date by the Town of Comox to help reduce inflow and infiltration (I&I):

- The Town of Comox initiated a cross connection control program throughout the summer and fall of 1996. This program consisted of "smoke testing" of all sanitary mains and services, with dye testing of those services which the above testing procedure could not definitively determine as satisfactory. This program resulted in a total of eight (8) cross connections being located, all of which were immediately repaired.
- The Town of Comox Subdivision and Development Specifications were updated in 1997 to require the use of inspection chambers on all new sanitary connections.
 This allows the Town of Comox building department to ensure the absence of crossconnections and that all private service laterals are watertight.
- In 1998, all sanitary manhole covers were equipped with carriage bolts to reduce inflow into the system. Sanitary manholes located in the foreshore have been inspected and sealed to ensure no inflow at these critical locations. This requirement forms part of the Town of Comox Subdivision and Services standard.
- In 1998 the Town of Comox instituted a program to address manhole infiltration. A survey of all sanitary manholes was conducted to categorize the severity of infiltration present. This program is conducted on an annual basis during the months of December through February while groundwater is at the highest level. From this, a schedule for repair is developed to ensure the most severe breaches in the system are dealt with. A total of one hundred and twenty nine (129) sanitary manholes were noted to require attention all of which were dealt with through the period of 1998 through to 2001.

- To date a total of 1,453m of sanitary main contained in 17 individual lengths have been subjected to cured-in-place sanitary sewer lining. A further 263m of sanitary main has been replaced through traditional open excavation methods. The Town of Comox has also completed interface grouting on 46 service laterals and "spot" repairs in four separate locations.
- In 2004, the Town of Comox Council formalized an annual budget of \$21,500 to fund an annual program of upgrades intended to reduce I&I. The same year general repairs to 18 sanitary manholes were completed.
- In 2005 the annual sanitary manhole inspection program resulted in a total of 16
 manholes receiving repairs to address I&I. This program also evidenced two cross
 connections in which residences were discharging storm water into the sanitary
 system. Both cross connections have since been dealt with.
- In 2005 the Town of Comox retained the services of McElhanney Consulting Services Ltd. (MCSL) to complete a comprehensive computer analysis of the sanitary sewer system. This study was submitted in April 2006 and included a recommendation calling for a detailed I&I study to identify and quantify areas most prone to contributing I&I to the system at large.
- In 2006 the Town of Comox retained the services of MCSL to institute an I&I study including flow monitoring for the purposes of meeting the above noted recommendation. Through this study it was determined that an area of Comox generally located in the Northwest quadrant is exhibiting inordinately high I&I flow rates. This area will be the target of a more detailed examination, including the use of "smoke testing", to determine the nature of this I&I and the most effective way to reduce its volume.
- In 2007 a total of 735m of poorly constructed sanitary main was replaced as part of a general road upgrade. This same year the annual manhole inspection program highlighted 11 sanitary manholes which received repairs to address I&I.
- Our current five year capital plan calls for a further 1,760m of sanitary main involving 6 separate projects, to be replaced or subjected to cured-in-place lining.

Should you have any further questions regarding the above, please do not hesitate to contact our office.

Glenn Westendorp

ours truly,

Public Works Superintendent

GW/II

cc: R. Kanigan

D. Jacquest

Jim Elliott - CVWPCC

08 I&I Review



APPENDIX K

OPTIONS FOR WASTEWATER TREATMENT

DAYTON & KNIGHT MEMORANDUM

MEMORANDUM

TO: Ian Whitehead, P.Eng.

McElhanney Consulting Services Ltd.

FROM: Al Gibb, Ph.D., P.Eng.

Dayton & Knight Ltd.

RE: Comox Valley Regional District Sanitary Sewerage Master Plan Update

Options for Wastewater Treatment

DATE: December 22, 2008

1.0 INTRODUCTION AND BACKGROUND

This Memorandum provides an outline of concept options for wastewater treatment in the Comox Valley Regional District. Only wastewater treatment and disposal will be discussed in this memorandum. Sewage conveyance will be covered elsewhere.

2.0 CONCEPT OPTIONS FOR WASTEWATER TREATMENT

In general, the options for wastewater collection and treatment can be focused on a single central treatment plant, or a distributed treatment strategy that includes two or more plants located to serve specific areas of development. The distributed treatment strategy can include small "satellite" treatment plants located in areas that are remote from the central collection system, and/or that are designed to produce reclaimed water for local use (e.g., irrigation, toilet flushing, industrial process water, etc.).

The concept of Integrated Resource Management (IRM) has been proposed for wastewater collection and treatment in the Capital Regional District (CRD). The IRN concept is designed to maximize recovery and reuse of resources from wastewater treatment. Recent applications to the Building Canada Fund for senior government funding to support wastewater infrastructure projects required a discussion of how IRM would be addressed. Thus the potential for funding assistance from senior government currently appears to be connected to the potential of the proposed project to allow recovery of resources. Proposed methods of resource recovery may include the following:

- biosolids and organic residuals (e.g., anaerobic digestion for production and use of biogas, production of compost, energy recovery from combustion, land application as a fertilizer/soil conditioner);
- flow energy management and pressure energy recovery (e.g., locating treatment facilities at low elevations to minimize pumping needs, minimize static lift at pump stations by



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- maintaining high wet well water surface elevations, use of low flow fixtures to minimize wastewater volume, use of turbines to recover energy from the wastewater stream);
- phosphorus recovery (e.g., crystallization treatment of high-strength return streams within treatment facilities);
- heat recovery from wastewater (e.g., heat exchangers and heat pumps);
- water reclamation and reuse (e.g., irrigation, toilet flushing, fire protection, on-site use at wastewater treatment facilities); and
- urine separation (e.g., for use as a fertilizer).

Of the above method of resource recovery, those commonly in use in North America include anaerobic digestion and composting of waste solids, flow energy management and to a lesser extent water reclamation and reuse. Phosphorus recovery and urine separation can be said to be in the developmental stages. Heat recovery is often considered for wastewater projects, but may not be implemented due to the relatively high cost to benefit ratio. For all methods of resource recovery, a local market for the resource is needed. This can present practical limitations in terms of seasonal demand for reclaimed water, local opportunities for use of waste solids, and potential users of recovered heat as well as the infrastructure needed to deliver the heat to end users.

The CVRD currently practices composting of the waste solids generated at the CVWPCC; this produces a marketable product, although at a net cost to the District (i.e., the market value of the compost is less than the cost of producing the compost). Anaerobic digestion of waste solids for biogas recovery is commonly used in British Columbia and throughout North America, but is typically only cost effective at relatively large treatment plants (i.e., those serving at least 20,000 people), due to the high capital cost of installing gas-tight anaerobic digesters. In some cases, recovery and combustion of biogas for generation of electricity and heat can generate a net positive financial gain (e.g., over a 20-year life cycle for the equipment).

Water reclamation and reuse in British Columbia is becoming more common. Successful large-scale irrigation projects using reclaimed water have to date been undertaken in the communities of Vernon and Armstrong, both of which are relatively arid areas with large agricultural land bases available. For the CVRD, there is potential for seasonal irrigation using reclaimed water, but 100% utilization of reclaimed water is unlikely within the forseeable future (i.e., large reservoirs for off-season storage or an alternative means of off-season disposal would be needed). Low water use fixtures to reduce wastewater volumes are now the standard for new development in B.C. One of the most cost effective uses of reclaimed water is on-site use at wastewater treatment facilities for non-potable applications (e.g., wash down water, process water, landscape irrigation), since the reclaimed water does not have to be pumped offsite to potential users; this application can generate a net financial gain over the life cycle of the project. For off-site uses of reclaimed water, the potential for a positive benefit to cost ratio depends in a large part on the proximity of potential end users and their water quality requirements.



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Four options for wastewater collection, treatment, and reuse or disposal are outlined below. The options are based on the "most likely" growth scenario developed in Memo No.1. The options are evaluated on the basis of cost, technical feasibility, resource recovery potential, and environmental and social values.

The potential for use of heat recovered from the wastewater stream at pumping facilities and treatment plants depends on the proximity of potential users of the heat. For all of the options, heat could potentially be recovered at strategic points on the collection system as well as at the treatment facilities. At his level of analysis, no one option is considered to have advantage over the others in terms of heat recovery.

The potential options were also discussed with the Ministry of Environment (MOE), Nanaimo Office. The MOE strongly supports regional planning for wastewater management, and recommends the preparation of a Liquid Waste Management Plan. For the current regional wastewater master plan, the MOE noted that siting of new treatment facilities and outfall discharges is typically protested by local stakeholders, and expansion of the CVPCC may also likely be resisted by local residents. Secondary treatment for open marine discharges as proposed in the options described below meets the MOE requirements. Discharges into Baynes Sound are likely to encounter significant resistance. All marine discharges will require consultation with the local shellfish industry. The MOE supports connection of the Cumberland system to the central collection system, rather than local discharge to constructed wetlands.

It was assumed that properties outside of urban centres (i.e., in low-density rural areas) would continue to be served by onsite (ground disposal) systems. If necessary, properties in areas with poor conditions for ground disposal might require single-home treatment systems to enhance the quality of wastewater prior to ground disposal. The ultimate density of development in unserviced areas will depend in part on the local conditions for ground disposal (see report from EBA).

Flow projections used to size the treatment plants and outfalls were based on the analysis of flows at the CVWPCC (see Memo No.1 appendix C). These flows are:

Average dry weather flow: 405 L/c/d
Average annual flow: 474 L/c/d
Maximum day flow: 971 L/c/d

2.1 Option 1: Centralized Treatment

Option 1 (see Figure O-1) would be to continue to route all wastewater flows from urban areas within the District to the existing CVWPCC. This would include decommissioning of the existing Cumberland STP and connecting this system the Courtenay collection system, as well as connection of other outlying communities (Saratoga/Miracle Beach, Ship's Point, Royston/Union Bay). The ultimate population for this option is about 180,000 people.



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The total useable site area for construction of treatment facilities at the CVWPCC site is estimated at about 9 hectares, assuming a 30 meter buffer zone within the property boundary. This site could contain treatment facilities for the ultimate service population of 180,000 people, provided that a more space-efficient technology than the existing plug-flow activated sludge process were used.

A second outfall would be required. The plant would continue to meet secondary treatment standards for open marine discharge.

For Option 1, the current method of resource recovery (composting of waste solids) could continue into the future, although this option may become more difficult as the plant grows in size. Anaerobic digestion for production of biogas can be considered for the future (this would require the use of space-efficient technologies for liquid treatment to allow space on the site for construction of anaerobic digesters for a total service population of 180,000 people); the biogas could potentially be used for generation of electricity, firing boilers, or as a vehicle fuel (requires prior scrubbing of the gas). As the facilities are upgraded and expanded, on-site use of reclaimed water for non-potable applications at the plant should be maximized. Production of reclaimed water for off-site use would depend on the proximity of potential users; if markets are identified, part of the effluent from the secondary treatment facilities could be treated to reclaimed water standards as required.

Advantages of Option 1

- Lowest cost option (see Section 4.0).
- · Maximizes use of existing infrastructure.
- · Does not require siting of new treatment facilities or outfall.
- Allows future use of anaerobic digestion for recovery and use of biogas.

Disadvantages of Option 1

- Requires pumping of all wastewater flows from Courtenay River PS catchment and Royston/Union Bay area (where the majority of development is expected to take place) to Comox WWTP.
- Some odour sensitivity associated with existing treatment plant site.
- Some areas (e.g., Ship's Point, Saratoga Beach) are remote from the central collection system and will require long force or gravity mains to convey sewage to the CVWPCC.
- Potential for use of reclaimed water may be limited.

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2.2 Option 1A: Centralized Treatment

From a treatment and cost standpoint Option 1A is essentially the same as Option 1, only with changes to sewage conveyance to the CVWPCC. Sewage conveyance is covered elsewhere.

2.3 Option 2: Decentralized Treatment

Option 2 would be to expand the existing CVWPCC and construct 3 new treatment plants, with 50-year tributary populations as shown in Table 1.

Table 1
Option 2 Treatment Plants

Plant	Tributary Areas	Service Population	Discharge	Treatment Standard
CVWPCC (existing plant expanded)	Comox, Courtney	114,300	Georgia Straight	Secondary for marine discharge
South STP (new plant)	Cumberland, RID, UBID, Ships Point (Area A)	48,600	Georgia Straight	Secondary for marine discharge
Kitty Coleman STP (new plant)	Kitty Coleman	2,800	Georgia Straight	Secondary for marine discharge
Saratoga STP (new plant)	Saratoga	14,400	Georgia Straight	Secondary for marine discharge
Total Population Served		180,000		

CVWPCC

The CVWPCC would continue to treat wastewater from Comox and Courtney. The total useable site area for construction of treatment facilities is estimated at about 9 hectares, assuming a 30 meter buffer zone within the property boundary. This site could contain treatment facilities for the ultimate service population of 114,300 people.

The outfall would require upgrading as flows increased.

South STP

For the purpose of this outline, it was assumed that a suitable site could be located for the South STP somewhere in the Royston/Union Bay area. Ideally, the new facility should be located in an area zoned for industrial development to avoid placing a treatment plant directly adjacent to residential development.

Treated sewage from the South STP would be pumped across the Comox Harbour to the existing CVWPCC outfall. A second outfall would be required as flows increase from both plants. The South STP would have to meet secondary treatment standards for open



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marine discharge, unless reclamation of some or all of the effluent for irrigation or other purposes was planned.

An area of approximately 5 hectares would be required for this treatment plant. This includes a 30 m buffer.

Kitty Coleman and Saratoga STPs

Satellite treatment plans would be constructed in Saratoga and Kitty Coleman. Treatment would have to meet secondary treatment standards for open marine discharge, unless reclamation of some or all of the effluent for irrigation or other purposes was planned. Outfalls for each plant would extend out into the Georgia Straight. The new facility should be located in an area zoned for industrial use if possible.

Areas of approximately 2 hectare and 3 hectares would be required for Kitty Coleman and Saratoga respectively. These areas include a 30 m buffer.

For Option 2, the options for recovery and beneficial use of waste solids at the two larger plants (CVWPCC and South Plant) would be similar to those for Option 1 (i.e., continue with composting, and consider anaerobic digestion for the future). Space limitations at the CVPCC would be less restrictive for Option 2 (i.e., use of a more space-efficient technology for liquid treatment may not be required). Use of multiple plants would potentially access a wider market for use of reclaimed water.

Advantages of Option 2

- Maximize gravity flow to reduce energy demand for pumping.
- New South STP would be located in the area containing the majority of planned development.
- Satellite plants increase potential local water reuse options.
- Allows potential use of anaerobic digester at CVWPCC and new South treatment plant for production and use of biogass.
- · Compatible with existing composting strategy for waste solids.

Disadvantages of Option 2

- Requires siting of three new treatment facilities and two new outfalls, which will
 require extensive public and stakeholder consultation.
- Operation of four treatment plants (three new plants plus existing CVWPCC) would be more costly than operation of a single plant (Option 1 and Option 1A).
- Some areas are remote from their treatment plants (e.g., Ship's Point is remote from the new South STP). Long forcemains and gravity mains will be required.
- More costly than Option 1 (see Section 4.0).



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2.4 Option 2A: Decentralized Treatment

Option 2A would further decentralize treatment from the concept in Option 2 (see Table 2). The South STP in Option 2 would be split into 4 treatment plants: Cumberland STP, RID STP, UBID STP and Ships Point STP. Expansion of the CVWPCC and new treatment plants at Kitty Coleman and Saratoga would be required as in Option 2.

Table 2
Option 2A Treatment Plants

Plant	Tributary Areas	Service Population	Discharge Location/Reuse	Treatment Standard
CVWPCC (existing plant expanded)	Comox, Courtney	114,300	Georgia Straight	Secondary for marine discharge
RID STP (New plant)	RID	8,900	Baynes Sound and reuse	Reclaimed Water
UBID STP (New plant)	UBID	13,900	Baynes Sound and reuse	Reclaimed Water
Cumberland STP (New plant)	Cumberland	20,100	Maple Lake Creek and reuse	Reclaimed Water
Ships Point STP (New plant)	Ships Point	5,600	Baynes Sound and reuse	Reclaimed Water
Kitty Coleman STP (New plant)	Kitty Coleman	2,800	Georgia Straight	Secondary for marine discharge
Saratoga STP (New plant)	Saratoga	14,300	Georgia Straight	Secondary for marine discharge
Total Population Served		180,000		

CVWPCC

The CVWPCC would continue to treat wastewater from Comox and Courtney. The total useable site area for construction of treatment facilities is estimated at about 9 hectares, assuming a 30 meter buffer zone within the property boundary. This site could contain treatment facilities for the ultimate service population of 114,000 people.

A second outfall would be required as flows increase.

UBID, RID and Ships Point STPs

These three treatment plants would all be located adjacent to Baynes Sound. Baynes Sound is a significant shellfish farming area, and there is likely to be opposition to any sewage discharge into this water body. However, previous studies have found that there are no rivers or streams in the area that can provide sufficient year-round dilution for sewage discharge, so stream discharge is not considered a viable option. Conditions for ground disposal are poor for the most part in this area (based on the preliminary evaluation by EBA). It is possible that suitable sites for ground disposal fields might be located if more detailed study were undertaken, but these are unlikely to provide sufficient capacity to dispose of all wastewater produced by the three plants.



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It is proposed that the new UBID, RID and Ships Point treatment plants would provide treatment to reclaimed water standards. The reclaimed water could potentially be used for local non-potable applications such as irrigation, toilet flushing, fire protection, etc. If the primary use of reclaimed water is to be irrigation, a wet-season storage reservoir may be required.

Outfalls into Baynes sound would be required for the three locations as it is very unlikely that all reclaimed water could be reused year round.

Approximately 3 hectares would be required for each of the treatment plants. These areas include a 30 m buffer.

Cumberland STP

The existing Cumberland STP is a partially-aerated lagoon facility with a service capacity of about 5,000 people that discharges to Maple Lake Creek. The current service population is estimated at about 2,500 people.

There are concerns with the existing Cumberland treatment facility, including insufficient dilution of the effluent discharge in Maple Lake Creek, and potential overflows of poorly treated wastewater directly to the Creek. The projected service population for the Cumberland area is about 20,000 people. If the Cumberland STP is to continue in service, a mechanical treatment plant producing an effluent that meets reclaimed water standards will be required. The reclaimed water could potentially be discharged to Maple Lake Creek (environmental impact studies and consultation with the MOE would be required), or used for local non-potable applications such as irrigation, toilet flushing, fire protection, etc. If the primary use of reclaimed water is to be irrigation, a wet-season storage reservoir may be required. Ground disposal for a discharge of this magnitude would not be practical.

Saratoga Beach and Kitty Coleman

Satellite treatment plans would be constructed in Saratoga and Kitty Coleman. Treatment would have to meet secondary treatment standards for open marine discharge, unless reclamation of some or all of the effluent for irrigation or other purposes was planned. Outfalls for each plant would extend out into the Georgia Straight. The new facility should be located in an area zoned for industrial use if possible.

Areas of approximately 2 hectare and 3 hectares would be required for Kitty Coleman and Saratoga respectively. These areas include a 30 m buffer.

For Option 3, the potential for biogas production from anaerobic would be more limited than for Options 1 and 2, since this would likely be cost effective only at the CVWPCC (however, waste solids from the satellite plants could potentially be transported to the CVPCC for digestion). Composting of waste solids from the smaller satellite plants could



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continue, although consumption of fuel for transportation of the solids might increase compared to the more centralized options. Increasing the number of satellite plants may also increase the potential markets for reclaimed water use.

Advantages of Option 2A

- Avoids the need for a major pumping station and forcemain to connect flow from Saratoga/Miracle Beach area to the CVWPCC system.
- Avoids the need for a major pumping station and forcemain to connect flow from the Ships Point/UBID/RID area to the CVWPCC system.
- · May increase potential for use of reclaimed water.

Disadvantages of Option 2A

- Requires siting of five new treatment facilities and outfalls, which will require extensive public and stakeholder consultation.
- Operation of an additional treatment plants would add to system complexity and operating costs for treatment.
- For the UBID, RID and Ships Point water reclamation plants, 100% use of reclaimed water difficult to achieve. Three new outfalls into Baynes sound will be required, and these are likely to meet public and stakeholder opposition. Discharge to Baynes sound will require environmental impact studies.
- For the Cumberland water reclamation plant, 100% use of reclaimed water difficult to achieve, unless discharge to Maple Lake Creek for stream augmentation is allowed.
 Discharge to Maple Lake Creek will require environmental impact studies and may encounter resistance from the community.
- Smaller satellite plnts are not large enough for cost-effective production of biogas.
- Much more costly than Options 1 and 2 (see Section 4.0).

3.0 INFLOW & INFILTRATION

3.1 Current I&I in the CVWPCC system

Infiltration can be divided into two components. Groundwater infiltration (GWI) enters the system through defects in pipes, which are located below the water table; GWI is relatively constant in intensity and is of long duration. Rainfall-derived infiltration (RDI) occurs during and immediately after rainfall events, and is caused by the seepage of percolating rainwater into defective pipes, which lie near the ground surface or through defective manholes or covers located in poorly graded pavement areas; RDI is typically of relatively short duration and high intensity, compared to GWI. Inflow can also be divided into two components. Dry weather inflow (DWI) results from surface water not caused by rain that enters the sewer system (e.g., street and vehicle washing). Stormwater inflow (SWI) results from the diversion of storm surface runoff into sanitary sewers (e.g., roof downspouts that are connected to the sanitary sewer).



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The Municipal Sewage Regulation (MSR) states that, where the maximum day flow (MDF) exceeds 2 times the average dry weather flow (ADWF) and if the contributory population exceeds 10,000 persons, the discharger must address how I&I can be reduced.

At the CVWPCC the ADWF to MDF ratio varied from 2.0 to 2.9 in the years from 2003 to 2007 (see Memo No.1 Appendix C). Under the MSR an I&I reduction program would be required for the CWWPCC system.

According to USEPA Regulations, the total daily flow in the sanitary sewer during a storm should not exceed 1,050 L/c/d, and if the total flow significantly exceeds 455 L/c/d based on the highest 7 to 14 day average, the collection system is subject to "excessive" I&I. In the years 2003 to 2007 the MDF exceeded 1,050 L/c/d once. The average yearly 7 day maximum flow at the CVWPCC was 738 L/c/d from the years 2003 to 2007. This is significantly higher than the USEPA recommends. The system would benefit from additional reduction of I&I.

3.2 Effect of Inflow and Infiltration on Wastewater Treatment

In general, process units for which hydraulic criteria (peak flow or average flow) is the governing design factor may benefit from I&I reduction. With regard to the CVWPCC (and other typical treatment facilities) these include:

- Influent screens.
- Grit tanks.
- Primary sedimentation tanks.
- Secondary aeration basins, under some circumstances.
- Secondary clarifiers, under some circumstances.
- Effluent pump station.
- o Outfall

The following process units would not typically benefit significantly from I&I reduction:

- Secondary (biological) treatment units (activated sludge tanks, etc.).
- Aeration blowers.
- Solids thickeners.
- Solids digestion facilities.
- Sludge holding tanks.
- Solids dewatering facilities.
- Solids pumping/handling.

In general, design of treatment units that are related to the organic loading on a treatment plant are not related to I&I reduction; this includes biological treatment reactors for secondary (and advanced) treatment, as well as virtually all of the solids treatment and handling facilities. These facilities can account for a large percentage of the total capital cost of treatment facilities. Therefore, I&I reduction may have a relatively small impact on the capital costs of treatment, depending on the nature of the treatment facilities.



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However, I&I reduction can have a much more direct impact on operating costs for treatment, including power demand for pumping and chemical addition where practiced (e.g., chlorine for disinfection, chemical addition for enhanced treatment).

4.0 COST ESTIMATES

Capital Costs, Yearly O & M Costs and 50 year Net Present Value are shown in Table 3.

Capital and O & M costs have been taken from Dayton & Knight cost curves. These curves show costs vs. average annual flow for a number of treatment plants in North America. Best fit curves have been applied to the data points in order to allow estimation of capital and O & M costs.

The following class D cost estimates for the above options include the following:

- · Construction of treatment facilities.
- Construction of outfalls, where required.
- Engineering and contingency.

The following are not included in the cost estimates:

- · Raw sewage conveyance.
- Land purchase, where required.
- Biosolids treatment.
- Construction and O & M for infrastructure for water reuse.

The 50 year net present value costs assume that the full capital cost of construction will be met at year zero, and that O & M costs are constant throughout the 50 year period. It is important to emphasize that the costs shown are for treatment only, and do not include wastewater conveyance and pumping or solids reuse. The costs are all-inclusive and should not be used for budgeting purposes, but are considered adequate for the purpose of comparing options.

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Table 3
Capital Costs, Yearly O & M Costs and 50 year Net Present Value (Millions of Dollars)

Option	Plant	Capital Cost	Yearly O & M	50 Year Net Present Value
Option 1	CVWPCC	\$103.7	\$5.9	\$217
	Total	\$103.7	\$5.9	\$217
Option 1A	CVWPCC	\$103.7	\$5.9	\$217
	Total	\$103.7	\$5.9	\$217
Option 2	CVWPCC	\$61.7	\$4.6	\$150
	South STP	\$54.2	\$2.4	\$100
	Kitty Coleman STP	\$6.5	\$0.3	\$12
	Saratoga STP	\$18.0	\$1.1	\$39
	Total	\$140.4	\$8.3	\$300
Option 2A	CVWPCC	\$61.7	\$4.6	\$150
	RID STP	\$21.3	\$1.5	\$50
	UBID STP	\$31.7	\$2.2	\$74
	Cumberland STP	\$41.9	\$3.2	\$103
	Ships Point STP	\$14.2	\$1.0	\$33
	Kitty Coleman STP	\$6.5	\$0.3	\$12
	Saratoga STP	\$18.0	\$1.1	\$39
	Total	\$195.2	\$13.9	\$461

As shown in Table 3, Option 1 and Option 1A have the lowest capital cost (about \$100 million) and annual O&M cost (about \$6 million per year for the 180,000 population). Option 2 is more costly at about \$140 million capital cost and \$8 million per year O&M. Option 3 is much more costly at about \$200 million capital cost and \$14 million per year O&M. It is apparent that, due to economies of scale and efficient use of facilities and resources, the cost of treatment is less for a smaller number of relatively large facilities than for more numerous small facilities.

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