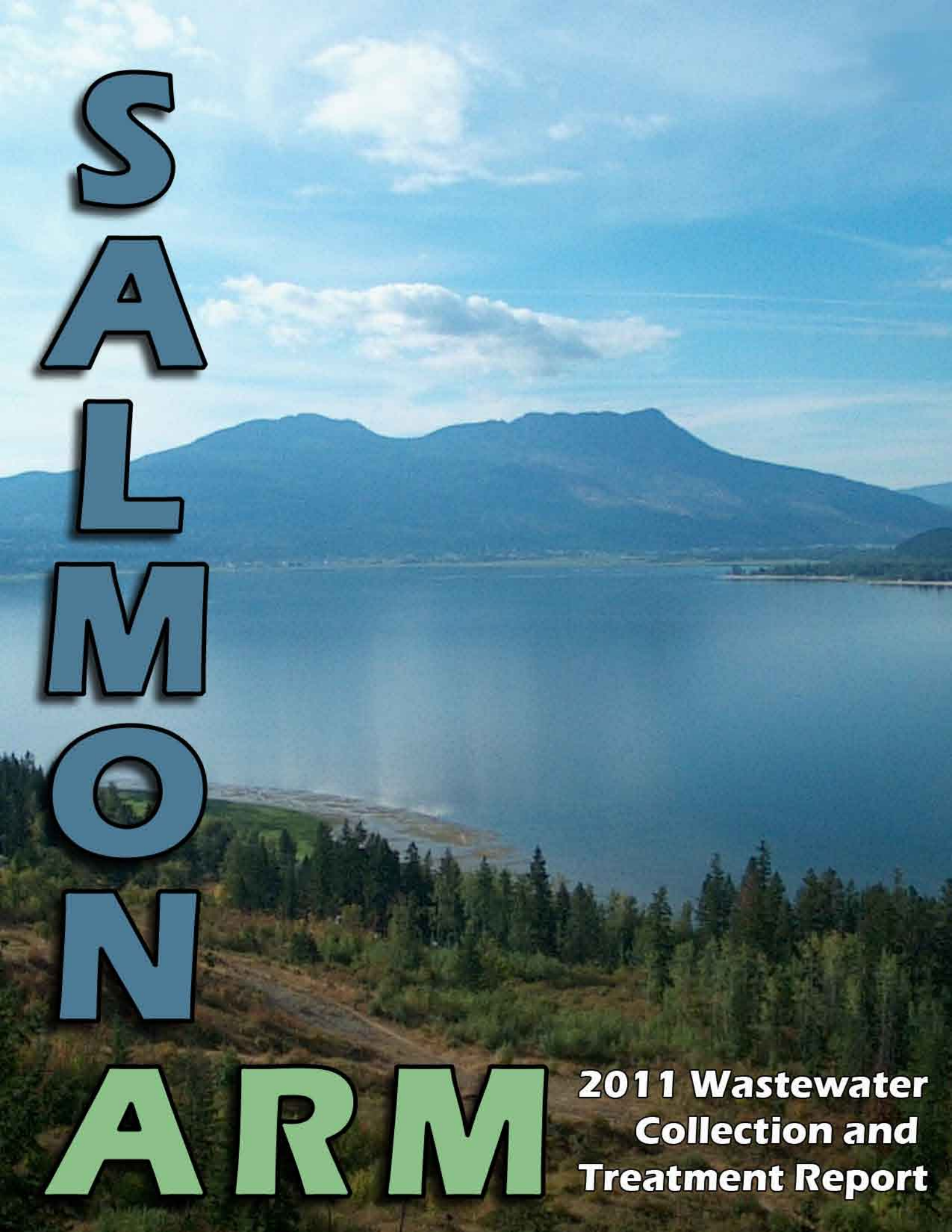
SALMON ARM
2011 Wastewater Collection and Treatment Report

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1.0 Community General

The City of Salmon Arm is located in the southern interior of British Columbia on the southwest shoreline of the extensive Shuswap Lake system. With over 17,000 residents, Salmon Arm is the largest urban centre in the Columbia Shuswap Regional District. It serves as the commercial, cultural and administrative hub for an additional 35,000 residents of the Shuswap Lake region. Located at the junction of the Trans Canada Highway (TCH) and Highway 97B, Salmon Arm is a one-half day drive to Vancouver or Calgary and a 70 minute drive to Kelowna or Kamloops.

With a land base of 175 km², Salmon Arm is a relatively large municipality by area with most of the population concentrated within a few kilometers of the Trans Canada Highway and the downtown core. The surrounding terrain varies from the low lying marsh flats of Salmon Arm Bay to the extinct volcanic peak of Mt. Ida and the ridge lines of Fly Hills to the west and Larch Hills to the east. These highlands form the Canoe Creek and Salmon River watersheds which empty into Shuswap Lake. Sustainable land use planning over the years has resulted in the formation of an attractive, bustling, compact community surrounded by thousands of hectares of arable farmland, green space and natural shorelines.

Salmon Arm's commercial and industrial base is continuing to diversify. The housing market continues to remain tight. Retail, construction, professional services and healthcare, along with a wide array of entrepreneurial activities, are major sources of employment. Small businesses flourish in Salmon Arm's business friendly environment. Key economic drivers are value-added wood processing, high tech and traditional manufacturing, tourism and agri-business. The continuing surge in construction activity points to a healthy market demand for new housing and floor space for commercial, industrial and institutional uses. By all indications, an average annual growth rate of 1.5% - 2% with an increase to be expected over the next three to four years.

1.1 Staffing

The City of Salmon Arm Engineering and Public Works Department is responsible for this municipal function. The Utilities Division is responsible for the operation and maintenance of the sanitary collection system and the Water Pollution Control Centre (WPCC) staff is responsible for the operation and maintenance of the Wastewater Treatment facility and the main lift Station located at Wharf Street. The WPCC is manned seven days of the week with 24-hour standby provisions for after hour alarm response.

Table 1 - Staff Overview

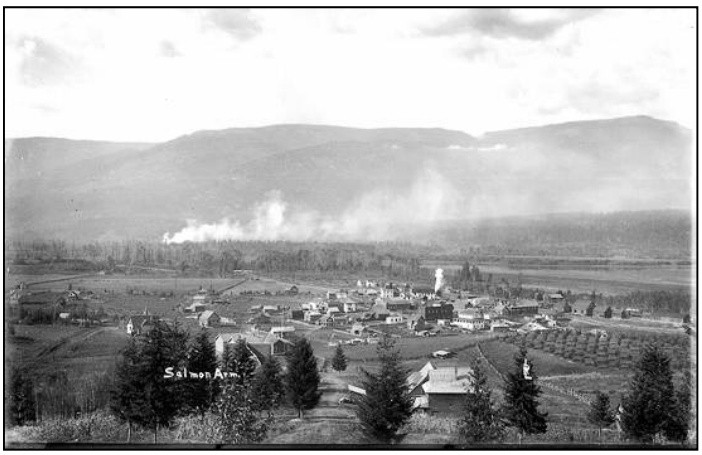
Engineering and Public Works	
Dale McTaggart, P. Eng., Director of Engineering and Public Works	
Robert Niewenhuizen, A.Sc.T., City Engineer	
Utilities Division	
Gerry Rasmuson, B. Sc. ***Utilities Manager*** ◆ Level IV - Water Distribution ◆ Level IV - Wastewater Treatment ◆ Level I - Wastewater Collection	**Roger Parkes** ***Utilities Supervisor*** ◆ Level I - Wastewater Collection
Mervin Arvay ◆ Level I - Wastewater Collection	**Mike Stremel** ◆ Level I - Wastewater Collection
Ray Muller ◆ Level I - Wastewater Collection	**Larry Kipp** ◆ Level I - Wastewater Collection
Water Pollution Control Centre	
Hart Frese, WPCC Manager ***Chief Operator*** ◆ Level IV - Wastewater Treatment	**Doug Stalker**, Dip. Water Quality ***Operator III*** ◆ Level IV - Wastewater Treatment ◆ Level I - Wastewater Collection
Conor O'Neill, Dip. Water Quality ***Operator III*** ◆ Level IV - Wastewater Treatment	**David Knowles** ***Operator I*** ◆ Operator in Training

2.0 Wastewater Treatment & Collection System History

2.1 Wastewater Collection System - History

The District of Salmon Arm and the Village or Salmon Arm amalgamated in 1971 to form the District Municipality of Salmon Arm on January 1, 1971, and then became the City of Salmon Arm in 2005. The Village was the original urban core area and sewer lines were installed during the 1930's to collect septic tank effluent and some crude wastes which were then discharged into an open ditch leading into Shuswap Lake. The surrounding District Municipality relied on septic systems as sewer collection was not an issue until the urban development of the Village overflowed into the surrounding Municipality. By 1964, the Village had initiated plans for sewage treatment which included the construction of a lagoon along the waterfront for treatment. The lagoons would also service the Adams lake Indian Band lands. Concerned about the level of treatment that a lagoon offered, the Village decided to review their plans and objectives. By 1966, the review board recommended that the Village and District combine in their efforts to collect and treat wastewater. However, unable to agree upon implementation of various plans the Village applied to the Pollution Control Board for a permit to discharge highly treated effluent into Shuswap Lake. By the time this permit was granted in 1972, the Village and District had amalgamated.

Ultimately the Engineering firm of Dayton and Knight Ltd were hired to undertake a Wastewater survey in 1972 to study various different treatment and effluent disposal methods. The Survey resulted in the construction and official opening of the existing Water Pollution Control Centre on May 14, 1977. Furthermore, the survey identified collection system priorities and set in motion the construction of the infrastructure that currently exists. The City's sewage collection and treatment systems have evolved into a well maintained collection system and a state of the art Wastewater Treatment Centre.



2.2 Wastewater Treatment Plant History

The original plant was constructed on the current site, 121 Narcisse Street NW, in 1977 after the proposed site at Minion Field, 2191 30th Street SW was rejected by the B.C. Agricultural Land Commission and Provincial Pollution Control Board. It was constructed at a cost of $0.9 M and consisted of primary sedimentation, activated sludge, secondary clarification with chlorine disinfection. Solids were aerobically digested and stored in two 1 acre lagoons. Capacity of the plant was 3,000 m^3 per day for a design service population of 6,250.

In 1982, phosphorus removal was added at a cost of $0.1 M and consisted of precipitating phosphorus out of the effluent by the addition of ferrous chloride. Phosphorus was determined to be the limiting nutrient which contributes to the eutrophication and degradation of water quality in Shuswap Lake, particularly, Salmon Arm Bay. Currently the Salmon Arm WPCC contributes less than 4% of the phosphorus loading in the bay.

Aerial Photo Stage IIIB prior to Landscaping

In 1986 the $1.8 M Stage II Upgrade was the first major upgrade to the facility. The liquid process was altered from a common activated sludge process to an experimental trickling filter biological nutrient removal (BNR) system (Fixed Growth Reactor – Suspended Growth Reaction or FGR-SGR. As well, the aerobic digester was upgraded to an Autothermal Thermophilic Aerobic Digester (ATAD). Plant Capacity was increased to 3,500 m^3 per day for a design service population of 8,750.

Improvements were made in 1991 to the solids process at a cost of $0.5 M. The improvements consisted of changing aeration and solids pumping equipment. Rebuilding the ATAD tanks and added waste biological sludge thickening.

The Stage III Upgrade was split into two upgrades with the first part, Stage IIIA completed in 1998 at a cost of $5.2 M. It consisted of improvements to the FGR- SGR process, new secondary clarifier, Supervisory Control and Data Acquisition system, increased ATAD capacity and biosolids dewatering. These improvements led to better control and monitoring, the ability to beneficially recycle biosolids and the decommissioning of the solids storage lagoons. Capacity was increased to 5,000 m^3 per day for a design service population of 12,900.

Stage IIIB was completed in 2005 without the Laboratory/Administration expansion. Of the $7.4 M upgrade, $2.3 M was funded by the Federal and Provincial Governments.

The upgrade consisted of a complete rebuild of the main lift station at Marine Drive with odour control, added redundancy to critical equipment, stand-by power, effluent filtration, replacement of the chlorination/de-chlorination system with Ultra Violet disinfection, an elaborate odour control system and architectural improvements to the original exterior of the original building.

2.2 Wastewater Treatment Plant History (Cont'd)

Capacity was increased to 6,700 m^3 per day average flow for a design service population of 15,000. Stage IIIB was completed in 2008 with the $0.4 M expansion of the Laboratory/Administration area. The Water Reclamation project was completed in 2010. This project utilizes the highly treated effluent for process water at the facility resulting in a 110 ML annual reduction in potable water use. In 2011, the Trickling Filter Media Upgrade was completed. The total cost of the project was $0.55 M and entailed removing approximately 1,560 m^3 of crossflow media and replacing with vertical flow media. This project was the result of the September 2007 pilot study (Dayton & Knight Ltd.) designed to reduce the impact of sloughing conditions currently problematic at the facility.

Table 2 - Cost Summary Table

Project	Cost	Year
Stage I - 6,250 connected population	$0.9 M	1977
Chemical Phosphorus Removal	$0.1 M	1982
Stage II - 8,250 connected population	$1.8 M	1986
Solids Improvements	$0.5 M	1991
Stage IIIA - 12,500 connected population	$5.3 M	1998
Stage IIIB – 15,000 connected population	$7.4 M	2004
Laboratory/Administration Expansion	$0.4 M	2008
Reclaimed Water	$0.1 M	2009
Trickling Filter Media Upgrade	$0.55 M	2011
Total	**$17.05 M**	
Estimated Insurable/Replacement Value (2005)	$35.0 M	

3.0 Wastewater Collection System

3.1 Overview of Collection System

The Utilities Division, through a schedule of systematic new improvements, upgrades and replacements strives to maintain and improve the sanitary sewer collection system. This Division plays an integral role in maintaining the health, safety and well being of the community. The sewer utility is a self-liquidating funded system which must provide for their own revenues through fees, taxes and other charges to support the expenditures required to operate and maintain infrastructure on a daily basis and long into the future.

3.2 Collection System

The City of Salmon Arm's sanitary sewer collection system consists of 14 sewerage sub areas and 128 km of gravity and force main sanitary sewer pipes covering approximately 1800 hectares. There are approximately 5,330 residential, commercial, industrial and institutional lots fronting onto the sanitary sewer system (2011 Sewer Frontage Tax Assessment Roll). There are eight (8) sewer lift stations that collect and pump sewerage to the Lakeshore Sewer Interceptor located on the foreshore where the main lift station, Wharf Street Pump Station, pumps the sewerage directly to the WPCC (see Map 3.2). The Interceptor provides storage and flow equalization capabilities.

3.3 Lift Stations

All eight of the tributary Lift stations are inspected once a week by the City of Salmon Arm's Utilities Division. All lift stations are thoroughly inspected and cleaned on a monthly basis. The stations are monitored using the City's SCADA system which enables staff to troubleshoot and trend data on the Cities SCADA system.

Table 3 - Wastewater Facilities

No.	Wastewater Lift Stations & Facilities	Address
1	Water Pollution Control Centre	121 Narcisse Street NW
2	Mosquito Park Lift Station	4290 Canoe Beach Drive NE
3	Clare's Cove Lift Station	5391-75 Avenue NE
4	Tippy Canoe Lift Station	Pump in MH under road at 50th Street & 75th Avenue NE intersection
5	Captain's Cove Lift Station	2251-73 Avenue NE
6	Canoe Beach Lift Station	7720-36 Street NE
7	Wharf Street Pump Station	1000 Marine Park Drive NE
8	Rotten Row Lift Station	681-10 Avenue SW
9	10 Avenue SW Lift Station	2270-10 Avenue SW [TCH]

3.4 Wharf Street Lift Station

The Wharf Street Lift station is gravity fed by the Lakeshore Interceptor. Three 30 Hp pumps with variable speed drives are used to feed the wastewater facility at rates determined by WPCC operators. The station was upgraded in 2002 with each pump rated at 80 liters/sec flow. The foul air is treated by utilizing ultraviolet light which catalyses the breaking of ambient oxygen and water vapor molecules into O^+ and OH^- ions. These free radicals oxidize the odourous contaminants in the air. This reaction results in a sequential and instantaneous gas breakdown of the contaminants with minimal by-products, such as elemental sulfur, CO_2, water vapor, molecular oxygen and trace ozone. In the event of an extended power outage, there is the capability to connect the City's portable generator to the station to run the pumps. A second portable generator was purchased in 2011 primarily to service this critical lift station.

3.5 Lift Station Repairs and Modifications

In 2011, the City renewed the Captains Cove Lift Station with a Pre-Engineered Fiberglass pump station complete with two new grinder pumps and a new force main. A new pump was purchased for 10th Ave SE lift station and pumps at both Mosquito Park and Claires Cove lift stations had repair kits installed.

3.6 Sanitary Flushing

Approximately 38.5 km of sanitary mains were flushed in 2011 as part of the maintenance program. Certain areas and services of concern as well as historically troublesome areas are flushed annually. In 2011, the Utilities Division continued to target the numerous sanitary Right of Ways within the collection system that are difficult to access.

3.7 Main and Service Interruptions

There were not any mainline blockages within the sanitary collection system in 2011 and only a handful of service interruptions typically attributed to grease build up within the service pipe from homeowners or roots from nearby trees and shrubbery.

3.8 Inflow and Infiltration Monitoring Program

The program identifies locations where storm water or ground water enters the sanitary system. We continue to provide system improvements in an effort to reduce the amount of rainwater and groundwater entering the sanitary sewer system when it is cost-effective to do so. Reduction of Inflow & Infiltration (I&I) in the system lowers the risk of sanitary sewer overflows and can decrease the costs of conveying and treating wastewater.

3.9 Wastewater Collection Capital Projects

Table 4 - Capital Project Information

Capital projects completed in 2011
◆ Purchased second portable generator
◆ Installed new pre-engineered lift station at Captain's Cove with new pumps.
◆ Upgraded the forcemain on 73rd avenue NE
◆ Upgraded the sanitary main in lane east of 50 Street NE from 70 to 73 Avenue NE
◆ Completed rebuild of 2nd pump at Wharf St. Lift Station
◆ Ongoing SCADA and GIS development
Capital Projects scheduled for 2012
◆ Complete rebuild of 3rd pump at Wharf St. Lift Station
◆ Ongoing SCADA and GIS development
◆ Complete biosolids fencing at the airport
◆ Upgrade sanitary main crossing the CPR ROW at 20 Avenue and Lakeshore Road NE.
◆ Construct sanitary main crossing of CPR ROW in the 4500 Block along Canoe Beach Drive NE
◆ Raise Canoe Beach pre-engineered lift station
◆ Purchase a sanitary crawler and skid plate for mainline inspection
◆ Renew the sanitary mainline along 75 Avenue NE west of 50 Street NE

4.0 Wastewater Treatment - Water Pollution Control Centre (WPCC)

The City of Salmon Arm WPCC is located at 121 Narcisse Street N.W. which is located west of the City's Town Centre adjacent to the Shuswap Lake. This section of the report will detail the performance and operational strategies of the plant during the past year.

WPCC – After renovations

Wharf Street Lift Station

4.1 Process Overview

The process of wastewater treatment can be separated into two flow streams – liquid and solids also referred to as the liquid train and solids train.

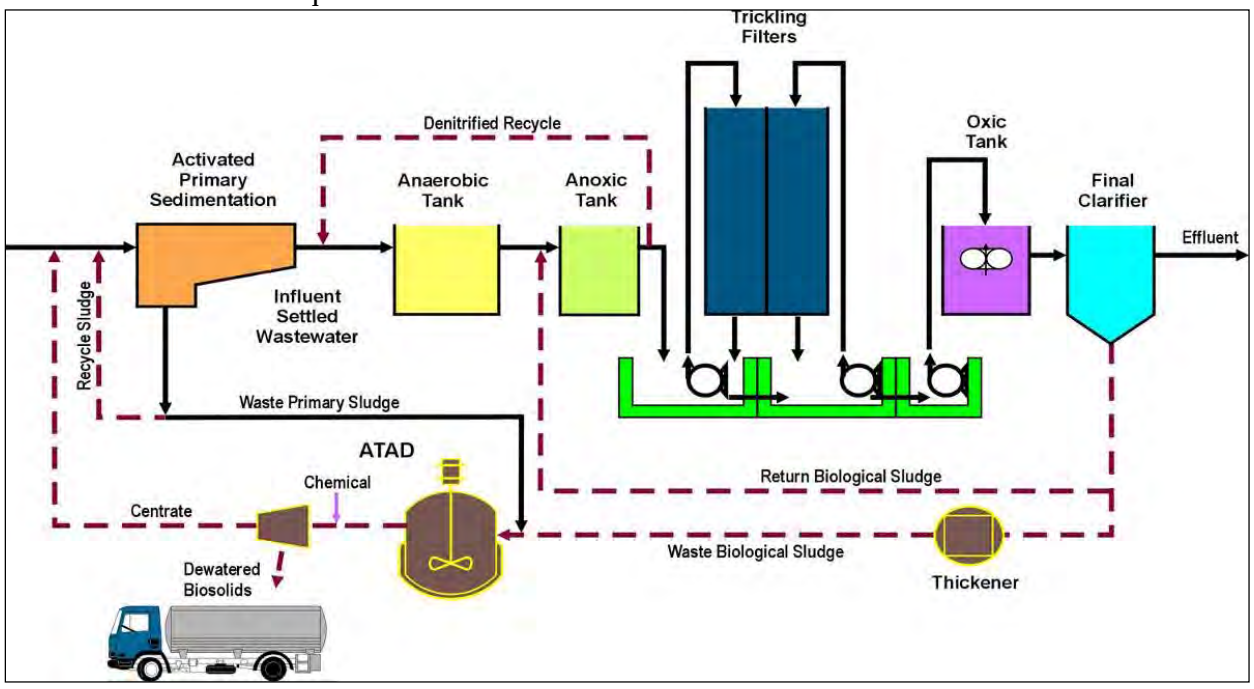


Figure 1: Wastewater Treatment Overview

Initially the wastewater flows into the plant from a sewage lift station located at Marine Park Drive. The influent then passes through several mechanical devices to remove large particles

including rocks, rags, plastics and grit. This is done in the headworks of the facility and prevents damage to downstream equipment.

Headworks

Primary Sedimentation Tanks

The flow then enters the Primary Sedimentation Tanks where heavier organic and inorganic solids are settled out of the liquid stream. These particles are then pumped to the ATAD for stabilization. The liquid, on the other hand, then enters the tertiary BNR and SGR-FGR part of the facility for further treatment.

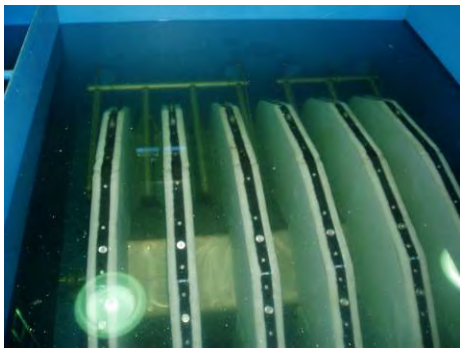
SGR's

FGR

The tertiary treatment involves the use of bacteria to convert degradable organic matter into bacterial cells. These cells are then separated from the liquid in the secondary clarifiers.

The growth portion of the bacteria is removed from the process by thickening and pumped to the ATAD while the remainder is recycled back to the incoming wastewater. This maintains a balance of food (wastewater organics) to micro organisms.

The secondary effluent then passes through the Aqua Aerobics disk filtration system which provides 10 micron filtration, the effluent is then disinfected using a Wedeco Ideal Horizons Ultra Violet Light (UV) disinfection system prior to it being discharged into the Salmon Arm Bay in the Shuswap Lake.



Cloth Disk Filters

Secondary Clarifiers

UV Treatment System

UV Bulbs

Solids are digested to form biosolids in the high temperature ATAD. This process uses high temperature bacteria (60 to 70 degrees Celsius) to stabilize and pasteurize the biosolids. Following processing, the biosolids are thickened with the use of high speed centrifuges and the biosolids are then incorporated with soil to produce a high quality top soil.

Centrifuge

Train B Odour Scrubber

Odour control is another major component of the plant operation. The odour control has been separated into two trains based on the concentration of odour generating compounds. One train deals with a large air volume of low odour concentration while the second train deals with a low air volume with a high concentration of odour compounds. The latter system uses a multi treatment system – biofilter, ozone contact, four (4) stage chemical scrubber and dilution while the other system uses a single stage chemical scrubber.

Single Stage Chemical Scrubber

ATAD & Piping

Generator Set, Train B - Odour Control and Filtration Building

4.2 Flows

Plant flow averaged 4,406 m^3 per day for the year. The highest flow was recorded on March 17th when snowmelt increased the 24-hour total influent flow to 6,013 m^3. This compares to the 2010 average flow of 4, 603 m^3 with a peak of 5,674 m^3 on January 13th when rainfall combined with snowmelt to increase the flow. The outfall was visually inspected on February 17th, 2011 and a new outfall marker buoy was installed. On March 17th the outfall was dye tested with no evidence of any failures.

Outfall with marker buoy

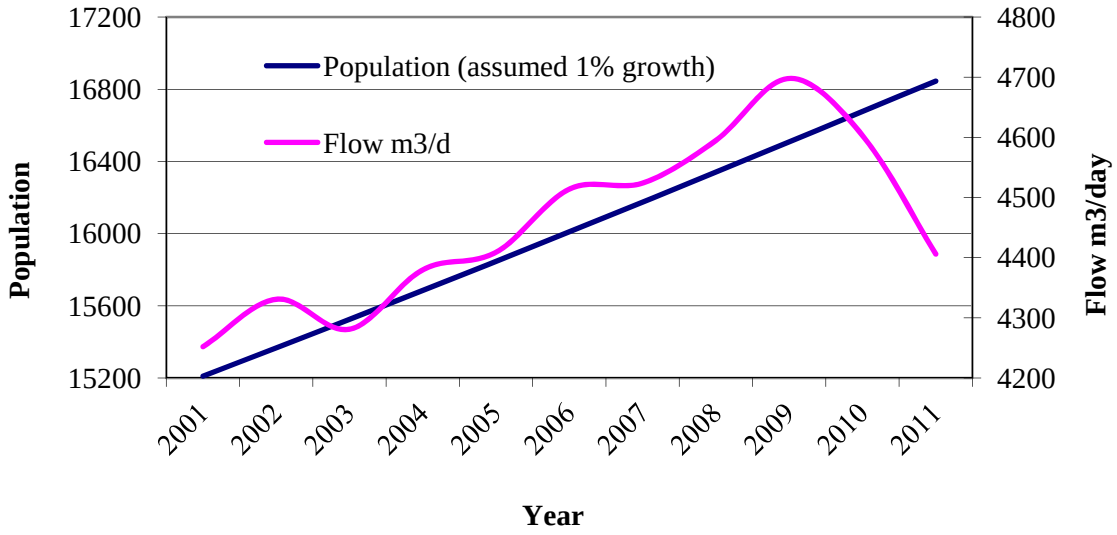


Figure 2: Yearly Average Daily Flow

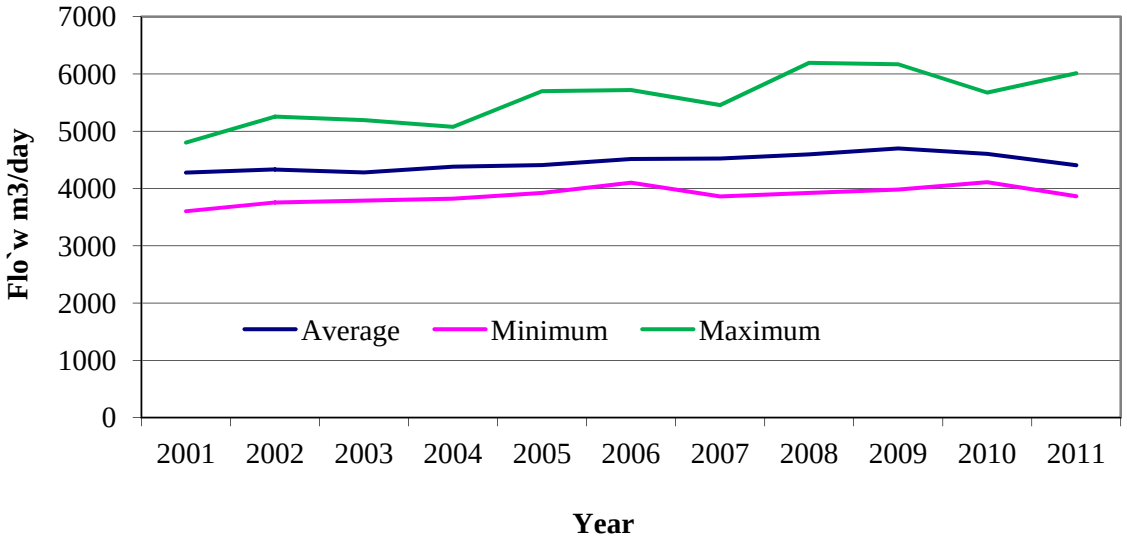


Figure 3: Minimum, Maximum and Average Daily Flows

4.3 Process Alterations

Biomass stability in the FGR and SGR's is the key parameter to constant quality effluent. In late 2009 and during all of 2010, Operators modified the strategy to maintain sufficient biomass in the SGR's by utilizing the final effluent clarifiers to store biomass prior to biomass accumulating in the FGR.

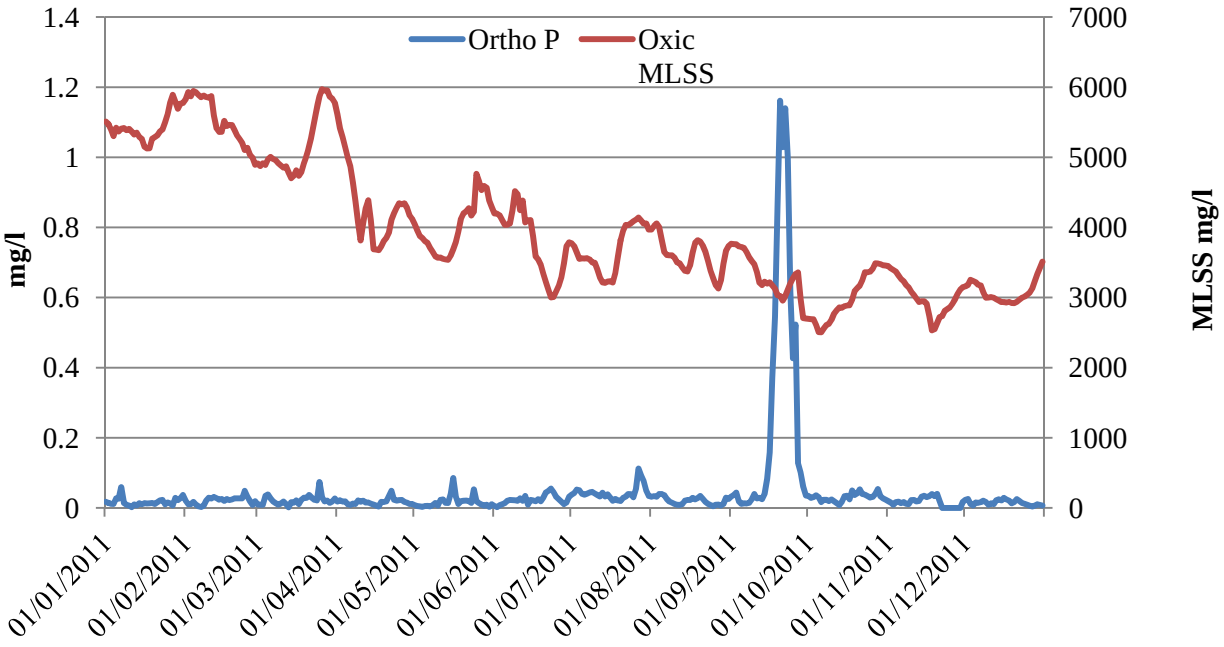


Figure 4: 2011 MLSS & Ortho P

This strategy proved to be very successful 2010 in maintaining needed biomass in the SGR's for effective biological nutrient removal. In late October 2010, the first phase of the FGR Media Upgrade project was started. This project involved replacement of 1,560 m^3 crossflow PVC media with the same amount of vertical flow PVC media which was shown in a September 2007 study to be less prone to biomass build up. Because the FGR would have to be isolated and shut down for the work to be completed, the project was staged in two phases allowing for half the FGR to be in operation at all times. The second phase was completed in April, 2011. Using data gathered during the first phase, operators were able to alter the process which resulted in little impact on effluent quality during the second phase of the upgrade. The process did experience one upset in late September which was originally attributed to servicing of one of the 4 Trickling Filter Recycle pumps. As a precaution, a spare pump has been budgeted for in 2012

Process response to the upgrade has been very favorable. Effluent quality has improved and stabilized as a result of reduced build up and subsequent sloughing events. This has also allowed operators to lower process MLSS to the original design target further reducing loadings on the final effluent clarifiers, cloth filters and UV disinfection system.

Table 5 - Oxic SGR MLSS Concentration

Oxic MLSS *mg/l*	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Average	3500	3200	4700	5100	4400	4100	4500	4700	5900	4400
Maximum	6600	4900	7100	7500	7000	7500	8500	8100	6900	6000
Minimum	1400	1100	2200	2100	2200	100	1200	1600	4100	2500

Note: 2007 Oxic MLSS of 100 occurred in January

4.4 Nutrient Removal

Phosphorus concentration is the key nutrient contributing to poor water quality in the Salmon Arm Bay as it is in most lakes in British Columbia. The WPCC contributed approximately 2% of the phosphorus loading to the Salmon Arm Bay in 2011.

Table 6 – Phosphorus Mass Loading to Salmon Arm Bay from Salmon River, White Creek, Tappen Creek and Salmon Arm WPCC at 2011 Concentration and Flow – Daily Annual Averages

Total Mass Load (kg/d)	Salmon River* 1985 - 1999		White Creek* 1987 - 1990		Tappen Creek* 1988 - 1990		WPCC Year 2011	
	(kg/d)	% of Total	(kg/d)	% of Total	(kg/d)	% of Total	(kg/d)	% of Total
75.0	65.7	88%	6.9	9%	0.9	1%	1.5	2%

- *Data supplied from WPCC Outfall Impact Study, August 2002 (Dayton & Knight Ltd.)

Table 7 - Effluent Quality Summary - Yearly

Parameter (*mg/l*)	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Permit
Flow (m^3)	4331	4281	4380	4409	4514	4524	4595	4698	4603	4406	8200
Total Phosphorus (mg/l)	1.22	0.82	0.46	0.41	0.38	0.45	0.64	0.66	0.49	0.35	1.0
Kg P per Day	5.28	3.51	2.01	1.81	1.72	2.04	2.94	3.07	2.26	1.54	8.2
Kg P per Year	1927	1281	736	660	626	745	1073	1121	823	563	2993
Suspended Solids (mg/l)	19.4	13.4	7.4	6.4	5.1	8.7	7.9	10.2	9.6	7.9	40
BOD_5 (mg/l)	17.1	13.5	9.4	9.0	7.7	7.3	7.7	3.6	4.9	4.8	30
Ortho Phosphorus (mg/l)	0.36	0.26	0.09	0.09	0.09	0.11	0.21	0.17	0.10	0.04	N/A
Ammonia (mg/l)	12.3	9.7	7.5	8.2	7.8	13.2	20.8	10.3	13.5	10.4	N/A
Nitrate & Nitrite (mg/l)	3.7	6.2	8.0	4.4	8.8	6.5	4.4	8.7	4.9	6.7	N/A
NH_4 NO_3 NO_2 (mg/l)	16.0	15.9	15.5	12.6	16.6	19.6	25.1	19.0	18.4	16.7	N/A

Note: Final Effluent Filtration commenced in 2004

Table 8 - Effluent Quality Summary - Weekly

Test Data	S.S. mg/l	BOD mg/l	Ortho P Mg/l	Total P mg/l	NH_4 mg/l	NOx mg/l	Oxic MLSS mg/l
January 6, 2011	8.7	4.8	0.03	0.22	23.8	N/A	5369
January 13, 2011	9.0	3.7	0.03	0.11	22.7	1.3	5349
January 20, 2011	9.0	3.2	0.03	0.23	25.0	2.6	5288
January 27, 2011	16.2	5.9	0.04	0.53	17.0	5.6	5891
February 3, 2011	18.7	5.0	0.04	0.49	8.9	11.5	5871
February 10, 2011	8.7	<2.0	0.04	0.27	6.5	11.8	5446
February 17, 2011	8.5	3.3	0.02	0.21	8.3	8.7	5850
February 24, 2011	6.7	2.9	0.03	0.52	14.0	5.4	5103
March 3, 2011	6.6	4.4	0.03	0.28	18.8	1.4	4913
March 10, 2011	5.9	3.9	0.03	0.27	23.8	0.5	4883
March 17, 2011	7.2	3.6	0.03	0.17	18.8	2.1	4737
March 24, 2011	11.7	5.8	0.04	0.44	15.5	5.0	5699
March 31, 2011	12.7	4.2	0.05	0.42	6.5	9.1	5776
April 7, 2011	6.6	N/A	0.03	0.17	12.8	6.3	4640
April 14, 2011	8.6	N/A	0.04	0.27	17.9	3.1	4102
April 21, 2011	6.9	N/A	0.08	0.46	22.7	0.6	3927
April 28, 2011	11.6	7.5	0.03	0.30	17.0	1.2	4280

Test Data	S.S. mg/l	BOD mg/l	Ortho P Mg/l	Total P mg/l	NH4 mg/l	NOx mg/l	Oxic MLSS mg/l
May 5, 2011	7.9	6.6	0.02	0.19	18.8	2.9	3806
May 12, 2011	10.1	8.0	0.03	0.35	23.8	0.6	3552
May 19, 2011	10.7	9.1	0.03	0.33	22.7	0.4	4122
May 26, 2011	8.5	7.1	0.02	0.37	14.0	4.0	4660
June 2, 2011	7.1	6.6	0.01	0.23	18.8	2.5	4195
June 9, 2011	8.6	8.9	0.01	0.28	18.8	3.7	4517
June 16, 2011	8.9	5.3	0.02	0.29	11.0	6.1	3875
June 23, 2011	4.8	4.5	0.02	0.24	10.0	7.7	3001
June 29, 2011	7.5	6.0	0.01	0.24	9.6	7.1	3732
July 7, 2011	8.6	4.0	0.02	0.30	5.9	10.7	3560
July 14, 2011	4.8	4.9	0.00	0.39	5.6	8.6	3209
July 20, 2011	4.6	6.5	0.00	0.14	6.5	9.4	3817
July 28, 2011	4.4	5.2	0.11	0.18	8.3	5.7	4099
August 4, 2011	4.7	6.5	0.02	0.26	9.1	5.8	4003
August 11, 2011	2.6	3.9	0.01	0.21	6.8	4.8	3502
August 18, 2011	3.8	4.7	0.01	0.24	7.2	6.2	3780
August 25, 2011	2.8	4.3	0.01	0.21	6.2	6.6	3273
September 1, 2011	6.0	5.6	0.00	0.32	3.0	9.8	3766
September 8, 2011	5.0	4.7	0.00	0.29	2.6	9.0	3572
September 16, 2011	16.1	3.7	0.20	0.54	7.2	10.9	3216
September 22, 2011	10.7	1.8	0.93	2.21	4.0	13.2	3021
September 29, 2011	6.0	2.8	0.09	0.43	2.8	11.4	2707
October 6, 2011	6.2	2.0	0.00	0.27	2.5	10.7	2506
October 13, 2011	6.7	1.0	0.01	0.32	2.0	10.3	2858
October 20, 2011	11.2	3.3	0.01	0.33	2.0	10.4	3134
October 27, 2011	9.8	5.1	0.03	0.50	2.8	11.5	3489
November 3, 2011	6.6	3.0	0.01	0.30	1.4	12.4	3394
November 10, 2011	5.6	1.7	0.01	0.48	1.2	9.2	3082
November 17, 2011	6.5	12.4	0.01	0.25	1.9	8.3	2500
November 24, 2011	7.3	6.4	0.01	0.30	1.2	8.0	2836
December 1, 2011	7.9	2.5	0.00	0.31	3.2	8.6	3159
December 8, 2011	6.7	4.1	0.00	0.26	1.4	8.4	3074
December 14, 2011	5.1	1	0.01	0.31	3.0	8.8	2956
December 22, 2011	5.1	4.1	0.00	0.45	3.8	5.6	2968
December 29, 2011	6.9	4.1	0.01	0.28	7.5	3.8	3338
Average	**7.9**	**4.8**	**0.04**	**0.35**	**10.3**	**6.7**	**3989**
Maximum	**18.7**	**12.4**	**0.93**	**2.21**	**25.0**	**13.2**	**5891**
Minimum	**2.6**	**1.0**	**0.00**	**0.11**	**1.2**	**0.4**	**2500**

4.5 Fecal Coliform

The ultraviolet disinfection system functioned well during 2011; however, this system will require upgrading in the near future.

4.6 Toxicity

The annual toxicity test was completed on November 8, 2011 by Maxxam Analytics and once again there were no mortalities with the fish all appearing and behaving normally.

4.7 Biosolids

The City of Salmon Arm produced approximately 300 dry tonnes of Class A biosolids during 2011. The biosolids are used by the Columbia Shuswap Regional District for local landfill reclamation. CARO Environmental Services conducted tests on the biosolids for nutrients, metals and fecal coliform on November 8, 2011. Test results, once again, verified the biosolids produced by the Auto Thermophilic Aerobic Digester (ATAD) were of the highest quality in managed under the Organic Matter Recycling Regulation.

4.8 Operating Certificate

The City operates the WPCC under draft Operating Certificate issued by the BC Ministry of Environment. The certificate is attached as **Appendix B**.

4.9 Liquid Waste Management Plan

The City's Liquid Waste Management Plan (LWMP) was adopted by City Council on November 2, 2004 and was subsequently approved by the Ministry of Environment (MOE). One of the commitments contained in the approved LWMP was to carry out a LWMP update during 2009 to review progress, update the schedule, and make any required revisions in consultation with MOE. The City has been working with Opus Dayton & Knight Consulting Engineer to update LWMP. In the fall of 2010 meetings were held with MOE staff in an effort to review the proposed updates and amendments. Resulting from these discussions a draft LWMP update memorandum has been prepared and submitted for MOE review and comment.

4.10 WPCC Capital Projects

Table 9 – WPCC Capital Project Information

WPCC Capital Projects completed in 2011
◆ Trickling Filter Media Replacement "New Vertical Flow Media"
Staff Initiated WPCC Projects Completed in 2011
◆ Trickling Filter Nozzle Upgrade
◆ Replace Dissolved Oxygen Sensors
◆ Improve Waste Biological Sludge Thickening System
◆ Replaced Primary Clarifier #1 Drive
WPCC Capital Projects scheduled for 2012
◆ Annual Staff initiated improvements
◆ Design of ultraviolet (UV) disinfection upgrade. This was budgeted in 2011; however, the decision was made to delay this project until the Trickling Filter Media Upgrade was completed. The new media may result in an improved effluent quality which may impact the design criteria of the new UV system.
◆ Enhance Train A Odour Scrubber

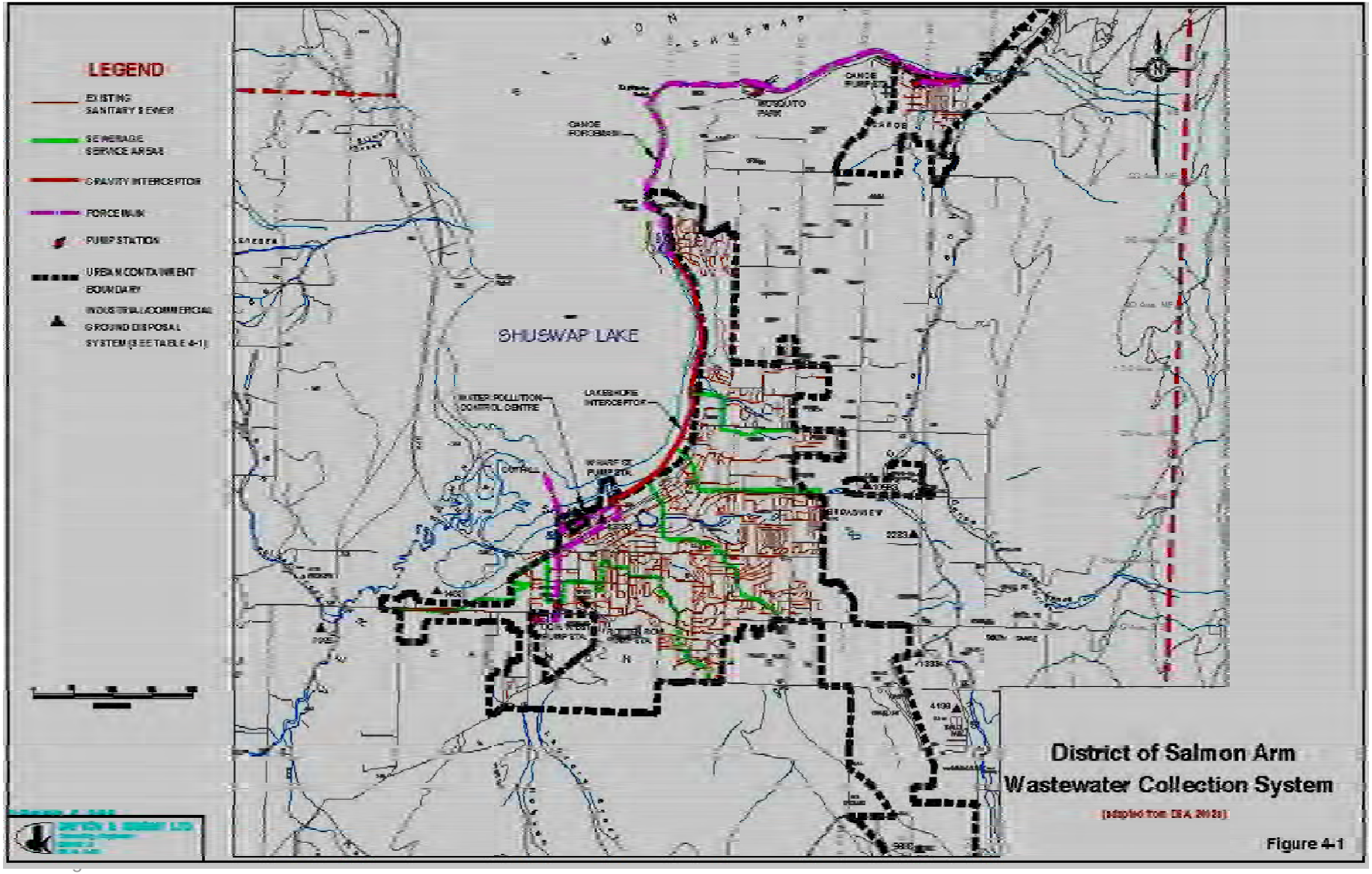
Old Splash Plate Nozzles with unequal distribution

Spinfree Nozzles with equal distribution

WPCC Trickling Filter Media Replacement

New Media Installation

APPENDIX A


LEGEND
EXISTING SANITARY SEWER
SEWERAGE SERVICE AREAS
GRAVITY INTERCEPTOR
FORCE MAIN
PUMP STATION
URBAN CONTAINMENT BOUNDARY
INDUSTRIAL/COMMERCIAL GROUND DISPOSAL SYSTEM (SEE TABLE 4-1)
SHUSWAP LAKE
WATER POLLUTION CONTROL CENTRE
LAKESHORE INTERCEPTOR
MOSQUITO PARK
District of Salmon Arm
Wastewater Collection System
(adapted from CBA, 2012a)
Figure 4-1

APPENDIX “B”

OPERATIONAL CERTIFICATE

BRITISH COLUMBIA

PROVINCE OF BRITISH COLUMBIA

MINISTRY OF ENVIRONMENT, LANDS AND PARKS

Environment and Lands
Pollution Prevention
1259 Dalhousie Drive
Kamloops, British Columbia
V2C 5Z5
Telephone: (250) 371-6200
Fax: (250) 828-4000

July 15, 1999

File: PE-1251

REGISTERED MAIL

District of Salmon Arm
450 - 2nd Avenue NE
PO Box 40
Salmon Arm, BC V1E 4N2

Dear Permittee:

Enclosed is amended Permit PE-1251 issued under the provisions of the *Waste Management Act.* Your attention is respectfully directed to the terms and conditions outlined in the Permit. An annual permit fee will be determined according to the Waste Management Permit Fees Regulation.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Permittee. This Permit is issued pursuant to the provisions of the *Waste Management Act* to ensure compliance with Section 54(3) of that statute, which makes it an offence to discharge waste without proper authorization. It is also the responsibility of the Permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This Permit may be appealed by persons who consider themselves aggrieved by this decision in accordance with Part 7 of the *Waste Management Act.* Written notice of intent to appeal must be received by the Environmental Appeal Board within thirty (30) days of the date of the Permit.

Administration of this Permit will be carried out by staff from the Regional Office located at 1259 Dalhousie Drive, Kamloops, British Columbia V2C 5Z5. Plans, data and reports pertinent to the Permit are to be submitted to the Regional Waste Manager at this address.

Yours truly,

T.R. Forty, P. Eng.
Assistant Regional Waste Manager
Southern Interior Region

enclosure

PROVINCE OF
BRITISH COLUMBIA

BRITISH COLUMBIA

Environment and Lands
Pollution Prevention
1259 Dalhousie Drive
Kamloops
British Columbia V2C 5Z5
Telephone: (250) 371-6200
Fax: (250) 828-4000

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

PERMIT
PE-1251

Under the Provisions of the Waste Management Act

District of Salmon Arm

is authorized to discharge effluent to Tappen Bay of Shuswap Lake from a municipal sewerage system located in Salmon Arm, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

This Permit supersedes and amends all previous versions of Permit **PE-1251**, issued under the Waste Management Act.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Permittee.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Dates Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

1. AUTHORIZED DISCHARGES

1.1 This subsection applies to the discharge of effluent from a **MUNICIPAL SEWAGE TREATMENT PLANT**. The site reference number for this discharge is **E212492**.

1.1.1 The maximum authorized rate of discharge is **8200 m^3/day**.

1.1.2 The characteristics of the discharge shall not exceed:

5 - day Biochemical Oxygen Demand (BOD)	**30 mg/L**
Non-filterable residue (TSS)	**40 mg/L**
Chlorine	**0.01 mg/L**
Total Phosphorus	**1.0 mg/L**

1.1.3 The authorized works are **a fixed growth - suspended growth secondary treatment plant with biological and/or chemical phosphorus removal, chlorination - dechlorination facilities, auto thermophilic aerobic digester, sludge handling facilities, outfall**, and related appurtenances approximately located as shown on attached Site Plan A.

1.1.4 The location of the facilities from which the discharge originates is **Lot 1 of the NW 1/4 of Section 14, Township 20, Range 10, West of the Sixth Meridian, Kamloops Division Yale District, Plan 26245.**

1.1.5 The location of the point of discharge is **unsurveyed Crown Land (all in the bed of Shuswap Lake).**

2. GENERAL REQUIREMENTS

2.1 Maintenance of Works and Emergency Procedures

The Permittee shall inspect the pollution control works regularly and maintain them in good working order. In the event of an emergency or condition beyond the control of the Permittee which prevents continuing operation of the approved method of pollution control, the Permittee shall immediately notify the Regional Waste Manager and take appropriate remedial action.

2.2 Bypasses

The discharge of effluent which has bypassed the designated treatment works is prohibited unless the approval of the Regional Waste Manager is obtained and confirmed in writing.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

2.3 Process Modifications

The Permittee shall notify the Regional Waste Manager prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

2.4 Plans - New Works

Plans and specifications of any proposed works shall be submitted to the Regional Waste Manager and the Manager's approval obtained before construction commences. The works shall be constructed in accordance with such plans.

2.5 Posting of Outfall

The Permittee shall erect a sign along the alignment of the outfall above high water mark. The sign shall identify the nature of the works. The wording and size of the sign requires the approval of the Regional Waste Manager.

2.6 Outfall Inspection

The Permittee may be required to conduct a dye test on the outfall line (or inspect by another method approved by the Regional Waste Manager). The test shall be conducted when directed by the Regional Waste Manager.

2.7 Chlorination

The Permittee shall maintain a chlorine residual prior to dechlorination between 0.5 and 1.0 mg/L at all times and provide not less than one hour contact time at average flow rates.

2.8 Dechlorination

The effluent shall be dechlorinated prior to discharge to reduce the chlorine residual to 0.01 mg/L or less.

2.9 Sludge Wasting and Disposal

Sludge wasted from the treatment plant shall be disposed of to a site and in a manner approved by the Regional Waste Manager.

2.10 Operator Certification

The sewage treatment facility shall be classified by the Environmental Operators Certification Program. The Permittee shall ensure that all operators of the facility be certified by the Program to the appropriate level for the facility, and to the satisfaction of the Regional Waste Manager.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

2.11 Phosphorus Study

The Permittee shall retain a suitably qualified professional to study the environmental impact of the phosphorus loading at the maximum discharge rate of 8200 m3/day. The study shall consider the morphology of the lake in the discharge area, other sources of contaminants (i.e. Salmon River, White Creek, stormwater runoff etc.) and the location of the outfall. As well as the phosphorus issue, this study shall address the toxicity of the effluent and the potential impacts on aquatic life, especially during low water conditions. This study shall be complete and submitted for approval by the Regional Waste Manager by December 31, 2000.

3. MONITORING AND REPORTING REQUIREMENTS

3.1 Discharge Monitoring

3.1.1 Composite Sampling

The Permittee shall obtain composite samples of the effluent. The composite samples shall comprise samples taken over a 24 hour period.

The following samples and analyses shall be obtained:

PARAMETERS	FREQUENCY
5-day Biochemical Oxygen Demand	weekly
Non-filterable Residue (total suspended solids)	weekly
Total Phosphorus	weekly
Ammonia	monthly
Nitrates	monthly
Fecal Coliforms	monthly
pH	monthly
Toxicity	annually
Chlorine	continuous

Proper care should be taken in sampling, storing and transporting the samples to adequately control temperature and avoid contamination, breakage, etc.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

3.2 Monitoring Procedures

3.2.1 Analyses

Analyses are to be carried out in accordance with procedures described in the latest version of "British Columbia Environmental Laboratory Manual for the Analysis of Water, Wastewater, Sediment and Biological Materials, (March 1994 Permittee Edition)", or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual may be purchased from Queen's Printer, P.O. Box 9452, Stn Prov Govt, Victoria, British Columbia V8W 9V7 (1-800-663-6105).

Analyses for determining the toxicity of liquid effluent to fish shall be carried out in accordance with the procedures described in the "Laboratory Procedures for Measuring Acute Lethal Toxicity of Liquid Effluent to Fish", dated November, 1982.

Copies of the above manual may be purchased from the Ministry of Environment, Lands and Parks, P.O. Box 9342, Stn Prov Govt, Victoria, British Columbia, V8W 9M1.

3.2.2 Sampling Location and Techniques

All sampling locations, techniques and equipment require the consent of the Regional Waste Manager prior to use.

Sampling and flow measurement shall be carried out in accordance with the procedures described in "British Columbia Field Sampling Manual for Continuous Monitoring plus the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples", as published by the Ministry of Environment, Lands and Parks, or by suitable alternative procedures as authorized by the Regional Waste Manager.

Copies of the above manual are available from the Ministry of Environment, Lands and Parks, P.O. Box 9342, Stn Prov Govt, Victoria, British Columbia V8W 9M1.

3.3 Flow Measurement

The Permittee shall provide and maintain a suitable flow measuring device and record once per day the effluent volume discharged over a 24-hour period.

3.4 Reporting

The Permittee shall maintain data of analyses and flow measurements for inspection and submit the data, suitably tabulated, to the Regional Waste Manager for the previous month.

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

3.5 Annual Report

The Permittee shall submit an annual report on or before March 31 of each year.

The annual report shall review and interpret monitoring data for the preceding calendar year and provide graphical analysis with suitable interpretations of any trends in the monitoring results.

The annual report shall review the performance of the sewage treatment system and identify any necessary changes to the treatment process and for works.

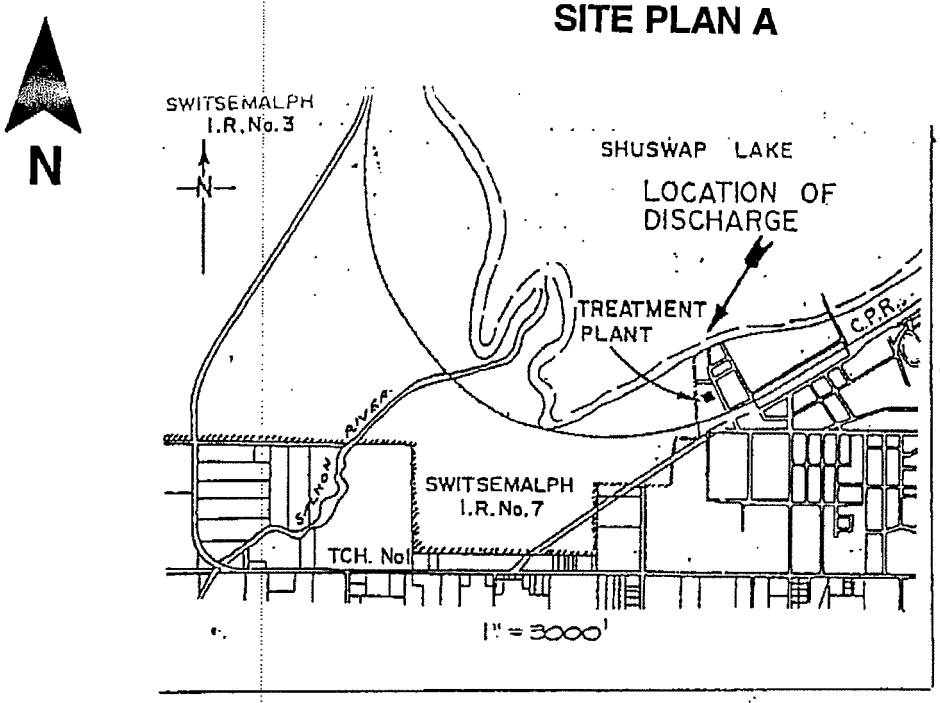
T.R. Forty, P. Eng.
Assistant Regional Waste Manager

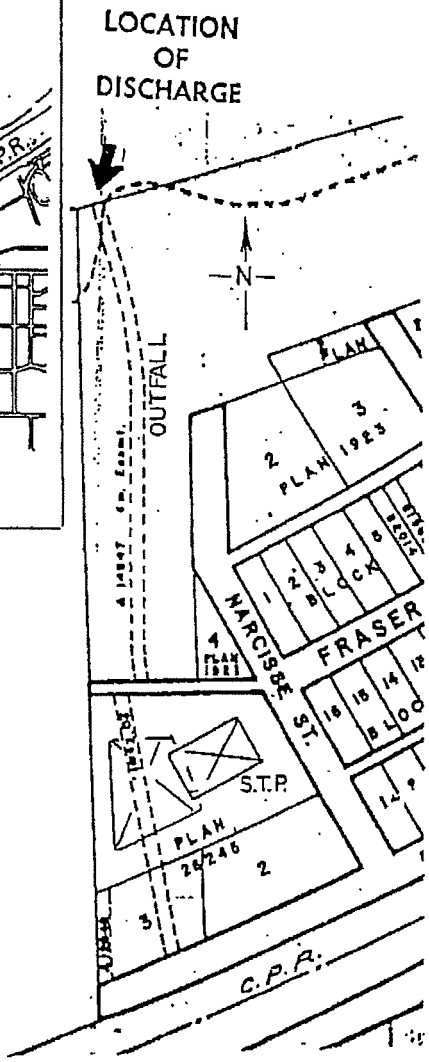
Date Issued: July 4, 1972
Date Amended: June 17, 1976
March 18, 1988
February 7, 1990
July 15, 1999

PROVINCE OF
BRITISH COLUMBIA

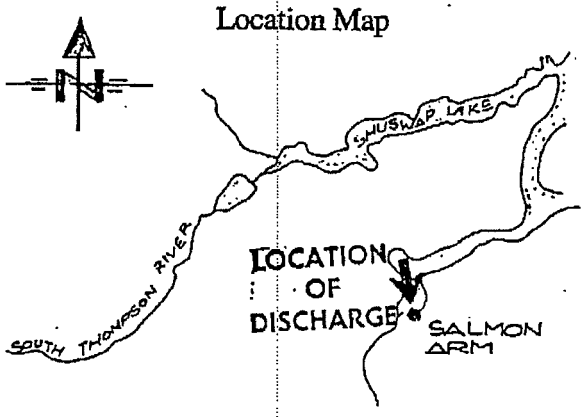
Pollution Prevention

SITE PLAN A





Location Map



Permit: PE-1251

Date: July 15, 1999

T.R. Forty, P. Eng.
Assistant Regional Waste Manager

Province of
British Columbia
Ministry of
Environment,
Lands and Parks

BC Environment

Southern Interior Region
1259 Dalhousie Drive
Kamloops
British Columbia
V2C 5Z5
Telephone: (604) 371-6200

October 21, 1996

File: PE 11402

REGISTERED MAIL

District of Salmon Arm
P.O.Box 40
450-2nd Ave NE
Salmon Arm , BC V1E 4N2

Dear Permittee:

Enclosed is Permit PE-11402 issued under the provisions of the Waste Management Act. Your attention is respectfully directed to the terms and conditions outlined in the permit. An annual permit fee will be determined according to the Waste Management Permit Fees Regulation.

This permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorised by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the permittee. This permit is issued pursuant to the provisions of the Waste Management Act to ensure compliance with Section 34(3) of that statute, which makes it an offence to discharge waste without proper authorisation. It is also the responsibility of the permittee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

This permit may be appealed by persons who consider themselves aggrieved by this decision in accordance with Part 5 of the Waste Management Act. Written notice of intent to appeal must be received by the Regional Waste Manager within twenty-one (21) days.

Administration of this permit will be carried out by staff from the Regional Office located at 1259 Dalhousie Drive, Kamloops, BC ., V2C 5Z5 . Plans, data and reports pertinent to the permit are to be submitted to the Regional Waste Manager at this address.

Yours truly,

Donald K. May, P.Eng.
Assistant Regional Waste Manager

enclosure

PROVINCE OF
BRITISH COLUMBIA

Environmental Protection
1259 Dalhousie Drive
Kamloops
British Columbia V2C 5Z5
Telephone: (604) 371-6200

MINISTRY OF ENVIRONMENT,
LANDS AND PARKS

PERMIT
PE 11402

Under the Provisions of the Waste Management Act

The District of Salmon Arm

is authorized to discharge thermophilically digested biosolids from a Sewage Treatment Plant located in Salmon Arm, British Columbia to land located in and around the District of Salmon Arm, British Columbia, subject to the conditions listed below. Contravention of any of these conditions is a violation of the Waste Management Act and may result in prosecution.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority rest with the Permittee.

Donald K. May, P.Eng.
Assistant Regional Waste Manager

Date Issued: October 21, 1996
Amendment Date:
(most recent)

PERMIT NO.: PE 11402

1. AUTHORIZED DISCHARGES

1.1 This subsection applies to the discharge of thermophilically digested biosolids from the District of Salmon Arm Water Pollution Control Centre located at 121 Narcisse Street SW in Salmon Arm.

1.1.1 The maximum authorized rate of discharge is 1500 cubic metres of thermophilically digested biosolids per year.

1.1.2 The characteristics of the biosolids shall be equivalent to or better than typical pasteurized sludge from the autothermophilic digestion of sewage sludge.

1.1.3 The authorized works are biosolids storage facilities, biosolids spreaders and related appurtenances.

2. Location of the Facilities

The lands to which the biosolids are to be applied are legally described as:

a) Lot 2, Plan KAP 47072, Section 7, Township 20, Range 9, Kamloops Division Yale District, West of the Sixth Meridian.

b) Various other locations in and around the District of Salmon Arm area, subject to written authorization by the Regional Waste Manager on a site specific basis.

c). Technical information regarding sites referred to in Section 2. (b) must be submitted to the Regional Waste Manager for reveiw, at least 60 days prior to the intended commencement of biosolids application. The Regional Waste Manager, at his discretion, may require public notification of the intent to discharge biosolids. If it is determined that such notification is required, the Permittee will be informed in writing by the Regional Waste Manager. The Permittee shall bear the costs of such notification.

3. GENERAL REQUIREMENTS Applicable to the Authorized Discharges

3.1 Biosolids shall have been stabilized by an acceptable process of digestion or composting. More stabilization may be required by the Regional Waste Manager if odour or vector problems develop.

Donald K. May, P.Eng.,
Assistant Regional Waste Manager

PROVINCE OF
BRITISH COLUMBIA

Environmental Protection

3.2 Biosolids shall be applied to land in accordance with the *draft Guidelines for Disposal of Domestic Sludge under the Waste Management Act (attached)*

3.3 Movement of biosolids and/or constituents off-site, subsequent to application, the result of rain, wind, water, or freeze-thaw conditions is prohibited.

3.4 Biosolids shall not be applied to frozen or snow covered land or to land with a slope of 10% or more.

3.5 Biosolids shall not be applied within 30 metres of a surface waterbody.

3.6 Biosolids shall be applied in a manner consistent with acceptable agricultural practise, as outlined in the *Agricultural Waste Control Regulation, B.C. Reg. 131/92.*

3.7 Biosolids shall not be applied to land where the groundwater table at the time of application is within one metre of the surface.

3.8 Public access to biosolids treated sites shall be controlled by means satisfactory to the Regional Waste Manager.

3.9 The Regional Waste Manager may prohibit application of biosolids to a site if, in his opinion, any substance in the soil is approaching levels detrimental to health and/or the environment.

4. Process Modifications

The Permittee shall notify the Regional Waste Manager prior to implementing changes to any process that may affect the quality and/or quantity of the discharge.

5. Bypasses

The discharge of biosolids which has bypassed the designated treatment works is prohibited unless the consent of the Regional Waste Manager is obtained and confirmed in writing.

6. Monitoring

The soils to which the biosolids are to be applied shall be analyzed prior to each application and once after each application of biosolids as directed by the Regional Waste Manager. The soils shall be analyzed for the following parameters:

Donald K. May, P.Eng.
Assistant Regional Waste Manager

Arsenic	Chromium	Mercury	Selenium
Cadmium	Copper	Molybdenum	Zinc
Cobalt	Lead	Nickel	Total Kjeldahl Nitrogen

The biosolids to be applied to the ground shall be analyzed once annually or as otherwise specified by the Regional Waste Manager. Analysis shall be in accordance with Schedule C of the *draft Guidelines for Disposal of Domestic Sludge under the Waste Management Act.*

Soils and biosolids sampling shall be conducted in accordance with the soils and biosolids sampling methodology defined in the *draft Guidelines for Disposal of Domestic Sludge under the Waste Management Act.*

The Regional Waste Manager may require the monitoring of vegetation grown on the land treated with biosolids.

7. Reporting

The Permittee shall keep records of the quantity of biosolids discharged, the application rate (kg/ha), the areas and locations of land treated with biosolids, and analysis for inspection by Environmental Protection staff and submit the data suitably tabulated to the Regional Waste Manager for the previous year by January 31st of the next year.

Donald K. May, P.Eng.,
Assistant Regional Waste Manager