CITY OF KAMLOOPS

2009 LIQUID WASTE MANAGEMENT PLAN REVIEW

FINAL REPORT

SUBMITTED BY:

URBAN SYSTEMS.

USL REF: 0368.0314.20
DECEMBER 2009

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

December 23, 2009

File: 0368.0314.20-R

City of Kamloops
105 Seymour Street
KAMLOOPS, BC V2C 2C6

Attention: Mike Warren, P. Eng., Engineering Manager

RE: 2009 LIQUID WASTE MANAGEMENT PLAN REVIEW – FINAL REPORT

We are pleased to provide three (3) hard copies and one (1) CD containing a PDF version of the Final Report. The Final Report includes a summary of the:

- LWMP Review process to date;
- Progress made by the City on commitments made in the 2003 LWMP;
- Proposed treatment alternative; and
- Commitments made as part of this LWMP Review.

We would like to thank the City for retaining Urban Systems to assist you in completing this review of the LWMP.

Yours truly,

URBAN SYSTEMS LTD.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA C. A. TOWN

Chris Town, P. Eng., MASc

/crb

Encls.

U:\Projects_KAM\0368\0314\20\R-Reports-Studies-Documents\Final\LWMP Review Report\2009-12-23-LET-LWMP review final cover-warren.doc

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

The City of Kamloops has embarked on a review of its Liquid Waste Management Plan (LWMP) which was completed in July 2003 and approved by the Minister of the Environment in May 2004. One of the commitments of the 2003 LWMP was to conduct a review after five years.

The primary objectives of this review are to:

.1 Consult with technical (government agencies) and public individuals to see if there are any other issues that have been identified over the last 5 years that should be addressed.

.2 Review progress on all of the commitments made in the 2003 LWMP; and

.3 Review the proposed alternate treatment process which maximizes the use of existing infrastructure, including alum addition for phosphorus reduction instead of using the biological phosphorus removal process recommended in the 2003 LWMP.

2.0 PUBLIC PROCESS

The first step in reactivating this review involved identifying government agencies and members of the public to participate on a combined Technical/Public Advisory Committee. The following agencies/individuals were invited to attend.

- Ministry of Environment – Carol Danyluk, P.Eng.,; Bob Grace, R.P.Bio.; Gabriele Matscha
- City of Kamloops – Mike Warren, P.Eng.; Jake Devlin, P.Eng.; Deven Matkowski, P.Eng.; David Teasdale, BASc.
- Interior Health Authority – Dan Ferguson
- Domtar – Kristin Dangelmaier, P.Eng.
- Ministry of Agriculture and Lands – Graham Strachan, P.Ag.
- Skeetchestn Indian Band – Mike Anderson
- Fraser Basin Council – Dr. Bob Smillie
- Tobiano – Michael Schaad, Utilities Manager
- Environment Canada – Snehal Lakhani
- Ministry of Community Development – Catriona Weidman, P.Eng.
- Fisheries and Oceans Canada – Michael Crowe, R.P.Bio.
- Kamloops Indian Band – Dave Kneeshaw, P.Eng.
- Thompson Rivers University – Susan Purdy, BASc
- Thompson Nicola Regional District – Greg Toma
- Public – Lido Doratti (Rayleigh); Tony Brumell (Valleyview)
- Urban Systems Ltd. – Chris Town, P.Eng., MASc; Dr. Joanne Harkness, R.P.Bio.

The first meeting of this group was held on October 9, 2008. The minutes are included in Appendix A. The purpose of the meeting was to review the "Background Report', dated September 2008, and to discuss any issues that have arisen since July 2003 and to discuss progress on all of the commitments in the LWMP.

The City hosted a booth at the Home Show from October 17 to 19, 2008 to present information to the public on the wastewater treatment and disposal systems. Appendix B includes all of the

materials displayed, the handouts and the questionnaire that were handed out. In total 80 questionnaires were filled in. Some of the relevant comments included:

- Deal with the odours;
- Try and reuse as much effluent as possible; potential for standing water at Cinnamon Ridge to create habitat for mosquitoes;
- Use xeriscaping at STP;
- Upgrade treatment plant;
- Rayleigh needs sewers; and
- Provide education to minimize inside water use.

The results of the following questions are noted:

	Question	Response	
1.	Were you aware that (except for areas like Rayleigh where on site treatment and disposal is employed) all of the City's sewage is treated at their Sewage Treatment Plant on Mission Flats Road?	Yes No	81% 19%
2.	Were you aware that 20% of the treated effluent is reused to irrigate property at Cinnamon Ridge and the Kamloops Golf and Country Club, and that 80% is discharged to the Thompson River?	Yes No	41% 59%
3.	Did you know that the City has applied for senior government funding to upgrade the facilities at the sewage treatment plant?	Yes No	66% 34%

The second meeting of the Committee was on June 11, 2009. The purpose of this meeting was to review the draft LWMP Review Report, what the Predesign process had concluded, notify the members of the Build Canada Fund Grant received by the City of Kamloops and to discuss the requirements to complete the public consultation process for this review. The minutes are included in Appendix A.

The public was further informed of the City's LWMP as follows:

- A four page Newsletter was prepared that described the issues and what the City is planning to do. This Newsletter was published in two editions of Kamloops This Week the week of July 19 – 25, 2009. It has also been posted on the City's website since July 19th, 2009. It was also made available at numerous City facilities as waiting room reading material. A copy of the Newsletter is included in Appendix A.
- The draft LWMP Review Report and the Newsletter were made available on the City's website via a direct link from their homepage for 4 weeks. Both have since been available on the City's website and can be found directly at http://www.kamloops.ca/water/index.shtml.

There were two responses from the public, one from Duane Henricks, P.Eng., inquiring about the apparent high per capita sewage flows. He did not have any concern regarding the City's upgrading plans. His questions were answered by Deven Matkowski, P.Eng., City Utilities Project Engineer. No further correspondence was received from Mr. Hendricks. The second response was a phone call from Julia Mitra who suggested the City check out what OSTARA has to offer. This is a Vancouver based company that extracts phosphorus from struvite which is a by product of the anaerobic digestion process. The City of Kamloops does not have an anaerobic digester.

3.0 EXISTING SYSTEMS

3.1 Introduction

A comprehensive wastewater collection, treatment and disposal review of the City's facilities was undertaken in the late 1970's. That review led to an $11 M treatment and disposal upgrade in 1984 and 1985. The upgrade was designed to accommodate 37,000 m^3/d of raw wastewater. The Ministry of Environment permit PE-399 governs the disposal criteria to the river, to rapid infiltration basins (these have been abandoned) and to irrigated lands. The permit requires the following:

Discharge to River Directly from Lagoons

Five Day Biochemical Oxygen Demand (BOD_5)	< 30 mg/L	monthly average
Total Suspended Solids (TSS)	< 30 mg/L	monthly average
Toxicity (96 hr LC 50)	100% effluent (this requirement has been suspended)	
Chlorine Residual	non detect	
Flow - April 16 to Nov. 30	< 55,000 m^3/d	
Total Phosphorus (TP) - April 16 to Nov. 30	< 2 mg/L	
TP - Dec. 1 to April 15	< 14.7 kg/d *	

Note: In 2007 the Permit was amended in accordance with the LWMP to have maximum TP < 1.5 mg/L, and an annual average ≤ 1.0 mg/L.

Discharge to Irrigated Lands

BOD_5	< 45 mg/L
TSS	< 60 mg/L
Chlorine Residual	< 1 mg/L after 1 hour contact time

3.2 Collection

Figure 1 illustrates the sewered and unsewered areas of the City. The unsewered areas include:

- Rayleigh;
- Heffley Creek;
- Noble Creek;
- Karindale;
- Some areas of Barnhartvale;
- Knutsford; and
- Tranquille.

Note that since 2003, Rosehill has connected to the City's sewer.

The City's collection system typically consists of pipes that convey raw wastewater – on-site septic tanks are not utilized. Where required, there are pump stations (109 in all) to overcome topographical constraints en route to the central sewage treatment plant (STP) at the west end of Mission Flats Road (approximately 10 km from the City centre).

3.3 Treatment

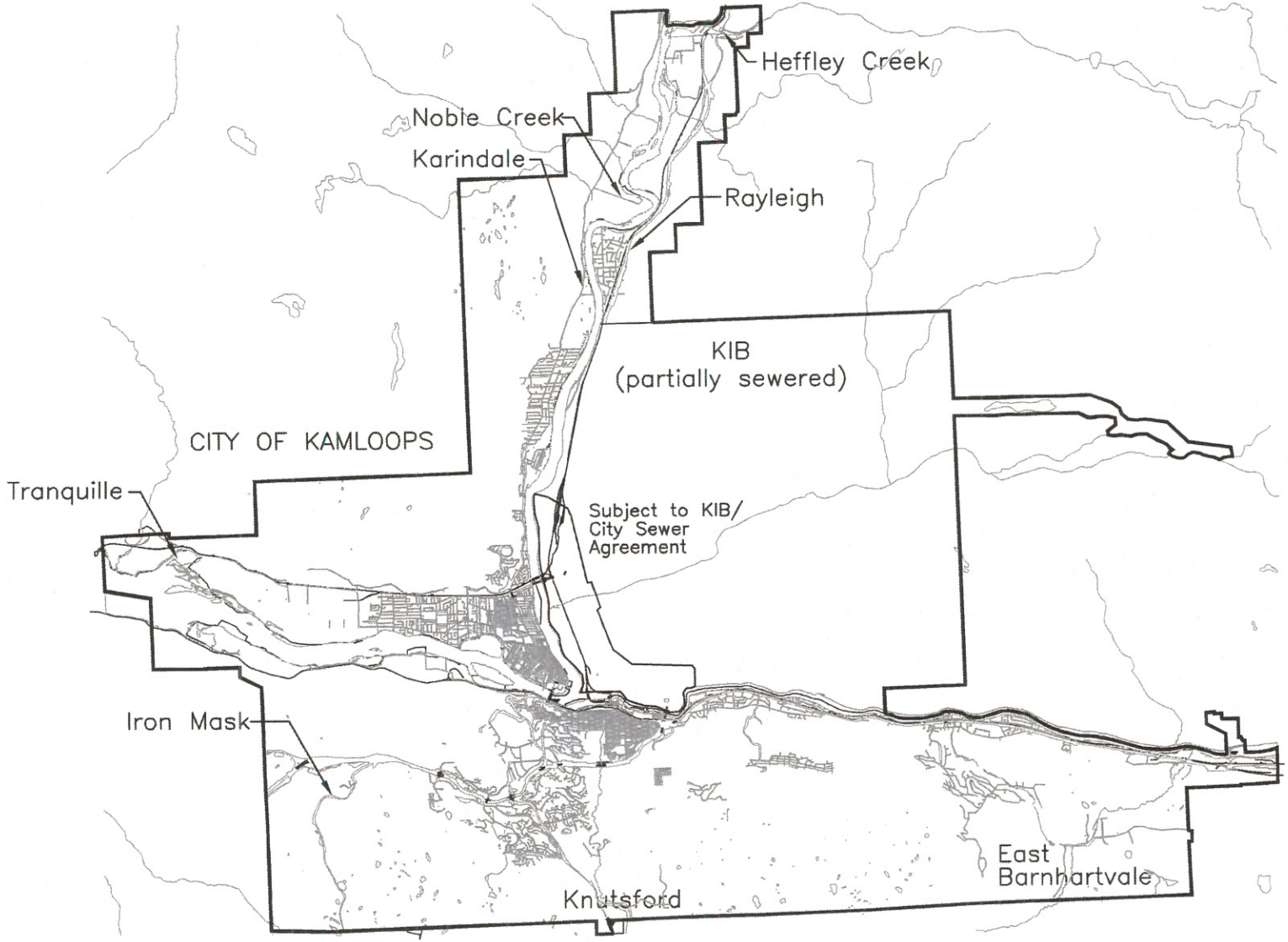
3.3.1 Introduction

Figure 2 illustrates the layout of the STP. The treatment process includes:

- An automatic rake bar screen (19 mm openings).
- Two anaerobic lagoons (Cell 1A – 74,000 m^3; Cell 1B – 92,485 m^3, including clay hole).
- One magnetic flowmeter.
- Three aerated lagoons (Cell 2A – 62,000 m^3; Cell 2B – 128,000 m^3; Cell 2C – 200,000 m^3).
- Two phosphorus removal lagoons (40,000 m^3 each).
- Chlorine contact lagoon (14,000 m^3).
- Two storage cells (Cell 3 – 770,000 m^3; Cell 4 – 1,700,000 m^3).

A brief description of each process component is included below.

2009 LIQUID WASTE MANAGEMENT PLAN REVIEW



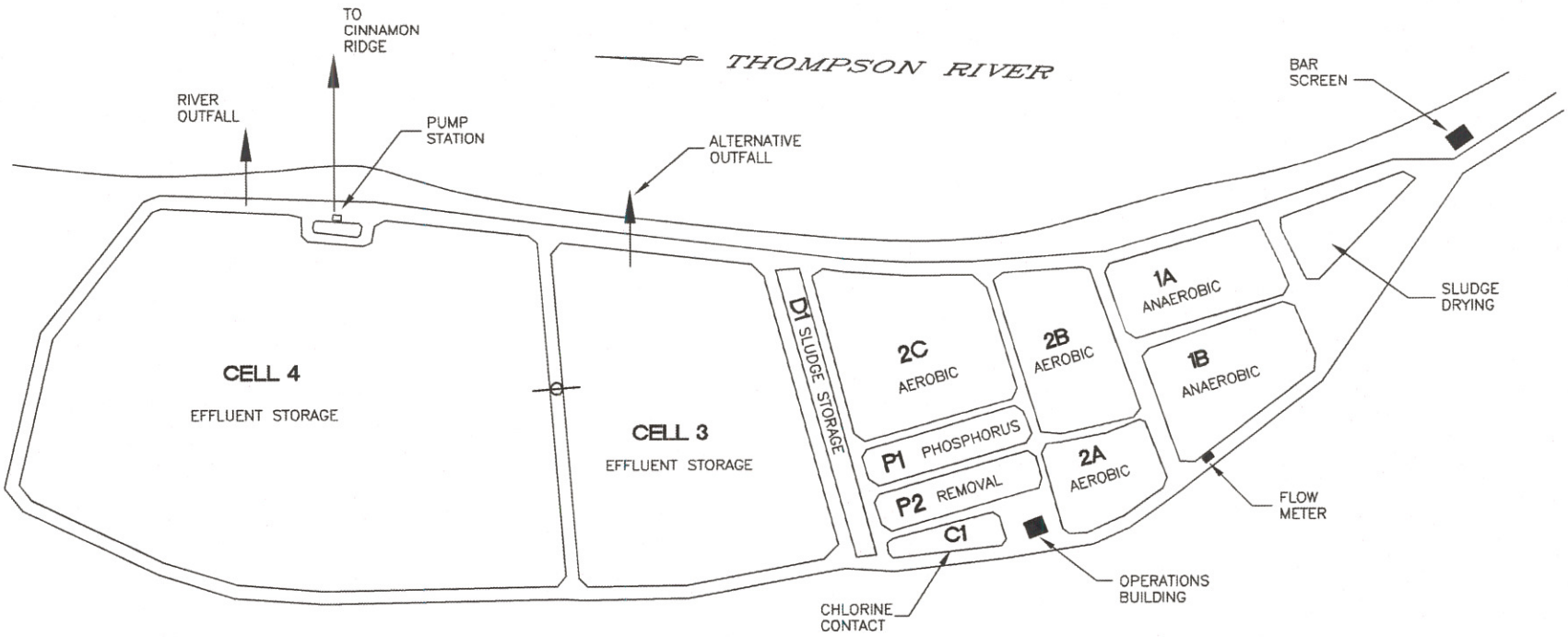
URBANSYSTEMS.

SUITE 200 - 286 ST. PAUL STREET
KAMLOOPS, BC, CANADA V2C 6G4
Tel. 250.374.8311
Fax. 250.374.5334
www.urban-systems.com

Kamloops
Canada's Tournament Capital

Client/Project	
CITY of KAMLOOPS	
2009 LIQUID WASTE MANAGEMENT PLAN REVIEW	
Scale	Date / Figure
nts	09-01-06 / 1
0368.0314.20	Title

UNSEWERED AREAS



URBAN SYSTEMS®

SUITE 200 - 286 ST. PAUL STREET
KAMLOOPS, BC, CANADA V2C 6G4
Tel. 250.374.8311
Fax. 250.374.5334
www.urban-systems.com

Kamloops
Canada's Tournament Capital

Client/Project	
CITY of KAMLOOPS	
2009 LIQUID WASTE MANAGEMENT PLAN REVIEW	
Scale	Date / Figure
nts	09-01-06 / 2
0368.0314.20	Title

EXISTING SEWAGE TREATMENT PLANT

3.3.2 Bar Screen

All of the raw wastewater passes through this screen. It is intended to remove all non-putrescrible (plastics, wood, etc.) materials that are larger than 19 mm in size. These materials are lifted with a rake mechanism to an auger that dewaters and compresses the contents. These compressed screenings are discharged outside and then hauled to the landfill as required.

3.3.3 Anaerobic Lagoons (Cells 1A and 1B)

The objective of the two anaerobic lagoons is to allow heavier solids to settle out and to achieve biological stabilization of some of the organic matter. Malodours emanating from these two cells have been the source of complaints in Brocklehurst, the golf course and the airport in warm weather conditions.

3.3.4 Flow Meter

A magnetic flow meter was placed between the anaerobic and aerated lagoons. It measures the influent flow and transmits the signal to the operations building where flow rates are continuously recorded.

3.3.5 Aerated Lagoons (Cells 2A, 2B and 2C)

The objective of these lagoons is to reduce the organic and suspended solids concentrations to less than 25 mg/L.

The aerated lagoons have subsurface diffusers which deliver air from centrifugal blowers into the wastewater to maintain aerobic conditions (a dissolved oxygen level > 2 mg/L). Cell 2A has fine bubble diffusers fed from a 500 hp blower (installed in 2000). Cells 2B and 2C have coarse bubble diffusers fed from three 200 hp blowers (installed in 1985). These conditions support aerobic microorganisms that biologically reduce the organic matter or biochemical oxygen demand (BOD_5). Aeration is tapered from more intense in Cell 2A to less intense in Cell 2C in order to properly satisfy the microbiological oxygen demand. In addition, the tapered aeration allows suspended solids to settle out as the flow proceeds from one cell to the next.

The power cost to operate the blowers is approximately $320,000/year.

3.3.6 Phosphorus Removal (Cells P1 and P2)

The two phosphorus cells are used (one at a time) to reduce the total phosphorus (TP) concentration. The effluent TP must be less than 1.5 mg/L. Alum is added into a rapid mix chamber upstream of the lagoon. The concentration of alum used ranges from 50 to 75 mg/L and costs approximately $220,000/year.

3.3.7 Chlorination (Cell C1)

Gaseous chlorine (from 1 tonne cylinders) is dissolved into effluent to make a concentrated solution which is then transferred to a mixing zone upstream of Cell C1. The purpose is to kill pathogenic bacteria and viruses.

Chlorine costs are approximately $35,000/year.

3.3.8 Storage Cells

Cells 3 and 4 are used to further reduce BOD_5 and to store treated effluent for irrigation at Cinnamon Ridge. These cells also naturally reduce chlorine residuals to zero.

There is an outfall from Cell 4 into the river with a flow meter. Also there is a pump station beside Cell 4 to convey effluent under the river to the spray irrigation system located on the north shore, west of the airport (Cinnamon Ridge Farm).

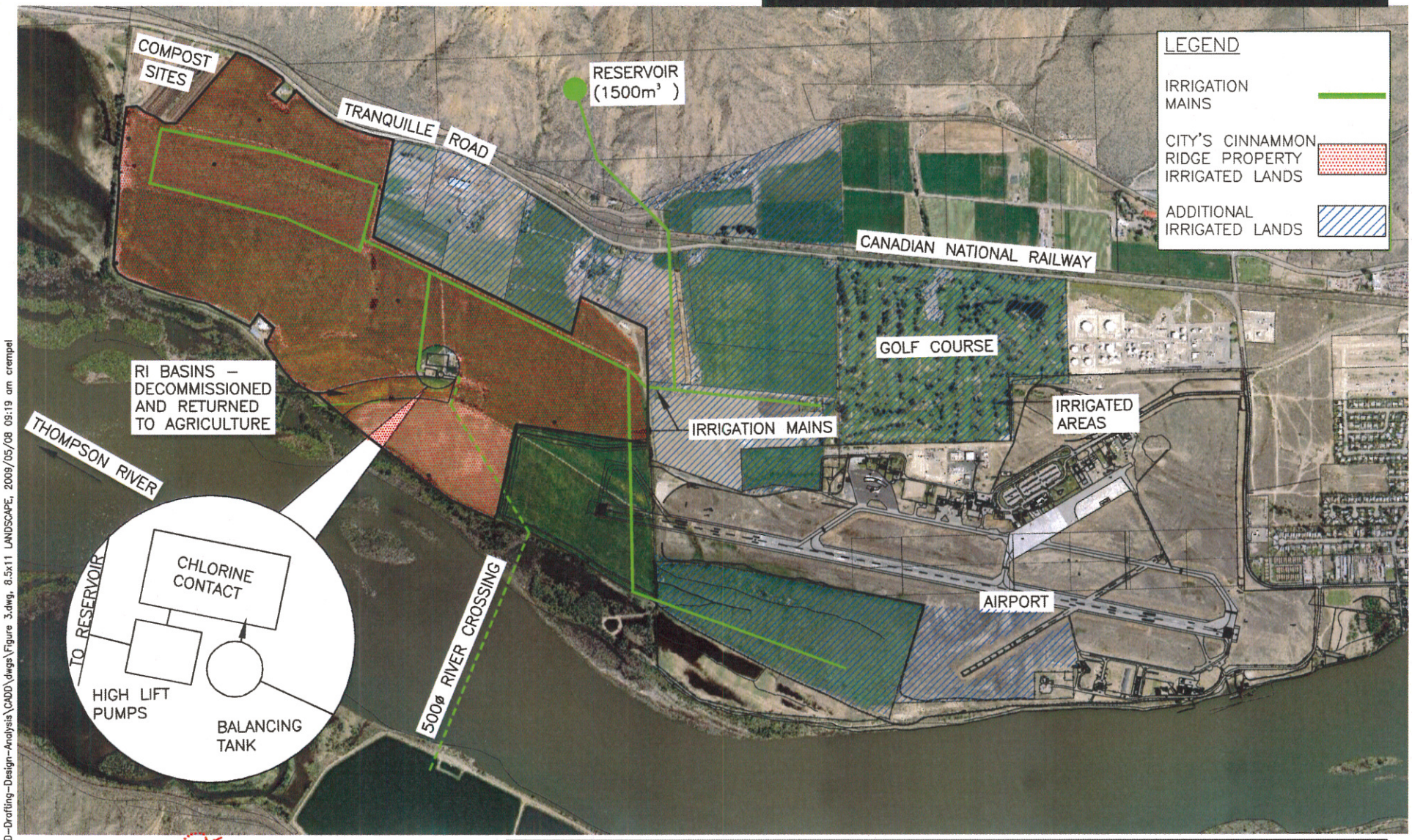
Bypass piping is not available at this time to permit the separate storage of high and low phosphorus concentration effluent.

3.4 Disposal

Figure 3 illustrates the City's disposal facilities. In 2007 the approximate percentage of treated effluent that was discharged via each method of disposal is noted below.

- Direct River Outfall 80%
- Spray Irrigation 20%

2009 LIQUID WASTE MANAGEMENT PLAN REVIEW



U:\Projects_KAM\0368\0314\20\D-Drafting-Design-Analysis\CADD\dwgs\Figure 3.dwg, 8.5x11 LANDSCAPE, 2009/05/08 09:19 am crempel

URBAN SYSTEMS

SUITE 200 - 286 ST. PAUL STREET
KAMLOOPS, BC, CANADA V2C 6G4
Tel. 250.374.8311
Fax. 250.374.5334
www.urban-systems.com

Kamloops
Canada's Tournament Capital

Client/Project
CITY of KAMLOOPS
2009 LIQUID WASTE MANAGEMENT PLAN REVIEW

Scale	Date	Figure
1:20,000	09-01-06	3
0368.0314.20		Title

CINAMMON RIDGE EFFLUENT DISPOSAL SITE

3.4.1 River Outfall

The outfall extends ± 3 m from the south bank. It is a 600 mm diameter pipe with an open end (i.e., there is no diffuser).

3.4.2 Spray Irrigation

The City irrigates approximately 300 ha of land at Cinnamon Ridge, 155 ha of which are owned by the City. The City also provides effluent to the Kamloops Golf and Country Club (included in the 300 ha). Effluent from Cell 4 is pumped under the river into a chlorine contact chamber. Pumps are then used to deliver the effluent into a pressurized network of irrigation mains controlled by the water level in a concrete reservoir on the hillside above Tranquille Road. Farming operations on City property are undertaken by a private contractor who pays the City $25,000/yr. The City maintains and replaces all of the irrigation equipment. The City budgets approximately $250,000 for the spray irrigation facility.

3.5 Performance

3.5.1 Bar Screen

The bar screen has been effective at reducing the quantity of non biodegradable materials from the process. However, some plastic products do make it through the screens and under certain influent flow conditions sewage does bypass the screen. The screen was installed in 1993 and is in a poor state of repair.

3.5.2 Anaerobic Lagoons (1A and 1B)

In 2007 the anaerobic lagoons removed an average 35% and 78% of the BOD_5 and TSS respectively. This is effective treatment given that no energy is applied to these lagoons.

These lagoons continue to generate malodours and floating mats of sludge, particularly in the summer time. Cell 1B is virtually full of sludge and needs to be desludged. Cell 1A appears to be half full and also should be desludged. In 2008 the anaerobic lagoons only removed 22% of the BOD_5, which is likely an indication of the impact the settled sludge is having on the treatment capability of the cell.

3.5.3 Flow Meter

The average flow rate in 2008 was 30,479 m^3/d. The maximum day flow was 35,305 m^3/d by comparison to the design flow of 37,000 m^3/d.

3.5.4 Aerated Lagoons (2A, 2B and 2C)

On November 9, 2007 a dissolved oxygen (DO) profile throughout the lagoons demonstrated that DO levels exceeded 1.5 mg/L through all depths in Cell 2A. Cell 2B and 2C had DO greater than 6.0 and 9.0 mg/L throughout the water column respectively.

The City upgraded the aeration system in Cell 2A by replacing the coarse bubble diffusers with fine bubble diffusers and by adding a new 500 hp blower in 2000. Settled sludge was removed from Cell 2A when the conversion was made.

The MOE permit is 30 mg/L for both BOD_5 and TSS when discharging to the river. At the end of Cell 2C the BOD_5 and TSS averaged 34 mg/L and 27 mg/L respectively in 2008. It is clear that downstream lagoons are required to meet the terms of the Permit. The maximum values in 2008 were 83 mg/L and 53 mg/L for BOD_5 and TSS respectively at the outlet of Cell 2C.

3.5.5 Phosphorus Removal (P1, P2)

In 2008 the City added approximately 60 mg/L of aluminum sulphate to reduce the total phosphorus (TP) levels to less than 1.5 mg/L. The City had no trouble meeting their permit for TP reduction.

Alum sludge requires removal every year. Current practice is to pump into the centrifuge where it is dewatered to approximately 20% dry solids. After dewatering it drops into a trailer and is then hauled to the Cinnamon Ridge compost facility. After composting it is sold to the public, and applied on the City's farm and some City parks, according to agronomic need and quality.

3.5.6 Chlorination

Chlorination has been effective at reducing the coliforms. Algae growth in the upstream cells creates an additional chlorine demand which costs an estimated $9,000/yr. The costs of reducing the algae (such as covering the lagoon to prevent algae growing) are significantly greater than $9,000/yr.

3.5.7 Storage Cells (3 and 4)

Effluent discharged to the river from Cell 4 averaged 7 mg/L BOD_5 and 12 mg/L TSS in 2008, well below the 30 mg/L Permit requirement. TP concentrations averaged 1.0 mg/L in 2008.

4.0 WHAT WERE THE COMMITMENTS OF THE LWMP?

The Stage 3 Report, dated July 2003, summarized all of the commitments made by the City. They are reiterated here for completeness.

This LWMP will be reviewed, as per the Ministry of Water, Land and Air Protection policy, every five (5) years.

4.1 Source Control

1. Construct a trucked waste receiving facility at the entrance to Mission Flats Road for primarily organic wastes (this is expected to be a net revenue source).
2. Construct a trucked waste receiving facility at the treatment plant for primarily inorganic wastes.
3. Review and amend the sewer bylaw, as required.
4. Review industrial/commercial discharges to the City's sewer system and implement management strategies as appropriate to ensure compliance with the sewer bylaw and that equitable charges are being levied.
5. Utilize an influent BOD_5 of 300 mg/L for design purposes (modify as appropriate based on actual data).

4.2 Sewage Reduction

1. Ensure that the City's video inspection crews alert the Manager of Operations of any significant potential sources of infiltration/inflow.
2. Inspect all manholes in the City to identify any significant sources of inflow.
3. Increase focus in the Watersmart program to reducing indoor water use.
4. Consider implementing a volunteer water meter program for residential properties.

4.3 Unsewered Areas

1. Implement a public education program in all the unsewered areas of the City with the objective of extending the life of on-site systems.

2. Implement a bylaw requiring property owners to submit a maintenance certificate every two years.

3. For Rayleigh and Karindale the recommended approach is to:

   a. Implement a public education program;

   b. Monitor septic system failures (severity, frequency) with Interior Health Authority;

   c. Assess availability of senior government grant programs;

   d. Undertake geotechnical investigations to confirm viability and location of Thompson River crossing (to confirm reliability of preliminary cost estimates);

   e. Prepare predesign studies of the sewer system, North Thompson river crossing, connection requirements, cost/lot;

   f. Convene an open house to explain concepts and costs; and

   g. If appropriate, apply for a grant.

4. For Rose Hill pursue the studies involving connection to the City's sewer system. Based on the results, and direction from the ratepayers pursue either a connection to the City or implement a public education program as in 1. above.

4.4 Effluent Criteria

4.4.1 River Discharge

Effluent criteria for discharge to the river, according to the 2003 LWMP, will meet the following:

Total Phosphorus	≤ 1.0 mg/L [(1)] Annual Average
Total Phosphorus	≤ 1.5 mg/L [(1)] Maximum daily
BOD_5	≤30 mg/L [(2)]
TSS	≤ 30 mg/L [(2)]
Faecal Coliforms	< 200 CFU/100 mL [(1)]
Ammonia	CEPA criteria, yet to be finalized
Disinfection	By ultraviolet light

(1) As recommended by the Environmental Management Committee.

(2) As per the City's existing permit.

4.4.2 Spray Irrigation

Effluent criteria for reuse on lands in the vicinity of Cinnamon Ridge Farm will meet the following:

BOD_5	< 45 mg/L (1)
TSS	< 60 mg/L (1)
Faecal Coliforms	< 200 CFU/100 mL
Disinfection	By Chlorination, > 1 mg/L after 1 hour contact

(1) As per the City's existing permit, consistent with the Restricted Public Access category in the Municipal Sewage Regulation.

4.4.3 Monitoring Program

The Environmental Management Committee is developing the monitoring program and will continue to review the receiving environment to confirm the appropriate effluent criteria with an emphasis on total phosphorus. If, after considered deliberations, the maximum criteria for river discharge should be lower than 1.5 mg/L total phosphorus, then upgrading of the preferred option would be undertaken to suit.

4.5 Biosolids

1. Select Option 5 – Class A Compost as the preferred method of treating and reusing sludge/biosolids generated from the City's sewage treatment plant.
2. Undertake pilot studies on windrow composting to monitor compost quality relative to Class B and Class A criteria in the Organic Matter Recycling Regulation. If quality meets the Class A criteria then continue with the windrow process. If it does not, or to address operational issues, then implement the aerated static pile process.
3. Implement a pilot study in 2003 to quantify the impact of effluent, compost and biosolids on the growth of corn for animal feed.
4. Create a biosolids growing medium with the stockpiled sludge and reuse as appropriate. Undertake pilot testing to determine if sludge from the phosphorus removal cells and sludge stored in the D cells can be converted to a biosolids growing medium.

5. Monitor the groundwater quality through existing and new monitoring wells to track any impacts from the compost site, and from effluent irrigation and application of compost/biosolids.

4.6 Treatment, Disposal and Reuse Options

1. Discontinue regular use of the rapid infiltration basins when the new plant is constructed (maintain for emergency use).
2. Continue with effluent irrigation at Cinnamon Ridge for at least 20 years. Dedicate approximately 5,500 m^3/d of screened raw sewage to Cell 2C for treatment, followed by storage in Cells 3 and 4.
3. Abandon or modify the anaerobic cells when the new plant is constructed (this will deal with odour complaints).
4. Replace chlorination facilities at the main plant with ultraviolet light when the new plant is constructed.
5. Select 420 litres per capita per day as the average daily influent design flow.
6. Select Option 5: Partial Biological Nutrient Removal Plant with disposal to the Thompson River as the preferred method of upgrading treatment and disposal processes.
7. Consider phasing opportunities to implement Option 5.
8. Abandon and cease analyses related to the overland/wetland pilots.
9. Undertake initial dilution studies on the Cell 3 outfall under low river flow conditions.
10. Improve the outfall in response to the dilution studies to hasten the dilution process.
11. Reconsider the feasibility of irrigating Kamloops Indian Band land in subsequent reviews of the LWMP.
12. Implement reliable and environmentally sustainable infrastructure.

4.7 Stormwater Management

1. Undertake a stormwater engineering study at the next review of the LWMP.

5.0 WHAT HAS TRANSPIRED SINCE JULY 2003?

5.1 Activities Related to Major Plant Upgrading

Since approval of the LWMP in 2004 the City has spent in the order of $460,000 examining and refining conceptual designs for various options and a further $320,000 completing a predesign on the preferred option.

In 2005 and 2006 conceptual designs for a Partial Biological Nutrient Removal Plant using membranes were prepared, including cost estimates. This included a site trip to Atlanta, Georgia to see membrane plants first hand. In May 2006, City Council approved implementation of the core Plant to an estimated $47.4 M (based on a design average daily flow of 42,000 m^3/d). However, the status of senior governments grant funding was unclear, as were the federal wastewater discharge regulations. So the City did not proceed at that time.

In early 2007, although there were no grant programs available, the federal regulations were becoming clearer. It was apparent that, based on the proposed regulations that Kamloops would not need to biologically reduce ammonia. Also, the City had undertaken numerous agricultural pilot test programs using the alum-based biosolids, which demonstrated no negative impacts (note that one of the primary reasons why the Environmental Experts from the Workshop in the first LWMP suggested a biological phosphorus removal process, was their understanding that biologically-derived sludge would be better than alum-based sludge for composting). Construction costs were escalating at this time as well.

In June 2007 the City retained Urban Systems to complete a feasibility study on upgrading the lagoons using alum for phosphorus removal. This study examined two different options - Convert to Activated Sludge and Enhance the Lagoons. The study also compared the costs of the earlier approved membrane process. The study culminated in the report "Feasibility of Upgrading the Lagoons", in March 2008. The Ministry of Environment reviewed and conceptually approved these options - although, because of the proposed change to use chemically-assisted phosphorus removal instead of biological processes, they did mention it would be necessary to re-open the LWMP. The results of the Feasibility Study are summarized in Table 5.1.

Table 5.1 – Summary of 2008 Feasibility Study

Option	Capital Cost (1)	Present Worth (2)	Comments
Enhance Lagoons	$23.4 M	$37.3 M	
Convert to Activated Sludge	$25.7 M	$38.7 M	Much less land used, more conducive to upgrading quality if required (esp. NH_3)
BNR with Membranes	$59.3 M	$72.3 M	

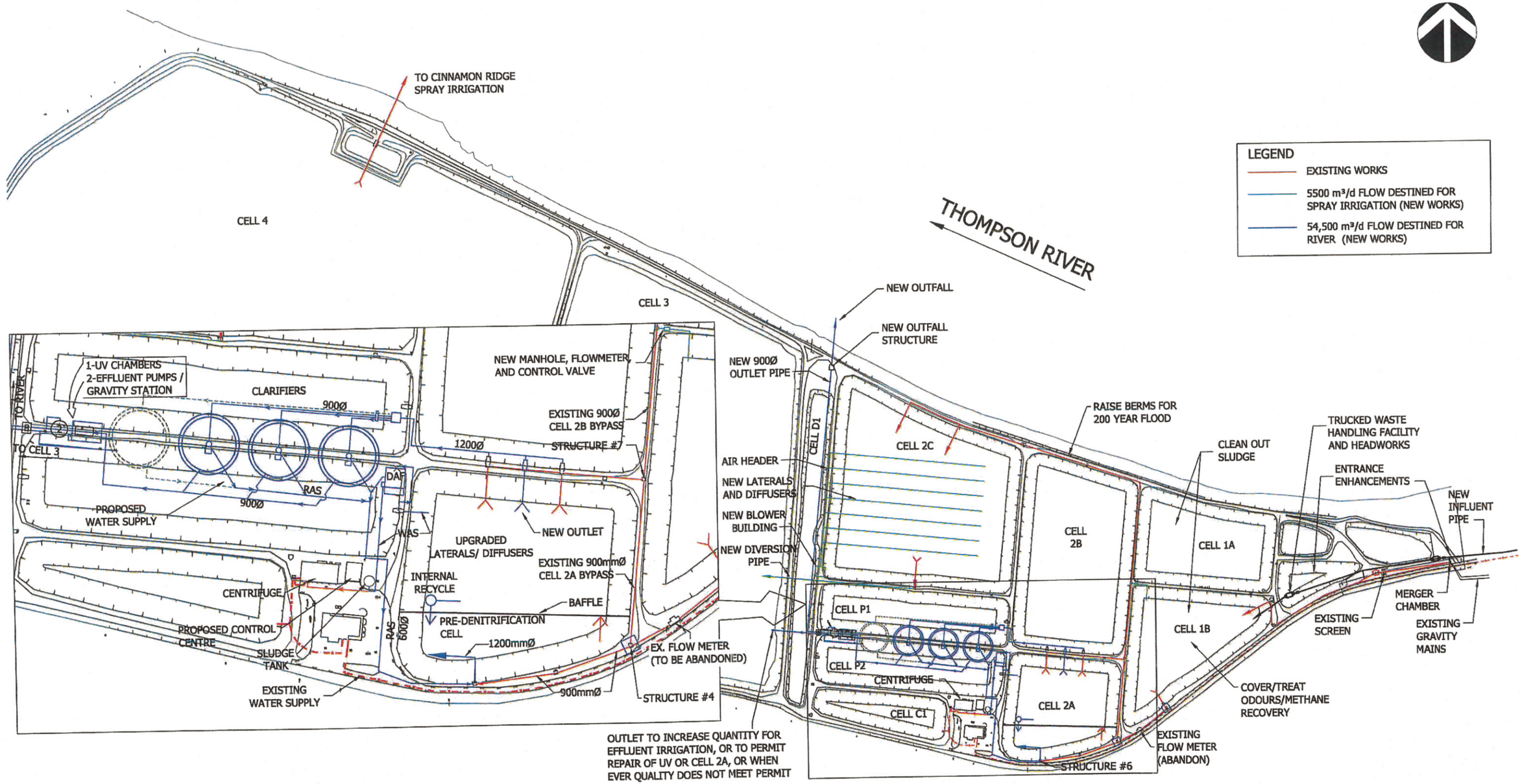
(1) Note: that this is a comparative cost and does not include common works to all three options such as outfall improvements, new influent forcemain, covering Cell 1B, raising the berms for flood protection, water supply improvements, septage handling and headworks.

(2) Including operating and maintenance costs over a 20 year horizon. Costs in 2008 dollars and for a design average daily flow of 51,800 m^3/d.

At this level of cost estimating the two options "Enhance Lagoons" and "Convert to Activated Sludge" are essentially the same. It was quite evident that either of these options was considerably less costly than utilizing membranes. The option "Convert to Activated Sludge" was selected as the preferred method of upgrading the plant, because it has the most flexibility to improve effluent quality in the future. The total estimated capital cost, including all of the common works noted above, in 2008 dollars was $36 M.

In response to selecting a preferred option the City retained Urban Systems to undertake a Predesign Report to examine the details of this option. The Executive Summary of the Predesign Study is included in Appendix C. In particular, the Predesign Report:

- Defined the design/horizon and flow requirements;
- Demonstrated the economic viability of the two parallel treatment trains – one for effluent destined for irrigation and one for effluent destined for the Thompson River;
- Confirmed the effluent criteria from the Canada-wide Municipal Wastewater Strategy with respect to ammonia and mixing requirements in the river; and
- Examined in some detail, the following components of the proposed upgrading as illustrated in Figure 4;
  - New influent forcemain;
  - Entrance enhancements;



URBAN SYSTEMS®
SUITE 200 - 286 ST. PAUL STREET
KAMLOOPS, BC, CANADA V2C 6G4
Tel. 250.374.8311
Fax. 250.374.5334
www.urban-systems.com

Kamloops
Canada's Tournament Capital

Client/Project	
CITY of KAMLOOPS	
2009 LIQUID WASTE MANAGEMENT PLAN REVIEW	
Scale	Date (yy/mm/dd) Figure
nts	09-01-06 4
0368.0314.20	Title

PROPOSED UPGRADING OF STP

Also during the course of the Predesign Report an opportunity arose where in the order of 5,000 m^3/d of the City's effluent was considered for reuse at the New Gold mine site. The City held a number of meetings to discuss the feasibility of the opportunity. This option appears technically feasible, however it is unclear who would pay to convey the effluent to New Gold's intake, some 3 km downstream of Cell 4. There is no cost saving to the City, since they will still have to build the infrastructure to handle/treat/dispose of the 25 year design flow. If New Gold could take 5,000 m^3/d of effluent it would simply reduce the amount discharged into the river. In any case, it did demonstrate that the City is open minded with respect to reuse opportunities.

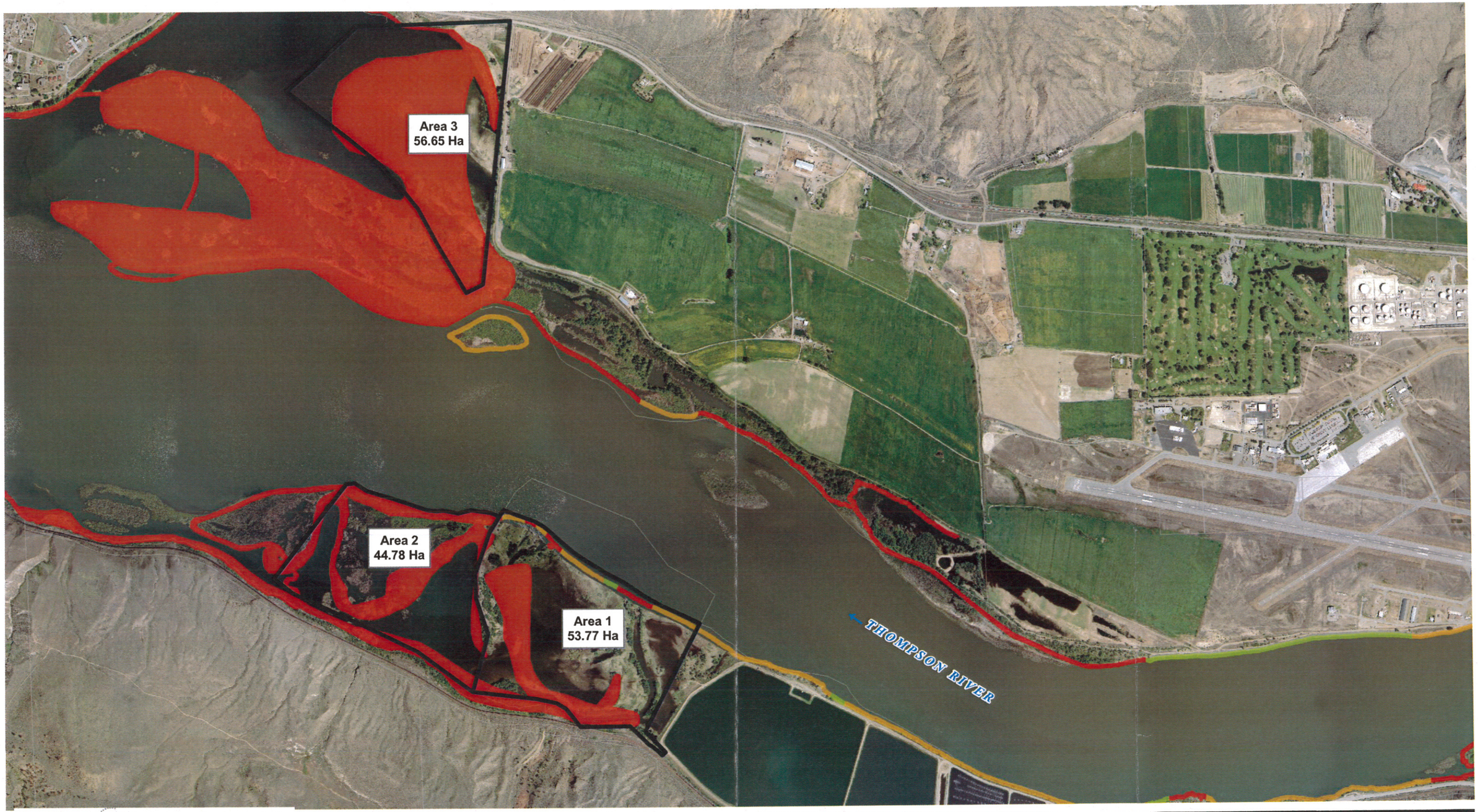
Another option the City has examined recently for discharge is the use of wetlands. Three potential sites were examined in some detail. These sites are illustrated in Figure 5. In general, each of these sites has been identified by Fisheries and Oceans Canada as having value to fish. It is difficult to predict what the cost of compensation would be if one of these sites were dedicated to an effluent discharge scheme. In addition, due to the prevailing concerns with endocrine disruptors and the potential for chronic effects on fish, fowl and amphibians particularly, it is assumed that if a wetland were used then a higher level of treatment would be required compared to the use of an outfall. This is because an outfall is designed to achieve relatively quick dispersion/mixing and dilution in the receiving environment. This mixing eliminates the potential negative effects of the endocrine disrupting chemicals. Based on these primary concerns, and others described in the memorandum contained in Appendix D, the recommendation is to proceed with a direct outfall into the thalweg of the Thompson River.

Subsequent to the Predesign Report, the City retained Urban Systems to examine in more detail the topic of desludging the anaerobic cells and the septage receiving pond which is just to the east of Cell 1B. This study concluded a preference to retain Cell 1A as the anaerobic lagoon (which would be covered), use Cell D2 (small cell just east of Cell 1A) as the initial settlement basin (which would also be covered) and to leave Cell 1B full of sludge. This approach will save the City approximately $2,700,000.

5.2 Progress on the Other Commitments

Commentary on the progress on each commitment is provided below in bold text.

1. Review of LWMP every five (5) years.
   - **This document is part of the Review required after 5 years.**



URBAN SYSTEMS®
SUITE 200 - 286 ST. PAUL STREET
KAMLOOPS BC, CANADA V2C 6G4
Tel. 250.374.8311
Fax. 250.374.5334
www.urban-systems.com

Fish Habitat

- Class 1 - Critical Fish Habitat
- Class 2 - Important Fish Habitat
- Class 3 - Minimally Productive Fish Habitat

Client/Project	
CITY OF KAMLOOPS	
2009 LIQUID WASTE MANAGEMENT PLAN REVIEW	
Scale	Date (yy/mm/dd)	Figure
1:15,000	09-06-29	5.0
0368.0314.20		Title
ALTERNATIVE OUTFALL OPTION - WETLAND DISCHARGE		

File Path: U:\Projects_KAM\0368\0368.0314.20\1D-Drafting+Design+Analysis\GIS\Projects\A-1.mxd

- New headworks with trucked waste handling facilities;
- Desludging of Cells 1A and 1B;
- Covering Cell 1B (reduce greenhouse gases and eliminate odours);
- Treatment components for the effluent train destined for irrigation (outlet from Cell 1B, aeration in Cell 2C, diversion pipe to Cell 3);
- Treatment components for the effluent train destined for discharge to the Thompson River (predenitrification cell, hydraulic improvements in and out of Cell 2A, aeration in Cell 2A, clarifiers, return activated sludge, waste activated sludge, sludge thickening and dewatering);
- Ultraviolet light disinfection;
- An effluent pump/gravity station with piping to the outfall structure;
- A water supply system;
- Electrical supply including standby power;
- Raising the berms to provide protection against the 200 year flood;
- Geotechnical aspects related to the proposed structures;
- Operational and maintenance issues;
- Management of the dewatered waste solids;
- More detailed cost estimates; and
- A schedule for implementation.

The estimated cost in 2009 dollars to complete all of the works to a design horizon of approximately 25 years and a maximum daily flow of 60,000 m^3/d (current maximum day flow is 37,000 m^3/d) is $40,220,000. It is estimated that it will take until the end of 2013 to commission the works into service, as per the schedule in Section 6.0. The City is committed to implementing the upgrades generally as described in the Predesign Report dated May 2009. By way of comparison, utilizing the membrane biological process accepted in 2006 would cost approximately $73.5 million.

During the course of the Predesign Report Urban Systems assisted the City to prepare an application under the Building Canada Fund for a grant to help defray the costs of the upgrade. In January 2009 the City was advised they will receive $14.2 M in grants from the Provincial and Federal governments.

2. Source Control

   a. Construct a trucked waste receiving facility primarily for organic wastes.

      - **This was built at the entrance to Mission Flats Road, but it is not a convenient location for control. It is proposed that this facility be added to the headworks at the new STP.**

   b. Construct a trucked waste receiving facility primarily for inorganic waste.

      - **This was constructed at the entrance to the STP, but it is unsightly and odourous. It is proposed that a new facility be added to the headworks in the new STP upgrades.**

   c. Review and amend the sewer bylaw.

      - **The sewer bylaw (32-35) has been amended five times since the LWMP was finalized. In essence the amendments deal with holding tanks for private systems and the requirement to hook up to the sewer system if the collection system is installed nearby. In addition a charge of $15/m^3$ for commercial liquid waste discharged into the Mission Flats disposal site was instituted. There is still a need to rewrite the bylaw to accommodate organic and inorganic trucked waste. It is proposed that this be done before the new trucked waste facilities are built.**

   d. Review industrial/commercial discharges to the sewer system.

      - **This has not been done in any systematic fashion. This should be done and the results incorporated into the bylaw.**

   e. Utilize an influent BOD_5 of 300 mg/L for design purposes.

      - **The average influent BOD_5 in 2008 was 255 mg/L. The most recent report "Sewage Treatment Plant Upgrade – Predesign Draft Report", dated March 2009, utilized 300 mg/L for an influent design value.**

3. Sewage Reduction

   a. Ensure the City's video inspection crews alert the Manager of Operations of any significant potential sources of infiltration/inflow.

      - **This is an ongoing operation. The City purchased a mechanically operated video for sewer inspections in mid 2007. In 2007 they inspected 10,000 m of sewer pipe, generally on the North Shore and downtown. In 2008, to end of August, they had inspected 16,000 m of**

pipe. There is no indication of infiltration into the pipes at any of the broken pipe or root intrusion locations.

b. Inspect all manholes to identify any sources of inflow. Rectify as necessary.

- **The City has identified some low lying manholes (particularly in Riverside Park and along the South Thompson River) that they temporarily plug during the freshet period when river levels are exceptionally high. This does reduce the quantity of inflow into the sewer system.**

c. Increase focus of Watersmart (now Ecosmart) to reduce indoor water use.

- **A new bylaw has been passed requiring all new construction to include low flow fixtures. The Ecosmart program has included advertising to encourage ways and means to minimize water use.**

d. Consider implementing a volunteer water meter program for residential properties.

- **City Council voted in August 2008 to implement 165 homes onto the volunteer water meter program and this program was expanded by approximately 100 homes in 2009.**

4. Unsewered Areas

a. Implement a public education program in all the unsewered areas with the objective of extending the life of on-site systems.

- **The City has not yet completed this task. This is proposed to be undertaken in 2009 as part of the ECOSmart Program.**

b. Implement a bylaw requiring property owners to submit a maintenance certificate every two years.

- **The City's understanding is that they do not have the legal right to create this bylaw, since they do not provide or regulate sewer service to these areas. In any case it would be impractical to enforce such a bylaw. It is proposed that education be used to encourage proper maintenance of septic tanks (refer to Section 4a).**

c. Rayleigh and Karindale

- **A public education program and monitoring of septic tank failures has not specifically been undertaken (the Interior Health Authority may have their own records of failures). Grant programs have been**

assessed over the last 5 years, but unless it can be demonstrated that there is at least 25% failure of on-site systems there is very little chance of securing senior level grants. Geotechnical investigations associated with a future river crossing and predesign studies have not been undertaken (logically these would occur when there is sufficient desire on the part of the residents of Rayleigh to proceed with a sewer system).

d. Rose Hill

- **The City was successful in receiving senior government funding to construct sewers in Rose Hill and to connect them to the City's system. They were connected in 2007 - 2008.**

5. Effluent Criteria

a. River Discharge criteria for effluent was set at maximum TP ≤ 1.5 mg/L and annual average TP ≤ 1.0 mg/L; BOD_5 < 30 mg/L; TSS < 30 mg/L; FC < 200 CFU/100 mL; ammonia to meet CEPA criteria and disinfection by ultraviolet light.

- **The City has been meeting these criteria, except that UV is planned to be added in the next capital upgrade. Disinfection is by chlorine, dechlorination is accomplished naturally in Cells 3 and 4.**

- **The CEPA process was completed in December 2004. The complexity of ammonia toxicity was recognised in the CEPA process and the result was that ammonia was to be dealt with through the Canada-wide Municipal Wastewater Strategy. The final document for this strategy was signed off by the Canadian Council of the Ministers of the Environment (CCME) in February 2009. The CCME strategy will form the basis of a municipal wastewater regulation under the Federal Fisheries Act, which is currently being developed. From the CCME strategy, ammonia must be considered in terms of acute toxicity (100% effluent) and chronic toxicity (in the receiving environment at the end of the mixing zone), to determine if ammonia treatment is required. An assessment has been completed for the City of Kamloops effluent, which indicates that acute ammonia toxicity is not anticipated in the future plant, and there is sufficient mixing potential (assuming the outfall is upgraded – refer to 7 i. below) to alleviate concerns over chronic toxicity at the end of the mixing zone.**

- **The Canada-wide Municipal Wastewater Strategy has recommended effluent monthly averages for discharge to surface waters of ≤ 25 mg/L for carbonaceous BOD_5 ($cBOD_5$) and TSS. These values will be adopted as part of the 2009 LWMP Review.**

b. Spray Irrigation criteria for effluent was set at BOD_5 < 45 mg/L; TSS < 60 mg/L; FC < 200 CFU/100 mL; disinfection using chlorine.

- **The City has been meeting these criteria. Once the new upgrades to the plant are completed the effluent destined for irrigation will have relatively high total phosphorus and nitrogen levels.**

c. A monitoring program was developed for Kamloops Lake, the Thompson River, upstream and downstream of the Lake.

- **Four years of data have been collected - three years with TP limits meeting the Permit requirements and one year so far with TP < 1.5 mg/L as per the LWMP criteria. To date it has not been possible to measure the environmental impact due to the City's effluent because it is too small.**

6. Biosolids

a. Select Class A: Compost as the preferred method of treating and reusing sludge generated at the plant.

- **This has been done. The City has continued to explore additional opportunities (for example, biofuel, industrial processes, land application plans, reuse at the landfill and alternative pathogen removal processes) for biosolids reuse as they have presented themselves.**

b. Undertake pilot studies on windrow composting.

- **These were completed between 2003 and 2005 and indicated that it was possible to implement a windrow composting process for the City's biosolids, resulting in a Class A compost. Since 2005, further work has been completed on process optimisation. In the spring of 2008, documentation was submitted for the biosolids composting process to be registered under the BC Organic Matter Recycling Regulation. Therefore, the biosolids composting process is now fully operational**

and the Class A compost can be distributed through the community without restrictions.

c. Implement corn growth trials with compost.

- **Corn trials were completed on soils which were amended with yard waste compost and biosolids. These trials were successful but, since completion, the direction at Cinnamon Ridge has been to focus on hay and silage production using pasture grass and alfalfa.**

d. Create a biosolids growing medium with the stockpiled sludge. Undertake pilot testing on sludge taken from phosphorus cells and D cells to see if a biosolids growing medium can be created.

- **These trials were completed and were successful. Several plant growth trials were also completed to determine the potential for impacts as a result of using alum-based wastewater residuals. These trials included growth on 100% biosolids. The well degraded nature of the City's biosolids resulted in these trials being successful.**

e. Monitor the groundwater quality to track any impacts from the compost site, and where compost is applied.

- **A monitoring program was developed and implemented for the Cinnamon Ridge site. This included the installation of 8 monitoring wells in 2003. The monitoring program provides for the long-term assessment on: groundwater quality, soil impacts, vegetation, leachate from the compost sites and the quality of the incoming material and final composts.**

7. Treatment, Disposal and Reuse Options

a. Discontinue regular use of rapid infiltration basins.

- **This was done by November 2004.**

b. Continue with effluent irrigation at Cinnamon Ridge for at least 20 years. Dedicate at least 5,500 m^3/d of screened sewage to Cell 2C, with storage of high phosphorus effluent in Cells 3 and 4.

- **Effluent irrigation has expanded on the North Shore to include the Kamloops Golf and Country Club.**

- **When the plant is upgraded, Cell 2C will be dedicated to treat effluent destined for irrigation (phosphorus will not be reduced). The economic viability of this approach was demonstrated in the Predesign Report.**

c. Abandon or modify the anaerobic cells when new plant is constructed (to deal with odour).

- **The intent is to take Cell 1B offline, but continue to use Cell 1A. However, Cell 1A will be covered and the gases will be collected and treated. This includes methane which is a notorious greenhouse gas, as well as odourous gases like hydrogen sulphide.**

d. Replace chlorine disinfection with UV.

- **This will be done for the effluent when the new plant is constructed. Return activated sludge (an internal process only) will continue to make use of the existing chlorination system in order to limit the growth of filamentous organisms, so as to improve the settleability of the sludge in the clarifiers.**

e. Select 420 litres per capita per day as the average daily influent design flow.

- **Based on this value 126,050 people would be served by the average day design flow of 52,940 m^3/d selected in the Predesign Report. This population at 2% growth per year would be reached in 2033.**

f. Select Option 5: Partial Biological Nutrient Removal with disposal to the Thompson River as the preferred method of upgrading treatment and disposal processes.

- **Refer to Section 5.1 for a detailed discussion on this commitment.**

g. Consider Phasing Opportunities.

- **The City was successful in securing a $14.2 M grant through the Building Canada Fund. There are discrete phases that can be done if deferral of some capital cost is necessary.**

h. Abandon and cease analyses related to overland/wetland pilots.

- **No further work has been done on these.**

i. Undertake initial dilution studies on the Cell 3 outfall under low flow studies.

- **The City did inject dye into the outfall and traced it downstream - in essence the dye hugged the shore and did not mix well with the full width of the River. The City has initiated a separate study to examine**

alternatives to achieve appropriate mixing in the river. Recently the finalization of the Canada-Wide Municipal Wastewater Strategy through the Canadian Council of Ministers of the Environment has provided direction with respect to what is required for an outfall design into the Thompson River. Essentially this strategy requires a mixing zone for ammonia which:

- **is less than 100 m in any direction;**
- **is less than 33% of the receiving flow during the seven day low flow in a 10 year return period (i.e. a flow of 123 m^3/s); and**
- **achieves the BC Environmental Quality Objective for chronic toxicity at the end of the mixing zone.**

In particular, this strategy will require an ammonia concentration $\leq$ 1.54 mg/L at the end of the mixing zone. Using the collected river hydrological and bathymetric data, a preliminary mixing and flow dispersion analysis was performed to assess the mixing potential of the maximum daily design (54,500 m^3/d) effluent discharge into the Thompson River. Based on these criteria and this analysis, a single point outfall extended ± 10 m from the south shore is adequate without any premixing prior to discharge.

j. Improve the outfall.

- **See "i" above.**

k. Reconsider the feasibility of irrigating Kamloops Indian Band land in subsequent reviews of the LWMP.

- **This is unlikely to be feasible, since the KIB is planning on installing their own STP near where irrigation was proposed.**

l. Implement reliable and environmentally sustainable infrastructure.

- **This will include significant reductions in greenhouse and odourous gases, high efficiency motors on blowers and pumps, reduced use of power and chemical costs by retaining Cell 1B and by diverting 5,500 m^3/d to the lagoon system for effluent irrigation, and reduced use of chemical fertilizer at Cinnamon Ridge.**

8. Stormwater Management

   a. Undertake a stormwater engineering study.

      - **The City initiated a three phase Integrated Stormwater Management Plan in early 2007. This study will examine all watersheds within the City's boundary. The master plan was completed in 2009. Individual basin plans will be updated on an annual basis over the next 12 years.**

6.0 COMMITMENTS

The following commitments (either unfulfilled ones from the LWMP or new ones) are made, as part of this LWMP review.

6.1 Source Control

.1 Construct a trucked waste receiving facility for organic and inorganic solids in the new headworks before December 31, 2013.

.2 Review and amend the Sewer Bylaw (32-35) to accommodate organic and inorganic trucked waste before the facilities are built. Consider regional rate structures, impact on downstream processes, source of waste, need for manifests and quality checks.

.3 Review the industrial/commercial discharges into the sewer system and incorporate the results into the bylaw.

6.2 Sewage Reduction

.1 Continue with education through the ECOSmart Program to encourage ways and means to reduce the amount of indoor water use.

.2 Encourage further reduction in water use through implementing household water meters whether by voluntary or mandatory means.

6.3 Unsewered Areas

.1 Implement a public education program in all unsewered areas with the objective of extending the life of existing onsite systems and encouraging the proper maintenance of septic tanks.

.2 Undertake a hydrogeological/near-surface water study for Rayleigh and Heffley Creek to check if septic tank effluent is negatively impacting the North Thompson River.

6.4 Effluent Criteria

.1 River Discharge Criteria to meet:

- $cBOD_5 \leq 25$ mg/L monthly average
- TSS ≤ 25 mg/L monthly average

- TP ≤ 1.5 mg/L maximum daily; ≤ 1.0 mg/L annual average
- Faecal coliforms < 200 CFU/100 mL
- Disinfection by ultraviolet light
- NH_3 to be non-acutely toxic or ≤ 1.54 mg/L at end of mixing zone which is less than 100 m in any direction, but using only a maximum of 33% of the river flow

.2 Spray Irrigation Criteria to Meet

- BOD_5 < 45 mg/L
- TSS < 60 mg/L
- Faecal coliforms < 200 CFU/100 mL
- Disinfection by chlorine; > 1.0 mg/L chlorine residual after 1 hour contact time

6.5 Biosolids

Continue with composting of biosolids as the primary reuse option, but consider other cost effective, reuse opportunities as they may present themselves.

6.6 Treatment, Disposal and Reuse Options

.1 Upgrade the sewage treatment plant generally as per the 2009 Predesign Report to include two parallel treatment trains – one for effluent destined for the Thompson River and one for effluent destined for irrigation that each meet the effluent criteria noted above.

.2 Reuse effluent in whatever applications that meet the City's objectives and the Provincial/Federal requirements while at the same time being cost effective. Specifically, the City has committed to a new reuse opportunity with the Provincial Fire Control Centre (a copy of the proposed outline is included in Appendix E)

.3 Disinfect effluent for discharge to the River using ultraviolet light.

.4 Cover Cell 1A, collect and treat gases to reduce greenhouse gas emissions and odours. Cell 1B is to be left full of sludge with vegetative treatments to improve the aesthetics.

.5 Improve the outfall to achieve the Provincial and Federal mixing requirements.

.6 Consider opportunities to implement cost effective and environmentally sustainable infrastructure as part of the STP upgrades.

6.7 Stormwater Management

.1 Update individual basin plans until the entire City has been addressed.

APPENDIX A

Meeting Notes/Newsletter

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

MEETING NOTES

subject:	**Liquid Waste Management Plan Review - Committee Meeting No. 1**
date:	October 22, 2008
meeting date:	October 9, 2008
location:	City of Kamloops - DESD Boardroom, 105 Seymour Street
file:	0368.0314.20
prepared by:	Chris Town, P. Eng.
distribution:	All Attendees, and Committee Members

Attendees: Present	**Email Address:**
Ministry of Environment	
Bob Grace	Bob.Grace@gov.bc.ca
Carol Danyluk	carol.danyluk@gov.bc.ca
Gabriele Matscha	Gabriele.Matscha@gov.bc.ca
City of Kamloops	
Mike Warren	mwarren@kamloops.ca
Jake Devlin	JDevlin@kamloops.ca
Deven Matkowski	dmatkowski@kamloops.ca
Dave Teasdale	dteasdale@kamloops.ca
Interior Health Authority	
Dan Ferguson	dan.ferguson@interiorhealth.ca
Domtar	
Kristin Dangelmaier	kristin.dangelmaier@n.domtar.com
Ministry of Agriculture and Lands	
Graham Strachan	graham.strachan@gov.bc.ca
Skeetchestn Indian Band	
Mike Anderson	mikeanderson@skeetchestn.ca
Fraser Basin Council	
Bob Smillie	rsmillie@shaw.ca
Tobiano	
Darcy Austin for Michael Schaad	daustin@tobianoutilities.com
Urban Systems Ltd.	
Chris Town	ctown@urban-systems.com
Dr. Joanne Harkness	jharkness@urban-systems.com
Others	
Lido Doratti	lidogold2@shaw.ca
Tony Brumell	Not Available
Attendees: Unavailable	**Email Address:**
Ministry of Environment	
Larry Gardner	Larry.Gardner@gov.bc.ca
Environment Canada	
Snehal Lakhani	Snehal.Lakhani@ec.gc.ca
Ministry of Community Development	
Catriona Weidman	Catriona.Weidman@gov.bc.ca
Fisheries and Oceans Canada	
Michael Crowe	michael.crowe@dfo-mpo.gc.ca
Kamloops Indian Band	
Dave Kneeshaw	dkneeshaw@kib.ca
Thompson Rivers University	
Susan Purdy	spurdy@tru.ca
Thompson Nicola Regional District	
Greg Toma	gtoma@tnrd.bc.ca
Tobiano	
Michael Schaad	mschaad@tobianoutilities.com
Doreen King	dkdirect@telus.net

URBANSYSTEMS.

ITEM	DISCUSSION	ACTION BY

1. **Introductions**
   - Mike Warren welcomed everyone to the LWMP Review Committee meeting. He thanked everyone for their willingness to participate.
   - Each person introduced themselves.

2. **Review Background Report**
   - Chris Town reviewed in detail the Background Report which was distributed to everyone in advance of the meeting. Some of the discussion that ensued:
     - Endocrine disruptors;
       - Where is the research at?
       - What can be done to lower these levels?
       - A lot of research has been undertaken over the last 5 years, but there are still many data gaps in our knowledge of what impact these compounds are having in the environment and how they might be removed. There are some data that suggest aerated lagoons are in fact a reasonably good method of reducing these compounds - because of the long sludge age. Based on the recent Aquatic Toxicity Conference attended by Joanne Harkness and Bob Grace, the sense was that source control has to play a bigger role in preventing these compounds from getting into the sewer systems. This issue will continue to be followed closely and the City will respond once it is clear how they can.
     - Has the City considered applying more effluent to ground instead of putting it into the river?
       - The City has examined effluent irrigation on lands owned by the KIB, Domtar and Afton. In all three cases it was either not cost effective or the land was not available.
     - There is an opportunity that the new Afton Mine may be able to use ± 5,500 m^3/d of effluent in 2010. (They are currently using water that is in the large pit.)
     - The integrated environmental monitoring program is now in its 5th year; it appears as though the environmental impact that the City is having on the Thompson River system is insignificant.
     - Chris reviewed the new proposed upgrade to the STP that relies on chemical addition for phosphorus reduction (as opposed to biological processes), which is estimated to save the City over $30 M. Effluent quality will still exceed the requirements set in the 2003 LWMP,

URBANSYSTEMS.

ITEM	DISCUSSION	ACTION BY
3.	**Discuss any Issues to be Addressed in this LWMP Review**	
	• Various topics were raised over the course of the meeting:	
	o Reducing quantities discharged to the River (such as new Afton Mine water requirements);	MW/CT
	o Following the endocrine disruptor issue/public education;	JH
	o Fulfilling the remaining commitments in the 2003 LWMP;	MW/CT
	o Trucked waste is coming from all around the region and it is not controlled;	CT
	o Involve the KIB in the environmental monitoring program, given they are pursuing the construction of a STP with a discharge to the North Thompson River.	JH/CD
	o Endorsement of the new proposed chemical addition option for the STP to reduce phosphorus levels.	All
4.	**Discuss Public Consultation Required**	
	• Some of the approaches mentioned:	
	o The City is planning on presenting information at the October 17th - 19th Homeshow. MoE would like to review draft information prior to the show. Include some educational materials on the endocrine subject;	MW/CT/JH
	o Update the City's website;	MW/JD/DM
	o Information in Utility Bills;	MW/JD/DM
	o City has a section of the paper every two weeks that could be utilized;	MW/JD/DM
	o School programs - Ecosmart program could be adapted to include a liquid waste component.	MW/JD/DM
5.	**Any Other Business**	
	• Tony Brumell suggested someone from the Sustainability Kamloops Committee be invited to attend these meetings - Mike suggested Andrea Pickard.	
6.	**Adjournment**	
	• Meeting adjourned at 5:45 p.m.	

The preceding is the writer's interpretation of the proceedings and any discrepancies and/or omissions should be reported to the writer.

URBAN SYSTEMS LTD.

Chris Town, P. Eng., MASc

/is

U:\Projects_KAM\0368\0314\20\M-Meetings\2008-10-17-MTGNTS-CommitteeMeetingNo1.doc

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

MEETING NOTES

subject:	**Liquid Waste Management Plan Review - Committee Meeting No. 2 - Revised**
date:	June 18, 2009
meeting date:	June 11, 2009
location:	City of Kamloops - DESD Boardroom, 105 Seymour Street
file:	0368.0314.20
prepared by:	Chris Town, P. Eng.
distribution:	All Attendees, and Committee Members

Attendees: Present	**Email Address:**
Ministry of Environment	
Bob Grace	Bob.Grace@gov.bc.ca
Carol Danyluk	carol.danyluk@gov.bc.ca
Gabriele Matscha	Gabriele.Matscha@gov.bc.ca
City of Kamloops	
Mike Warren	mwarren@kamloops.ca
Deven Matkowski	dmatkowski@kamloops.ca
Interior Health Authority	
Dan Ferguson	dan.ferguson@interiorhealth.ca
Fraser Basin Council	
Bob Smillie	rsmillie@shaw.ca
Urban Systems Ltd.	
Chris Town	ctown@urban-systems.com
Dr. Joanne Harkness	jharkness@urban-systems.com
Kamloops Indian Band	
Jim Nastrom	*jnastrom@kib.ca*
Tobiano	
Mike Grenier	
Michael Schaad	mschaad@tobianoutilities.com
Others	
Lido Doratti	lidogold2@shaw.ca

Attendees: Unavailable	**Email Address:**
Ministry of Environment	
Larry Gardner	Larry.Gardner@gov.bc.ca
Environment Canada	
Snehal Lakhani	Snehal.Lakhani@ec.gc.ca
Ministry of Community Development	
Catriona Weidman	Catriona.Weidman@gov.bc.ca

URBANSYSTEMS.

Fisheries and Oceans Canada
Michael Crowe — michael.crowe@dfo-mpo.gc.ca

Thompson Rivers University
Susan Purdy — spurdy@tru.ca

Thompson Nicola Regional District
Greg Toma — gtoma@tnrd.bc.ca

Tobiano
Doreen King
Tony Brumell — dkdirect@telus.net
2566 Skeena Drive, Kamloops, BC, V2E 1V5 (250-828-0782)

Skeetchestn Indian Band
Mike Anderson — mikeanderson@skeetchestn.ca

ITEM	DISCUSSION	ACTION BY

1. **Introductions**

   - Each person introduced themselves

2. **Brief Summary of the Predesign Process**

   - Chris Town reviewed the predesign process noting that the Final Report was completed June 10, 2009. The Predesign Report identifies approximately $40M worth of work that could be done to upgrade the Sewage Treatment Plant. A copy of the Executive Summary from the Predesign Report was included in the draft Liquid Waste Management Plan Review Report sent to all committee members. No questions were raised on the Report.
   - Mike Grenier presented two graphs – one showing the historical phosphorus loadings from Domtar and the City of Kamloops Sewage Treatment Plant. The other graph projects the City's phosphorus loading out to 2031. The trend line is to an increased quantity of phosphorus. Mike asked if there was anything we were planning that would restrict the opportunity of reducing phosphorus to lower levels in the future, if that became the will of the public? The answer given is that future upgrades could be undertaken to drop phosphorus levels further. Mike pointed out that national trends are to reduce nutrients not increase. Ministry of Environment & Chris explained that a lengthy environmental impact study was completed (and is now supported by 5 years of in situ monitoring from 12 sites, 6-8 times a year), that demonstrated an annual average phosphorus concentration of 1 mg/L will not negatively impact the Thompson River.

URBANSYSTEMS.

ITEM	DISCUSSION	ACTION BY

3. **Build Canada Grant**

- Chris reported that the City received word in January 2009 that they would receive $14.2 M towards the Upgrade. A contract between the Province/Federal Governments and the City will be available after the Environmental Assessment is completed and approved. Carol to see if she can speed up the release of the Terms of Reference for Environmental Assessment. — Carol

4. **Discuss LWMP Review Draft Report**

- Chris highlighted two aspects of the Report – the process undertaken to consider the reuse of effluent (5000m^3/d) at New Gold and the consideration of 3 wetland sites that could have been used instead of a deep river outfall. Conclude that a deep river outfall is preferred for environmental and cost reasons.
- It was suggested that the stormwater management commitment in Section 6 be tied to the Integrated Stormwater Management Plan — CT
- It was also suggested that a hydrogeological/near-surface water study be done for Rayleigh and Heffley Creek to check if septic tank effluent is negatively impacting the North Thompson River. This study is to be added as a commitment — CT

5. **Completion of Public Process**

- Draft Newsletter – It was felt that the newsletter should not be so technical and wordy. It was suggested that Chris take a first cut at rewriting it, then get the City's Public Relations group to review, then back to the Committee for Final approval. — CT
- It was felt that one distribution in each the Daily News and Kamloops This Week was sufficient; however, this should occur on days when there are no or few inserts. Also distribution at Interior Health Authority, Ministry of Environment, Tournament Capital was suggested. — DM
- The website will be updated to include the more technical newsletter and the LWMP Review – Draft Report for those that may be interested in more detail. — DM

URBANSYSTEMS.

ITEM	DISCUSSION	ACTION BY

6. **Next Steps**
   - Finalize and distribute newsletter
   - Receive and report comments
   - Update draft report
   - Secure City Council endorsement
   - Finalize report and submit to Ministry of Environment for Minister's approval

7. **Adjournment**
   - Meeting adjourned at 3:00pm

The preceding is the writer's interpretation of the proceedings and any discrepancies and/or omissions should be reported to the writer.

URBAN SYSTEMS LTD.

Chris Town, P. Eng., MASc

/ak

U:\Projects_KAM\0368\0314\20\M-Meetings\2009-06-11-NTGWTS-CommitteeMEetingNo2.doc

After the flush . . . What happens next?

City of Kamloops - Liquid Waste Management Plan Review Newsletter

July 2009 No. 2

What's Up With Sewage in Kamloops?

The City has been hard at work to protect the Thompson River and Kamloops Lake water quality. Their vision is to provide environmentally sound, financially affordable and generationally sustainable sewage infrastructure after you flush the toilet! To that end, the City recently received a grant of $14.2 million towards the construction of a new sewage treatment plant. The last major upgrade of the sewage treatment plant was in 1984/85. This new plant is the outcome of more than 10 years of studies and discussion with all affected stakeholders. The new plant incorporates some innovative concepts that will save the residents of Kamloops over $30 million.

The aims of the next upgrade are to:

- Reduce greenhouse gases;
- Provide capacity for growth within the City;
- Improve operations to sludge handling;
- Eliminate odours;
- Meet new government regulations;
- Maximize nutritional value of effluent being reused for irrigation; and
- Provide a more consistent quality of treated sewage (effluent).

The purpose of this newsletter is to engage the community in understanding the issues and the solutions relating to liquid waste management.

If you would like more details on this topic please visit our website at: www.kamloops.ca

What is a Liquid Waste Management Plan Review?

A Liquid Waste Management Plan Review is required after five years of the first LWMP being completed, particularly if circumstances have changed. The review involves:

- Reconstituting the technical and public advisory committees;
- Reviewing progress with respect to commitments made in the 2003 LWMP;
- Identifying any issues that may have arisen that need to be dealt with;
- Assessing the suitability of the alternative process to meet the intent of the 2003 LWMP; and
- Involving the public in the review.

As part of this review, the City has prepared a background report, submitted it to the technical and public advisory committee members, met with the members on October 9, 2008, hosted a booth at the 2008 October Home Show, completed a detailed predesign report on the way to move forward and met with the Committee on June 11, 2009.

Who is Involved?

Ministry of Environment (MoE)
- Reviews and Approves Plan

City of Kamloops City Council
- Reviews and Adopts Plan
- Submits to MoE for Approval

Steering Committee
- Directs work of TAC and PAC, provides input on options and reports to Council on progress

Technical Advisory Committee (TAC)

Public Advisory Committee (PAC)

What Are the Key Issues?

Financial Affordability:

The City applied to the Building Canada Fund in September 2008 to have the provincial and federal governments share some of the costs. In early 2009, the City was advised it will receive $14.2 million towards upgrades to the sewage treatment plant.

Unsewered Areas:

About 4,000 Kamloops residents rely on individual on-site septic disposal systems. On-site systems are prominent in areas such as Rayleigh, Karindale, Heffley, Knutsford, and parts of Barnhartvale. These systems use a septic tank for treatment (through removal of solids and floatables) and subsurface trenches or beds for disposal of liquid emerging from the septic tank. There are no conclusive plans to connect these areas to the primary collection and treatment system within the 5 yr term covered by the LWMP review. The City will provide education on the proper maintenance of on-site systems.

Treatment Process:

The primary issue in the LWMP Review is to explain and seek approval for the alternative treatment process that is being proposed to meet the required effluent criteria for discharge to the Thompson River. In essence, the alternative process would continue to use a chemical coagulant to reduce phosphorus levels instead of using biological processes. This has been the City's practice for the last 20 years, with no adverse effect on the effluent or the biosolids. The alternative process is estimated to cost approximately $40 million, which is $35 million less than the other option.

Spray Irrigation

Flow Increases:

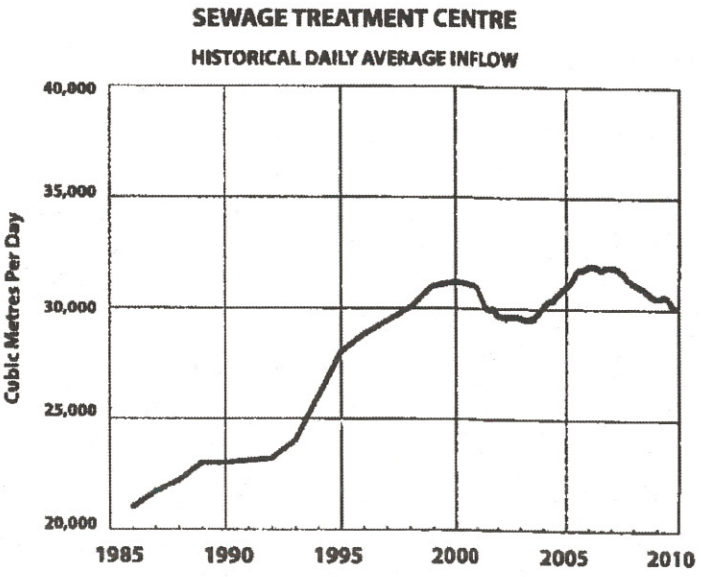
The flows entering the plant are close to its capacity. To accommodate growth within the City, it is necessary to expand the plant.

Sewage That is Trucked to the Plant:

At present, there is very little control over what trucked waste is discharged into the City's sewer system. The plan is to add the necessary facilities.

Environmental Monitoring:

The City and the Ministry of Environment (MOE) have been taking samples upstream and downstream of the outfall in the Thompson River for over five years. The results have demonstrated that the City's effluent is causing no measurable effect.



Stormwater:

The City has completed an Integrated Stormwater Management Plan to address the appropriate collection, treatment and release of stormwater into the receiving environment.

What Treatment and Discharge Solutions Have Been Identified So Far?

Treatment Level Required:

The treatment level required to protect the Thompson River has been determined by the City's existing permit, the BC Municipal Sewage Regulation, the Canada-wide Municipal Wastewater Strategy, and an Environmental Impact Study that was completed as part of the 2003 LWMP. The treatment level to protect irrigable lands has been determined in the City's Permit.

Discharge Solutions:

The City has committed to the reuse of effluent at Cinnamon Ridge for 20 years. This currently accounts for approximately 20 per cent of the annual volume of treated effluent. The balance of treated effluent will be discharged into the deep portion of the river to achieve the appropriate level of mixing.

Treatment Solutions:

The preferred treatment solution is illustrated below. It consists of two parallel treatment plants. The first plant will treat 5,500 m³ per day and will not reduce phosphorus or nitrogen because the effluent will be reused for irrigation on the north side of the river. This will reduce the amount of chemical fertilizer required.

The second treatment plant will treat the balance of flows (at design that would be 54,500 m³ per day). This consists of an activated sludge plant with clarifiers and ultraviolet light for disinfection that maximizes the reuse of existing infrastructure. In this way construction costs are minimized.

Comments/Information

If you have any comments or concerns or would like to discuss the LWMP Review, please contact:

Deven Matkowski, Utilities Project Engineer
City of Kamloops
Phone: 250-828-3318
Email: dmatkowski@kamloops.ca

If you would like more details on this topic please visit our website at: www.kamloops.ca

APPENDIX B

Home Show Materials

Canada's Tournament Capital

title: **LIQUID WASTE MANAGEMENT PLAN - PUBLIC QUESTIONNAIRE**
date: October 15, 2008
file no.: 0368.0314.20

1. Do you live in Kamloops? Yes No

Area _____

2. Were you aware that (except for areas like Rayleigh where on-site treatment and disposal is employed) all of the City's sewage is treated at their sewage treatment plant on Mission Flats Road?

Yes No

3. Were you aware that 20% of the treated effluent is reused to irrigate property at Cinnamon Ridge and the Kamloops Golf & Country Club, and that 80% is discharged to the Thompson River?

Yes No

4. Did you know the City has applied for senior government funding to upgrade the facilities at the sewage treatment plant?

Yes No

5. Are there any particular issues related to design, construction, operations, or costs for the collection, treatment, reuse or disposal of sewage that you would like to bring to the City's attention?

_____

_____

_____

_____

_____

CITY OF KAMLOOPS

LIQUID WASTE MANAGEMENT PLAN

2008 FALL HOMESHOW

Canada's Tournament Capital

Emerging Issues
Endocrine Disrupting Substances

What are these substances?

These substances are used in our every day life and include a whole range of different products.

For example, Cosmetics and perfumes, soaps, toothpastes, deodorants, paints, pesticides, and medications.

Why are they a concern?

These substances are being released to the sewer system and can be difficult to treat at a sewage treatment plant. This means that they are often released with the effluent. There have been occasions when these substances have resulted in impacts to the fish population. The most well publicised impact has been the feminisation of fish in receiving environments that consist predominantly of effluent. In Kamloops' case, our effluent forms a very small fraction of the receiving environment.

What is being done about this?

This problem has been recognised as a world-wide issue and is being dealt with on a world-wide basis. Much is still not known about these substances and much research is currently being completed to help us fully understand this issue. Once better understanding is achieved, direction for dealing with these substances can be developed. The Canadian government and many research institutes are working on this as part of the Canada-wide Municipal Wastewater Strategy.

What is the City doing about these substances?

The City has been participating in the Canada-wide Municipal Wastewater Strategy and is keen to play a part in addressing this concern. The City completed studies on these substances during the development of its Liquid Waste Management Plan. At the time, the predicted impacts as a result of the City release were considered to be of low risk. This needs to be re-evaluated as the research and more information become available.

Emerging Issues
Endocrine Disrupting Substances

How can I help?

There are many ways in which you can help. It is easier to limit the amount of these substances entering the sewer than to try and treat them with the sewage. Source control is one of the best ways of addressing this concern. Be aware of what you are flushing down the drain or toilet. Do not dispose of excess paints, pharmaceuticals or pesticides down the sink or toilet.

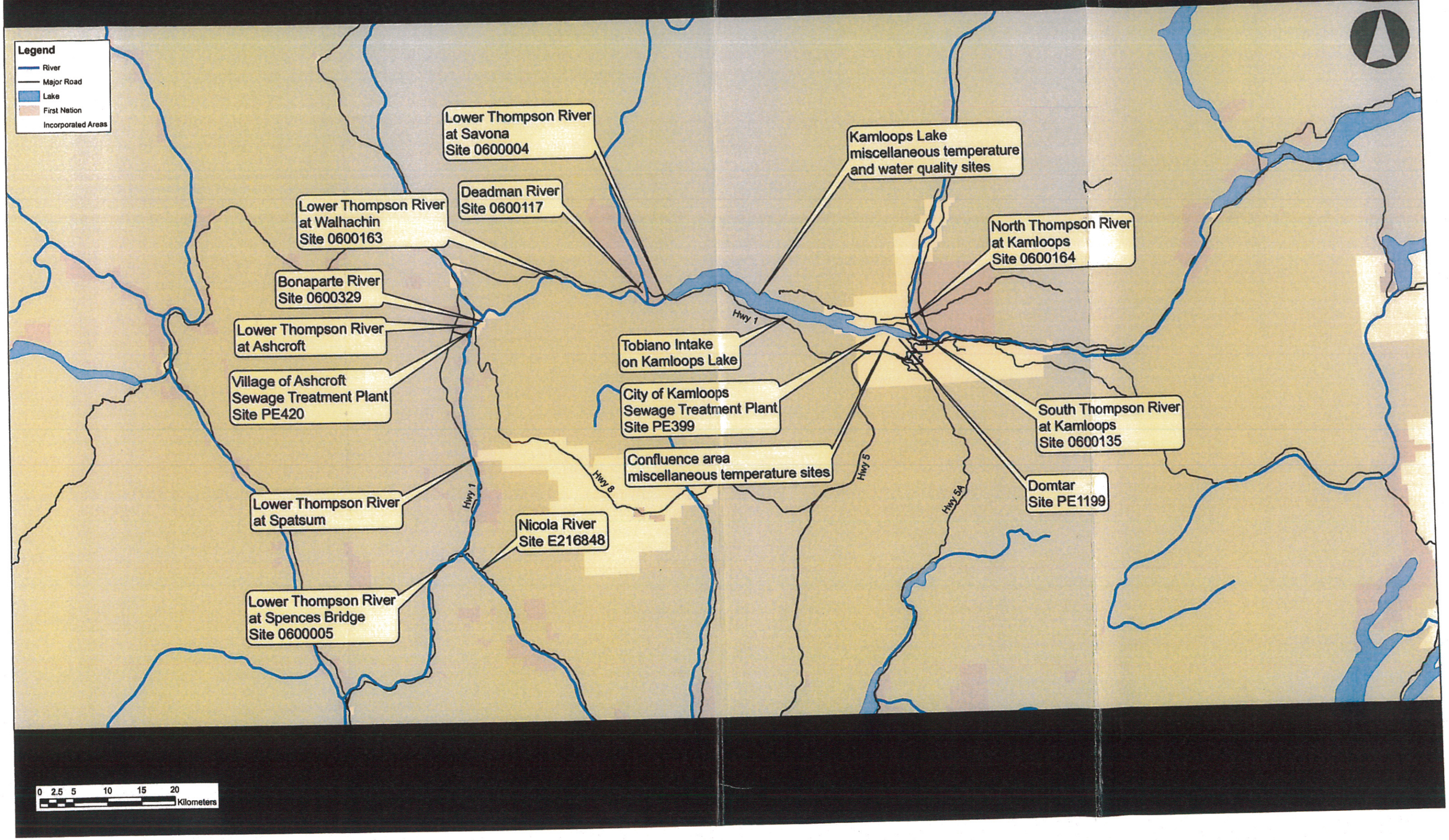
CITY OF KAMLOOPS

LIQUID WASTE MANAGEMENT PLAN

2008 FALL HOMESHOW

Canada's Tournament Capital

Thompson River Monitoring Program - Sampling Locations



ISSUES		
NO.	DESCRIPTION	DATE (yy/mm/dd)
1	FOR PRELIMINARY	--
2	FOR APPROVAL	--
3	FOR TENDER	--
4	FOR CONSTRUCTION	--
5	FOR RECORD	--
6	FOR ARCHIVE	--

NO.	m³/mm day	DESCRIPTION	BY	APP'D
7				
6				
5				
4				
3				
2				
1				

REVISIONS

DES.
DWN.
DATE 2008-10-06
CHK.

P. ENG. _____ DATE _____

SCALE NTS

URBANSYSTEMS.

Kamloops Tournament Capital of Canada

UPGRADE SEWAGE TREATMENT PLANT: PREDESIGN

EXISTING SEWAGE TREATMENT PLANT

PROJECT No. 0368.0459.11

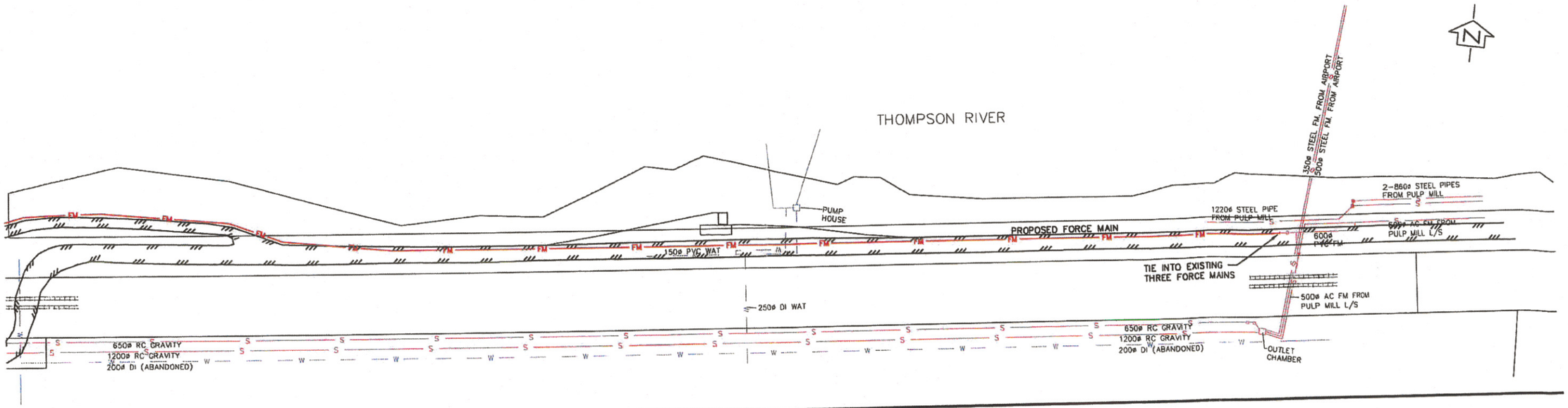
SHEET OF

DRAWING NAME Ortho-1

REVISION ALL PRINTS PRIOR TO

R

U:\Projects_KAM\0368\0459.11\0-Drafting-Design-Analysis\CAD\Dwgs\Existing_STP_Ortho.dwg, Orth_One%, 2008/10/15 11:41 am mvemelle



URBANSYSTEMS.

SUITE 200 - 286 ST. PAUL STREET
KAMLOOPS, BC, CANADA V2C 6G4
Tel. 250.374.8311
Fax. 250.374.5334
www.urban-systems.com

Client/Project	
CITY of KAMLOOPS STP UPGRADE: PREDESIGN	
Scale	Date (Y/M/D)
NTS	2008-10-03
0368.0459.11	

Figure 5-4

Title

INFLUENT FORCEMAIN SITE PLAN

APPENDIX C

Executive Summary of Predesign Study

CITY OF KAMLOOPS

Sewage Treatment Plant Upgrade Predesign Report

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Background

The City of Kamloops' sewage treatment plant (STP) primarily consists of a series of anaerobic, aerobic lagoons, phosphorus reduction and storage cells. The last major upgrade to the plant was in 1984, and the plant has served the City well for over 20 years, but it is now approaching its capacity. The City's 2003 Liquid Waste Management Plan (LWMP) recommended converting the lagoon system into two parallel treatment trains – one to treat effluent destined for irrigation, and one to treat effluent to low phosphorous levels, utilizing a biological process, for discharge to the Thompson River. A subsequent study recommended that the low phosphorous train utilize the existing chemical process. Urban Systems Ltd. was retained to undertake predesign of the proposed upgrade. In addition, a five year review of the LWMP is being undertaken by the City concurrently with this report.

1.2 LWMP Review

The LWMP, completed in 2003, included a commitment to review the plan after five years. This review allowed the City to consult the members of the public and technical advisory agencies about any issues arising in the last five years that should be addressed by the LWMP. Additional public consultation was also incorporated into the LWMP Review.

It was important to review the proposed alternate plant upgrades – the 2003 LWMP envisaged phosphorous removal by a biological process, whereas the alternate plan proposes to retain the use of alum to reduce the total phosphorous concentration.

A background report was submitted to committee members prior to the first committee meeting, held in October 2008. The City presented, and hosted a display for the three days of the Kamloops home show also in October 2008, during which seventy questionnaires were completed and returned by members of the public.

A draft final LWMP Review report will be sent to all committee members for their input. A newsletter will be included in the local newspapers as part of the public dialogue, before the report is finalized and sent to the Minister of the Environment for final approval.

2. DESIGN FLOWS

The City chose to use a design horizon of 2031. A 2% growth rate was used to project design flows, this is intended to include the impacts of tourists and TRU students, neither of which are included in City census figures. Table 2.1 summarizes the current influent flows and design flows. Based on the LWMP per capita flow of 420 L/d the upgraded facility will serve 126,050 people.

Table 2.1 Summary of Current and Design Flows

Year	Average Day (m^3/d)	Max Month (m^3/d)	Max Day (m^3/d)
2003-2007 Average	31,149	33,538	35,371
2031 Projected	52,940	57,000	60,000

Peak instantaneous flow was estimated using data from the Airport and Pulp Mill lift stations. The five minute peak:max daily flow ratio was 1.88:1; a peaking factor of 2.0:1 is recommended for design. Therefore, the design influent peak flow is 120,000 m^3/d or 1.39 m^3/s.

3. EFFLUENT CRITERIA

Table 3.1 summarizes the proposed effluent criteria, which have evolved from the City's permit PE-399, the 2003 LWMP and the new Canada-wide Municipal Wastewater Strategy.

Table 3.1 - Effluent Criteria

Criteria	To River	To Irrigation
5-day Carbonaceous BOD	≤25 mg/L	NA
5-day Biochemical Oxygen Demand	NA	< 45 mg/L
Total Suspended Solids	≤ 25 mg/L	< 60 mg/L
Chlorine Residual	Not detectable	>1mg/L after 1 hour contact
Total Phosphorus	≤ 1.5 mg/L max day	NA
Total Phosphorus	≤ 1.0 mg/L Annual Average	NA
Faecal Coliforms	<200 CFU/100 mL	< 200 CFU/100 mL
Total Ammonia	≤ 1.54 mg/L[(1)]	NA

(1) At end of mixing zone.

4. EXISTING SYSTEMS

Figure 4.1 illustrates the layout of the existing components at the sewage treatment plant.

The treatment process includes:

- an automatic rake bar screen;
- two anaerobic lagoons (Cells 1A and 1B);
- one influent magnetic flow meter;
- three aerated lagoons (Cells 2A, 2B and 2C);
- two phosphorus removal lagoons (one redundant) (Cells P1 and P2);
- one chlorine contact lagoon (Cell C1);
- two storage cells (Cells 3 and 4);
- sludge dewatering facilities; and
- two effluent flow meters.

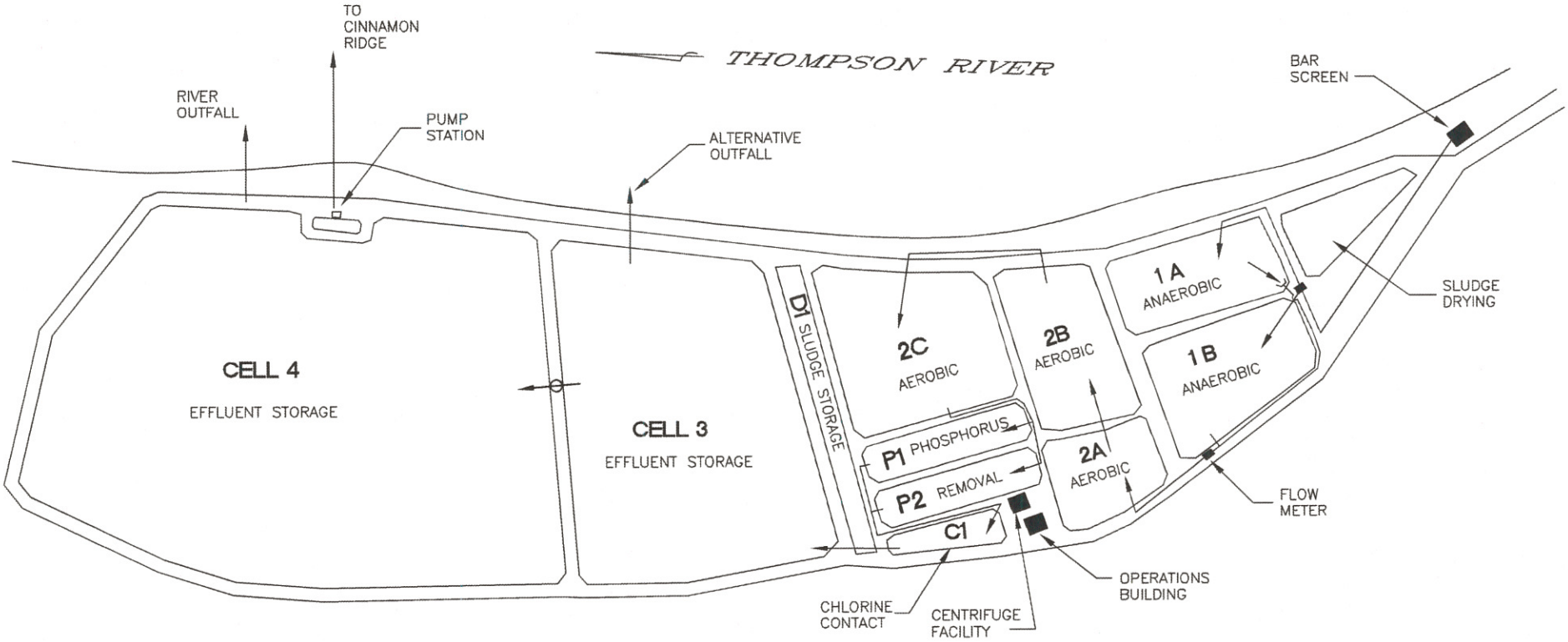
4.1 Screening

Raw sewage entering the plant first flows through the bar screen, at this stage TSS and BOD_5 are approximately 300 and 260 mg/L respectively. The bar screen removes solid particles greater than 19 mm in size. The screenings are dewatered and compressed by a screw auger and hauled to the landfill.

4.2 Biological Treatment

Following screening the sewage flows to the anaerobic cells 1A and 1B. These cells allow solids to settle and are the first biological treatment step at the Kamloops STP; TSS and BOD_5 are typically reduced to approximately 50 and 215 mg/L respectively. Methane, a strong greenhouse gas, and strongly odorous, reduced sulphur compounds are generated in the anaerobic cells.

Between Cell 1B and Cell 2A the flow is measured by a 600 mm diameter magnetic flow meter. Aerobic biological treatment begins in Cell 2A, and continues through Cells 2B and 2C. Blowers deliver air to each lagoon via subsurface diffusers to maintain aerobic conditions. At the outlet of Cell 2C TSS and BOD_5 are approximately 30 and 35 mg/L respectively.



URBAN SYSTEMS®

SUITE 200 - 286 ST. PAUL STREET
KAMLOOPS, BC, CANADA V2C 6G4
Tel. 250.374.8311
Fax. 250.374.5334
www.urban-systems.com

Kamloops
Canada's Tournament Capital

Client/Project	
CITY of KAMLOOPS STP UPGRADE: PREDESIGN	
Scale	**Date (yy/mm/dd)** / **Figure**
nts	09-01-06 / 4.1
0368.0459.11	**Title**
STP: EXISTING COMPONENTS	

4.3 Phosphorous Removal and Sludge Handling

Alum is added into a rapid mix chamber upstream of the phosphorous cells, P1 and P2, which are used to settle solids. The phosphorous cells are used on a rotational basis, one cell in use and one cell being de-sludged each year. The total phosphorous concentration is reduced to ≤ 1 mg/L.

Each year, P Cell sludge is pumped through a day tank to the centrifuge. The centrifuge dewaters the sludge to approximately 20% solids content and deposits it in a trailer for haulage. Because the sludge undergoes biological stabilisation in the P Cells, it is now called biosolids. Dewatered biosolids are hauled to the City's facility at Cinnamon Ridge, and composted to a Class A biosolid standard.

4.4 Disinfection

Gaseous chlorine is used to make a concentrated hypochlorite solution that is injected into the effluent between the P cells and Cell C1. Chlorine contact takes place in Cell C1, and then dechlorination occurs by natural off-gassing in Cells 3 and 4. Faecal coliforms are reduced from several thousand, to less than 200 CFU/100 mL.

4.5 Storage

Treated, disinfected effluent flows from Cell C1 to Cell 3 for storage. Cells 3 and 4 are hydraulically connected and have a combined storage volume of approximately 2.47 million m^3. Further TSS and BOD_5 reduction occurs in Cells 3 and 4; in 2008 the effluent discharged from Cell 4 averaged 12 and 7 mg/L for TSS and BOD_5 respectively. This storage capacity gives the City great flexibility, and enhanced ability to manage plant upsets, variable flows and irrigation demands without exceeding the permit requirements.

4.6 Disposal/Reuse

Treated effluent from the Kamloops STP has two destinations. Approximately 80% of the effluent is discharged to the Thompson River through an outfall from Cell 4. The remaining effluent is pumped from Cell 4 to the north shore of the Thompson River where it is used for irrigation on both public and private land. Effluent flow to each destination is metered and recorded.

5. PROPOSED UPGRADING

5.1 Introduction

The study, "Feasibility of Upgrading the Lagoons", completed in 2008 by Urban Systems, evaluated three options to upgrade the STP, and recommended conversion to an activated sludge process. This option was supported by the Ministry of Environment, the City of Kamloops Steering Committee and the recent LWMP Review and lies at the heart of the proposed upgrades. Figure 5.1 schematically illustrates the proposed processes.

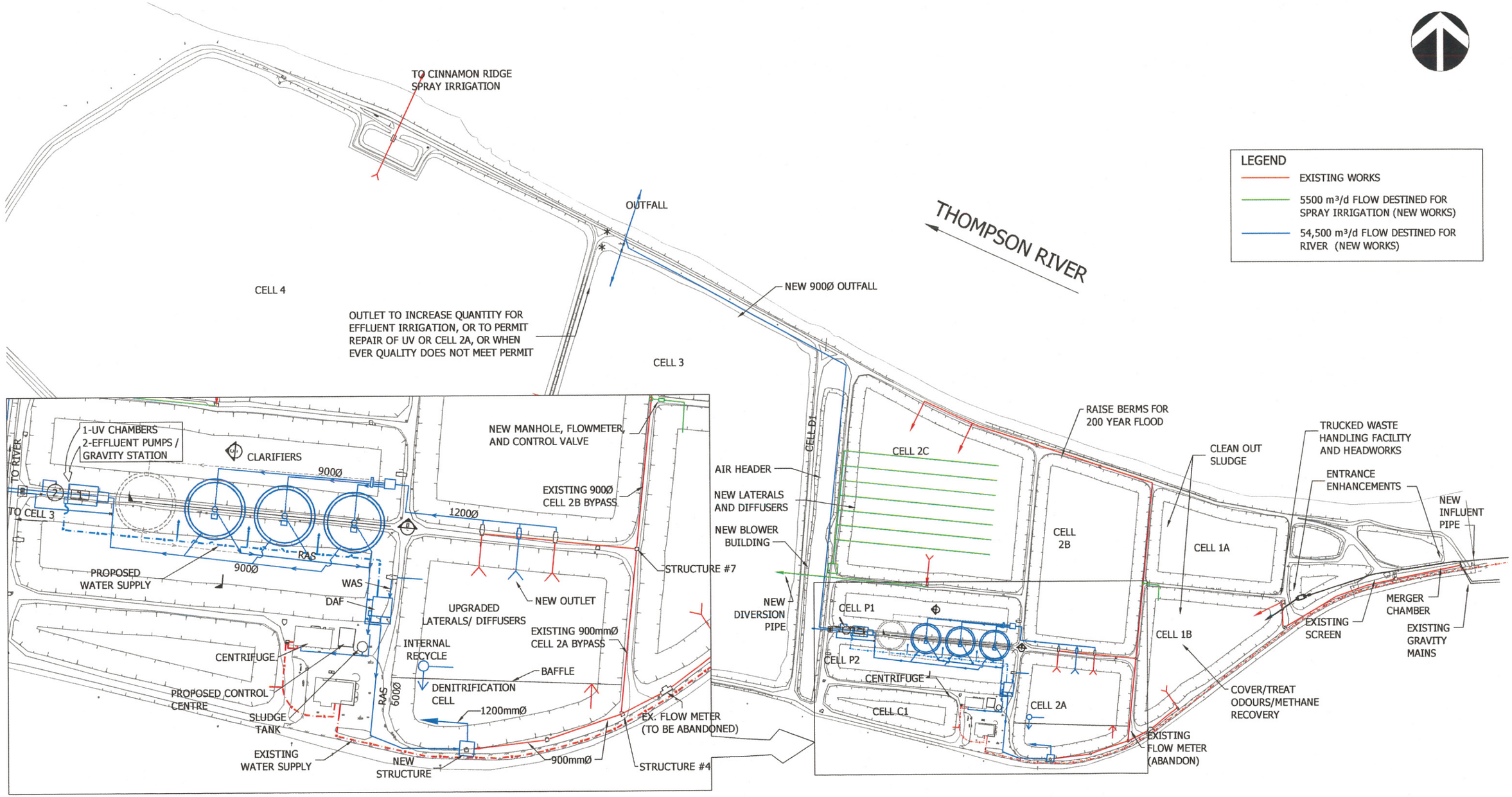
5.2 General Description

A new forcemain will convey sewage from the termination of forcemains coming from the Airport and Pulp Mill lift stations directly to the STP; the gravity mains will remain in place to provide redundancy and to convey wastewater from existing services.

Sewage entering the plant will flow through the new headworks building, a new flow meter, and then to Cell 1B. New facilities for trucked waste will be incorporated into the headworks building. Effluent destined for irrigation will leave Cell 1B through a new outfall at a constant rate of 5500 m^3/d for treatment in Cell 2C, and then storage in Cells 3 and 4. The remaining effluent will flow to Cell 2A for treatment by the activated sludge process. Alum will be added to reduce phosphorous. Aerated effluent will flow to new clarifiers, the underflow returning to Cell 2A as Return Activated Sludge, the overflow continuing to the UV disinfection system. Depending upon the seasonal river level, effluent may be pumped, or may flow by gravity from the UV disinfection system to a new river outfall adjacent to Cell 3. If necessary or desired, this effluent may be diverted from the river to Cell 3.

Figure 5.1 illustrates the following components of the proposed upgrade:

- Trucked waste facilities;
- New influent forcemain;
- Entrance enhancements;
- New headworks/flow meter;
- Cover Cell 1B (treat odours, possibly recover/reuse methane);
- Effluent destined for irrigation;



LEGEND

- EXISTING WORKS
- 5500 m³/d FLOW DESTINED FOR SPRAY IRRIGATION (NEW WORKS)
- 54,500 m³/d FLOW DESTINED FOR RIVER (NEW WORKS)

URBAN SYSTEMS®

SUITE 200 - 286 ST. PAUL STREET
KAMLOOPS, BC, CANADA V2C 6G4
Tel. 250.374.8311
Fax. 250.374.5334
www.urban-systems.com

Canada's Tournament Capital

Client/Project	
CITY of KAMLOOPS	
STP UPGRADE: PREDESIGN	
Scale	**Date (yy/mm/dd)** / **Figure**
nts	09-01-06 / 5.1
0368.0459.11	**Title**

STP UPGRADE SITE PLAN

- The activated sludge plant;
  - Upgrade aeration to Cell 2A (pre-denitrification cell);
  - Clarifiers;
  - WAS piping;
  - DAF;
  - Piping to centrifuge;
  - Alum addition (chlorine for RAS control);
- Ultraviolet light disinfection;
- Effluent pump/gravity station;
- Outfall;
- Water supply improvements;
- Electrical supply/SCADA/standby power/controls; and
- Berm protection to 200 year flood levels.

Each of these components is discussed below.

5.3 Trucked Waste Facilities

Trucked waste (organic and inorganic) will be handled in the headworks building.

Septage and holding tank waste (organic) will pass through a macerator and a flow meter, and then discharge into the headworks channel upstream of the bar screen. The macerator will break up consolidated organic solids so that they are not removed with the screenings from the bar screen.

Primarily inorganic, gritty waste such as catch basin clean out waste will pass through a grit classifier and a flow meter and then into the headworks channel upstream of the bar screen. Sand and grit will be conveyed from the grit classifier into a roll-off bin for disposal.

Both streams will have locking valves connected to a card reader. The controller will record each user's discharge to charge their account. Revision to the City's sewer bylaw is recommended to incorporate appropriate fees, regulation and penalties for the trucked waste handling system.

5.4 Influent Forcemain

All sewage from the North Shore is pumped from the Airport Lift Station through two forcemains (350 mm and 500 mm diameter) under the Thompson River. All sewage from the South Shore is

pumped via the Pulp Mill Lift Station along a 600 mm diameter forcemain. Both forcemains terminate in the Forcemain Outlet Chamber (FOC), approximately 1200 m east of the STP. Sewage flows in two gravity mains from the FOC to the STP; the FOC, and the gravity mains are corroded and their useful lifespan is limited.

To provide redundancy to the gravity mains, it is proposed to construct a new 900 mm diameter forcemain along Mission Flats Road to bypass the FOC and gravity mains. The Airport and Pulpmill lift stations will both pump directly into the new forcemain. The gravity mains will remain in place as a redundant bypass, and to collect and convey sewage/leachate from the landfill to the STP.

5.5 Entrance Enhancements

The Sewage Treatment Plant is accessed via Mission Flats Road at an intersection near the railway crossing to the Kamloops landfill. The entrance road extends approximately 1,400 metres to the plant site, headworks area and the operations building. The proposed upgrades to the STP will increase traffic to the plant, and require enhancement to the access road, headworks site area and the entrance corridor to address functional, safety and aesthetic considerations.

The enhancements will consist of:

- Move the Mission flats road intersection west to the railway crossing;
- Relocate and improve the facility sign;
- A paved turn-around at the plant gate;
- Restore disturbed sites with native topsoil and vegetation;
- Relocate entrance road, separate traffic to headworks area and main plant;
- Headworks layout to facilitate pumper, and dumpster truck activities; and
- Clean up northeast corner of STP, remove old Quonset hut and surplus materials, restore site with native vegetation.

The entrance enhancements will provide excellent operational functionality, and give the site a more positive image, reflecting its riverside location.

5.6 Headworks

The initial stage in the wastewater treatment process is preliminary treatment. Raw sewage entering the treatment process contains various non-biodegradable materials, such as plastic and

rocks. The purpose of the preliminary treatment process is to remove these undesirable materials from the influent flow.

The proposed facility will be in a building parallel to, but west of, the existing headworks. The existing facility will be used as a back-up or bypass. The new screen will be installed in a concrete channel inside the building, and will remove solids greater than 6 mm diameter (existing screen removes 19 mm solids), resulting in significantly increased solids capture, thereby reducing loading in Cell 1B. Screened solids will be compressed, dewatered, deposited in a roll off bin, and land-filled as required. Fine grit in the influent sewage will be collected in a stilling chamber at the front of Cell 1B rather than in the headworks. Odour control will be provided by blowing air from the building through a biofilter adjacent to the building.

The headworks building will incorporate the trucked waste handling facilities described in Section 5.3.

A flow meter will be installed in a manhole on the piping downstream of the headworks to monitor plant inflow.

5.7 CELLS 1A/1B

The sludge in Cells 1A and 1B has not been removed since the cells were first constructed in 1985. Bathymetric surveys indicate that these cells have accumulated excessive quantities of sludge; this sludge should be removed to upgrade the plant.

Cell 1B will continue to operate as an anaerobic lagoon and will produce significant quantities of methane gas, and odourous reduced sulphur compounds. The cell will be fitted with a cover and a gas collection system to prevent odour problems and to minimize the release of greenhouse gases; when the methane gas production rate and quality is known, after operation for a year or two, it may be possible to utilize this gas for energy production.

5.8 Effluent Destined for Irrigation

The City has committed to retaining the existing effluent irrigation system at Cinnamon Ridge for at least 20 years. A cost/benefit analysis indicated that operating a separate treatment train for irrigation effluent is advantageous. The proposed separate treatment train will remove less nitrogen and phosphorous than the activated sludge process, thereby reducing fertilizer requirements on the irrigated lands. Additionally, the aerated lagoon process in Cell 2C that will be used to treat the effluent will require less energy to operate, reduce alum consumption, and less solids handling than would be required if all the flow were directed to Cell 2A.

The separate treatment train will begin with a new outfall from Cell 1B into existing pipework leading to Cell 2C. A flow meter and control valve will regulate flow to a constant 5500 m^3/d. The aeration equipment in Cell 2C will be upgraded and a new blower building will be constructed. Treated effluent from Cell 2C will be stored in Cells 3 and 4 and then pumped across the river to Cinnamon Ridge, using existing facilities, during the irrigation season.

5.9 Activated Sludge Process

The activated sludge process is the core process of the proposed plant upgrades. The balance of sewage not destined for irrigation will be treated in the activated sludge process centred in Cell 2A.

The activated sludge process components are to be located as shown in Figure 5.1. The primary components are:

.1 Pre-denitrification Cell (front part of Cell 2A)

.2 Aeration Basin (Cell 2A)

.3 Clarifiers

.4 Solids Handing

It is proposed that a new office building be constructed to provide a central control center, lunch room, washrooms and showers. Space has also been allocated for a teaching facility.

Anaerobic effluent from Cell 1B will flow by gravity to the pre-denitrification cell which will be created by a baffle in the front end of Cell 2A. The anaerobic effluent entering the pre-denitrification cell will be mixed with nitrified, mixed liquor suspended solids (MLSS) recycled from the aerated portion of Cell 2A and with nitrified return activated sludge (RAS) from the secondary clarifiers. This cell will reduce some of the BOD, as well as virtually all of the nitrates recycled to this cell (representing approximately 75% of the nitrates generated in the aeration basins). The pre-denitrification cell is mixed, but not aerated. The MLSS from the pre-denitrification cell will pass into the aeration cell where soluble CBOD will be reduced to below 25 mg/L and ammonia will be biologically converted to nitrate. Alum will be added to ensure total phosphorus is reduced to below 1 mg/L. Aerated effluent will flow into the clarifiers where the solids will be separated from the liquid. A portion of the MLSS from the aeration basin will be wasted (waste activated sludge - WAS) to a dissolved air flotation unit (DAF). The DAF will thicken the waste solids enough for dewatering in the centrifuge. Solids from the centrifuge will be treated by composting.

After the clarifiers the effluent will be disinfected with UV and then will flow to a new outfall structure at the north end of Cell D1.

5.10 Ultraviolet Light Disinfection

Disinfection of treated effluent is intended to ensure that disease-causing organisms do not contaminate receiving environments. Disinfection, as opposed to sterilization, does not eliminate all organisms but reduces the concentration of active pathogenic organisms. Currently, the Kamloops STP practices disinfection by chlorination; the Liquid Waste Management Plan (LWMP) recommended conversion from chlorination to ultraviolet light (UV).

Ultraviolet light inactivates organisms by causing photo-chemical damage to nucleic acids in genetic material, thereby making them unable to reproduce. UV light in wastewater disinfection systems is produced by mercury vapour lamps. The UV disinfection system will be located in a new building located immediately west of the secondary clarifiers (see Figure 5.1). The disinfection system will be comprised of 400 low pressure/high intensity mercury vapour lamps arranged in two concrete channels. Each channel will house 5 UV modules, each module containing 40 vertically oriented lamps. The system is designed to achieve its disinfection target (<200 CFU/100mL) at design flow with one module out of service in each channel.

5.11 Effluent Pump/Gravity Station

Effluent will flow from the UV equipment into a concrete wet well having a full water level of 342.8 m, and then through a 900 mm pipe to the river outfall. Hydraulic grade calculations indicate that at the design daily flow of 54,500 m^3/d, pumping will be required if the river level exceeds 341.5 m at the outfall, below this level effluent will flow by gravity. Records indicate that this level was exceeded in 17 of the 20 recorded years, the longest period being 62 days in 1999.

There will be three outlets from this wet well. The first is the gravity outlet which would be through an automatic slide gate or check valve at the invert of the tank. This valve would normally be open. If the water level in the wet well rises to 342.8 m, the operators could initiate one of the other two outlets - the pump discharge or gravity overflow into Cell 3.

5.12 Outfall

There are two outfalls at the Kamloops STP. One serves as an outlet for Cell 4 and one for Cell 3. The Cell 4 outlet is in use now. Both outfalls have single ports and terminate at elevations that are visible during low river flow conditions. It is proposed that a new outfall be installed at the north end of Cell D1.

During the 2003 LWMP process, the Ministry of Environment expressed concern over the apparent lack of mixing in the receiving reaches of the Thompson River as a result of the existing outfall. Consequently, the Ministry of Environment raised the need to assess more appropriate methods of discharge with the STP upgrades. In addition, the recently released Canada-wide Municipal Wastewater Strategy contains additional criteria and guidance for surface water discharge of treated effluent.

Environmental hydraulics is a complex and challenging discipline and the Thompson River is very dynamic – bathymetric surveys report up to 7 m variation in river bed level at the outfall location over the 12 year record period. A separate outfall feasibility study is currently in progress to address this issue.

A preliminary mixing and flow dispersion analysis was performed to assess the mixing potential of the effluent discharge into the Thompson River. The conditions of the Municipal Wastewater Strategy could be met using a single port outfall extended out from the shore. The highly variable river bed levels present a major challenge for the outfall design.

Outfall design options will be reviewed with the Department of Fisheries and Oceans, Transport Canada (Navigable Waters) and with the BC Ministry of Environment (Water Stewardship Division) to ascertain their concerns and constraints.

5.13 Water Supply Improvements

Currently there are three water supply systems at the plant. One system takes water from a shallow culvert well next to the Thompson River, east of the plant. This water is used in the headworks area and the operations building. Water for indoor use is treated by a Big Iron system to reduce iron and some turbidity. Bottled water is used for drinking. The other two systems take treated effluent from Cell C1 for use as process water in the Chlorination system and in the centrifuge building.

The supply line from the well passes nearby the new headworks building; it is proposed to use this water in the headworks. This line continues to the operations building where it is treated by the Big Iron system. It is proposed to install a reverse osmosis system after the Big Iron unit and then direct treated water to the existing storage tank, this water would be available for showering and other domestic use in the existing building and the new control centre.

Cell C1 will no longer be used, so a new water system will take water from a wet well located downstream of the UV disinfection system. This system will supply non-potable water to the

clarifiers, UV disinfection system, effluent pump/gravity station, DAF unit, centrifuge building and chlorination for return activated sludge.

5.14 Electrical Supply/Controls/Standby Power

The site is fed by a B.C. Hydro 25 kV overhead service. The 25 kV power system is distributed throughout the site on the City's pole-line system. City electrical maintenance staff have identified the following concerns with the existing power system.

- Pole condition: Approximately one-third of the poles on site are wooden and near the end of their lifespan.
- Power Interruptions: The site experiences numerous power interruptions throughout the year, primarily due to bird strikes.
- The recloser is installed on the centre phase only, so provides only limited protection.

The new plant will have a total connected loading of approximately 2400 kW. The pole line system will be upgraded to include bird strike protection, and three phase recloser protection. A new electrical building will be constructed west of the existing operations building. This new building will house medium voltage (4160 V) switchgear, two emergency power generators and associated parallel switchgear. The new building will be fed from an outdoor circuit breaker and 25 kV – 4.16 kV, 3.0 mVA transformer. Medium voltage power will be distributed in underground power lines to provide increased reliability, safety and convenience. Each service point will be fitted with a new 750 kVA transformer providing 600 V power for pumps, blowers, UV modules, centrifuge and other equipment.

Because the headworks area is some distance from the operations building, electrical loads in this area will be fed from a pole mounted 25 kV- 600 V transformer. Another standby generator will be located in this area.

Control panels complete with PLC's will be installed at all process locations. Each site will be complete with a graphical operator interface for viewing local status and alarms. The STP site is well suited for radio monitoring and control as the area is flat and clear of obstructions. A network will be established by using wireless Ethernet adapters at all sites. A dedicated Historian computer will provide the logging of process data and the system will be linked to the City's existing wireless wide area network.

5.15 200 Year Flood Protection

The outer berm protecting the STP ranges in elevation from 345.2 to 346.0 m. The 200 year river level is 345.7 m; therefore, allowing for 0.6 m of freeboard, the berm top elevation should be raised to 346.3 m.

To protect the core facility and lagoons will require approximately 4,000 m^3 of compacted fill material.

5.16 Management of the Dewatered Waste Solids

In the existing process, sludge is pumped from the P cells, dewatered to 20% solids by the centrifuge, and then hauled to Cinnamon Ridge for composting. This seasonal operation occurs between April and October; approximately 1750 m^3 of sludge is hauled each year. The waste spends several months in the P Cells, during this time biological stabilization takes place that reduces the activity and odour potential of the sludge. At Cinnamon Ridge the sludge is composted with bulking agents, such as yard waste, in a windrow process to the OMRR Class A biosolid standard.

The waste activated sludge (WAS) from the upgraded process will be more active and will have a high odour potential. Dewatered solids will be produced virtually every day, and in greater volumes than now.

There are two options for the management of the future sludge which will be produced at the sewage treatment plant:

- Continue composting at Cinnamon Ridge, which may be possible using the windrow process or may require upgrading to a system where greater odour control is achieved, such as the aerated static pile process, or
- Develop a new site, located at the sewage treatment plant, where measures would be put in place to control odours, thus minimising any odour risk before the onset of problems.

Management of waste solids is a complex issue, involving factors such as land values, transportation costs, transportation risk, odour potential, ultimate destination of biosolids, source and quantity of amendments, cost, and operational issues. Further study of this issue is required to properly address the many factors involved, and then achieve the best solution. To avoid the potential of public perception challenges it is strongly recommended that this issue be dealt with pro-actively and that a solution is in place in time for commissioning of the main plant upgrades. Following review of this Predesign Report these steps are recommended:

- Establish direction as to the ultimate aims of the composting facility;
- Estimate volumes of incoming and produced materials;
- Review location options, constraints, costs and preferences;
- Develop a biosolids/compost management plan; and
- Develop interim measures which can be implemented to manage the initial biosolids that will be produced, prior to the development and implementation of more permanent measures.

5.17 Operational/Maintenance Issues

The existing lagoon process has been rated by the BC Environmental Operators Certification Program as a Level 4 plant. This is the highest rating of sewage plants in BC. The City is requiring all current Operator positions to have at least a level 3 or 4 designation. The new plant will also be rated a level 4, but it will be considerably more complex than the existing plant from operational, mechanical, and control perspectives. The operators will require additional training. The head operator should be granted the opportunity to participate in the detailed design and construction phases of the upgrade.

There are three operators currently; 4 or 5 additional operators may be required to cover 7 days per week and vacation/sick time.

6. SCHEDULE AND COSTS

Table 6.1 outlines the proposed schedule for the plant upgrades. Table 6.2 summarizes the estimated costs of each component, including engineering and contingency in 2009 dollars. Inflation over 5 years is not included.

Table 6.1 – Estimated Project Schedule

ACTIVITY	YEAR/QUARTER																			
	2009				2010				2011				2012				2013			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Environmental Assessment																				
Cell 1A/1B Sludge Removal, Site Preloading																				
LWMP Review and Approval																				
Cell 1B Cover Design and Construction																				
Headworks Design and Construction																				
Influent Forcemain Design and Construction																				
Detailed Design of Main Plant																				
Main Plant Construction																				
Outfall Design, Permitting and Construction																				
Commission Entire Facility																				

Table 6.2 – Summary of Cost Estimates

Item	Cost Estimate
1. Trucked Waste Facilities	$ 775,000
2. Influent Forcemain	$ 1,700,000
3. Entrance Enhancements	$ 355,000
4. Headworks/Piping to Cell 1B (including Desludging)	$ 3,670,000
5. Remove Sludge from Cells 1A and 1B	$ 3,000,000
6. Cover Cell 1B/Collect Gases/Flare/Separation Wall	$ 3,600,000
7. Effluent Destined for Irrigation	$ 1,050,000
8. Activated Sludge Process	$ 15,060,000
9. Ultraviolet Light Disinfection	$ 1,500,000
10. Effluent Pump/Gravity Station/Outlet Pipe	$ 1,190,000
11. Outfall Allowance	$ 750,000
12. Water Supply Improvements	$ 305,000
13. Electrical Supply/Controls/Standby Power/Building	$ 4,200,000
14. 200 Year Flood Protection (protecting all lagoons)	$ 65,000
15. Composting Biosolids (Allowance)	$ 1,000,000
16. Environmental Enhancements	$ 2,000,000
Total Capital Cost Estimate	**$ 40,220,000**

APPENDIX D

Wetland Discharge Memorandum

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

title:	**ALTERNATIVE OUTFALL OPTION - WETLAND DISCHARGE**
date:	April 28, 2009
file no.:	0368.0314.20

1. Background

The City has two outfalls located at the sewage treatment plant: one located at Cell 3 and one located at Cell 4. The Cell 4 outfall is used on a day to day basis, with the Cell 3 outfall only being used in an emergency. The Cell 4 outfall is the deeper of the two and the effluent is of slightly higher quality at the Cell 4 location compared to the Cell 3 outfall location.

Although the Cell 4 outfall is located in the deep section of the Thompson River, poor mixing occurs between the effluent and the river water. The lack of mixing is a factor of the hydraulics and morphology of the river at this location and the design of the existing outfall. The upgrades to which the City of Kamloops committed in the 2003 Liquid Waste Management Plan (LWMP) process will likely result in the abandonment of the Cell 4 outfall, with the Cell 3 outfall becoming the primary point of discharge. This is located upstream of the Cell 4 outfall and it is suspected that limited mixing between the river and effluent will also occur at this point.

The need to assess a more appropriate method of discharge was raised during the City's LWMP process. The poor outfall structure and resulting lack of mixing has also been raised by the BC Ministry of Environment. The need for adequate mixing is also a component of the Canada-wide Municipal Wastewater Strategy. This Strategy will be incorporated into existing Provincial legislation and will form the basis of future Federal wastewater regulations, to be developed under the Federal Fisheries Act.

Currently, an outfall Feasibility Study is being completed in order to assess if environmental objectives can be met at the end of the initial dilution zone, and the configuration of the outfall which would be required in order to achieve this mixing. Although not within the scope of the Feasibility Study, the Ministry of Environment has raised discussion regarding alternative discharge options, with the emphasis being on the development or use of a wetland area. Below is a summary of the potential for wetland use for the City of Kamloops. The wetland area would need to manage 80% of the effluent discharge, with the remaining 20% being used at Cinnamon Ridge for spray irrigation. Currently the discharge to the Thompson River is in the order of 24,900 m^3/d (approximately 9,000,000 m^3/annum), with the future average daily design flows being 47,440 m^3/d (approximately 17,300,000 m^3/annum).

URBANSYSTEMS.

2. Historical Wetland Studies

The option of developing a wetland was reviewed during the 2003 LWMP process, with the emphasis being wetlands for treatment, rather than wetlands as a discharge option. During the LWMP process, pilot trials were completed, using wetlands with or without additional pre-treatment by a gravel filter. The studies indicated that some treatment was achieved by the wetland system, but that this treatment was not to a standard which would be suitable for river discharge, nor could the level of treatment be relied upon in the cooler months. Pre-treatment (e.g. using the gravel filters) would be required to ensure that consistent effluent quality would be achieved year-round. Significant land requirements were identified for the development of a wetland for treatment, based on the City's flows. The concerns with the reliability and seasonality of the wetland process resulted in the recommendation that this option should not be pursued further for the City of Kamloops.

3. Potential Wetland Areas for Discharge

The purpose of developing a wetland area would be for discharge, either resulting in a diffuse discharge into the Thompson River or an indirect discharge into the Thompson River. Three potential areas were identified as locations of a wetland. These are identified on Figure 3.1, and are described in greater details below.

Area 1: Approximately 54 hectares of land located immediately to the west of the sewage treatment plant. This land is owned by Domtar and is currently leased to a rancher for grazing purposes, with the livestock being horses. The land is not irrigated, but hay can be harvested from this area. The harvest is limited to a single cut due to the inundation of river water which occurs on an annual basis over the freshet period. The land is well vegetated with grasses and natural trees/shrubs. The annual flooding results in fish accessing this area, many of which have the risk of becoming stranded, even though there is a single small low lying pool which contains water throughout the year. This pool is used year-round for watering the livestock. In 1997, Fisheries and Oceans Canada (DFO) completed a habitat assessment for the Thompson River[1]. The river bank was identified as being Class 2 habitat, with small sections of Class 1 and Class 3 habitat. However, the most valuable habitat was identified in areas which become flooded during the freshet period. These areas are located at the south of the property and are away from direct contact with the river bank, and include the small low lying pool (Figure 3.1). Class 1 habitat is defined as containing critical habitat types and require a high level of protection. Class 2 habitat is described as containing 1 or more important habitat types and Class 3 habitat contains marginal habitat types.

[1] Stalberg, H.C., Redden, R.J. and Hickey, D.G. (1997). Thompson River Salmonid Habitat Classification in the Vicinity of Kamloops, B.C. Department of Fisheries and Oceans Canada, Fraser River Action Plan.

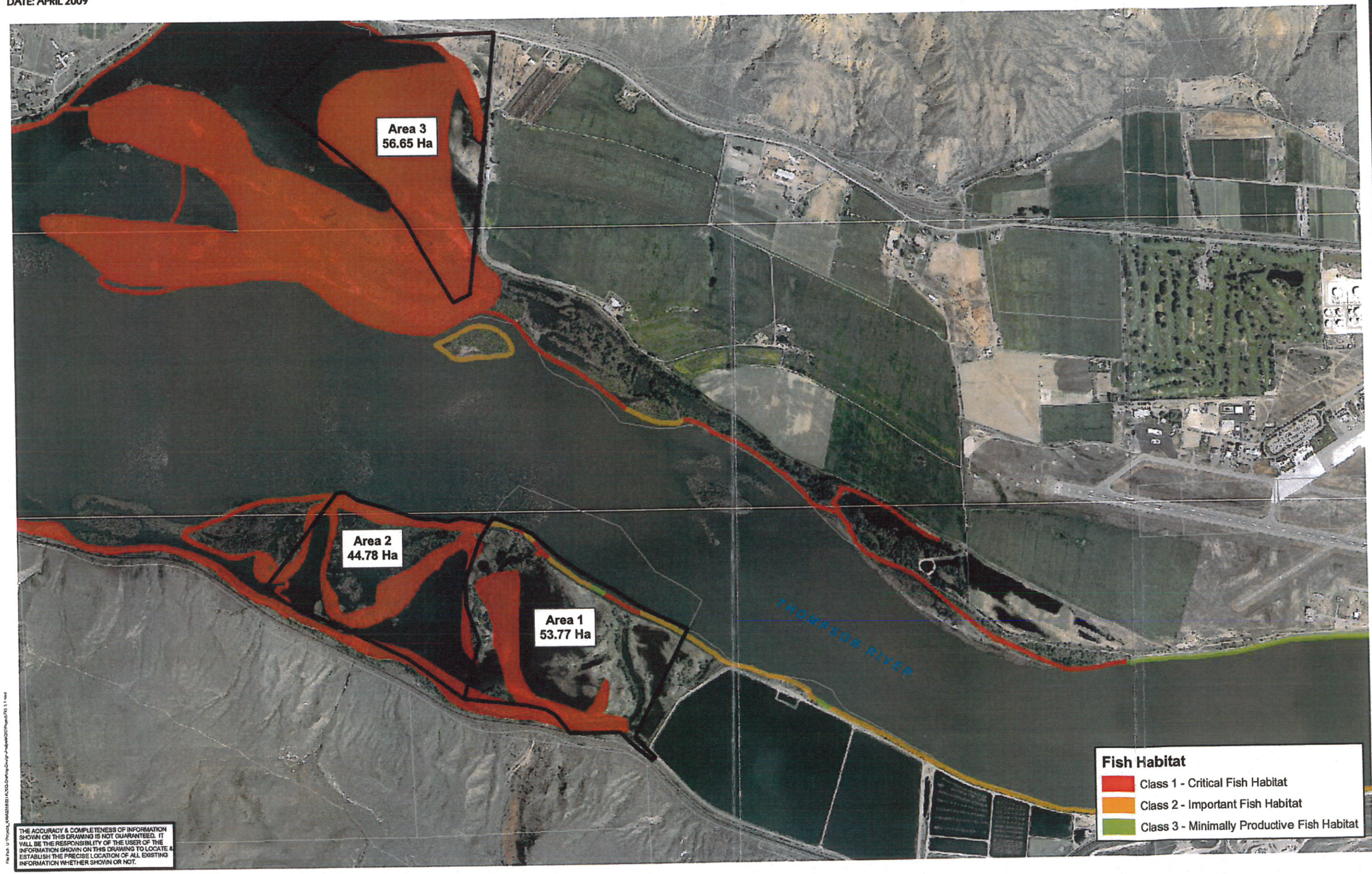
URBANSYSTEMS.

2009 LIQUID WASTE MANAGEMENT PLAN REVIEW

DATE: APRIL 2009

CITY OF KAMLOOPS

1:15,000



THE ACCURACY & COMPLETENESS OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED. IT WILL BE THE RESPONSIBILITY OF THE USER OF THE INFORMATION SHOWN ON THIS DRAWING TO LOCATE & ESTABLISH THE PRECISE LOCATION OF ALL EXISTING INFORMATION WHETHER SHOWN OR NOT.

File Path: U:\Projects_KAM\0458\01\0530-Drafting\Drwgs-Final\mxd\2009\Report\FIG 3.1.mxd

ALTERNATIVE OUTFALL OPTION - WETLAND DISCHARGE

FIGURE 3.1

Area 2: Approximately 45 hectares of land located immediately to the west of the Domtar land. This land is Crown Land and has no known current uses or leases. The land is well vegetated with grasses and natural trees/shrubs, and there are many young willows growing in the section which borders the Thompson River. As with the Domtar property, this section of land is inundated with river water during the high flow period. The inundation is greater than that observed on the Domtar property, due to its lower elevation and lack of defined bank between the property and the river/sandbar. During the period of inundation, fish will be able to access the property, and there is a risk of becoming stranded in areas when the water recedes. This area was also included in the 1997 DFO habitat assessment, and was identified as Class 1 habitat.

Area 3: Approximately 57 hectares of land located immediately to the west of the City's property at Cinnamon Ridge. This area is Crown Land and historically was leased for agricultural purposes to Frolek. However, the lease expired in the early 1990's. Under the lease, the land was used for grazing and hay production, but was not irrigated. The area is low-lying and is not protected by a dike. Therefore, the area is inundated with river water for an extended period of time during the freshet period, during which there are no barriers to fish access. This area was also included in the 1997 DFO habitat assessment, and was identified as Class 1 habitat.

4. Discussion on Feasibility of Wetland Option

4.1 General Discussion

The purpose behind developing a wetland option for discharge would be based on aesthetics and perception. A wetland area is considered to be a "green approach", and is not only aesthetically pleasing, but will also enhance habitat for fish, waterfowl etc. However, the studies which have been completed during the LWMP process, and the subsequent monitoring of the Thompson River have indicated that there are no technical/scientific concerns with regard to the concept of a direct river discharge for the City of Kamloops.

The development of a wetland area would create habitat, which could be focused towards enhancing fisheries or may focus on enhancing general aquatic related wildlife, such as water fowl. There are some general considerations, which would be applicable to all sites, which would need to be overcome before this approach could be accepted. These general considerations are focused on the need to mitigate both acute and chronic effects from the treated effluent. For the species which could use a wetland, fish are the most vulnerable to acute effects, which would result in death over a short period of time. Chronic effects are harder to identify and may affect a range of different species, including fish and invertebrates. Although substances such as ammonia can result in chronic effects, the most recently publicised concerns

for chronic effects and sewage effluents relate to the potential for endocrine disruption. There are a range of different substances which are present in sewage that can cause disruption with the endocrine system. These substances include naturally excreted hormones, synthetic hormones, medications and personal care products (e.g. soaps, etc). The effects can vary in nature and include reduced fertility, growth defects, feminization and reduced resistance to disease. As chronic effects occur over a prolonged period of time, there may be a significant time lag before the impacts are fully observed. In addition, the very nature of chronic effects means that the causing agent may be in very low concentrations, yet still be able to have an effect over an extended period of exposure. The Canada-wide Municipal Wastewater Strategy recognises the potential for acute and chronic toxicity, as a result of sewage effluents, and the need to treat for these components must be evaluated.

Based more on the potential for chronic effects, the following would need to be addressed before a wetland option could proceed:

- The determination of which species would have access to the wetland area. There is a greater concern if fish can access the area, compared with more transient species, such as water fowl. If the wetland area is to be non-fish bearing, then fish barriers would be needed. This could cause concerns with existing fisheries values which have been identified by DFO for all three potential sites.

- The determination of effluent quality and an appropriate level of treatment to mitigate the potential for chronic impacts. It is anticipated that a higher effluent quality, and corresponding higher treatment requirement, would be needed for the wetland release, compared with the release directly to the Thompson River. This is based on the concept that there would be a greater risk of chronic and acute effects in a wetland area due to the higher concentration of effluent compared with the river release, where mixing and dispersion occurs. Therefore, it is reasonable to assume that there would be an increase in costs related to the wetland option in order to achieve the higher effluent quality. This increase would need to be evaluated, but could be significant, for a community the size of the City of Kamloops.

4.2 Site Specific Discussion – Site 1

The development of a wetland for Site 1 should consider:

- The land is owned by Domtar, and discussions have indicated that Domtar is hesitant to allow such a committed use of their land. At this time, Domtar is not certain what their long-term plans are for this land.

- Conversion to a wetland or modification of the lands could prevent the stranding of fish which occurs each year as the flood waters recede.

- The land has existing uses and the termination of agricultural leases would be needed. There may also be concerns with the existing fresh water pond, which is used year-round by livestock and wildlife. Conversion to a wetland with effluent would inhibit the use by wildlife as a drinking water source.

- Diking costs would be less than for Site 2, because dikes would only be required on two sides.

- An access agreement with Domtar and/or CP Rail may be required.

4.3 Site Specific Discussion – Site 2

The development of a wetland for Site 2 should consider:

- The land is owned by the Crown, which could facilitate access agreements and the conversion to a wetland facility. Confirmation is required regarding leases for this land.

- Conversion to a wetland or modification of the lands could prevent the stranding of fish, if this occurs as the river levels decrease after the spring freshet.

- The land has few or no concerns with existing uses, but is further away from the sewage treatment plant, requiring additional connecting pipework through privately-owned lands.

- Diking costs would be higher than Site 1 because Site 2 is lower lying and dikes would be required on 3 sides.

4.4 Site Specific Discussion – Site 3

The development of a wetland for Site 3 should consider:

- The land is owned by the Crown, which could facilitate access agreements and the conversion to a wetland facility.

- Effluent is currently pumped to Cinnamon Ridge along a pipe located under the Thompson River. This is to serve the whole of Cinnamon Ridge for irrigation purposes, with the effluent containing high concentrations of nitrogen and phosphorus. It is assumed that the effluent which would be

discharged to a wetland would be of a higher quality. Therefore, a new dedicated pump station and a pipeline would have to be installed under the Thompson River; this would incur significant additional costs. There would also be additional pumping costs.

- The land has existing uses and the termination of agricultural leases may be needed.

5. Conclusions and Next Steps

The concept of a wetland area is one which is favoured based on the aesthetics and perception. However, it is not feasible to pursue this option for the sites identified at this time, due to the concerns which have been raised (financial, environmental, and land ownership). Therefore, the following are recommended:

- The City should continue to pursue the outfall to the Thompson River for the discharge of effluent.

- The City should review alternative options for a wetland development in the future, as they arise. This should be based on alternative sites (e.g. preference being away from the Thompson River) or outcomes of work which is being completed on chronic impacts as a result of sewage effluents.

U:\Projects_KAM\0368\0314\20\X-Single-File\2009-04-28-wetland review summary.doc

APPENDIX E

Reuse Outline for the Provincial Fire Control Centre

Suite 200 - 286 St. Paul Street, Kamloops, BC V2C 6G4
Telephone: 250-374-8311 Fax: 250-374-5334

URBANSYSTEMS.

title:	**CITY OF KAMLOOPS EFFLUENT REUSE - AIRPORT LANDS**
date:	July 29, 2009
file no.:	0368.0450.04

1. Background

The BC Ministry of Forests and Range operates a Provincial Fire Control Centre at the Kamloops Airport. This site consists of administration and personnel facilities and the air tanker facility. Currently this site is serviced by City water, which is of potable quality and has been treated at the City's water treatment plant. However, there are two water uses (irrigation and fire suppression) which are non-potable in nature and the intent would be for effluent from the City's sewage treatment plant to be the water source for these operations. This would be an extension of the existing effluent reuse which is currently practiced on agricultural lands (both City-owned and privately-owned) and the golf course.

Below is a summary of the proposed effluent reuse activities and the management strategies which will be implemented in each case.

2. Reuse of Effluent for Irrigation

2.1 Intent and Location

The Ministry of Forests and Range is currently planning a new personnel building for the Provincial Fire Control Centre at the Kamloops Airport. The location of the existing buildings and proposed new building are shown on Figure 2.1, and are located to the north west of the airport terminus. The access to the Provincial Fire Control Centre is via a single road along the back of the airport public parking lot, through a commercial area. The commercial area consists of facilities associated with the air tanker facility. The road has no restrictions with regards to access by the public, although the location of the road and the location of the Provincial Fire Control Centre are such that only personnel associated directly with the developed sites would be likely to access the area.

The existing buildings are currently surrounded by landscaped areas (grass, shrubs and mature trees). This area is currently irrigated using potable City water. Further landscaping is planned around the future new building, using vegetation which is consistent with the existing landscaping. The intent would be for effluent to be used for all future irrigation at the Provincial Fire Control Centre. The current and future landscaped areas are shown on Figure 2.2. Although the irrigation season is weather dependent, it is expected that irrigation would typically be required from May

through to the end of September, depending on weather conditions. It is estimated that the irrigation rate would be in the order of 13 m^3/d during the months of May, June and September. The peak irrigation rates would occur in the months of July and August, to approximately 26 m^3/d. Therefore, it is anticipated that the effluent requirement for irrigation would be in the order of 2,800 m^3 for the duration of the irrigation season.

The area planned for irrigation is bordered by the golf course to the north, agricultural fields to the west, the fire tanker facility and airport lands to the south and the fire retardant manufacturing facility (ICL Performance Products Canada Ltd.) to the east. The golf course and the agricultural area immediately to the west both currently irrigate using effluent from the City of Kamloops' sewage treatment plant. The fire tanker facility is located inside the airport lands to the south and, therefore, are designated as air-side and fully fenced. This site is designated as restricted for public access. The fire retardant manufacturing facility, located immediately adjacent to the Provincial Fire Control Centre administration buildings, is also fully fenced with access restrictions to operational staff only. Access to the Provincial Fire Control Centre is via a single road, which is not gated, nor is it signed for public access restrictions, although there are signs at other locations on site indicating the site designation and activities.

2.2 Management of Effluent Irrigation

The landscape irrigation system is designed to be fully automated, with pop-up sprinklers which can be programmed for activation. The system will have a rain gauge which will override the programmed start times if there is sufficient rainfall to meet the irrigation needs. The rain gauge will also protect against over-irrigation of the area.

Although the City's effluent is of high quality with a residual chlorine concentration for pathogen control, it is recognised that the effluent does not meet the classification requirements in the Municipal Sewage Regulation for "unrestricted public access". Therefore, the following measures will be implemented in order to manage the effluent irrigation process for this site:

- Timing of irrigation – personnel are only on site during daylight/normal working hours. Therefore, the irrigation activities will be timed to occur when the site is not manned. The irrigation system will be programmed to operate only during the early hours of the morning, and it is proposed that the automated timing will be set for between 3:00 AM and 4:00 AM each day.

- Sprinkler locations – the sprinklers will be positioned to direct the effluent towards the vegetation only. Over-spray to the adjacent roads, access ways and parking areas will be avoided. The sprinkler system will be designed to prevent over-irrigation and the occurrence of run-off, through both the positioning of the sprinklers and the rain gauge controls.

- Signage will be posted around the site, as follows:

  - A sign near the entrance to the Provincial Fire Control Centre site indicating that the site is designated as the Provincial Fire Control Centre with directions (e.g. please report directly to the administration building) for visitors to the site.

  - Signs around the irrigation areas indicating that reclaimed water is used for irrigation, along with the appropriate precautions (no drinking).

The wording on these signs will be consistent with the City's current signs, located around the effluent irrigation areas at the City of Kamloops.

2.3 Proposed Timescale

The construction work on the new building has already started and the installation of the effluent main is planned for September/October 2009. Effluent irrigation will commence on May 1st, 2010.

3. Reuse of Effluent for Fire Retardant

3.1 Intent and Location

The use of effluent for fire retardant will be the primary use of effluent at this site, and will also be a seasonal operation, with the demands being during the fire season. The amount of effluent used at the facility will vary from year to year, according to the intensity of the fire season. Data from 2003 to 2008 indicate that between 775 m^3 and 7,160 m^3 of water was required annually for fire suppression, with the higher amount representing the extreme fire events in 2003. Over this time period, the average water usage was 2,490 m^3/annum. The system is being designed to accommodate a peak day demand of 351 m^3, which is representative of water usage over a 12 hour period due to the restrictions of flying times to daylight hours only. The effluent main has been designed to allow flows of up to 25 L/s.

The activities relating to the fire suppressant are within a fenced area with restrictions allowing only personnel who work on this site to access the facility. Concentrated liquid retardant is stored on site in two tanks (each approximately 40 m^3) and is blended in a 6.5:1 ratio (make-down water:concentrate) for fire fighting purposes. The make-down and loading system is fully enclosed and automated, allowing the diluted liquid retardant to be pumped to the plane on demand. The facility can accommodate two planes for loading at any one time. The loading area is located immediately to the south of the administration buildings (Figure 2.1), and is airside, so it is fully fenced with public access restrictions. There is a washdown facility for the aircraft at the loading site, and this also accommodates any spills which may occur as a result of loading the fire retardant. Any washdown is collected through an existing drainage system, which terminates in a recycle pit. Any liquid in this recycle pit is reused as retardant make-down water.

3.2 Management of Effluent for Use as a Fire Suppressant

This system is already closely controlled, as it is fully fenced with access restrictions and fully automated. The system is designed to minimise the risk of contact between the workers and the fire suppressant (in its concentrated or diluted form). The greatest risk of direct contact would be when the plane is being hooked up or disconnected from the fire suppressant feed line. The following precautions will also be taken at this site:

- Signs will be posted around the site indicating that reclaimed water is used for the fire suppressant. These signs will be consistent with those already used at the effluent irrigation areas at Cinnamon Ridge.

- Hand wash or sanitizer stations will be provided in the immediate area of the aircraft hook up.

- Signs will be posted in the hook up area notifying staff to wash hands before eating, drinking or smoking. This should be in accordance with standard practices, due to the nature of the chemicals used in the retardant.

3.3 Proposed Timescale

As the installation of the effluent main is planned for September/October 2009, use of effluent for fire suppression is not intended to be required until the 2010 fire season.

URBANSYSTEMS.

4. Summary

The intent is for effluent to be used for landscape irrigation and retardant make-down at the Provincial Fire Control Centre, located at Kamloops airport. Out of these two uses, the primary use is the retardant make-down, the volume of which will be contingent on the fire season. Measures are outlined above in order to protect public health and the environment. With these measures in place, there are no concerns that use of the effluent for landscape irrigation and fire suppression will present unacceptable risks.

U:\Projects_KAM\0368\0450\04\X-Single-File\2009-07-29 DOC effluent reuse at airport.doc

URBANSYSTEMS.

CITY OF KAMLOOPS EFFLUENT REVIEW - AIRPORT LANDS

DATE: JULY 2009

CITY OF KAMLOOPS

1:3,500

THE ACCURACY & COMPLETENESS OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED. IT WILL BE THE RESPONSIBILITY OF THE USER OF THE INFORMATION SHOWN ON THIS DRAWING TO LOCATE & ESTABLISH THE PRECISE LOCATION OF ALL EXISTING INFORMATION WHETHER SHOWN OR NOT

U:\Projects_KAM\0368\0450\04D-Drafting-Design-Analysis\GIS\Projects\FIG 2.1.mxd

FIGURE 2.1

KEY FEATURES

URBANSYSTEMS.

CITY OF KAMLOOPS EFFLUENT REVIEW - AIRPORT LANDS

DATE: JULY 2009

CITY OF KAMLOOPS

1:3,500

THE ACCURACY & COMPLETENESS OF INFORMATION SHOWN ON THIS DRAWING IS NOT GUARANTEED. IT WILL BE THE RESPONSIBILITY OF THE USER OF THE INFORMATION SHOWN ON THIS DRAWING TO LOCATE & ESTABLISH THE PRECISE LOCATION OF ALL EXISTING INFORMATION WHETHER SHOWN OR NOT.

U:\Projects_KAM\0368\0465\04\D-Drafting-Design-Analysis\GIS\Projects\FIG 2.2.mxd

FIGURE 2.2

IRRIGATION AREAS

APPENDIX F

City Council Endorsement

CITY OF KAMLOOPS

EXTRACT OF A RESOLUTION FROM THE MINUTES OF A REGULAR MEETING OF THE MUNICIPAL COUNCIL OF THE CITY OF KAMLOOPS, HELD IN THE COUNCIL CHAMBERS, CITY HALL, KAMLOOPS, BC

RESOLVED:

"That Council adopt the 2009 Liquid Waste Management Plan Review and authorize Administration to forward the plan to the Ministry of Environment for approval.

I HEREBY CERTIFY that this is a true copy of a resolution from the Minutes of a meeting of the Kamloops City Council held on the 26th day of January, 2010.

Dated at Kamloops, BC, this 2nd day of February, 2010.

L. W. Hrycan
Corporate Officer

PATH