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The Greater Vancouver Sewerage & Drainage District Quality Control Annual Report 2009

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INTRODUCTION

The Quality Control Division of the Operations and Maintenance Department is responsible for monitoring and reporting on influent, effluent, process and receiving water quality for the Greater Vancouver Sewerage and Drainage District (GVS&DD). The attached annual report summarizes the information gathered through the various GVS&DD monitoring programs (operational certificates, process and LWMP-related) carried out by the Division in 2009, and provides evaluation of the operational effectiveness of the wastewater treatment plants, review of effluent quality and receiving water quality. The report also provides assessments of effluent and receiving water quality as compared to applicable standards and discusses biosolids quality issues. Some of the information in the report is the result of joint efforts between the Quality Control Division and the Utility Analysis and Environmental Management Division of the Policy and Planning Department. The report will be posted on Metro Vancouver's website at the following location:

http://www.metrovancouver.org/services/wastewater/treatment/Pages/monitoring.aspx

EXECUTIVE SUMMARY

The Greater Vancouver Sewerage and Drainage District (GVS&DD) operates five wastewater treatment plants (WWTPs) in the region. Three of the five plants provide full secondary treatment (Annacis Island, Lulu Island and Northwest Langley) and discharge into the lower Fraser River. The remaining two wastewater treatment plants (Iona Island and Lions Gate) discharge to Georgia Strait and First Narrows respectively and provide primary treatment only.

Under the provisions of the Waste Management Act, the B.C. Ministry of the Environment issued operational certificates to the GVS&DD in 2004. These certificates allow the District to operate each of its wastewater treatment plants and to discharge treated effluent to the receiving waters. The District's objective is to maintain ongoing compliance with the operational certificates including compliance with sewage quality parameters and by doing so continue to protect the receiving environment.

Metro Vancouver is committed to the principle of managing liquid waste in a manner that enhances environmental quality. This commitment is outlined in Metro Vancouver's Liquid Waste Management Plan (LWMP). The LWMP process is mandated by the Province of British Columbia and designed to ensure an integrated and local approach to informed liquid waste management decisions is followed.

The purpose of this report is to document the performance of the WWTPs during the previous year in regards to effluent quality and in meeting the regulatory requirements as specified by the Ministry of Environment. Most of the laboratory analytical services and data analyses upon which this report is based were provided by the Quality Control Division of the Operations and Maintenance Department. Other programs and projects discussed in this report are in support of ongoing commitments under the LWMP.

Outlined below is an overview of the information collected as a result of Quality Control's monitoring programs for the wastewater treatment plants, including monitoring for effluent toxicity, biosolids, and receiving environment quality.

Wastewater Treatment Plants

Operational Certificates

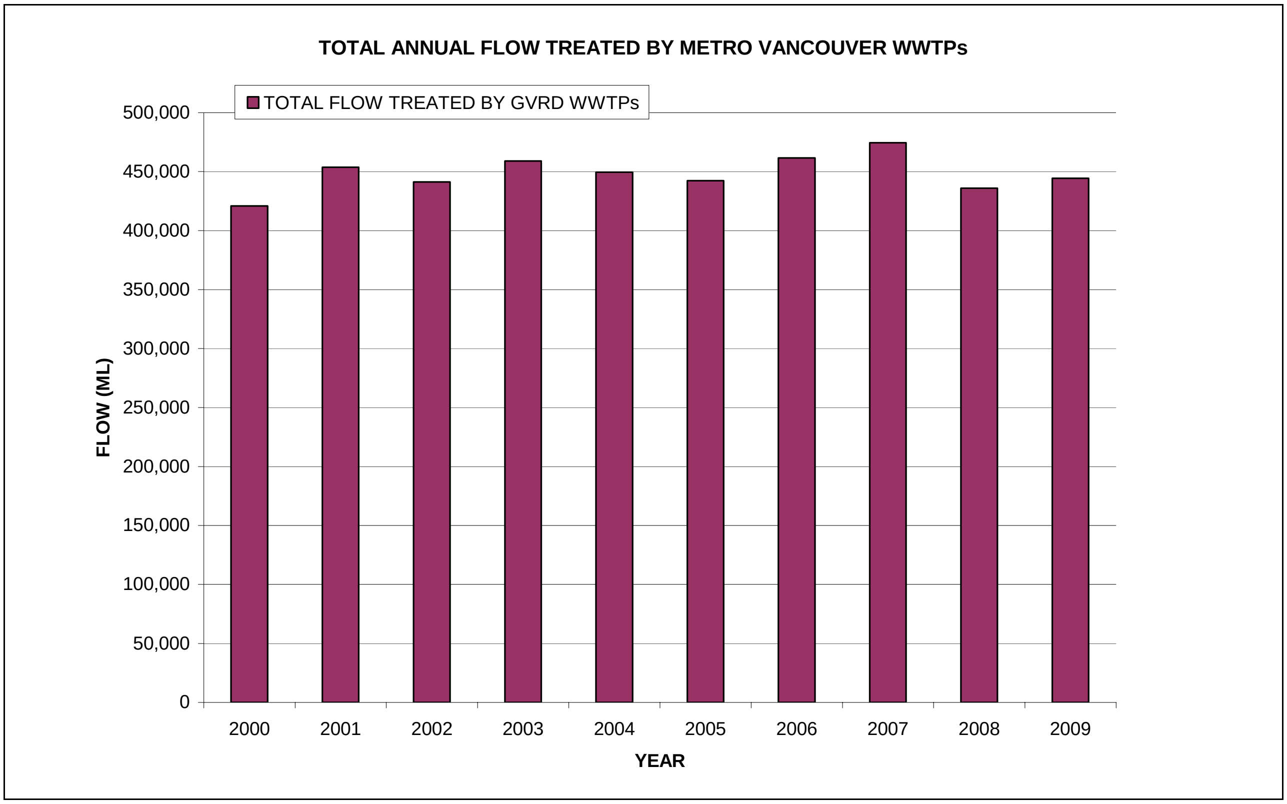
The Operational Certificates (OCs) issued April 23, 2004 by the Ministry of Environment under the provisions of the Waste Management Act include daily compliance levels for flow and daily loadings for BOD (Biochemical Oxygen Demand) or cBOD (carbonaceous Biochemical Oxygen Demand, where applicable) and suspended solids. The loadings parameters listed as "maximum daily loadings" are used to calculate the annual waste discharge fees as required by the Waste Management Waste Permit Fee regulation and are based on a calendar year.

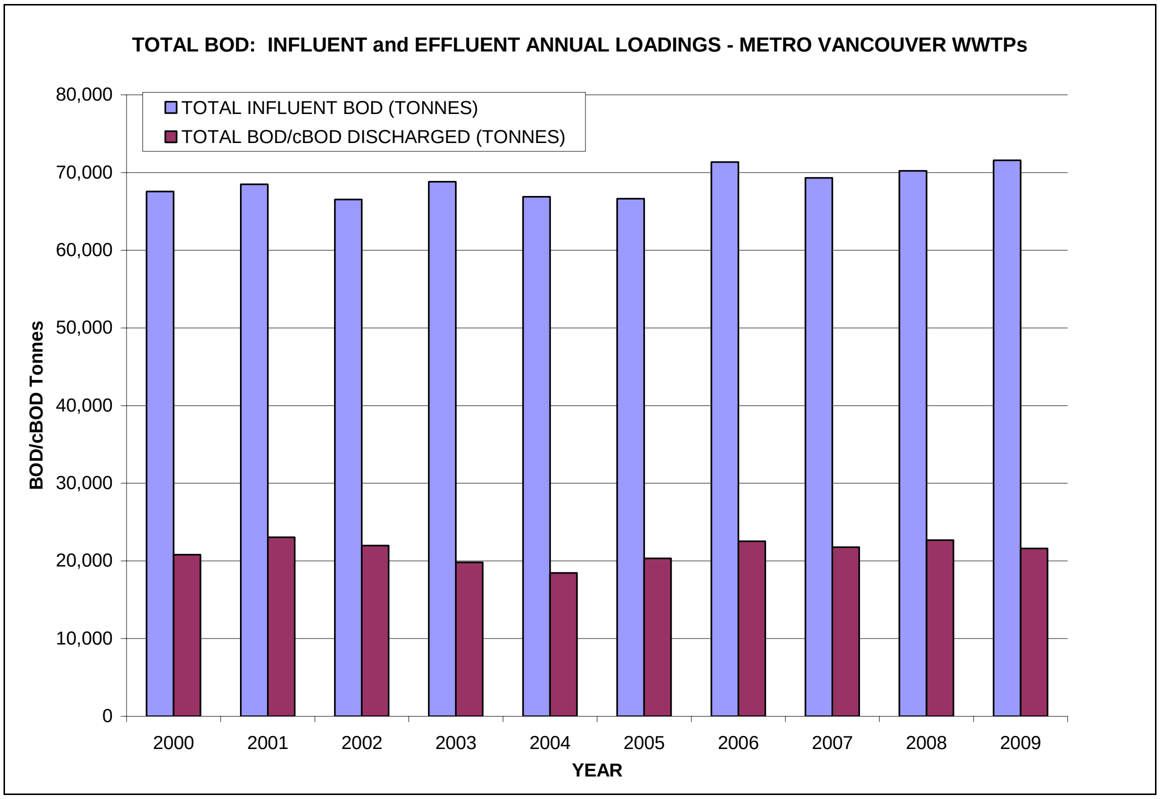
Additional requirements were listed for disinfection of the effluent at all WWTPs (except Iona Island) so that fecal coliform water quality objectives are not exceeded at the edge of the initial dilution zone as described in the Municipal Sewage Regulation. Where chlorine is used, it must be removed from the effluent before discharge to the receiving water.

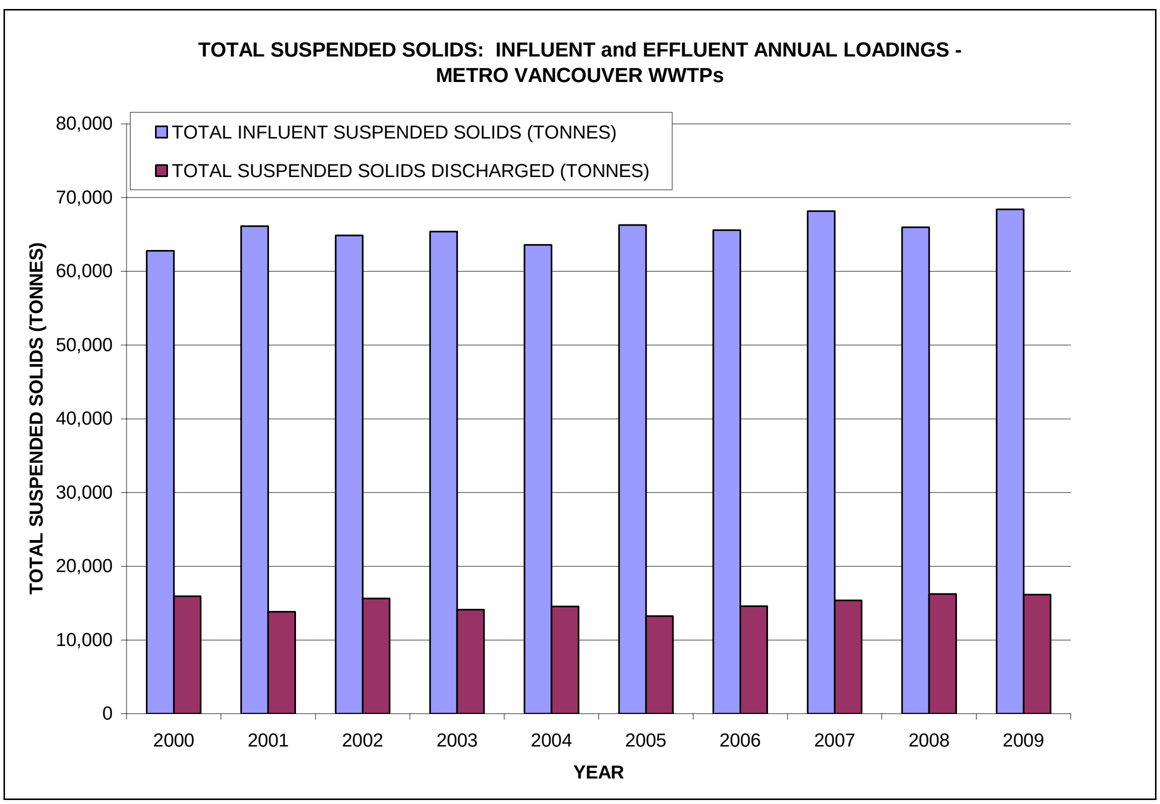
In 2009, over 444 billion litres of wastewater were treated at the GVS&DD's five wastewater treatment plants. Of this total, 234 billion litres received primary treatment (Iona Island and Lions Gate) with the remaining 210 billion litres treated at the three secondary wastewater plants (Annacis Island, Lulu Island and Northwest Langley). Individual treated effluent flows for each wastewater treatment plant and quantities of BOD and suspended solids removed in 2009 are summarized as follows:

Total for 2009	ANNACIS	IONA	LIONS GATE	LULU	NWL	TOTAL
Effluent Flow, ML	177,746	200,625	33,974	27,805	4,226	444,376
BOD, Tonnes Removed	30,924	9,022	1,842	6,919	1,249	49,956
Susp. Solids, Tonnes Removed	27,526	13,802	3,404	6,636	878	52,246

Total wastewater flows, and influent/effluent loadings for BOD and suspended solids over a ten year period are shown on the following charts.




TOTAL BOD: INFLUENT and EFFLUENT ANNUAL LOADINGS - METRO VANCOUVER WWTPs
TOTAL INFLUENT BOD (TONNES)
TOTAL BOD/cBOD DISCHARGED (TONNES)
BOD/cBOD Tonnes
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
YEAR


TOTAL SUSPENDED SOLIDS: INFLUENT and EFFLUENT ANNUAL LOADINGS -
METRO VANCOUVER WWTPs
TOTAL INFLUENT SUSPENDED SOLIDS (TONNES)
TOTAL SUSPENDED SOLIDS DISCHARGED (TONNES)
TOTAL SUSPENDED SOLIDS (TONNES)
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
YEAR

Treatment Plant Performance and Compliance Review

In general, the overall performance of the GVS&DD's five wastewater treatment plants (WWTPs) was good and operational objectives for removing BOD and total suspended solids were met throughout 2009 with a few exceptions. High flows at Iona plant contributed to slightly lower reductions of suspended solids. The following table summarizes the reduction in BOD and total suspended solids loadings during 2009 for all the plants.

Wastewater Treatment Plant	% BOD Reduction	% TSS Reduction
Iona Island *	**35**	**54**
Lions Gate*	**38**	**62**
Annacis Island **	**95**	**92**
Lulu Island **	**98**	**98**
Northwest Langley**	**96**	**91**

* Reduction for primary plants expected to be 30% for BOD and 60% for TSS.

** Reduction for Secondary Plants expected to be 90% for both TSS and BOD.

In 2009, GVS&DD's WWTPs met compliance requirements throughout the year with 18 exceptions.

Daily suspended solids loadings were exceeded once at Annacis WWTP, once at Lions Gate WWTP and three times at Northwest Langley WWTP. Daily BOD loading was exceeded once at Lions Gate WWTP. Non-compliance on the maximum daily discharge loadings was due to extremely high flows in January.

BOD concentrations were over the permitted limits once for Lions Gate WWTP in February and once for Iona Island WWTP in September. High effluent BOD concentrations were due to high influent organic loading.

There were three instances of effluent dechlorination failures, one at Northwest Langley WWTP on July 25 and two at Lions Gate WWTP on June 15 and August 10. Incidents at Lions Gate WWTP were primarily due to problems with the online chlorine analyzer and fluctuation in chlorine demand. The problem at Northwest Langley WWTP was due to equipment which failed to restart automatically after a complete power outage.

Four cases of disinfection failures occurred in 2009, one at Lulu Island WWTP on August 11 and three at Lions Gate WWTP on July 5, July 6 and September 3. These were primarily due to equipment failures.

There were two occasions on which untreated wastewater bypassed the Iona Island WWTP. Less than 1% of the plant flow was bypassed on March 30 due to equipment failure during an extreme flow event. About 10% of the plant flow was bypassed on December 20 due to power interruption.

There was a bypass of secondary treatment at Lulu Island WWTP on December 20 due to power failure. The suspended solids concentrations of the primary effluent samples collected during the bypass event were within the acceptable limit but the BOD results exceeded the 130 mg/L limit.

A summary of non-compliance with the parameters required by the Operational Certificates for the District's wastewater treatment plants is shown in the tables below.

Iona Island WWTP Operational Certificate ME 00023 - April 23, 2004

Parameter	2004	2005	2006	2007	2008	2009
Max. Daily Discharge (exceeded)	0	0	0	0	0	0
Biochemical Oxygen Demand (BOD)	0	0	1 (of 98)	0	0	1 (of 103)
Suspended Solids	0	0	0	0	0	0
BOD Daily Loading	0	0	0	0	1 (of 106)	0
Suspended Solids Daily Loading	0	0	0	2 (of 356)	1 (of 366)	0
Plant Bypass	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	2 (of 365)

Lions Gate WWTP Operational Certificate ME 00030 – April 23, 2004

Parameter	2004	2005	2006	2007	2008	2009
Max. Daily Discharge (exceeded)	0	0	0	0	0	0
Max. Flow Rate (exceeded)	0	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
Biochemical Oxygen Demand (BOD)	0	1 (of 101)	0	0	4 (of 106)	1 (of 103)
Suspended Solids	0	1 (of 361)	0	0	0	0
BOD Daily Loading	0	0	1 (of 101)	0	0	1 (of 103)
Suspended Solids Daily Loading	0	1 (of 361)	0	1 (of 363)	0	1 (of 365)
Chlorine Residual*	4 (of 180)	1 (of 166)	0	6 (of 157)	2 (of 170)	2 (of 156)
Disinfection Failure	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	3 (of 156)

* measured during disinfection season only - after dechlorination. The chlorine residual must be removed from the effluent before discharge.

Annacis Island WWTP Operational Certificate ME 00387 – April 23, 2004

Parameter	2004	2005	2006	2007	2008	2009
Max. Daily Discharge (exceeded)	0	0	0	0	0	0
Carbonaceous Biochemical Oxygen Demand (cBOD)	0	0	0	0	0	0
Suspended Solids	0	0	0	1 (of 364)	2 (of 360)	0
cBOD Daily Loading	0	0	0	0	1 (of 105)	0
Suspended Solids Daily Loading	0	1 (of 358)	5 (of 365)	7 (of 364)	3 (of 360)	1 (of 356)
Chlorine Residual*	0	0	0	1 (of 234)	0	0

* measured during disinfection season only - after dechlorination. The chlorine residual must be removed from the effluent before discharge.

Lulu Island WWTP Operational Certificate ME 00233– April 23, 2004

Parameter	2004	2005	2006	2007	2008	2009
Max. Daily Discharge (exceeded)	0	0	0	0	0	0
Carbonaceous Biochemical Oxygen Demand (cBOD)	0	0	0	0	0	0
Suspended Solids	0	0	0	0	0	0
cBOD Daily Loading	0	0	0	0	0	0
Suspended Solids Daily Loading	0	0	0	0	0	0
Chlorine Residual *	0	0	0	0	1 (of 222)	0
Disinfection Failure	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	1(of 221)
Primary Bypass						
Biochemical Oxygen Demand (BOD)	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	1 (of 1)
Suspended Solids	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	0

* measured during disinfection season only - after dechlorination. The chlorine residual must be removed from the effluent before discharge.

Northwest Langley WWTP Operational Certificate ME 04339– April 23, 2004

Parameter	2004	2005	2006	2007	2008	2009
Maximum Discharge Rate	0	0	0	0	0	0
Carbonaceous Biochemical Oxygen Demand (cBOD)	0	0	0	0	0	0
Suspended Solids	0	8 (of 360)	0	1 (of 365)	1 (of 366)	0
cBOD Daily Loading	*n/a*	0	0	0	0	0
Suspended Solids Daily Loading	*n/a*	10 (of 360)	3 (of 364)	2 (of 365)	1 (of 366)	3 (of 365)
Chlorine Residual *	0	0	0	0	1 (of 214)	1 (of 215)

* measured during disinfection season only - after dechlorination. The chlorine residual must be removed from the effluent before discharge.

Comparison with CEPA Requirements

CEPA Notices

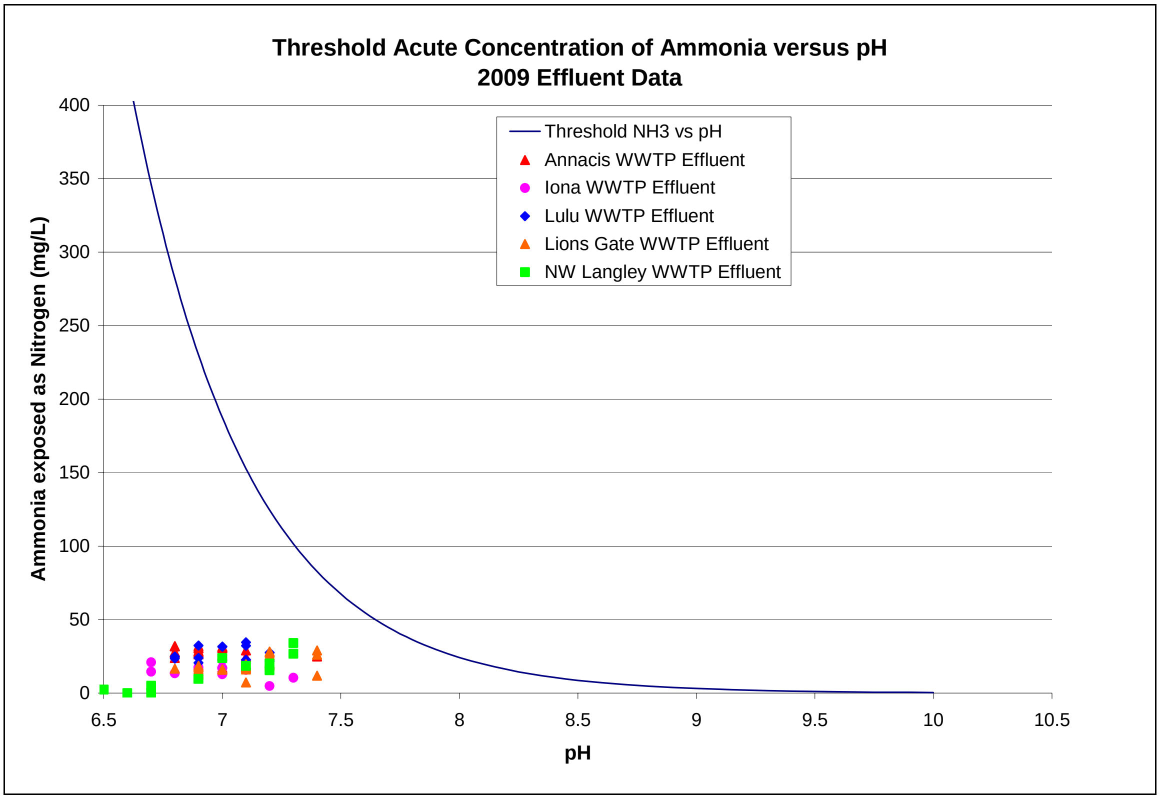
On December 4, 2004 Environment Canada published two notices in the Canada Gazette specific to the preparation of pollution prevention plans for chlorinated municipal effluents and a guideline for the release of ammonia dissolved in water. These notices were published as required in accordance with the Canadian Environmental Protection Act (CEPA).

Chlorinated Effluents

If the discharge is greater than 5,000 cubic metres per day and the total residual chlorine is greater than 0.02 mg/L it will be necessary to develop a formal pollution prevention plan in accordance with the notice. Pollution prevention plans for the GVS&DD wastewater treatment plants are not triggered by this notice because a de-chlorination chemical is utilized at all plants that use chlorine to disinfect the effluent. The de-chlorination process ensures, by maintaining an excess of de-chlorinating agent that there is no total residual chlorine present and, therefore, a pollution prevention plan is not required.

Ammonia

The guideline for ammonia[1] is based on acute and chronic considerations for ammonia. For acute end-of-pipe toxicity a threshold toxicity curve is provided. The pH of the water is a factor in the ammonia toxicity, and the curve takes this into account. Frequency of the GVS&DD monitoring programs (paired analyses for pH and ammonia) in final effluent was increased to a weekly basis at each wastewater treatment plant in early 2005 to meet the requirements of the guideline. Effluent quality data for 2009 for each of the five GVS&DD wastewater treatment plants was compared to the curve and the results are shown in the figure below. The guideline requirement, that the concentration of ammonia in the effluent should not be acutely toxic, was met at all five wastewater treatment plants in 2009 as shown in the following chart.



For chronic toxicity the guideline refers to the concentration of unionized ammonia in the aquatic environment, which should not exceed 0.019 mg/L. Previous studies conducted by the GVS&DD in the vicinity of the wastewater discharges in the Fraser River have shown that the water quality objective for unionized ammonia was met.

[1] Guideline for the release of ammonia dissolved in water found in wastewater effluents. Canada Gazette, Part 1. December 4, 2004. Appendix A - Acute Ammonia Toxicity.

Effluent Toxicity Monitoring

Operational Certificates for the GVS&DD wastewater treatment include the following requirements for monitoring effluent toxicity:

> *If the monthly bioassay test fails, the operational certificate holder will conduct a Toxicity Identification Evaluation (TIE) study for the purpose of determining the probable cause of the failure. The results of the failed monthly test and TIE study will be submitted to the Regional Waste Manager by the end of the month following the month that the bioassay test occurred.*

Environment Canada's standard reference method[2] for determining acute lethality of effluents to Rainbow trout exposes test fish to a series of effluent dilutions, and determines the fish survival rate at the end of a 96-h exposure period. The final result is reported as the 96-h LC_{50} value, which is the % by volume (of the original sample) at which 50% of the test fish survive. A "pass" or non-toxic result for all sewage effluents requires that the LC_{50} value must be *equal to* or *greater than* 100% (v/v sample). This means that 50% or more of the test fish must survive for 96 hours in the original undiluted sample.

In 2008, Environment Canada published an add-on test procedure[3] for pH stabilization during the testing of acute lethality. The add-on procedure is applicable only to wastewater effluents. The purpose of pH stabilization is to replace the carbon dioxide lost due to aeration in order to maintain the pH throughout the test at the same levels observed at the start of the test. This add-on procedure recognizes that toxicity observed in municipal wastewater effluents may be an artifact of the standard reference method.

The add-on procedure can be used only when the standard reference method gives a false result due to pH shift during the test. Consequently a second test is run concurrently with the standard reference method. The second test utilizes the reference method with the add-on pH stabilization procedure. Other tests are also run in conjunction with the standard reference method to determine the probable causes of toxicity whenever results are less than 100%.

Toxicity Results and Evaluations

Outlined below is a summary of effluent toxicity results and evaluations for 2009.

Secondary Treatment Plants (Annacis Island, Lulu Island and NW Langley)

All effluent samples from the Annacis Island, Lulu Island and NW Langley wastewater treatment plants passed the required monthly toxicity test using Environment Canada's standard reference method (18 cases) or the reference method with the add-on pH stabilization procedure (18 cases). Effluent ammonia concentrations were below the Environment Canada guideline curve for threshold acute toxicity.

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[2] Environment Canada. 2000. Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout. Method Development and Applications Section, Environment Canada. Ottawa ON. Report EPS 1/RM/13, Second Edition – December 2000.

[3] Environment Canada, Report EPS 1/RM/50 – March 2008, p. 10.

Primary Treatment Plants (Iona Island and Lions Gate)
All but four effluent samples from the Iona Plant passed the required monthly toxicity test using Environment Canada's standard reference method (8 cases). In order for the exception samples (4 cases) to pass, more oxygen had to be added to these samples than is allowed by the technical specifications of the reference method. However, studies and ongoing monitoring carried out by the GVS&DD have shown that the high initial dilution of the Iona effluent in the marine environment will maintain dissolved oxygen at an acceptable concentration for the protection of aquatic life.

For the Lions Gate Plant, all effluent samples passed the required monthly toxicity test using Environment Canada's standard reference method (10 cases) or the reference method with the add-on pH stabilization procedure (2 cases). As in the previous year, there were no occurrences of effluent toxicity related to surfactants (constituents of detergents and cleansing agents) at the Lions Gate Plant. This would suggest that the public education campaign to encourage North Shore residents to use less detergent has been effective in reducing the level of surfactants entering the Plant, and/or detergent and cleansing formulations are becoming more environmentally friendly.

Additionally, effluent ammonia concentrations for both the Iona and Lions Gate Plants were below the Environment Canada guideline curve for threshold acute toxicity.

Biosolids Monitoring Program

Process Requirements and Quality Assurance/Quality Control Procedures
The Organic Matter Recycling Regulation (OMRR) governs the management of biosolids and compost as soil amendments in the Province of British Columbia. Under this regulation, sampling frequencies and criteria values for fecal coliforms and metals as specified for Class A and Class B biosolids are based on several parameters including: type of treatment process (pathogen reduction requirements, vector attraction reduction), the amount of dry solids produced on a monthly basis and the intended use of the material. The GVS&DD's monitoring program and contingency procedures ensure that any sub-class biosolids are identified, tracked and managed appropriately.

Thermophilic digesters at the Annacis Island WWTP consistently meet requirements for pathogen reduction and vector attraction reduction to produce a Class A quality biosolids suitable for recycling to land. The Lulu Island WWTP digesters are operated at mesophilic temperatures, producing Class B biosolids, also suitable for recycling to land. The Lions Gate WWTP provides thermophilic digestion achieving Class B biosolids quality.

The Iona Island WWTP operates mesophilic digesters which produce digested sludge complying with Class B pathogen levels. The Northwest Langley WWTP operates aerobic digesters that provide Class B biosolids. At both the Iona Island and Northwest Langley WWTPs, discharges from the digesters are further processed via lagoon stabilization and land-drying to produce a Class B biosolids product with soil-like consistency. These biosolids are currently stockpiled on site with anticipated use in future recycling projects.

Biosolids Quality
In 2009, the results of the testing programs, (grab samples for fecal coliform analyses and weekly composite samples for metals), showed that metals concentrations for biosolids were generally well below the criteria value limits specified by OMRR.

Data values produced during 2009 for fecal Coliforms in biosolids were within the Class A or Class B criteria except for two instances. Samples collected at Annacis Island WWTP on August 4 and August 8 had fecal coliform results of 1,700 MPN/g and 1,800 MPN/g respectively. Digestion and dewatering systems were operating normally on both days. Subsequent samples from the same centrifuge unit and upstream samples prior to the dewatering system were collected and results were lower than the Class A limit of 1,000 MPN/g. It was concluded that the August 4th and 8th samples were an anomaly and contamination was the likely source of the unusually high fecal coliform results for those samples.

Receiving Environment Monitoring

A key component of Metro Vancouver's Liquid Waste Management Plan involves monitoring, assessment and forecasting to evaluate the environmental effects of its liquid waste discharges including wastewater treatment plant effluents, combined sewer overflows and stormwater. This monitoring information is vital in providing information to effectively manage liquid waste in a manner that enhances environmental quality.

Monitoring for receiving environment quality in 2009 indicated the following:

- With one exception, the bacteriological quality for primary-contact recreation was met for all bathing (swimming) beaches in Metro Vancouver during the bathing beach season from May through September. The sole exception was White Pine Beach on Sasamat Lake, which was posted for a few days in July of 2009 due to elevated levels of fecal coliform bacteria. Non-bathing beach areas, including all of False Creek, easily met the working guideline for secondary-contact recreation.

- There were eight isolated incidents due to sewage spills and treatment plant upsets which required extra sampling and posting at some of the recreational-water areas in the summer of 2009. Four incidents, involving the release of non-disinfected effluent from wastewater treatment plants, were due to disinfection-system equipment failures: 3 times at Lions Gate and one time at Lulu. As well, there were a total of four incidents involving the sewage collection system: a power failure at Brockton Point and another one at Westridge Pump Station, a circuit board failure at Harbour Pump Station, and a pipe failure involving the Gleneagles forcemain.

- No exceedances of the Fraser River water quality objectives were attributable to wastewater treatment plants.

- Monitoring of the marine receiving environment around the two primary wastewater treatment plant outfalls indicated some potential changes. The significance of these small and erratic changes is uncertain. Continued monitoring of the two outfall areas is needed in order to investigate whether these subtle changes and their potential causes are outfall related, or are due to regional long-term fluctuations in oceanographic conditions, or a combination of these or other factors.

1.0 WASTEWATER TREATMENT MONITORING PROGRAM

1.1 Laboratory programs

In 2009, the Quality Control Division carried out all routine monitoring programs as required by the Ministry of Environment (MOE) relating to the discharge of primary and secondary treated effluent from the Greater Vancouver Sewerage and Drainage District's wastewater treatment plants. As specified in the Operational Certificates issued by MOE in April, 2004 for each treatment plant, the GVS&DD is required to monitor and report data for effluent quality, treated sludge, groundwater and receiving waters. Quality Control laboratory staff also conducted analyses of influent wastewater and sludge stabilization processes at each wastewater treatment plant, provided analytical services for the Residuals Management and Liquid Waste (Source Control) areas and maintained a high level of laboratory and technical support for special projects at all wastewater treatment plants.

The total number of analyses completed by the various laboratory sections for all GVS&DD programs was approximately 145,855 in 2009.

Monitoring programs carried out in 2009 provided a comprehensive set of influent and effluent characteristics for each wastewater treatment plant and included all the monitoring requirements specified in the Wastewater Treatment Plant Operational Certificates. The full set of parameters for influent/effluent programs are presented on Table 1 following. Parameters indicated with a **"C"** are the specific compliance parameters listed in the operational certificate for each treatment plant whereas parameters indicated with a **"M"** are required only for reporting effluent characteristics. Parameters designated "R" are monitored on a routine basis for wastewater characterization.

A review of activities for each Wastewater laboratory, Chemistry laboratory and Bacteriology laboratory is provided in Section 9 (Levels of Activity). Additional information and presentation of selected data for key wastewater treatment parameters and monthly comprehensive data for 2009 are shown in the Appendices (A1 to A5).

Raw data and summaries used to provide the information in this report were prepared on Excel workbooks and are available to all Metro Vancouver staff only on an internal network server.

The workbooks contain the routine data (produced by each WWTP lab) and the monthly data provided by the Chemistry laboratory (Monthly Comprehensive program) for the current year and for previous years. For 2009, the archive contains current data and previous years' data summaries for the Biosolids Monitoring program. Data for the 2009 programs is updated on a monthly basis.

1.2 Monthly Reporting for Operational Certificates

In accordance with the Operational Certificates, all routine data reports for each wastewater treatment plant are posted on Metro Vancouver's website and updated on a monthly basis at the following location:
http://www.metrovancouver.org/services/wastewater/treatment/Pages/monitoring.aspx

Table 1-1: Wastewater Treatment Plant Monitoring Parameters – Influent and Effluent
2009 Routine Sampling and Operational Certificates (April 23, 2004) requirements

Operating Certifcate - April 23, 2004

Parameter	Test Lab Location	Sample Type	Frequency	ANNACIS ME-00387	IONA ME-00023	LIONS GATE ME-00030	LULU ME-00233	NW Langley ME-04339
TKN	Chemistry	Composite	1/mo	R	R	R	R	R
NO3/N02 N	" "	Grab	1/mo	R	R	R	R	R
Total Ammonia N***	" "	Grab	1/wk	M(1/wk)	M(2/mo)	M(2/mo)	M(1/wk)	M(1/mo)
M.B.A.S.	" "	Grab	1/mo	R	R	R	R	R
SO4	" "	Composite	1/mo	R	R	R	M	M
Alkalinity	" "	Composite	1/mo	R	R	R	R	R
Hardness (Total)	" "	Composite	1/mo	M	M	M	M	M
Tot. Phosphorous	" "	Composite	1/mo	R	R	R	R	R
Diss. Phosphorous	" "	Composite	1/mo	R	R	R	R	R
LC50 (effluent)	Consultants	Grab	1/mo	M(1/mo)	M(1/mo)	M(1/mo)	M(1/mo)	M(1/mo)
Oil & Grease	Chemistry	Grab	1/mo	R	R	R	R	R
Phenol	" "	Grab	1/mo	M	M	R	M	M
Tot. CN	" "	Grab	1/mo	R	R	R	R	R
Tot. Al	" "	Composite	1/mo	M	M	M	M	M
Tot. As	" "	Composite	1/mo	M	M	M	R	M
Tot. Ba	" "	Composite	1/mo	M	M	M	M	M
Tot. B	" "	Composite	1/mo	M	M	M	M	M
Tot. Cd	" "	Composite	1/mo	M	M	M	M	R
Tot. Co	" "	Composite	1/mo	M	R	R	R	M
Tot. Cr	" "	Composite	1/mo	R	R	R	R	R
Tot. Cu	" "	Composite	1/mo	M	M	M	M	M
Tot. Fe	" "	Composite	1/mo	M	M	M	M	M
Tot. Pb	" "	Composite	1/mo	M	M	M	M	M
Tot. Mn	" "	Composite	1/mo	M	M	R	M	M
Tot. Hg	" "	Composite	1/mo	M	M	R	M	M
Tot. Mo	" "	Composite	1/mo	M	M	M	M	M
Tot. Ni	" "	Composite	1/mo	M	M	M	M	M
Tot. Se	" "	Composite	1/mo	M	M	M	R	R
Tot. Ag	" "	Composite	1/mo	M	M	M	M	M
Tot. Sn	" "	Composite	1/mo	R	R	R	R	R
Tot. Zn	" "	Composite	1/mo	M	R	M	M	M
Diss. Al	" "	Composite	1/mo	R	R	R	R	R
Diss. Ba	" "	Composite	1/mo	R	R	R	R	R
Diss. B	" "	Composite	1/mo	R	R	R	R	R
Diss. Cd	" "	Composite	1/mo	R	R	R	R	R
Diss. Co	" "	Composite	1/mo	R	R	R	R	R
Diss. Cr	" "	Composite	1/mo	R	R	R	R	R
Diss. Cu	" "	Composite	1/mo	R	R	R	R	R
Diss. Fe	" "	Composite	1/mo	R	R	R	R	R
Diss. Pb	" "	Composite	1/mo	R	R	R	R	R
Diss. Mn	" "	Composite	1/mo	R	R	R	R	R
Diss. Mo	" "	Composite	1/mo	R	R	R	R	R
Diss. Ni	" "	Composite	1/mo	R	R	R	R	R
Diss. Se	" "	Composite	1/mo	R	R	R	R	R
Diss. Ag	" "	Composite	1/mo	R	R	R	R	R
Diss. Sn	" "	Composite	1/mo	R	R	R	R	R
Diss. Zn	" "	Composite	1/mo	R	R	R	R	R
pH	WWTP	Grab	1 to 5/wk	M	M	M	M	M
BOD**	" "	Composite	2 to 3/wk	**-**	**C****	**C****	**-**	**-**
cBOD**	" "	Composite	2 to 3/wk	**C****	-	-	**C****	**C(1/wk)**
Susp. Solids	" "	Composite	Daily	**C(5/wk)**	**C(5/wk)**	**C(5/wk)**	**C(5/wk)**	**C(1/wk)**
Vol. Susp. Solids	" "	Composite	Daily	R	R	R	R	R
COD**	" "	Composite	5 d/wk	M**	M**	M**	M**	-
Conductivity	" "	Composite	5/wk to Daily	R	R	R	R	-
Chloride	" "	Composite	1/wk	R	R	R	R	-
Res. Chlorine*	" "	Grab	Daily	**C**	-	**C**	**C**	**C**
Dissolved Oxygen	" "	Grab	1/mo to 5/wk	R	R	R	R	R
Temperature	" "	Grab	1/mo to 5/wk	M	M	M	M	M
Fecal Coliform (eff.)*	Bacti	Grab	1 to 3/wk	M(1/wk)	-	M(1/wk)	M(1/wk)	M(1/mo)

Composite sample are 24 hrs

* During chlorination periods only.

**** (COD is reported five times per week with BOD once per week as allowed under the new OC reporting requirements.)**

*** Ammonia and pH are done on weekly grabs for all WWTP for CEPA monitoring.

C= Compliance parameter

M = Operational Certificate Monitoring (Effluent)

R = Routine Monitoring, Influent and Effluent

( )= Operational Certificate Reporting Requirements

2.0 QUALITY ASSURANCE/QUALITY CONTROL

The mission of the Metro Vancouver Quality Control Laboratory is to provide the highest quality of analytical services to Metro Vancouver and its member municipalities. Analytical services include environmental testing on water, wastewater, receiving water, process control, air and solid waste samples.

To fulfill this commitment, the Metro Vancouver Quality Control Laboratory is accredited by the Canadian Association for Laboratory Accreditation (CALA) for its chemical and microbiological testing programs, and the Microbiological laboratory section is also approved by the Provincial Health Officer for performing microbiological tests. The International Standard against which the Metro Vancouver Quality Control Laboratory is accredited is ISO/IEC 17025:2005. Accreditation under ISO/IEC 17025 is a demonstration of confidence in the laboratory's technical competence. Accreditation provides formal recognition of the competence of a laboratory to manage and perform specific tests. Furthermore, the accreditation program is based on satisfactory participation in a site assessment plus satisfactory compliance with the CALA Proficiency Testing Requirements for accreditation.

The Main Chemistry laboratory section is located at the Annacis Island WWTP and the Microbiology laboratory section is located at the Lake City Operations Centre. The process control analyses and a portion of the permit testing work for the Wastewater Treatment Plants are carried out in laboratory facility located at each Wastewater Treatment Plant.

In 2009, over 353,000 analyses were performed by the Metro Vancouver Laboratory sections. This number of analysis encompasses all analytical programs of the Metro Vancouver Laboratory. Additionally, more than 47,000 determinations were conducted on quality control samples. These analyses were part of an on-going QA/QC program carried out by all laboratory sections. The quality control samples represented an additional 13 % of the routine laboratory work and accounted for about 12 % of the overall analytical workload.

The analysis of quality control samples were related to the following parameters: Alkalinity Total, Ammonia, Biochemical Oxygen Demand, Carbon Total Organic, Chemical Oxygen Demand, Chlorate, Chloride, Chlorine, Conductivity, Cyanide, Dissolved Oxygen, Fluoride, HPC, Kjeldahl Nitrogen Total, MBAS, Nitrate, Nitrite, Oil and Grease, Phenols, Phosphorus Dissolved Reactive, Phosphorus Total, pH, Residue Total, Residue Total Volatile, Sulfate, Suspended Solids Total, Suspended Solids Volatile, THM, Total and Fecal Coliforms, Turbidity, UV Absorbance and Metals.

Periodically, the QA/QC Coordinator collects available quality control data and assesses the effectiveness of the established quality control program. In the year 2009, QA/QC audit reports were prepared and issued on a tri-annual basis by the QA/QC Coordinator and distributed to laboratory senior staff and superintendents. Copies of these reports are available upon request to the QA/QC Coordinator.

During the year 2009, the Metro Vancouver Laboratory participated in the following inter-laboratory analytical performance/certification programs:

- The BC EDQA (British Columbia Environmental Data Quality Assurance) Program. Metro Vancouver laboratory has been participating in this program since May 1991. The program has been administered by CALA (formerly CAEAL) since January 1999.

- CALA (Canadian Association for Laboratory Accreditation). This program grants accreditation to laboratories that successfully meet the requirements of the international standards ISO 17025, and successfully pass analyses of proficiency testing (performance evaluation) samples and site inspections.

The Metro Vancouver Laboratory (Microbiology, Chemistry and WWTP sections) participated in four rounds of CALA performance evaluation in 2009. Results from the proficiency testing samples are used to evaluate the laboratory performance by a quantitative method based on the International Harmonized Protocol for Proficiency Testing of (chemical) Analytical Laboratories. CALA Proficiency Testing (PT) Program meets the requirements of ILAC:G13 and accredited to ISO/IEC Guide 43. These are international standards that outline the specific requirements for the accreditation of Proficiency Testing providers. Each PT sample is assigned a value which is usually calculated as the mean (consensus) value from all participating laboratories with outliers removed. PT participation is a powerful quality assurance tool for monitoring laboratory performance and comparing their results to peer laboratories. Laboratory proficiency recognition is granted after a successful PT study and is required for laboratory accreditation to ISO/IEC 17025. This signifies that the laboratory is recognized as a competent laboratory which generates precise and accurate data. For the year 2009, Metro Vancouver laboratory performed 400 analyses on PT samples which included 45 parameters. Satisfactory qualification was achieved by 100% of the PT results.

In order to maintain laboratory accreditation, Metro Vancouver Laboratory is required to undergo a site reassessment every two years where conformance to the standard ISO/IEC 17025 (General Requirements for the Competence of Testing and Calibration Laboratories) is assessed. An assessment based on ISO/IEC 17025 covers the overall quality system of the laboratory and assesses the technical competence of the laboratory to conduct specific tests. In the week of September 28, 2009, CALA conducted the bi-annual site assessment at all Metro Vancouver laboratory sections. Following the successful site audit, the CALA Accreditation Council approved maintenance of accreditation of the Metro Vancouver Laboratory. Information relating to the CALA accreditation and registration program, directory of participating laboratories, etc., may be accessed through the CALA website at: http://www.cala.ca/

In 1994, the Ministry of Health introduced a new BC Legislation (Drinking Water Protection Act and Regulation) which requires all public and private laboratories that perform microbiological analysis on drinking water for regulatory purposes must be approved by the BC Provincial Health Officer (PHO). In compliance with the new legislation, the Metro Vancouver Microbiology Laboratory Section received a certificate of approval from the Provincial Health Officer to perform microbiological testing on potable water. An on-going requirement of this approval is to enroll and provide evidence of satisfactory performance in the Clinical Microbiology Proficiency Testing (CMPT) program or its equivalent, and pass an on-site inspection. The Microbiology Laboratory section has been successfully participating in this program since 1994. EWQA (Enhanced Water Quality Assurance) acts on behalf of the PHO by conducting on-site laboratory inspections and also makes recommendations regarding certification. EWQA conducted a site inspection of the Metro Vancouver Microbiology Laboratory section at the Lake City Operation Centre (LCOC) in December, 2009. Following the successful EWQA audit, the Metro Vancouver Microbiological laboratory section received the PHO Approval Certificate.

3.0 ANNACIS ISLAND WWTP

3.0 ANNACIS ISLAND WWTP 2009 ANNUAL SUMMARY

3.1 Effluent Quality

The quality of effluent from the Annacis Island WWTP in 2009 is summarized in the following table, along with compliance with parameters listed in the Operational Certificates.

Table 3-1: Annacis Island WWTP – 2009 Compliance Summary

Operational Certificate Requirement - ME00387, April 23, 2004.

				No. of times Criteria Exceeded												
Compliance Parameters	**Frequency**	**OC Limits**	**Max. Value for the Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Yr to Date**
Total Flow (MLD)	Daily	1050	944	0	0	0	0	0	0	0	0	0	0	0	0	0
cBOD (mg/L)*	3/week	45.0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	5/week	45.0	26	0	0	0	0	0	0	0	0	0	0	0	0	0
cBOD (Tonnes/Day)*	3/week	17.0	9.8	0	0	0	0	0	0	0	0	0	0	0	0	0
Susp. Solids (tonnes/Day)	5/week	20.0	20.9	1	0	0	0	0	0	0	0	0	0	0	0	1 of 356
Chlorine Residual (mg/L)	Daily	<0.1	<0.1	0	0	0	0	0	0	0	0	0	0	0	0	0

* cBOD reported 1/week when COD are reported 5/week

Monitoring Parameters	**OC Frequency**	**Sample Type**	**Year 2009 Maximum**	**Minimum**	**Average**
pH**	1/month	Grab	7.4	6.8	7.1
Toxicity, 96-hour LC_{50} (%V/V)	1/month	Grab	>100	59	>83
Ammonia (mg/L)**	1/week	Grab	34.1	16.5	27.5
Hardness (mg/L CaCO3)	1/month	Comp	74.4	38.2	47.8
COD (mg/L)*	5/week	Comp	106	49	77
Conductivity (umhos/cm)	-	Grab	988	364	571
Temperature ^oC	1/month	Grab	22	10	17
Fecal Coliform MPN	1/Week	Grab	1100	<20	30***
Residual Chlorine (mg/L)	Daily	Grab	<0.1	<0.1	<0.1
Oil and Grease (mg/L)	-	Grab	<7	<5	<6
Phenol (mg/L)	1/month	Grab	0.010	<0.01	<0.01
Aluminum, Total (mg/L)	1/month	Comp	0.19	0.10	0.13
Arsenic, Total (mg/L)	1/month	Comp	0.002	<0.001	<0.002
Barium, Total (mg/L)	1/month	Comp	0.023	0.005	0.009
Boron, Total (mg/L)	1/month	Comp	0.23	0.15	0.18
Cadmium, Total (mg/L)	1/month	Comp	<0.0005	<0.0005	<0.0005
Chromium, Total (mg/L)	-	Comp	0.010	<0.001	<0.003
Cobalt, Total (mg/L)	1/month	Comp	<0.001	<0.001	<0.001
Copper , Total (mg/L)	1/month	Comp	0.104	0.027	0.042
Iron, Total (mg/L)	1/month	Comp	0.85	0.38	0.60
Lead, Total (mg/L)	1/month	Comp	0.002	<0.001	<0.002
Manganese, Total (mg/L)	1/month	Comp	0.09	0.05	0.06
Mercury, Total (µg/L)	1/month	Comp	0.05	<0.05	<0.05
Molybdenum, Total (mg/L)	1/month	Comp	0.003	<0.002	<0.003
Nickel, Total (mg/L)	1/month	Comp	0.003	0.002	0.003
Selenium, Total (mg/L)	1/month	Comp	<0.01	<0.01	<0.01
Silver, Total (mg/L)	1/month	Comp	<0.001	<0.001	<0.001
Zinc, Total (mg/L)	1/month	Comp	0.043	0.027	0.037

** Minimum, Maximum and average values are calculated from all available weekly grab data.

*** Fecal Coliform results are monthly geomean values and are only done during the disinfection period under the new Operational Certificate.

Note 1. Toxicity requirements, April 23, 2004 Operational Certificate: If a fish bioassay toxicity test fails to meet or exceed a LC50 value of 100%, the permittee is required to conduct a Toxicity Identification Evaluation (TIE) study for the purpose of determining the probable cause of the failure.

Note 2: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.

3.2 Compliance Review (ME-00387) and Performance Summary

The Annacis Island effluent permit (June 28, 1999) was replaced with Operational Certificate ME-00387, issued April 23, 2004 by the Ministry of Environment under the provisions of the Waste Management Act. The new operational certificate included revised compliance levels for carbonaceous BOD (cBOD) and suspended solids loadings. The loadings parameters listed as "maximum daily loadings" are used to calculate the annual waste discharge fees as required by the Waste Management Waste Permit Fee regulation and are based on a calendar year.

Previous Permit Levels	cBOD (tonnes/day)	Susp. Solids (tonnes/day)
On and from March 3, 2003*	30.624	30.624
On and from March 3, 2004	31.696	31.696
Operational Certificate Levels		
2004 (effective April 23, 2004)	14.0	17.0
2005	15.0	18.0
2006	16.0	19.0
2007 and thereafter	17.0	20.0

* Beginning May 01, 2003, carbonaceous BOD replaced total BOD in reporting final effluent BOD concentrations and no further analyses for Total BOD in final effluent were conducted at the secondary treatment plants.

Discharge Monitoring

A total of 28 parameters and the two daily loadings for final effluent are posted on Metro Vancouver's website on a monthly basis, however, specific compliance levels apply to only six parameters: Total daily discharge flow, cBOD, suspended solids, chlorine residual and maximum daily loadings for cBOD and suspended solids.

3.2.1 Compliance Review

Annacis Island Wastewater Treatment Plant had one instance of non-compliance in 2009. During a period of exceptionally high flow, the limit for suspended solids loading was exceeded in January 06. The 2009 level of compliance for these parameters are shown in Table 3.1.

Effluent bypasses:

Wastewater flows exceeding the capacity of the secondary treatment works may bypass those works when flows are greater than two times measured dry weather flow, providing that primary effluent standards are maintained for the effluent not receiving secondary treatment.

There was no reported bypassing of the secondary treatment process in 2009.

Parameter	Compliance level	Non -compliance
5-day biochemical oxygen demand (BOD5)	130 mg/L	0
Total suspended solids (TSS)	130 mg/L	0

Disinfection

The effluent is disinfected using chorine between April 1 and October 31 so that the Fraser River fecal coliform water quality objective is not exceeded at the edge of the initial dilution zone as described in the Municipal Sewage regulation.

As required by the Operational Certificate, effluent was disinfected between April 1 and October 31. The plant continued to use chlorine gas for disinfection and SO_2 gas for dechlorination prior to discharge to the Fraser River. The average chlorine dosage was 3.2 mg/L and the average SO_2 dosage was 2.5 mg/L. Starting May 22, samples for residual chlorine, residual SO_2 and fecal coliform were collected before the level control gates at the end of the chlorine contact tanks.

The Fraser River fecal coliform Water Quality Objective (WQO) at the edge of the initial dilution zone (IDZ) of 200 MPN/100 mL was met.

Table 3-2: 30 day Fecal Coliform Geomean at the Annacis Island WWTP IDZ

Final Effluent	April	May	June	July	August	September	October
Max 30 day Gmean*	-	50	50	29	39	41	34
Dil Factor**	-	40	40	40	40	40	40
IDZ Result ***	-	1.3	1.3	0.7	1.0	1.0	0.9
WQO (pass or fail)	-	Pass	Pass	Pass	Pass	Pass	Pass

* Gmean (MPN/100ml) over 30 day period.

** Dil Factor - minimum dilution factor for initial dilution zone at the Annacis outfall.

*** IDZ Result - determined by calculation of Geometric Mean of fecal coliforms levels in the receiving water due to discharges of final effluent, for 30 day periods at the edge of the initial dilution zone (IDZ). Measured only during disinfection season (April 1-October 31).

3.2.2 Performance Summary

Annacis Island WWTP treated an average effluent daily flow of 487 MLD in 2009 which was 2.6% higher than in 2008. The highest daily flow of 944 MLD was recorded in January 7 and the peak flow rate was 12.2 m^3/sec (1055 MLD) noted in January 6.

Influent SS concentrations were between 71 to 270 mg/L with an average of 174 mg/L. Influent BOD concentrations were between 87 to 252 mg/L with an average of 190 mg/L. Influent SS loading of 30,041 tonnes/year was 3.9% higher than 2008 and influent BOD loading of 32,611 tonnes/year was 2.8% higher than 2008.

The plant continued to produce acceptable effluent quality in 2009. Suspended solids concentrations were within the range of 6 to 26 mg/L with an average value of 14 mg/L. Carbonaceous BOD (cBOD) results were within the range of 5 to 16 mg/L with an average value of 9 mg/L. Effluent SS loading of 2,514 tonnes/year was 9.4 % lower than 2008 and effluent cBOD loading of 1,687 tonnes/year was 0.7% lower than 2008.

The average reduction of suspended solids was 92% and average reduction of BOD was 95 %.

Table 3-3: 2000-2009 Annual Average Data for Flow, Suspended Solids and BOD

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD mg/L	cBOD mg/L	BOD Tonnes/year	cBOD Tonnes/year
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2000	439	169	9	26884	1517	200	7	31348	1089
2001	455	164	10	26853	1606	180	7	29496	1130
2002	460	169	11	27932	1890	186	7	30532	1256
2003	485	164	12	28534	2112	184	8	31736	1442
2004	497	161	11	28697	2078	180	7	32072	1373
2005	483	167	10	28803	1777	175	7	29945	1238
2006	497	159	12	28090	2200	179	9	31175	1675
2007	510	164	13	29648	2522	176	9	31146	1719
2008	475	170	16	28921	2774	187	10	31719	1698
2009	487	174	14	30041	2514	190	9	32611	1687

3.3 Secondary Process

Annacis Island WWTP secondary process operated satisfactorily in 2009 with the following major secondary process units removed from service for repair and maintenance.

- Trickling Filter #2 August 14 to November 24 (102 days)
- Trickling Filter #4 May 28 to August 05 (69 days)
- Trickling Filter #4 December 23 to December 31 (8 days)
- Secondary Clarifier #4 April 17 to October 13 (179 days)
- Secondary Clarifier #12 January 17 to February 10 (24 days)
- Secondary Clarifier #12 February 22 March 11 (17 days)
- Solids Contact Tank #2 June 18 to September 28 (101 days)

The plant continued to operate with three aeration tanks in contact mode and one aeration tank in re-aeration mode. Wasting of secondary solids was still withdrawn from the re-aeration tank. Mean Cell Residence Time (MCRT) in the aeration tanks were adjusted seasonally which ranges from 1.0 to 3.3 days with an average of 2.1 days. Mixed Liquor Suspended Solids (MLSS) concentrations varied with the MCRT. MLSS concentrations were between 774 to 2200 mg/L with an average of 1430 mg/L. Operating the secondary clarifiers during peak weather events continued to be a challenge. The peak Sludge Overflow Rate (SOR) for the clarifier was 69.9 m/d which occurred in January. The clarifier suspended solids concentrations were between 67 to 968 mg/L with an average of 345 mg/L. The soluble cBOD (scBOD) removal across the trickling filters was 40 to 78% with an average of 67%. The trickling effluent scBOD concentrations were in the range of 8 to 41 mg/L. The fine bubble membrane diffuser aerators in Solids Contact Tank (SCT) #2 were replaced with Sanitaire Silver Series II in June.

Annacis received about 223 trucks of spent airport de-icing fluid from Inland Technologies from January to May.

3.4 Sludge Treatment

Primary sludge from the primary sedimentation tanks were thickened into two gravity thickeners and screened in one sludge screen. The average Thickened Screened Primary Sludge (TSPS) and sludge screenings total solids were 5.0 % and 32.9%.

Waste secondary sludge from the re-aeration tank was thickened using two Dissolved Air Floatation Thickeners (DAFTs). The average Thickened Wasted Secondary Sludge (TWSS) total solids were 5.0 % with subnatant suspended solids of 37 mg/L and Thickened Bottom Sludge (TBS) of 73 mg/L. The average DAFT polymer dosage was 3.2 kg/tonne.

Mixed sludge from the primary and secondary processes, which have an average total solids of 4.6 % was digested in three thermophilic primary digesters and one secondary digester or Flow Through Vessel (FTV). The average mixed sludge composition was 54% primary sludge and 46 % secondary sludge.

Annacis digester operation was very stable. The average hydraulic retention time (HRT) for the primary digesters was 21 days and for the FTV was 3 days with the average volatile reduction of 62 % and the average organic loading rate of 1.97 kg/m3 - day. Bicarbonate alkalinity concentrations ranged between 4660 and 5870 mg/L.

On July 24, Digester #7 was removed from service for cleaning, repair and inspection and Digester 8 was returned to service. FTV#1 remained in standby mode. FTV#3, which was not in service since November 14, was returned to service on August 18 as a replacement for Digested Sludge Storage Tank (DSST).

Annacis co-digestion full load test took place from August 5 to October 31. The test loads received were from West Coast Reduction (WCR) and Inland Technologies. There was no negative impact on digester operation during the test. Annacis plant continued to receive WCR loads for the rest of the year, rather than returning this waste stream to Iona plant for processing. Total of 125 loads (approximately 569 m^3) of fats, oils and grease (FOG) from WCR and 1 load of spent airport de-icing fluid from Inland Technologies were injected into Digester#8 from August to December. The usual loading rate was one to two 4.55 m3 loads per day on weekdays. The average increase on organic loading over the mixed sludge loading was 11% while the increase on the daily gas production was 28%.

Annacis received Lions Gate thickened primary sludge from May 25 to June 15.

The average total solids in dewatered sludge (biosolids) was 30.2% and centrate suspended solids was 1150 mg/L with an average recovery of 94 %. The average polymer usage was 8.8 kg/tonne.

Table 3-4: Annacis Island WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Max. Inst.Flow Rate (m3/sec)	Total Daily Effluent Flow (MLD)			Composite pH Average		Grab pH Average	Grab NH3 Average (mg/L)	96 hr LC50 (%v/v) Standard Test & Add-on pH Stabilization
		Max.	Min.	Ave.	RAW INF	FINAL EFF	FINAL EFF	FINAL EFF	FINAL EFFLUENT
JAN	12.2	944	454	595	7.3	7.6	7.2	23.8	>100
FEB	9.0	575	423	472	7.2	7.7	7.2	25.4	>100
MAR	10.6	656	431	504	7.2	7.7	7.1	25.4	>100*
APR	10.3	709	435	485	7.2	7.7	7.1	29.6	>100*
MAY	9.2	500	423	452	7.3	7.7	7.1	28.8	>100*
JUN	8.4	449	405	429	7.2	7.7	7.0	30.5	>100*
JUL	6.6	439	404	420	7.2	7.7	7.1	29.3	>100*
AUG	7.4	510	395	424	7.2	7.7	7.1	30.3	>100
SEP	9.3	501	412	435	7.2	7.6	7.0	29.4	>100*
OCT	10.1	722	407	477	7.2	7.6	7.2	28.2	>100*
NOV	11.8	901	461	656	7.2	7.6	7.2	21.3	>100*
DEC	10.7	748	437	498	7.2	7.7	7.2	27.2	>100
# Samples	-	-	-	**365**	**360**	**355**	**55**	**52**	12
Maximum-Yr.	**12.2**	**944**	-	-	**7.5**	**7.9**	**7.4**	**34.1**	>100
Minimum-Yr.	-	-	**395**	-	**6.8**	**7.4**	**6.8**	**16.5**	>100*
Average-Yr.	-	-	-	**487**	**7.2**	**7.7**	**7.1**	**27.5**	>100*

* Standard with Add-on pH Stabilization test result reported.

MONTH	Conductivity (umhos/cm)		Ave Chloride (mg/L)	Ave Temp. (oC)	Chlorine Ave. Calc. Dosage (mg/L)	Ave. Residual Chlorine Final Effluent (mg/L)		Residual SO_2 (mg/L)	Fec. Coliform (MPN/100mL) Final	
	RAW INF	FINAL EFF	FINAL EFF	FINAL EFF	FINAL EFF	Before SO2	After SO2	Effluent Outfall	Monthly Geomean	Max Geomean in month
JAN	584	645	73	11	-	-	-	-	-	-
FEB	504	573	51	13	-	-	-	-	-	-
MAR	489	574	55	13	2.3	0.71	<0.1	1.34	-	-
APR	518	611	74	15	2.9	1.15	<0.1	0.96	20	-
MAY	516	618	66	16	3.0	1.06	<0.1	1.10	56	50
JUN	496	597	55	20	3.2	1.03	<0.1	1.57	20	50
JUL	472	557	43	20	3.4	1.04	<0.1	1.73	29	29
AUG	479	565	44	22	3.6	1.17	<0.1	1.64	26	39
SEP	467	549	41	22	3.3	1.06	<0.1	1.74	34	41
OCT	455	533	41	20	3.2	1.29	<0.1	1.70	22	34
NOV	399	469	38	16	-	-	-	-	-	-
DEC	483	563	51	15	-	-	-	-	-	-
# Samples	**359**	**354**	**51**	**61**	**220**	**240**	**240**	**240**	**64**	**54**
Maximum-Yr.	**992**	**988**	**86**	**22**	**3.8**	**2.0**	**<0.1**	**4.50**	**1100**	**50**
Minimum-Yr.	**321**	**364**	**34**	**10**	**1.9**	**<0.1**	**<0.1**	**0.16**	**<20**	**20**
Average-Yr.	**488**	**571**	**53**	**17**	**3.2**	**1.10**	**<0.1**	**1.48**	**-**	**-**
Geomean	**-**	**-**		**-**	**-**	**-**	**-**	**-**	**27**	**30**

(1) pH, Temperature, ammonia, Residual Chlorine(taken before and after dechlorination), Residual SO2, 96 hour LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.

(2) Summer = Mar. 25 - Oct.31, 2009 inclusive: Chlorinated Effluent; Winter = Jan. 1 - Mar. 24, 2009 and Nov. 1 - Dec. 31, 2009: No Chlorination

Table 3-4 Con't: Annacis Island WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Total Suspended Solids (mg/L)						Total Susp. Solids Ave % Reduction		Ave. Susp. Solids Loadings (Tonnes/day)		Average VSS (mg/L)		Average VSS % Reduction	
	RAW INFLUENT			FINAL EFFLUENT					RAW INF	FINAL EFF	RAW INF	FINAL EFF		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Primary	Final					Primary	Final
JAN	173	71	144	26	13	21	51	86	80.4	11.5	129	18	52	86
FEB	212	142	168	25	12	17	55	90	79.2	8.24	157	15	58	90
MAR	231	126	159	26	13	20	52	87	79.2	9.92	146	17	54	88
APR	256	121	171	20	13	15	55	91	82.9	7.51	156	14	56	91
MAY	226	150	183	19	9	13	56	93	82.5	5.77	166	11	58	93
JUN	246	184	212	16	10	12	59	94	91.1	5.34	198	10	60	95
JUL	259	178	201	15	7	10	60	95	84.5	4.22	185	9	62	95
AUG	244	170	197	14	6	10	60	95	83.3	4.27	181	9	61	95
SEP	270	158	200	16	8	12	61	94	86.8	5.02	189	11	62	94
OCT	206	120	170	18	7	12	56	93	79.6	5.51	161	11	57	93
NOV	176	88	128	24	9	14	52	88	80.6	9.56	116	13	52	88
DEC	195	104	158	20	9	13	54	91	77.7	6.6	145	12	55	91
# Samples	-	-	360	-	-	356	357	354	360	356	234	232	232	231
Maximum-Yr.	**270**	**-**	**-**	**26**	**-**	**-**	**72**	**97**	**121**	**20.9**	**251**	**25**	**71**	**97**
Minimum-Yr.	**-**	**71**	**-**	**-**	**6**	**-**	**30**	**78**	**58.7**	**2.43**	**60**	**6**	**29**	**80**
Average-Yr.	**-**	**-**	**174**	**-**	**-**	**14**	**56**	**92**	**82.3**	**6.89**	**161**	**13**	**57**	**92**
Total to Date - Suspended Solids Loadings (Tonnes):									**30,041**	**2,514**				

MONTH	BOD/cBOD (mg/L)						BOD/cBOD Ave % Reduction		BOD/cBOD Loadings (Tonnes/day)		Average COD (mg/L)		Ave. COD % Reduction	
	RAW INFLUENT			FINAL EFFLUENT					RAW INF	FINAL EFF	RAW INF	FINAL EFF		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Primary	Final					Primary	Final
JAN	192	117	163	13	11	12	16	93	91.2	6.42	345	79	21	76
FEB	211	144	186	16	9	11	23	94	88.8	5.21	402	79	27	80
MAR	218	139	182	15	9	13	26	93	91.0	6.42	392	82	27	79
APR	225	152	199	12	7	9	23	95	94.8	4.40	408	81	25	80
MAY	214	155	199	10	5	7	21	96	93.6	3.43	445	76	25	83
JUN	252	192	210	7	6	7	28	97	90.9	2.93	458	71	29	85
JUL	236	178	209	11	6	9	31	96	88.2	3.58	457	76	31	83
AUG	241	186	205	10	5	8	29	97	87.5	3.52	430	78	26	81
SEP	249	170	205	14	9	11	30	95	89.5	4.89	411	83	20	79
OCT	216	158	199	13	6	9	29	95	89.2	4.33	425	79	32	82
NOV	182	87	130	13	6	9	29	93	76.8	5.53	298	69	24	76
DEC	228	133	179	13	6	9	29	95	90.5	4.66	393	77	27	80
# Samples	-	-	100	-	-	100	99	97	100	100	345	256	242	240
Maximum-Yr.	**252**	**-**	**-**	**16**	**-**	**-**	**38**	**98**	**128**	**9.8**	**584**	**106**	**46**	**89**
Minimum-Yr.	**-**	**87**	**-**	**-**	**5**	**-**	**1.3**	**89**	**70.2**	**2.11**	**155**	**49**	**-26**	**62**
Average-Yr.	**-**	**-**	**190**	**-**	**-**	**9**	**26**	**95**	**89.3**	**4.62**	**406**	**77**	**26**	**80**
Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):									**32,611**	**1,687**				

(1) Percent reduction is calculated only for days when both influent and effluent tests were done.

(2) Total BOD are reported for influent and cBOD are reported for final effluent. Percent BOD reduction is calculated from the BOD and cBOD reported for each day reported.

Table 3-5: Annacis Island WWTP – 2009 Comprehensive Program Concentrations Summary

Parameters	Sample Type	INFLUENT Max.	INFLUENT Min.	INFLUENT Ave.	EFFLUENT Max.	EFFLUENT Min.	EFFLUENT Ave.
		mg/L (unless specified)			mg/L (unless specified)		
Kjeldahl Nitrogen	Comp.	33	22	30	35	20	31
N-Nitrate	Grab	0.68	<0.01	<0.09	0.02	<0.01	<0.02
N-Nitrite	Grab	0.07	<0.01	<0.03	0.05	0.01	0.03
N-Ammonia	Comp.	23.5	13.9	20.2	33.4	19.9	29.3
Sulphate	Comp.	25.5	17.6	21.2	28.9	18.6	23.8
Total Phosphorus	Comp.	5.47	2.68	4.57	3.71	2.46	3.15
Dissolved Phosphorus	Comp.	2.14	1.23	1.95	3.07	1.82	2.53
MBAS	Grab	4.5	2.4	3.5	0.4	0.2	0.3
Oil & Grease	Grab	80	31	46	<7	<5	<6
Phenols	Grab	0.06	0.02	0.03	0.01	<0.01	<0.01
Cyanide Total	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aluminum Total	Comp.	0.81	0.57	0.67	0.19	0.10	0.13
Aluminum Dissolved	Comp.	0.09	0.04	0.06	0.04	0.02	0.03
Arsenic Total	Comp.	0.008	<0.001	<0.002	0.002	<0.001	<0.002
Barium Total	Comp.	0.040	0.024	0.028	0.023	0.005	0.009
Barium Dissolved	Comp.	0.021	0.005	0.009	0.015	0.002	0.005
Boron Total	Comp.	0.22	0.13	0.16	0.23	0.15	0.18
Boron Dissolved	Comp.	0.21	0.13	0.16	0.21	0.15	0.17
Calcium Total	Comp.	22.5	13.2	15.6	22.6	11.4	14.2
Cadmium Total	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium Dissolved	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium Total	Comp.	0.009	0.002	0.005	0.010	<0.001	<0.003
Chromium Dissolved	Comp.	0.003	<0.001	<0.002	0.004	<0.001	<0.002
Cobalt Total	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper Total	Comp.	0.159	0.059	0.094	0.104	0.027	0.042
Copper Dissolved	Comp.	0.047	0.010	0.022	0.058	0.010	0.025
Iron Total	Comp.	3.21	1.10	2.02	0.85	0.38	0.60
Iron Dissolved	Comp.	1.10	0.36	0.63	0.18	0.13	0.15
Lead Total	Comp.	0.010	0.003	0.006	0.002	<0.001	<0.002
Lead Dissolved	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium Total	Comp.	3.85	2.57	3.10	4.35	2.36	3.02
Manganese Total	Comp.	0.091	0.062	0.079	0.087	0.048	0.063
Manganese Dissolved	Comp.	0.069	0.041	0.055	0.078	0.042	0.055
Mercury Total **(µg/L)**	Comp.	0.53	0.09	0.18	0.05	<0.05	<0.05
Molybdenum Total	Comp.	0.004	<0.002	<0.003	0.003	<0.002	<0.003
Molybdenum Dissolved	Comp.	0.003	<0.002	<0.003	0.002	<0.002	<0.002
Nickel Total	Comp.	0.004	0.002	0.003	0.003	0.002	0.003
Nickel Dissolved	Comp.	0.003	0.001	0.002	0.002	0.002	0.002
Selenium Total	Comp.	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver Total	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tin Total	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tin Dissolved	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc Total	Comp.	0.142	0.072	0.101	0.043	0.027	0.037
Zinc Dissolved	Comp.	0.039	0.011	0.021	0.028	0.018	0.023

Note: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.
See Appendix A1-10 & A1-11 for more details.

Table 3-6: Annacis Island WWTP – 2009 Comprehensive Program Loadings Summary

	INFLUENT				EFFLUENT			
	Max.	Min.	Ave.	Tonnes	Max.	Min.	Ave.	Tonnes
Parameters	kg/day			per year	kg/day			per year
Kjeldahl Nitrogen	16400	12900	14300	5210	17000	13100	14700	5360
N-Nitrate	508	<4.3	<57	<20	9.5	<4.3	<6.7	<2.5
N-Nitrite	37	<4.3	<13	<4.5	22	4.5	13	4.7
N-Ammonia	10600	8820	9570	3490	15700	12000	13900	5060
Sulphate	13400	8730	10100	3680	13900	9970	11300	4110
Total Phosphorus	2380	2000	2150	785	1840	1200	1500	547
Dissolved Phosphorus	986	835	920	336	1430	861	1200	438
MBAS	1980	1400	1640	598	224	92	144	52
Oil & Grease	34400	15226	22000	8030	<4500	<2600	<2900	<1100
Phenols	25	10	16	5.7	7.5	<4.3	<4.9	<1.8
Cyanide Total	<15	<8.5	<9.7	<3.6	<15	<8.5	<9.7	<3.6
Aluminum Total	441	263	321	117	135	42	64	24
Aluminum Dissolved	44	17	28	10	22	8.5	14	5.2
Arsenic Total	3.4	<0.5	<0.8	<0.3	0.9	<0.5	<0.6	<0.2
Barium Total	30	10	14	5.1	17	2.1	4.8	1.8
Barium Dissolved	16	2.1	4.7	1.7	11	0.8	2.6	0.9
Boron Total	112	63	78	29	135	74	87	32
Boron Dissolved	112	64	77	28	135	72	84	31
Calcium Total	16800	5710	7700	2810	16900	4820	7070	2580
Cadmium Total	<0.4	<0.3	<0.3	<0.09	<0.4	<0.3	<0.3	<0.09
Cadmium Dissolved	<0.4	<0.3	<0.3	<0.09	<0.4	<0.3	<0.3	<0.09
Chromium Total	4.4	0.9	2.2	0.8	4.9	<0.5	<1.1	<0.4
Chromium Dissolved	1.5	<0.5	<0.9	<0.4	2.0	<0.5	<0.7	<0.3
Cobalt Total	0.7	<0.5	<0.5	<0.2	<0.8	<0.5	<0.5	<0.2
Cobalt Dissolved	<0.8	<0.5	<0.5	<0.2	<0.8	<0.5	<0.5	<0.2
Copper Total	73	36	44	16	78	12	22	8.0
Copper Dissolved	22	4.9	10	3.8	43	4.7	13	4.7
Iron Total	1430	507	951	347	419	175	286	104
Iron Dissolved	485	166	298	109	112	57	73	27
Lead Total	4.7	1.4	2.7	1.0	1.0	<0.5	<0.6	<0.3
Lead Dissolved	0.7	<0.5	<0.5	<0.2	<0.8	<0.5	<0.5	<0.2
Magnesium Total	2880	1090	1520	553	3250	1010	1490	545
Manganese Total	68	28	39	14	65	21	31	11
Manganese Dissolved	52	18	27	10	58	18	27	10
Mercury Total	0.23	0.04	0.08	0.03	0.04	<0.03	<0.03	<0.009
Molybdenum Total	2.2	<0.9	<1.3	<0.5	1.5	<0.9	<1.0	<0.4
Molybdenum Dissolved	1.5	<0.9	<1.1	<0.4	1.5	<0.9	<1.0	<0.4
Nickel Total	1.79	0.95	1.37	0.50	1.49	0.85	1.19	0.44
Nickel Dissolved	1.49	0.44	0.85	0.31	1.49	0.85	0.96	0.35
Selenium Total	7.5	<4.3	<4.9	<1.8	<7.5	<4.3	<4.9	<1.8
Silver Total	0.7	<0.5	<0.5	<0.2	<0.8	<0.5	<0.5	<0.2
Silver Dissolved	<0.8	<0.5	<0.5	<0.2	<0.8	<0.5	<0.5	<0.2
Tin Total	<7.5	<4.3	<4.9	<1.8	<7.5	<4.3	<4.9	<1.8
Tin Dissolved	<7.5	<4.3	<4.9	<1.8	<7.5	<4.3	<4.9	<1.8
Zinc Total	64	41	48	17	31	12	18	6.6
Zinc Dissolved	22	4.7	10	3.8	18	8.5	11	4.1

Method: Maximums, minimums and averages calculated from loadings obtained for each sampling date.

3.5 Effluent Toxicity

In 1999 and 2000, comprehensive assessments of acute effluent toxicity at the Annacis Island WWTP were conducted. The findings of the assessment studies were presented at an inter-governmental agency workshop held in March 2001. The findings showed that ammonia was the primary cause of toxicity. The toxicity, however, appeared to be largely a function of the test protocol as aeration during the test drove off CO2, resulting in an increase in pH. The increase in pH during the test increased the proportion of un-ionized ammonia, a more toxic form of ammonia.

Environment Canada's standard reference method[4] for determining acute lethality of effluents to Rainbow trout exposes test fish to a series of effluent dilutions, and determines the fish survival rate at the end of a 96-h exposure period. The final result is reported as the 96-h LC_{50} value, which is the % by volume (of the original sample) at which 50% of the test fish survive. A pass for all effluent samples requires that the LC_{50} value must be *equal to* or *greater than* 100% (v/v sample). This means that 50% or more of the test fish must survive for 96 hours in the original undiluted sample.

In 2008, Environment Canada published an add-on test procedure[5] for pH stabilization during the testing of acute lethality. The add-on procedure is applicable only to wastewater effluents. The purpose of pH stabilization is to replace the CO_2 lost due to aeration in order to maintain the pH throughout the test at the same levels observed at the start of the test. This add-on procedure recognizes that toxicity observed in municipal wastewater effluents may be an artifact of the standard reference method.

The add-on procedure can be used only when the standard reference method gives a false result due to pH shift during the test. Consequently a second test is run concurrently with the standard reference method. The second test utilizes the reference method with the add-on pH stabilization procedure.

2009 Program

As required by the Liquid Waste Management Plan and the plant's Operational Certificate, all regular LC_{50} results for effluent samples from GVS&DD WWTPs are followed up with work to explain the cause of results of less than 100%. Outlined below is a summary of Annacis effluent toxicity results and evaluations for 2009.

All effluent samples from the Annacis Island WWTP passed the required monthly toxicity test using Environment Canada's standard reference method (4 cases) or the reference method with the add-on pH stabilization step (8 cases).

Additionally, the pH and ammonia values in 2009 showed that the concentration of ammonia in the undiluted effluent was not acutely toxic at the measured pH value. This is demonstrated in the following chart for pH and ammonia data collected during the year. All results were below the threshold acute concentration curve for ammonia at the measured pH value of the effluent discharge.

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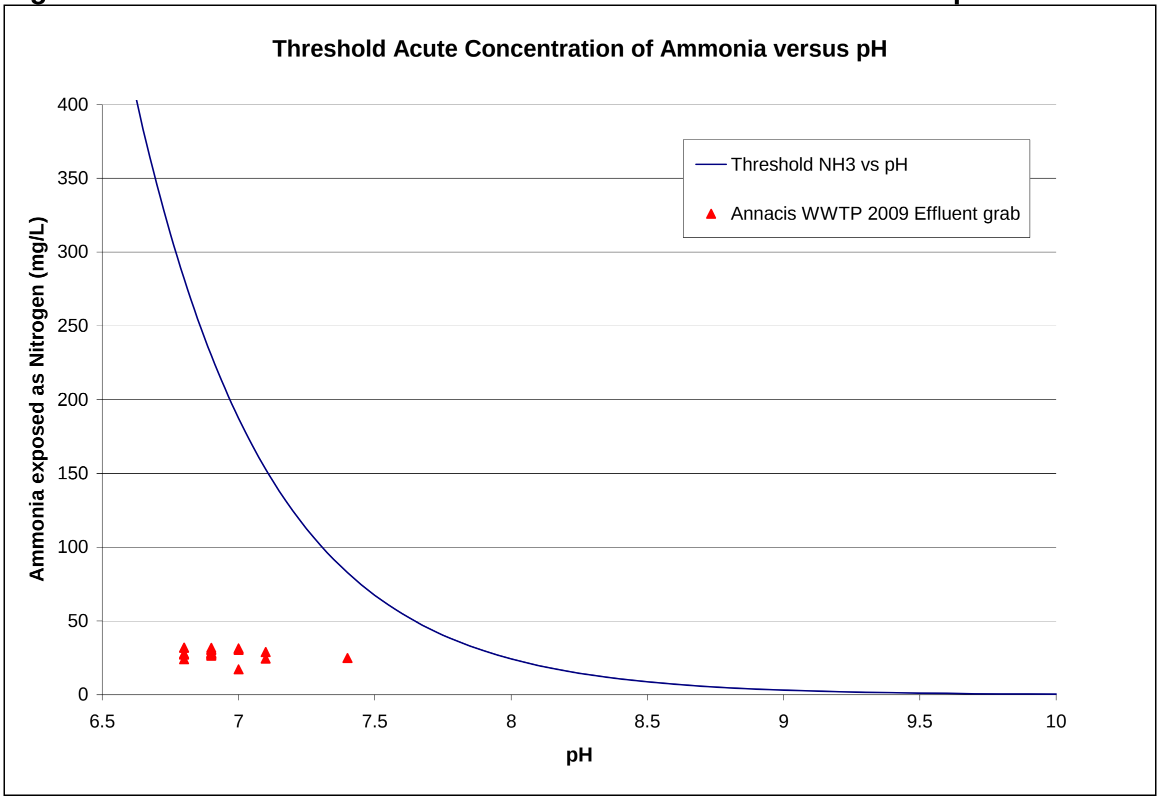
[4] Environment Canada, Report EPS 1/RM/13, Second Edition – December 2000, p. 9.

[5] Environment Canada, Report EPS 1/RM/50 – March 2008, p. 10.

Figure 3-1: Annacis Island WWTP - Ammonia Concentration versus pH Value



3.6 Biosolids Monitoring

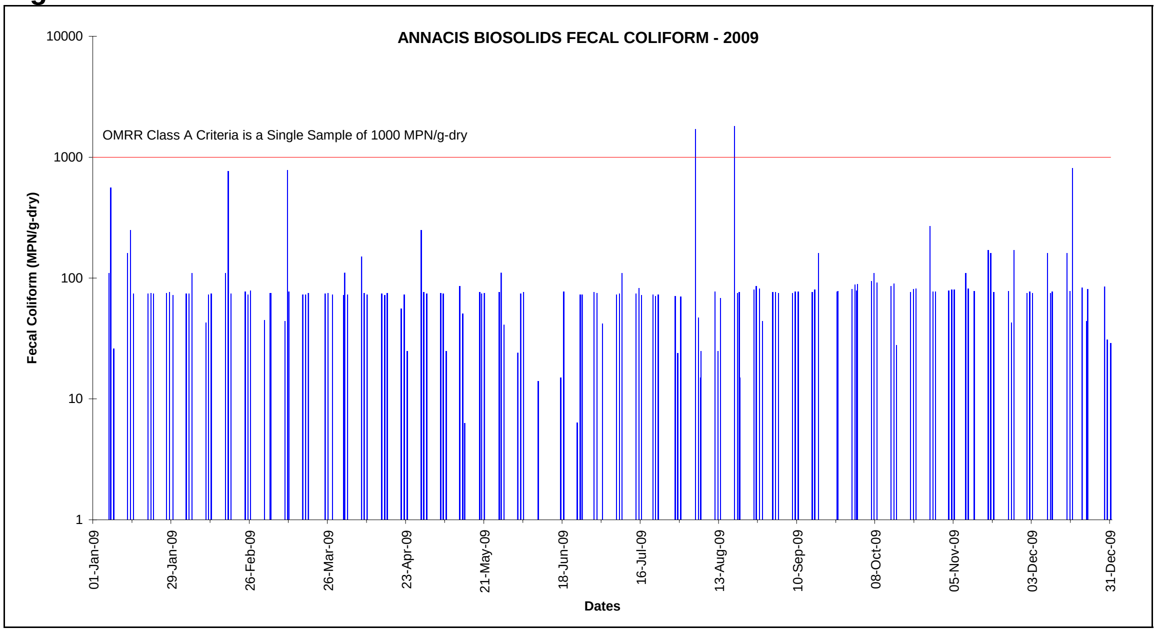
Results of monthly testing programs for Biosolids and the criteria values required under the Organic Matter Recycling Regulation (OMRR), February, 2002 are shown in the following table:

Class A Criteria (mg/kg)	Arsenic	Cadmium	Chromium *	Cobalt	Copper *	Lead	Mercury	Moly	Nickel	Selenium	Zinc	Fecal Coliform (MPN/g)
	75	**20**	**1060**	**150**	**2200**	**500**	**5**	**20**	**180**	**14**	**1850**	**1,000**
MAX	7	3.4	176	11.0	1120	120	3.6	14	31	7.8	1400	1,800
MIN	2.0	2.1	41	3.7	722	51	1.7	8.7	19	6	1010	6
AVE	3.9	2.5	67	5.7	940	83	2.6	10.6	24	6.9	1120	76**
# Times Exceeded	0	0	0	0	0	0	0	0	0	0	0	2

* Class B Biosolids limits shown for reference
There are no limits for Chromium and Copper for Class A Biosolids
**Geomean for Year

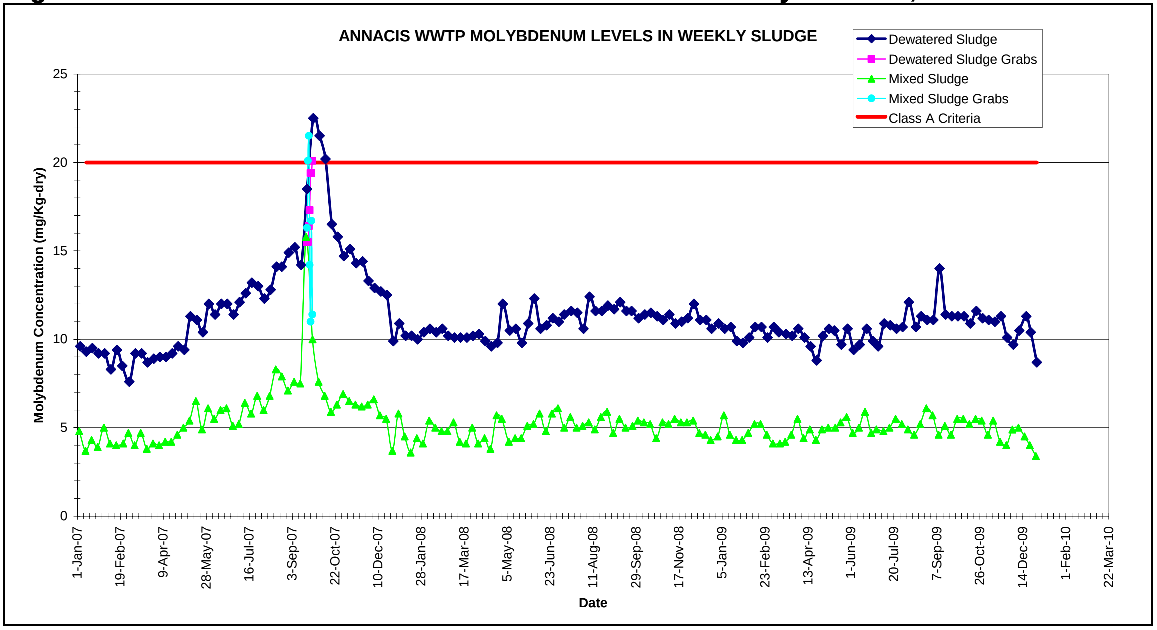
Data values produced during 2009 for fecal Coliforms in biosolids were within the Class A criteria except for two instances. Samples collected on August 4 and August 8 had fecal coliform results of 1,700 MPN/g and 1,800 MPN/g. Digestion and dewatering systems were operating normally on both days. Subsequent samples from the same centrifuge unit and upstream samples prior to the dewatering system were collected and results were lower than the Class A limit of 1,000 MPN/g. It was concluded that the samples were an anomaly and contamination was the likely source of the unusual high fecal coliform results. The maximum value was 1,800 MPN/g and the geometric mean for all samples collected in the year was 76 MPN/gram. Biosolids samples were collected approximately three times per week to meet the sample frequency requirements for Class A biosolids.

Figure 3-2: Annacis Island WWTP Biosolids – Fecal Coliform



Metals: Criteria values for all metal parameters were met throughout 2009. All regulated metals were below the three quarter of the OMRR limits.

Figure 3-3: Annacis Island WWTP Biosolids – Total Molybdenum, 2007-2009 Data



Additional Information for 2008 and 2009 Fecal Coliforms and Metals Data are found in: Appendix D - Biosolids and Digester Sludge Monitoring Programs.

Iona WWTP

4.0 IONA ISLAND WWTP

4.0 IONA ISLAND WWTP 2009 ANNUAL SUMMARY

4.1 Effluent Quality

The quality of effluent from the Iona Island WWTP in 2009 is summarized in the following table, along with compliance with parameters listed in the Operational Certificates.

Table 4-1: Iona Island WWTP – 2009 Compliance Summary

Operational Certificate Requirements - ME-00023, April 23, 2004

				No. of times Criteria Exceeded												
Compliance Parameters	**Frequency**	**OC Limits**	**Max. Value for the Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Yr to Date**
Total Flow (MLD)	Daily	1,530	1,445	0	0	0	0	0	0	0	0	0	0	0	0	0
B.O.D. (mg/L)*	3/week	130	134	0	0	0	0	0	0	0	0	1	0	0	0	1 of 103
Suspended Solids (mg/L)	5/week	100	83	0	0	0	0	0	0	0	0	0	0	0	0	0
BOD (Tonnes/Day)*	3/week	84.0	77.5	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (Tonnes/Day)	5/week	78.0	77.5	0	0	0	0	0	0	0	0	0	0	0	0	0
Plant Bypass	-	-	-	0	0	1	0	0	0	0	0	0	0	0	1	2 of 365

* BOD reported 1/week when COD are reported 5/week

Monitoring Parameters	OC Frequency	Sample Type	Year 2009 Maximum	Minimum	Average
pH**	1/month	Grab	7.6	6.6	7.1
Toxicity, 96 hour LC_{50} (%v/v)	1/month	Grab	>100	67	>94
Ammonia (mg/L)**	2/month	Grab	37.9	1.6	14.0
Hardness (mg/L CaCO3)	1/month	Comp	73.6	39.7	57.4
COD (mg/L)*	5/week	Comp	262	69	190
Conductivity (umhos/cm)	-	Grab	1140	210	513
Temperature ^{o}C	1/month	Grab	21	10	16
Phenol (mg/L)	1/month	Grab	0.02	<0.01	<0.02
Oil and Grease (mg/L)	1/month	Grab	14	<5	<10
Aluminum, Total (mg/L)	1/month	Comp	0.49	0.24	0.33
Arsenic , Total (mg/L)	1/month	Comp	0.005	<0.001	<0.002
Barium, Total (mg/L)	1/month	Comp	0.030	0.011	0.016
Boron, Total (mg/L)	1/month	Comp	0.10	0.05	0.09
Cadmium, Total (mg/L)	1/month	Comp	0.0130	<0.0005	<0.0017
Chromium,Total (mg/L)	1/month	Comp	0.004	0.001	0.002
Cobalt, Total (mg/L)	1/month	Comp	<0.001	<0.001	<0.001
Copper, Total (mg/L)	1/month	Comp	0.107	0.052	0.085
Cyanide, Total (mg/L)	1/month	Comp	<0.02	<0.02	<0.02
Iron, Total (mg/L)	1/month	Comp	0.76	0.51	0.62
Lead , Total (mg/L)	1/month	Comp	0.036	0.001	0.005
Manganese, Total (mg/L)	1/month	Comp	0.049	0.038	0.043
Mercury, Total (µg/L)	1/month	Comp	0.09	<0.05	<0.07
Molybdenum, Total (mg/L)	1/month	Comp	0.004	0.002	0.003
Nickel, Total (mg/L)	1/month	Comp	0.002	<0.001	<0.002
Selenium, Total (mg/L)	1/month	Comp	<0.01	<0.01	<0.01
Silver, Total (mg/L)	1/month	Comp	0.001	<0.001	<0.001
Zinc, Total (mg/L)	1/month	Comp	0.084	0.051	0.071

** Minimum, Maximum and average values are calculated from all available data.

Note 1. Toxicity requirements, April 23, 2004 Operational Certificate: If a fish bioassay toxicity test fails to meet or exceed a LC50 value of 100%, the permittee is required to conduct a Toxicity Identification Evaluation (TIE) study for the purpose of determining the probable cause of the failure.

Note 2: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.

4.2 Compliance Review (ME-000023) and Performance Summary

The Iona Island WWTP effluent permit (March 16, 2000) was replaced with Operational Certificate ME-00023, issued April 23, 2004 by the Ministry of Environment under the provisions of the Waste Management Act. The new operational certificate included revised compliance levels for BOD and suspended solids loadings. The loadings parameters listed as "maximum daily loadings" are used to calculate the annual waste discharge fees as required by the Waste Management Waste Permit Fee regulation and are based on a calendar year.

Previous Permit Levels	BOD (tonnes/day)	Susp. Solids (tonnes/day)
On and from April 2, 2003	75.8	82.0
On and from April 2, 2004	78.1	84.4
Operational Certificate Levels		
2004 (effective April 23, 2004)	78.1	72.0
2005	80.0	74.0
2006	82.0	76.0
2007 and thereafter	84.0	78.0

Discharge Monitoring
A total of 24 parameters and the two daily loadings for final effluent are posted on Metro Vancouver's website on a monthly basis; however specific permit levels apply to only five parameters: Total daily discharge flow, BOD, suspended solids, and daily loadings for BOD and suspended solids.

4.2.1 Compliance Review

In 2009, Iona Island Wastewater Treatment Plant met the monitoring requirements for flow, suspended solids concentration, suspended solids loading and BOD loading. However, there was one day on which the BOD concentration exceeded the OC limit of 130 mg/L. The level of compliance for these parameters is shown in Table 4.1.

On September 22, the effluent composite BOD concentration (134 mg/L) exceeded the Operating Certificate limit of 130 mg/L. The trigger system used to initiate chemical enhanced primary treatment indicated that no chemical treatment was required. Prior to and following the September 22 incident, the trigger has been adequate to ensure compliance with the Operating Certificate.

Primary Influent Bypasses
There were two occasions on which untreated wastewater bypassed the plant.

On March 30, less than 1 % of the total plant flow (5.5 ML) was bypassed to the effluent pump station and was discharged through the deep sea outfall for 20 minutes. Two influent pumps failed during an extreme flow event. Iona has six influent pumps and five pumps must be in service to prevent by-pass.

On December 20, about 11 % of the total plant flow (116 ML) was bypassed and discharged through the near shore discharge. Power interruption occurred at 10:37 caused both the influent and effluent pumps to stop. This in turn caused the main plant influent gates to close due to a high influent well level. Influent flow was diverted to the plant spill containment pond. At 11:37, bypass of untreated wastewater occurred because the spill containment pond had reached maximum capacity. Full pumping and treatment capacity was restored at 13:25. Remaining untreated wastewater in the spill containment pond was then pumped to the plant head works.

4.2.2 Performance Summary

Iona Island WWTP treated an average effluent daily flow of 550 MLD in 2009. The 2009 average effluent daily flow was 1.6 % higher than in 2008. The maximum daily flow of 1,445 MLD occurred on January 10, 2009.

The plant continued to produce satisfactory effluent quality. Suspended solids concentrations were within the range of 32 to 83 mg/L with an average value of 58 mg/L. BOD concentrations were within the range of 32 to 134 mg/L with an average of 90 mg/L.

Iona Island WWTP has a combined sanitary/storm water collection system. Variations in annual rainfall greatly influence average flow, SS and BOD loadings.

Table 4-2: 2000-2009 Annual Average Data for Flow, Suspended Solids and BOD

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD mg/L		BOD Tonnes/year	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2000	535	127	51	23723	9883	139	83	24982	15298
2001	617	121	53	26168	11889	125	80	27202	17650
2002	574	128	49	25371	10209	128	84	25031	16585
2003	597	121	48	24736	10358	130	76	25872	15260
2004	551	122	46	22723	9023	122	73	23171	14134
2005	552	132	55	24467	10644	136	86	24699	15966
2006	587	128	53	24553	11076	150	92	27583	17494
2007	603	126	53	25159	11441	132	83	25613	16772
2008	541	133	57	24516	11149	144	94	26179	17728
2009	550	139	58	25199	11397	144	90	25786	16764

Storm water at times, is a major component of the Iona WWTP combined wastewater influent. At the onset of storm flows, a first flush action can add BOD and suspended solids to the combined influent flow. Under sustained high flows, BOD and suspended solids concentrations in the influent are diluted by the storm flow and BOD and suspended solids removal efficiencies are greatly reduced.

In 2009, the average suspended solids removal was 54 % and the average BOD removal was 35 %. Those removals were similar to the TSS (54 %) and BOD (31 %) removals in 2008.

4.3 Chemically Enhanced Primary Treatment

Chemically Enhanced Primary Treatment (CEPT) using alum and an anionic polymer was installed at the Iona Island WWTP to help meet the effluent quality standards for BOD during periods of dry weather flow and high influent BOD concentrations. COD test results for a half-day effluent composite sample are used to determine when to operate the CEPT system. The system is initiated if the half day sample COD exceeds 250 mg/L. Chemical treatment is maintained for the remainder of the day.

On September 28, the chemical addition COD trigger was lowered from 250 mg/L to 235 mg/L in reaction to a non-compliance event on BOD concentration when the original COD trigger was not exceeded.

In 2009, there were 23 trigger events for CEPT treatment. However, CEPT treatment was not used on 4 of the 23 trigger events. On March 13 and July 7, there was no CEPT treatment due cold weather equipment operation problems (March 13) and mechanical failure (July 7). On June 24 and August 13, plant management decided not to use treatment due to the high plant flows in the afternoon on those days. High flows decrease the effectiveness of and the need for chemical treatment.

4.4 Sludge Treatment/Digester Operations

For about 111 days in 2009, Iona WWTP had three of four mesophilic digesters in operation while the fourth digester was out of service for cleaning and maintenance. Digester #2 was out of service from March 1 to May 26 and Digester #4 was out of service from December 8 to December 31.

The digesters remained mostly upset free for most of the year. However, there was a loss of circulation in Digester #3 from May 23 to May 26 and there was a significant upset in that digester from May 29 to June 6. The upset was believed to be started by a scum blanket that moved into the digestion zone of the digester. Prior to the upset, both plant scum and truck liquid waste from West Coast Reduction was being fed to Digester #3 along with thickened primary sludge. The West Coast Reduction waste was delivered as a heated product to keep the liquid from solidifying in the delivery truck tank. Due to the solidification properties of the WCR waste and suspicions that the received WCR truck loads accelerated the build up of a scum blanket in Digester #3; WCR loads were diverted to AI WWTP in early August. There was no major digester upset in Iona Digester #3 since the diversion.

4.5 Effluent Sampling

North and South Effluent Sampling:

Beginning on July 16, 2006, composite samples of North Plant effluent and South Plant effluent were collected and analyzed to characterize treatment on both sections of the Plant. In 2008 CEPT trials, improved CEPT treatment was achieved by controlling chemical feed based on the individual North and South Plant flows rather than by the total Plant flow divided by two.

Further work to be done to balance the loadings and CEPT treatment efficiencies in the North and South Plant flows will focus on controlling the sedimentation tanks in use during low flow periods to even out the flows through the tanks.

Table 4-3: Iona Island WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Max. Inst. Flow Rate (m3/sec)	Total Daily Flow (MLD)			Grab pH	Grab Ammonia mg/L	96 hr LC_{50} (%v/v)	96 hr LT_{50} O_2 (Hrs)
		Max.	Min.	Average	EFF	EFF	EFF	EFF
JAN	17.9	1445	445	757	7.2	9.1	>100	-
FEB	17.4	802	414	511	7.2	11.4	>100	-
MAR	17.7	1089	422	604	7.1	8.9	>100	-
APR	17.6	1083	412	538	7.0	11.7	>100	>96
MAY	17.4	760	397	466	7.0	9.9	75	>96
JUN	12.6	562	376	407	7.0	19.3	>100	>96
JUL	11.2	535	358	402	6.9	19.3	>100	>96
AUG	15.5	805	378	417	7.1	18.9	94	>96
SEP	18.2	716	382	442	6.9	16.2	94	>96
OCT	18.7	1127	369	591	7.1	18.9	67	>96
NOV	18.5	1398	479	904	7.1	7.5	>100	>96
DEC	17.9	1104	409	556	7.2	15.0	>100	-
# Samples	-	-	-	365	56	53	12	-
Maximum-Yr.	**18.7**	**1445**	-	-	**7.6**	**37.9**	**>100**	**-**
Minimum-Yr.	-	-	**358**	-	**6.6**	**1.6**	**67**	**-**
Average-Yr.	-	-	-	**550**	**7.1**	**14.0**	**>94**	**-**

MONTH	Ave. Temp. (°C)	Ave. D.O. (mg/L)	Average Conductivity (umhos/cm)		Average Chloride (mg/L)		Composite Average pH	
	EFF	EFF	INF	EFF	INF	EFF	INF	EFF
JAN	10	9.2	547	553	164	164	7.2	7.3
FEB	12	6.0	496	508	80	82	7.3	7.3
MAR	12	6.5	466	468	94	93	7.3	7.4
APR	15	5.0	554	549	94	93	7.2	7.3
MAY	14	4.9	486	492	80	84	7.2	7.3
JUN	19	4.1	565	573	89	88	7.2	7.3
JUL	18	3.4	582	563	97	84	7.3	7.4
AUG	21	3.4	516	522	83	84	7.3	7.4
SEP	21	3.0	497	501	68	72	7.2	7.3
OCT	20	3.2	498	495	88	86	7.2	7.3
NOV	16	4.4	373	387	67	69	7.2	7.3
DEC	13	6.3	548	552	107	107	7.3	7.3
# Samples	12	0	248	247	58	58	248	247
Maximum-Yr.	**21**	**9.2**	**1090**	**1140**	**278**	**280**	**7.5**	**7.6**
Minimum-Yr.	**10**	**3.0**	**206**	**210**	**24**	**31**	**6.8**	**6.9**
Average-Yr.	**16**	**5.0**	**510**	**513**	**95**	**94**	**7.2**	**7.3**
Geomean	**-**	**-**	**-**	**-**	**-**	**-**	`	**-**

(1) Grab pH, Diss. Oxygen, Temperature, Ammonia, LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.
(2) Jan. 1 - Dec. 31, 2009: No Chlorination

Table 4-3 cont'd: Iona Island WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Total Suspended Solids (mg/L)						Susp. Solids % Average Reduction	Total Suspended Solids Average Loadings (Tonnes/day)		Average VSS (mg/L)		VSS % Average Reduction
	INFLUENT			EFFLUENT								
	Max.	Min.	Ave.	Max.	Min.	Ave.		INF	EFF	INF	EFF	
JAN	165	29	97	69	32	51	39	61.6	36.6	85	45	36(1)
FEB	176	87	129	78	47	60	53	65.1	30.9	114	52	53
MAR	170	71	122	82	48	59	49	70.1	35.6	106	50	51
APR	216	70	139	70	44	56	58	70.9	29.8	131	50	60
MAY	192	102	155	76	51	61	60	71.6	28.6	132	54	59
JUN	197	142	173	78	49	63	64	70.7	25.8	157	57	64
JUL	237	133	175	79	52	64	63	70.1	25.9	153	57	62
AUG	218	135	174	77	50	63	64	72.4	26.1	160	57	64
SEP	211	104	164	77	51	63	61	71.7	28.1	149	57	61
OCT	220	60	137	73	41	57	54	73.7	32.9	128	52	55
NOV	165	33	77	64	32	48	31	63.7	42.4	67	40	34
DEC	187	41	126	83	41	57	52	66.6	31.5	114	52	50
# Samples	-	-	363	-	-	362	361	363	362	237	236	235
Maximum-Yr.	**237**	**-**	**-**	**83**	**-**	**-**	**81**	**176**	**77.5**	**200**	**69**	**73**
Minimum-Yr.	**-**	**29**	**-**	**-**	**32**	**-**	**-28**	**32.3**	**16.2**	**25**	**26**	**-41**
Average-Yr.	**-**	**-**	**139**	**-**	**-**	**58**	**54**	**69.0**	**31.2**	**125**	**52**	**54**
Total to Date - Suspended Solids Loadings (Tonnes):								**25,199**	**11,397**			

MONTH	Biochemical Oxygen Demand (mg/L)						BOD % Average Reduction	BOD Average Loadings (Tonnes/day)		Average COD (mg/L)		COD % Average Reduction
	INFLUENT			EFFLUENT								
	Max.	Min.	Ave.	Max.	Min.	Ave.		INF	EFF	INF	EFF	
JAN	171	83	134	117	59	91	27	74.8	58.0	228	164	23
FEB	176	101	142	120	80	95	32	71.5	48.4	301	203	31
MAR	173	70	123	108	58	88	26	69.2	50.4	269	184	30
APR	189	78	154	114	75	96	35	75.3	48.6	302	185	37
MAY	162	97	138	104	65	85	38	71.9	44.8	343	209	39
JUN	184	167	173	114	96	105	39	73.6	44.5	387	220	43
JUL	193	123	169	115	75	99	41	69.4	40.7	364	217	40
AUG	184	158	169	118	84	94	44	69.4	38.7	359	215	40
SEP	235	93	159	134	66	95	39	72.8	44.0	345	203	41
OCT	193	94	157	120	64	90	42	74.9	42.8	300	179	37
NOV	154	33	79	90	32	56	23	54.8	41.2	164	127	18
DEC	187	83	127	115	48	84	28	70.8	50.3	272	181	31
# Samples	-	-	99	-	-	103	99	99	103	362	361	360
Maximum-Yr.	**235**	**-**	**-**	**134**	**-**	**-**	**57**	**99**	**77.5**	**572**	**262**	**66**
Minimum-Yr.	**-**	**33**	**-**	**-**	**32**	**-**	**3**	**39.0**	**31.9**	**64**	**69**	**-28**
Average-Yr.	**-**	**-**	**144**	**-**	**-**	**90**	**35**	**70.6**	**45.9**	**303**	**190**	**34**
Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):								**25,786**	**16,764**			

(1) Percent reduction is calculated only for days when both influent and effluent tests were done

Table 4-4: Iona Island WWTP – 2009 Comprehensive Program Concentrations Summary

Parameters	Sample Type	INFLUENT			EFFLUENT		
		Max.	Min.	Ave.	Max.	Min.	Ave.
		mg/L (unless specified)			mg/L (unless specified)		
Kjeldahl Nitrogen	Comp.	32	14	27	28	12	24
N-Nitrate	Grab	1.31	<0.01	<0.25	1.48	<0.01	<0.22
N-Nitrite	Grab	0.11	<0.01	<0.05	0.11	<0.01	<0.04
N-Ammonia	Comp.	18.5	7.5	15.4	18.1	6.5	15.0
Sulphate	Comp.	31	16.4	21.5	34.3	16.4	21.8
Total Phosphorus	Comp.	5.19	1.89	4.00	3.90	1.62	3.17
Dissolved Phosphorus	Comp.	2.13	0.94	1.69	2.00	0.94	1.68
MBAS	Grab	1.0	0.6	0.8	1.7	0.3	1.1
Oil & Grease	Grab	23	8	13	14	<5	<10
Phenols	Grab	0.02	<0.01	<0.02	0.02	<0.01	<0.02
Cyanide Total	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aluminum Total	Comp.	1.11	0.39	0.67	0.49	0.24	0.33
Aluminum Dissolved	Comp.	0.08	0.03	0.05	0.09	0.03	0.05
Arsenic Total	Comp.	0.006	<0.001	<0.002	0.005	<0.001	<0.002
Barium Total	Comp.	0.031	0.020	0.024	0.030	0.011	0.016
Barium Dissolved	Comp.	0.020	0.006	0.009	0.019	0.006	0.009
Boron Total	Comp.	0.10	0.05	0.08	0.10	0.05	0.09
Boron Dissolved	Comp.	0.10	0.05	0.08	0.10	0.05	0.09
Calcium Total	Comp.	22.3	10.9	14.3	22.0	10.1	13.5
Cadmium Total	Comp.	0.0167	<0.0005	<0.0021	0.0130	<0.0005	<0.0017
Cadmium Dissolved	Comp.	0.0037	<0.0005	<0.0008	0.0057	<0.0005	<0.001
Chromium Total	Comp.	0.006	0.002	0.003	0.004	0.001	0.002
Chromium Dissolved	Comp.	0.002	<0.001	<0.002	0.002	<0.001	<0.002
Cobalt Total	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper Total	Comp.	0.139	0.053	0.106	0.107	0.052	0.085
Copper Dissolved	Comp.	0.037	0.017	0.026	0.050	0.020	0.031
Iron Total	Comp.	1.54	0.65	1.05	0.76	0.51	0.62
Iron Dissolved	Comp.	0.28	0.13	0.21	0.23	0.14	0.20
Lead Total	Comp.	0.090	0.002	0.012	0.036	0.001	0.005
Lead Dissolved	Comp.	0.002	<0.001	<0.002	0.004	<0.001	<0.002
Magnesium Total	Comp.	9.2	3.8	5.9	10.4	3.5	5.8
Manganese Total	Comp.	0.058	0.046	0.052	0.049	0.038	0.043
Manganese Dissolved	Comp.	0.039	0.028	0.033	0.037	0.027	0.033
Mercury Total **(µg/L)**	Comp.	0.23	<0.05	<0.125	0.09	<0.05	<0.06083
Molybdenum Total	Comp.	0.004	<0.002	<0.003	0.004	0.002	0.003
Molybdenum Dissolved	Comp.	0.003	<0.002	<0.003	0.004	<0.002	<0.002
Nickel Total	Comp.	0.004	0.001	0.002	0.002	<0.001	<0.002
Nickel Dissolved	Comp.	0.002	<0.001	<0.002	0.002	<0.001	<0.001
Selenium Total	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver Total	Comp.	0.002	<0.001	<0.002	0.001	<0.001	<0.001
Silver Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tin Total	Comp.	0.03	<0.01	<0.02	0.02	<0.01	<0.02
Tin Dissolved	Comp.	0.01	<0.01	<0.01	0.01	<0.01	<0.01
Zinc Total	Comp.	0.173	0.059	0.112	0.084	0.051	0.071
Zinc Dissolved	Comp.	0.052	0.028	0.039	0.05	0.023	0.038

Note: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.
See Appendix A2-10 & A2-11 for more details.

Table 4-5: Iona Island WWTP – 2009 Comprehensive Program Loadings Summary

Parameters	INFLUENT Max. (kg/day)	INFLUENT Min. (kg/day)	INFLUENT Ave. (kg/day)	INFLUENT Tonnes per year	EFFLUENT Max. (kg/day)	EFFLUENT Min. (kg/day)	EFFLUENT Ave. (kg/day)	EFFLUENT Tonnes per year
Kjeldahl Nitrogen	15690	11600	13200	4820	13800	9640	11500	4190
N-Nitrate	1310	<4	<180	<66	1479	<4	<180	<64
N-Nitrite	80	<5	<27	<9.9	70	<4	<21	<7.7
N-Ammonia	8680	6340	7450	2720	8680	5860	7260	2650
Sulphate	16400	6940	10800	3950	17900	7100	11000	4020
Total Phosphorus	2380	1610	1930	704	1860	1190	1540	562
Dissolved Phosphorus	940	662	824	301	1010	590	821	300
MBAS	600	281	391	143	837	300	530	193
Oil & Grease	11000	4240	6320	2310	6000	<3400	<4700	<1800
Phenols	11	<4	<7	<3	11	<4	<6	<3
Cyanide Total	<20	<8	<11	<4	<20	<8	<11	<4
Aluminum Total	581	234	335	122	320	103	172	63
Aluminum Dissolved	40	12	23	8	48	12	24	9
Arsenic Total	3.1	<0.4	<0.9	<0.4	2.6	<0.4	<0.9	<0.3
Barium Total	31	7.9	12	4.6	30	4.4	8.8	3.2
Barium Dissolved	20	2.4	5.0	1.8	19	2.4	4.9	1.8
Boron Total	52	36	41	15	52	36	42	15
Boron Dissolved	50	36	41	15	52	32	42	15
Calcium Total	22300	4380	7690	2810	22000	4060	7320	2670
Cadmium Total	6.8	<0.2	<1.0	<0.4	5.3	<0.2	<0.8	<0.3
Cadmium Dissolved	1.5	<0.2	<0.4	<0.2	2.3	<0.2	<0.5	<0.2
Chromium Total	3.1	0.8	1.5	0.5	2.1	0.4	0.9	0.3
Chromium Dissolved	1.1	<0.4	<0.6	<0.3	1.0	<0.4	<0.6	<0.3
Cobalt Total	<1	<0.4	<0.6	<0.2	<1	<0.4	<0.6	<0.2
Cobalt Dissolved	<1	<0.4	<0.6	<0.2	<1	<0.4	<0.6	<0.2
Copper Total	66	38	51	19	52	29	41	15
Copper Dissolved	18	8.9	13	4.7	26	10	15	5.6
Iron Total	805	375	520	190	570	235	317	116
Iron Dissolved	130	83	101	37	140	79	97	35
Lead Total	37	1.1	5.0	1.8	15	0.4	2.1	0.8
Lead Dissolved	1.0	<0.4	<0.6	<0.2	2	<0.4	<0.7	<0.3
Magnesium Total	4800	1530	2970	1080	5440	1420	2940	1070
Manganese Total	46	19	26	10	43	15	22	8.1
Manganese Dissolved	34	11	17	6.2	32	11	17	6.1
Mercury Total	0.12	<0.03	<0.06	<0.03	0.08	<0.02	<0.04	<0.02
Molybdenum Total	3.0	<0.9	<1.2	<0.6	3.0	0.8	1.4	0.5
Molybdenum Dissolved	2.0	<0.8	<1.1	<0.4	2.0	<0.8	<1.3	<0.5
Nickel Total	2.1	0.5	1.1	0.4	1.1	<0.5	<0.9	<0.3
Nickel Dissolved	1.0	<0.4	<0.6	<0.3	1.1	<0.4	<0.8	<0.3
Selenium Total	<10	<4	<6	<2	<10	<4	<6	<2
Silver Total	1.0	<0.4	<0.6	<0.3	1.0	<0.4	<0.6	<0.2
Silver Dissolved	<1.0	<0.4	<0.6	<0.2	<1.0	<0.4	<0.6	<0.2
Tin Total	17	<4	<7	<3	10	<5	<6	<2
Tin Dissolved	10	<4	<6	<2	10	<4	<6	<2
Zinc Total	90	41	55	20	51	28	35	13
Zinc Dissolved	28	13	20	7.1	25	14	19	6.8

Method: Maximums, minimums and averages calculated from loadings obtained for each sampling date.

4.6 Effluent Toxicity

In 2000, comprehensive assessment of acute effluent toxicity showed that fish mortality was largely due to oxygen depletion during the 96 hour LC50 test. This was a result of the high dissolved-oxygen demand of an active microbial population in the non-disinfected effluent. Ongoing studies using aeration supplemented with pure oxygen resulted in marked improvements in fish survival during the test. Other studies and ongoing monitoring by the GVS&DD showed that the high initial dilution of the Iona effluent in the marine environment will maintain dissolved oxygen at an acceptable concentration for the protection of aquatic life.

Environment Canada's standard reference method[6] for determining acute lethality of effluents to Rainbow trout exposes test fish to a series of effluent dilutions, and determines the fish survival rate at the end of a 96-h exposure period. The final result is reported as the 96-h LC_{50} value, which is the % by volume (of the original sample) at which 50% of the test fish survive. A pass for all effluent samples requires that the LC_{50} value must be *equal to* or *greater than* 100% (v/v sample). This means that 50% or more of the test fish must survive for 96 hours in the original undiluted sample.

In 2008, Environment Canada published an add-on test procedure[7] for pH stabilization during the testing of acute lethality. The add-on procedure is applicable only to wastewater effluents. The purpose of pH stabilization is to replace the CO_2 lost due to aeration in order to maintain the pH throughout the test at the same levels observed at the start of the test. This add-on procedure recognizes that toxicity observed in municipal wastewater effluents may be an artifact of the standard reference method.

The add-on procedure can be used only when the standard reference method gives a false result due to pH shift during the test. Consequently a second test is run concurrently with the standard reference method. The second test utilizes the reference method with the add-on pH stabilization procedure.

Other tests are also run in conjunction with the standard reference method whenever the dissolved oxygen concentration of the effluent sample is equal to or less than 3.0 mg/L after the pre-aeration step. These additional tests involve the use of oxygen and a combination of O_2/CO_2 to supplement sample aeration during testing.

2009 Program

As required by the Liquid Waste Management Plan and the plant's Operational Certificate, all regular LC_{50} results for effluent samples from GVS&DD WWTPs are followed up with work to explain the cause of results of less than 100%. Outlined below is a summary of Iona effluent toxicity results and evaluations for 2009.

All but four effluent samples from the Iona Plant passed the required monthly toxicity test using Environment Canada's standard reference method (8 cases). In order for the exception samples (4 cases) to pass, more oxygen had to be added to these samples in excess of the procedure in the technical specifications of the Environment Canada method. Other studies and ongoing monitoring by the GVS&DD showed that the high initial dilution of the Iona effluent in the marine environment will maintain dissolved oxygen at an acceptable concentration for the protection of aquatic life.

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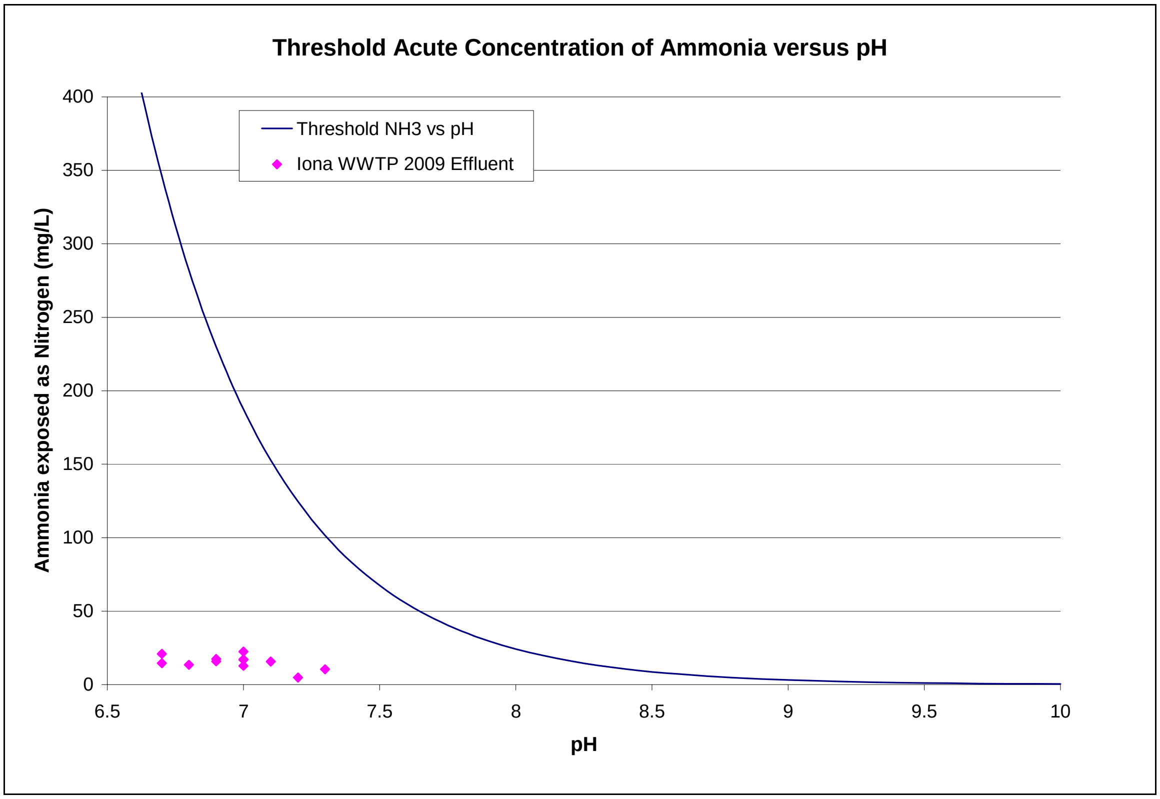
[6] Environment Canada, Report EPS 1/RM/13, Second Edition – December 2000, p 9.
[7] Environment Canada, Report EPS 1/RM/50 – March 2008, p. 10.

Additionally, the pH and ammonia values in 2009 showed that the concentration of ammonia in the undiluted effluent was not acutely toxic at the measured pH values. This is demonstrated in the following chart for pH and ammonia data collected during the year.

Figure 4-1: Iona Island WWTP - Ammonia Concentration versus pH Value



4.7 Digested Sludge Monitoring

Iona WWTP operates mesophilic digesters which produce digested sludge to Class B pathogen levels. The sludge is further processed via lagoon stabilization. The land-dried materials are stockpiled at Iona WWTP.

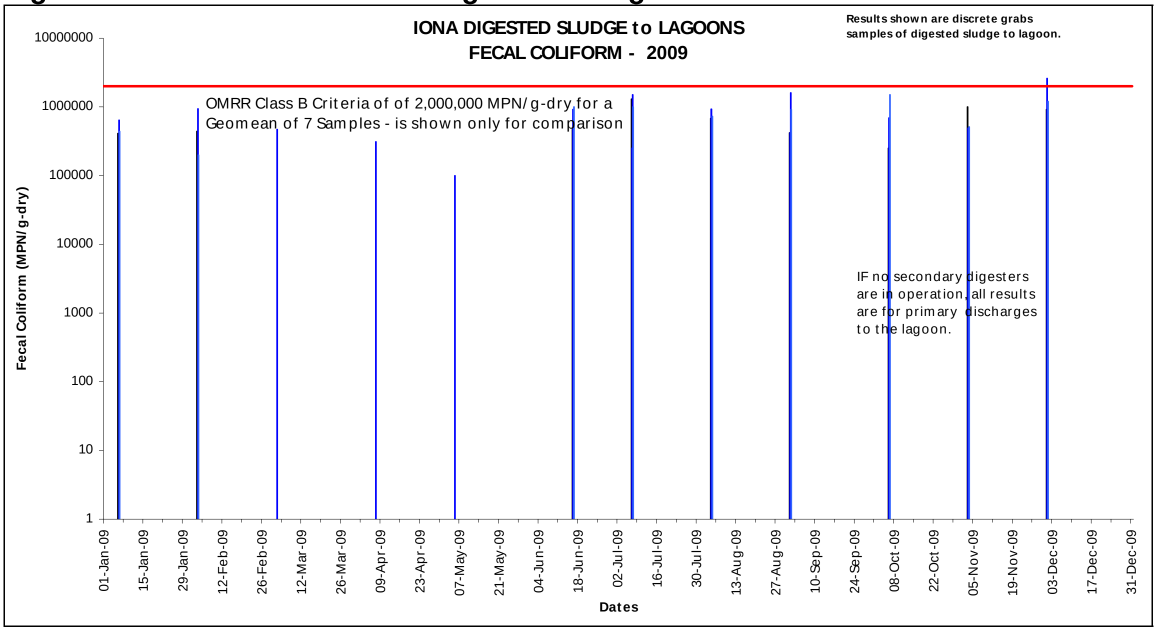
Results of monthly composite testing programs for digested sludge and the criteria values required under the Organic Matter Recycling Regulation, February, 2002 are shown in the following table:

Class B Criteria	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Moly	Nickel	Selenium	Zinc	Fecal Coliform (MPN/g)*
(mg/kg)	**75**	**20**	**1060**	**150**	**2200**	**500**	**5**	**20**	**180**	**14**	**1850**	**2,000,000**
MAX	6	8.4	55	6.7	814	118	4.5	9.8	26	4.5	810	2,600,000
MIN	3	2.8	39	4.1	630	62	1.3	5.6	20	2.6	594	100,000
AVE	4	4.5	47	5.3	718	83	2.7	7.0	23	3.4	660	604,000*
# Times Exceeded	0	0	0	0	0	0	0	0	0	0	0	-

* Geomean for the Year

Iona Island WWTP is not required to meet OMRR parameters as digested sludges are not directly applied to land.

Figure 4-2: Iona Island WWTP Digested Sludge – Fecal Coliform



Additional Information for 2008 and 2009 Fecal Coliforms and Metals Data are found in: Appendix D - Biosolids and Digester Sludge Monitoring Programs.

Lions Gate WWTP

5.0 LIONS GATE WWTP

5.0 LIONS GATE WWTP 2009 ANNUAL SUMMARY

5.1 Effluent Quality

The quality of effluent from the Lions Gate WWTP in 2009 is summarized in the following table, along with compliance with parameters listed in the Operational Certificates.

Table 5-1: Lions Gate WWTP – 2009 Compliance Summary

Operational Certificate Requirement- ME-00030, April 23,2004

Compliance Parameters	Frequency	OC Limits	Max. Value for the Year	No. of times Criteria Exceeded												
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr to Date
Total Plant Flow (MLD)	Daily	318*	241	0	0	0	0	0	0	0	0	0	0	0	0	0
BOD (mg/L)**	3/Week	130	134	0	1	0	0	0	0	0	0	0	0	0	0	1 of 103
Suspended Solids (mg/L)	5/Week	130	97.0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOD (Tonnes/Day)**	3/Week	13.5	13.8	1	0	0	0	0	0	0	0	0	0	0	0	1 of 103
Suspended Solids (Tonnes/Day)	5/Week	14.5	14.6	1	0	0	0	0	0	0	0	0	0	0	0	1 of 365
Chlorine Residual (mg/L)	Daily	<0.1	0.3	0	0	0	0	0	1	0	1	0	0	0	0	2 of 156
Disinfection Failure	-	-	-	0	0	0	0	0	0	2	0	1	0	0	0	3 of 156

* April 23, 2004 New Operational Certificate: Discharge limit based on total flow of 318,000 m3/day.
** BOD reported 1/week when COD are reported 5/week

Monitoring Parameters	OC Frequency	Sample Type	Year 2009 Maximum	Minimum	Average
pH***	1/Month	Grab	7.4	6.9	7.1
Toxicity,96 hour LC_{50} (%v/v)	1/Month	Grab	>100	94	>99
Ammonia (mg/L)***	2/Month	Grab	32.4	3.7	15.1
Hardness (mg/L CaCO3)	1/Month	Comp	266	161	213
COD (mg/L)**	5/Week	Comp	314	113	210
Conductivity (umhos/cm)	-	Grab	3610	690	2384
Temperature ^oC	1/Month	Grab	20	10	15
Fecal Coliform (Summer) MPN	1/week	Grab	2800000	20	216
Residual Chlorine (mg/L)	Daily	Grab	0.3	<0.1	<0.1
Chloride (mg/L)	-	Comp	960	160	623
Phenol (mg/L)	-	Grab	0.02	<0.01	<0.01
Oil and Grease (mg/L)	-	Grab	13	<5	<9
Aluminum, Total (mg/L)	1/Month	Comp	0.37	0.26	0.31
Arsenic, Total (mg/L)	1/Month	Comp	0.001	<0.001	<0.001
Barium, Total (mg/L)	1/Month	Comp	0.04	0.02	0.02
Boron, Total (mg/L)	1/Month	Comp	0.31	0.16	0.23
Cadmium, Total (mg/L)	1/Month	Comp	<0.0005	<0.0005	<0.0005
Chromium, Total (mg/L)	-	Comp	0.002	<0.001	<0.001
Cobalt, Total (mg/L)	-	Comp	<0.001	<0.001	<0.001
Copper, Total (mg/L)	1/Month	Comp	0.107	0.072	0.092
Cyanide, Total (mg/L)	-	Grab	<0.02	<0.02	<0.02
Iron, Total (mg/L)	1/Month	Comp	1.12	0.70	0.86
Lead, Total (mg/L)	1/Month	Comp	0.002	<0.001	<0.002
Manganese, Total (mg/L)	-	Comp	0.088	0.043	0.058
Mercury, Total (µg/L)	1/Month	Comp	0.06	<0.05	<0.06
Molybdenum, Total (mg/L)	1/Month	Comp	0.003	<0.002	<0.003
Nickel, Total (mg/L)	1/Month	Comp	0.003	0.001	0.002
Selenium, Total (mg/L)	1/Month	Comp	0.01	<0.01	<0.01
Silver, Total (mg/L)	1/Month	Comp	<0.001	<0.001	<0.001
Tin, Total (mg/L)	-	Comp	<0.01	<0.01	<0.01
Zinc, Total (mg/L)	1/Month	Comp	0.093	0.056	0.067

*** Minimum, Maximum and average values are calculated from all available weekly grab data.
**** Fecal Coliform results are geomean values and are only done during the disinfection period under the new Operational Certificate.
Note 1. Toxicity requirements, April 23, 2004 Operational Certificate: If a fish bioassay toxicity test fails to meet or exceed a LC_{50} value of 100%, the permittee is required to conduct a Toxicity Identification Evaluation (TIE) study for the purpose of determining the probable cause of the failure.
Note 2: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.

5.2 Compliance Review (ME-00030) and Performance Summary

The Lions Gate WWTP effluent permit (February 4, 1998) was replaced with Operational Certificate ME-00030, issued April 23, 2004 by the Ministry of Environment under the provisions of the Waste Management Act. The new operational certificate included revised compliance levels for BOD and suspended solids loadings. The loadings parameters listed as "maximum daily loadings" are used to calculate the annual waste discharge fees as required by the Waste Management Waste Permit Fee regulation and are based on a calendar year.

Previous Permit Levels	BOD (tonnes/day)	Susp. Solids (tonnes/day)
On and from February 17, 1999	14.456	15.346
On and from February 17, 2000	14.889	15.806
Operational Certificate Levels		
2004 (effective April 23, 2004)	12.0	13.0
2005	12.5	13.5
2006	13.0	14.0
2007 and thereafter	13.5	14.5

Discharge Monitoring
A total of 25 parameters and the two daily loadings for final effluent are posted on Metro Vancouver's website on a monthly basis, however, specific compliance levels apply to only six parameters: Total daily discharge flow, BOD, suspended solids, chlorine residual and maximum daily loadings for BOD and suspended solids.

5.2.1 Compliance Review

In 2009, Lions Gate Wastewater Treatment Plant met all the monitoring requirements for flow and suspended solids (TSS) concentration. However, the Operational Certificate levels for BOD concentration, BOD loading, TSS loading, and chlorine residual were exceeded on at least one occasion. See Table 5.1 for details on the level of compliance.

The BOD loading and TSS loading non-compliance occurred on January 6 as the result of an exceptionally high wet weather flow event. On February 17, the effluent BOD exceeded the OC limit possibly as the result of an unusual plant influent with a high COD loading.

Disinfection
The effluent is disinfected using hypochlorite between May 1 and September 30 so that the Burrard Inlet coliform water quality objective is not exceeded at the edge of the initial dilution zone as described in the Municipal Sewage regulation.

The plant continued to use sodium hypochlorite solution for disinfection and SO_2 gas for dechlorination prior to discharge to Burrard Inlet. The average chlorine dosage was 6.8 mg/L and average SO_2 dosage was 1.6 mg/L during the disinfection period.

The plant had three instances of disinfection failure which occurred on July 5, July 6 and September 3. About 64 ML of non-chlorinated effluent was discharged on July 5 because the hypochlorite pump discharge flow piping was damaged preventing the hypochlorite disinfection chemical from reaching the plant effluent. On July 6, a logic error in a recently configured logic control for an upgraded alarm caused a sodium hypochlorite pump failure. About 2.4 ML of effluent was released with no chlorine disinfection. On September 3, a leak in the SO_2 system caused an automatic shutdown of the entire disinfection system resulting in a discharge of 4.8 ML of non-chlorinated effluent.

The Plant had two instances of effluent dechlorination failure. On June 15, there was a discharge of 6.1 ML of primary sewage containing approximately 0.53 mg/L of residual chlorine. This occurred when the residual chlorine analyzers were out of calibration at the same time that the Plant was experiencing a fluctuation in chlorine demand. On August 10, there was an incident of reduced dechlorination of the effluent that resulted from fouling of the online chlorine analyzer cell. The effluent may have contained residual chlorine of 0.15 mg/L for a period of approximately 1 hour for a total volume of 4.26 ML.

The 30-day Geometric Means calculated for fecal coliform levels in final effluent and at the edge of the initial dilution zone (IDZ) are summarized in the following table. In 2009, the calculated results for fecal coliform levels at the edge of the IDZ met the Burrard Inlet fecal water quality objective (WQO) of 200 MPN/100/ml.

Table 5-2: 30 day Fecal Coliform Geomean at the Lions Gate WWTP IDZ

Final Effluent	May	June	July	August	September
Max 30 day Gmean*	-	626	2005	292	86
Dil Factor**	-	250	250	250	250
IDZ Result ***	-	2.5	8.0	1.2	0.3
WQO (pass or fail)	-	Pass	Pass	Pass	Pass

* Gmean (MPN/100ml) over 30 day period.
** Dil Factor - minimum dilution factor for initial dilution zone at the Lions Gate outfall.
*** IDZ Result - determined by calculation of Geometric Mean of fecal coliforms levels in the receiving water due to discharges of final effluent, for 30 day periods at the edge of the initial dilution zone (IDZ). The IDZ Result is determined only during disinfection season (May 1-September 30).

5.2.2 Performance Summary

The Lions Gate Wastewater Treatment Plant (LG WWTP) treated a total of 33,974 ML in 2009. The highest daily flow of 241 MLD and maximum peak of 3.4 m^3/sec or 293 MLD were recorded in January. As indicated by the elevated chloride levels, storm water and seawater infiltration to the wastewater collection system contributed to the total daily flow. The average daily flow of 93 MLD was 3.3% higher compared to the 2008 average of 90 MLD.

The average influent suspended solids and BOD concentrations were 1.0% and 3.7% lower as compared with 2008 data. The influent BOD loading was 3.1 % lower in 2009 than in 2008 while the influent SS loading was about the same for the two years.

Lions Gate WWTP continued to produce good primary treated effluent quality. Suspended solids concentrations were within the range of 40 mg/L to 97 mg/L with an average value of 60 mg/L. Total BOD results were within the range of 47 mg/L to 134 mg/L with an average value of 91 mg/L. The highest effluent BOD concentration of 134 mg/L was reported on February 17 when the Plant received an exceptionally high influent organic loading with an unusual wine-like odour. On the same day, a Metro Vancouver environmental monitoring technician found an unusually high COD and solids discharge at an industrial connection to the LG WWTP wastewater collection system.

During long periods of dry weather and low plant flows, a significant generation of soluble BOD is noted within the plant that increases effluent BOD. The conditions for the generation of soluble BOD increase with the higher wastewater temperatures prevalent during the summer months.

The 2009 average suspended solids reduction was 62 % and the average BOD reduction was 38 %. The suspended solids reductions were at or near their lowest in January, March, and November which coincided with the higher flow periods. While there was more variability with BOD reductions, some of the lowest BOD reductions also occurred during the high flow periods of the year.

Table 5-3: 2000 - 2009 Annual Average Data for Flow, Suspended Solids and BOD

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD mg/L		BOD Tonnes/year	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2000	96	162	58	5609	2040	131	86	4479	2963
2001	92	189	53	6215	1770	131	92	4330	3047
2002	90	168	53	5416	1736	139	91	4479	2912
2003	92	165	54	5364	1806	135	89	4404	2897
2004	92	163	56	5335	1889	132	83	4317	2745
2005	91	189	57	6112	1903	146	91	4644	2927
2006	92	184	56	5890	1879	170	97	5358	3139
2007	98	173	57	5848	2047	158	91	5278	3083
2008	90	169	61	5448	2012	154	95	4970	3074
2009	93	167	60	5435	2031	148	91	4814	2973

5.3 Sedimentation Tank and Primary Sludge Thickener Studies

There were more sedimentation tank studies during July 2009 to supplement the studies in 2008 and in March 2009. The focus of the 2009 studies was to determine if there is more solubilization of COD at higher wastewater temperatures.

There was some indication of increased solubilization of COD at higher wastewater temperatures. However, at 19 °C on July 20, there were mixed results. While there was some indication of COD solubilization in three of the smaller sedimentation tanks (# 3, 7, & 8), there was little indication of solubilization in the two large tanks that represent 61 % of the flow. For the combined flow through the sedimentation tanks, there appeared to be about a 2 % increase in soluble COD.

On July 20, a thickener overflow sample was collected during the sedimentation tank study. On that day, the soluble COD loading contributed to the Plant effluent from in the thickener overflow (77 %) was significantly higher than the soluble COD loading from the sedimentation tanks (23 %). In the future, more studies will be done to determine the best way to minimize solubilization of COD and BOD in the sedimentation tanks and in the primary sludge thickener. For the sedimentation tanks, studies will be done to determine the best flow balance among the tanks. For the primary sludge thickener, chemical treatment studies will be done to inhibit acid fermentation.

5.4 Sludge Treatment /Dewatering

One of the two digesters, digester # 4, was out of service for cleaning, maintenance, and renovations since August 11, 2008. As the result of having only one digester in operation during the year, the average hydraulic retention time was 18 days and the average volatile solids reduction was 67 % in 2009. That is down in comparison with an average HRT of 25 days and an average volatile reduction of 69 % in 2008 when two digesters were in operation for more than half of the year.

On May 19, the digester #3 volatile acids/bicarbonate alkalinity ratio (0.3) indicated an upset condition in the digester. There was no significant increase in loading. However, there was a problem with scum build up in the digester and a scum removal system that was not working. It is possible that some of the scum entered the digester mixing zone causing an overload condition. As the plant has only one operating digester, it was necessary to truck thickened primary sludge away to stabilize the digester performance. Annacis plant received thickened primary sludge from May 25 to June 15. As the digester condition improved, the proportion of sludge trucked to Annacis was reduced.

A contributing factor to the above noted digester #3 upset was the relatively low bicarbonate alkalinity concentration (approximately 2,500 mg/L) in the digester prior to the upset. When the organic loading to the digester was reduced by trucking thickened primary sludge to Annacis, the bicarbonate alkalinity in digester # 3 increased to above 3,000 mg/L. Primary thickener control was improved to prevent digester alkalinity washout. Higher bicarbonate alkalinity concentrations are required to buffer increases in organic loading.

Sludge dewatering is provided by one of two centrifuges operated 6 days per week on a 4 to 8 hours per day basis. During the 7 am to 11 am period when the diurnal ammonia levels are high, centrate from the dewatering operation is stored in the old chlorination tank. Between 11 am and 7 am, the stored centrate is slowly returned to the influent channel.

The average total solids in dewatered sludge (biosolids) was 31.2 % and centrate suspended solids was 2,590 mg/L with an average recovery of 84.6 %. The average polymer dosage was 5.7 kg/tonne.

Table 5-4: Lions Gate WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Max. Inst.Flow Rate (m^3/sec)	Total Daily Effluent Flow (MLD)			Composite Average pH		Grab pH	Grab NH3 (mg/L)	96 hr LC50 (%v/v) FINAL EFF	
		Max.	Min.	Ave.	INF	EFF	EFF	EFF	Regular	Parallel CO2
JAN	3.39	241	83	117	7.2	7.3	7.1	13.7	>100	>100
FEB	1.63	107	81.5	90.5	7.2	7.3	7.1	16.6	>100	>100
MAR	1.98	133	80.1	96.1	7.2	7.2	7.1	14.8	>100	>100
APR	1.88	121	77.7	88.7	7.2	7.3	7.0	14.5	>100	>100
MAY	1.45	89.8	75.3	81.0	7.2	7.4	7.2	14.9	>100	>100
JUN	1.28	81	73.3	77.6	7.1	7.3	7.3	19.0	94	>100
JUL	1.41	83.4	73.5	76.8	7.0	7.2	7.0	15.1	98	>100
AUG	1.54	90.1	72.9	76.7	7.0	7.2	7.3	16.6	>100	>100
SEP	1.54	93	76.0	80.6	7.1	7.3	7.1	15.6	>100	>100
OCT	2.35	142	74.0	95.6	7.1	7.3	7.0	11.5	>100	>100
NOV	2.99	196	90.0	135	7.2	7.3	7.1	12.8	>100	>100
DEC	3.17	170	85.6	101	7.1	7.3	7.1	16.5	>100	>100
# Samples	-	-	-	365	241	247	57	58	12	12
Maximum-Yr.	**3.39**	**241**	**-**	**-**	**7.4**	**7.5**	**7.4**	**32.4**	**>100**	**>100**
Minimum-Yr.	**-**	**-**	**72.9**	**-**	**6.8**	**7.0**	**6.9**	**3.7**	**94**	**>100**
Average-Yr.	**-**	**-**	**-**	**93.1**	**7.1**	**7.3**	**7.1**	**15.1**	**>99**	**>100**

MONTH	Average Conductivity (umhos/cm)		Ave Chloride (mg/L)	Ave Temp. (oC)	Chlorine Dosage (mg/L)	Ave. Residual Chlorine (mg/L)		Residual SO_2 (mg/L)	Fec. Coliform (MPN/100mL) Final	
	RAW INF	FINAL EFF	FINAL EFF	FINAL EFF	FINAL EFF	Before SO_2	After SO_2	Effluent Outfall	Monthly Geomean	Max Geomean in month
JAN	1974	2015	480	10	-	-	-	-	-	-
FEB	2691	2623	700	10	-	-	-	-	-	-
MAR	2512	2513	633	11	-	-	-	-	-	-
APR	2175	2163	559	13	4.8	1.2	<0.1	0.8	-	-
MAY	2110	2180	526	14	4.9	0.9	<0.1	1.2	135	-
JUN	2118	2290	613	17	6.3	1.1	0.30	1.3	626	626
JUL	2724	2734	709	18	7.4	1.1	<0.1	0.9	251	2005
AUG	2829	2851	794	20	8.2	1.1	0.20	1.0	74	292
SEP	2692	2743	733	20	7.3	1.0	<0.1	1.1	74	86
OCT	2592	2602	720	18	-	-	-	-	1700000	226
NOV	1502	1589	418	15	-	-	-	-	-	-
DEC	2165	2243	568	12	-	-	-	-	-	-
# Samples	242	248	52	12	156	147	156	154	46	
Maximum-Yr.	**3760**	**3610**	**960**	**20**	**10.6**	**2.4**	**0.30**	**2.3**	**2800000**	**7483**
Minimum-Yr.	**718**	**690**	**160**	**10**	**3.9**	**<0.1**	**<0.1**	**<0.01**	**20.0**	**49**
Average-Yr.	**2353**	**2384**	**623**	**15**	**6.8**	**<0.97**	**<0.1**	**<1.07**	**-**	
Geomean	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**216**	

(1) pH, ammonia, Dissolved Oxygen, Temperature,Residual Chlorine, 96 hour LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.
(2) Residual Chlorine were taken before dechlorination, mg/L.
(3) Summer = April 28 - Sept. 30, 2009 inclusive: Chlorinated Effluent;
Winter = Jan. 1 - Apr. 27, 2009 and Oct. 1 - Dec. 31, 2009: No Chlorination .

Table 5-4 Con't: Lions Gate WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Total Suspended Solids (mg/l)						Susp. Solids % Average	Total Susp. Solids Average Loadings (Tonnes/day)		Average VSS (mg/L)		VSS % Average
	INFLUENT			EFFLUENT								
	Max.	Min.	Ave.	Max.	Min.	Ave.	Reduction	INF	EFF	INF	EFF	Reduction
JAN	184	66	135	78	43	60	54	14.7	6.8	123	54	54
FEB	210	120	162	94	59	69	57	14.5	6.2	144	62	56
MAR	178	105	144	87	60	72	50	13.7	6.9	133	64	51
APR	304	103	166	86	57	71	56	14.6	6.3	153	63	57
MAY	314	164	214	69	47	60	71	17.3	4.8	193	53	72
JUN	304	176	211	74	49	57	73	16.3	4.4	189	51	73
JUL	208	152	178	72	44	56	69	13.7	4.3	167	50	70
AUG	254	154	179	75	43	56	69	13.7	4.3	169	51	70
SEP	242	132	180	66	40	53	70	14.5	4.3	167	49	71
OCT	368	111	169	94	44	60	63	15.6	5.6	151	53	64
NOV	208	72	115	65	43	51	54	15.3	6.8	107	46	54
DEC	226	100	150	97	46	61	58	14.8	6.1	137	56	58
# Samples	-	-	356	-	-	365	356	356	365	236	242	236
Maximum-Yr.	**368**	**-**	**-**	**97**	**-**	**-**	**82**	**30.2**	**14.6**	**286**	**91**	**83**
Minimum-Yr.	**-**	**66**	**-**	**-**	**40**	**-**	**22**	**10.1**	**3.1**	**64**	**39**	**19**
Average-Yr.	**-**	**-**	**167**	**-**	**-**	**60**	**62**	**14.9**	**5.6**	**153**	**54**	**63**
Total to Date - Suspended Solids Loadings (Tonnes):								**5,435**	**2,031**			

MONTH	Biochemical Oxygen Demand (mg/L)						BOD (%) Average	BOD Average Loadings (Tonnes/day)		Average COD (mg/L)		COD % Average
	INFLUENT			EFFLUENT								
	Max.	Min.	Ave.	Max.	Min.	Ave.	Reduction	INF	EFF	INF	EFF	Reduction
JAN	182	107	148	123	62	93	36	16.7	10.0	287	191	33
FEB	192	135	155	134	84	100	35	14.2	9.2	332	218	34
MAR	166	109	137	101	82	90	33	12.9	8.6	312	212	31
APR	168	102	142	103	77	92	34	12.4	8.1	335	205	38
MAY	199	146	162	119	85	98	39	13.5	8.2	384	217	42
JUN	211	154	182	104	92	96	47	14.3	7.6	415	224	45
JUL	177	136	153	110	80	92	40	11.8	7.1	366	222	39
AUG	169	107	146	106	83	93	36	11.2	7.1	363	228	37
SEP	191	129	158	112	85	97	38	12.9	7.9	371	231	37
OCT	200	102	154	102	68	89	41	13.2	7.7	323	212	33
NOV	127	65	94	80	47	62	35	12.1	7.8	232	154	33
DEC	204	96	139	111	65	85	38	13.9	8.9	318	208	34
# Samples	-	-	100	-	-	103	100	100	103	301	313	301
Maximum-Yr.	**211**	**-**	**-**	**134**	**-**	**-**	**55**	**30.2**	**13.8**	**586**	**314**	**64**
Minimum-Yr.	**-**	**65**	**-**	**-**	**47**	**-**	**18**	**8.4**	**6.2**	**116**	**113**	**3**
Average-Yr.	**-**	**-**	**148**	**-**	**-**	**91**	**38**	**13.2**	**8.1**	**337**	**210**	**36**
Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):								**4,814**	**2,973**			

(1) Percent reduction is calculated only for days when both influent and effluent tests were done

Table 5-5: Lions Gate WWTP – 2009 Comprehensive Program Concentrations Summary

Parameters	Sample Type	INFLUENT Max.	INFLUENT Min.	INFLUENT Ave.	EFFLUENT Max.	EFFLUENT Min.	EFFLUENT Ave.
		mg/L (unless specified)			mg/L (unless specified)		
Kjeldahl Nitrogen	Comp.	31	20	27	34	17	26
N-Nitrate	Grab	0.90	<0.01	<0.30	1.01	<0.01	<0.24
N-Nitrite	Grab	0.10	<0.01	<0.06	0.07	<0.01	<0.04
N-Ammonia	Comp.	19.0	12.4	17.0	21.8	12.0	18.1
Sulphate	Comp.	135	63.5	95.9	114	56.3	90.6
Total Phosphorus	Comp.	4.88	3.27	4.06	4.21	2.61	3.63
Dissolved Phosphorus	Comp.	2.16	1.51	1.86	2.93	1.38	2.21
MBAS	Comp.	1.8	0.9	1.2	2.2	0.6	1.5
Oil & Grease	Grab	32	13	26	13	<5	<9
Phenols	Grab	0.04	0.01	0.02	0.02	<0.01	<0.01
Cyanide Total	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aluminum Total	Comp.	0.76	0.45	0.51	0.37	0.26	0.31
Aluminum Dissolved	Comp.	0.05	0.02	0.03	0.09	0.02	0.04
Arsenic Total	Comp.	0.002	<0.001	<0.002	0.001	<0.001	<0.001
Barium Total	Comp.	0.043	0.021	0.028	0.035	0.016	0.021
Barium Dissolved	Comp.	0.017	0.008	0.011	0.025	0.008	0.012
Boron Total	Comp.	0.34	0.18	0.24	0.31	0.16	0.23
Boron Dissolved	Comp.	0.33	0.17	0.23	0.30	0.15	0.23
Calcium Total	Comp.	28.8	20.8	23.5	26.0	19.8	23.3
Cadmium Total	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium Dissolved	Comp.	<0.0005	<0.0005	<0.0005	0.0005	<0.0005	<0.0005
Chromium Total	Comp.	0.004	0.002	0.003	0.002	<0.001	<0.001
Chromium Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt Total	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper Total	Comp.	0.140	0.088	0.122	0.107	0.072	0.092
Copper Dissolved	Comp.	0.022	0.007	0.015	0.048	0.007	0.019
Iron Total	Comp.	1.48	0.95	1.15	1.12	0.70	0.86
Iron Dissolved	Comp.	0.27	0.14	0.18	0.32	0.15	0.21
Lead Total	Comp.	0.004	<0.001	<0.003	0.002	<0.001	<0.002
Lead Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium Total	Comp.	57.6	26.7	39.2	49.2	23.4	37.5
Manganese Total	Comp.	0.092	0.045	0.061	0.088	0.043	0.058
Manganese Dissolved	Comp.	0.076	0.035	0.046	0.075	0.035	0.047
Mercury Total **(µg/L)**	Comp.	0.40	0.07	0.15	0.06	<0.05	<0.06
Molybdenum Total	Comp.	0.004	<0.002	<0.003	0.003	<0.002	<0.003
Molybdenum Dissolved	Comp.	0.002	<0.002	<0.002	0.002	<0.002	<0.002
Nickel Total	Comp.	0.010	0.002	0.007	0.003	0.001	0.002
Nickel Dissolved	Comp.	0.008	0.001	0.005	0.002	<0.001	<0.001
Selenium Total	Comp.	0.02	<0.01	<0.02	0.01	<0.01	<0.01
Silver Total	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tin Total	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tin Dissolved	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc Total	Comp.	0.110	0.072	0.089	0.093	0.056	0.067
Zinc Dissolved	Comp.	0.039	0.024	0.032	0.046	0.023	0.033

NOTE: In calculating average results, all < or > signs are removed and the number values are used in the calculations. The sign is added back to the calculated average value. See Appendix A3-10 & A3-11 for more details.

Table 5-6: Lions Gate WWTP – 2009 Comprehensive Program Loadings Summary

Parameters	INFLUENT				EFFLUENT			
	Max.	Min.	Ave.	Tonnes	Max.	Min.	Ave.	Tonnes
	kg/day			per year	kg/day			per year
Kjeldahl Nitrogen	2610	2170	2400	875	2680	2170	2320	846
N-Nitrate	119	<0.9	<32	<12	133	<0.8	<27	<9.6
N-Nitrite	10	<0.8	<5.1	<1.9	6.6	<0.8	<3.6	<1.4
N-Ammonia	1620	1380	1500	547	1820	1370	1630	597
Sulphate	10600	6110	8410	3070	9670	5700	8170	2980
Total Phosphorus	427	320	358	131	353	298	328	120
Dissolved Phosphorus	201	139	164	60	227	168	198	72
MBAS	145	79	107	39	184	79	128	47
Oil & Grease	4180	1710	2380	867	1140	<390	<820	<300
Phenols	3.4	0.8	1.8	0.6	1.7	<0.8	<1.0	<0.4
Cyanide Total	<2.7	<1.6	<1.9	<0.7	<2.7	<1.6	<1.9	<0.7
Aluminum Total	61	39	46	17	43	21	29	10
Aluminum Dissolved	4.1	1.6	2.8	1.0	7.9	1.6	3.6	1.3
Arsenic Total	0.17	<0.08	<0.1.0	<0.04	0.13	<0.08	<0.1.0	<0.04
Barium Total	3.8	1.8	2.5	0.9	4.6	1.3	2.1	0.8
Barium Dissolved	1.6	0.6	1.0	0.4	3.3	0.6	1.2	0.4
Boron Total	27	17	21	7.7	25	16	21	7.7
Boron Dissolved	26	16	21	7.5	24	16	20	7.4
Calcium Total	2970	1690	2100	767	3420	1610	2180	795
Cadmium Total	<0.07	<0.04	<0.05	<0.02	<0.07	<0.04	<0.046	<0.02
Cadmium Dissolved	<0.07	<0.04	<0.05	<0.02	0.07	<0.04	<0.05	<0.02
Chromium Total	0.38	0.15	0.23	0.08	0.18	<0.08	<0.11	<0.04
Chromium Dissolved	<0.14	<0.08	<0.09	<0.04	<0.14	<0.08	<0.10	<0.04
Cobalt Total	<0.14	<0.08	<0.09	<0.04	<0.14	<0.08	<0.10	<0.04
Cobalt Dissolved	<0.14	<0.08	<0.09	<0.04	<0.14	<0.08	<0.10	<0.04
Copper Total	11.7	9.4	10.7	3.9	10.0	7.1	8.4	3.1
Copper Dissolved	2.1	0.6	1.3	0.5	3.7	0.6	1.7	0.6
Iron Total	159	78	104	38	147	55	81	30
Iron Dissolved	25	12	16	5.9	38	12	19	7.1
Lead Total	0.39	<0.08	<0.26	<0.10	0.26	<0.08	<0.15	<0.06
Lead Dissolved	<0.14	<0.08	<0.09	<0.04	<0.14	<0.08	<0.10	<0.04
Magnesium Total	4540	2530	3440	1260	3980	2370	3390	1240
Manganese Total	9.4	3.8	5.5	2.0	9.3	3.4	5.5	2.0
Manganese Dissolved	7.8	2.8	4.2	1.5	7.8	2.9	4.5	1.6
Mercury Total	0.033	0.006	0.013	0.005	0.008	<0.004	<0.005	<0.002
Molybdenum Total	0.35	<0.16	<0.22	<0.08	0.26	<0.16	<0.20	<0.08
Molybdenum Dissolved	0.26	<0.16	<0.18	<0.07	0.26	<0.16	<0.19	<0.07
Nickel Total	1.31	0.15	0.63	0.23	0.39	0.08	0.20	0.07
Nickel Dissolved	0.91	0.08	0.49	0.18	0.26	<0.08	<0.14	<0.05
Selenium Total	1.6	<0.8	<1.0	<0.4	1.3	<0.8	<1.0	<0.4
Silver Total	0.13	<0.08	<0.09	<0.04	<0.14	<0.08	<0.10	<0.04
Silver Dissolved	<0.14	<0.08	<0.09	<0.04	<0.14	<0.08	<0.10	<0.04
Tin Total	<1.4	<0.8	<0.9	<0.4	<1.4	<0.8	<1.0	<0.4
Tin Dissolved	<1.4	<0.8	<0.9	<0.4	<1.4	<0.8	<1.0	<0.4
Zinc Total	9.5	6.7	7.8	2.9	8.4	4.9	6.1	2.2
Zinc Dissolved	3.4	2.1	2.8	1.0	5.0	1.8	3.1	1.1

Method 1: Maximums, minimums and averages calculated from loadings obtained for each sampling date.

5.5 Effluent Toxicity

In 2000, Toxicity Identification Evaluation studies (TIE) showed that anionic surfactants (represented by methylene blue active substances or MBAS) were the most frequent cause of toxicity in samples examined from the Lions Gate WWTP. Ammonia also contributed to the toxicity in some samples.

Environment Canada's standard reference method[8] for determining acute lethality of effluents to Rainbow trout exposes test fish to a series of effluent dilutions, and determines the fish survival rate at the end of a 96-h exposure period. The final result is reported as the 96-h LC_{50} value, which is the % by volume (of the original sample) at which 50% of the test fish survive. A pass for all effluent samples requires that the LC_{50} value must be *equal to* or *greater than* 100% (v/v sample). This means that 50% or more of the test fish must survive for 96 hours in the original undiluted sample.

In 2008, Environment Canada published an add-on test procedure[9] for pH stabilization during the testing of acute lethality. The add-on procedure is applicable only to wastewater effluents. The purpose of pH stabilization is to replace the CO_2 lost due to aeration in order to maintain the pH throughout the test at the same levels observed at the start of the test. This add-on procedure recognizes that toxicity observed in municipal wastewater effluents may be an artifact of the standard reference method.

The add-on procedure can be used only when the standard reference method gives a false result due to pH shift during the test. Consequently a second test is run concurrently with the standard reference method. The second test utilizes the reference method with the add-on pH stabilization procedure.

2009 Program

Outlined below is a summary of Lions Gate effluent toxicity results and evaluations for 2009.

All effluent samples from the Lions Gate WWTP passed the required monthly toxicity test using Environment Canada's standard reference method (10 cases) and the reference method with the add-on pH stabilization procedure (2 cases).

As in the previous year, there were no occurrences of effluent toxicity at the Lions Gate Plant. This would suggest that the public education campaign to encourage North Shore residents to use less detergent has been effective in reducing the level of surfactants entering the Plant, and/or detergent and cleansing formulations are becoming more environmentally friendly.

Additionally, the pH and ammonia values in 2009 showed that the concentration of ammonia in the undiluted effluent was not acutely toxic at the measured pH values. This is demonstrated in the following chart for pH and ammonia data collected during the year. All results were below the threshold acute concentration curve for ammonia at the measured pH value of the effluent discharge.

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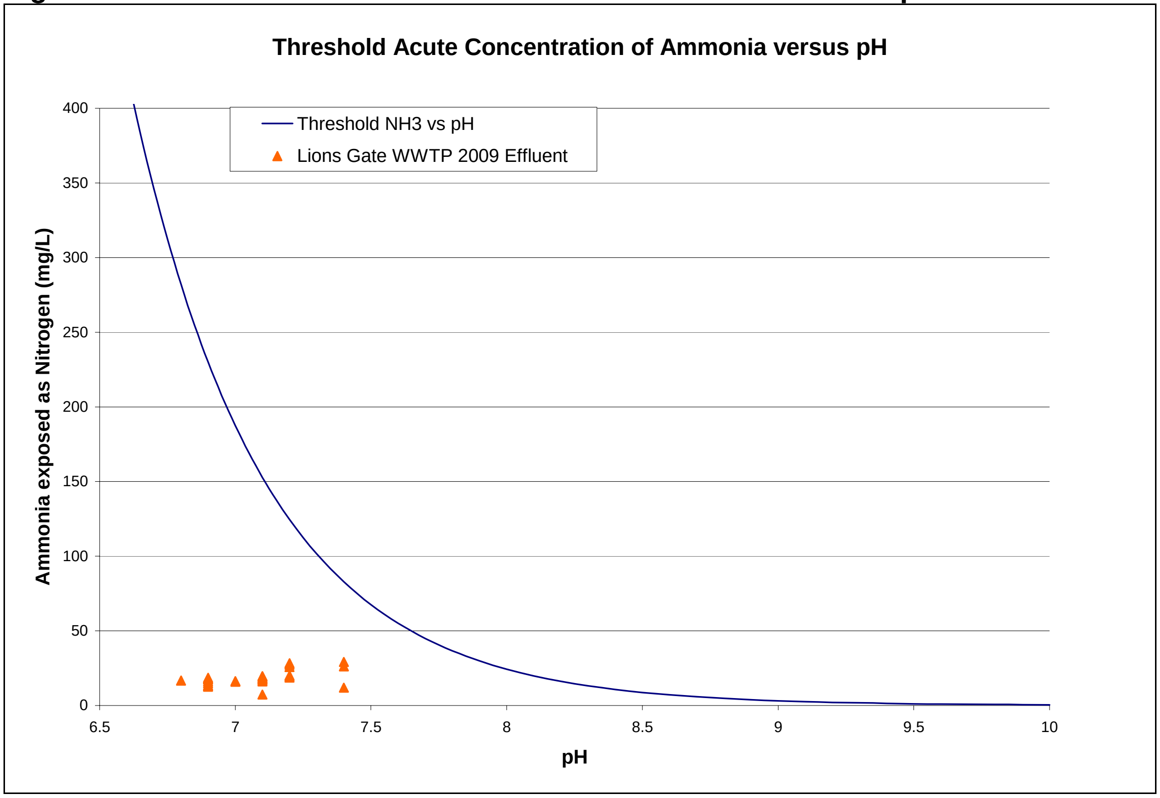
8 Environment Canada, Report EPS 1/RM/13, Second Edition – December 2000, p. 9.
9 Environment Canada, Report EPS 1/RM/50 – March 2008, p. 10.

Figure 5-1: Lions Gate WWTP - Ammonia Concentration versus pH Value



5.6 Biosolids Monitoring

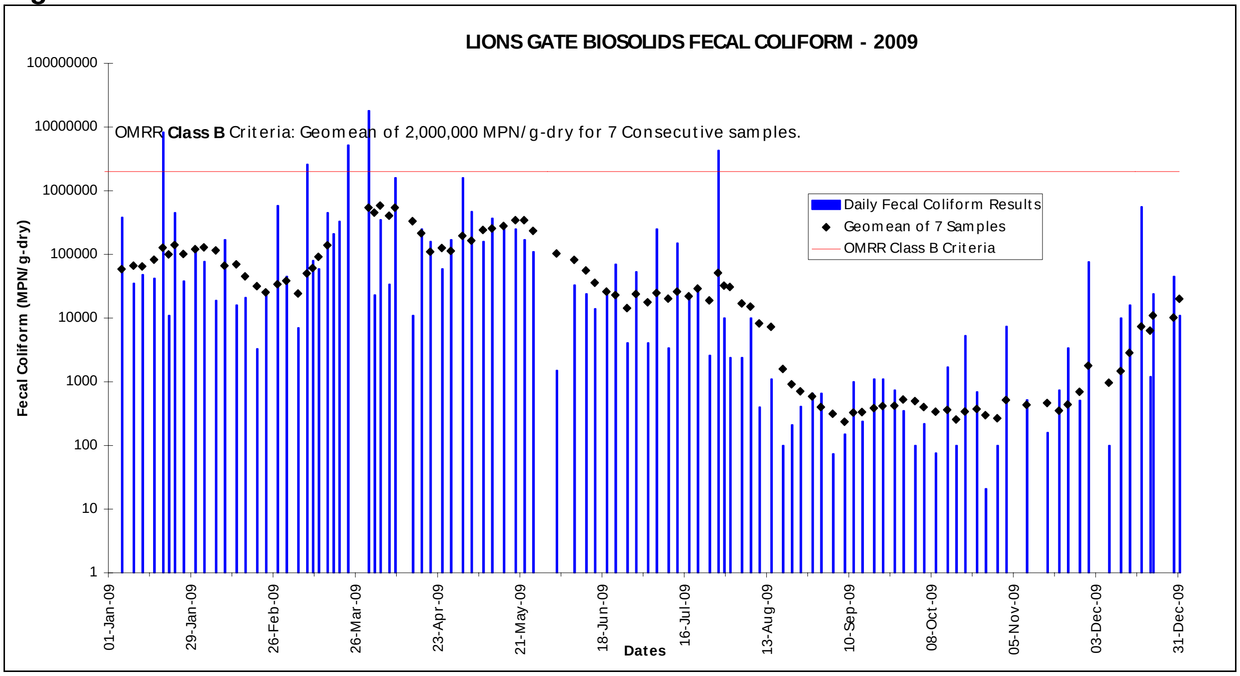
Lions Gate Wastewater Treatment plant produces Class B dewatered biosolids product. In 2009, biosolids produced at Lions Gate consistently achieved the Class B criteria for metals as shown in the Organic Matter Recycling Regulation. Results of weekly testing programs for Biosolids and the criteria values required under the Organic Matter Recycling Regulation, February, 2002 are shown in the following table:

Class B Criteria (mg/kg)	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Moly	Nickel	Selenium	Zinc	Fecal Coliform (MPN/g)
	75	**20**	**1060**	**150**	**2200**	**500**	**15**	**20**	**180**	**14**	**1850**	**2,000,000**
MAX	4.0	4.0	52	4.7	1530	85	4.7	15	74	7	1130	585,000*
MIN	<2	1.7	30	2.1	1020	54	2	6.1	18	4.8	651	237*
AVE	<2.5	2.5	40	3.0	1270	66	2.9	8.4	27	5.8	909	14,000**
# Times Exceeded	0	0	0	0	0	0	0	0	0	0	0	0

* Geomean of 7 samples
** Geomean for year

Fecal coliform tests were conducted twice per week in 2009. The plant consistently achieved the Class B fecal coliform criteria of 2,000,000 MPN/g for seven consecutive samples. The highest geometric mean was 585,000 MPN/g and the geometric mean for all samples collected during the year was 14,000 MPN/g.

Figure 5-2: Lions Gate WWTP Biosolids – Fecal Coliform



Metals: Criteria values for all other parameters (metals) were met throughout 2009. Levels of molybdenum in the final biosolids never exceeded the OMRR limit of 20 mg/kg. Mercury values were well below the OMRR criteria of 15 mg/kg in 2009.

Figure 5-3: Lions Gate WWTP Biosolids – Total Molybdenum, 2007-2009 Data

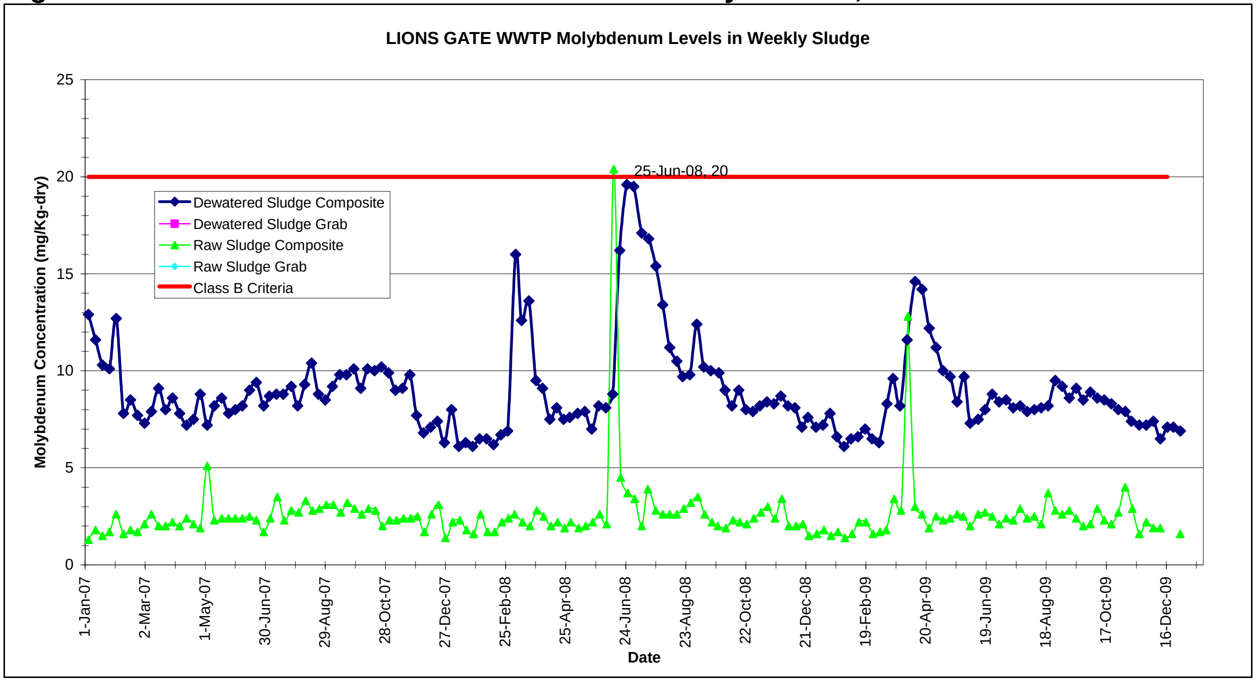
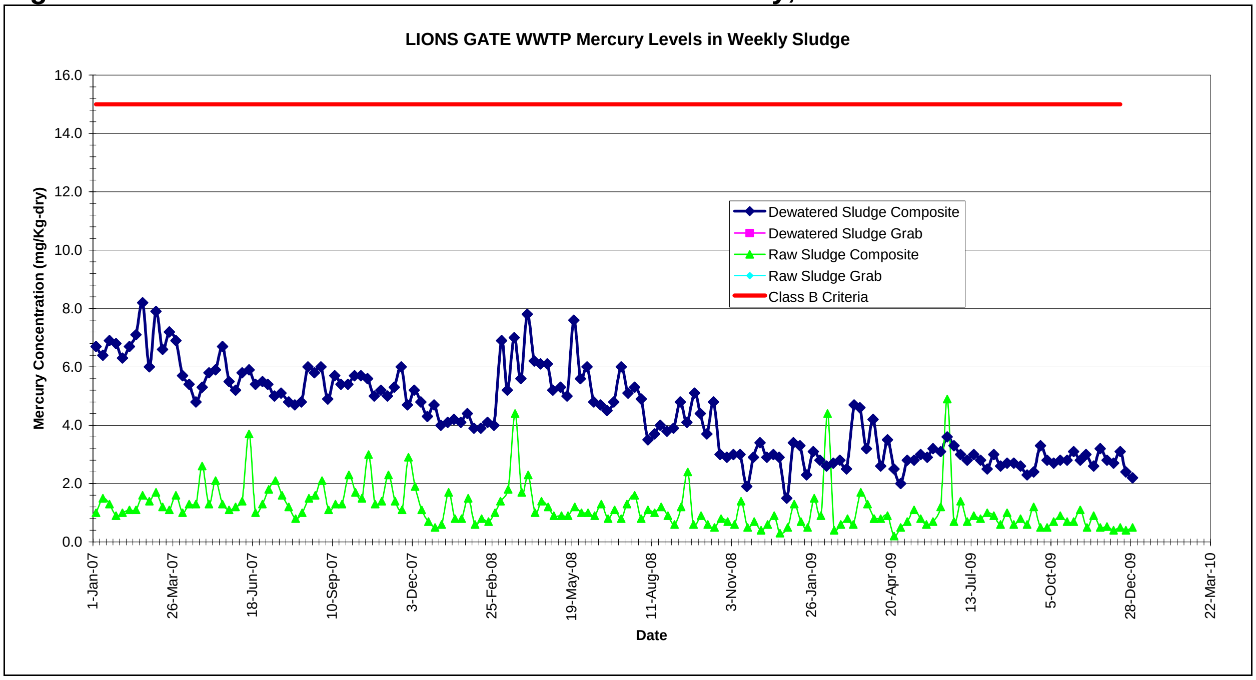


Figure 5-4: Lions Gate WWTP Biosolids – Total Mercury, 2007-2009 Data



Additional Information for 2008 and 2009 Fecal Coliforms and Metals Data are found in: Appendix D - Biosolids and Digester Sludge Monitoring Programs.

Lulu WWTP

6.0 LULU ISLAND WWTP

6.0 LULU ISLAND WWTP 2009 ANNUAL SUMMARY

6.1 Effluent Quality

The quality of effluent from the Lulu Island WWTP in 2009 is summarized in the following table, along with compliance with parameters listed in the Operational Certificates

Table 6-1: Lulu Island WWTP – 2009 Compliance Summary

Operational Certificate Requirement - ME-00233, April 23, 2004

				No. of times Criteria Exceeded												
Compliance Parameters	**Frequency**	**OC Limits**	**Max. Value for the Year**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Yr to Date**
Total Flow (MLD)	Daily	233	110	0	0	0	0	0	0	0	0	0	0	0	0	0
cBOD (mg/L)*	3/week	45	8	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	5/week	45	10	0	0	0	0	0	0	0	0	0	0	0	0	0
cBOD (Tonnes/Day)*	3/week	3.6	4.8	0	0	0	0	0	0	0	0	0	0	0	0	0
Susp. Solids (Tonnes/Day)	5/week	4.5	2.7	0	0	0	0	0	0	0	0	0	0	0	0	0
Chlorine Residual (mg/L)**	Daily	<0.1	<0.1	0	0	0	0	0	0	0	0	0	0	0	0	0
Disinfection Failure	-	-	-	0	0	0	0	0	0	0	1	0	0	0	0	1 of 221

* cBOD reported 1/week when COD are reported 5/week

Monitoring Parameters	**OC**	**Sample Type**	**Year 2009 Maximum**	**Minimum**	**Average**
pH****	1/month	Grab	7.4	6.7	7.1
Toxicity, 96 hour LC_{50} (% v/v)	1/month	Grab	>100	60	>85
Ammonia (mg/L)****	1/week	Grab	31.5	6.6	20.7
Hardness (mg/L CaCO3)	1/month	Comp	43.5	28.8	34.6
COD (mg/L)	5/week	Comp	94	55	90
Conductivity ($u$mhos/cm)	-	Grab	1180	439	549
Temperature ^{o}C	1/month	Grab	21	10	17
Fecal Coliform (Summer) MPN	1/week	Grab	230	<20	26***
Residual Chlorine (mg/L)**	daily	Grab	<0.1	<0.1	<0.1
Oil and Grease (mg/L)	-	Grab	<7	<5	<7
Phenol (mg/L)	1/month	Grab	<0.01	<0.01	<0.01
Suphate (mg/L)	1/month	Comp	20.6	16.5	17.9
Aluminum, Total (mg/L)	1/month	Comp	0.10	0.05	0.08
Arsenic, Total (mg/L)	-	Comp	<0.001	<0.001	<0.001
Barium, Total (mg/L)	1/month	Comp	0.004	0.002	0.003
Boron, Total (mg/L)	1/month	Comp	0.11	0.10	0.11
Cadmium, Total (mg/L)	1/month	Comp	<0.0005	<0.0005	<0.0005
Chromium, Total (mg/L)	-	Comp	0.001	<0.001	<0.001
Cobalt, Total (mg/L)	1/month	Comp	0.001	<0.001	<0.001
Copper , Total (mg/L)	1/month	Comp	0.036	0.023	0.029
Iron, Total (mg/L)	1/month	Comp	0.36	0.23	0.29
Lead, Total (mg/L)	1/month	Comp	0.003	<0.001	<0.002
Manganese, Total (mg/L)	1/month	Comp	0.057	0.007	0.017
Mercury, Total (µg/L)	1/month	Comp	0.11000	<0.05	<0.055
Molybdenum, Total (mg/L)	1/month	Comp	0.004	<0.002	<0.003
Nickel, Total (mg/L)	1/month	Comp	0.005	0.002	0.003
Silver, Total (mg/L)	1/month	Comp	<0.001	<0.001	<0.001
Zinc, Total (mg/L)	1/month	Comp	0.058	0.026	0.038

** Chlorination period is between March 28 to November 5.

*** Fecal Coliform results are geomean values and only done during chlorination as per new Operational Certificate.

**** Minimum, Maximum and average values are calculated from weekly grab data.

Note 1. Toxicity requirements, April 23, 2004 Operational Certificate: If a fish bioassay toxicity test fails to meet or exceed a LC_{50} value of 100%, the permittee is required to conduct a Toxicity Identification Evaluation (TIE) study for the purpose of determining the probable cause of the failure.

Note 2: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.

6.2 Compliance Review (ME-00233) and Performance Summary

The Lulu Island effluent permit (July 14, 1999) was replaced with Operational Certificate ME-00233, issued April 23, 2004 by the Ministry of Environment under the provisions of the Waste Management Act. The new operational certificate included revised compliance levels for BOD and suspended solids loadings. The loadings parameters listed as "maximum daily loadings" are used to calculate the annual waste discharge fees as required by the Waste Management Waste Permit Fee regulation and are based on a calendar year.

Previous Permit Levels	BOD (tonnes/day)	Susp. Solids (tonnes/day)
On and from June 24, 2002	3.617	3.617
On and from June 24, 2003*	3.669	3.669
Operational Certificate Levels		
2004 (effective April 23, 2004)	3.0	3.0
2005	3.2	3.5
2006	3.4	4.0
2007 and thereafter	3.6	4.5

* Beginning May 01, 2003, carbonaceous BOD was used to replace total BOD in reporting final effluent BOD concentrations and no further analyses for Total BOD in final effluent were conducted at the secondary treatment plants.

Discharge Monitoring

A total of 27 parameters and the two daily loadings for final effluent are posted on Metro Vancouver's website on a monthly basis, however, specific compliance levels apply to only six parameters: Total daily discharge flow, carbonaceous BOD (cBOD), suspended solids, chlorine residual and maximum daily loadings for cBOD and suspended solids.

6.2.1 Compliance Review

Lulu Island Wastewater Treatment Plant had one instance of non-compliance in 2009. Due to mechanical failure, disinfection system failed for 1.55 hour in August 11.The level of compliance for these parameters was shown in Table 6.1.

Effluent bypasses:

Wastewater flows exceeding the capacity of the secondary treatment works may bypass those works when flows are greater than two times measured dry weather flow, providing that primary effluent standards are maintained for the effluent not receiving secondary treatment.

There was one instance that secondary process unit was bypassed in 2009. Due to power failure, 38.3 ML of treated primary effluent bypassed secondary process for 12.3 hours in December 20. The suspended solids concentrations of the primary effluent samples collected during the bypass event were within the acceptable limit. The BOD results were 177 mg/L and 174 mg/L, which exceeded the limit of 130 mg/L for primary treated effluent.

Parameter	Compliance level	Non -compliance
5-day biochemical oxygen demand (BOD5)	130 mg/L	1
Total suspended solids (TSS)	130 mg/L	0

Disinfection

The effluent is disinfected using chorine between April 1 and October 31 so that the Fraser River coliform water quality objective is not exceeded at the edge of the initial dilution zone as described in the Municipal Sewage regulation.

Final effluent was disinfected with sodium hypochlorite solution. The plant uses a dechlorinating agent, sodium bisulfite (SBS) solution before discharging to the Fraser River. The average chlorine dosage was 2.3 mg/L, and the average SBS dosage as SO_2 was 2.3 mg/L.

The plant had only one instance of disinfection failure which occurred in August 11. A broken valve on the Sodium Hypochlorite Solution (SHS) disinfection system resulted in the drainage of the two SHS storage tanks into the containment area and therefore there was no disinfection chemical available for the feed pumps. About 5.9 ML of effluent was discharged from the plant with low or no chlorine disinfection.

The 30-day Geometric Means calculated for fecal coliform levels in final effluent and at the edge of the initial dilution zone (IDZ) are summarized in the following table. In 2008, the calculated results for fecal coliform levels at the edge of the IDZ met the Fraser River fecal water quality objective (WQO) of 200 MPN/100 ml.

Table 6-2: 30 day Fecal Coliform Geomean at the Lulu WWTP IDZ

Final Effluent	April	May	June	July	August	September	October
Max 30 day Gmean*	-	34	31	20	20	33	38
Dil Factor**	-	30	30	30	30	30	30
IDZ Result ***	-	1.1	1.0	0.7	0.7	1.1	1.3
WQO (pass or fail)	-	Pass	Pass	Pass	Pass	Pass	Pass

* Gmean (MPN/100ml) over 30 day period.

** Dil Factor - minimum dilution factor for initial dilution zone at the Lulu outfall.

*** IDZ Result (MPN/100 ml) - determined by calculation of Geometric Mean of fecal coliforms levels in the receiving water due to discharges of final effluent, for 30 day periods at the edge of the initial dilution zone (IDZ).Measured only during disinfection season (April 1-October 31).

6.2.2 Performance Summary

The Lulu Island Wastewater Treatment Plant treated a total of 27,844 ML in 2009. The average flow of 76.2 MLD was 2.7 % higher as compared to last year's average of 74.2 MLD. The highest daily flow of 110 MLD was recorded in January 7 while the maximum peak flow of 1.89 m^3/sec or 163 MLD was reported in December 20.

The plant's overall performance was excellent. The effluent suspended solids (SS) concentrations were between 2 to 46 mg/L with an average of 5 mg/L. The effluent carbonaceous BOD levels were between <4 to 83 mg/L with an average of <6 mg/L. The high suspended solids and cBOD concentrations of 46 mg/L and 83 mg/L occurred in December 20 due to primary effluent bypassing secondary treatment for 12.5 hours. Effluent collected in December 20 was a blend of primary and secondary treated effluent. Taking into account secondary treated effluent only, the maximum suspended solids and cBOD concentrations in 2009 were 10 mg/L and 8 mg/L. Effluent SS loading of 133 tonnes/year was 9.6 % lower than 2008 and effluent cBOD loading of 145 tonnes/year was 10.3 % higher than 2008.

The influent suspended solids concentrations were between 164 to 361 mg/L with an average of 244 mg/L. The influent BOD concentrations were between 174 to 365 mg/L with an average of 254 mg/L. The average influent loadings for SS and BOD were 6,769 tonnes/year and 7,064 tonnes/year. These values were 8.1% and 14.3% higher as compared to last year's SS and BOD loadings.

The plant maintained average of 98% efficiencies in removal of BOD and TSS.

Table 6-3: 2000-2009 Annual Data for Flow, Suspended Solids and BOD

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD	cBOD	BOD	cBOD
						mg/L		Tonnes/year	
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2000	71.9	213	12	5590	306	213	10	5593	272
2001	73.9	216	12	5802	326	231	11	6229	289
2002	76.4	189	8	5270	234	197	8	5539	234
2003	79.3	210	8	6062	237	204	6	5954	185
2004	79.1	206	7	5947	202	218	6	6310	174
2005	76.5	219	7	6088	198	228	6	6347	164
2006	80.0	217	6	6313	179	216	<7	6314	189
2007	77.8	237	7	6718	187	221	<6	6232	159
2008	74.2	232	5	6261	147	225	<6	6180	131
2009	76.2	244	5	6769	133	254	<6	7064	145

6.3 Secondary Process

The secondary process continued to operate very well with three trickling filters, three aeration tanks in contact mode and four secondary clarifiers. Trickling Filter #1 was taken out of service for repair and maintenance on June 23, 2009 and was put back in service on March 12, 2010. Trickling Filter # 3 was taken out of service on March 19 and remained in standby mode for the rest of year. The overall Soluble cBOD (scBOD) removal across the trickling filters was between 62 to 89 % with an average of 79%. The overall trickling effluent scBOD concentrations were in the range of 11 to 33 mg/L.

The newly constructed Trickling Filter #4 which was started on September 17, 2008 has vertical flow media and a motorized distributor arm. The motorized drive allowed the distributor arm to operate a lower rotation speed. The process performance testing of Trickling Filter #4 was conducted from September 2008 to October 2009. A new operating parameter called SpülKraft Rate or SK Rate, which has the units of mm of water per pass of the distributor arms, is used to operate the new trickling filter. The operating SpülKraft Rate or SK Rate was adjusted in the range of 30 to 90 mm/pass to determine the optimum setting to achieve scBOD removal target of 80%. The flushing SK was set at 387 mm/pas for one hour and the daily flushing regimen started on February 15. The scBOD removal in Trickling Filter #4 was ranging from 32 to 82 % with an average of 69%. On December 1, the motor drive was removed from service and the orifice plates were adjusted to hydraulically drive the arm similar to the older filters.

Four solids contact tanks were in service for 145 days from January 21 to June 15. One of the solids contact tanks were not in service either due to preventive maintenance and inspection work or in standby mode. The average mixed liquor suspended solids (MLSS) of 1290 mg/L and the mean cell residence time (MCRT) was varying from 1.0 day to 2.0 days.

With additional clarifier capacity, the peak Sludge Overflow Rate (SOR) for the clarifier excluding December 20th data was 52.1 m/d, which occurred in January. The clarifier suspended solids concentrations were between 215 to 1,373 mg/L with an average of 545 mg/L.

Lulu Island WWTP experienced significant foaming events on September 3, 8, 9, 11, 12, 13, 16 and 18. Light white foam appeared in the solids contact tanks and in the clarifier weirs. The maximum foam height was approximately 3 meters. Water hoses were set-up to break up control the foam in the tanks. Discrete samplers were set-up in the plant and selected strategic key sampling locations in Richmond. The investigation concluded that the problem was not caused by any activity in the plant. There was no effluent deterioration during these events. Regulation and Enforcement staff investigated numerous sewer dischargers without determining the source of the foam.

6.4 Sludge Treatment

Primary sludge from the primary sedimentation tanks were thickened into one gravity thickeners and screened in one sludge screen. The average Thickened Screened Primary Sludge (TSPS) was 3.8%.

One Dissolved Air Flotation Thickeners (DAFT) unit is used in thickening wasted secondary sludge from the mixed liquor channel. The average Thickened Wasted Secondary Sludge (TWSS) total solids were 3.7 % with subnatant suspended solids of 56 mg/L and Thickened Bottom Sludge (TBS) of 296 mg/L. The average polymer dosage was 3.4 kg/tonne.

The average blend of mixed sludge was 56% primary sludge and 44% secondary sludge. Sludges with an average of 3.7% total solids were mixed into a sludge blending tank.

Digestion was very stable with two mesophilic digesters. On March 6, mode of operation for Digester #2 was changed from secondary to primary. The average hydraulic retention time was 24 days with volatile solids reduction was 61% and organic loading rate of 1.47 kg/m3 - day. Bicarbonate alkalinity concentrations ranged between 3,480 and 4,480 mg/L.

Iona WWTP moved temporarily West Coast Reduction loads to Lulu on June 5, 8, 9 and 12. The total of four loads (approximately 18.2 m3) of fats, oils and grease (FOG) from WCR was added directly to the digester.

6.5 Dewatered Sludge

One centrifuge was normally in operation for six times a week with an average total run time of 12.8 hours to dewatered digested sludge. The other centrifuge served as redundancy available for maintenance. The average total solids in dewatered sludge (biosolids) was 23.7% and centrate suspended solids was 954 mg/L with an average recovery of 94 %. The average polymer dosage was 11.5 kg/tonne.

Table 6-4: Lulu Island WWTP – 2009 Routine Monitoring Results and Performance Summary

MONTH	Max. Inst.Flow Rate	Total Daily Effluent Flow (MLD)			Average Composite pH		Ave. Grab pH	Ave. Grab NH3 mg/L	96 hr LC50 (%v/v) Standard Test & Add-on pH Stabilization
	(m3/sec)	Max.	Min.	Ave.	RAW INF	FINAL EFF	FINAL EFF	FIN. EFF	FINAL EFFLUENT
JAN	1.85	109.6	63.8	80.6	7.2	7.5	7.1	24	>100*
FEB	1.24	78.0	72.2	74.3	7.2	7.5	7.1	24	>100*
MAR	1.28	79.8	70.9	74.4	7.2	7.6	7.1	23	>100*
APR	1.39	83.9	70.7	74.5	7.1	7.5	7.0	19	>100*
MAY	1.79	78.7	69.4	73.9	7.1	7.5	7.2	19	>100*
JUN	1.34	80.4	70.2	75.4	7.0	7.5	7.2	21	>100*
JUL	1.29	81.2	71.6	74.6	7.0	7.6	7.1	19	>100
AUG	1.28	77.7	68.8	74.7	7.1	7.6	7.1	20	>100*
SEP	1.30	79.1	73.1	76.5	7.0	7.6	7.0	21	>100
OCT	1.35	86.8	73.0	77.2	7.0	7.6	7.1	21	>100
NOV	1.80	103.2	74.6	83.5	7.1	7.5	7.0	16	>100*
DEC	1.89	86.0	57.8	74.3	7.1	7.5	7.1	20	>100
# Samples	-	-	-	365	353	361	56	52	12
Maximum-Yr.	**1.89**	**109.6**	**-**	**-**	**7.4**	**7.7**	**7.4**	**32**	>100
Minimum-Yr.	**-**	**-**	**57.8**	**-**	**6.7**	**7.2**	**6.7**	**6.6**	>100*
Average-Yr.	**-**	**-**	**-**	**76.2**	**7.1**	**7.5**	**7.1**	**21**	>100*

* Standard with Add-on pH Stabilization test result reported.

MONTH	Conductivity (umhos/cm)		Ave Chloride (mg/L)	Ave Temp. (oC)	Ave. Chlorine .Dosage (mg/L)	Average Residual Chlorine Final Effluent (mg/L)		Residual SO_2 (mg/L)	Fec. Coliform (MPN/100mL) Final Effluent	
	RAW INF	FINAL EFF	FINAL EFF	FINAL EFF	FINAL EFF	Before SO2	After SO2	Effluent Outfall	Monthly Geomean	Max Geomean in month
JAN	449	517	49	14	-	-	-	-	-	-
FEB	452	535	51	14	-	-	-	-	-	-
MAR	555	641	131	13	1.3	0.5	<0.1	1.2	-	-
APR	437	534	56	16	1.6	0.8	<0.1	1.0	27	-
MAY	435	531	50	17	2.1	0.7	<0.1	1.1	33	34
JUN	465	550	58	20	2.4	0.8	<0.1	1.0	20	31
JUL	438	528	49	20	2.6	0.7	<0.1	1.1	20	20
AUG	451	531	53	21	2.6	0.7	<0.1	1.2	20	20
SEP	475	568	63	21	2.5	0.7	<0.1	1.8	33	33
OCT	504	563	64	19	2.5	0.7	<0.1	1.3	29	38
NOV	478	527	51	17	-	-	-	-	-	-
DEC	497	561	58	15	-	-	-	-	-	-
# Samples	353	361	55	59	215	221	221	227	62	53
Maximum-Yr.	**998**	**1180**	**235**	**21**	**3.4**	**1.4**	**<0.1**	**3.3**	**230**	**38**
Minimum-Yr.	**384**	**439**	**44**	**10**	**1.2**	**0.2**	**<0.1**	**0.4**	**<20**	**20**
Average-Yr.	**470**	**549**	**66**	**17**	**2.3**	**0.7**	**<0.1**	**1.2**	**-**	**-**
Geomean					**-**	**-**	**-**	**-**	**26**	**-**

(1) pH, Ammonia, Dissolved Oxygen, Temperature,Residual Chlorine, 96 hour LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.
(2) Residual Chlorine were taken before and after dechlorination, mg/L.
(3) Summer = March 24 - Oct. 31, 2009 inclusive: Chlorinated Effluent; Winter = Jan. 1 - March 23, 2009 and Nov. 1 - Dec. 31, 2009: No chlorination

Table 6-4 Cont'd: Lulu Island WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Total Suspended Solids (mg/l)						Total Susp. Solids Average % Reduction		Ave. Suspended Solids Loadings (Tonnes/day)		Ave. VSS (mg/L)		Vol. Susp. Solids Ave. % Reduction	
	RAW INFLUENT			FINAL EFFLUENT					RAW	FINAL	RAW	FINAL		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Primary	Final	INF	EFF	INF	EFF	Primary	Final
JAN	361	172	255	7	4	6	78	98	20.4	0.4	243	5	80	98
FEB	316	218	261	7	4	5	79	98	19.4	0.4	250	5	80	98
MAR	320	236	272	7	4	5	79	98	20.2	0.4	258	5	80	98
APR	310	218	255	6	3	4	77	99	18.9	0.3	244	4	78	98
MAY	292	191	232	6	4	5	74	98	17.2	0.3	219	4	75	98
JUN	313	212	250	6	3	4	77	98	18.9	0.3	238	4	78	98
JUL	315	215	254	5	3	4	76	99	18.9	0.3	235	3	77	99
AUG	270	198	230	5	2	4	74	98	17.2	0.3	218	3	75	98
SEP	300	194	240	8	3	5	76	98	18.4	0.4	232	5	77	98
OCT	273	198	229	5	3	4	78	98	17.7	0.3	213	4	78	98
NOV	268	164	220	6	4	5	77	98	18.3	0.4	199	5	77	98
DEC	288	190	231	46	4	8	76	97	17.2	0.6	223	8	77	96
# Samples	-	-	356	-	-	362	352	353	356	362	231	236	229	229
Maximum-Yr.	**361**	**-**	**-**	**46(1)**	**-**	**-**	**84**	**99**	**27.4**	**2.7**	**341**	**42**	**85**	**99**
Minimum-Yr.	**-**	**164**	**-**	**-**	**2**	**-**	**67**	**78**	**12.1**	**0.1**	**151**	**2**	**68**	**79**
Average-Yr.	**-**	**-**	**244**	**-**	**-**	**5**	**77**	**98**	**18.5**	**0.4**	**231**	**4**	**78**	**98**
Total to Date - Suspended Solids Loadings (Tonnes):									**6,769**	**133**				

MONTH	BOD* (mg/L)			cBOD (mg/L)			BOD Average % Reduction		Average BOD/cBOD Loadings (Tonnes/day)		Average COD (mg/L)		COD Ave. % Reduction	
	RAW INFLUENT			FINAL EFFLUENT					RAW	FINAL	RAW	FINAL		
	Max.	Min.	Ave.	Max.	Min.	Ave.	Primary	Final	INF	EFF	INF	EFF	Primary	Final
JAN	365	189	267	5	<4	<5	44	98	20.9	<0.4	521	55	48	89
FEB	273	225	247	5	<4	<5	39	98	18.4	<0.4	555	56	47	90
MAR	303	209	257	6	<4	<5	43	98	19.2	<0.4	558	56	48	90
APR	294	193	236	5	<4	<5	40	98	17.4	<0.4	507	54	44	89
MAY	259	174	220	6	4	5	37	98	16.3	0.4	497	58	41	88
JUN	280	225	256	6	<4	<5	44	98	19.3	<0.4	582	55	51	91
JUL	324	224	270	5	<4	<5	48	98	20.3	<0.4	575	53	52	91
AUG	303	192	237	5	<4	<5	42	98	17.8	<0.4	530	51	47	90
SEP	326	230	270	8	<4	<5	41	98	20.7	<0.4	538	53	48	90
OCT	347	258	284	4	<4	<4	46	99	21.6	<0.4	564	48	50	92
NOV	278	195	234	5	<4	<5	44	98	19.3	<0.4	514	51	48	90
DEC	310	223	266	83(1)	4	14	43	98	20.6	0.9	531	63	47	88
*** Effective May 1, 2004, all final effluent BOD results are reported to the MoE as cBOD**														
# Samples	-	-	97	-	-	101	96	95	97	101	340	260	237	240
Maximum-Yr.	**365**	**-**	**-**	**83**	**-**	**-**	**58**	**99**	**26.3**	**4.8**	**713**	**206**	**61**	**94**
Minimum-Yr.	**-**	**174**	**-**	**-**	**<4**	**-**	**20**	**97**	**13.0**	**<0.3**	**371**	**32**	**27**	**55**
Average-Yr.	**-**	**-**	**254**	**-**	**-**	**<6**	**43**	**98**	**19.4**	**<0.4**	**540**	**54**	**48**	**90**
Total to Date - Biochemical Oxygen Demand Loadings (Tonnes):									**7,064**	**145**				

(1) These max value on Dec. 20, 2009 during bypass; Only Secondary Effluent results are reported for compliance.

Table 6-5: Lulu Island WWTP – 2009 Comprehensive Program Concentrations Summary

Parameters	Sample Type	INFLUENT Max.	INFLUENT Min.	INFLUENT Ave.	EFFLUENT Max.	EFFLUENT Min.	EFFLUENT Ave.
		mg/L (unless specified)			mg/L (unless specified)		
Kjeldahl Nitrogen	Comp.	37	27	32	34	28	31
N-Nitrate	Grab	0.04	<0.01	<0.02	0.10	0.01	0.05
N-Nitrite	Grab	0.06	<0.01	<0.02	0.28	0.03	0.09
N-Ammonia	Comp.	21.8	16.9	19.0	34.4	26.1	29.9
Sulphate	Comp.	19.1	9.0	13.3	20.6	16.5	17.9
Total Phosphorus	Comp.	5.13	4.10	4.62	3.91	2.86	3.35
Dissolved Phosphorus	Comp.	2.92	1.63	2.16	3.61	2.57	3.01
MBAS	Grab	3.5	1.7	2.5	0.4	0.1	0.2
Oil & Grease	Grab	49	13	34	<7	<5	<7
Phenols	Grab	0.04	0.02	0.03	<0.01	<0.01	<0.01
Cyanide Total	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aluminum Total	Comp.	0.77	0.53	0.63	0.10	0.05	0.08
Aluminum Dissolved	Comp.	0.11	0.05	0.07	0.04	0.02	0.03
Arsenic Total	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium Total	Comp.	0.027	0.017	0.021	0.004	0.002	0.003
Barium Dissolved	Comp.	0.006	0.004	0.005	0.003	0.002	0.002
Boron Total	Comp.	0.11	0.09	0.10	0.11	0.10	0.11
Boron Dissolved	Comp.	0.11	0.09	0.10	0.11	0.09	0.10
Calcium Total	Comp.	11.3	7.54	8.94	10.2	6.42	7.68
Cadmium Total	Comp.	0.0044	<0.0005	<0.0009	<0.0005	<0.0005	<0.0005
Cadmium Dissolved	Comp.	0.0016	<0.0005	<0.0006	<0.0005	<0.0005	<0.0005
Chromium Total	Comp.	0.004	0.002	0.003	0.001	<0.001	<0.001
Chromium Dissolved	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt Total	Comp.	0.001	<0.001	<0.001	0.001	<0.001	<0.001
Cobalt Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper Total	Comp.	0.133	0.083	0.107	0.036	0.023	0.029
Copper Dissolved	Comp.	0.045	0.015	0.027	0.024	0.011	0.018
Iron Total	Comp.	3.24	1.50	1.87	0.36	0.23	0.29
Iron Dissolved	Comp.	0.99	0.32	0.55	0.20	0.13	0.16
Lead Total	Comp.	0.004	<0.001	<0.003	0.003	<0.001	<0.002
Lead Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium Total	Comp.	5	3.08	3.86	5.02	3.02	3.74
Manganese Total	Comp.	0.105	0.058	0.071	0.057	0.007	0.017
Manganese Dissolved	Comp.	0.064	0.036	0.046	0.048	0.005	0.012
Mercury Total **(µg/L)**	Comp.	0.59	0.13	0.28	0.11	<0.05	<0.06
Molybdenum Total	Comp.	0.009	<0.002	<0.003	0.004	<0.002	<0.003
Molybdenum Dissolved	Comp.	0.008	<0.002	<0.003	0.003	<0.002	<0.003
Nickel Total	Comp.	0.017	0.003	0.006	0.005	0.002	0.003
Nickel Dissolved	Comp.	0.012	0.001	0.003	0.004	0.002	0.003
Selenium Total	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Silver Total	Comp.	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Silver Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tin Total	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tin Dissolved	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc Total	Comp.	0.147	0.082	0.105	0.058	0.026	0.038
Zinc Dissolved	Comp.	0.034	0.015	0.024	0.051	0.021	0.030

Note: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.
See Appendix A4-10 & A4-11 for more details.

Table 6-6: Lulu Island WWTP – 2009 Comprehensive Program Loadings Summary

	INFLUENT				EFFLUENT			
	Max.	Min.	Ave.	Tonnes	Max.	Min.	Ave.	Tonnes
Parameters	kg/Day			per year	kg/Day			per year
Kjeldahl Nitrogen	2810	2200	2430	885	2550	2130	2340	853
N-Nitrate	3.1	<0.8	<1.4	<0.6	7.6	0.7	3.8	1.4
N-Nitrite	4.6	<0.8	<1.4	<0.6	21	2.2	6.4	2.4
N-Ammonia	1650	1300	1440	524	2570	2030	2260	824
Sulphate	1560	675	1010	368	1680	1230	1350	494
Total Phosphorus	398	315	350	128	293	218	253	92
Dissolved Phosphorus	221	124	163	59	271	195	228	83
MBAS	266	138	190	69	31	7.6	17	6.2
Oil & Grease	3700	962	2550	930	<570	<380	<470	<170
Phenols	3.1	1.4	1.9	0.7	<0.9	<0.8	<0.8	<0.3
Cyanide Total	<1.7	<1.5	<1.6	<0.6	<1.7	<1.5	<1.6	<0.6
Aluminum Total	60	40	47	17	7.6	3.7	5.7	2.1
Aluminum Dissolved	8.3	3.7	5.1	1.9	3.3	1.5	2.2	0.8
Arsenic Total	<0.09	<0.08	<0.08	<0.03	<0.09	<0.08	<0.08	<0.03
Barium Total	2.09	1.28	1.57	0.57	0.33	0.15	0.22	0.08
Barium Dissolved	0.46	0.30	0.36	0.13	0.24	0.14	0.16	0.06
Boron Total	8.3	6.7	7.6	2.8	8.5	7.2	7.9	2.9
Boron Dissolved	8.2	6.7	7.6	2.8	8.5	6.7	7.8	2.8
Calcium Total	920	565	677	247	831	481	582	212
Cadmium Total	0.34	<0.04	<0.07	<0.03	<0.05	<0.04	<0.04	<0.02
Cadmium Dissolved	0.12	<0.04	<0.05	<0.02	<0.05	<0.04	<0.04	<0.02
Chromium Total	0.31	0.14	0.20	0.07	0.08	<0.08	<0.08	<0.03
Chromium Dissolved	0.08	<0.08	<0.08	<0.03	<0.09	<0.08	<0.08	<0.03
Cobalt Total	0.08	<0.08	<0.08	<0.03	0.08	<0.08	<0.08	<0.03
Cobalt Dissolved	<0.09	<0.08	<0.08	<0.03	<0.09	<0.08	<0.08	<0.03
Copper Total	10.3	6.3	8.1	2.9	2.7	1.7	2.2	0.8
Copper Dissolved	3.4	1.1	2.0	0.7	1.8	0.8	1.4	0.5
Iron Total	251	112	142	52	28	17	22	7.9
Iron Dissolved	77	24	42	15	15	9.9	12	4.5
Lead Total	0.31	<0.08	<0.24	<0.09	0.22	<0.08	<0.09	<0.04
Lead Dissolved	<0.09	<0.08	<0.08	<0.03	<0.09	<0.08	<0.08	<0.03
Magnesium Total	387	231	293	107	388	226	283	103
Manganese Total	8.1	4.3	5.4	2.0	4.6	0.5	1.3	0.5
Manganese Dissolved	5.0	2.7	3.5	1.3	3.9	0.4	0.9	0.3
Mercury Total	0.044	0.010	0.021	0.008	0.008	<0.004	<0.004	<0.002
Molybdenum Total	0.70	<0.15	<0.20	<0.08	0.30	<0.15	<0.18	<0.07
Molybdenum Dissolved	0.62	<0.15	<0.19	<0.07	0.23	<0.15	<0.17	<0.07
Nickel Total	1.22	0.22	0.43	0.16	0.37	0.15	0.25	0.09
Nickel Dissolved	0.86	0.07	0.26	0.09	0.33	0.14	0.20	0.07
Selenium Total	<0.9	<0.8	<0.8	<0.3	<0.9	<0.8	<0.8	<0.3
Silver Total	0.15	<0.08	<0.088	<0.04	<0.09	<0.08	<0.08	<0.03
Silver Dissolved	<0.09	<0.08	<0.08	<0.03	<0.09	<0.08	<0.08	<0.03
Tin Total	<0.9	<0.8	<0.8	<0.3	<0.9	<0.8	<0.8	<0.3
Tin Dissolved	<0.9	<0.8	<0.8	<0.3	<0.9	<0.8	<0.8	<0.3
Zinc Total	11.4	6.1	8.0	2.9	4.3	1.9	2.8	1.0
Zinc Dissolved	2.6	1.2	1.8	0.7	3.8	1.6	2.2	0.8

Method: Maximums, minimums and averages calculated from loadings obtained for each sampling date.

6.6 Effluent Toxicity

In 1999 and 2000, comprehensive assessments of acute effluent toxicity at the Lulu WWTP were conducted. The findings of the assessment studies were presented at an inter-governmental agency workshop held in March 2001. The findings showed that ammonia was the primary cause of toxicity. The toxicity, however, appeared to be largely a function of the test protocol as aeration resulted in an increase in sample pH that ultimately increased the proportion un-ionized ammonia, a more toxic form of ammonia, during the test.

Environment Canada's standard reference method10 for determining acute lethality of effluents to Rainbow trout exposes test fish to a series of effluent dilutions, and determines the fish survival rate at the end of a 96-h exposure period. The final result is reported as the 96-h LC50 value, which is the % by volume (of the original sample) at which 50% of the test fish survive. A pass for all effluent samples requires that the LC50 value must be equal to or greater than 100% (v/v sample). This means that 50% or more of the test fish must survive for 96 hours in the original undiluted sample.

In 2008, Environment Canada published an add-on test procedure11 for pH stabilization during the testing of acute lethality. The add-on procedure is applicable only to wastewater effluents. The purpose of pH stabilization is to replace the CO2 lost due to aeration in order to maintain the pH throughout the test at the same levels observed at the start of the test. This add-on procedure recognizes that toxicity observed in municipal wastewater effluents may be an artifact of the standard reference method.

The add-on procedure can be used only when the standard reference method gives a false result due to pH shift during the test. Consequently a second test is run concurrently with the standard reference method. The second test utilizes the reference method with the add-on pH stabilization procedure.

2009 Program

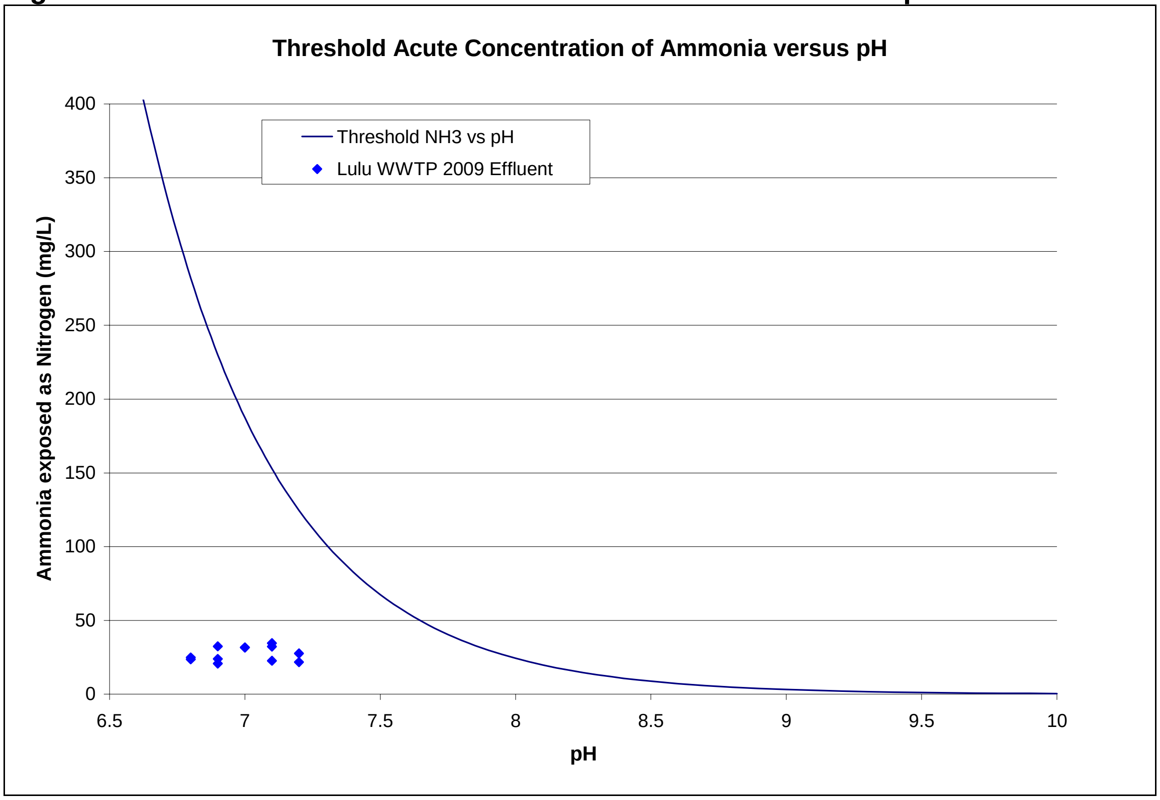
As required by the Liquid Waste Management Plan and the plant's Operational Certificate, all regular LC50 results for effluent samples from GVS&DD WWTPs are followed up with work to explain the cause of results of less than 100%. Outlined below is a summary of Lulu effluent toxicity results and evaluations for 2009.

All effluent samples from the Lulu Island WWTP passed the required monthly toxicity test using Environment Canada's standard reference method (4 cases) or the reference method with the add-on pH stabilization step (8 cases).

Additionally, the pH and ammonia values in 2009 showed that the concentration of ammonia in the undiluted effluent was not acutely toxic at the measured pH value. This is demonstrated in the following chart for pH and ammonia data collected during the year. All results were below the threshold acute concentration curve for ammonia at the measured pH value of the effluent discharge.

[10] Environment Canada, Report EPS 1/RM/13, Second Edition – December 2000, p. 9.
[11] Environment Canada, Report EPS 1/RM/50 – March 2008, p. 10.

Figure 6-1: Lulu Island WWTP - Ammonia Concentration versus pH Value



6.7 Biosolids Monitoring

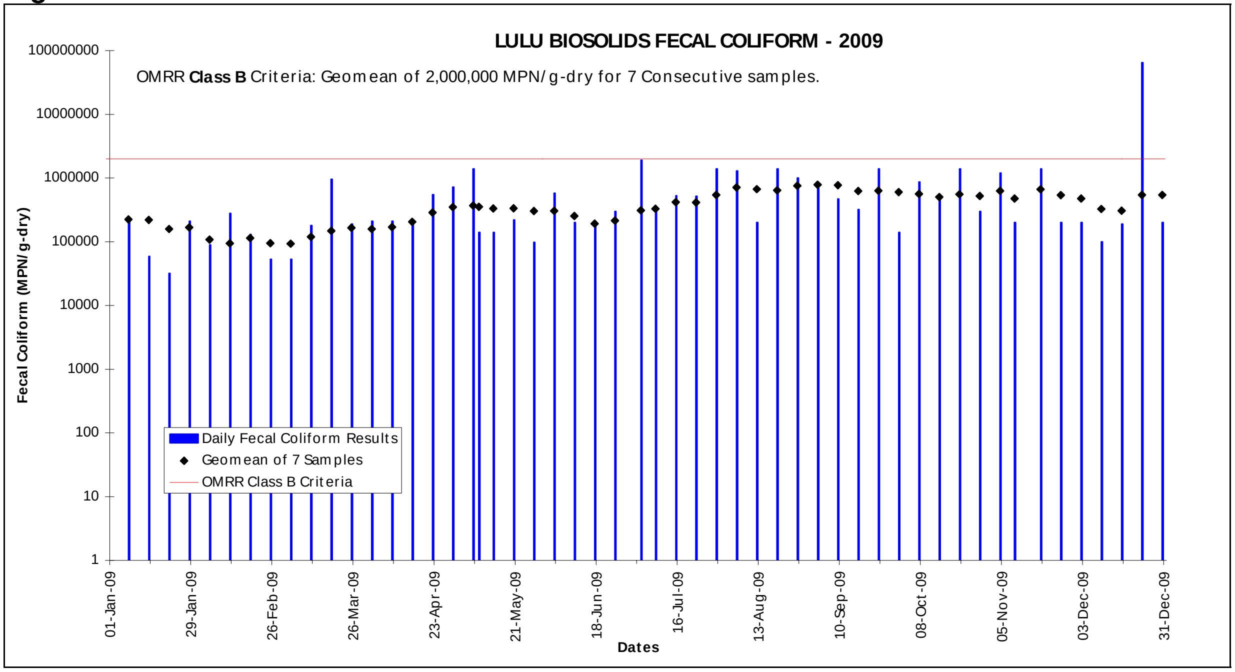
Lulu Island Wastewater Treatment plant produces a Class B dewatered biosolids product. In 2009, biosolids produced at Lulu consistently achieved the Class B criteria for fecal coliform and metals as stated in the Organic Matter Recycling Regulation. Results of weekly testing programs for Biosolids and the criteria values required under the Organic Matter Recycling Regulation, February, 2002 are shown in the following table:

Class B Criteria (mg/kg)	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Moly	Nickel	Selenium	Zinc	Fecal Coliform (MPN/g)
	75	**20**	**1060**	**150**	**2200**	**500**	**15**	**20**	**180**	**14**	**1850**	**2,000,000***
MAX	5.0	7.5	45	9	1410	56	4.4	11	48	6.7	1200	784,500*
MIN	3.0	2	32	4.8	1050	42	1.7	7.4	28	5.3	863	93,200*
AVE	4.1	4.5	38	6.5	1216	48	2.9	9	35	5.8	1045	345,000**
# Times Exceeded	0	0	0	0	0	0	0	0	0	0	0	0

* Geomean of 7 samples
** Geomean for Year

Fecal coliform tests were conducted at least once per week in 2009. The plant consistently achieved the Class B fecal coliform criteria (geomean of 2,000,000 MPN/g for seven consecutive samples) in the final biosolids - the highest geometric mean was 784,500 MPN/g and the geometric mean for all samples collected during the year was 345,000 MPN/g (dry weight basis).

Figure 6-2: Lulu Island WWTP Biosolids – Fecal Coliform



Metals: In 2009, criteria values for metals were met at all times during the year. Cadmium level was well below the OMRR values. Molybdenum values in raw sludge and biosolids were consistently below the OMRR criteria of 20 mg/kg, oscillating between 7.4 and 11 mg/kg.

Figure 6-3: Lulu Island WWTP Biosolids – Total Cadmium, 2007-2009 Data

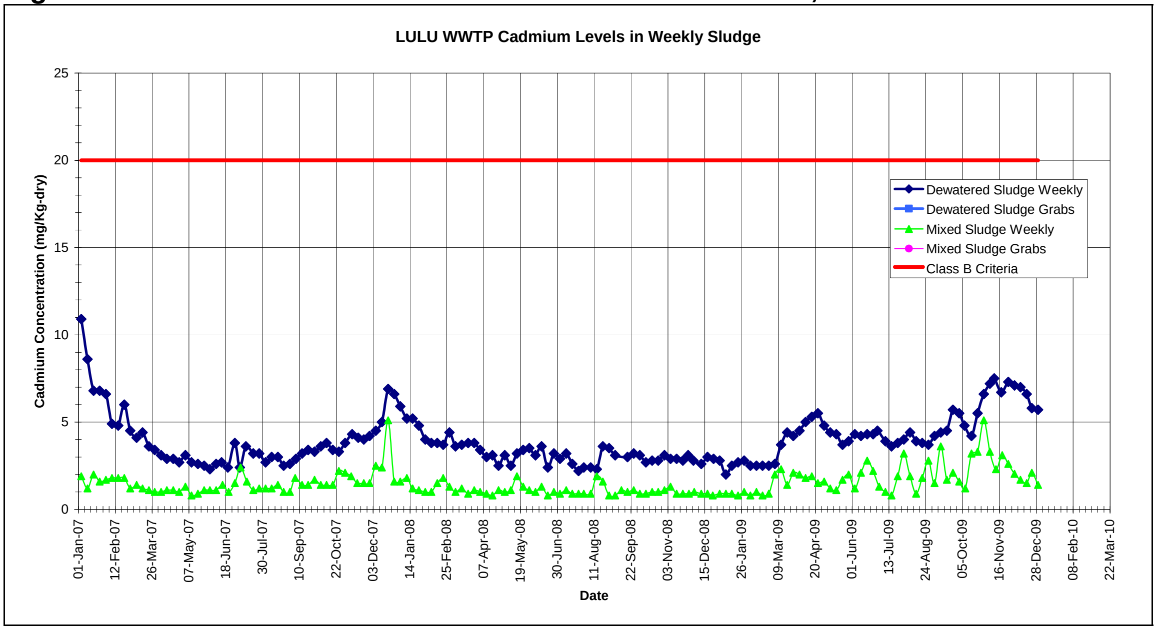
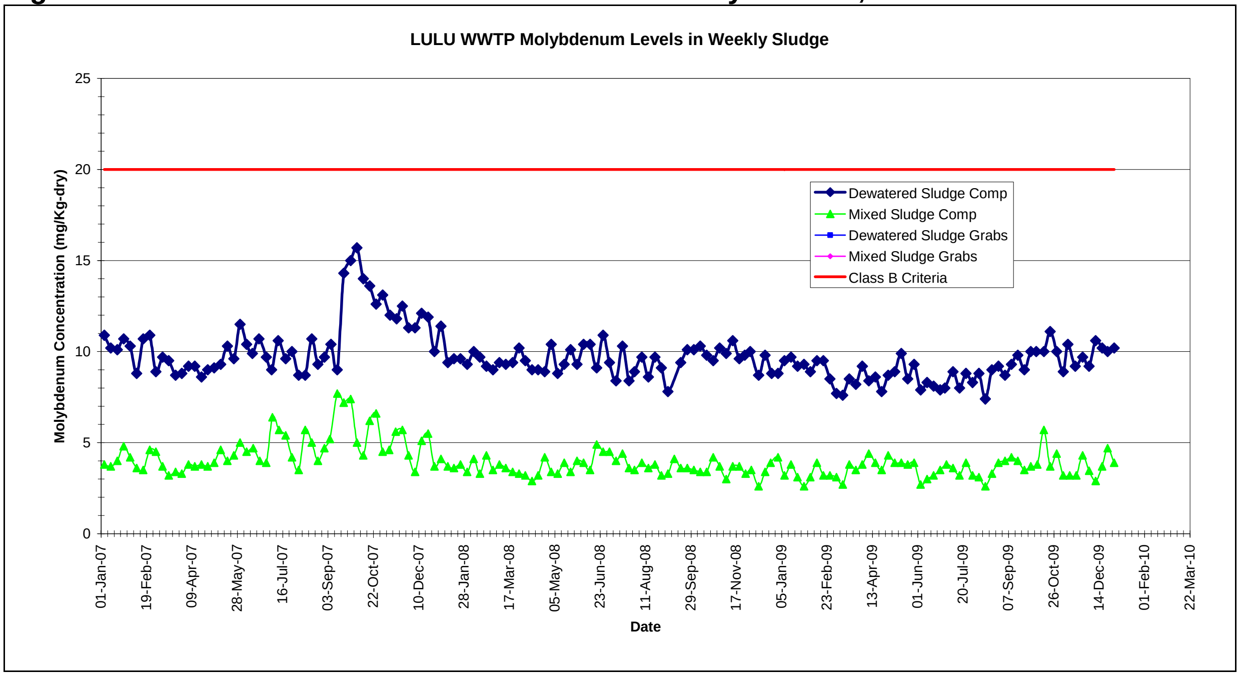


Figure 6-4: Lulu Island WWTP Biosolids – Total Molybdenum, 2007-2009 Data



Additional Information for 2008 and 2009 Fecal Coliforms and Metals Data are found in: Appendix D - Biosolids and Digester Sludge Monitoring Programs

7.0 NORTHWEST LANGLEY WWTP

7.0 NW LANGLEY WWTP 2009 ANNUAL SUMMARY

7.1 Effluent Quality

The quality of effluent from the NW Langley WWTP in 2009 is summarized in the following table, along with compliance with parameters listed in the Operational Certificates.

Table 7-1: NW Langley WWTP – 2009 Compliance Summary

Operational Certificate Requirement - ME-04339, April 23, 2004

Compliance Parameters	Frequency	OC Limits	Max. Value for the Year	No. of times Criteria Exceeded												
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr to Date
Total Flow (MLD)	Daily	42	20.1	0	0	0	0	0	0	0	0	0	0	0	0	0
cBOD (mg/L)	1/week	45	32	0	0	0	0	0	0	0	0	0	0	0	0	0
Suspended Solids (mg/L)	1/week	45	38	0	0	0	0	0	0	0	0	0	0	0	0	0
cBOD (Tonnes/Day)	1/week	0.50	0.37	0	0	0	0	0	0	0	0	0	0	0	0	0
Susp. Solids (Tonnes/Day)	1/week	0.50	0.60	3	0	0	0	0	0	0	0	0	0	0	0	3 of 365
Chlorine Residual (mg/L)	Daily	<0.1	0.9	0	0	0	0	0	0	1	0	0	0	0	0	1 of 215

Monitoring Parameters	OC Frequency	Sample Type	Year 2009		
			Maximum	Minimum	Average
pH*	1/month	Grab	7.6	5.5	6.8
Toxicity, 96 hour LC_{50} (% v/v)	1/month	Grab	>100	64.8	>95
Ammonia (mg/L)*	1/month	Grab	27.3	0.2	12.0
Hardness (mg/L CaCO3)	1/month	Comp	58.1	38.3	50.7
Temperature ^{o}C	1/month	Grab	23	3.8	15
Fecal Coliform (Summer) MPN	1/month	Grab	3095	20	293
Residual Chlorine (mg/L)	Daily	Grab	0.9	<0.1	<0.02
Oil and Grease (mg/L)	-	Grab	7	<5	<7
Phenol (mg/L)	1/month	Grab	0.01	<0.01	<0.01
Suphate (mg/L)	1/month	Comp	37.5	28.2	34.4
Aluminum, Total (mg/L)	1/month	Comp	0.20	0.10	0.14
Arsenic, Total (mg/L)	-	Comp	<0.001	<0.001	<0.001
Barium, Total (mg/L)	1/month	Comp	0.007	0.004	0.005
Boron, Total (mg/L)	1/month	Comp	0.21	0.14	0.18
Cadmium, Total (mg/L)	1/month	Comp	<0.0005	<0.0005	<0.0005
Chromium, Total (mg/L)	-	Comp	0.005	0.003	0.004
Cobalt, Total (mg/L)	1/month	Comp	<0.001	<0.001	<0.001
Copper , Total (mg/L)	1/month	Comp	0.034	0.016	0.025
Iron, Total (mg/L)	1/month	Comp	0.21	0.13	0.17
Lead, Total (mg/L)	1/month	Comp	0.002	<0.001	<0.002
Manganese, Total (mg/L)	1/month	Comp	0.064	0.046	0.053
Mercury, Total (µg/L)	1/month	Comp	0.06	<0.05	<0.06
Molybdenum, Total (mg/L)	1/month	Comp	0.003	<0.002	<0.003
Nickel, Total (mg/L)	1/month	Comp	0.069	0.004	0.013
Silver, Total (mg/L)	1/month	Comp	<0.001	<0.001	<0.001
Zinc, Total (mg/L)	1/month	Comp	0.114	0.058	0.077

* Minimum, Maximum and average values are calculated from all available weekkly grab data.

** Fecal Coliform results are monthly geomean values and are only done during the disinfection period under the new Operational Certificate.

Note 1. Toxicity requirements, April 23, 2004 Operational Certificate: If a fish bioassay toxicity test fails to meet or exceed a LC50 value of 100%, the permittee is required to conduct a Toxicity Identification Evaluation (TIE) study for the purpose of determining the probable cause of the failure.

Note 2: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.

7.2 Compliance Review (ME-04339) and Performance Summary

The Northwest Langley effluent permit (September 24, 1999) was replaced with Operational Certificate ME-004339, issued April 23, 2004 by the Ministry of Environment under the provisions of the Waste Management Act. The new operational certificate included revised compliance levels for BOD and Suspended solids loadings. The loadings parameters listed as "maximum daily loadings" are used to calculate the annual waste discharge fees as required by the Waste Management Waste Permit Fee regulation and are based on a calendar year.

Previous Permit Levels	cBOD (tonnes/day)	Susp. Solids (tonnes/day)
On and from September 24, 1999*	N/A	N/A
Operational Certificate Levels		
2004 (effective April 23, 2004)	0.35	0.35
2005	0.40	0.40
2006	0.45	0.45
2007 and thereafter	0.50	0.50

* Beginning May 01, 2003, carbonaceous BOD was used to replace total BOD in reporting final effluent BOD concentrations and no further analyses for Total BOD in final effluent were conducted at the secondary treatment plants.

Discharge Monitoring

A total of 26 parameters and the two daily loadings for final effluent are posted on Metro Vancouver's website on a monthly basis, however, specific compliance levels apply to only six parameters: Total daily discharge flow, carbonaceous BOD (cBOD), suspended solids, chlorine residual and maximum daily loadings for cBOD and suspended solids.

7.2.1 Compliance Review

In 2009, Northwest Langley Wastewater Treatment Plant met all the requirements for flow, suspended solids concentration, cBOD concentration and cBOD loading except for chlorine residual and suspended solids loadings. The level of non-compliance for these parameters was shown in Table 7.1.

The daily discharge loading on for total suspended solids on January 6, 7 and 8 were above the allowable limit because of extreme high wet weather flow events.

Disinfection

The effluent is disinfected between April 1 and October 31 so that the Fraser River coliform water quality objective is not exceeded at the edge of the initial dilution zone as described in the Municipal Sewage regulation.

Northwest Langley WWTP disinfected the final effluent using sodium hypochlorite solution (SHS) and de-chlorinates the effluent to less than 0.1 mg/L using sodium bisulfite solution (SBS). The average SHS dosage as chlorine was 6.0 mg/L and the average SBS dosage as SO_2 was 1.9 mg/L.

The plant had one instance of dechlorination failure on July 25, about 5 ML of treated effluent with an estimated chlorine residual of 0.9 mg/L was discharged without dechlorination over a 12 hour period. A major electrical storm in Langley caused a complete power outage at the plant. All flow was temporarily diverted to the plant equalization pond. The operator on call attended the plant and reset all equipment and re-established flow through the plant. The electrical problem caused the SBS pumps to change operating mode requiring a manual mode change before pump restart was possible. This change in operating mode does not normally occur during power outages. The SBS pump failed to restart resulting in no flow of the dechlorination solution. The problem was discovered and corrected when the operator performed a routine chlorine residual analysis the next day.

The 30-day Geometric Means calculated for fecal coliform levels in final effluent and at the edge of the initial dilution zone (IDZ) are summarized in the following table. In 2008, the calculated results for fecal coliform levels at the edge of the IDZ met the Fraser River fecal water quality objective (WQO) of 200 MPN/100 ml.

Table 7-2: 30 day Fecal Coliform Geomean at the NW Langley WWTP IDZ

Final Effluent	April	May	June	July	August	September	October
Max 30 day Gmean*	-	20	20	116	1373	3095	28
Dil Factor**	-	575	575	575	575	575	575
IDZ Result ***	-	0.03	0.03	0.20	2.39	5.38	0.05
WQO (pass or fail)	-	Pass	Pass	Pass	Pass	Pass	Pass

* Gmean (MPN/100ml) over 30 day period.
** Dil Factor - minimum dilution factor for initial dilution zone at the North West Langley outfall.
***IDZ Result - determined by calculation of Geometric Mean of fecal coliforms levels in the receiving water due to discharges of final effluent, for 30 day periods at the edge of the initial dilution zone (IDZ). Measured only during disinfection season (April 1-October 31).

7.2.2 Performance Summary

North West Langley WWTP treated an average daily flow of 11.6 MLD which was 5.3% higher as compared to 2008 data. The highest daily flow of 20.1 MLD occurred in January 7.

The influent suspended solids concentrations ranged from 67 to 825 mg/L with an average of 227 mg/L. The influent BOD concentrations varied from 192 to 533 mg/L with an average of 309 mg/L. The influent suspended solids and BOD loadings were higher by 14.9% and 10.8 % respectively than the 2008 data.

Table 7-3: 2000 - 2009 Annual Data for Flow, Suspended Solids and BOD

YEAR	FLOWS MLD	Suspended Solids mg/L		Suspended Solids Tonnes/year		BOD mg/L	cBOD mg/L	BOD Tonnes/year	cBOD Tonnes/year
		INF	EFF	INF	EFF	INF	EFF	INF	EFF
2000	8.7	304	29	970	92	366	17	1176	56
2001	8.8	343	16	1104	50	382	9	1223	28
2002	8.9	263	12	867	40	291	8	949	25
2003	9.2	208	<13	705	43	251	9	839	31
2004	9.3	256	11	861	39	304	8	1030	28
2005	9.2	241	18	810	62	297	10	996	35
2006	9.9	203	14	730	53	255	<9	908	29
2007	10.9	198	16	786	63	264	<10	1050	40
2008	11.0	207	16	831	65	295	<11	1173	43
2009	11.6	227	18	955	77	309	<12	1300	51

The plant continued to produce acceptable effluent quality. The effluent suspended solids concentrations were between 6 to 38 mg/L with average of 18 mg/L. The effluent cBOD concentrations were between <4 mg/L to 32 mg/L with an average of <12mg/L. The average suspended solids and cBOD loadings of 77 tonnes/year and 51 tonnes/year, respectively were 17.6% and 19.3% higher than last year. The plant attained average of 91% and 96% reduction in SS and BOD.

7.3 Secondary Process

The secondary process continued to operate with approximately 50% raw influent and 50% equalization pond effluent to the trickling filters (TF). Capacity of the trickling filter in service was varied throughout year depending on the nitrification level in the plant.

• One Trickling Filter	January 29 to May 26	(118 days)
• Two thirds of Trickling Filter #1	January 1 to January 28	(28 days)
	May 27 to July 28	(63 days)
	September 2 to November 18	(78 days)
	December 19 to December 31	(13 days)
• One half of Trickling Filter #1	November 19 to December 18	(30 days)
• One third of Trickling Filter #1	July 29 to September 1	(35 days)

The average soluble cBOD removal across the trickling filters was 73%.

North West Langley operated with two activated sludge (AS) tanks in service until April 15. The standby unit, AS#1 was then returned to service to allow for scheduled maintenance and inspection works on AS#2 and AS#3. Three aeration tanks were continuously in operation from April 22 to September 28. Mixed Liquor Suspended Solids (MLSS) concentrations were between 1,390 to 3,680 mg/L with an average of 2,610 mg/L.

The plant also experienced nitrite lock from August to early September which resulted in higher chlorine consumption. The chlorine dosage during this period was ranging from 5.5 to 17.5 mg/L.

The plant continued to receive intermittent shock loadings high BOD loads throughout the year. These high loads that resulted in significant drop in dissolved oxygen readings in equalization pond and aeration tanks. Additional sampling and testing of plant's influent, manhole and industrial dischargers were done.

The monitoring program that was started in April 2006 on one of industrial dischargers continued in 2009. Daily discharge flow and duration were recorded and composite samples were tested for pH, SS, COD and tBOD.

7.4 Sludge Treatment

Thickened wasted secondary sludge was stabilized using one of the two aerobic digesters. One 35 hp mixer/aerator was used to provide aeration. Digested sludge produced was very stable with average volatile solids reduction of 41 % and average hydraulic retention time 42 days. Average digester temperature was 42 ºC.

Table 7-4: NW Langley WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Max. Inst.Flow Rate (m^3/sec)	Total Daily Effluent Flow (MLD) Max.	Min.	Ave.	Average Comp. pH pH Units RAW INF	FINAL EFF	Average Grab pH FINAL EFF	Average Grab NH3 (mg/L) FINAL EFF	96 hr * (LC50/LT50) Stand./pH Stab. EFF
JAN	0.31	20.1	9.9	12.4	7.3	7.4	7.3	21.6	>100 (%v/v)
FEB	0.30	12.9	10.3	11.5	7.2	7.4	7.2	21.7	>100 (%v/v)
MAR	0.17	13.0	4.3	11.1	7.3	7.5	7.2	24.3	>96 Hr
APR	0.29	14.2	10.5	12.0	7.2	7.5	7.2	25.3	>96 Hr
MAY	0.21	12.6	10.7	11.5	7.2	6.9	6.7	10.1	>100 (%v/v)
JUN	0.21	12.3	10.6	11.4	7.2	6.6	6.3	0.7	>100 (%v/v)
JUL	0.31	12.0	9.2	10.8	7.2	6.6	6.4	2.0	>100 (%v/v)
AUG	0.20	11.3	10.2	10.7	7.2	7.0	6.8	4.1	>100 (%v/v)
SEP	0.20	13.0	8.9	11.1	7.2	6.8	6.5	0.2	>100 (%v/v)
OCT	0.20	14.5	7.8	11.6	7.2	7.0	6.7	1.2	>100 (%v/v)
NOV	0.20	15.0	11.0	13.0	7.2	6.9	6.6	4.2	>100 (%v/v)
DEC	0.19	14.0	10.4	11.8	7.2	7.3	7.1	15.9	>100 (%v/v)
# Samples	-	-	-	365	248	248	247	49	13
Maximum-Yr.	**0.31**	**20.1**	**-**	**-**	**7.5**	**7.7**	**7.6**	**27.3**	**>100 (%v/v)**
Minimum-Yr.	**-**	**-**	**4.3**	**-**	**6.8**	**5.9**	**5.5**	**0.2**	**>96 Hr**
Average-Yr.	**-**	**-**	**-**	**11.6**	**7.2**	**7.1**	**6.8**	**12.0**	**-**

* Standard LC50 tests reported in (% v/v) and Standard with pH Stabilization LT50 reported in (hours)

MONTH	Ave Temp (oC) FINAL EFF	Ave. Diss. Oxygen (mg/L) RAW INF	FINAL EFF	Ave. Chlorine Calc. Dosage (mg/L) EFF	Ave. Residual Chlorine Final Effluent (mg/L) Before SO2	After SO2	Residual SO_2 (mg/L) Effluent Outfall	Fec. Coliform (MPN/100mL) Final Effluent Monthly Geomean	Max Geomean in month
JAN	10	8.2	3.9	-	-	-	-	-	-
FEB	10	7.6	3.6	-	-	-	-	-	-
MAR	10	8.3	3.9	3.2	1.3	<0.1	0.71	-	-
APR	13	7.6	4.7	2.7	0.9	<0.1	1.04	20	-
MAY	16	7.6	4.8	3.5	0.8	<0.1	1.12	20	20
JUN	19	7.2	5.0	6.8	0.8	<0.1	1.10	20	20
JUL	20	6.3	3.7	9.1	0.8	0.9	1.18	180	116
AUG	20	6.9	4.1	9.3	0.7	<0.1	1.38	553	1373
SEP	20	7.0	4.5	7.2	0.7	<0.1	1.53	112	3095
OCT	16	7.3	4.4	3.2	0.8	<0.1	1.48	24	28
NOV	14	7.7	4.1	-	-	-	-	-	-
DEC	11	7.5	3.8	-	-	-	-	-	-
# Samples	247	248	247	215	215	215	215	8	4
Maximum-Yr.	**23**	**9.7**	**6.1**	**17.5**	**2.1**	**0.9**	**4.68**	**45**	**3095**
Minimum-Yr.	**3.8**	**4.1**	**2.8**	**2.2**	**0.1**	**<0.1**	**0.20**	**<20**	**20**
Average-Yr.	**15**	**7.4**	**4.2**	**6.0**	**0.8**	**<0.2**	**1.26**	**-**	**-**
Geomean	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**66195**	**293**

(1) ammonia, Dissolved Oxygen, Temperature,Residual Chlorine(taken before and after dechlorination), Residual SO2, 96 hour LC50 and Coliform are determined on grab samples; all other parameters are determined on 24 hr. flow proportioned composite samples.

(2) Effluent was chlroinated between Mar. 30 to Oct. 31, 2009 inclusive.

Table 7-4 Con't: NW Langley WWTP - 2009 Routine Monitoring Results and Performance Summary

MONTH	Total Suspended Solids (mg/L)						AVE TSS % Reduct.	Total Susp. Solids Average Loadings (Tonnes/day)		Average VSS (mg/L)		VSS % Average Reduction
	RAW INFLUENT			FINAL EFFLUENT								
	Max.	Min.	Ave.	Max.	Min.	Ave.		INF	EFF	INF	EFF	
JAN	386	83	218	36	16	25	88	2.7	0.32	195	24	87
FEB	338	84	198	36	15	26	86	2.3	0.29	175	23	86
MAR	351	99	211	38	14	28	86	2.4	0.31	194	26	86
APR	410	68	220	23	9	16	92	2.6	0.19	209	14	92
MAY	306	88	199	21	9	14	92	2.3	0.16	191	14	93
JUN	314	142	226	21	9	15	93	2.6	0.17	214	14	93
JUL	825	67	340	18	8	11	96	3.7	0.12	277	11	95
AUG	320	103	223	22	6	12	94	2.4	0.13	193	11	94
SEP	340	154	243	17	7	11	95	2.7	0.12	231	10	95
OCT	355	140	227	20	12	16	93	2.6	0.18	203	15	92
NOV	400	86	199	33	16	22	88	2.6	0.28	183	21	87
DEC	278	111	211	26	14	21	90	2.5	0.24	189	20	89
# Samples	-	-	365	-	-	365	365	365	365	239	239	239
Maximum-Yr.	**825**	**-**	**-**	**38**	**-**	**-**	**99**	**8.8**	**0.60**	**490**	**34**	**98**
Minimum-Yr.	**-**	**67**	**-**	**-**	**6**	**-**	**67**	**0.6**	**0.06**	**59**	**4**	**70**
Average-Yr.	**-**	**-**	**227**	**-**	**-**	**18**	**91**	**2.6**	**0.21**	**205**	**17**	**91**
Total to Date - Suspended Solids Loadings (Tonnes):								**955**	**76.8**			

MONTH	Biochemical Oxygen Demand (mg/L)			Carbonaceous Biochemical Oxygen Demand (mg/L)			AVE BOD % Reduct.	BOD/cBOD Average Loadings (Tonnes/day)		Average COD (mg/L) Total RAW
	RAW INFLUENT			FINAL EFFLUENT						
	Max.	Min.	Ave.	Max.	Min.	Ave.		INF	EFF	INF
JAN	363	260	311	21	14	19	94	3.8	0.23	590
FEB	469	244	312	32	11	19	94	3.6	0.22	595
MAR	350	221	285	27	9	17	94	3.1	0.18	576
APR	376	220	302	16	6	12	96	3.6	0.14	584
MAY	317	222	280	9	5	7	97	3.2	0.08	555
JUN	386	301	337	11	7	8	97	3.9	0.10	605
JUL	533	260	361	10	<4	<7	98	3.9	<0.07	778
AUG	402	206	285	12	8	10	96	3.0	0.11	597
SEP	400	290	341	8	5	7	98	3.9	0.08	575
OCT	412	259	334	12	9	10	97	3.8	0.12	615
NOV	292	192	239	18	6	13	94	3.2	0.17	504
DEC	309	278	297	18	11	15	95	3.6	0.17	562
*** Effective May 1, 2004, all final effluent BOD results are reported to the MoE as cBOD**										
# Samples	-	-	98	-	-	101	96	98	101	364
Maximum-Yr.	**533**	**-**	**-**	**32**	**-**	**-**	**99**	**6.4**	**0.37**	**1420**
Minimum-Yr.	**-**	**192**	**-**	**-**	**<4**	**-**	**91**	**0.9**	**<0.04**	**362**
Average-Yr.	**-**	**-**	**309**	**-**	**-**	**<12**	**96**	**3.6**	**<0.14**	**595**
Total to Date - BOD Loadings (Tonnes):								**1300**	**49.6**	**-**

(1) Percent reduction is calculated only for days when both influent and effluent tests were done

Table 7-5: NW Langley WWTP – 2009 Comprehensive Program Concentrations Summary

Parameters	Sample Type	INFLUENT Max.	INFLUENT Min.	INFLUENT Ave.	EFFLUENT Max.	EFFLUENT Min.	EFFLUENT Ave.
		mg/L (unless specified)			mg/L (unless specified)		
Kjeldahl Nitrogen	Comp.	44	35	41	30	4	16
N-Nitrate	Grab	1.1	<0.01	<0.28	18	0.02	6.8
N-Nitrite	Grab	0.47	<0.01	<0.15	6.32	<0.01	<0.77
N-Ammonia	Comp.	27.7	21.8	24.7	27.9	0.6	11.5
Sulphate	Comp.	42.0	29.6	33.8	37.5	28.2	34.4
Total Phosphorus	Comp.	11.9	6.1	9.7	7.3	4.1	5.6
Dissolved Phosphorus	Comp.	8.3	3.6	6.5	6.2	3.4	4.7
MBAS	Grab	1.8	0.7	1.2	0.2	<0.1	<0.2
Oil & Grease	Grab	125	16	47	7.0	<5	<7
Phenols	Grab	0.04	0.01	0.03	0.01	<0.01	<0.01
Cyanide Total	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Aluminum Total	Comp.	1.91	0.85	1.21	0.20	0.10	0.14
Aluminum Dissolved	Comp.	0.22	0.11	0.17	0.09	0.03	0.05
Arsenic Total	Comp.	0.002	<0.001	<0.002	<0.001	<0.001	<0.001
Barium Total	Comp.	0.049	0.026	0.037	0.007	0.004	0.005
Barium Dissolved	Comp.	0.008	0.005	0.006	0.004	0.003	0.004
Boron Total	Comp.	0.20	0.15	0.18	0.21	0.14	0.18
Boron Dissolved	Comp.	0.20	0.14	0.17	0.21	0.14	0.17
Calcium Total	Comp.	20.8	11.9	15.4	15.1	10.6	13.4
Cadmium Total	Comp.	0.0007	<0.0005	<0.0006	<0.0005	<0.0005	<0.0005
Cadmium Dissolved	Comp.	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium Total	Comp.	0.018	0.010	0.013	0.005	0.003	0.004
Chromium Dissolved	Comp.	0.009	0.005	0.007	0.004	0.002	0.003
Cobalt Total	Comp.	0.002	<0.001	<0.002	<0.001	<0.001	<0.001
Cobalt Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper Total	Comp.	0.170	0.103	0.139	0.034	0.016	0.025
Copper Dissolved	Comp.	0.032	0.017	0.025	0.026	0.007	0.015
Iron Total	Comp.	1.91	0.77	1.09	0.21	0.13	0.17
Iron Dissolved	Comp.	0.32	0.20	0.25	0.15	0.08	0.09
Lead Total	Comp.	0.011	0.004	0.007	0.002	<0.001	<0.002
Lead Dissolved	Comp.	0.002	<0.001	<0.002	0.002	<0.001	<0.002
Magnesium Total	Comp.	5.95	3.28	4.85	5.03	2.88	4.18
Manganese Total	Comp.	0.087	0.063	0.076	0.064	0.046	0.053
Manganese Dissolved	Comp.	0.056	0.039	0.048	0.058	0.039	0.047
Mercury Total **(µg/L)**	Comp.	0.27	0.11	0.16	0.06	<0.05	<0.06
Molybdenum Total	Comp.	0.005	0.003	0.004	0.003	<0.002	<0.003
Molybdenum Dissolved	Comp.	0.003	<0.002	<0.003	0.003	<0.002	<0.003
Nickel Total	Comp.	0.022	0.004	0.008	0.069	0.004	0.013
Nickel Dissolved	Comp.	0.016	0.002	0.004	0.063	0.004	0.012
Selenium Total	Comp.	0.01	<0.01	<0.01	0.01	<0.01	<0.01
Silver Total	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver Dissolved	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tin Total	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tin Dissolved	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc Total	Comp.	0.199	0.146	0.167	0.114	0.058	0.077
Zinc Dissolved	Comp.	0.081	0.054	0.069	0.101	0.046	0.065

Note: In calculating average results, all < or > signs are removed and the numbers are used in the calculations. The sign is added back to the calculated average value.

Table 7-6: NW Langley WWTP – 2009 Comprehensive Program Loadings Summary

Parameters	INFLUENT Max. (kg/Day)	INFLUENT Min. (kg/Day)	INFLUENT Ave. (kg/Day)	INFLUENT Tonnes per year	EFFLUENT Max. (kg/Day)	EFFLUENT Min. (kg/Day)	EFFLUENT Ave. (kg/Day)	EFFLUENT Tonnes per year
Kjeldahl Nitrogen	571	440	473	173	351	52	184	67
N-Nitrate	15	<0.2	<3.4	<1.3	198	0.2	78	29
N-Nitrite	5.0	<0.2	<1.7	<0.7	71	<0.2	<8.7	<3.2
N-Ammonia	331	252	287	105	309	7.8	135	49
Sulphate	468	343	393	143	474	318	401	146
Total Phosphorus	149	76	112	41	79	54	64	24
Dissolved Phosphorus	104	45	75	27	67	45	55	20
MBAS	20	8.4	14	5.2	2.8	<1.1	<2.1	<0.8
Oil & Grease	1340	225	535	195	91	<60	<72	<27
Phenols	0.5	0.1	0.3	0.11	0.1	<0.2	<0.2	<0.05
Cyanide Total	<0.3	<0.3	<0.3	<0.09	<0.3	<0.3	<0.3	<0.09
Aluminum Total	21	9.6	14	5.1	2.2	1.2	1.6	0.6
Aluminum Dissolved	2.6	1.2	1.9	0.7	1.1	0.3	0.6	0.2
Arsenic Total	0.02	<0.02	<0.02	<0.005	<0.02	<0.02	<0.02	<0.005
Barium Total	0.55	0.33	0.43	0.16	0.08	0.05	0.06	0.02
Barium Dissolved	0.11	0.06	0.07	0.03	0.05	0.03	0.04	0.01
Boron Total	2.3	1.7	2.0	0.7	2.4	1.9	2.0	0.7
Boron Dissolved	2.3	1.6	2.0	0.7	2.4	1.7	2.0	0.7
Calcium Total	292	138	181	66	204	123	157	57
Cadmium Total	0.008	<0.006	<0.006	<0.003	<0.008	<0.006	<0.006	<0.003
Cadmium Dissolved	0.007	<0.006	<0.006	<0.003	<0.008	<0.006	<0.006	<0.003
Chromium Total	0.20	0.11	0.15	0.06	0.07	0.03	0.04	0.02
Chromium Dissolved	0.11	0.06	0.08	0.03	0.06	0.02	0.03	0.01
Cobalt Total	0.02	<0.02	<0.02	<0.006	<0.02	<0.02	<0.02	<0.005
Cobalt Dissolved	<0.02	<0.02	<0.02	<0.005	<0.02	<0.02	<0.02	<0.005
Copper Total	1.88	1.20	1.62	0.59	0.39	0.20	0.29	0.11
Copper Dissolved	0.41	0.20	0.29	0.10	0.29	0.08	0.18	0.06
Iron Total	20.9	8.69	12.7	4.64	2.81	1.56	1.98	0.72
Iron Dissolved	3.79	2.27	2.92	1.06	1.80	0.90	1.10	0.40
Lead Total	0.123	0.048	0.076	0.028	0.028	<0.011	<0.017	<0.007
Lead Dissolved	0.023	<0.011	<0.016	<0.006	0.023	<0.011	<0.013	<0.005
Magnesium Total	84	38	57	21	61	33	49	18
Manganese Total	1.18	0.73	0.89	0.32	0.83	0.51	0.62	0.23
Manganese Dissolved	0.76	0.44	0.56	0.21	0.75	0.43	0.55	0.20
Mercury Total	0.0038	0.0012	0.0019	0.0007	0.0007	<0.0006	<0.0006	<0.0003
Molybdenum Total	0.065	0.032	0.046	0.017	0.035	<0.022	<0.025	<0.010
Molybdenum Dissolved	0.035	<0.022	<0.028	<0.011	0.039	<0.022	<0.025	<0.010
Nickel Total	0.25	0.04	0.09	0.03	0.78	0.05	0.15	0.06
Nickel Dissolved	0.18	0.02	0.05	0.02	0.71	0.05	0.13	0.05
Selenium Total	0.14	<0.11	<0.12	<0.05	0.14	<0.11	<0.12	<0.05
Silver Total	<0.02	<0.02	<0.02	<0.005	<0.02	<0.02	<0.02	<0.005
Silver Dissolved	<0.02	<0.02	<0.02	<0.005	<0.02	<0.02	<0.02	<0.005
Tin Total	<0.15	<0.11	<0.12	<0.05	<0.15	<0.11	<0.12	<0.05
Tin Dissolved	<0.15	<0.11	<0.12	<0.05	<0.15	<0.11	<0.12	<0.05
Zinc Total	2.20	1.65	1.93	0.71	1.22	0.72	0.89	0.32
Zinc Dissolved	0.96	0.61	0.80	0.29	1.08	0.58	0.75	0.27

Method: Maximums, minimums and averages calculated from loadings obtained for each sampling date.

7.5 Effluent Toxicity

At the NW Langley WWTP, occasionally there is potential for ammonia to be the cause of toxicity in some samples of effluent. This generally occurs during cold-weather periods when the treatment process does not produce a nitrified effluent. The toxicity, however, appears to be largely a function of the test protocol as aeration results in an increase in sample pH that ultimately increases the proportion un-ionized ammonia, a more toxic form of ammonia, during the test.

Environment Canada's standard reference method[12] for determining acute lethality of effluents to Rainbow trout exposes test fish to a series of effluent dilutions, and determines the fish survival rate at the end of a 96-h exposure period. The final result is reported as the 96-h LC_{50} value, which is the % by volume (of the original sample) at which 50% of the test fish survive. A pass for all effluent samples requires that the LC_{50} value must be *equal to* or *greater than* 100% (v/v sample). This means that 50% or more of the test fish must survive for 96 hours in the original undiluted sample.

In 2008, Environment Canada published an add-on test procedure[13] for pH stabilization during the testing of acute lethality. The add-on procedure is applicable only to wastewater effluents. The purpose of pH stabilization is to replace the CO_2 lost due to aeration in order to maintain the pH throughout the test at the same levels observed at the start of the test. This add-on procedure recognizes that toxicity observed in municipal wastewater effluents may be an artifact of the standard reference method.

The add-on procedure can be used only when the standard reference method gives a false result due to pH shift during the test. Consequently a second test is run concurrently with the standard reference method. The second test utilizes the reference method with the add-on pH stabilization procedure.

2009 Program

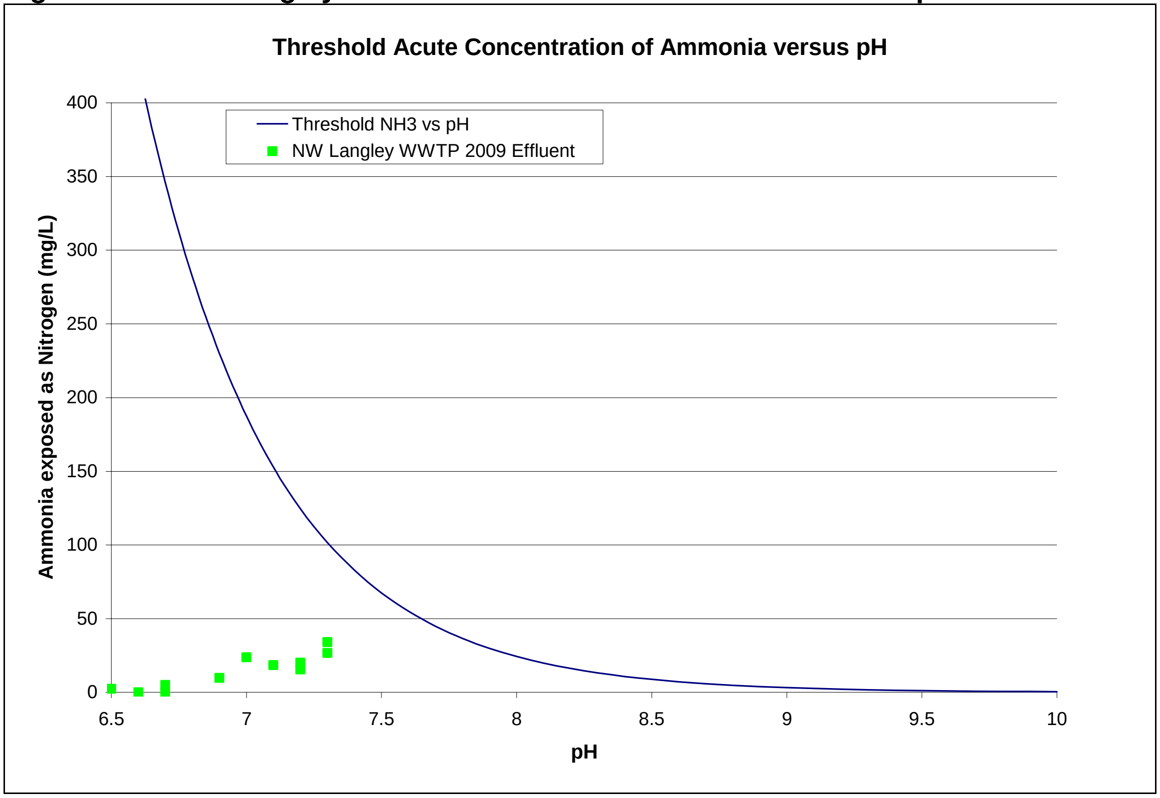
As required by the Liquid Waste Management Plan and the plant's Operational Certificate, all regular LC_{50} results for effluent samples from GVS&DD WWTPs are followed up with work to explain the cause of results of less than 100%. Outlined below is a summary of NW Langley effluent toxicity results and evaluations for 2009.

All effluent samples from the NW Langley WWTP passed the required monthly toxicity test using Environment Canada's standard reference method (10 cases) or the reference method with the add-on pH stabilization step (2 cases).

Additionally, the pH and ammonia values in 2008 showed that the concentration of ammonia in the undiluted effluent was not acutely toxic at the measured pH values. This is demonstrated in the following chart for pH and ammonia data collected during the year. All results were below the threshold acute concentration curve for ammonia at the measured pH value of the effluent discharge.

[12] Environment Canada, Report EPS 1/RM/13, Second Edition – December 2000, p.9.
[13] Environment Canada, Report EPS 1/RM/50 – March 2008, p. 10.

Figure 7-1: NW Langley WWTP - Ammonia Concentration versus pH Value



7.6 Digested Sludge Monitoring

NW Langley Wastewater Treatment Plant produces digested sludge complying with OMRR Class B pathogen levels. The digested sludge is discharged to lagoons and then to drying beds.

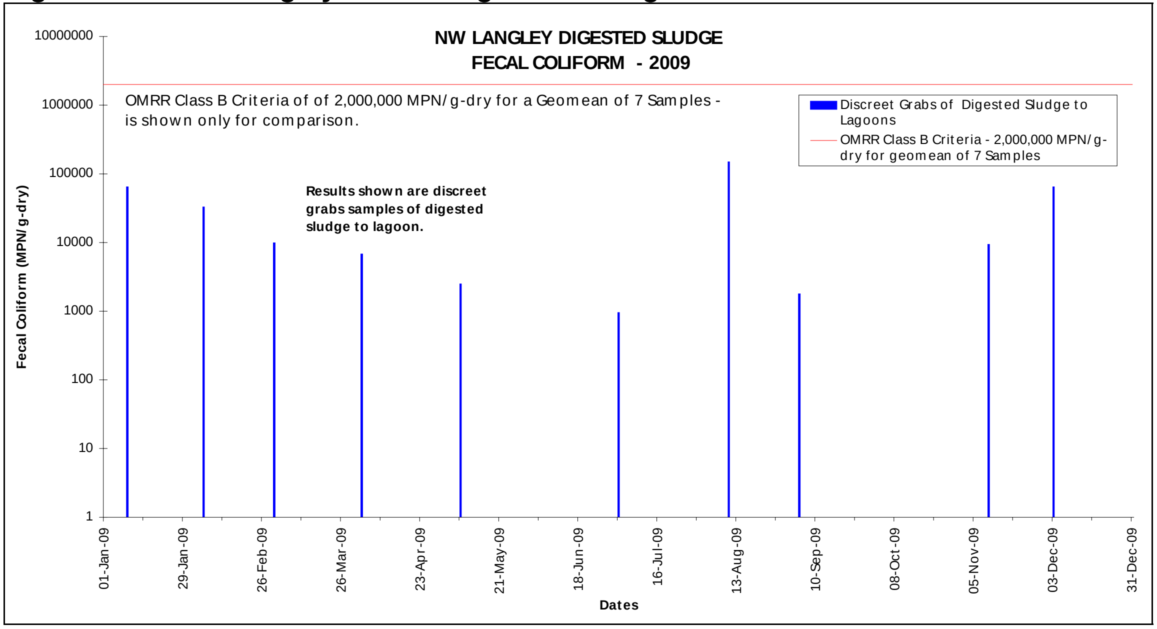
Weekly composite of digested sludge and single grab sample collected during discharge cycles to the lagoons were tested to monitor the quality of raw sludge and digested sludge discharged to the lagoon.

A comparison of the results for metal values and fecal coliform levels obtained in 2009 with the OMRR Class B criteria is present in the following table:

Class B Criteria	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Moly	Nickel	Selenium	Zinc	Fecal Coliform (MPN/g)*
(mg/kg)	**75**	**20**	**1060**	**150**	**2200**	**500**	**5**	**20**	**180**	**14**	**1850**	**2,000,000**
MAX	3.0	5.9	187	10.7	1430	67	1.4	16	105	5.6	1160	150,000
MIN	<2.0	2.6	110	6.1	1020	36	0.7	11.7	39	3.6	843	960
AVE	<2.5	4.5	142	8.1	1228.1	48	1.0	14.2	69	4.5	962	11,900*
# Times Exceeded	0	0	0	0	0	0	0	0	5	0	0	-

*Geomean for Year

Figure 7-2: NW Langley WWTP Digested Sludge – Fecal Coliform



Metals Data

The digested sludge stored in all four lagoons at NW Langley WWTP contains high levels of nickel and other heavy metals. In November 2008, Nickel was exceeding the OMRR limit. However, during 2009 Nickel was within the OMRR limit. Molybdenum levels (as shown in Fig 7.5) never exceeded the OMRR limit of 20 mg/kg.

Sludge discharges with high metal content were directed to a dedicated lagoon in order to minimize further metals contamination in the remaining cells of the lagoon system.

Figure 7-3: NW Langley Raw and Digested Sludge – Total Nickel, 2007-2009 Data

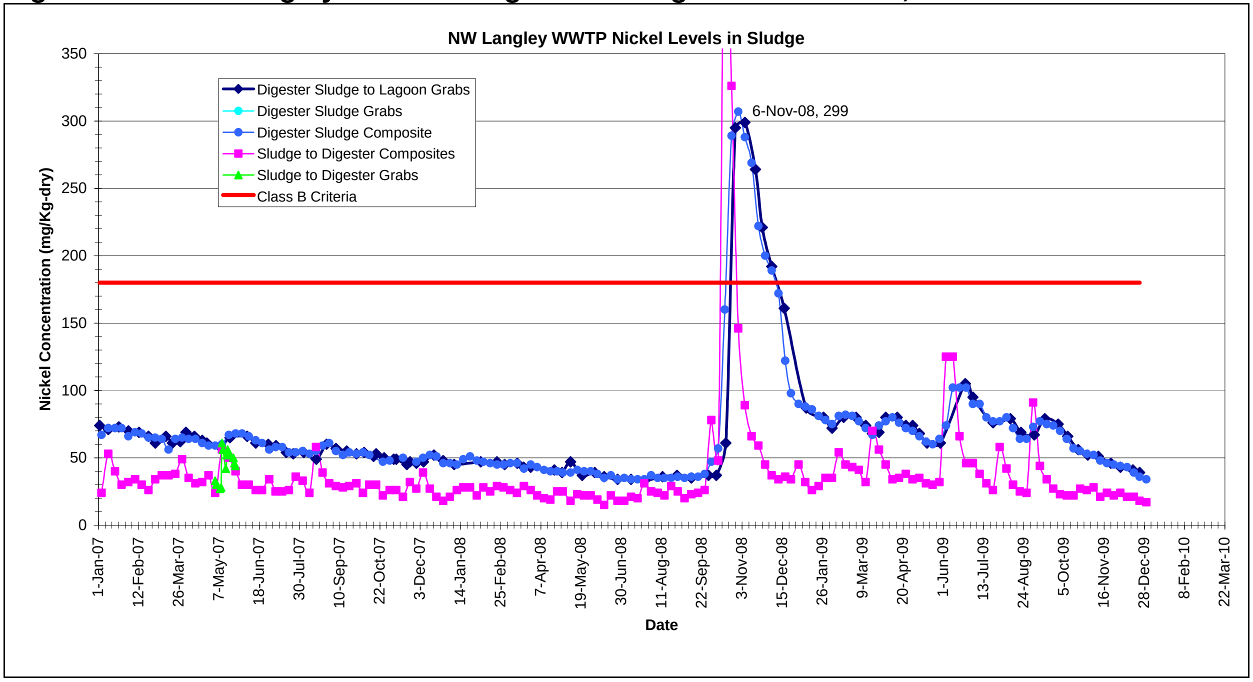


Figure 7-4: NW Langley Raw and Digested Sludge – Total Cadmium, 2007-2009 Data

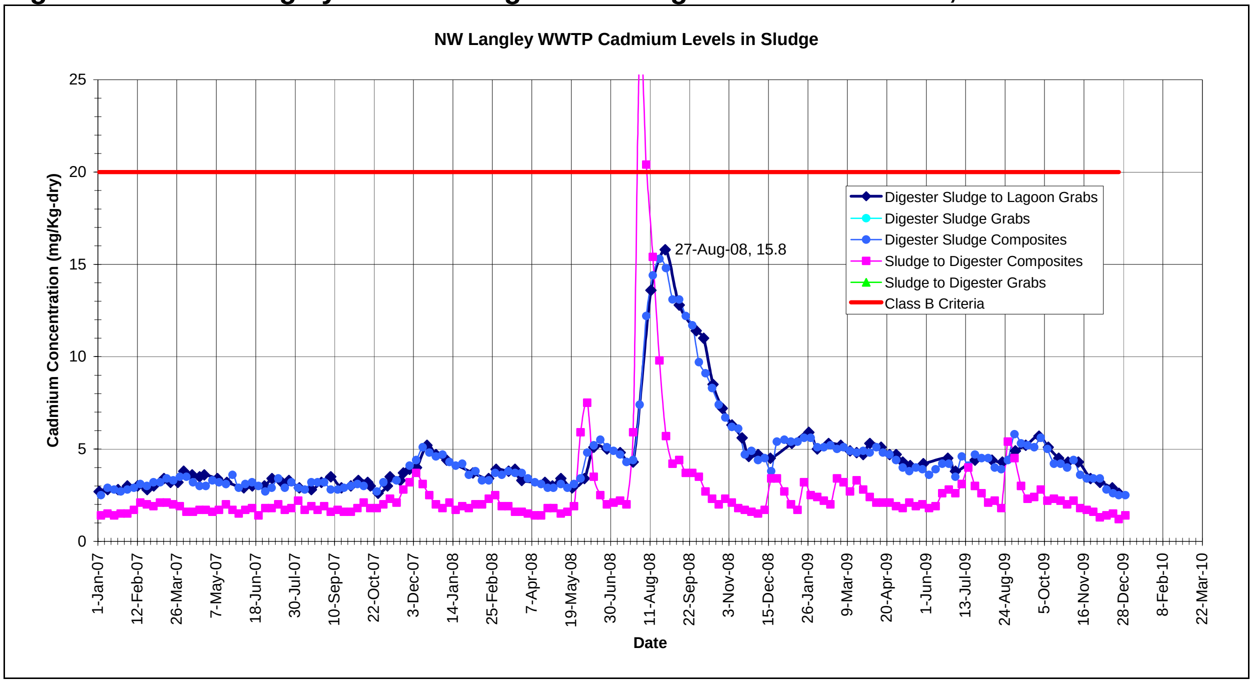
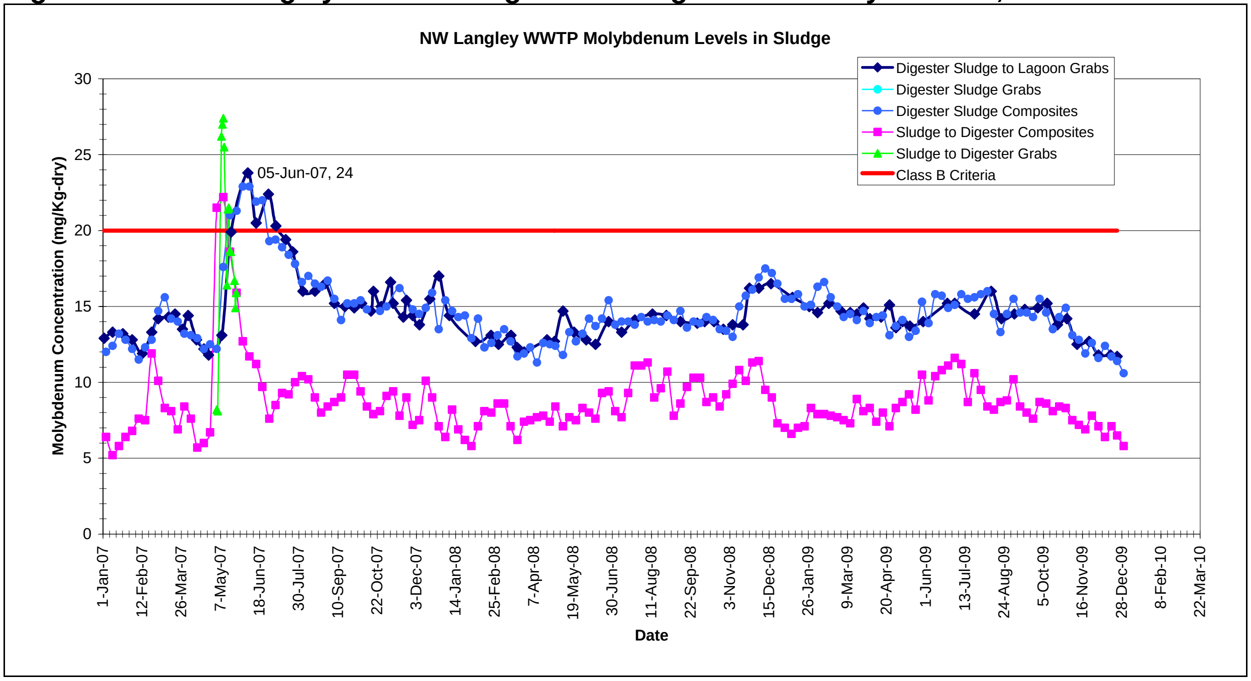


Figure 7-5: NW Langley Raw and Digested Sludge – Total Molybdenum, 2007-2009 Data



Additional Information for 2008 and 2009 Fecal Coliforms and Metals Data are found in: Appendix D - Biosolids and Digester Sludge Monitoring Programs.

Environmental
Monitoring

8.0 Receiving Environment Monitoring Programs

8.0 Receiving Environment Monitoring Programs

Metro Vancouver is committed to the principle of managing liquid waste in a manner that enhances environmental quality. This commitment is detailed in Metro Vancouver's Liquid Waste Management Plan (LWMP). The LWMP is mandated by the Province of British Columbia and designed to ensure that an integrated and local approach to making informed liquid waste management decisions is followed.

A key component of the LWMP involves monitoring, assessment and forecasting to evaluate the effects of wastewater discharges, such as wastewater treatment plant effluents and combined sewer overflows, and stormwater into the receiving environment. Receiving environment monitoring determines if Metro Vancouver's wastewater discharges are contributing to exceedances of water quality objectives.

As well, monitoring characterizes the surrounding environment, provides background data, develops indicators of environmental change, assesses long-term trends, and provides input data into a framework for environmental cautions, warnings and triggers. This framework forms the basis of a process for indicating ecological changes prior to adverse environmental impacts occurring due to Metro Vancouver's wastewater discharges to the receiving environment.

The monitoring programs are guided and reviewed by the Environmental Monitoring Committee, a technical advisory committee to Metro Vancouver under the LWMP. The committee is made up of representatives from the federal and provincial governments, member municipalities, Metro Vancouver, universities and one public member.

The Greater Vancouver Sewerage & Drainage District (GVS&DD) collects and treats wastewater from its member municipalities, which together forms Metro Vancouver. After treatment, the treated wastewater is discharged to the receiving environment. The treated and dispersed wastewater in the receiving environment must meet applicable water quality objectives.

The GVS&DD owns and operates five wastewater treatment plants that service a population of about 2 million people in the lower mainland (see Figure 8.1). The Iona Island and Lions Gate wastewater treatment plants discharge primary treated wastewater into marine water in the Strait of Georgia and Burrard Inlet, respectively. The Annacis Island, Lulu Island and Northwest Langley wastewater treatment plants discharge secondary treated wastewater into the Main Arm of the Fraser River. In 2009, Metro Vancouver's treatment plants collected and treated about 444 billion litres of wastewater before discharging to the receiving waters.

This section presents an overview of the monitoring and assessment programs associated with Metro Vancouver's wastewater treatment plant discharges. These programs include:

- Recreational Water Quality Monitoring
- Iona Deep-Sea Outfall Environmental Monitoring
- Lions Gate Outfall Receiving Environment Monitoring
- Receiving Environment Monitoring of Metro Vancouver's Fraser River Wastewater Treatment Plants
- Combined Sewer Overflow Monitoring

The receiving environment monitoring programs form a major part of the Metro Vancouver's integrated approach to managing liquid wastes. Other components of this approach include ambient monitoring programs, special studies and research projects.

Figure 8-1: Map of Metro Vancouver's Wastewater Treatment Plants

8.1 Recreational Water Monitoring Program

Indicator

Fecal coliform bacteria can be used as an indicator of recreational water quality to determine the safety of recreational waters for activities such as swimming, windsurfing, waterskiing, boating and fishing. These bacteria are used as an indicator for the potential presence of pathogenic organisms associated with fecal matter that may cause infection in humans.

Fecal coliform bacteria are found in the intestinal tract of warm-blooded animals and birds. These bacteria may enter waterbodies directly from humans and animals, agricultural and stormwater runoff, and wastewater.

Common sources of fecal coliforms in recreational waters

- feces from humans, pets and birds
- agricultural and stormwater runoff
- combined sewer overflows
- malfunctions in the sewage collection or treatment systems
- improperly maintained septic tanks
- release of raw sewage from boat holding tanks (many marinas provide pump-out facilities)

Monitoring

Metro Vancouver monitors the bacteriological quality of recreational waters on a weekly basis throughout the bathing season from May to September. Sampling may also occur during the remainder of the year, but with less coverage.

Collecting recreational-water samples

Metro Vancouver's Recreational Water Monitoring Program has been in place for approximately 50 years. During this time, many monitoring sites have been added to the program. Both bathing (swimming) and non-bathing beaches are monitored. At present, there are 101 sampling sites at 38 locations (Table 8.1). A minimum of five samples are collected from each site within a 30-day period.

Testing and Reporting

The Quality Control Laboratory at Metro Vancouver analyzes recreational water samples collected throughout the region for levels of fecal coliform bacteria. The results of these analyses are sent to the appropriate health authority and municipality. As well, the Laboratory calculates the 30-day running geometric mean (which is a type of average) of fecal coliform levels to determine compliance with guidelines and forwards this information the health unit.

The results are communicated twice weekly to the health authority. A new geometric mean is calculated every time a beach is sampled. As well, notification of elevated counts is also given at time of reporting (i.e., when a beach geometric mean is approaching the guideline or the guideline is exceeded).

Analyzing samples for fecal coliforms

Guidelines
Vancouver Coastal Health and Fraser Health are the local health authorities that set the monitoring requirements, and have the overall responsibility to determine whether recreational waters are safe for public use. Guidelines for recreational waters are outlined in a Health Canada document titled "Guidelines for Canadian Recreational Water Quality" and in a summary document "Water Quality Criteria for Microbiological Indicators" by BC Environment. The primary objective of these guidelines is the protection of public health and safety.

Health Canada defines primary contact as a recreational activity in which there is the intentional or incidental immersion of the whole body or the face and trunk, and where it is likely some water will be swallowed. Primary contact activities include swimming, windsurfing and waterskiing.

For primary or whole body contact activities, the guidelines establish a maximum limit for the geometric-mean fecal concentration: less than or equal to 200 fecal coliform bacteria per 100 mL of recreational water. This concentration is based on at least five samples taken during a period not to exceed 30 days.

A working guideline is also available for secondary or incidental contact activities, such as boating and fishing, in which greater contact with water is rare. The working guideline is set at 1,000 fecal coliforms per 100 mL of recreational water. This is equivalent to 5 times the guideline value for the geometric-mean concentration for primary-contact recreation.

When levels exceed the guidelines, the health authority requires the beach operator to post clear advisory and warning signs without delay along the affected recreational water. These signs warn potential users of the recreational water that the water is contaminated and is unsafe for use. The signage is left in place for as long as necessary and removed once the health authority determines that the health hazard no longer exists.

Comparison to Guidelines
In 2009 most recreational waters in Metro Vancouver met the primary-contact guideline and were well below the 200 limit during the summer season, except for a few days at Gary Point and White Pine Beach. Gary Point is located south of Sturgeon Bank at the mouth of the Fraser River near historic Steveston, and White Pine Beach is situated at the north end of Sasamat Lake in Belcarra Regional Park. Gary Point, a non-swimming area, did exceed the 200 limit and was posted from July 28th to 31st. As well, the swimming area at White Pine Beach was posted from July 17th to 20th.

All of False Creek, a non-swimming area, easily met the working guideline limit of 1,000 for secondary-contact activities. One new swimming area was sampled in 2009 at Rocky Point Park located in Port Moody.

Even though the summer months saw very few postings, there were a few incidents that required extra sampling at some locations in 2009. Ambleside Beach had several occasions with high individual fecal coliform counts, and these incidents were related to a sewer spills and upsets at wastewater treatment plants. Jericho and Locarno Beaches experienced one day of very high fecal coliform counts simultaneously, but the specific cause could not be determined. All affected beaches were re-sampled. The main causes of the sewage spills and plant upsets were due to power outages and equipment failures. Other possible contributors of fecal coliforms include combined sewer overflows, urban stormwater runoff, and the presence of geese and dogs.

Table 8-1: List of sampling locations and record of meeting guidelines

Area	Location	Recreational Water Quality Guidelines Met Since 2005 (if No then number of days guidelines not met for given year)*
West Vancouver	Whytecliff Park	Yes
	Eagle Harbour	No: 2007 (6 days)
	Dundarave	Yes
	Ambleside	Yes
Burrard Inlet	Cates Park	No: 2005 (13 days)
(Indian Arm, Port Moody Arm &	Deep Cove	No: 2005 (30 days); 2006 (3 days)
Vancouver Harbour)	Bedwell Bay	Yes
	Belcarra Park - Picnic Area	Yes
	Old Orchard Park	No: 2006 (5 days)
	Rocky Point Park**	Yes
	Barnet Marine Park	No; 2005 (26 days); 2006 (5 days)
	Brockton Point	No: 2006 (6 days)
English Bay	Third Beach	Yes
	Second Beach	Yes
	English Bay Beach	Yes
	Sunset Beach	Yes
	Kitsilano Point	No: 2006 (7 days)
	Kitsilano Beach	Yes
	Jericho Beach	Yes
	Locarno Beach	No: 2007 (3 days)
	Spanish Banks	Yes
False Creek* **	West False Creek	Yes
	Central False Creek	Yes
	East False Creek	2008 (26 days)
Wreck Beach	Foreshore East	Yes
	Foreshore West (Acadia Beach)	Yes
	Trail 4 (Towers Beach)	Yes
	Trail 6 (North-Arm Breakwater)	Yes
	Trail 7 (Oasis)	No: 2006 (9 days)
Richmond	Iona Beach	Yes
	Gary Point	No: 2006 (41 days); 2009 (6 days)
Boundary Bay	Centennial Beach	Yes
	Crescent Beach North	Yes
	Crescent Beach	Yes
	White Rock Beach	Yes
Lakes	Aldergrove Lake	Yes
	Sasamat Lake - Float Walk	Yes
	Sasamat Lake - Outdoor Centre	Yes
	Sasamat Lake - White Pine Beach	No: 2009 (2 days)

* Number of days that water quality was over the guideline limit of 200 for primary-contact recreation during May 1st to September 30th, except False Creek.

** In 2009, one new sampling location was added at Rocky Point Park.

*** False Creek is not classified as a primary-contact recreational water body (i.e., not a swimming or bathing beach). So a working guideline limit of 1,000 for secondary-contact recreation is used to indicate the number of days that this guideline was over the limit during May 1st to September 30th.

Table 8.1 above provides a listing of sampling locations along with a record of meeting the guideline for primary-contact recreation during the summer season for the past 5 years. If the guideline at a given location was not met then the number of days that the guideline was above the limit for a given year is shown. This record does not include any advisories and postings for other biological and chemical hazards, if any, since they would have to be assessed on a case-by-case basis.

Most or all of the recreational waters in Metro Vancouver met the guideline for primary-contact recreation and the working guideline for secondary-contact recreation during the summer season for the 5-year review period from 2005 to 2009 (Table 8.1). There were a few locations, albeit for relatively short periods, that did not meet the guidelines. Generally, the locations that exhibit poor water quality were in areas that receive limited tidal circulation.

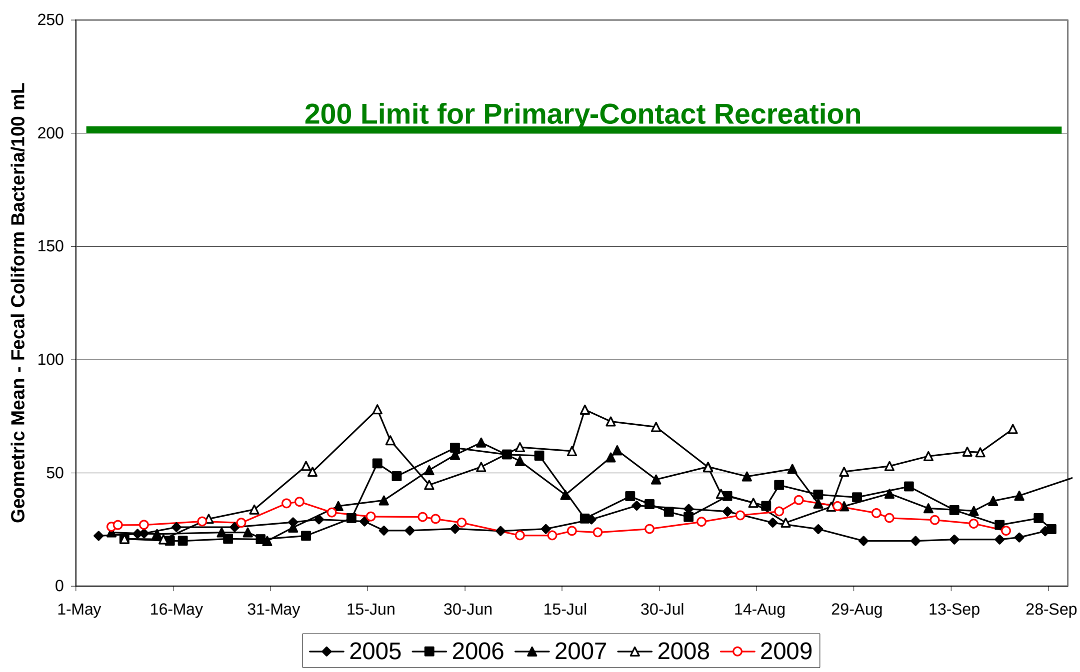
Status and Trends

When fecal-coliform results are expressed as geometric means, the results are useful in assessing the bacteriological quality of recreational waters over time, and showing any underlying trends in the data. Graphs of the 30-day geometric means of fecal coliform results for the 2009 recreational water monitoring program (May to September) are shown in Appendix C. Included with the 2009 results are the geometric means for the years 2005 to 2008.

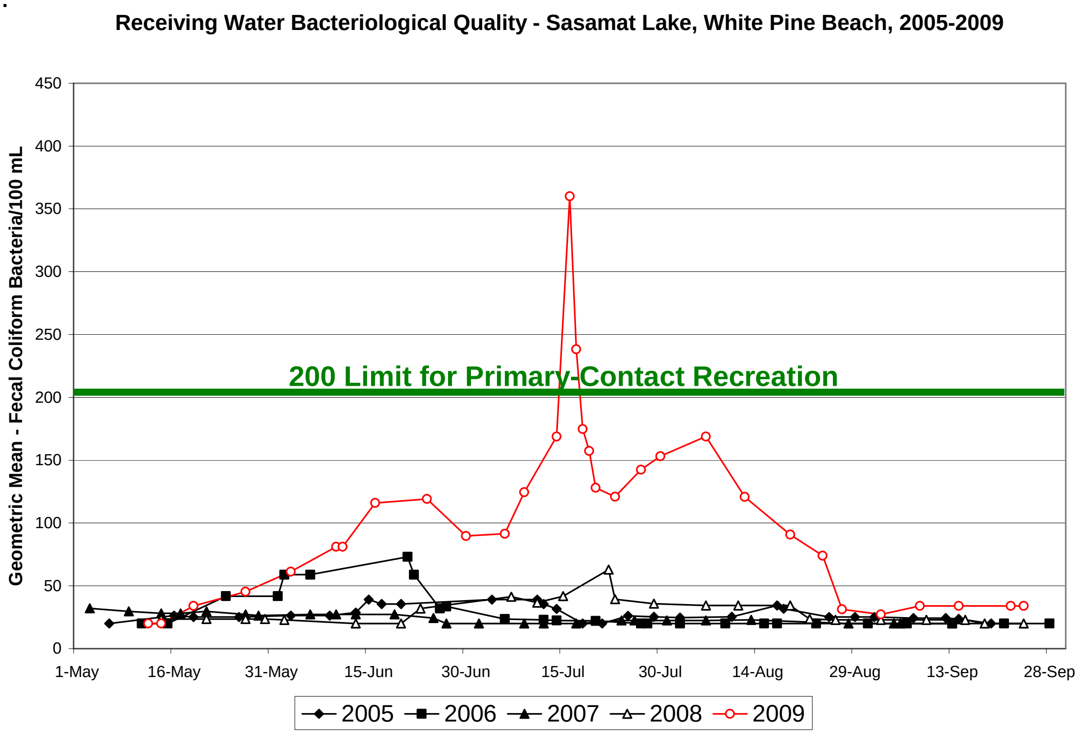
For comparison purposes, graphs of one unaffected beach, Wreck Beach - Trail 6, and one affected water body, White Pine Beach, are shown below along with the corresponding guideline limit (see Figure 8.2).

Figure 8-2: 30-Day Geometric Means of Fecal Coliform Results, 2005-2009
A. Wreck Beach – Trail 6; B. White Pine Beach at Sasamat Lake

A.



B.



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8.2 Iona Deep-Sea Outfall Receiving Environment Monitoring Program

Annual monitoring of the Iona Deep-Sea Outfall discharge and vicinity started in 1986. This monitoring has included two years of baseline monitoring prior to the start of the deep-sea discharge and 22 years following its start up. The overall objective of the monitoring program is to determine possible short and long-term effects of the Iona Deep-Sea Outfall discharge on the receiving environment.

Annual monitoring reports are produced that incorporate the results and provide assessments of the monitoring work. These annual reports are offset by one year to allow for completion of data analysis and interpretation, as well as report production and review.

The work conducted under the monitoring program has included assessments of effluent quality, plume dispersion modelling, receiving water quality, sediment quality, composition and structure of the organisms that dwell in and on the sediments, contaminant uptake in fish and crab as well as fish and crab health. Overall, the monitoring program is cyclic and each complete cycle is repeated about every five years and in some cases about every 10 years.

In 1988, the Iona deep-sea outfall diffuser system commenced operation and replaced the previous surface discharge at Sturgeon Bank. The deep-sea outfall discharges primary-treated effluent from the Iona Island Wastewater Treatment Plant at an average depth of about 90 metres into the Strait of Georgia, some seven kilometers west of the Iona Island shoreline. The treatment plant effluent is not disinfected. In 2009, the average daily plant discharge was 550 megalitres.

Program Review

Typically the Iona monitoring program undergoes a comprehensive review upon completion of a major monitoring cycle. The objectives of such a review is to strengthen the program design, make monitoring simplifications, improve the cost effectiveness of monitoring, and identify critical program gaps.

To date, the Iona monitoring program and associated study findings have undergone two critical reviews. The first review was conducted after completion of the second post-discharge monitoring cycle in 1997. The recommendations from the first review of the first and second monitoring cycles were to increase the annual level of monitoring, modify the sampling grid, establish a hypothesis-based monitoring program, and conduct long-term trend analysis. These recommendations were used to strengthen the monitoring program for the next (third) cycle of monitoring.

Six independent experts carried out a review of the third monitoring cycle. Overall, the experts were pleased with Metro Vancouver's approach to monitoring, and found no significant shortcoming with the work undertaken. The high quality of data collected was one of the outstanding features of the monitoring program, placing Metro Vancouver in a position where the environmental data can be used with confidence to support liquid-waste management decisions. The experts also provided recommendations that are being used to further strengthen the monitoring program in the fourth cycle of monitoring that began in 2005.

2009 Monitoring Program

The 2009 program included sediment and bottom-water quality evaluation studies relative to chemistry and bacteriology, and a comprehensive infaunal community structure evaluation. These components have been monitored annually since 2000 to strengthen the database on sediment-dwelling organisms and to evaluate potential long-term effects of the Iona discharge on the receiving environment.

The Iona study area for the sediment survey is shown in Figure 8.3 below. An overview of the results of the sediment effects survey is summarized below. Field sampling was conducted in March 2009 to coincide with the pre-freshet period of the Fraser River. Sediment and bottom-water samples were collected at each of 16 sampling stations located on a north-south transect on the 80-m depth contour in the Iona outfall study area (Figure 8.4).

Water quality near the sediment surface (bottom-water) was within average ranges for coastal marine environments. As well, findings of the triggers assessment for benthos at Iona indicated that there were no exceedances of either warnings or triggers for the Iona receiving environment as defined in Metro Vancouver's triggers document. Sediment biotic indicators of increased organic enrichment, however, have continued in the study area for several years. Although the changes in these indicators are erratic, these changes and their potential causes will be investigated.

In addition to the annual monitoring of sediment, last year's program also included a study on contaminant uptake and health indicators in demersal biota. The purpose of this study was to evaluate contaminant uptake and health of three sentinel species: English sole, Dungeness crab and Pink shrimp. Although some histopathological changes were noted, no consistent patterns could yet be attributed. Generally, findings of tissue contaminant concentrations and health assessment indices were similar to those of the previous study carried out in 2001.

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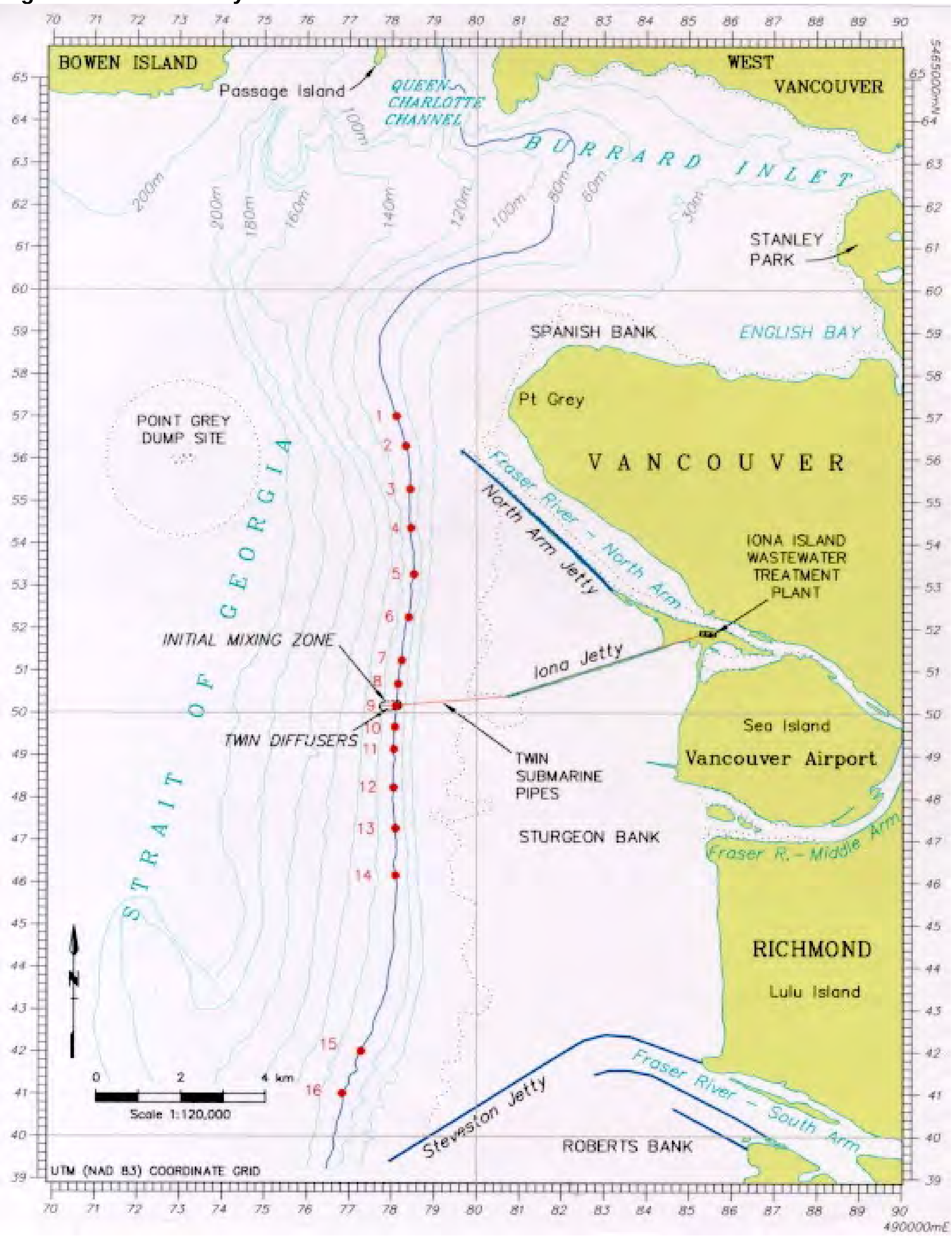
Figure 8-3: Iona Study Area



8.3 Lions Gate Outfall Receiving Environment Monitoring Program

The Lions Gate Outfall Monitoring Program is a program committed to under the LWMP. In December 2000, a workshop was held where a set of 15 monitoring and investigative activities were proposed, which were designed to allow Metro Vancouver to meet its objectives for a receiving environment monitoring program (GVRD 2000). Based on these recommendations and results of effluent dispersion and solids deposition modeling (Seaconsult and EVS, 1999; Hodgins and Hodgins, 2000), special studies were undertaken in 2001/2002 to begin laying the framework for a Receiving Environment Monitoring (REM) program for the Lions Gate WWTP. These included sediment imaging techniques and sediment sampling. These studies were designed to provide the necessary background for the development of a receiving environment program for Lions Gate WWTP.

Lions Gate WWTP

The Lions Gate outfall discharges primary treated effluent into the turbulent First Narrows area of Burrard Inlet through an outfall and diffuser located just to the west of the Lions Gate Bridge in West Vancouver. Minimum initial dilutions measured following the turn of the tide at 100 m from the outfall ranged from about 10:1 to 30:1. Effluent is trapped at depth at most times except for short periods during turns of the tide when some surfacing of effluent can be expected. The average diffuser depth is about 20 metres. The effluent is dispersed initially throughout the Outer and Inner Harbours before entering the Strait of Georgia. Between May and September the effluent is disinfected. In 2009, the average daily plant discharge was 93 megalitres per day.

Program Development

The imaging surveys carried out subsequent to the effluent dispersion and solids deposition modelling (Seaconsult and EVS, 1999; Hodgins and Hodgins, 2000) included Seabed Imaging and Mapping Survey (SIMS) (Seaconsult and EVS, 2002), Side Scan Sonar (TERRA, 2002) and Remote Operated Vehicle (ROV) (CORI, 2002) surveys, with one of the objectives being to confirm the solids deposition modeling. Results for physical habitat characteristics were comparable among these studies. That is, the substrate adjacent to the outfall consists primarily of cobble, while with increasing distance from the outfall (both into the Inner and Outer Harbours) the substrate becomes finer changing from mainly sand to silt to mud at the furthest extent. To corroborate these imaging surveys as well as to gain additional information about the environmental quality, reconnaissance sediment surveys were conducted in autumn of 2002 to assess the overall utility of this approach.

The 2003-2009 sediment effects surveys followed the general outline of the program initiated in 2002. The primary modifications included the following: 1) conducting the survey during pre-freshet (March/April) rather than autumn, 2) a subset of stations sampled for bacteriology in 2002 were included in subsequent surveys for bacteriology and chemistry, 3) the same or more stations were sampled for benthos overtime, 4) a few new stations were added to provide reference areas as well as more closely follow the predicted path of the wastewater plume, 5) in addition to bottom-water sample collection, a mid-water column or trapping depth sample was collected beginning in 2006, and 6) the types of chemical analysis has widened over time.

Sediment Effects Survey Program

The annual reports for the Lions Gate sediment effects survey findings are offset by one year to allow for completion of data analysis and interpretation, as well as report production and review, presentation to the Environmental Monitoring Committee (EMC) and finalization of a formal report.

The 2009 program includes monitoring water quality through on-site measurements, nutrient analyses and fecal coliform concentrations, and more specifically sediment quality. Sediment quality monitoring includes measurements of bacteriology, chemistry and benthic infauna. In 2009, surface sediment and bottom- and trapping depth-water samples were collected from 16 stations located in inner and outer Burrard Inlet and outside Burrard Inlet (Figure 8.4) in late March.

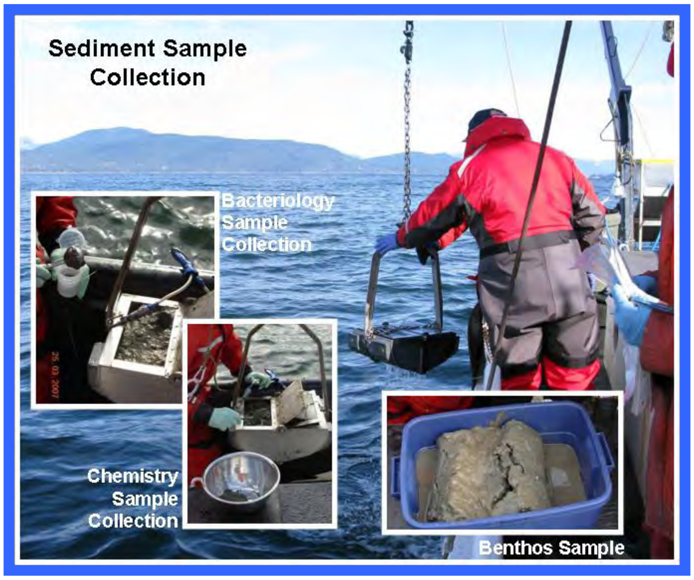
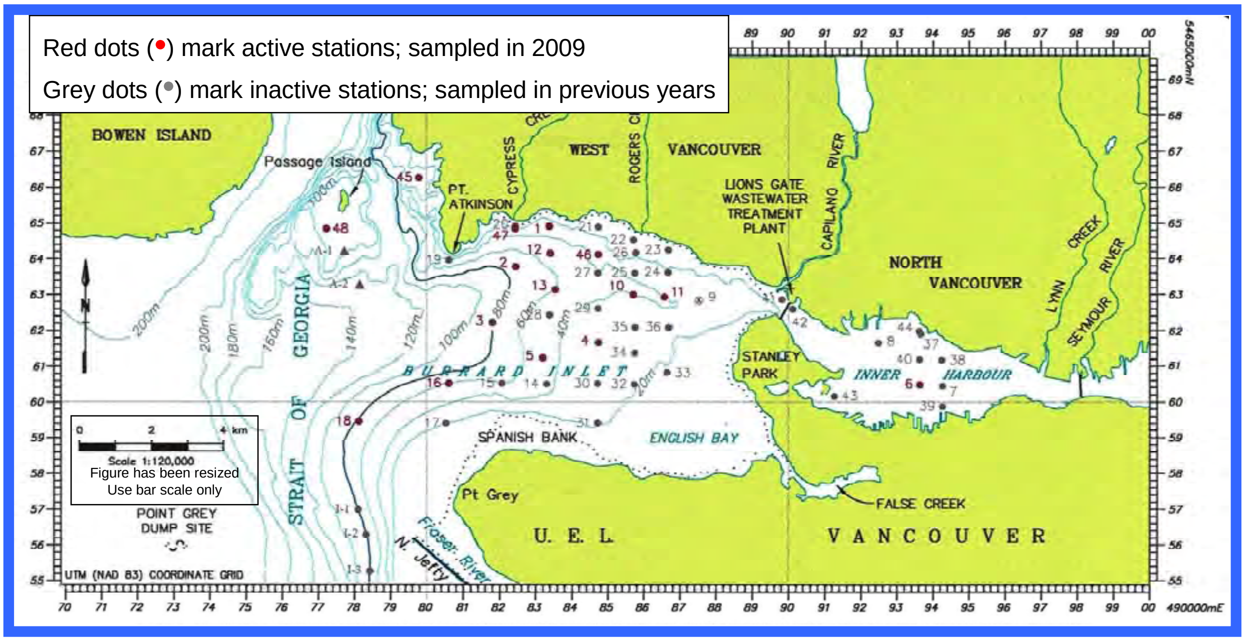


Figure 8-4: Lions Gate Sediment Effects Survey Area, 2009



The Lions Gate 2009 monitoring data for outer Burrard Inlet show that biota from most of the historically sampled stations are within background conditions within the sampling region. Only Station 1, located west of the outfall along the north shore of the Outer Harbour, has consistently shown moderate but variable organic enrichment and elevated indicators. The source of this material, however, may or may not be attributable to the Lions Gate outfall. The one Inner Harbour station sampled (Station 6) shows organic enrichment, but confounding factors are even more extreme in this area due to the more enclosed geography and extensive confounding sources. No notable changes in sediment biotic or geochemical conditions occurred in outer Burrard Inlet between 2008 and 2009.


Sieving Sediment for Benthic Animal Collection

Water quality within the Lions Gate study area was within average ranges expected for urban coastal marine environments. As well, findings of the triggers assessment for benthos at Lions Gate indicated that there were no exceedances of either warnings or triggers for the Lions Gate receiving environment as defined in Metro Vancouver's triggers document. Nonetheless, the Lions Gate receiving environment is seriously confounded by multiple anthropogenic sources, and the complex and unpredictable hydrographic mixing and currents in the area have made it difficult to confirm the modelled deposition pattern of particulates from the outfall.

Initial Dilution Zone Boundary Sampling

Initial dilution zone (IDZ) boundary sampling is an annual component of the Lions Gate outfall receiving environment program. The objective of this monitoring is to determine whether monitoring results at the boundary of the IDZ meet Burrard Inlet Water Quality Objectives. The sampling program was conducted during the effluent non-disinfection period, and consisted of five-sampling events conducted over a 30-day period starting in November/December 2009. Data analysis and reporting is scheduled to be completed in 2010.

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8.4 Receiving Environment Monitoring Program for Metro Vancouver's Fraser River Wastewater Treatment Plants

Metro Vancouver owns and operates three secondary wastewater treatment plants (WWTPs) that discharge treated effluent into the Main Arm of the Fraser River. The largest of these plants is the Annacis Island WWTP, which discharges into the Fraser River immediately downstream of the Alex Fraser Bridge. The two smaller plants are the Lulu Island WWTP and the Northwest Langley WWTP that discharge into the Fraser River respectively at the foot of Gilbert Street in Richmond and nearby the foot of 201st Street in Langley. In 2009, the average total daily discharge was 487, 76.2 and 11.6 megalitres, respectively for the Annacis Island, Lulu Island and Northwest Langley WWTPs.

The Fraser River receiving environment monitoring program for Metro Vancouver's three secondary wastewater treatment plants is designed on a five-year cycle and includes the following program components: annual initial dilution zone boundary sampling; bi-annual sublethal effluent toxicity testing; and sediment sampling conducted once during the five-year cycle (McCallum et al., 2003). Initial dilution zone boundary sampling started in 2003, sublethal toxicity testing began in 2004 and sediment sampling commenced in 2006. The first monitoring cycle was completed in 2007. Year 2009 represents the second year of the second monitoring cycle.

Initial Dilution Zone (IDZ) Boundary Sampling

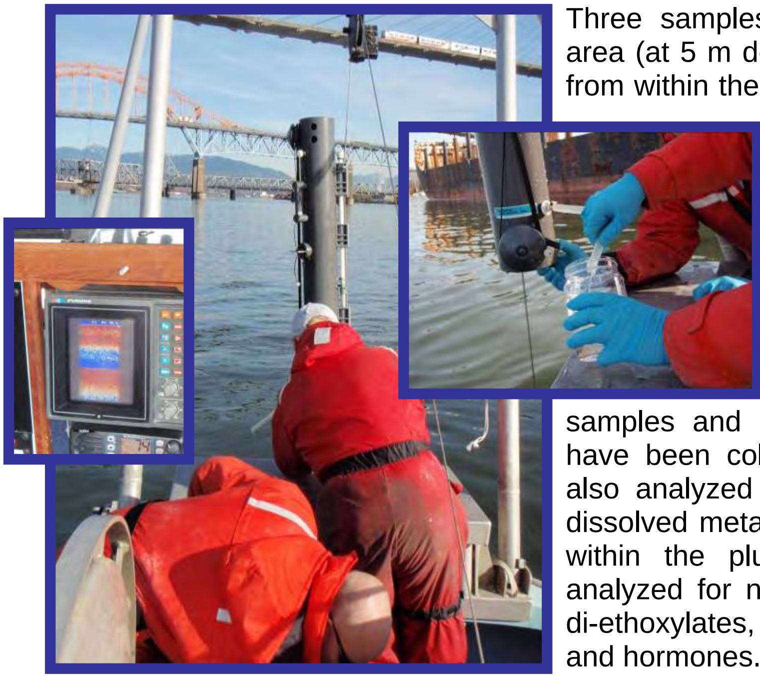
IDZ boundary sampling is an annual component of the Fraser River receiving environment program. The objective of this monitoring is to assess whether site-specific water quality objectives are being met at the IDZ boundary for Metro Vancouver's Fraser River WWTP discharges. The IDZ is defined as "extending up to 100 m upstream or downstream from a discharge, and occupying no more than 25% of the stream width around the discharge point, from the bed of the stream to the surface" (Swain, 1998). Water samples are collected from within the effluent plume at the edge of the IDZ, and results are compared with corresponding water quality objectives.

Sampling is typically focused at the Annacis Island WWTP outfall. The rationale being that the effluent plume at Annacis can be sampled with a relatively high success rate compared to the highly transient plumes located at Lulu Island and NW Langley, and the Annacis Island WWTP effluent discharge rate is substantially greater than the Lulu Island and NW Langley discharges combined. Consequently, indicators of potential effects, if present, would likely be detected first in the Annacis Island WWTP receiving environment. The study area for the IDZ boundary sampling at the Annacis Island WWTP is shown in Figure 8.5.

The IDZ sampling occurs in February during typically low river flows and at specific tidal conditions (ebb, flood and slack tides), to reflect the worst-case water quality or lowest dilution. Sample locations include a reference location upstream of the Fraser River Trifurcation near the SkyTrain Bridge in New Westminster, and from within the plume at the edge of the initial dilution zone (IDZ) at the Annacis Island WWTP.

Field Work

In 2009, five surveys were conducted at one week intervals between February 4 to March 4, to provide for comparison with 30-day average water quality objectives (five samples collected within a 30-day period).



Sample Collection

Three samples were collected from the reference area (at 5 m depth) and five samples were collected from within the effluent plume (depth 3 to 8 m) at the edge of the IDZ boundary. An onboard colour video sounder was used to determine the location, depth and extent of the effluent plume.

In addition to bacteriological analyses, all samples were analyzed for pH, total ammonia, nitrate, nitrite and chloride. All reference area samples and IDZ boundary samples confirmed to have been collected from the effluent plume were also analyzed for conventional variables, total and dissolved metals. In addition, selected samples from within the plume and the reference area were analyzed for nonlyphenols (including its mono- and di-ethoxylates, and octylphenol) and selected sterols and hormones.

Confirmation of sampling from the plume was based on fecal coliform results. Coliform results ≥1000 MPN/100 mL were assumed to indicate sampling within the Annacis plume. Sampling at the Annacis IDZ boundary was generally successful. Based on elevated coliform counts, 92% of the IDZ samples were collected from the plume.

Results

The specific water-quality parameters sampled and tested for at the boundary of the initial dilution zone (IDZ) at the Annacis Island WWTP were compared with applicable water quality objectives. Concentrations of dissolved oxygen, total ammonia, nitrate, total suspended solids and total metals (i.e., copper, lead, manganese, and zinc) measured at the edge of the Annacis IDZ all met the relevant water quality objectives for the Fraser River (Enkon, 2009).

Sublethal Effluent Toxicity Testing

Effluent sampling for chronic toxicity testing has been a bi-annual component of the receiving environment monitoring program, which involves the collection and testing of samples of whole effluent from Metro Vancouver's three secondary wastewater treatment plants discharging into the Fraser River: Annacis Island, Lulu Island and Northwest Langley. In addition, a water sample collected from the Fraser River was added to the study design to provide information on background environmental conditions. This water sample is collected at a reference area located at Derby Reach Regional Park, which is upstream of the wastewater treatment plants and beyond their zone of influence.

The rationale for chronic toxicity of effluent samples is to provide guidance where there might be a concern adjacent to a given discharge. The regulatory interest for chronic toxicity is at the initial dilution zone boundary, which is defined as 100 m from the discharge or a maximum of one-quarter of the channel width from the outfall (whichever is less).

In prior years, samples of secondary-treated effluent were collected twice per year: once during the disinfection period of the wastewater treatment plants (April 1st – October 31st), and once during the non-disinfection period (November 1st to March 31st). With the recent development of the CCME Canada-wide Municipal Effluent Strategy (CCME, 2009), the objective has been to move towards aligning with the Strategy. As such two samples were collected during the disinfection period (June and October) and two during the non-disinfection period (November and December).

Previously, the suite of chronic toxicity tests included rainbow trout embryo viability, and water flea partial life-cycle, and growth tests for plants (duckweed and algae). In 2008, the fathead minnow survival and growth test was added in anticipation of the CCME strategy for toxicity testing. While in 2009, the test suite was revised again to match that outlined by the CCME and included both fathead minnow and water flea tests.

Test results varied by test organism, WWTP effluent and the sample periods tested. Determining if there is a pattern to the observed variability, and subsequently identifying potential sources of apparent chronic toxicity will require further testing.

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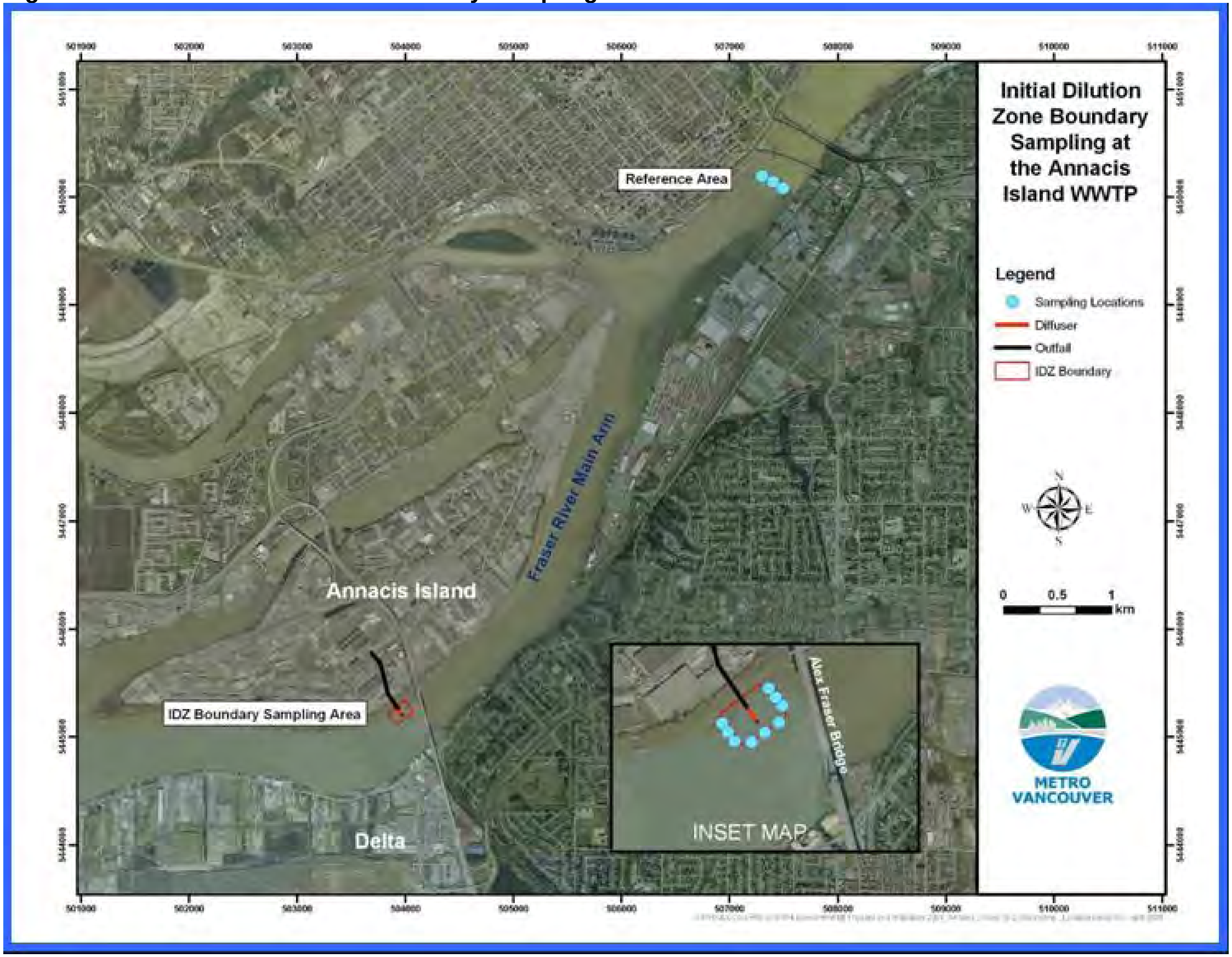
Figure 8-5: Initial Dilution Zone Boundary Sampling at the Annacis Island Wastewater Treatment Plant



8.5 Combined Sewer Overflow Monitoring Program

Early in the twentieth century, most cities lacked sewage treatment facilities so the accepted practice was to consolidate sanitary sewage and stormwater flows into a single pipe. This type of collection system is known as a combined sewer system. Although combined sewers are no longer being built, they are an extensive part of the existing infrastructure at various locations.

Wastewater treatment plants typically receive and treat all combined and sanitary sewer flows in dry or moderate rainfall periods. During heavy rainfalls, the levels in the combined sewer pipe network and interceptors can rise beyond their conveyance capacity. Therefore, to prevent sewer backups into homes and businesses, the combined sewer systems were designed to overflow untreated wastewater directly to the receiving environment via Combined Sewer Overflows (CSOs), as illustrated below.

Metro Vancouver's Liquid Waste Management Plan states that no new combined sewers will be constructed within the Metro Vancouver geographical area and that existing combined sewers will be separated into storm and sanitary sewers via infrastructure replacement or sewer capacity upgrading programs. As such, the Liquid Waste Management Plan outlines a commitment to characterize the quality of its CSO discharges.

Typical Combined Sewer (Metro Vancouver, 2006)

Contaminants in CSO discharges may interfere with the attainment of water quality objectives and could cause adverse effects in the receiving environment. Currently the Metro Vancouver operates 19 CSOs at 14 locations in addition to locations operated by the Cities of Vancouver, Burnaby and New Westminster (Figure 8.6).

CSO Monitoring Program

The purpose of the CSO Monitoring Program is to characterize the quality of CSO discharges by collecting representative samples for the analysis of physico-chemical constituents and toxicity testing. These include fecal coliform bacteria, conventional parameters, metals, and selected trace organics conducted routinely, as well as toxicity testing is conducted periodically. All of Metro Vancouver's 14 CSO locations will be monitored over a five-year cycle. The goal is to sample CSOs at a rate of three locations per year with up to ten overflow events sampled at each location over the five-year cycle of monitoring.

Figure 8-6: CSO Locations in Metro Vancouver

Autosampler Infrastructure

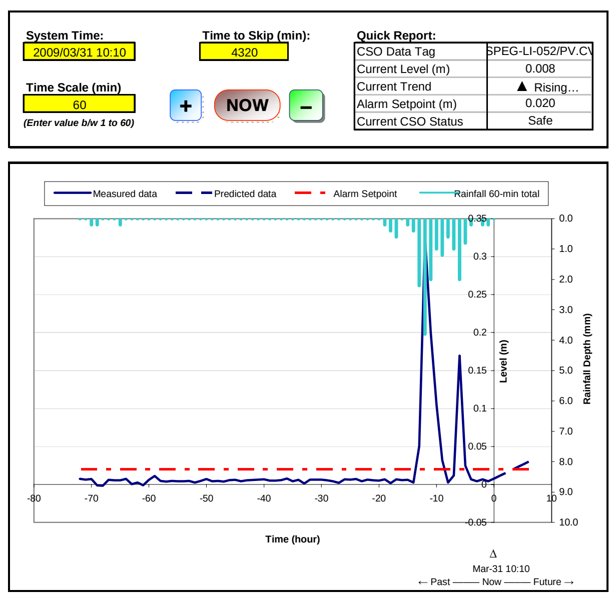
Autosamplers are installed where technically feasible at CSO locations upstream of the outfalls. The sampling sites consist of prefabricated above ground metal kiosks or in-ground concrete vaults. The kiosks and vaults are secured structures that house the autosampler which is connected to sampling lines and associated electronics. Each sampling site utilizes existing Metro Vancouver level monitoring electronics to communicate with the autosampler. The autosampler is triggered to begin sampling when the level monitor detects a pre-established overflow level specific for a given CSO site. When automatic triggering is not available, samples are initiated manually.

Heather CSO kiosk, sampling tube installation in Balaclava CSO and kiosk electronics

Water levels and autosampler status information are recorded electronically and compared to rainfall data obtained from local rain gauges. This information is collectively used to characterize each sampling event by describing the conditions under which sampling was performed.

Sampling Approach

Sampling begins by tracking developing storms using online forecasting tools and Metro Vancouver rain gauge data. The autosampler is programmed prior to the storm onset for time-based interval sampling of the sewer discharge during the CSO event. The objective is to sample as much of the CSO event as possible with emphasis on collecting its first flush. First flush occurs at the beginning of the CSO event and is caused by the re-suspension of solids in the sewer system. This gives higher constituent concentrations during the initial discharge, which subsequently becomes diluted by incoming stormwater.



Event-mean concentrations are typically associated with the collection of interval samples in proportion to measured flow. Time-based interval sampling was performed in 2009, but to minimize the effect of time-based sampling on mean-concentration estimates, when feasible, sampling was conducted at a higher frequency for storms of shorter duration.

2009 CSO Sampling Locations

Five CSOs were sampled in 2009, where Balaclava, Heather and Westridge were newly constructed sampling locations as outlined below:

CSO	Construction Period	Automated	Sample Collection Period	Comments
Balaclava	Feb 2009	July 2009	Feb 23, 2009 to Dec 15, 2009	First 2 samples were triggered manually, 11 samples total. Automation performed in conjunction with a Metro Vancouver upgrade of main computer network.
Heather	May to Sept 2009	Nov 2009	May 13, 2009 to Dec 15, 2009	First 9 samples triggered manually, 13 samples total. Automation pushed forward due to coordination with Canada Line construction.
Manitoba	May 2007	July 2007	Apr 1, 2009	One sample only. Other sites not yet constructed so a site from the previous year was sampled.
South Hill	Dec 2008 to March 2009	May 2009	Nov 6, 2008 to May 13, 2009[1]	No power until March 2009. Sampling line inadvertently placed in wrong location. [1] Sampling line will be relocated to correct location.
Westridge	July 2009	Sept 2009	Oct 23 to Nov 23, 2009	Excessive sewage velocity overwhelmed autosampler's pump suction. Small weir engineered and to be installed near tubing suction early 2010.

1. CSO quality data reported previously reported for South Hill CSO should be considered invalid, because the sampling line was inadvertently placed in the wrong location. A new data set will be started in 2010.

Results

Table 8.2 summarizes estimates of CSO discharge occurrences, duration and volume for 2009. The total discharge volume for all of Metro Vancouver CSOs was about 30 million cubic meters. The collected CSO samples from Balaclava, Heather, Manitoba and Westridge CSOs were submitted for physico-chemical analyses and toxicity testing with results provided in Tables 8.3 to 8.7. The sampling dates extend through 2009 but the bulk of the sampling occurred during the rainfall periods of autumn and winter.

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Table 8-2: GVS&DD CSO Discharge Occurrences, Duration & Volume for 2009

Receiving Water	CSO Outfall	Total Duration of Discharges (hours)	Number of Discharge Events	Total Discharge Volume (million m^3)
Burrard Inlet - Second Narrows to Roche point	Westridge	1,018	83	0.30
	Willingdon	1,485	96	0.75
Burrard Inlet - First to Second Narrows	Cassiar	2,109	125	6.47
	Clark/Vernon (Clark #1, Clark #2, Vernon) **(See Note 1)**	2,442	239	14.78
	Brockton	72	27	0.14
Burrard Inlet - False Creek	Heather	591	100	1.35
Burrard Inlet – Outer Harbour	Balaclava	158	35	1.10
	English Bay / Alma Discovery (English Bay #1, English Bay #2)	239	81	0.29
Fraser River – North Arm	Macdonald	4	10	0.01
	Angus	220	83	1.33
	Manitoba	346	62	1.04
	South Hill	563	96	0.82
	Borden	1,218	93	0.31
Fraser River – Main Stem	Glenbrook **(See Note 2)**	541	108	1.17
Total Discharge Volume				**29.85**

Notes:
1. Clark #2 discharges subject to movable overflow gates continuing to be offline following widening of the overflow channels.
2. Glenbrook monitor offline in January, July/August and again in December. Monthly totals estimated.

Data source: Technical Support Division, Operations & Maintenance Department, Metro Vancouver.

Table 8-3: Balaclava CSO Quality Monitoring, 2009

The sampling location for the Balaclava CSO is located at the north end of Balaclava Street past Point Grey Road in Vancouver. The CSO sewer discharges into English Bay.

Group	Subgroup	Parameter	Units	Descriptive Statistics [1]												
				Grab				Comp				All				
Microbiology				Range	Geomean	Std Dev	n	Range	Geomean	Std Dev	n	Range	Geomean	Std Dev	n	% ND
		Fecal Coliforms (Comp)	MPN/100mL	- - -	**	**	**	49,000 - 330,000	180,000	80,000	7					
		Grab Sample Time:	*(24 Hour)*									49,000 - 330,000	190,000	90,000	11	0%
		Fecal Coliforms (Grab)	MPN/100mL	79,000 - 330,000	190,000	120,000	4	- - -	**	**	**					
Chemistry				Range	Average	Std Dev	n	Range	Average	Std Dev	n	Range	Average	Std Dev	n	% ND
Inorganic and Physical		Biochemical Oxygen Demand	mg/L	17 - 38	26	10.7	3	10 - 38	20	14	4	10 - 38	22	12	7	14%
		Chemical Oxygen Demand	mg/L	61 - 197	100	65	4	32 - 186	102	63	7	32 - 197	101	60	11	0%
		Conductivity	µS/cm	73 - 128	97	25	4	60 - 139	85	12	7	60 - 139	89	25	11	0%
		Hardness	mg/L	19 - 36.1	28.6	7.9	4	20.6 - 35.9	27.5	5.6	7	19 - 36.1	27.9	6.2	11	0%
		Nitrogen - Ammonia as N	mg/L	0.66 - 1.20	0.89	0.28	3	0.50 - 1.60	0.97	0.42	7	0.50 - 1.60	0.95	0.38	10	0%
		Nitrogen - Nitrate as N	mg/L	0.19 - 0.73	0.48	0.23	4	0.25 - 0.58	0.40	0.113	7	0.19 - 0.73	0.43	0.16	11	0%
		Nitrogen - Nitrite as N	mg/L	0.03 - 0.04	0.04	0.01	4	0.01 - 0.04	0.03	0.01	7	0.01 - 0.04	0.03	0.01	11	9%
		pH units	pH units	6.8 - 7.08	7	0.1	4	6.6 - 6.9	6.8	0.1	7	6.6 - 7.08	6.8	0.1	11	0%
		Total Suspended Solids	mg/L	45 - 174	83	61.1	4	21 - 277	88	96.6	7	21 - 277	86	79.4	11	0%
		Turbidity	NTU	28.2 - 37.5	32.9	6.6	2	10.8 - 105	45.8	37.7	7	10.8 - 105	42.9	32.5	9	0%
		Dissolved Oxygen	mg/L	9.3 - 9.8	9.6	0.3	2	7.1 - 10.8	9	1.3	7	7.1 - 10.8	9.2	1.1	9	0%
Organics	BETX	Benzene	µg/L	0.5 - 0.5	0.5	0	3	0.5 - 0.5	0.5	0	7	0.5 - 0.5	0.5	0	10	100%
		Ethylbenzene	µg/L	0.5 - 0.5	0.5	0	3	0.5 - 0.5	0.5	0	7	0.5 - 0.5	0.5	0	10	100%
		Toluene	µg/L	0.5 - 0.7	0.6	0.1	3	0.5 - 0.8	0.5	0.1	7	0.5 - 0.8	0.6	0.1	10	70%
		Xylenes	µg/L	0.5 - 0.5	0.5	0	3	0.5 - 0.5	0.5	0	7	0.5 - 0.5	0.5	0	10	100%
	PAH [2]	Low Molecular Weight PAHs[10]	µg/L	0.07 - 0.6	0.24	0.2	4	0.08 - 0.21	0.13	0.04	7	0.07 - 0.6	0.17	0.15	11	0%
		High Molecular Weight PAHs[10]	µg/L	0.14 - 1.3	0.66	0.5	4	0.03 - 2.2	0.48	0.82	7	0.03 - 2.2	0.55	0.66	11	0%
		Total PAH	µg/L	0.21 - 1.9	0.90	0.7	4	0.14 - 2.4	0.61	0.85	7	0.14 - 2.4	0.72	0.75	11	0%
	Low MW PAH [3]	Naphthalene	µg/L	0.03 - 0.12	0.05	0.05	4	0.02 - 0.04	0.03	0.01	7	0.02 - 0.12	0.04	0.03	11	0%
		Acenaphthylene	µg/L	0.01 - 0.03	0.02	0.01	4	0.01 - 0.01	0.01	0	7	0.01 - 0.03	0.01	0.01	11	82%
		Acenaphthene	µg/L	0.01 - 0.02	0.01	0.01	4	0.01 - 0.01	0.01	0	7	0.01 - 0.02	0.01	0.003	11	82%
		Fluorene	µg/L	0.01 - 0.04	0.02	0.02	4	0.01 - 0.02	0.01	0.004	7	0.01 - 0.04	0.01	0.01	11	45%
		Phenanthrene	µg/L	0.03 - 0.23	0.10	0.09	4	0.02 - 0.11	0.05	0.03	7	0.02 - 0.23	0.07	0.06	11	0%
		Anthracene	µg/L	0.01 - 0.03	0.02	0.01	4	0.01 - 0.01	0.01	0	7	0.01 - 0.03	0.01	0.01	11	73%
	High MW PAH [4]	Fluoranthene	µg/L	0.04 - 0.28	0.14	0.11	4	0.01 - 0.32	0.09	0.11	7	0.01 - 0.32	0.11	0.10	11	0%
		Pyrene	µg/L	0.04 - 0.31	0.15	0.12	4	0.02 - 0.32	0.09	0.11	7	0.02 - 0.32	0.11	0.11	11	0%
		Benzo(a)anthracene	µg/L	0.01 - 0.1	0.05	0.04	4	0.01 - 0.17	0.04	0.06	7	0.01 - 0.17	0.04	0.05	11	27%
		Chrysene	µg/L	0.02 - 0.16	0.08	0.06	4	0.01 - 0.25	0.06	0.09	7	0.01 - 0.25	0.07	0.07	11	9%
		Benzo(b&j)fluoranthene	µg/L	0.01 - 0.11	0.07	0.05	4	0.01 - 0.24	0.06	0.09	7	0.01 - 0.24	0.06	0.07	11	27%
		Benzo(k)fluoranthene	µg/L	0.02 - 0.09	0.04	0.04	4	0.01 - 0.19	0.04	0.07	7	0.01 - 0.19	0.04	0.05	11	45%
		Benzo(a)pyrene	µg/L	0.01 - 0.11	0.06	0.04	4	0.01 - 0.22	0.05	0.08	7	0.01 - 0.22	0.05	0.06	11	27%
		Indeno(1,2,3-cd)pyrene	µg/L	0.02 - 0.08	0.05	0.03	4	0.02 - 0.21	0.05	0.08	7	0.02 - 0.21	0.05	0.06	11	55%
		Dibenz(a,h)anthracene	µg/L	0.02 - 0.03	0.02	0.01	4	0.02 - 0.04	0.02	0.01	7	0.02 - 0.04	0.02	0.01	11	82%
		Benzo(g,h,i)perylene	µg/L	0.02 - 0.1	0.06	0.04	4	0.02 - 0.21	0.05	0.08	7	0.02 - 0.21	0.05	0.06	11	45%
	Other PAHs	2-Methylnaphthalene [5]	µg/L	0.02 - 0.13	0.05	0.05	4	0.02 - 0.06	0.04	0.01	7	0.02 - 0.13	0.04	0.03	11	0%
		Quinoline [6]	µg/L	0.05 - 0.05	0.05	0	4	0.05 - 0.05	0.05	0	7	0.05 - 0.05	0.05	0	11	100%
		Acridine [6]	µg/L	0.05 - 0.05	0.05	0	4	0.05 - 0.05	0.05	0	7	0.05 - 0.05	0.05	0	11	100%
	EPH [7]	HEPH (C19-C32 less PAH) [8]	mg/L	0.08 - 0.08	0.08	0	4	0.08 - 0.08	0.08	0	7	0.08 - 0.08	0.08	0	11	100%
		LEPH (C10-C19 less PAH) [9]	mg/L	0.08 - 0.08	0.08	0	4	0.08 - 0.08	0.08	0	7	0.08 - 0.08	0.08	0	11	100%
Bioassay																
Acute		Bioassay - Rainbow Trout 96 Hour	LT50	>96 Hr - >96 Hr	**	**	1									
			LC50	100% - 100%	**	**	1									

- Not sampled/analyzed or insufficient sample
** Not applicable
1 All averages calculated using detection limit as minimum value
2 PAH = Polyaromatic Hydrocarbon
Total Low MW PAHs = listed Low MW PAH + Other PAHs only
Total High MW PAHs = listed High MW PAH only
Total PAH = total of all listed PAHs only
3 Low MW PAH = Low Molecular Weight Polyaromatic Hydrocarbon (2-3 rings)
4 High MW PAH = High Molecular Weight Polyaromatic Hydrocarbon (4-7 rings)
5 Alkylated Low Molecular Weight PAH
6 N-Heterocycle Low Molecular Weight PAH
7 EPH = Extractable Petroleum Hydrocarbon
8 LEPH = Light Extractable Petroleum Hydrocarbon
9 HEPH = Heavy Extractable Petroleum Hydrocarbon
10 Totals are a calculated value based on the target list shown. Low MW PAHs also include compounds listed under "Other PAHs"

Table 8-3: Balaclava CSO Quality Monitoring, 2009, Cont'd

Group	Parameter	Units	Descriptive Statistics [1]												
			Grab				Comp				All				
Chemistry			Range	Average	Std Dev	n	Range	Average	Std Dev	n	Range	Average	Std Dev	n	% ND
Dissolved Metals	Aluminium Dissolved	mg/L	0.049 - 0.06	0.05	0.01	4	0.03 - 0.05	0.04	0.01	7	0.03 - 0.06	0.04	0.01	11	0%
	Arsenic Dissolved	mg/L	0.0056 - 0.01	0.009	0.002	4	0.01 - 0.01	0.010	0	7	0.0056 - 0.01	0.010	0.001	11	91%
	Barium Dissolved	mg/L	0.005 - 0.01	0.008	0.002	4	0.006 - 0.014	0.009	0.003	7	0.005 - 0.014	0.009	0.003	11	0%
	Boron Dissolved	mg/L	0.02 - 0.05	0.03	0.01	4	0.02 - 0.03	0.02	0.004	7	0.02 - 0.05	0.03	0.01	11	27%
	Cadmium Dissolved	mg/L	0.00004 - 0.0005	0.0004	0.0002	4	0.0005 - 0.0005	0.0005	0	7	0.00004 - 0.0005	0.0005	0.0001	11	91%
	Calcium Dissolved	mg/L	4.25 - 9.57	6.49	2.27	4	4.7 - 9.16	6.4	0.7	7	4.25 - 9.57	6.44	1.64	11	0%
	Chromium Dissolved	mg/L	0.001 - 0.002	0.002	0.001	4	0.001 - 0.003	0.002	0.001	7	0.001 - 0.003	0.002	0.001	11	0%
	Cobalt Dissolved	mg/L	0.0005 - 0.001	0.001	0.0003	4	0.001 - 0.001	0.001	0	7	0.0005 - 0.001	0.001	0.0002	11	100%
	Copper Dissolved	mg/L	0.009 - 0.012	0.010	0.001	4	0.005 - 0.016	0.009	0.004	7	0.005 - 0.016	0.010	0.003	11	0%
	Iron Dissolved	mg/L	0.05 - 0.08	0.07	0.01	4	0.05 - 0.08	0.06	0.01	7	0.05 - 0.08	0.06	0.01	11	0%
	Lead Dissolved	mg/L	0.0005 - 0.004	0.003	0.002	4	0.004 - 0.004	0.004	0	7	0.0005 - 0.004	0.004	0.001	11	91%
	Magnesium Dissolved	mg/L	0.73 - 1.51	1.01	0.36	4	0.49 - 1.66	0.99	0.21	7	0.49 - 1.66	1.00	0.33	11	0%
	Manganese Dissolved	mg/L	0.009 - 0.017	0.013	0.004	4	0.010 - 0.025	0.017	0.006	7	0.009 - 0.025	0.015	0.005	11	0%
	Mercury Dissolved	µg/L	0.02 - 0.02	0.02000	**	1	- - -	**	**	**	0.02 - 0.02	0.02000	**	1	100%
	Molybdenum Dissolved	mg/L	0.001 - 0.002	0.002	0.001	4	0.002 - 0.002	0.002	0	7	0.001 - 0.002	0.002	0.0003	11	100%
	Nickel Dissolved	mg/L	0.001 - 0.001	0.001	0.000	4	0.001 - 0.001	0.001	0.000	7	0.001 - 0.001	0.001	0	11	82%
	Phosphorus Dissolved	mg/L	0.22 - 0.32	0.3	0.048	4	0.14 - 0.48	0.274	0.128	7	0.14 - 0.48	0.3	0.094	11	0%
	Selenium Dissolved	mg/L	0.0001 - 0.01	0.008	0.005	4	0.01 - 0.01	0.010	0	7	0.0001 - 0.01	0.009	0.003	11	100%
	Silver Dissolved	mg/L	0.00002 - 0.001	0.001	0.0005	4	0.001 - 0.001	0.001	0	7	0.00002 - 0.001	0.001	0.0003	11	100%
	Sodium Dissolved	mg/L	5.2 - 16.2	8.2	5.4	4	2.8 - 10.1	4.9	1.0	7	2.8 - 16.2	6.1	3.9	11	0%
	Zinc Dissolved	mg/L	0.017 - 0.025	0.020	0.004	4	0.016 - 0.033	0.024	0.007	7	0.016 - 0.033	0.023	0.006	11	0%
Total Metals	Aluminium Total	mg/L	1.04 - 1.86	1.44	0.41	4	0.45 - 6.95	1.95	2.49	7	0.45 - 6.95	1.76	1.86	11	0%
	Arsenic Total	mg/L	0.005 - 0.007	0.006	0.001	4	0.004 - 0.012	0.007	0	7	0.004 - 0.012	0.007	0.002	11	0%
	Barium Total	mg/L	0.018 - 0.046	0.027	0.013	4	0.011 - 0.087	0.030	0.029	7	0.011 - 0.087	0.029	0.022	11	0%
	BoronTotal	mg/L	0.02 - 0.05	0.04	0.01	4	0.02 - 0.03	0.03	0.01	7	0.02 - 0.05	0.03	0.01	11	27%
	Cadmium Total	mg/L	0.00023 - 0.0005	0.0004	0.0001	4	0.0005 - 0.0006	0.0005	0	7	0.00023 - 0.0006	0.0005	0	11	82%
	Calcium Total	mg/L	5.53 - 11.5	9.02	2.85	4	6.55 - 10.4	8.3	1.4	7	5.53 - 11.5	8.58	1.99	11	0%
	Chromium Total	mg/L	0.003 - 0.006	0.004	0.002	4	0.002 - 0.017	0.006	0.006	7	0.002 - 0.017	0.005	0.004	11	0%
	Cobalt Total	mg/L	0.001 - 0.001	0.001	0	4	0.001 - 0.003	0.001	0	7	0.001 - 0.003	0.001	0.001	11	73%
	Copper Total	mg/L	0.024 - 0.0607	0.036	0.017	4	0.013 - 0.105	0.040	0.033	7	0.013 - 0.105	0.039	0.027	11	0%
	Iron Total	mg/L	1.06 - 2.10	1.51	0.50	4	0.48 - 6.34	1.91	2.26	7	0.48 - 6.34	1.76	1.70	11	0%
	Lead Total	mg/L	0.006 - 0.0223	0.012	0.007	4	0.003 - 0.043	0.013	0.015	7	0.003 - 0.043	0.013	0.012	11	0%
	Magnesium Total	mg/L	1.2 - 1.94	1.46	0.34	4	1.02 - 2.42	1.61	0.50	7	1.02 - 2.42	1.55	0.43	11	0%
	Manganese Total	mg/L	0.035 - 0.077	0.050	0.019	4	0.022 - 0.19	0.063	0.065	7	0.022 - 0.19	0.058	0.049	11	0%
	Mercury Total	µg/L	0.05 - 0.07	0.06	0.01	3	0.05 - 0.28	0.16	0.09	5	0.05 - 0.28	0.12	0.09	8	63%
	Molybdenum Total	mg/L	0.001 - 0.002	0.002	0.001	4	0.002 - 0.002	0.002	0	7	0.001 - 0.002	0.002	0.0003	11	73%
	Nickel Total	mg/L	0.001 - 0.003	0.002	0.001	4	0.001 - 0.007	0.003	0.002	7	0.001 - 0.007	0.003	0.002	11	0%
	Phosphorus Total	mg/L	0.48 - 1.07	0.66	0.27	4	0.28 - 1.09	0.643	0.305	7	0.28 - 1.09	0.65	0.28	11	0%
	Selenium Total	mg/L	0.0001 - 0.001	0.001	0.0005	4	0.001 - 0.001	0.001	0	7	0.0001 - 0.001	0.001	0.0003	11	100%
	Silver Total	mg/L	0.00004 - 0.001	0.001	0.0005	4	0.001 - 0.001	0.001	0	7	0.00004 - 0.001	0.001	0.0003	11	91%
	Sodium Total	mg/L	5.5 - 15	8	4.6	4	2.8 - 11.4	5.4	1.0	7	2.8 - 15	6	3.6	11	0%
	Zinc Total	mg/L	0.04 - 0.099	0.061	0.028	4	0.033 - 0.203	0.074	0.065	7	0.033 - 0.203	0.069	0.050	11	0%

- Not sampled/analyzed or insufficient sample

** Not applicable

*** Grab sample during Bioassay collection at conclusion of composite sampling.

1 All averages calculated using detection limit as minimum value

Table 8-4: Balaclava CSO Bioassay and Chemical Characterization - December 15, 2009, 1640 h, Grab Sample

The sampling location for the Balaclava CSO is located at the north end of Balaclava Street past Point Grey Road in Vancouver. The CSO sewer discharges into English Bay. A single grab sample was collected for testing.

Group		Parameter	Units	Result[1]	
Chronic Bioassay					
Ceriodaphnia dubia				Survival	Reproduction
		LC50	%v/v	>100	>100
		IC25	%v/v	**	**
		IC50	%v/v	**	**
		NOEC[11]	%v/v	100	100
		LOEC[12]	%v/v	>100	>100
Fathead Minnow				Survival	Growth
		LC50	%v/v	>100	>100
		IC25	%v/v	**	**
		IC50	%v/v	**	**
		NOEC[11]	%v/v	100	100
		LOEC[12]	%v/v	>100	>100
Microbiology					
		Fecal Coliforms (Grab)	MPN/100mL	330,000	
Chemistry					
Inorganic and Physical		Biochemical Oxygen Demand	mg/L	38	
		Chemical Oxygen Demand	mg/L	197	
		Conductivity	µS/cm	128	
		Hardness	mg/L	33.8	
		Nitrogen - Ammonia as N	mg/L	0.66	
		Total Kjeldahl Nitrogen N	mg/L	5.3	
		Nitrogen - Nitrate as N	mg/L	0.19	
		Nitrogen - Nitrite as N	mg/L	0.04	
		pH units	pH units	7.08	
		Total Suspended Solids	mg/L	174	
		Volatile Suspended Solids	mg/L	94	
		Total Alkalinity CaCO3	mg/L	24.8	
		Bicarbonate Alkalinity HCO3	mg/L	30.2	
		Carbonate Alkalinity CO3	mg/L	< 0.5	
		Hydroxide Alkalinity OH	mg/L	< 0.5	
		Dissolved Fluoride F	mg/L	< 0.05	
		Dissolved Chloride Cl	mg/L	22.2	
		Dissolved Nitrate N	mg/L	0.19	
		Dissolved Sulphate SO4	mg/L	2.46	
		Turbidity	NTU	-	
		Dissolved Oxygen	mg/L	-	
		Total Oil and Grease	mg/L	7	
		Hydrocarbon Oil and Grease	mg/L	3	
Organics	BETX	Benzene	µg/L	<0.5	
		Ethylbenzene	µg/L	<0.5	
		Toluene	µg/L	0.7	
		Xylenes	µg/L	<0.5	
	PAH[2]	Low Molecular Weight PAHs[10]	µg/L	0.6	
		High Molecular Weight PAHs[10]	µg/L	1.3	
		Total PAH	µg/L	1.9	
	Low MW PAH[3]	Naphthalene	µg/L	0.12	
		Acenaphthylene	µg/L	0.03	
		Acenaphthene	µg/L	0.02	
		Fluorene	µg/L	0.04	
		Phenanthrene	µg/L	0.23	
		Anthracene	µg/L	0.03	
	High MW PAH[4]	Fluoranthene	µg/L	0.28	
		Pyrene	µg/L	0.31	
		Benzo(a)anthracene	µg/L	0.1	
		Chrysene	µg/L	0.16	
		Benzo(b&j)fluoranthene	µg/L	0.11	
		Benzo(k)fluoranthene	µg/L	0.09	
		Benzo(a)pyrene	µg/L	0.11	
		Indeno(1,2,3-cd)pyrene	µg/L	0.08	
		Dibenz(a,h)anthracene	µg/L	0.03	
		Benzo(g,h,i)perylene	µg/L	<0.1	
	Other PAHs	2-Methylnaphthalene[5]	µg/L	0.13	
		Quinoline[6]	µg/L	<0.05	
		Acridine[6]	µg/L	<0.05	
	EPH[7]	HEPH (C19-C32 less PAH)[8]	mg/L	<0.08	
		LEPH (C10-C19 less PAH)[9]	mg/L	<0.08	

Group	Parameter	Units	Result[1]
Chemistry			
Dissolved Metals	Aluminium Dissolved	mg/L	0.049
	Arsenic Dissolved	mg/L	0.0056
	Barium Dissolved	mg/L	0.01
	Boron Dissolved	mg/L	<0.05
	Cadmium Dissolved	mg/L	0.00004
	Calcium Dissolved	mg/L	5.53
	Chromium Dissolved	mg/L	0.002
	Cobalt Dissolved	mg/L	<0.0005
	Copper Dissolved	mg/L	0.0101
	Iron Dissolved	mg/L	0.069
	Lead Dissolved	mg/L	0.0005
	Magnesium Dissolved	mg/L	0.78
	Manganese Dissolved	mg/L	0.017
	Mercury Dissolved	µg/L	<0.02
	Molybdenum Dissolved	mg/L	<0.001
	Nickel Dissolved	mg/L	<0.001
	Phosphorus Dissolved	mg/L	0.22
	Selenium Dissolved	mg/L	<0.0001
	Silver Dissolved	mg/L	<0.00002
	Sodium Dissolved	mg/L	16.2
	Zinc Dissolved	mg/L	0.022
Total Metals	Aluminium Total	mg/L	1.86
	Arsenic Total	mg/L	0.0069
	Barium Total	mg/L	0.046
	BoronTotal	mg/L	<0.05
	Cadmium Total	mg/L	0.00023
	Calcium Total	mg/L	11.5
	Chromium Total	mg/L	0.005
	Cobalt Total	mg/L	0.001
	Copper Total	mg/L	0.0607
	Iron Total	mg/L	2.1
	Lead Total	mg/L	0.0223
	Magnesium Total	mg/L	1.2
	Manganese Total	mg/L	0.077
	Mercury Total	µg/L	0.05
	Molybdenum Total	mg/L	0.001
	Nickel Total	mg/L	0.003
	Phosphorus Total	mg/L	1.07
	Selenium Total	mg/L	<0.0001
	Silver Total	mg/L	0.00004
	Sodium Total	mg/L	15
	Zinc Total	mg/L	0.099

- \- Not sampled/analyzed or insufficient sample
- ** Not applicable
- 1 Grab sample collected in the middle of bioassay sampling in the tables 'Balaclava CSO Quality Monitoring, 2009'
- 2 PAH = Polyaromatic Hydrocarbon
  - Total Low MW PAHs = listed Low MW PAH + Other PAHs only
  - Total High MW PAHs = listed High MW PAH only
  - Total PAH = total of all listed PAHs only
- 3 Low MW PAH = Low Molecular Weight Polyaromatic Hydrocarbon (2-3 rings)
- 4 High MW PAH = High Molecular Weight Polyaromatic Hydrocarbon (4-7 rings)
- 5 Alkylated Low Molecular Weight PAH
- 6 N-Heterocycle Low Molecular Weight PAH
- 7 EPH = Extractable Petroleum Hydrocarbon
- 8 LEPH = Light Extractable Petroleum Hydrocarbon
- 9 HEPH = Heavy Extractable Petroleum Hydrocarbon
- 10 Totals are a calculated value based on the target list shown. Low MW PAHs also include compounds listed under "Other PAHs"
- 11 NOEC = No Observable Effects Concentration
- 12 LOEC = Lowest Observable Effects Concentration

Table 8-5: Heather CSO Quality Monitoring, 2009

The sampling location for the Heather CSO is located the corner of Cambie Street and 6th Avenue in Vancouver, at the foot of Cambie Street Bridge. The CSO sewer discharges into False Creek.

Group		Parameter	Units	Descriptive Statistics [1]												
				Grab				Comp				All				
Microbiology				Range	Geomean	Std Dev	n	Range	Geomean	Std Dev	n	Range	Geomean	Std Dev	n	% ND
		Fecal Coliforms (Comp)	MPN/100mL	- - -	**	**	**	4,600 - 1,300,000	270,000	370,000	11	4,600 - 1,700,000	320,000	490,000	13	0%
		Grab Sample Time:	*(24 Hour)*													
		Fecal Coliforms (Grab)	MPN/100mL	330,000 - 1,700,000	750,000	970,000	2	- - -	**	**	**	- - -	**	**	**	**
Chemistry				Range	Average	Std Dev	n	Range	Average	Std Dev	n	Range	Average	Std Dev	n	% ND
Inorganic and Physical		Biochemical Oxygen Demand	mg/L	26 - 26	26	**	1	14 - 48	40	35	8	14 - 121	38	33	9	0%
		Chemical Oxygen Demand	mg/L	74 - 76	75	1.4	2	56 - 227	123	70	11	56 - 267	116	66	13	0%
		Conductivity	µS/cm	112 - 133	122.5	14.8	2	76 - 635	152	162	11	76 - 635	148	148	13	0%
		Hardness	mg/L	28.1 - 43.2	35.7	10.7	2	20.5 - 60.2	34.4	11.2	11	20.5 - 60.2	34.6	10.7	13	0%
		Nitrogen - Ammonia as N	mg/L	0.80 - 1.00	0.90	0.14	2	0.50 - 2.00	1.28	0.73	11	0.50 - 2.90	1.22	0.69	13	0%
		Nitrogen - Nitrate as N	mg/L	0.27 - 0.41	0.34	0.099	2	0.22 - 3.35	0.69	0.915	11	0.22 - 3.35	0.63	0.846	13	0%
		Nitrogen - Nitrite as N	mg/L	0.03 - 0.03	0.03	0	2	0.02 - 0.27	0.1	0.1	11	0.02 - 0.27	0.1	0.1	13	0%
		pH units	pH units	7 - 7.1	7.1	0.1	2	6.4 - 7.1	6.9	0.2	11	6.4 - 7.1	6.9	0.2	13	0%
		Total Suspended Solids	mg/L	44 - 60	52	11.3	2	35 - 176	79	46	11	35 - 176	75	43	13	0%
		Turbidity	NTU	30.5 - 35.2	32.9	3.3	2	20 - 67.8	42.7	22.6	10	20 - 86	41.0	20.8	12	0%
		Dissolved Oxygen	mg/L	8.7 - 9	9	0.21	2	7.3 - 10.2	9	1.3	10	7.3 - 11.1	9	1.2	12	0%
Organics	BETX	Benzene	µg/L	0.5 - 0.5	0.5	0	2	0.5 - 0.5	0.5	0	7	0.5 - 0.5	0.5	0	9	100%
		Ethylbenzene	µg/L	0.5 - 0.5	0.5	0	2	0.5 - 0.5	0.5	0	7	0.5 - 0.5	0.5	0	9	100%
		Toluene	µg/L	0.5 - 0.5	0.5	0	2	0.5 - 29.5	4.9	10.9	7	0.5 - 29.5	3.9	9.6	9	44%
		Xylenes	µg/L	0.5 - 0.5	0.5	0	2	0.5 - 0.5	0.5	0	7	0.5 - 0.5	0.5	0	9	100%
	PAH [2]	Low Molecular Weight PAHs[10]	µg/L	0.14 - 0.25	0.20	0.08	2	0.11 - 0.26	0.23	0.08	8	0.11 - 0.34	0.22	0.08	10	0%
		High Molecular Weight PAHs[10]	µg/L	0.46 - 0.6	0.53	0.10	2	0.42 - 1	0.93	0.39	8	0.42 - 1.5	0.85	0.38	10	0%
		Total PAH	µg/L	0.6 - 0.85	0.73	0.18	2	0.53 - 1.3	1.17	0.47	8	0.53 - 1.8	1.08	0.46	10	0%
	Low MW PAH [3]	Naphthalene	µg/L	0.04 - 0.08	0.06	0.03	2	0.03 - 0.08	0.05	0.02	8	0.03 - 0.08	0.05	0.02	10	0%
		Acenaphthylene	µg/L	0.01 - 0.01	0.01	0	2	0.01 - 0.01	0.01	0	8	0.01 - 0.02	0.01	0.003	10	80%
		Acenaphthene	µg/L	0.01 - 0.01	0.01	0	2	0.01 - 0.01	0.01	0	8	0.01 - 0.01	0.01	0	10	90%
		Fluorene	µg/L	0.01 - 0.02	0.02	0.01	2	0.01 - 0.02	0.01	0.01	8	0.01 - 0.02	0.01	0.01	10	40%
		Phenanthrene	µg/L	0.06 - 0.1	0.08	0.03	2	0.05 - 0.14	0.10	0.04	8	0.05 - 0.15	0.10	0.03	10	0%
		Anthracene	µg/L	0.01 - 0.01	0.01	0	2	0.01 - 0.01	0.01	0.00	8	0.01 - 0.02	0.01	0.004	10	70%
	High MW PAH [4]	Fluoranthene	µg/L	0.11 - 0.14	0.13	0.02	2	0.09 - 0.26	0.23	0.11	8	0.09 - 0.42	0.21	0.11	10	0%
		Pyrene	µg/L	0.11 - 0.12	0.12	0.01	2	0.1 - 0.22	0.22	0.09	8	0.1 - 0.35	0.20	0.09	10	0%
		Benzo(a)anthracene	µg/L	0.02 - 0.04	0.03	0.01	2	0.03 - 0.06	0.06	0.02	8	0.02 - 0.11	0.05	0.03	10	10%
		Chrysene	µg/L	0.05 - 0.07	0.06	0.01	2	0.06 - 0.13	0.12	0.05	8	0.05 - 0.19	0.11	0.05	10	0%
		Benzo(b&j)fluoranthene	µg/L	0.04 - 0.07	0.06	0.02	2	0.04 - 0.14	0.10	0.04	8	0.04 - 0.16	0.09	0.04	10	10%
		Benzo(k)fluoranthene	µg/L	0.03 - 0.03	0.03	0	2	0.02 - 0.07	0.05	0.03	8	0.02 - 0.1	0.05	0.03	10	20%
		Benzo(a)pyrene	µg/L	0.02 - 0.04	0.03	0.01	2	0.03 - 0.08	0.06	0.03	8	0.02 - 0.13	0.06	0.03	10	10%
		Indeno(1,2,3-cd)pyrene	µg/L	0.03 - 0.05	0.04	0.01	2	0.03 - 0.07	0.06	0.02	8	0.03 - 0.09	0.05	0.02	10	0%
		Dibenz(a,h)anthracene	µg/L	0.02 - 0.02	0.02	0	2	0.02 - 0.02	0.02	0	8	0.02 - 0.03	0.02	0.003	10	100%
		Benzo(g,h,i)perylene	µg/L	0.03 - 0.05	0.04	0.01	2	0.04 - 0.09	0.07	0.03	8	0.03 - 0.12	0.07	0.03	10	0%
	Other PAHs	2-Methylnaphthalene [5]	µg/L	0.03 - 0.05	0.04	0.01	2	0.03 - 0.05	0.04	0.02	8	0.03 - 0.07	0.04	0.01	10	0%
		Quinoline [6]	µg/L	0.05 - 0.05	0.05	0	2	0.05 - 0.05	0.05	0	8	0.05 - 0.08	0.05	0	10	100%
		Acridine [6]	µg/L	0.05 - 0.05	0.05	0	2	0.05 - 0.05	0.05	0	8	0.05 - 0.05	0.05	0	10	110%
	EPH [7]	HEPH (C19-C32 less PAH) [8]	mg/L	0.08 - 0.08	0.08	0	2	0.08 - 0.09	0.67	1.63	8	0.08 - 4.71	0.55	1.46	10	80%
		LEPH (C10-C19 less PAH) [9]	mg/L	0.08 - 0.08	0.08	0	2	0.08 - 0.08	0.08	0.01	8	0.08 - 0.11	0.08	0.01	10	100%
Bioassay																
Acute		Bioassay - Rainbow Trout 96 Hour	LT50	>96 Hr - >96 Hr	**	**	2									

- Not sampled/analyzed or insufficient sample
** Not applicable
1 All averages calculated using detection limit as minimum value
2 PAH = Polyaromatic Hydrocarbon
3 Low MW PAH = Low Molecular Weight Polyaromatic Hydrocarbon (2-3 rings)
4 High MW PAH = High Molecular Weight Polyaromatic Hydrocarbon (4-7 rings)
5 Alkylated Low MW PAH
6 N-Heterocycle Low MW PAH
7 EPH = Extractable Petroleum Hydrocarbon
8 LEPH = Light Extractable Petroleum Hydrocarbon
9 HEPH = Heavy Extractable Petroleum Hydrocarbon
10 Totals are a calculated value based on the target list shown. Low MW PAHs also include compounds listed under "Other PAHs"

Table 8-5: Heather CSO Quality Monitoring, 2009, Cont'd

Group	Parameter	Units	Descriptive Statistics [1]				Comp				All				
			Grab				Comp				All				
Chemistry			Range	Geomean	Std Dev	n	Range	Geomean	Std Dev	n	Range	Geomean	Std Dev	n	% ND
Dissolved Metals	Aluminium Dissolved	mg/L	0.03 - 0.05	0.04	0.01	2	0.03 - 0.06	0.04	0.02	11	0.03 - 0.09	0.04	0.02	13	0%
	Arsenic Dissolved	mg/L	0.01 - 0.01	0.010	0	2	0.01 - 0.01	0.010	0	11	0.01 - 0.01	0.010	0	13	100%
	Barium Dissolved	mg/L	0.009 - 0.012	0.011	0.002	2	0.006 - 0.02	0.011	0.004	11	0.006 - 0.02	0.011	0.004	13	0%
	Boron Dissolved	mg/L	0.02 - 0.04	0.03	0.01	2	0.02 - 0.04	0.03	0.01	11	0.02 - 0.07	0.03	0.01	13	23%
	Cadmium Dissolved	mg/L	0.0005 - 0.0005	0.0005	0	2	0.0005 - 0.0005	0.0005	0	11	0.0005 - 0.0005	0.0005	0	13	100%
	Calcium Dissolved	mg/L	7 - 11.4	9.2	3.11	2	5.72 - 12	8.3	2.0	11	5.72 - 12	8.5	2.09	13	0%
	Chromium Dissolved	mg/L	0.001 - 0.002	0.002	0.001	2	0.001 - 0.004	0.002	0.001	11	0.001 - 0.004	0.002	0.001	13	31%
	Cobalt Dissolved	mg/L	0.001 - 0.001	0.001	0	2	0.001 - 0.001	0.001	0	11	0.001 - 0.001	0.001	0	13	100%
	Copper Dissolved	mg/L	0.013 - 0.013	0.013	0	2	0.007 - 0.02	0.023	0.035	11	0.007 - 0.127	0.021	0.032	13	0%
	Iron Dissolved	mg/L	0.05 - 0.05	0.05	0	2	0.03 - 0.10	0.07	0.03	11	0.03 - 0.15	0.06	0.03	13	0%
	Lead Dissolved	mg/L	0.004 - 0.004	0.004	0	2	0.004 - 0.007	0.004	0.001	11	0.004 - 0.007	0.004	0.001	13	92%
	Magnesium Dissolved	mg/L	1.2 - 2.06	1.63	0.61	2	0.77 - 4.63	1.67	1.04	11	0.77 - 4.63	1.66	0.97	13	0%
	Manganese Dissolved	mg/L	0.011 - 0.012	0.012	0.001	2	0.010 - 0.035	0.019	0.013	11	0.010 - 0.051	0.018	0.012	13	0%
	Mercury Dissolved	µg/L	- - -	-	-	-	- - -	-	-	-	- - -	-	-	-	-
	Molybdenum Dissolved	mg/L	0.002 - 0.002	0.002	0	2	0.002 - 0.002	0.002	0	11	0.002 - 0.002	0.002	0	13	92%
	Nickel Dissolved	mg/L	0.001 - 0.001	0.001	0	2	0.001 - 0.002	0.001	0.001	11	0.001 - 0.003	0.001	0.001	13	69%
	Phosphorus Dissolved	mg/L	0.24 - 0.36	0.300	0.085	2	0.13 - 0.36	0.257	0.063	11	0.13 - 0.36	0.264	0.064	13	0%
	Selenium Dissolved	mg/L	0.01 - 0.01	0.010	0	2	0.01 - 0.01	0.010	0	11	0.01 - 0.01	0.010	0	13	92%
	Silver Dissolved	mg/L	0.001 - 0.001	0.001	0	2	0.001 - 0.001	0.001	0	11	0.001 - 0.001	0.001	0	13	100%
	Sodium Dissolved	mg/L	4.7 - 9.1	6.9	3.1	2	3.5 - 100	14.5	28.4	11	3.5 - 100	13.3	26.1	13	0%
	Zinc Dissolved	mg/L	0.033 - 0.045	0.039	0.008	2	0.021 - 0.081	0.048	0.033	11	0.021 - 0.138	0.047	0.031	13	0%
Total Metals	Aluminium Total	mg/L	0.74 - 1.49	1.12	0.53	2	0.6 - 2.97	1.45	0.79	11	0.6 - 2.97	1.40	0.74	13	0%
	Arsenic Total	mg/L	0.002 - 0.003	0.003	0.001	2	0.002 - 0.013	0.004	0	11	0.002 - 0.013	0.004	0	13	0%
	Barium Total	mg/L	0.023 - 0.025	0.024	0.001	2	0.014 - 0.06	0.032	0.016	11	0.014 - 0.06	0.031	0.015	13	0%
	BoronTotal	mg/L	0.03 - 0.04	0.04	0.01	2	0.02 - 0.04	0.04	0.01	11	0.02 - 0.07	0.04	0.01	13	8%
	Cadmium Total	mg/L	0.0005 - 0.0005	0.0005	0	2	0.0005 - 0.0084	0.0013	0	11	0.0005 - 0.0084	0.0011	0	13	77%
	Calcium Total	mg/L	8.39 - 13.1	10.7	3.33	2	6.27 - 14.8	10.1	2.7	11	6.27 - 15	10.2	2.66	13	0%
	Chromium Total	mg/L	0.003 - 0.005	0.004	0.001	2	0.002 - 0.013	0.006	0.003	11	0.002 - 0.013	0.005	0.003	13	0%
	Cobalt Total	mg/L	0.001 - 0.001	0.001	0	2	0.001 - 0.002	0.001	0	11	0.001 - 0.002	0.001	0	13	69%
	Copper Total	mg/L	0.04 - 0.041	0.041	0.001	2	0.022 - 0.116	0.074	0.080	11	0.022 - 0.297	0.069	0.074	13	0%
	Iron Total	mg/L	0.89 - 1.64	1.27	0.53	2	0.67 - 3.42	1.73	0.98	11	0.67 - 3.42	1.66	0.92	13	0%
	Lead Total	mg/L	0.008 - 0.011	0.010	0.002	2	0.005 - 0.079	0.018	0.021	11	0.005 - 0.079	0.017	0.019	13	0%
	Magnesium Total	mg/L	1.74 - 2.55	2.15	0.57	2	1.17 - 5.67	2.24	1.22	11	1.17 - 5.67	2.23	1.12	13	0%
	Manganese Total	mg/L	0.028 - 0.043	0.036	0.011	2	0.025 - 0.113	0.055	0.034	11	0.025 - 0.113	0.052	0.032	13	0%
	Mercury Total	µg/L	0.05 - 0.05	0.05	0	2	0.05 - 0.14	0.06	0.03	11	0.05 - 0.14	0.06	0.03	13	62%
	Molybdenum Total	mg/L	0.002 - 0.002	0.002	0	2	0.002 - 0.002	0.002	0	11	0.002 - 0.003	0.002	0	13	77%
	Nickel Total	mg/L	0.002 - 0.003	0.003	0.001	2	0.001 - 0.006	0.003	0.002	11	0.001 - 0.006	0.003	0.002	13	0%
	Phosphorus Total	mg/L	0.53 - 0.6	0.565	0.049	2	0.33 - 1.16	0.666	0.276	11	0.33 - 1.16	0.651	0.255	13	0%
	Selenium Total	mg/L	0.001 - 0.001	0.001	0	2	0.001 - 0.001	0.001	0	11	0.001 - 0.001	0.001	0	13	92%
	Silver Total	mg/L	0.001 - 0.001	0.001	0	2	0.001 - 0.001	0.001	0	11	0.001 - 0.001	0.001	0	13	92%
	Sodium Total	mg/L	5.2 - 10.1	7.7	3.5	2	4.3 - 103	15.3	29.2	11	4.3 - 103	14.1	26.8	13	0%
	Zinc Total	mg/L	0.076 - 0.084	0.080	0.006	2	0.052 - 0.222	0.119	0.073	11	0.052 - 0.275	0.113	0.068	13	0%

- Not sampled/analyzed or insufficient sample
** Not applicable
*** Grab sample during Bioassay collection at conclusion of composite sampling.
1 All averages calculated using detection limit as minimum value

Table 8-6: Manitoba CSO Quality Monitoring, 2009

The Manitoba CSO was sampled at the corner of 297 W. 63rd Ave (63rd Avenue and Columbia Street) in Vancouver, two blocks north of Southwest Marine Drive. Discharges enter the North Arm of the Fraser River.

Group		Parameter	Units	Descriptive Statistics [1] – Comp				
Microbiology				**Range**	**Geomean**	**Std Dev**	**n**	**% ND**
		Fecal Coliforms (Comp)	MPN/100mL	110,000 - 110,000	110,000	**	1	0%
		Grab Sample Time:	*(24 Hour)*					
		Fecal Coliforms (Grab)	MPN/100mL					
Chemistry				**Range**	**Average**	**Std Dev**	**n**	**% ND**
Inorganic and Physical		Biochemical Oxygen Demand	mg/L	12 - 12	12	**	1	0%
Inorganic and Physical		Chemical Oxygen Demand	mg/L	44 - 44	44	**	1	0%
Inorganic and Physical		Conductivity	µS/cm	77 - 77	77	**	1	0%
Inorganic and Physical		Hardness	mg/L	21 - 21	21	**	1	0%
Inorganic and Physical		Nitrogen - Ammonia as N	mg/L	0.60 - 0.60	0.60	**	1	0%
Inorganic and Physical		Nitrogen - Nitrate as N	mg/L	0.34 - 0.34	0.34	**	1	0%
Inorganic and Physical		Nitrogen - Nitrite as N	mg/L	0.03 - 0.03	0.0	**	1	0%
Inorganic and Physical		pH units	pH units	7 - 7	7.0	**	1	0%
Inorganic and Physical		Total Suspended Solids	mg/L	34 - 34	34	**	1	0%
Inorganic and Physical		Turbidity	NTU	- - -	**	**	0	**
Inorganic and Physical		Dissolved Oxygen	mg/L	10.6 - 10.6	11	**	1	0%
Organics	BETX	Benzene	µg/L	- - -	**	**	0	**
Organics	BETX	Ethylbenzene	µg/L	- - -	**	**	0	**
Organics	BETX	Toluene	µg/L	- - -	**	**	0	**
Organics	BETX	Xylenes	µg/L	- - -	**	**	0	**
Organics	PAH [2]	Low Molecular Weight PAHs[10]	µg/L	0.08 - 0.08	0.08	**	1	0%
Organics	PAH [2]	High Molecular Weight PAHs[10]	µg/L	0.03 - 0.03	0.03	**	1	0%
Organics	PAH [2]	Total PAH	µg/L	0.11 - 0.11	0.11	**	1	0%
Organics	Low MW PAH [3]	Naphthalene	µg/L	0.03 - 0.03	0.03	**	1	0%
Organics	Low MW PAH [3]	Acenaphthylene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	Low MW PAH [3]	Acenaphthene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	Low MW PAH [3]	Fluorene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	Low MW PAH [3]	Phenanthrene	µg/L	0.02 - 0.02	0.02	**	1	0%
Organics	Low MW PAH [3]	Anthracene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	High MW PAH [4]	Fluoranthene	µg/L	0.02 - 0.02	0.02	**	1	0%
Organics	High MW PAH [4]	Pyrene	µg/L	0.02 - 0.02	0.02	**	1	0%
Organics	High MW PAH [4]	Benzo(a)anthracene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	High MW PAH [4]	Chrysene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	High MW PAH [4]	Benzo(b&j)fluoranthene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	High MW PAH [4]	Benzo(k)fluoranthene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	High MW PAH [4]	Benzo(a)pyrene	µg/L	0.01 - 0.01	0.01	**	1	100%
Organics	High MW PAH [4]	Indeno(1,2,3-cd)pyrene	µg/L	0.02 - 0.02	0.02	**	1	100%
Organics	High MW PAH [4]	Dibenz(a,h)anthracene	µg/L	0.02 - 0.02	0.02	**	1	100%
Organics	High MW PAH [4]	Benzo(g,h,i)perylene	µg/L	0.02 - 0.02	0.02	**	1	100%
Organics	Other PAHs	2-Methylnaphthalene [5]	µg/L	0.03 - 0.03	0.03	**	1	0%
Organics	Other PAHs	Quinoline [6]	µg/L	0.05 - 0.05	0.05	**	1	100%
Organics	Other PAHs	Acridine [6]	µg/L	0.05 - 0.05	0.05	**	1	100%
Organics	EPH [7]	HEPH (C19-C32 less PAH) [8]	mg/L	0.08 - 0.08	0.08	**	1	100%
Organics	EPH [7]	LEPH (C10-C19 less PAH) [9]	mg/L	0.08 - 0.08	0.08	**	1	100%

- Not sampled/analyzed or insufficient sample
** Not applicable
1 All averages calculated using detection limit as minimum value
2 PAH = Polyaromatic Hydrocarbon
Total Low MW PAHs = listed Low MW PAH + Other PAHs only
Total High MW PAHs = listed High MW PAH only
Total PAH = total of all listed PAHs only
3 Low MW PAH = Low Molecular Weight Polyaromatic Hydrocarbon (2-3 rings)
4 High MW PAH = High Molecular Weight Polyaromatic Hydrocarbon (4-7 rings)
5 Alkylated Low Molecular Weight PAH
6 N-Heterocycle Low Molecular Weight PAH
7 EPH = Extractable Petroleum Hydrocarbon
8 LEPH = Light Extractable Petroleum Hydrocarbon
9 HEPH = Heavy Extractable Petroleum Hydrocarbon

Group	Parameter	Units	Descriptive Statistics [1] – Comp				
Chemistry			**Range**	**Geomean**	**Std Dev**	**n**	**% ND**
Dissolved Metals	Aluminium Dissolved	mg/L	0.04 - 0.04	0.04	**	1	0%
Dissolved Metals	Arsenic Dissolved	mg/L	0.01 - 0.01	0.010	**	1	100%
Dissolved Metals	Barium Dissolved	mg/L	0.006 - 0.006	0.006	**	1	0%
Dissolved Metals	Boron Dissolved	mg/L	0.02 - 0.02	0.02	**	1	100%
Dissolved Metals	Cadmium Dissolved	mg/L	0.0005 - 0.0005	0.0005	**	1	100%
Dissolved Metals	Calcium Dissolved	mg/L	5.57 - 5.57	5.6	**	1	0%
Dissolved Metals	Chromium Dissolved	mg/L	0.001 - 0.001	0.001	**	1	0%
Dissolved Metals	Cobalt Dissolved	mg/L	0.001 - 0.001	0.001	**	1	100%
Dissolved Metals	Copper Dissolved	mg/L	0.013 - 0.013	0.013	**	1	0%
Dissolved Metals	Iron Dissolved	mg/L	0.06 - 0.06	0.06	**	1	0%
Dissolved Metals	Lead Dissolved	mg/L	0.004 - 0.004	0.004	**	1	100%
Dissolved Metals	Magnesium Dissolved	mg/L	0.93 - 0.93	0.93	**	1	0%
Dissolved Metals	Manganese Dissolved	mg/L	0.015 - 0.015	0.015	**	1	0%
Dissolved Metals	Mercury Dissolved	µg/L	- - -	**	**	0	**
Dissolved Metals	Molybdenum Dissolved	mg/L	0.002 - 0.002	0.002	**	1	100%
Dissolved Metals	Nickel Dissolved	mg/L	0.001 - 0.001	0.001	**	1	100%
Dissolved Metals	Phosphorus Dissolved	mg/L	0.17 - 0.17	0.170	**	1	0%
Dissolved Metals	Selenium Dissolved	mg/L	0.01 - 0.01	0.010	**	1	100%
Dissolved Metals	Silver Dissolved	mg/L	0.001 - 0.001	0.001	**	1	100%
Dissolved Metals	Sodium Dissolved	mg/L	5.5 - 5.5	5.5	**	1	0%
Dissolved Metals	Zinc Dissolved	mg/L	0.013 - 0.013	0.013	**	1	0%
Total Metals	Aluminium Total	mg/L	0.92 - 0.92	0.92	**	1	0%
Total Metals	Arsenic Total	mg/L	0.004 - 0.004	0.004	**	1	0%
Total Metals	Barium Total	mg/L	0.016 - 0.016	0.016	**	1	0%
Total Metals	BoronTotal	mg/L	0.02 - 0.02	0.02	**	1	100%
Total Metals	Cadmium Total	mg/L	0.0005 - 0.0005	0.0005	**	1	100%
Total Metals	Calcium Total	mg/L	6.33 - 6.33	6.3	**	1	0%
Total Metals	Chromium Total	mg/L	0.004 - 0.004	0.004	**	1	0%
Total Metals	Cobalt Total	mg/L	0.001 - 0.001	0.0010	**	1	100%
Total Metals	Copper Total	mg/L	0.029 - 0.029	0.029	**	1	0%
Total Metals	Iron Total	mg/L	1.03 - 1.03	1.03	**	1	0%
Total Metals	Lead Total	mg/L	0.005 - 0.005	0.005	**	1	0%
Total Metals	Magnesium Total	mg/L	1.25 - 1.25	1.25	**	1	0%
Total Metals	Manganese Total	mg/L	0.046 - 0.046	0.046	**	1	0%
Total Metals	Mercury Total	µg/L	0.07 - 0.07	0.070	**	1	0%
Total Metals	Molybdenum Total	mg/L	0.002 - 0.002	0.002	**	1	100%
Total Metals	Nickel Total	mg/L	0.001 - 0.001	0.001	**	1	0%
Total Metals	Phosphorus Total	mg/L	0.32 - 0.32	0.32	**	1	0%
Total Metals	Selenium Total	mg/L	0.001 - 0.001	0.001	**	1	100%
Total Metals	Silver Total	mg/L	0.001 - 0.001	0.001	**	1	100%
Total Metals	Sodium Total	mg/L	5.9 - 5.9	5.9	**	1	0%
Total Metals	Zinc Total	mg/L	0.031 - 0.031	0.031	**	1	0%

- Not sampled/analyzed or insufficient sample
** Not applicable
*** Grab sample during Bioassay collection at conclusion of composite sampling.
1 All averages calculated using detection limit as minimum value

Table 8-7: Westridge CSO Quality Monitoring, 2009

The Westridge CSO is located at the northern tip of Cliff Avenue in Burnaby. The CSO discharges into Burrard Inlet.

Group	Parameter	Units	Grab Range	Grab Geomean / Average	Grab Std Dev	Grab n	Comp Range	Comp Geomean / Average	Comp Std Dev	Comp n	All Range	All Geomean / Average	All Std Dev	All n	All % ND
			Descriptive Statistics [1]												
			Grab				**Comp**				**All**				
Microbiology			**Range**	**Geomean**	**Std Dev**	**n**	**Range**	**Geomean**	**Std Dev**	**n**	**Range**	**Geomean**	**Std Dev**	**n**	**% ND**
	Fecal Coliforms (Comp)	MPN/100mL	170,000 - 7,000,000	940,900	3,800,000	3	490,000 - 490,000	490,000	**	1	170,000 - 7,000,000	799,300	3,281,000	4	0%
	Grab Sample Time:	*(24 Hour)*													
	Fecal Coliforms (Grab)	MPN/100mL	- - -	**	**	0	- - -	**	**	**					
Chemistry			**Range**	**Average**	**Std Dev**	**n**	**Range**	**Average**	**Std Dev**	**n**	**Range**	**Average**	**Std Dev**	**n**	**% ND**
Inorganic and Physical	Biochemical Oxygen Demand	mg/L	- - -	**	**	0	- - -	**	**	0	- - -	**	**	0	**
Inorganic and Physical	Chemical Oxygen Demand	mg/L	90 - 104	95	8	3	110 - 110	110	**	1	90 - 110	99	10	4	0%
Inorganic and Physical	Conductivity	µS/cm	138 - 184	165	24	3	117 - 117	117	**	1	117 - 184	153	31	4	0%
Inorganic and Physical	Hardness	mg/L	34.6 - 37	35.8	1.7	2	0 - 0	-	**	0	34.6 - 37	35.8	1.7	2	0%
Inorganic and Physical	Nitrogen - Ammonia as N	mg/L	2.90 - 3.80	3.35	0.64	2	0 - 0	-	**	0	2.90 - 3.80	3.35	0.64	2	0%
Inorganic and Physical	Nitrogen - Nitrate as N	mg/L	0.04 - 2.18	1.14	1.07	3	0.52 - 0.52	0.52	**	1	0.04 - 2.18	0.99	0.93	4	0%
Inorganic and Physical	Nitrogen - Nitrite as N	mg/L	0.05 - 0.75	0.29	0.40	3	0.05 - 0.05	0.05	**	1	0.05 - 0.75	0.23	0.35	4	0%
Inorganic and Physical	pH units	pH units	7 - 7.4	7.2	0.2	3	7.2 - 7.2	7.2	**	1	7 - 7.4	7.2	0.2	4	0%
Inorganic and Physical	Total Suspended Solids	mg/L	39 - 43	41	2	3	41 - 41	41	**	1	39 - 43	41	1.7	4	0%
Inorganic and Physical	Turbidity	NTU	26 - 26.7	26.4	0.5	2	18.6 - 18.6	18.6	**	1	18.6 - 26.7	23.8	4.5	3	0%
Inorganic and Physical	Dissolved Oxygen	mg/L	9.3 - 10.6	10.0	0.9	2	9.8 - 9.8	9.8	**	1	9.3 - 10.6	10	0.7	3	0%
Organics – BETX	Benzene	µg/L	0.5 - 0.5	0.5	**	1	- - -	**	**	0	0.5 - 0.5	0.5	**	1	100%
Organics – BETX	Ethylbenzene	µg/L	0.5 - 0.5	0.5	**	1	- - -	**	**	0	0.5 - 0.5	0.5	**	1	100%
Organics – BETX	Toluene	µg/L	0.5 - 0.5	0.5	**	1	- - -	**	**	0	0.5 - 0.5	0.5	**	1	100%
Organics – BETX	Xylenes	µg/L	0.5 - 0.5	0.5	**	1	- - -	**	**	0	0.5 - 0.5	0.5	**	1	100%
Organics – PAH [2]	Low Molecular Weight PAHs	µg/L	0.08 - 0.08	0.08	**	1	- - -	**	**	0	0.08 - 0.08	0.08	**	1	0%
Organics – PAH [2]	High Molecular Weight PAHs	µg/L	0.03 - 0.03	0.03	**	1	- - -	**	**	0	0.03 - 0.03	0.03	**	1	100%
Organics – PAH [2]	Total PAH	µg/L	0.08 - 0.08	0.08	**	1	- - -	**	**	0	0.08 - 0.08	0.08	**	1	0%
Organics – Low MW PAH [3]	Naphthalene	µg/L	0.02 - 0.02	0.02	**	1	- - -	**	**	0	0.02 - 0.02	0.02	**	1	0%
Organics – Low MW PAH [3]	Acenaphthylene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – Low MW PAH [3]	Acenaphthene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – Low MW PAH [3]	Fluorene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – Low MW PAH [3]	Phenanthrene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	0%
Organics – Low MW PAH [3]	Anthracene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – High MW PAH [4]	Fluoranthene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – High MW PAH [4]	Pyrene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – High MW PAH [4]	Benzo(a)anthracene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – High MW PAH [4]	Chrysene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – High MW PAH [4]	Benzo(b&j)fluoranthene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – High MW PAH [4]	Benzo(k)fluoranthene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – High MW PAH [4]	Benzo(a)pyrene	µg/L	0.01 - 0.01	0.01	**	1	- - -	**	**	0	0.01 - 0.01	0.01	**	1	100%
Organics – High MW PAH [4]	Indeno(1,2,3-cd)pyrene	µg/L	0.03 - 0.03	0.03	**	1	- - -	**	**	0	0.03 - 0.03	0.03	**	1	100%
Organics – High MW PAH [4]	Dibenz(a,h)anthracene	µg/L	0.02 - 0.02	0.02	**	1	- - -	**	**	0	0.02 - 0.02	0.02	**	1	100%
Organics – High MW PAH [4]	Benzo(g,h,i)perylene	µg/L	0.02 - 0.02	0.02	**	1	- - -	**	**	0	0.02 - 0.02	0.02	**	1	100%
Organics – Other PAHs	2-Methylnaphthalene [5]	µg/L	0.05 - 0.05	0.05	**	1	- - -	**	**	0	0.05 - 0.05	0.05	**	1	0%
Organics – Other PAHs	Quinoline [6]	µg/L	0.05 - 0.05	0.05	**	1	- - -	**	**	0	0.05 - 0.05	0.05	**	1	100%
Organics – Other PAHs	Acridine [6]	µg/L	0.05 - 0.05	0.05	**	1	- - -	**	**	0	0.05 - 0.05	0.05	**	1	100%
Organics – EPH [7]	HEPH (C19-C32 less PAH) [8]	mg/L	0.08 - 0.08	0.08	**	1	- - -	**	**	0	0.08 - 0.08	0.08	**	1	100%
Organics – EPH [7]	LEPH (C10-C19 less PAH) [9]	mg/L	0.08 - 0.08	0.08	**	1	- - -	**	**	0	0.08 - 0.08	0.08	**	1	100%

- Not sampled/analyzed or insufficient sample
** Not applicable
1 All averages calculated using detection limit as minimum value
2 PAH = Polyaromatic Hydrocarbon
  Total Low MW PAHs = listed Low MW PAH + Other PAHs only
  Total High MW PAHs = listed High MW PAH only
  Total PAH = total of all listed PAHs only
3 Low MW PAH = Low Molecular Weight Polyaromatic Hydrocarbon (2-3 rings)
4 High MW PAH = High Molecular Weight Polyaromatic Hydrocarbon (4-7 rings)
5 Alkylated Low Molecular Weight PAH
6 N-Heterocycle Low Molecular Weight PAH
7 EPH = Extractable Petroleum Hydrocarbon
8 LEPH = Light Extractable Petroleum Hydrocarbon
9 HEPH = Heavy Extractable Petroleum Hydrocarbon

Table 8-7: Westridge CSO Quality Monitoring, 2009, Cont’d

The Westridge CSO is located at the northern tip of Cliff Avenue in Burnaby. The CSO discharges into Burrard Inlet.

Group	Parameter	Units	Descriptive Statistics [1]												
			Grab				Comp				All				
Chemistry			Range	Geomean	Std Dev	n	Range	Geomean	Std Dev	n	Range	Geomean	Std Dev	n	% ND
Dissolved Metals	Aluminium Dissolved	mg/L	0.03 - 0.05	0.04	0.01	2	- - -	**	**	0	0.03 - 0.05	0.04	0.01	2	0%
	Arsenic Dissolved	mg/L	0.01 - 0.01	0.01	0.000	2	- - -	**	**	0	0.01 - 0.01	0.010	0	2	100%
	Barium Dissolved	mg/L	0.01 - 0.012	0.011	0.001	2	- - -	**	**	0	0.01 - 0.012	0.011	0.001	2	0%
	Boron Dissolved	mg/L	0.03 - 0.04	0.04	0.01	2	- - -	**	**	0	0.03 - 0.04	0.04	0.01	2	0%
	Cadmium Dissolved	mg/L	0.0005 - 0.0005	0.0005	0	2	- - -	**	**	0	0.0005 - 0.0005	0.0005	0	2	100%
	Calcium Dissolved	mg/L	10.3 - 11.4	10.85	0.78	2	- - -	**	**	0	10.3 - 11.4	10.9	0.78	2	0%
	Chromium Dissolved	mg/L	0.001 - 0.001	0.001	0.000	2	- - -	**	**	0	0.001 - 0.001	0.001	0.000	2	100%
	Cobalt Dissolved	mg/L	0.001 - 0.001	0.001	0.0000	2	- - -	**	**	0	0.001 - 0.001	0.001	0	2	100%
	Copper Dissolved	mg/L	0.018 - 0.024	0.021	0.004	2	- - -	**	**	0	0.018 - 0.024	0.021	0.004	2	0%
	Iron Dissolved	mg/L	0.05 - 0.07	0.06	0.01	2	- - -	**	**	0	0.05 - 0.07	0.06	0.01	2	0%
	Lead Dissolved	mg/L	0.004 - 0.004	0.004	0.000	2	- - -	**	**	0	0.004 - 0.004	0.004	0.000	2	100%
	Magnesium Dissolved	mg/L	1.19 - 1.34	1.27	0.11	2	- - -	**	**	0	1.19 - 1.34	1.27	0.11	2	0%
	Manganese Dissolved	mg/L	0.010 - 0.019	0.015	0.006	2	- - -	**	**	0	0.010 - 0.019	0.015	0.006	2	0%
	Mercury Dissolved	µg/L	- - -	**	**	0	- - -	**	**	0	- - -	**	**	0	**
	Molybdenum Dissolved	mg/L	0.002 - 0.002	0.002	0.000	2	- - -	**	**	0	0.002 - 0.002	0.002	0	2	100%
	Nickel Dissolved	mg/L	0.001 - 0.001	0.001	0.000	2	- - -	**	**	0	0.001 - 0.001	0.001	0	2	50%
	Phosphorus Dissolved	mg/L	0.91 - 1.07	0.99	0.113	2	- - -	**	**	0	0.91 - 1.07	0.990	0.113	2	0%
	Selenium Dissolved	mg/L	0.01 - 0.01	0.01	0	2	- - -	**	**	0	0.01 - 0.01	0.010	0	2	100%
	Silver Dissolved	mg/L	0.001 - 0.001	0.001	0	2	- - -	**	**	0	0.001 - 0.001	0.001	0	2	100%
	Sodium Dissolved	mg/L	10.6 - 14.9	12.8	3.0	2	- - -	**	**	0	10.6 - 14.9	12.8	3.0	2	0%
	Zinc Dissolved	mg/L	0.013 - 0.015	0.014	0.001	2	- - -	**	**	0	0.013 - 0.015	0.014	0.001	2	0%
Total Metals	Aluminium Total	mg/L	0.32 - 0.32	0.32	0.00	2	- - -	**	**	0	0.32 - 0.32	0.32	0.00	2	0%
	Arsenic Total	mg/L	0.001 - 0.001	0.001	0.000	2	- - -	**	**	0	0.001 - 0.001	0.001	0	2	100%
	Barium Total	mg/L	0.018 - 0.019	0.019	0.001	2	- - -	**	**	0	0.018 - 0.019	0.019	0.001	2	0%
	BoronTotal	mg/L	0.03 - 0.04	0.04	0.01	2	- - -	**	**	0	0.03 - 0.04	0.04	0.01	2	0%
	Cadmium Total	mg/L	0.0005 - 0.0005	0.0005	0	2	- - -	**	**	0	0.0005 - 0.0005	0.0005	0	2	100%
	Calcium Total	mg/L	11.4 - 12.6	12.00	0.85	2	- - -	**	**	0	11.4 - 12.6	12.0	0.85	2	0%
	Chromium Total	mg/L	0.001 - 0.001	0.001	0.000	2	- - -	**	**	0	0.001 - 0.001	0.001	0.000	2	100%
	Cobalt Total	mg/L	0.001 - 0.001	0.001	0.0000	2	- - -	**	**	0	0.001 - 0.001	0.001	0	2	100%
	Copper Total	mg/L	0.038 - 0.047	0.043	0.006	2	- - -	**	**	0	0.038 - 0.047	0.043	0.006	2	0%
	Iron Total	mg/L	0.31 - 0.34	0.33	0.02	2	- - -	**	**	0	0.31 - 0.34	0.33	0.02	2	0%
	Lead Total	mg/L	0.002 - 0.003	0.003	0.001	2	- - -	**	**	0	0.002 - 0.003	0.003	0.001	2	0%
	Magnesium Total	mg/L	1.38 - 1.46	1.42	0.06	2	- - -	**	**	0	1.38 - 1.46	1.42	0.06	2	0%
	Manganese Total	mg/L	0.015 - 0.033	0.024	0.013	2	- - -	**	**	0	0.015 - 0.033	0.024	0.013	2	0%
	Mercury Total	µg/L	0.05 - 0.07	0.06	0.01	2	- - -	**	**	0	0.05 - 0.07	0.06	0.01	2	50%
	Molybdenum Total	mg/L	0.002 - 0.002	0.002	0.000	2	- - -	**	**	0	0.002 - 0.002	0.002	0	2	100%
	Nickel Total	mg/L	0.001 - 0.001	0.001	0.000	2	- - -	**	**	0	0.001 - 0.001	0.001	0	2	0%
	Phosphorus Total	mg/L	1.34 - 1.54	1.44	0.141	2	- - -	**	**	0	1.34 - 1.54	1.440	0.141	2	0%
	Selenium Total	mg/L	0.001 - 0.001	0.001	0	2	- - -	**	**	0	0.001 - 0.001	0.001	0	2	100%
	Silver Total	mg/L	0.001 - 0.001	0.001	0	2	- - -	**	**	0	0.001 - 0.001	0.001	0	2	100%
	Sodium Total	mg/L	10.9 - 16.1	13.5	3.7	2	- - -	**	**	0	10.9 - 16.1	13.5	3.7	2	0%
	Zinc Total	mg/L	0.029 - 0.031	0.030	0.001	2	- - -	**	**	0	0.029 - 0.031	0.030	0.001	2	0%

- Not sampled/analyzed or insufficient sample
** Not applicable
*** Grab sample during Bioassay collection at conclusion of composite sampling.
1 All averages calculated using detection limit as minimum value

Levels of Activities

9.0 LEVELS OF ACTIVITY

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9.1 Wastewater Treatment Plant Laboratories

During 2009, wastewater treatment plant laboratories performed more than 87,000 tests. The laboratory testing was carried out to provide ongoing information for process control and performance evaluation, special projects and included a portion of the effluent monitoring requirements for the B.C. Ministry of Environment Operational certificates. A summary of the laboratory activity by treatment plants is as follows:

	ANNACIS	IONA	LIONSGATE	LULU	NW LANGLEY	TOTAL
TOTAL WWTP LABS	27,071	14,454	9,243	22,450	14,309	87,527

Special Projects

In 2009, Quality Control staff at the WWTP process laboratories was involved in the following projects and initiatives.

9.1.1 Annacis Island Wastewater Treatment Plant

- **Gas Analysis**
  Method development in determining nitrogen, methane and carbon dioxide concentrations using gas chromatographic method was started.

- **Co-Digestion Project**
  Testing of potential substrates from various industries was started in 2008 and continued in 2009. Biochemical methane potential (BMP) test was started.

- **Co-Digestion – Full Load Testing**
  The co-digestion full load test started on August 5 and completed on October 31. Test loads received were from West Coast Reduction and Inland Technologies. Samples were tested for chemical oxygen demand (COD), pH, total solids and volatile solids. Digester testing frequency was increased to monitor the effect of the new substrates.

- **Risk Assessment for Struvite Formation Potential**
  Determine the struvite formation potential at different locations in the treatment plant by determining the concentration of various ions and parameters within the system.

9.1.2 Lulu Island Wastewater Treatment Plant

- **Trickling Filter No.4 Process Performance Testing**
  Performance testing was started in 2008 and completed in February 2009. Samplers were set-up to collect secondary influent and effluent from trickling filter #4 to monitor the performance of the new trickling filter.

- **Foaming Event**
  Plant received unusual influent that caused significant foaming in the solids contact tank in September. Discrete samplers were set-up to collect raw influent samples and

selected strategic key sampling locations in Richmond. Samples were tested for pH, COD, soluble COD, conductivity and MBAS. Foam potential of the samples collected was determined by using the Alka-Seltzer® foaming test for influent and effluent streams. Two tablets of Alka-Seltzer tablets were added on 25 mL sample to a 500 mL graduated cylinder. Maximum foam volume was observed as well as the time taken until the foam volume collapsed. Tap water was used as control to calculate the foam volume and collapse time values from the sample

9.1.3 Lions Gate Wastewater Treatment Plant

- **Sedimentation Tank Study**

  Study was started in 2008 and continued in 2009. Samples were collected in and out of the sedimentation tanks. Samples were tested for suspended solids (SS), COD, pH and soluble COD.

9.1.4 Northwest Langley Wastewater Treatment Plant

- **Source of High Influent Loadings**

  Monitoring and testing program was started in April 3, 2006. A composite sampler was installed on one of the major contributors of organic loading to the plant. Samples were tested for SS, pH, COD and biochemical oxygen demand (BOD). Flow data and duration were also entered in LIMS database.

9.2 Main Chemistry Laboratory

As part of the Quality Control Division, the main chemistry laboratory is involved in providing analytical services, sampling, data summary, special project support, and data interpretation to the many departments and groups within Metro Vancouver. Approximately 82% of all work performed in the main chemistry laboratory in 2009 was related to monitoring the collection, treatment, and discharge of wastewater. (The remainder of the work is related to drinking water) These activities include WWTP permit monitoring, source control (industrial discharges to sewers), monitoring biosolids quality, and special engineering initiatives.

The total number of analyses completed by the main chemistry laboratory sections for all GVS&DD programs was approximately 46,800 in 2009.

9.2.1 Program Descriptions

Following are brief outlines of the activities associated with the different programs and special project initiatives completed by the main Chemistry laboratory during the year 2008. In the following sections, those projects designated as “Routine” are long term programs that are often permit driven or used in evaluation of the wastewater treatment processes. Those projects designated “Special Projects” typically are short term or one-off initiatives designed to meet a particular need.

9.2.2 Routine Programs

- **WWTP Permit Monitoring and Performance Evaluation**

To meet the BC MOE Operating Certificate (OC) requirements, effluent samples from each WWTP are collected and analyzed for a wide variety of parameters. In conjunction with the

OC work, supporting information is collected to provide additional information on the efficiencies of the treatment processes. The Quality Control department reviews and summarizes this data for use by many departments.

- **Bioassay Sampling**

As part of the BC MOE Operating Certificate requirements for the wastewater treatment plants, assessment of effluent toxicity is required. Sampling, chemical analysis, management of contracts for the bioassay tests, and data interpretation are all handled by Quality Control staff. Increased emphasis has been placed on bioassay testing over the last number of years including increased sampling/testing when a failure occurs.

- **Liquid Waste Regulation (Source Control)**

The work for this program is derived from the sampling of industrial discharges to the sewers so that compliance with GVS&DD sewer use regulations can be monitored. Information is used in the determination of the BOD/TSS surcharge. Permit holders submit compliance data on their own behalf, and Metro Vancouver's sampling and analysis program acts as an audit function for the data submitted. Analyses are done in support of legal actions undertaken by Regulation and Enforcement

Another aspect of this program includes an investigative function which looks at identifying sources when problematic contaminants are found in wastewater treatment and collections systems. Sampling and analytical monitoring programs are often initiated as a consequence. Routine sampling of Septic Tank truck loads is included to monitor contaminants entering the WWTPs through this route.

- **Biosolids Management**

Digested sludge generated from the waste-water treatment process requires disposal. This is accomplished by de-watering the sludge and recycling the material (known as biosolids or Nutrifor) for use as a nutrient source in such projects as mine reclamation, landfill restoration, tree farming, and rangeland conditioning. In 2002 the Organic Matter Recycling Regulation (OMRR) established rules for classifying the quality of biosolids and how it can be used. To insure compliance with the OMRR, frequent analysis of dewatered sludge, raw sludge, stored sludge, and shipped biosolids is carried out for all WWTP locations.

- **Digester Sludge Quality**

At present, Iona and Northwest Langley WWTPs are not part of the routine Biosolids/ Nutrifor program. To date, digested sludge is sent to lagoons and eventually dewatered for land storage. The digester sludge quality is monitored for metals content to provide information for future biosolids recycling of the land dried sludge.

- **Chronic Bioassays**

Started in 2005 and continuing through 2009 special bioassays were done to assess the sub-lethal (chronic) toxicity to freshwater aquatic species of the whole effluent from those WWTPs fronting the Fraser River. In support of this project, the chemistry laboratory provided analytical data to characterize the samples collected for the bioassay tests.

- **Initial Dilution Zone Study**

Sampling of Annacis effluent and receiving waters to monitor the extent of dilution at the outfall. The chemistry laboratory provided assays of the effluent.

- **WWTP NO2/NO3 Monitoring**

In support of WWTP process monitoring, ammonia and nitrite/nitrate were tested on a regular basis.

9.2.3 Special Projects During 2009

- Increased analysis regarding frequent D.O. events at the North West Langley WWTP.
- Lulu foaming event (September, 2009) involved extensive MBAS analysis by the QC lab, both anionic and cationic MBAS.
- Key Manhole Monitoring; coordinated by Dave Ferguson of Regulation and enforcement.

9.3 Bacteriology Laboratory

In 2009, the bathing beach monitoring program went from April to September, and the bacteriological water quality at almost every beach was excellent and met the recreational water guidelines. For primary-contact recreation, the Canadian recreational guidelines require that each beach geometric mean not exceed 200 fecal coliforms/100mL in a 30 day period and that there be a minimum of five samples. There is a working secondary guideline for non-bathing beaches, like False Creek, that are used for secondary recreational purposes and that guideline is raised to 1000 fecal coliforms/100mL. False Creek East, West and Central all met the secondary guideline. One new recreational area was sampled in 2009 – Rocky Point Park. The geometric means for each beach for five years are included in the appendix to this report.

Even though the summer months saw very few beach postings, there were a few problems worth noting. Gary Point (a non-swimming area) did exceed the 30 day limit and was posted from July 28 – 31 but it passed the secondary guideline. Ambleside beach had several occasions with high individual fecal coliform counts and these incidents were related to a sewer main break and Lions Gate WWTP malfunctions. Jericho and Locarno beach experienced one day of very high fecal coliform counts simultaneously but the specific cause was not determined. Sasamat lake- White Pine beach, part of Belcarra Regional Park, was posted from July 17-20. All the subject beaches were resampled. Power failures, combined sewer overflows, urban stormwater runoff, WWTP malfunctions and the presence of geese and dogs are all possible contributors of fecal coliforms.

In the spring of 2009, the laboratory reported the results of a recreational water indicator study started in 2007 and concluded in 2008 to the health authorities and interested municipalities. The indicators tested were Enterococci, fecal coliforms and E. coli and the beaches chosen were ones that historically provided a good range of results. The study showed that all three indicators were easy to detect using MPN methods so our laboratory is ready to test whichever indicator is selected as the best indicator of water quality for our recreational waters.

The bacteriology laboratory also provided their analytical services to other programs as described below.

Regular sampling for fecal coliforms on WWTP effluent continued during chlorination months and testing of Annacis Island, Lulu Island and Lions Gate dewatered sludge (biosolids) continued all year long with the level of sampling activity determined by the quantity of biosolids produced at each plant. These results will be discussed elsewhere in the WWTP reports.

Ongoing projects include the Annacis and Lions Gate Initial Dilution Zone (IDZ), Lions Gate sediment study and the Fraser River and Burrard Inlet ambient waters programs. A new multi-year, multi-agency Boundary Bay project started in 2009 and our laboratory is providing the fecal coliform testing data to be incorporated with the other parameters analysed by other laboratories. Separate reports will be issued for these projects by the program owners.

A summary of activity levels carried out by the Bacteriology laboratory for GVS & DD in 2009 is as follows:

Receiving Water and Effluent Monitoring	8,038
Biosolids/Sludge/Miscellaneous Sewage Projects	3,490
Total Analyses	11,528

Appendix A

APPENDIX A

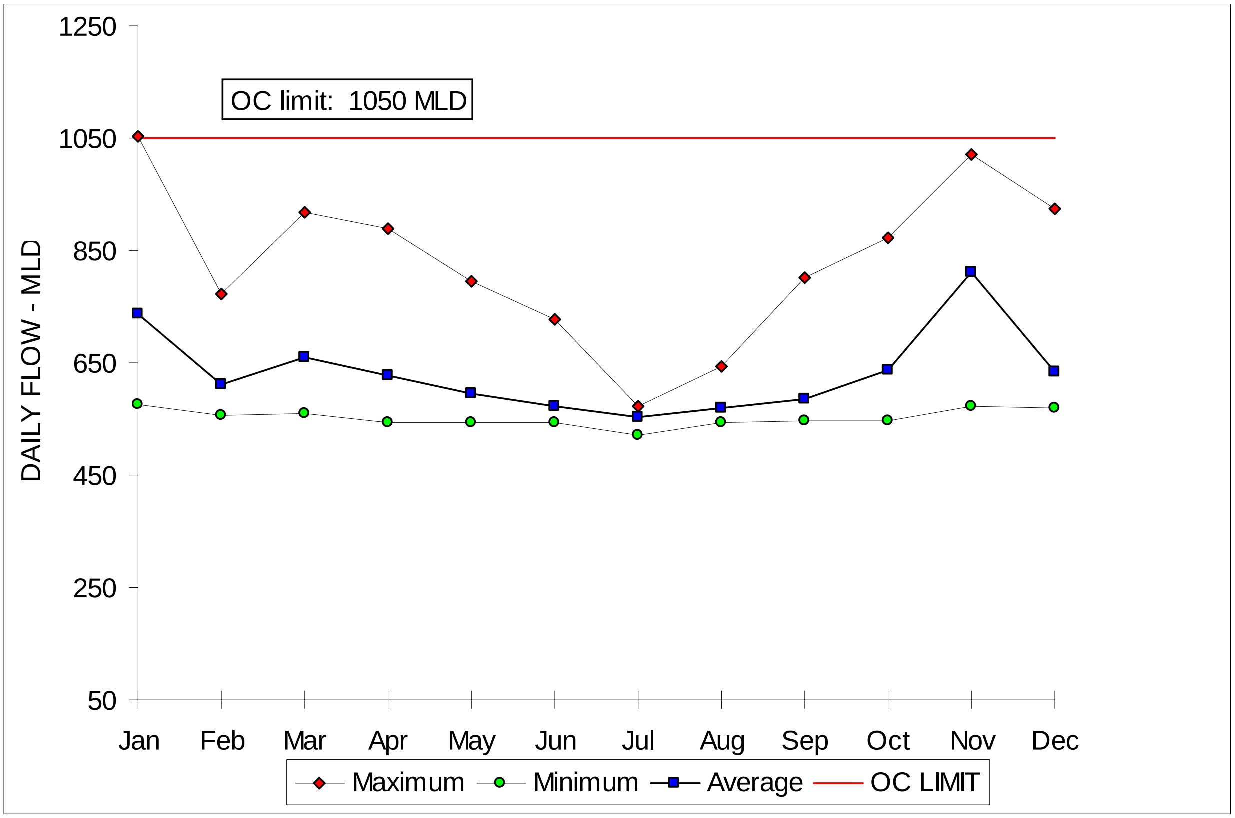
2009 WWTP DATA

MONTHLY AND ANNUAL SUMMARIES

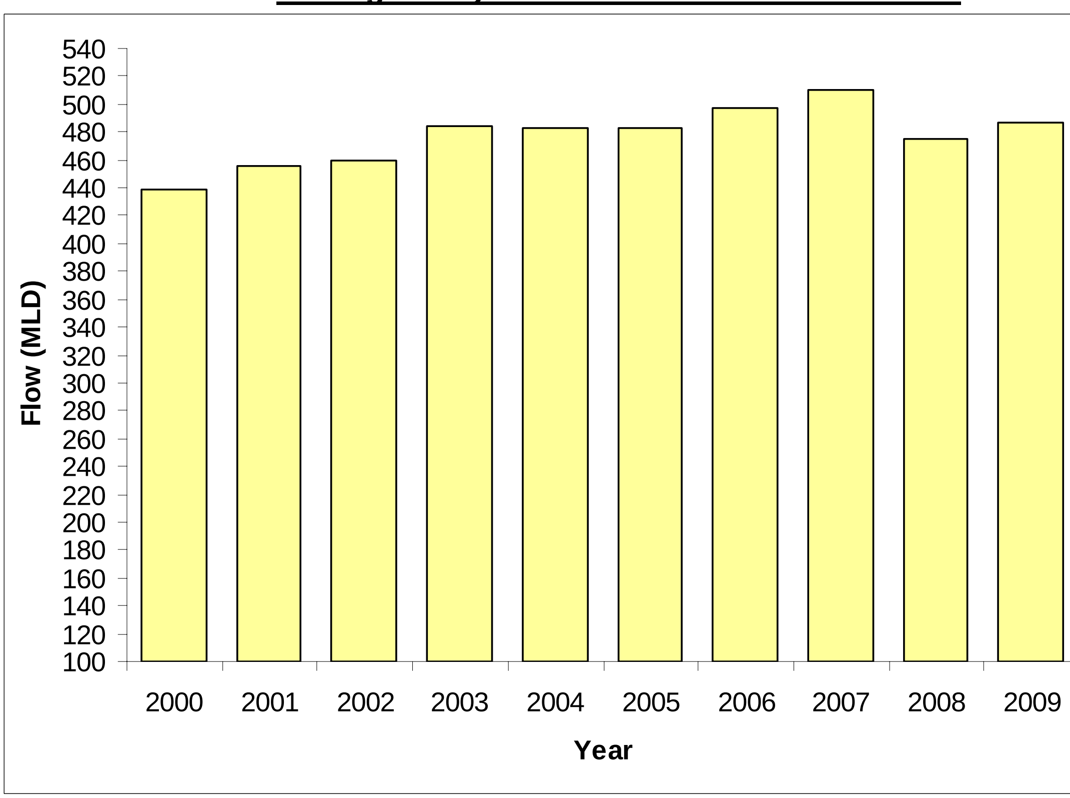
APPENDIX A1

ANNACIS ISLAND WASTEWATER TREATMENT PLANT

ANNACIS WWTP - 2009 Wastewater Flow - Monthly Summary

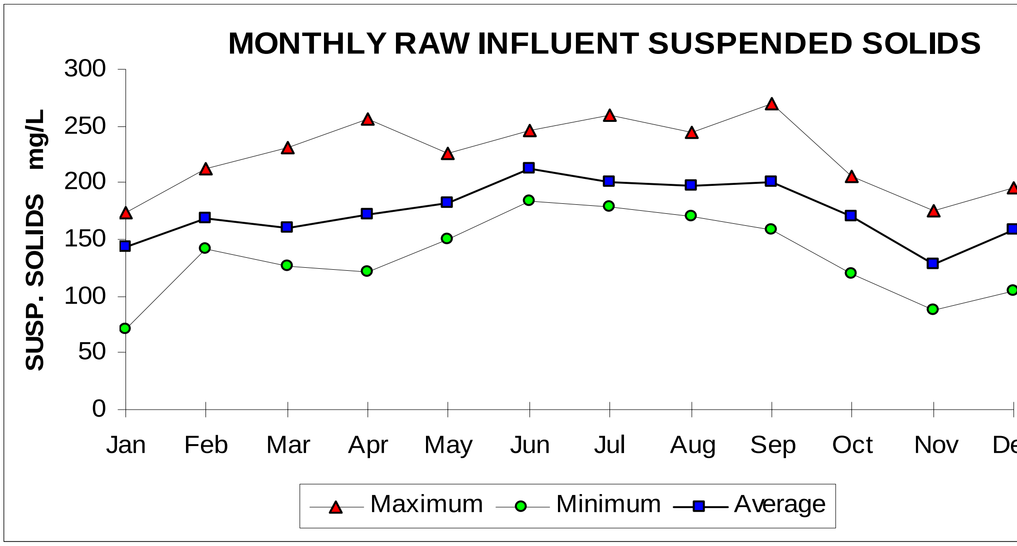


Average Daily Wastewater Flows 2000– 2009

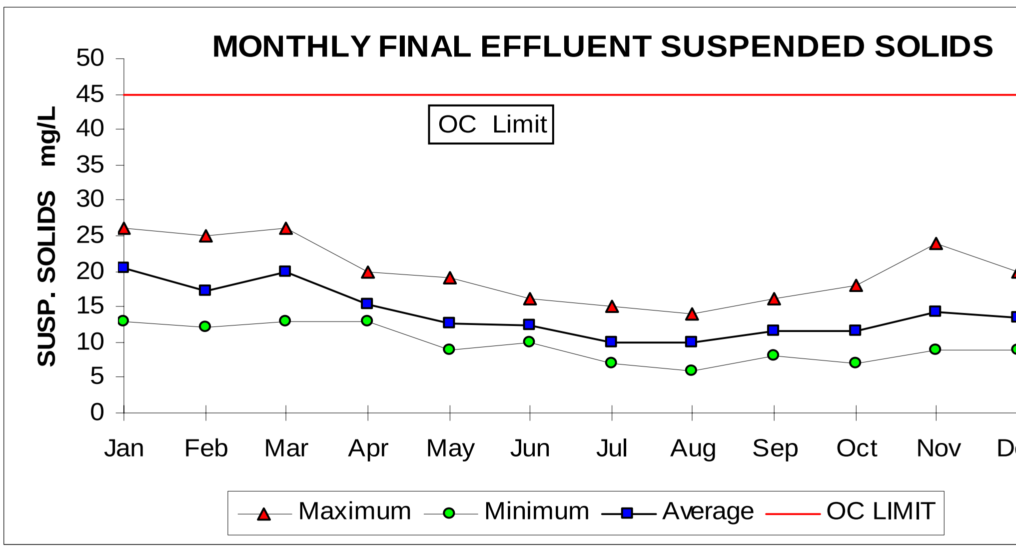


Year	Flow (MLD)
2000	439
2001	455
2002	460
2003	485
2004	497
2005	483
2006	497
2007	510
2008	475
2009	487

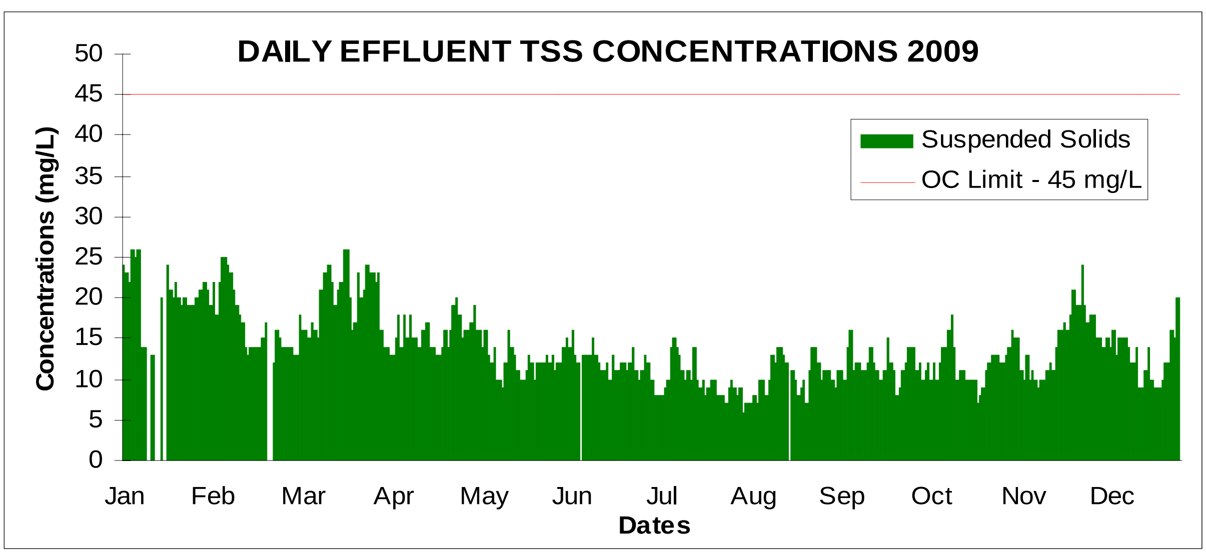
ANNACIS WWTP – 2009 Suspended Solids Concentrations Summary



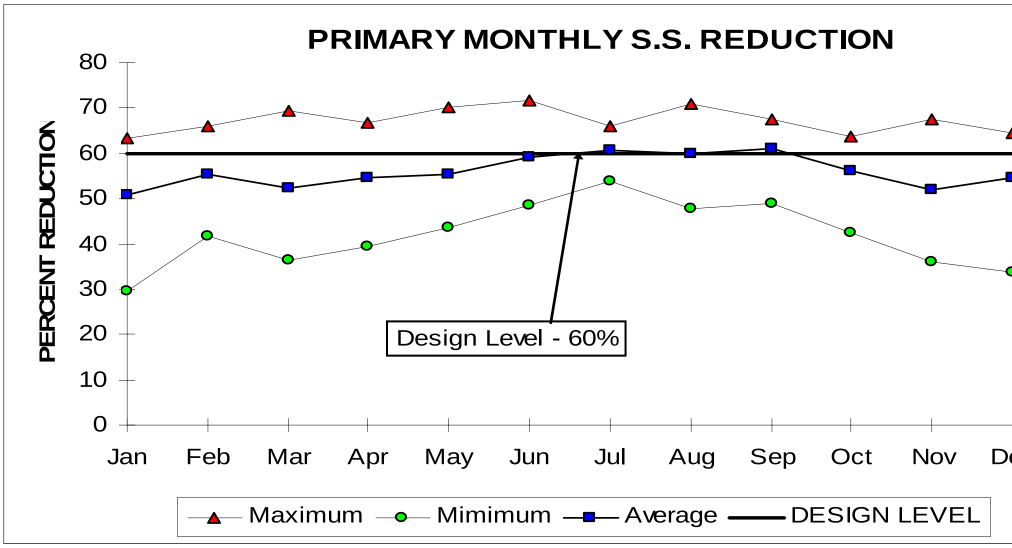
Mth	Max	Min	Ave
Jan	173	71	144
Feb	212	142	168
Mar	231	126	159
Apr	256	121	171
May	226	150	183
Jun	246	184	212
Jul	259	178	201
Aug	244	170	197
Sep	270	158	200
Oct	206	120	170
Nov	176	88	128
Dec	195	104	158



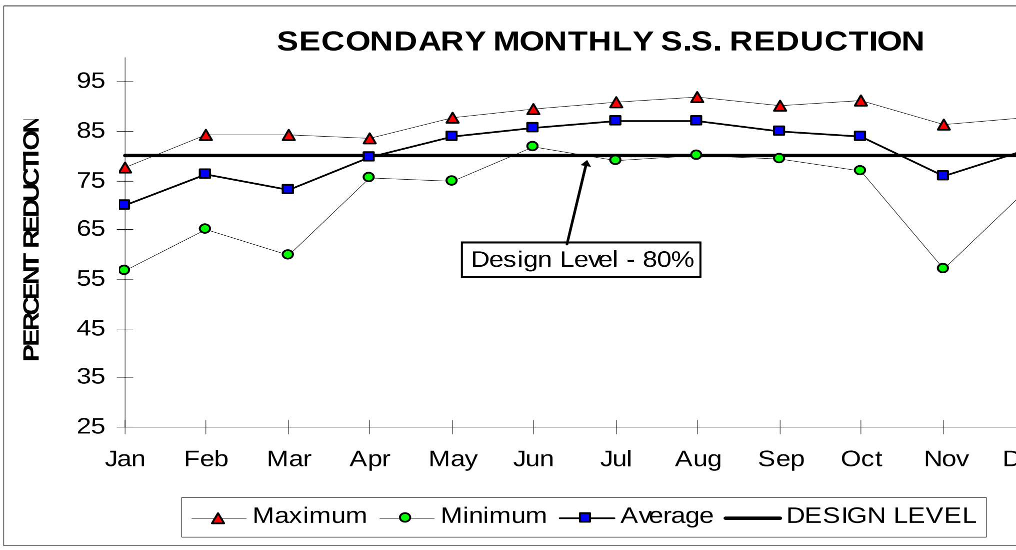
Mth	Max	Min	Ave
Jan	26	13	21
Feb	25	12	17
Mar	26	13	20
Apr	20	13	15
May	19	9	13
Jun	16	10	12
Jul	15	7	10
Aug	14	6	10
Sep	16	8	12
Oct	18	7	12
Nov	24	9	14
Dec	20	9	13



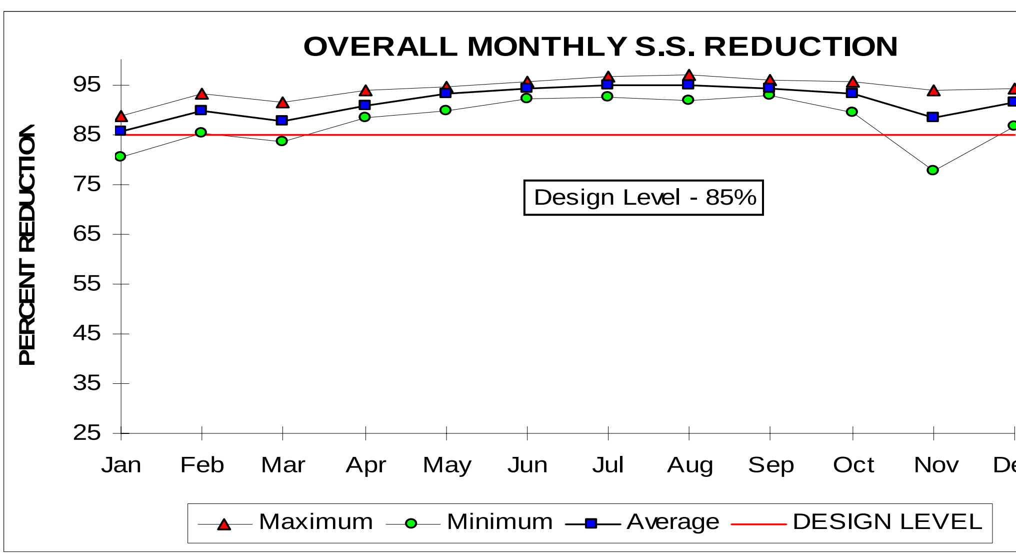
ANNACIS WWTP – 2009 Suspended Solids Reductions



Mth	Max	Min	Ave
Jan	63	30	51
Feb	66	42	55
Mar	69	36	52
Apr	67	40	55
May	70	43	56
Jun	72	49	59
Jul	66	54	60
Aug	71	48	60
Sep	67	49	61
Oct	64	43	56
Nov	68	36	52
Dec	65	34	54

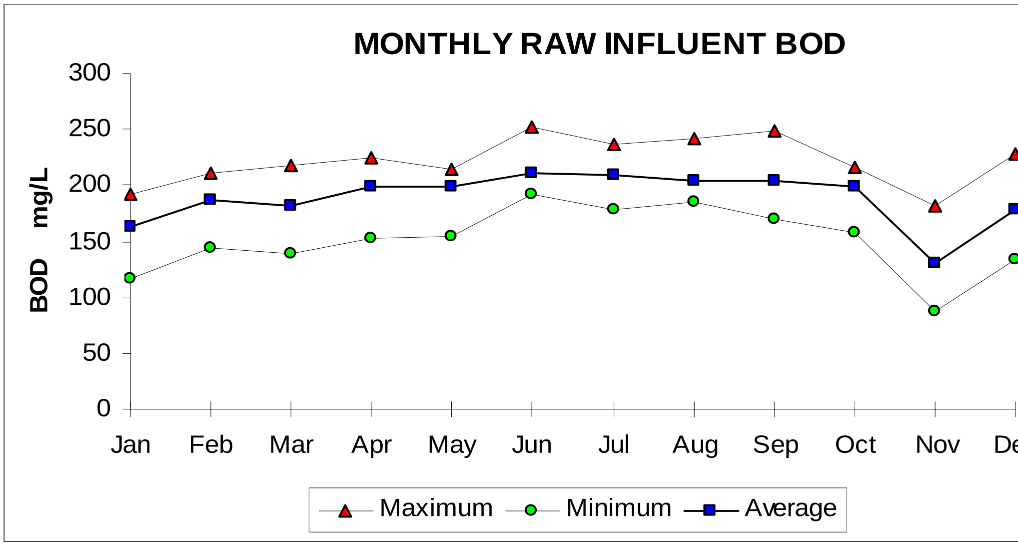


Mth	Max	Min	Ave
Jan	78	57	70
Feb	84	65	76
Mar	84	60	73
Apr	84	76	80
May	88	75	84
Jun	89	82	86
Jul	91	79	87
Aug	92	80	87
Sep	90	79	85
Oct	91	77	84
Nov	86	57	76
Dec	88	73	81

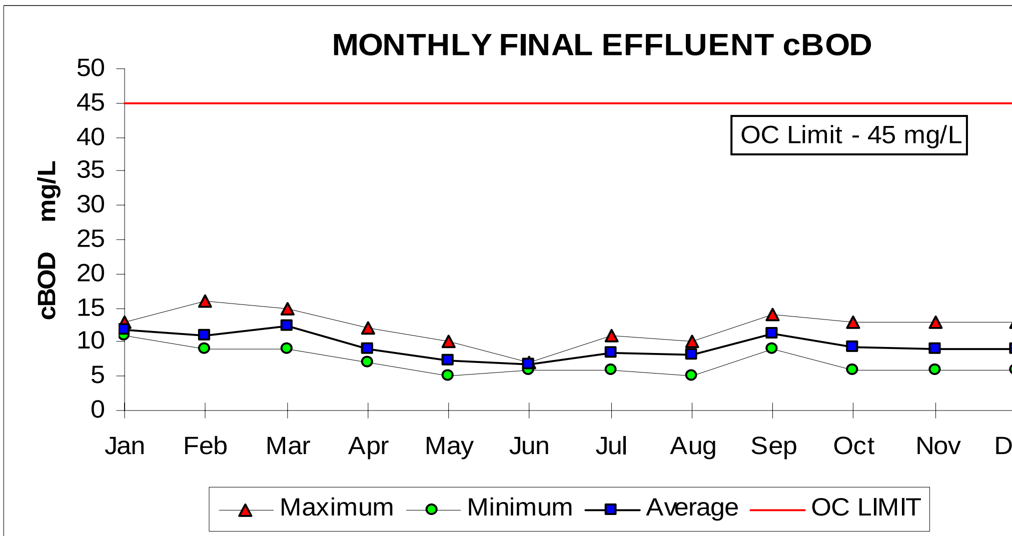


Mth	Max	Min	Ave
Jan	89	80	86
Feb	93	85	90
Mar	91	84	87
Apr	94	88	91
May	95	90	93
Jun	96	92	94
Jul	97	93	95
Aug	97	92	95
Sep	96	93	94
Oct	96	89	93
Nov	94	78	88
Dec	94	87	91

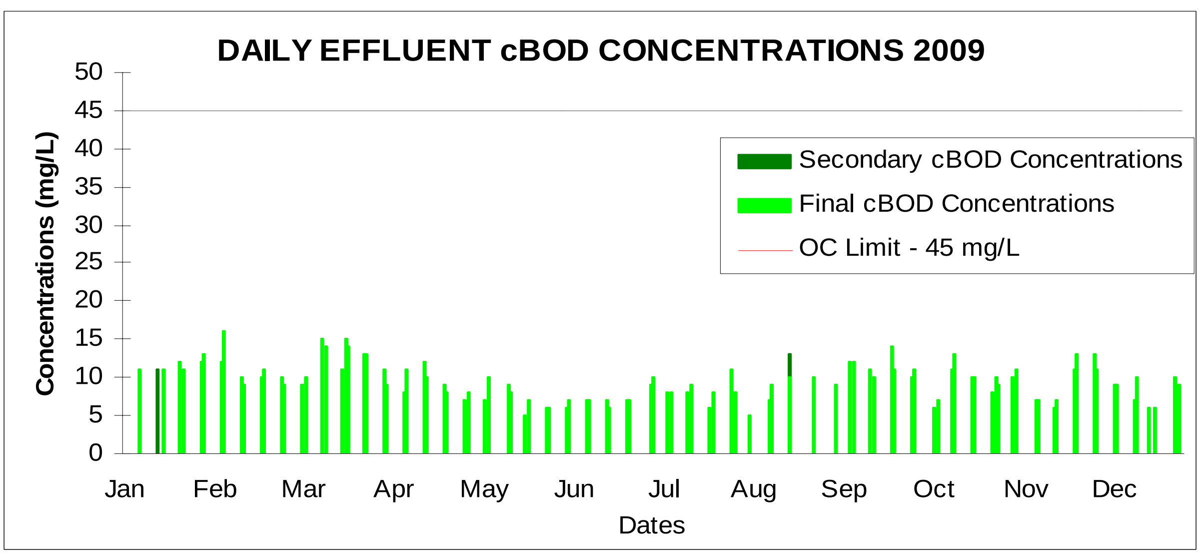
ANNACIS WWTP – 2009 BOD Concentrations Summary



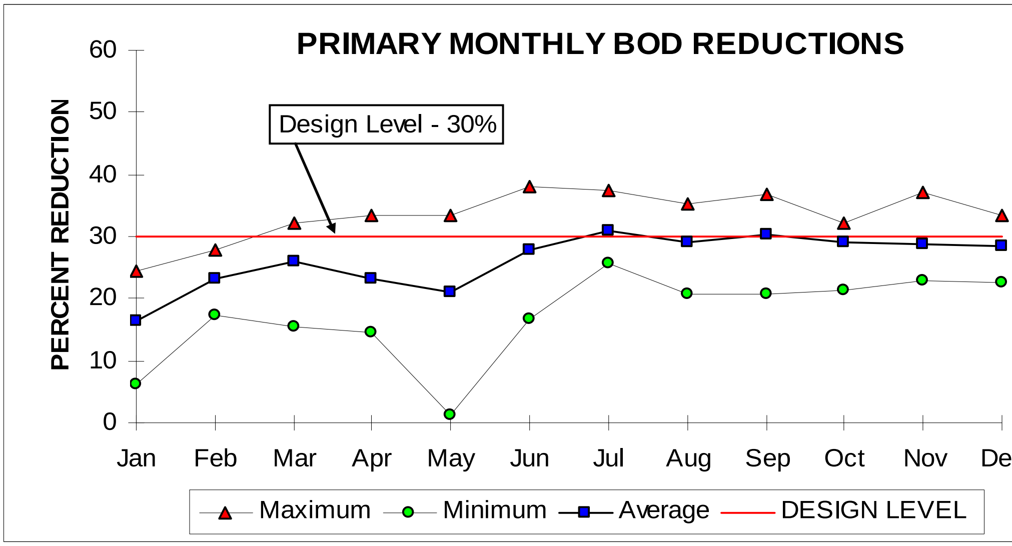
Mth	Max	Min	Ave
Jan	192	117	163
Feb	211	144	186
Mar	218	139	182
Apr	225	152	199
May	214	155	199
Jun	252	192	210
Jul	236	178	209
Aug	241	186	205
Sep	249	170	205
Oct	216	158	199
Nov	182	87	130
Dec	228	133	179



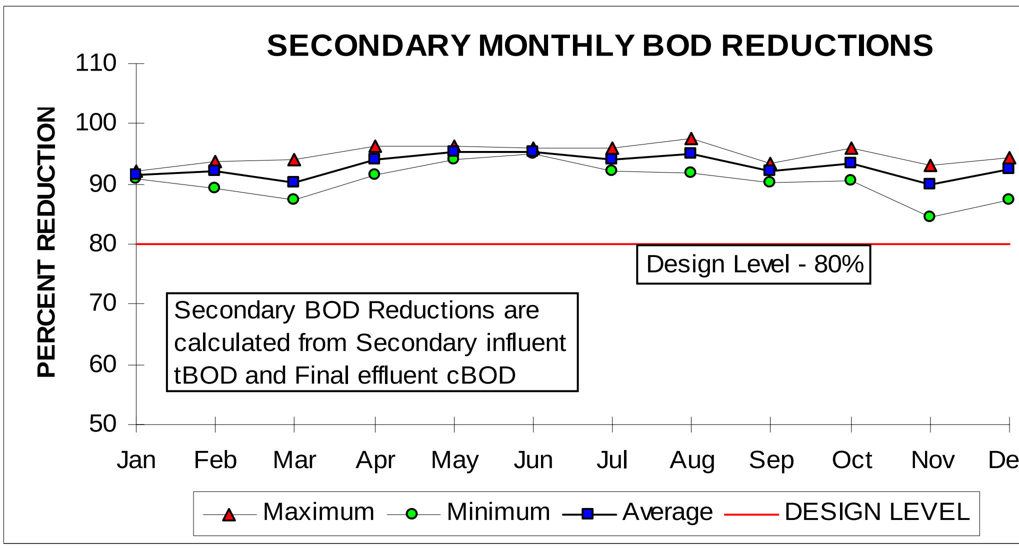
Mth	Max	Min	Ave
Jan	13	11	12
Feb	16	9	11
Mar	15	9	13
Apr	12	7	9
May	10	5	7
Jun	7	6	7
Jul	11	6	9
Aug	10	5	8
Sep	14	9	11
Oct	13	6	9
Nov	13	6	9
Dec	13	6	9



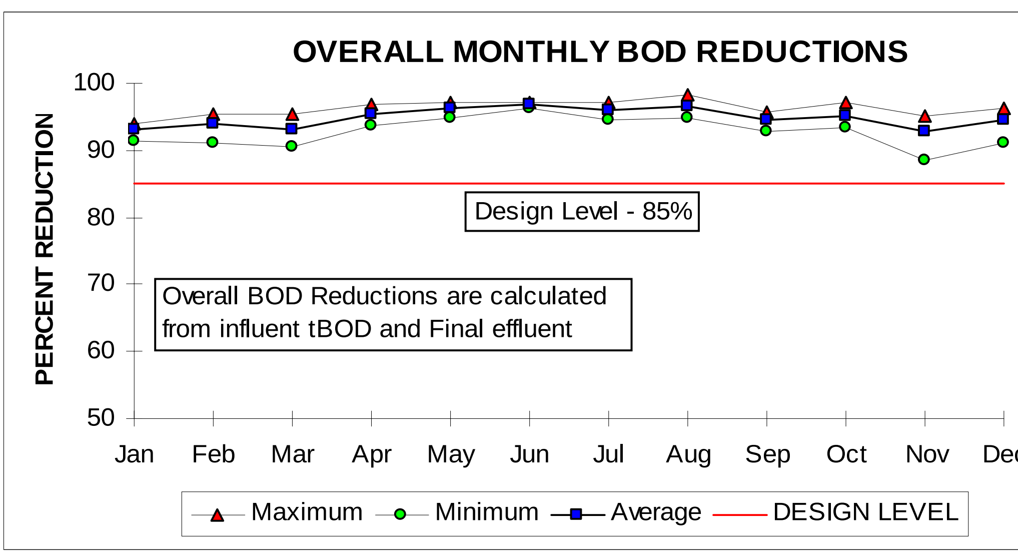
ANNACIS WWTP – 2009 BOD Reductions



Mth	Max	Min	Ave
Jan	24	6	16
Feb	28	17	23
Mar	32	16	26
Apr	33	15	23
May	34	1	21
Jun	38	17	28
Jul	37	26	31
Aug	35	21	29
Sep	37	21	30
Oct	32	21	29
Nov	37	23	29
Dec	33	23	29

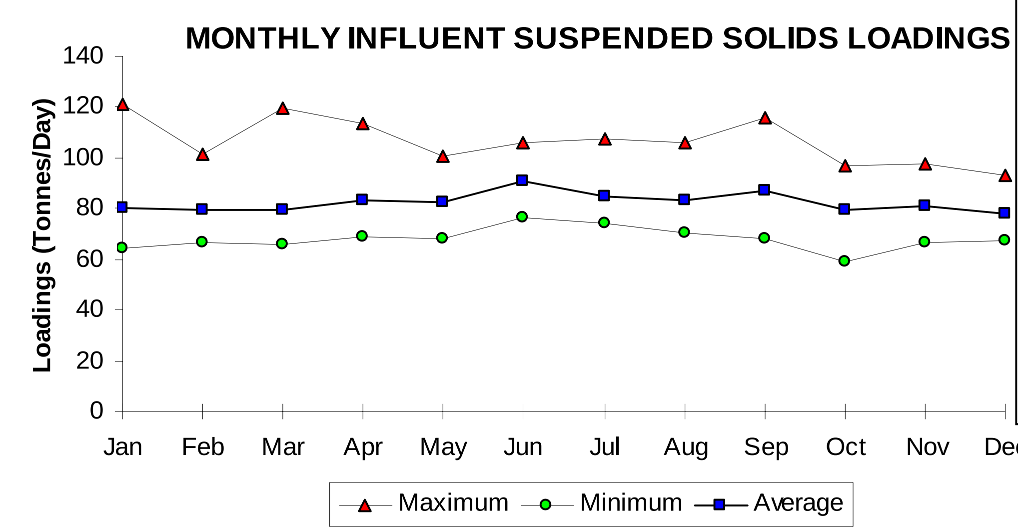


Mth	Max	Min	Ave
Jan	92	91	92
Feb	94	89	92
Mar	94	87	90
Apr	96	92	94
May	96	94	95
Jun	96	95	95
Jul	96	92	94
Aug	98	92	95
Sep	93	90	92
Oct	96	91	93
Nov	93	85	90
Dec	94	88	92

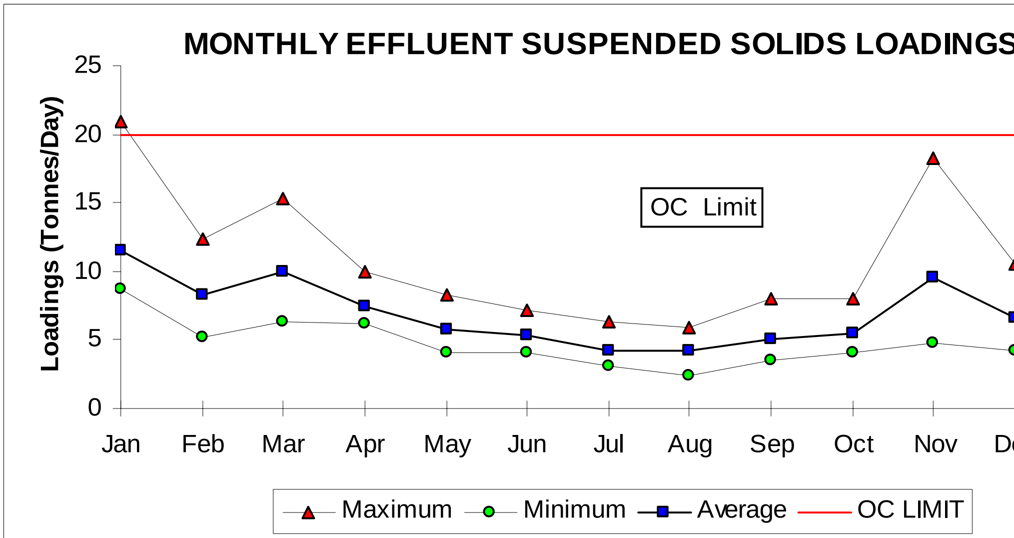


Mth	Max	Min	Ave
Jan	94	91	93
Feb	95	91	94
Mar	95	91	93
Apr	97	94	95
May	97	95	96
Jun	97	96	97
Jul	97	94	96
Aug	98	95	97
Sep	96	93	95
Oct	97	93	95
Nov	95	89	93
Dec	96	91	95

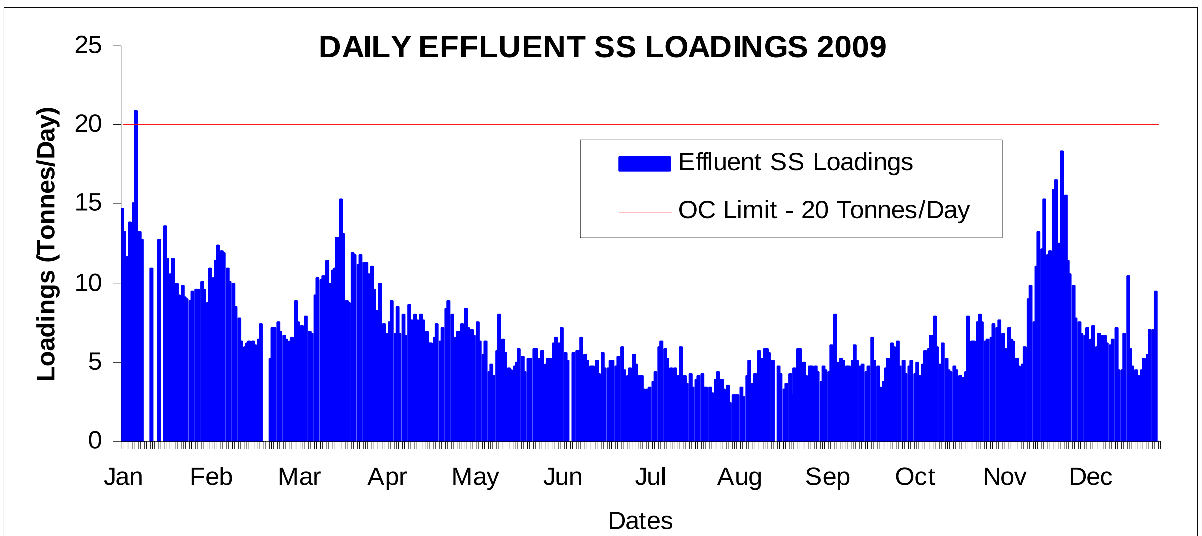
ANNACIS WWTP – 2009 Suspended Solids Loadings Summary



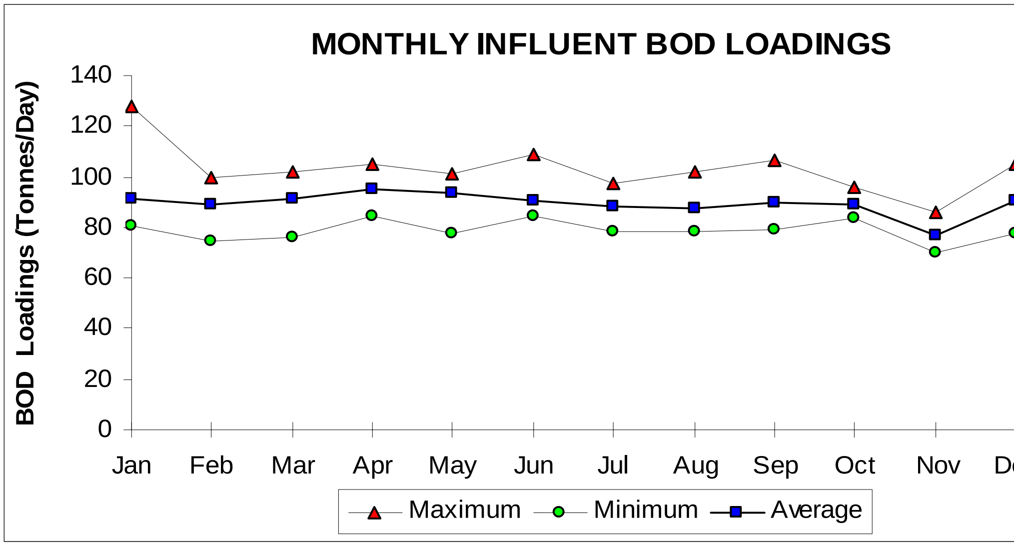
Mth	Max	Min	Ave
Jan	121	64	80
Feb	101	66	79
Mar	120	66	79
Apr	114	69	83
May	101	68	82
Jun	106	76	91
Jul	108	74	85
Aug	106	70	83
Sep	116	68	87
Oct	97	59	80
Nov	97	66	81
Dec	93	67	78



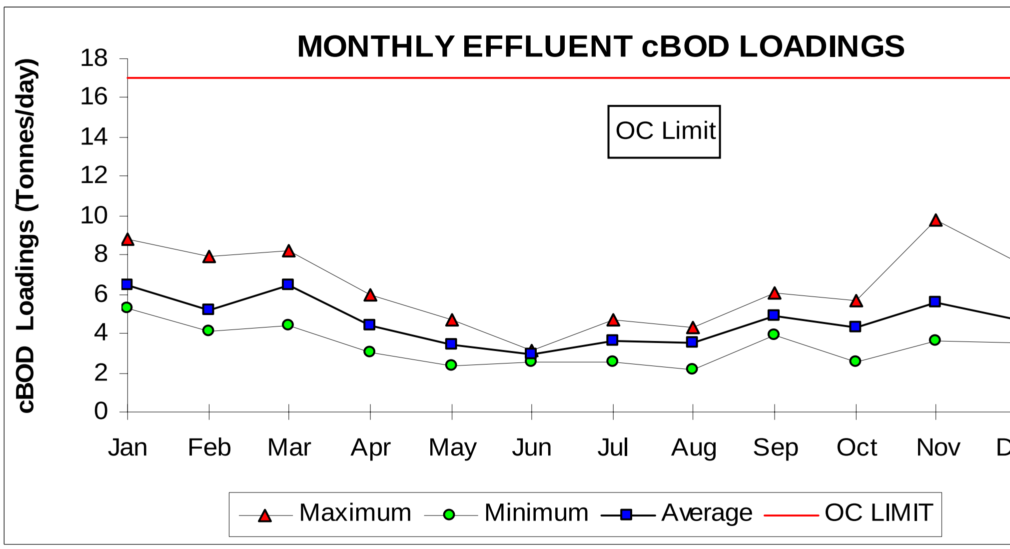
Mth	Max	Min	Ave
Jan	20.9	8.7	11.5
Feb	12.4	5.3	8.2
Mar	15.3	6.3	9.9
Apr	9.9	6.1	7.5
May	8.3	4.1	5.8
Jun	7.1	4.1	5.3
Jul	6.3	3.0	4.2
Aug	5.9	2.4	4.3
Sep	8.0	3.4	5.0
Oct	8.0	4.0	5.5
Nov	18.3	4.8	9.6
Dec	10.6	4.2	6.6



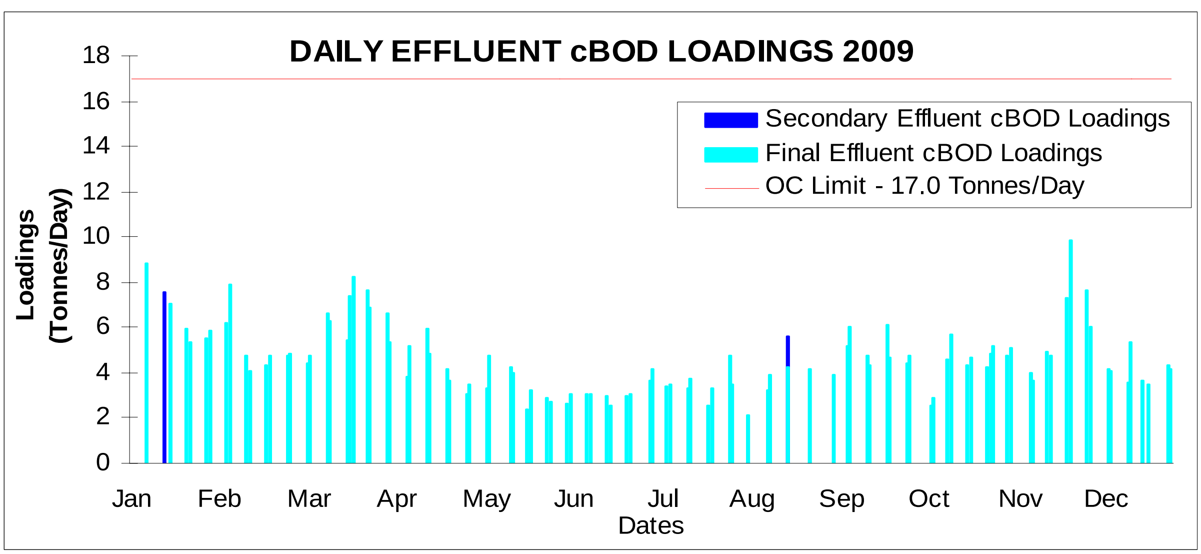
ANNACIS WWTP – 2009 BOD Loadings Summary



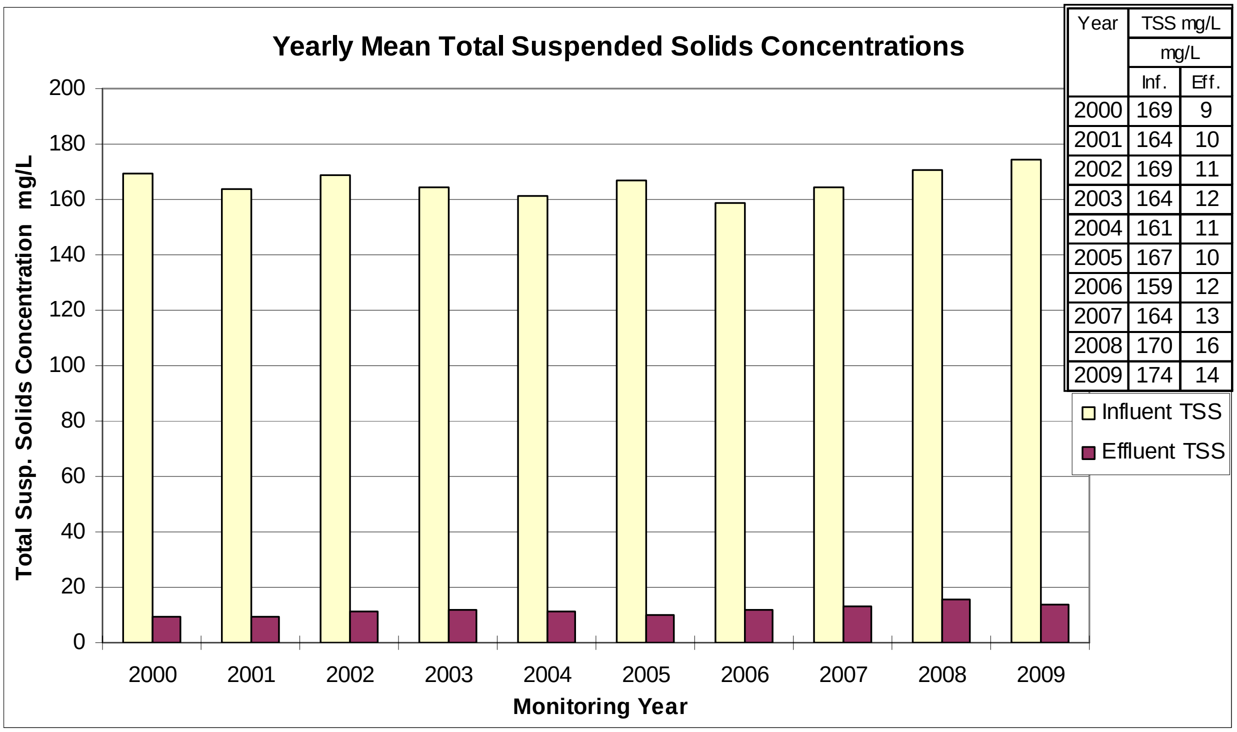
Mth	Max	Min	Ave
Jan	128	80	91
Feb	100	74	89
Mar	102	76	91
Apr	105	85	95
May	101	77	94
Jun	109	85	91
Jul	98	78	88
Aug	102	78	87
Sep	107	79	89
Oct	96	84	89
Nov	86	70	77
Dec	105	78	91



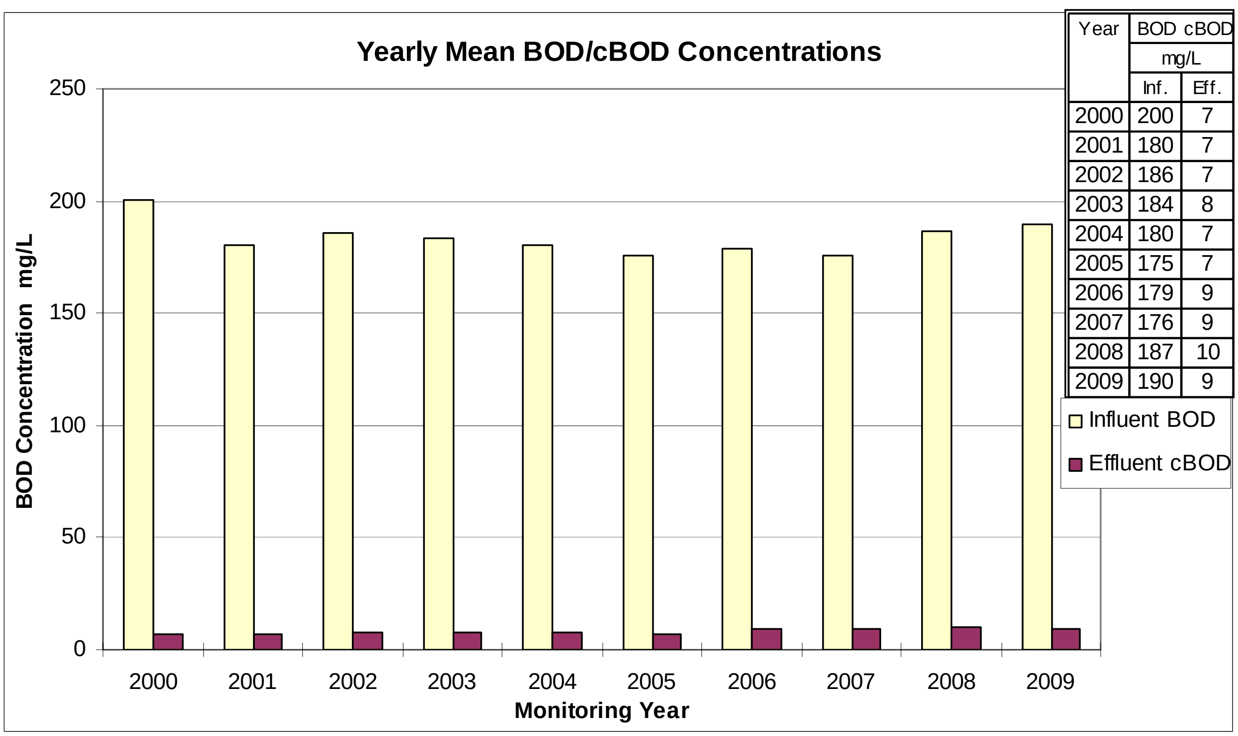
Mth	Max	Min	Ave
Jan	8.8	5.3	6.4
Feb	7.9	4.1	5.2
Mar	8.2	4.4	6.4
Apr	6.0	3.1	4.4
May	4.7	2.4	3.4
Jun	3.1	2.6	2.9
Jul	4.7	2.6	3.6
Aug	4.3	2.1	3.5
Sep	6.1	3.9	4.9
Oct	5.7	2.6	4.3
Nov	9.8	3.6	5.5
Dec	7.6	3.5	4.7



ANNACIS WWTP 2000 – 2009 Historical Concentrations Comparison

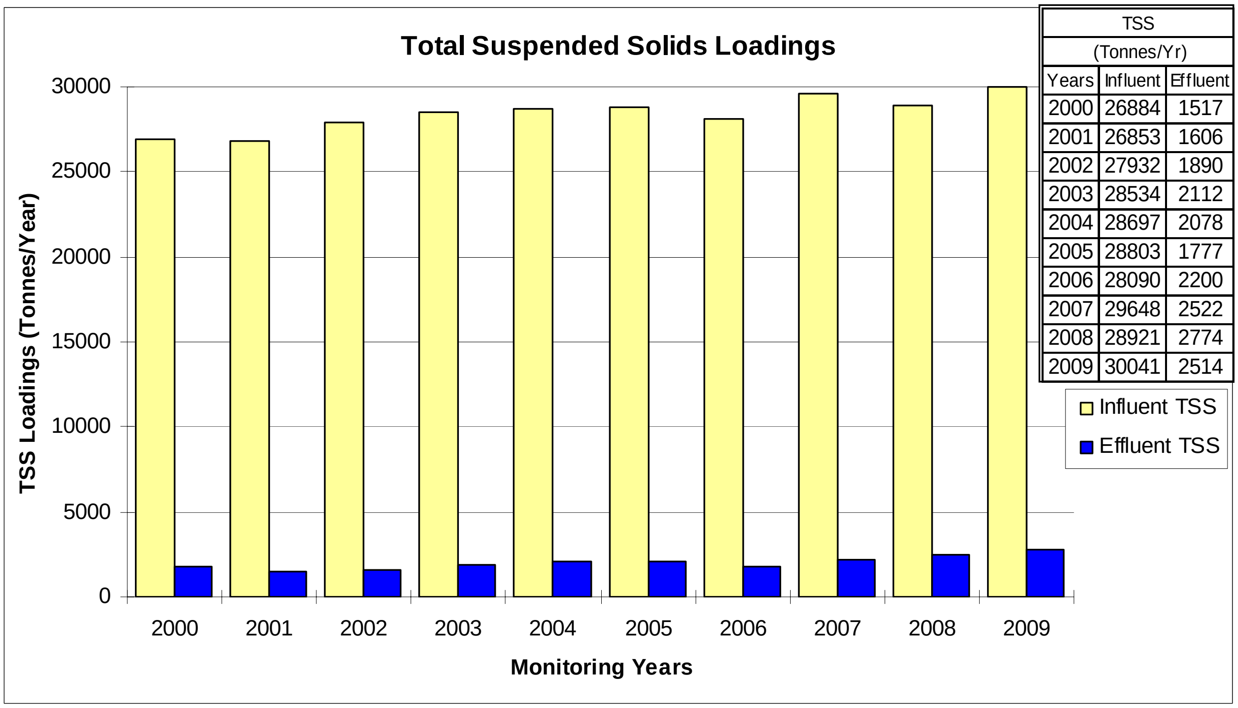


Year	TSS mg/L	
	mg/L	
	Inf.	Eff.
2000	169	9
2001	164	10
2002	169	11
2003	164	12
2004	161	11
2005	167	10
2006	159	12
2007	164	13
2008	170	16
2009	174	14

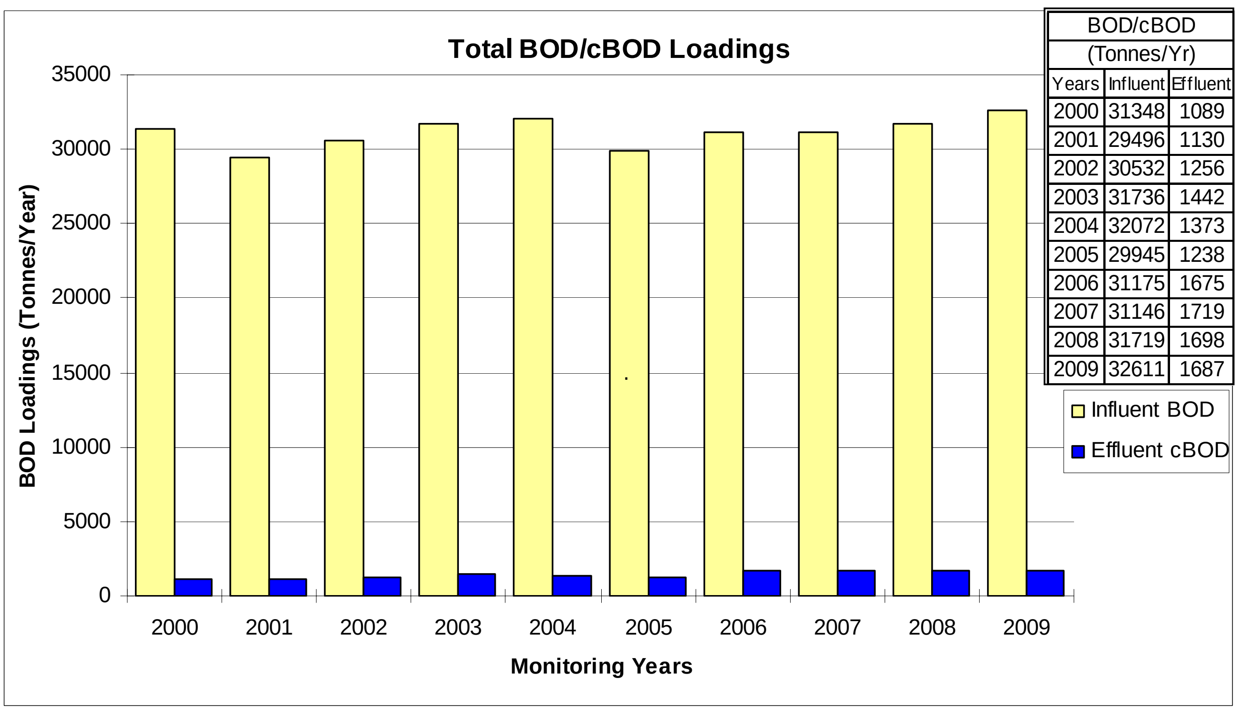


Year	BOD cBOD	
	mg/L	
	Inf.	Eff.
2000	200	7
2001	180	7
2002	186	7
2003	184	8
2004	180	7
2005	175	7
2006	179	9
2007	176	9
2008	187	10
2009	190	9

ANNACIS WWTP 2000 – 2009 Historical Loadings Comparison



TSS		
(Tonnes/Yr)		
Years	Influent	Effluent
2000	26884	1517
2001	26853	1606
2002	27932	1890
2003	28534	2112
2004	28697	2078
2005	28803	1777
2006	28090	2200
2007	29648	2522
2008	28921	2774
2009	30041	2514



BOD/cBOD		
(Tonnes/Yr)		
Years	Influent	Effluent
2000	31348	1089
2001	29496	1130
2002	30532	1256
2003	31736	1442
2004	32072	1373
2005	29945	1238
2006	31175	1675
2007	31146	1719
2008	31719	1698
2009	32611	1687

ANNACIS WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	22	30	27	32	31	33	32	30	32	33	31	28
NO3	Grab	0.68	0.22	0.01	0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.02	0.02
NO2	Grab	0.05	0.07	<0.01	<0.01	0.01	<0.01	0.02	0.03	<0.01	<0.01	0.02	0.04
NH3	Comp.	14	20	18.9	24	20	20	22	21	22	22	20	19
SO4	Comp.	18	21	18	19	22	22	24	24	22	26	21	18
PTot	Comp.	2.7	4.2	4.2	4.9	4.8	5.4	4.8	5.5	4.6	5.2	4.7	4.0
PDis	Comp.	1.2	1.9	2.0	2.1	2.1	2.0	2.1	2.1	2.1	2.0	2.1	1.8
MBAS	Grab	2.4	3.3	3.1	4	3.8	4.5	3.5	3.6	3.2	4.3	3.2	2.7
O&G	Grab	31	-	45	47	60	38	42	80	34	40	36	56
Phenol	Grab	0.02	0.03	0.02	0.04	0.04	0.03	0.06	0.05	0.03	0.03	0.03	0.02
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.59	0.61	0.69	0.68	0.81	0.76	0.69	0.75	0.68	0.64	0.57	0.58
AlDis	Comp.	0.05	0.05	0.09	0.05	0.07	0.05	0.06	0.06	0.06	0.04	0.06	0.06
AsTot	Comp.	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.008	0.001	0.001	<0.001	<0.001
BaTot	Comp.	0.040	0.029	0.029	0.032	0.030	0.026	0.024	0.027	0.025	0.024	0.025	0.026
BaDis	Comp.	0.021	0.009	0.012	0.008	0.008	0.006	0.006	0.006	0.007	0.005	0.008	0.012
BTot	Comp.	0.15	0.17	0.13	0.17	0.17	0.17	0.15	0.22	0.17	0.16	0.15	0.15
BDis	Comp.	0.15	0.16	0.13	0.16	0.16	0.17	0.16	0.21	0.18	0.16	0.15	0.15
CaTot	Comp.	22.5	16.6	15.2	16.4	15.3	15.3	13.5	15.2	13.2	13.7	14.7	15.4
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.003	0.003	0.009	0.004	0.005	0.007	0.004	0.006	0.005	0.004	0.002	0.004
CrDis	Comp.	0.001	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.002	<0.001	<0.001	0.001
CoTot	Comp.	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.059	0.093	0.083	0.091	0.084	0.112	0.096	0.095	0.086	0.101	0.159	0.069
CuDis	Comp.	0.015	0.030	0.010	0.023	0.019	0.019	0.023	0.024	0.024	0.014	0.047	0.017
FeTot	Comp.	1.33	1.73	1.62	1.88	3.02	3.21	2.09	2.37	1.22	3.20	1.10	1.50
FeDis	Comp.	0.42	0.65	0.39	0.62	0.92	1.10	0.78	0.82	0.39	0.62	0.36	0.53
PbTot	Comp.	0.004	0.010	0.003	0.005	0.005	0.008	0.006	0.008	0.007	0.006	0.003	0.004
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	3.85	3.19	3.00	3.08	3.29	3.33	2.57	2.66	3.19	2.98	2.95	3.10
MnTot	Comp.	0.091	0.086	0.078	0.084	0.091	0.089	0.069	0.070	0.062	0.072	0.072	0.086
MnDis	Comp.	0.069	0.059	0.062	0.057	0.064	0.058	0.046	0.042	0.041	0.044	0.047	0.066
HgTot	Comp.	0.11	0.09	0.14	0.11	0.17	0.53	0.17	0.11	0.20	0.11	0.28	0.13
MoTot	Comp.	0.003	0.002	0.002	0.002	0.002	0.002	<0.002	0.003	0.004	0.003	0.003	0.003
MoDis	Comp.	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	0.003	0.002
NiTot	Comp.	0.002	0.002	0.002	0.003	0.003	0.004	0.003	0.003	0.004	0.004	0.003	0.002
NiDis	Comp.	0.002	0.002	0.001	0.002	0.001	0.001	0.002	0.002	0.003	0.002	0.001	0.002
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.072	0.090	0.095	0.142	0.097	0.134	0.099	0.115	0.100	0.099	0.088	0.084
ZnDis	Comp.	0.030	0.023	0.039	0.019	0.025	0.011	0.015	0.016	0.018	0.011	0.021	0.024

Note: All results reported are in mg/L; except for Mercury which is reported as ug/L.

ANNACIS WWTP – 2009 Comprehensive Effluent Data

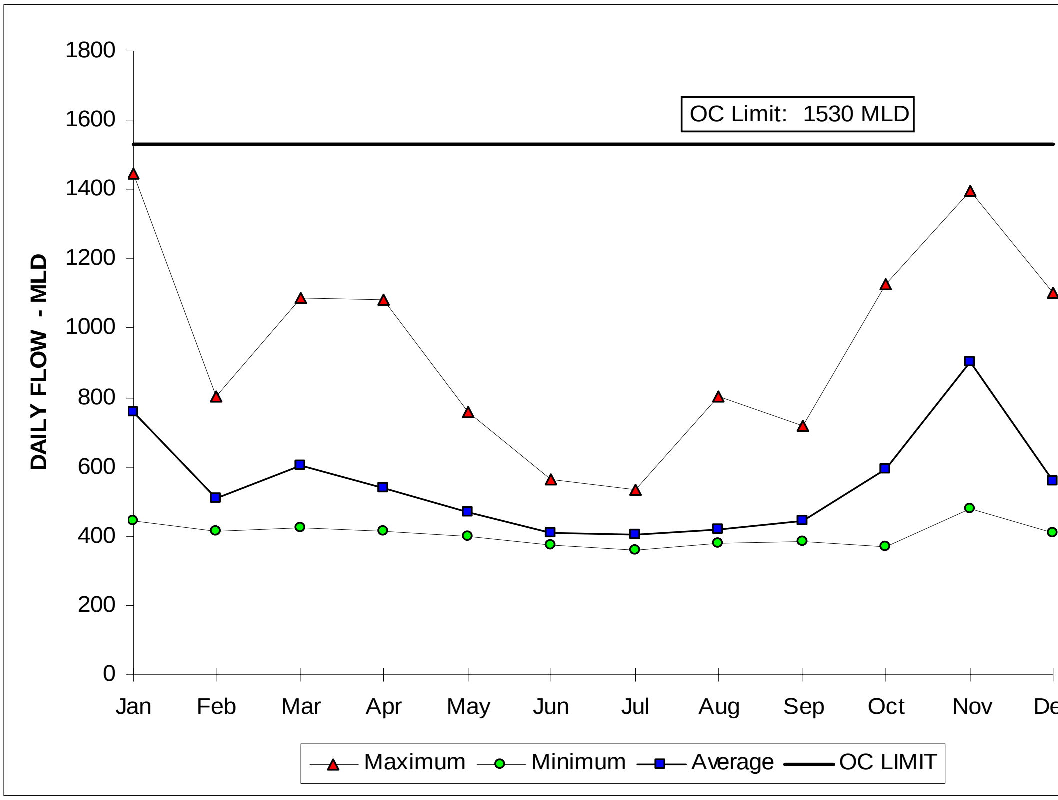
Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	20	28	29	32	35	34	31	34	34	35	33	28
NO3	Grab	0.01	0.02	0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	0.02	0.01
NO2	Grab	0.02	0.02	0.02	0.01	0.02	0.03	0.05	0.05	0.03	0.03	0.03	0.02
NH3	Comp.	20	26	25	32	33	32	32	31	30	33	31	27
SO4	Comp.	19	21	20	23	25	29	25	29	25	29	23	19
PTot	Comp.	2.5	2.5	3.1	3.0	3.1	3.6	3.2	3.6	3.6	3.4	3.7	2.6
PDis	Comp.	1.9	1.8	2.2	2.3	2.4	3.0	2.6	3.0	3.0	2.9	3.1	2.1
MBAS	Grab	0.3	0.2	0.2	0.3	0.3	0.4	0.4	0.3	0.4	0.3	0.2	0.3
O&G	Grab	<6	<6	<6	<7	<6	<6	<6	<6	<6	<6	<6	<5
Phenol	Grab	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.18	0.13	0.19	0.11	0.12	0.10	0.10	0.11	0.13	0.10	0.13	0.16
AlDis	Comp.	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.04	0.02	0.04	0.04
AsTot	Comp.	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.023	0.010	0.010	0.012	0.007	0.005	0.005	0.006	0.007	0.005	0.009	0.012
BaDis	Comp.	0.015	0.005	0.004	0.003	0.002	0.002	0.002	0.003	0.004	0.003	0.006	0.008
BTot	Comp.	0.18	0.18	0.15	0.18	0.18	0.18	0.18	0.23	0.18	0.18	0.17	0.17
BDis	Comp.	0.18	0.18	0.15	0.17	0.18	0.18	0.17	0.21	0.17	0.17	0.16	0.17
CaTot	Comp.	22.6	15.2	14.0	15.1	13.3	13.4	11.4	12.9	11.7	12.3	13.4	14.9
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.002	0.002	0.010	0.002	0.001	0.002	<0.001	0.001	0.002	0.001	<0.001	0.001
CrDis	Comp.	<0.001	0.001	0.004	<0.001	<0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.104	0.036	0.044	0.031	0.027	0.027	0.051	0.029	0.031	0.027	0.065	0.037
CuDis	Comp.	0.058	0.010	0.015	0.022	0.019	0.021	0.039	0.021	0.023	0.020	0.036	0.017
FeTot	Comp.	0.56	0.59	0.62	0.79	0.80	0.85	0.49	0.53	0.45	0.58	0.38	0.50
FeDis	Comp.	0.15	0.13	0.15	0.13	0.14	0.13	0.18	0.17	0.16	0.16	0.17	0.16
PbTot	Comp.	<0.001	0.002	0.002	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.35	3.24	3.02	3.00	3.35	2.92	2.38	2.36	2.65	2.91	2.83	3.18
MnTot	Comp.	0.087	0.073	0.067	0.070	0.068	0.062	0.053	0.049	0.048	0.052	0.054	0.075
MnDis	Comp.	0.078	0.061	0.056	0.065	0.059	0.054	0.045	0.042	0.042	0.046	0.047	0.066
HgTot	Comp.	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MoTot	Comp.	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.002	0.003	<0.002	<0.002
MoDis	Comp.	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	0.002	<0.002
NiTot	Comp.	0.002	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.002
NiDis	Comp.	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.042	0.041	0.043	0.043	0.034	0.035	0.031	0.036	0.037	0.027	0.042	0.033
ZnDis	Comp.	0.024	0.018	0.024	0.022	0.022	0.024	0.021	0.024	0.028	0.020	0.028	0.022

Note: All results reported are in mg/L; except for Mercury which is reported as ug/L.

APPENDIX A2

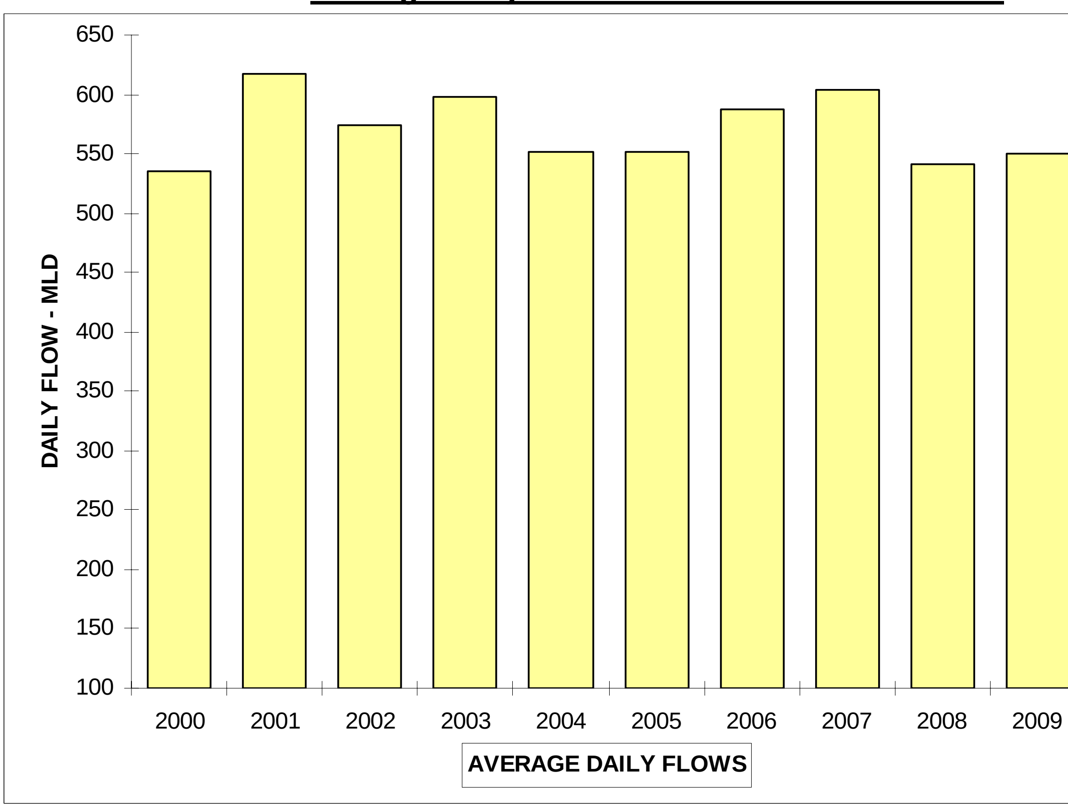
IONA ISLAND WASTEWATER TREATMENT PLANT

IONA WWTP – 2009 Wastewater Flows – Monthly Summary



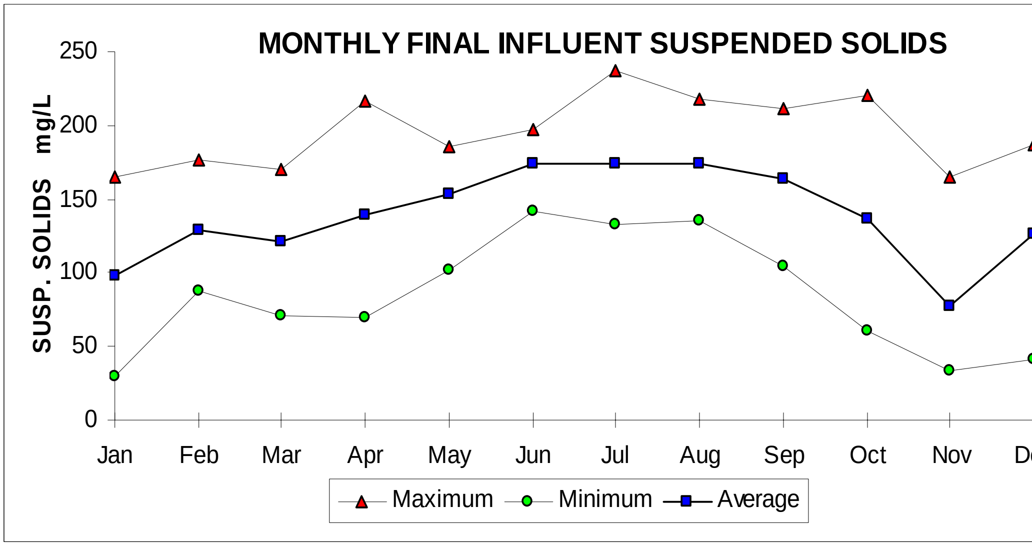
Mth	Max	Min	Ave
Jan	1445	445	757
Feb	802	414	511
Mar	1089	422	604
Apr	1083	412	538
May	760	397	468
Jun	562	376	407
Jul	535	358	402
Aug	805	378	417
Sep	716	382	442
Oct	1127	369	591
Nov	1398	479	904
Dec	1104	409	556

Average Daily Wastewater Flows 2000 – 2009

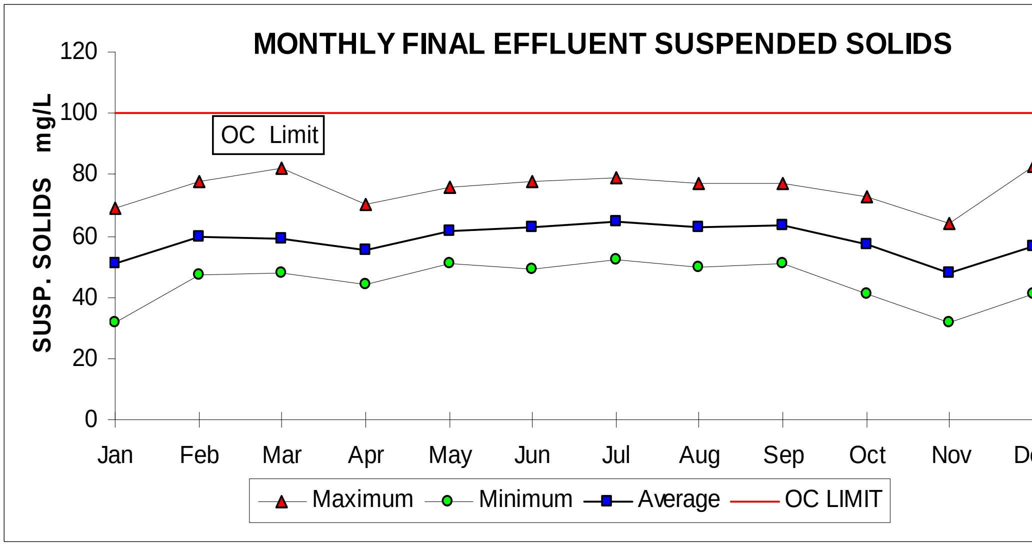


Year	Flow **(MLD)**
2000	535
2001	617
2002	574
2003	597
2004	551
2005	552
2006	587
2007	603
2008	541
2009	550

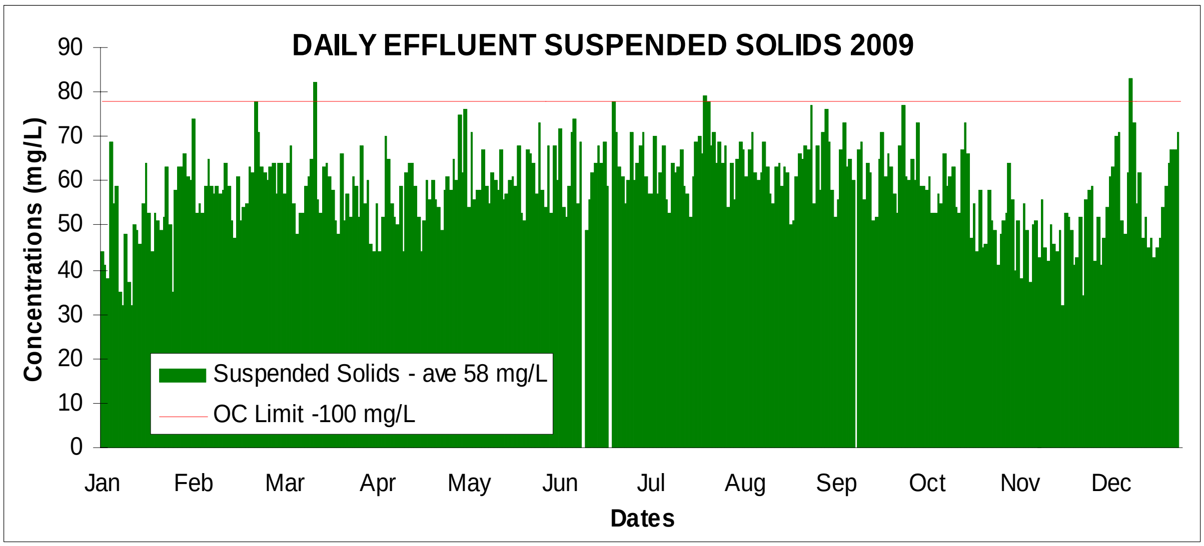
IONA WWTP – 2009 Suspended Solids Concentrations



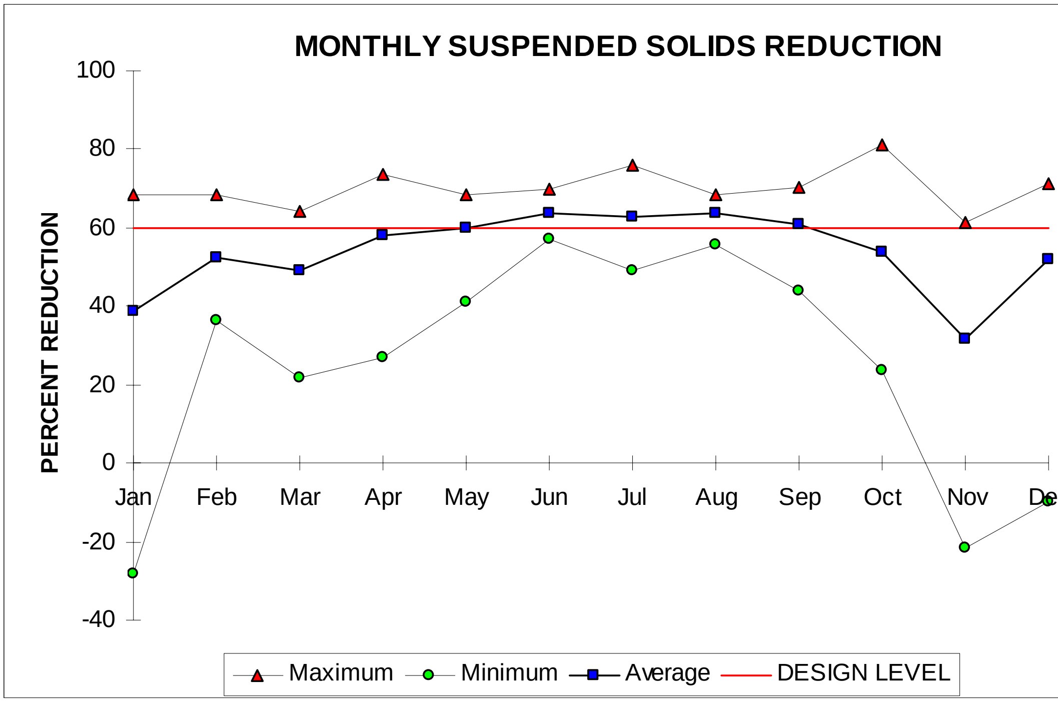
Mth	Max	Min	Ave
Jan	165	29	97
Feb	176	87	129
Mar	170	71	122
Apr	216	70	139
May	185	102	154
Jun	197	142	173
Jul	237	133	175
Aug	218	135	174
Sep	211	104	164
Oct	220	60	137
Nov	165	33	77
Dec	187	41	126



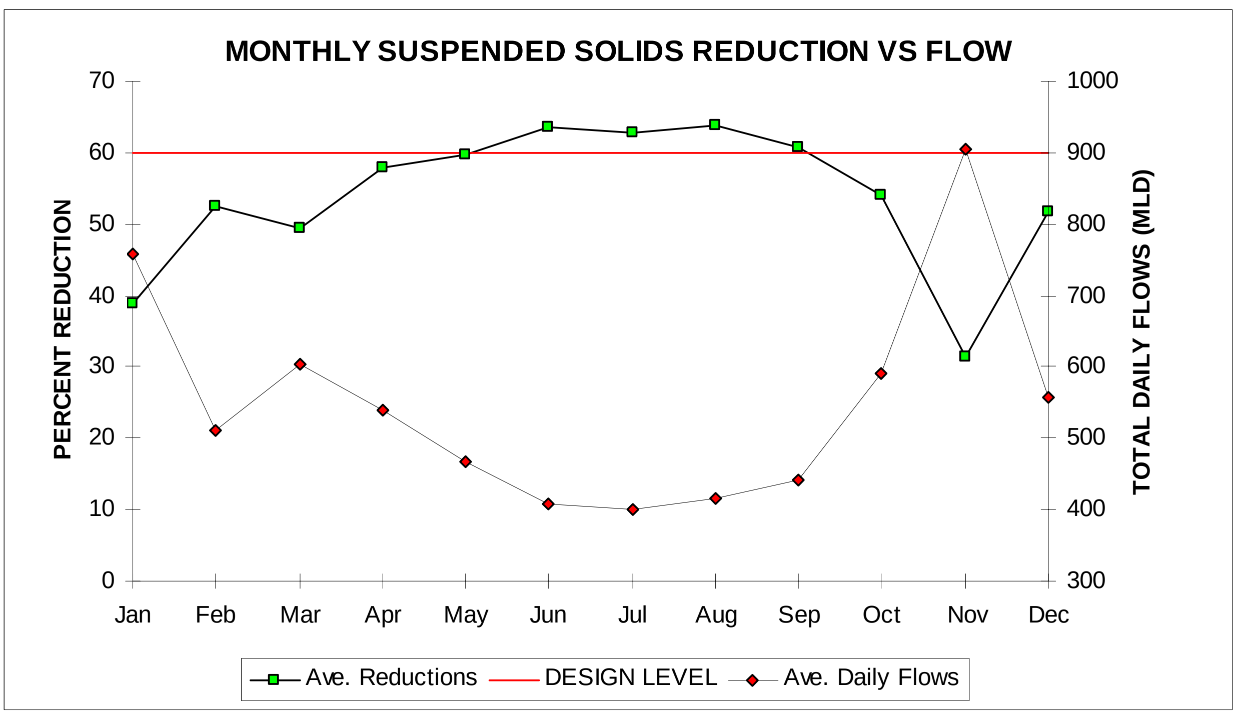
Mth	Max	Min	Ave
Jan	69	32	51
Feb	78	47	60
Mar	82	48	59
Apr	70	44	56
May	76	51	61
Jun	78	49	63
Jul	79	52	64
Aug	77	50	63
Sep	77	51	63
Oct	73	41	57
Nov	64	32	48
Dec	83	41	57



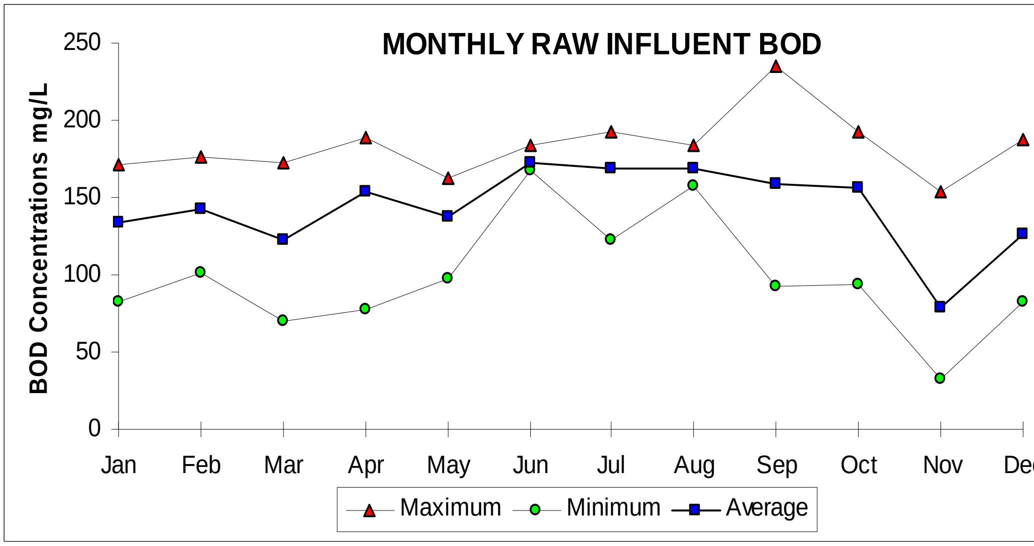
IONA WWTP – 2009 Suspended Solids Reductions



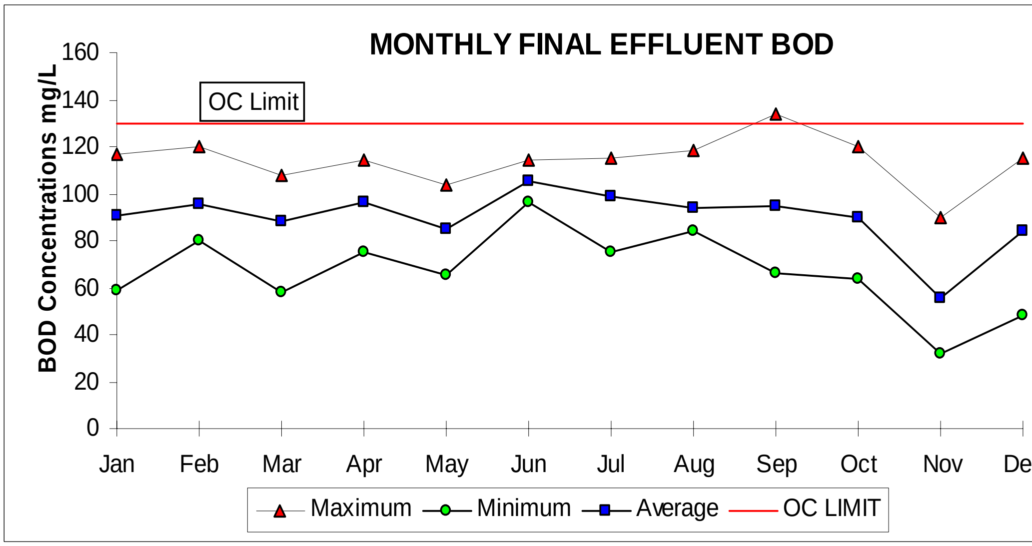
Mth	Max	Min	Ave
Jan	68	-28	39
Feb	68	37	53
Mar	64	22	49
Apr	74	27	58
May	69	41	60
Jun	70	57	64
Jul	76	49	63
Aug	68	56	64
Sep	71	44	61
Oct	81	24	54
Nov	61	-21	31
Dec	71	-10	52



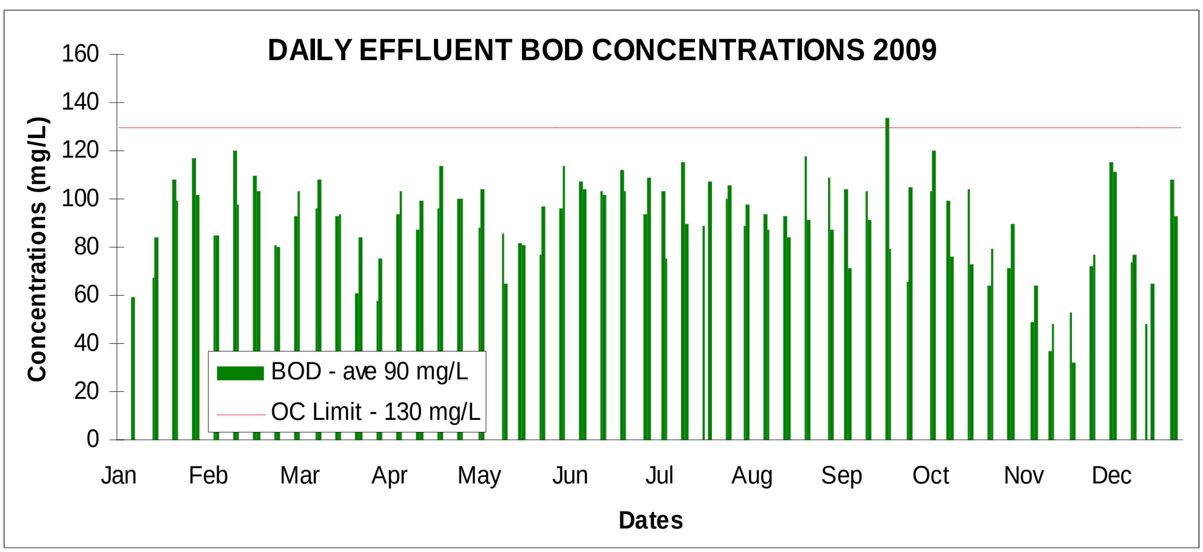
IONA WWTP – 2009 BOD Concentrations



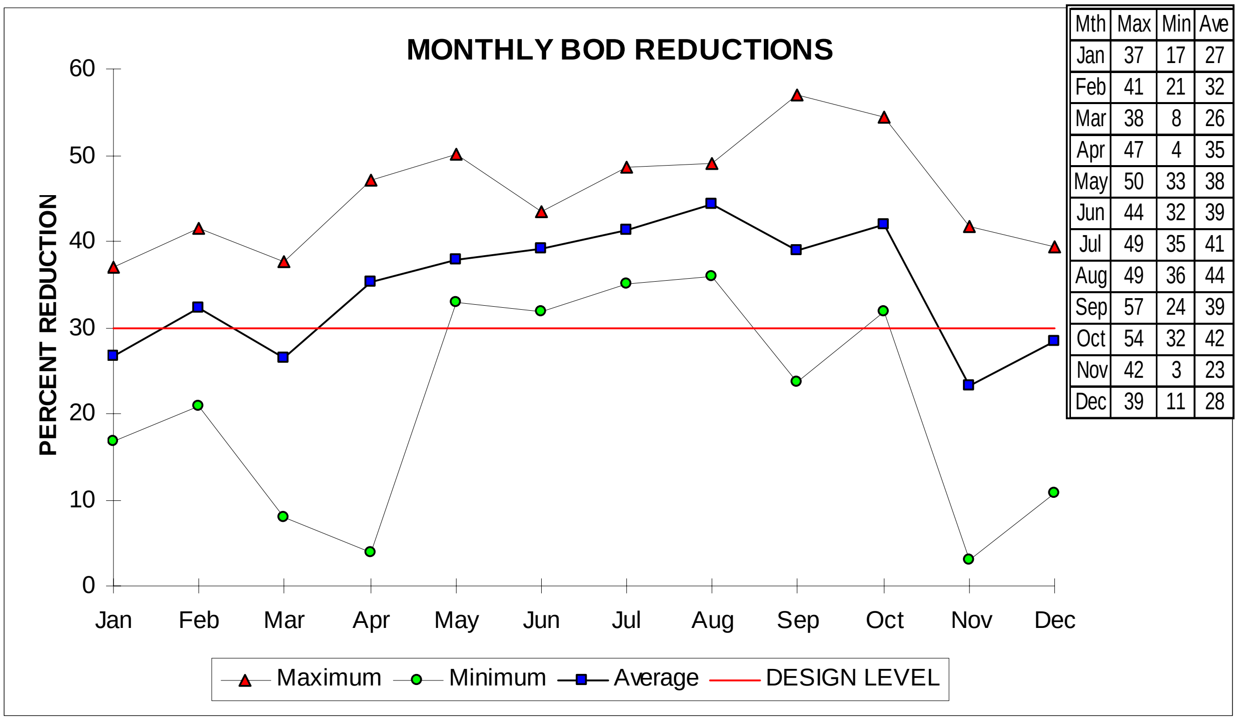
Mth	Max	Min	Ave
Jan	171	83	134
Feb	176	101	142
Mar	173	70	123
Apr	189	78	154
May	162	97	138
Jun	184	167	173
Jul	193	123	169
Aug	184	158	169
Sep	235	93	159
Oct	193	94	157
Nov	154	33	79
Dec	187	83	127



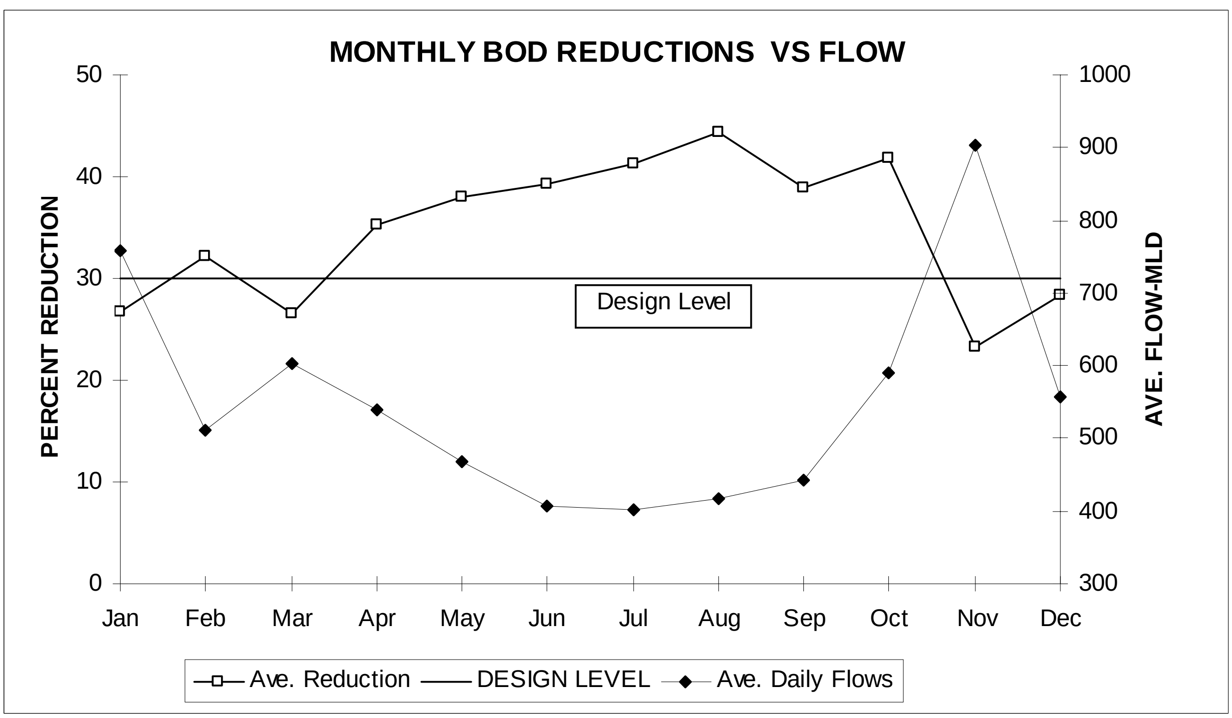
Mth	Max	Min	Ave
Jan	117	59	91
Feb	120	80	95
Mar	108	58	88
Apr	114	75	96
May	104	65	85
Jun	114	96	105
Jul	115	75	99
Aug	118	84	94
Sep	134	66	95
Oct	120	64	90
Nov	90	32	56
Dec	115	48	84



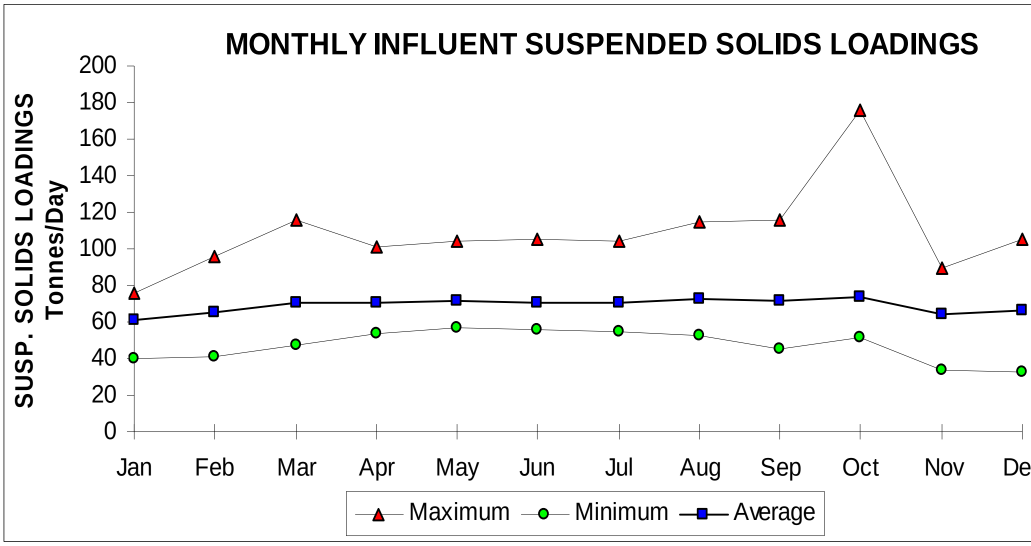
IONA WWTP - 2009 BOD Reductions



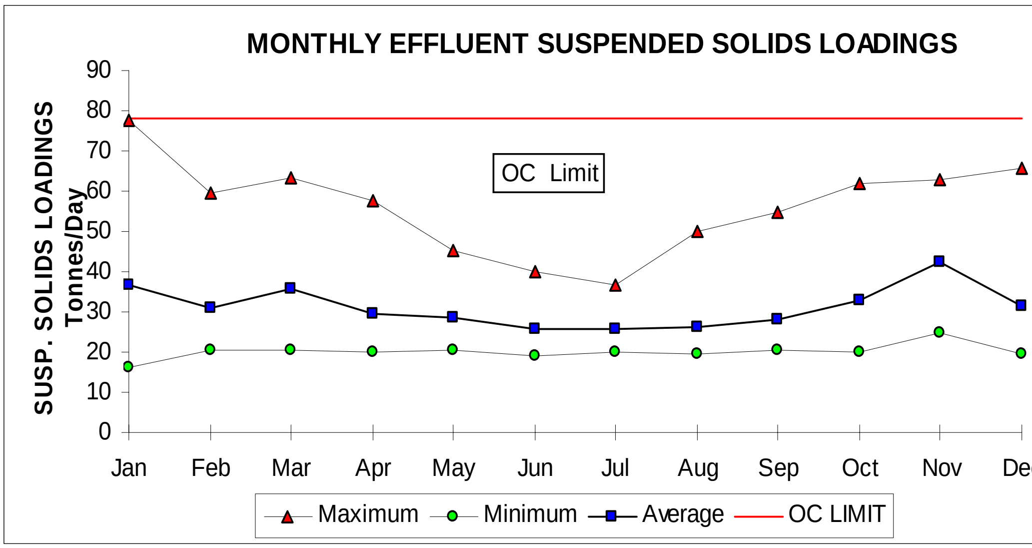
Mth	Max	Min	Ave
Jan	37	17	27
Feb	41	21	32
Mar	38	8	26
Apr	47	4	35
May	50	33	38
Jun	44	32	39
Jul	49	35	41
Aug	49	36	44
Sep	57	24	39
Oct	54	32	42
Nov	42	3	23
Dec	39	11	28



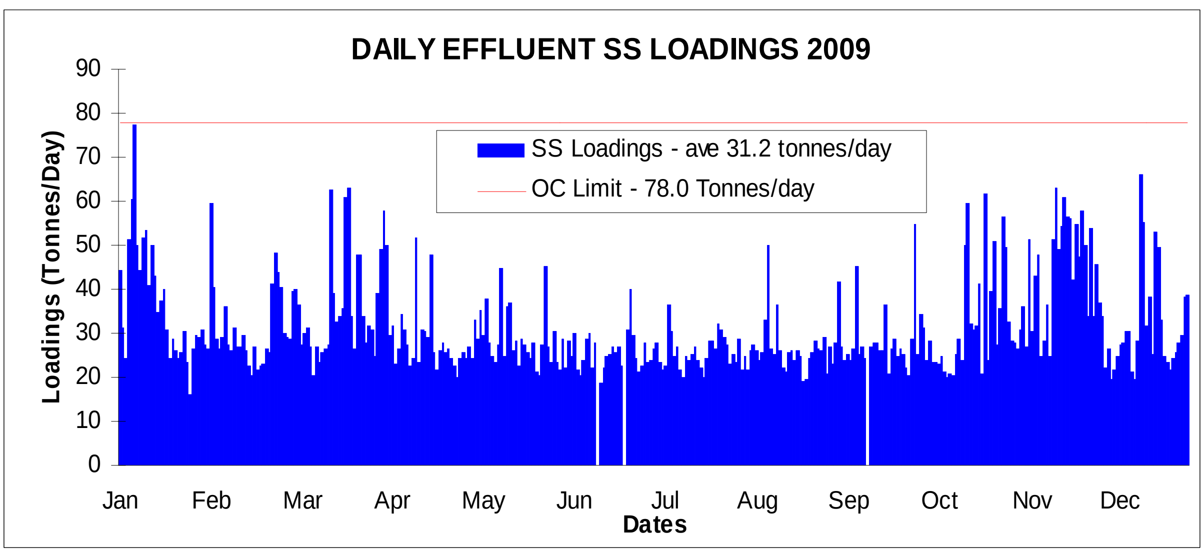
IONA WWTP – 2009 Suspended Solids Loadings Summary



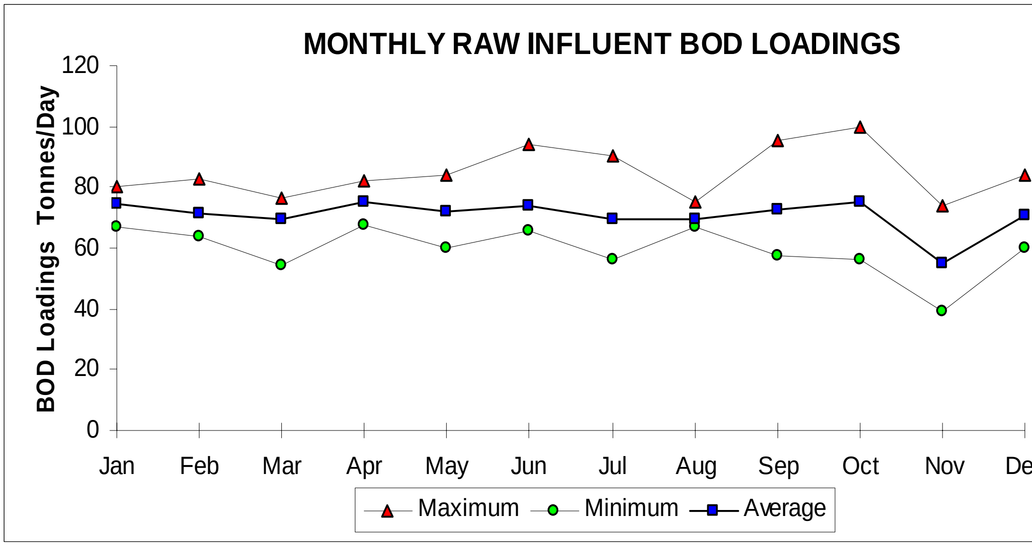
Mth	Max	Min	Ave
Jan	76	40	62
Feb	95	41	65
Mar	116	47	70
Apr	101	54	71
May	104	57	71
Jun	105	56	71
Jul	105	55	70
Aug	115	53	72
Sep	116	46	72
Oct	176	51	74
Nov	89	34	64
Dec	105	32	67



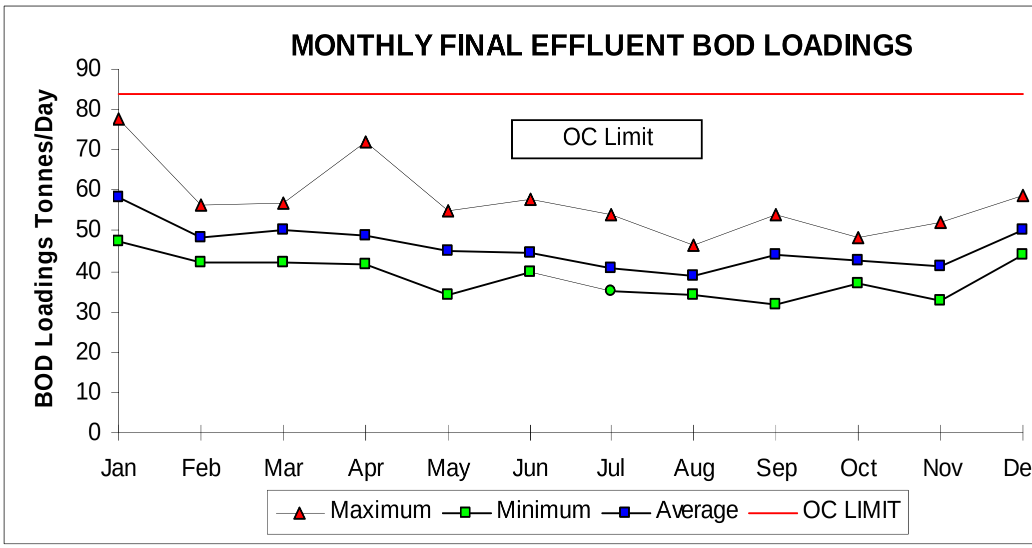
Mth	Max	Min	Ave
Jan	77	16	37
Feb	59	20	31
Mar	63	21	36
Apr	58	20	30
May	45	20	29
Jun	40	19	26
Jul	37	20	26
Aug	50	19	26
Sep	55	20	28
Oct	62	20	33
Nov	63	25	42
Dec	66	20	32



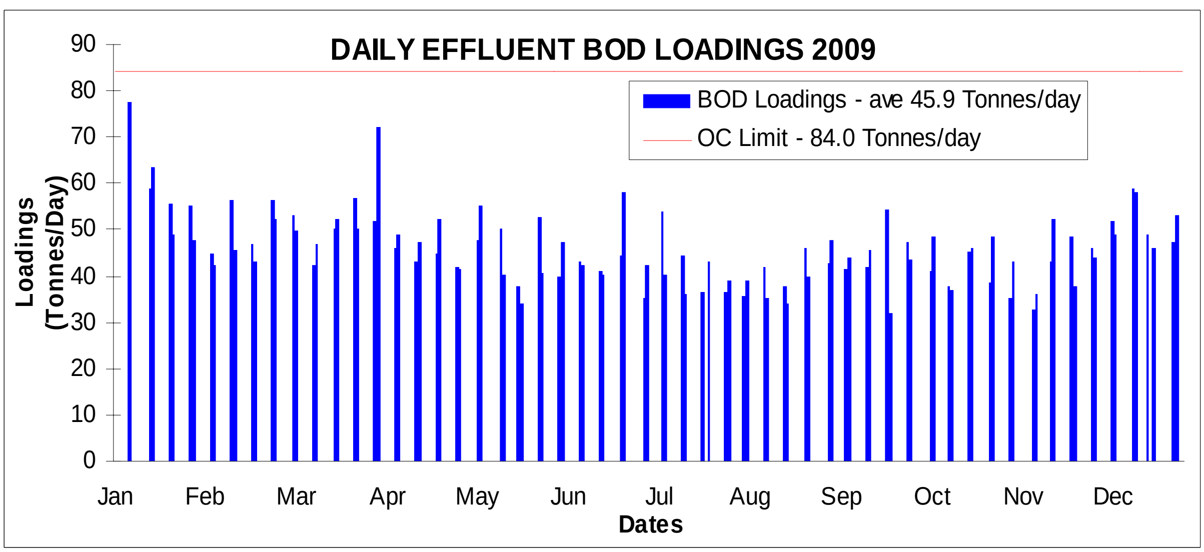
IONA WWTP – 2009 BOD Loadings Summary



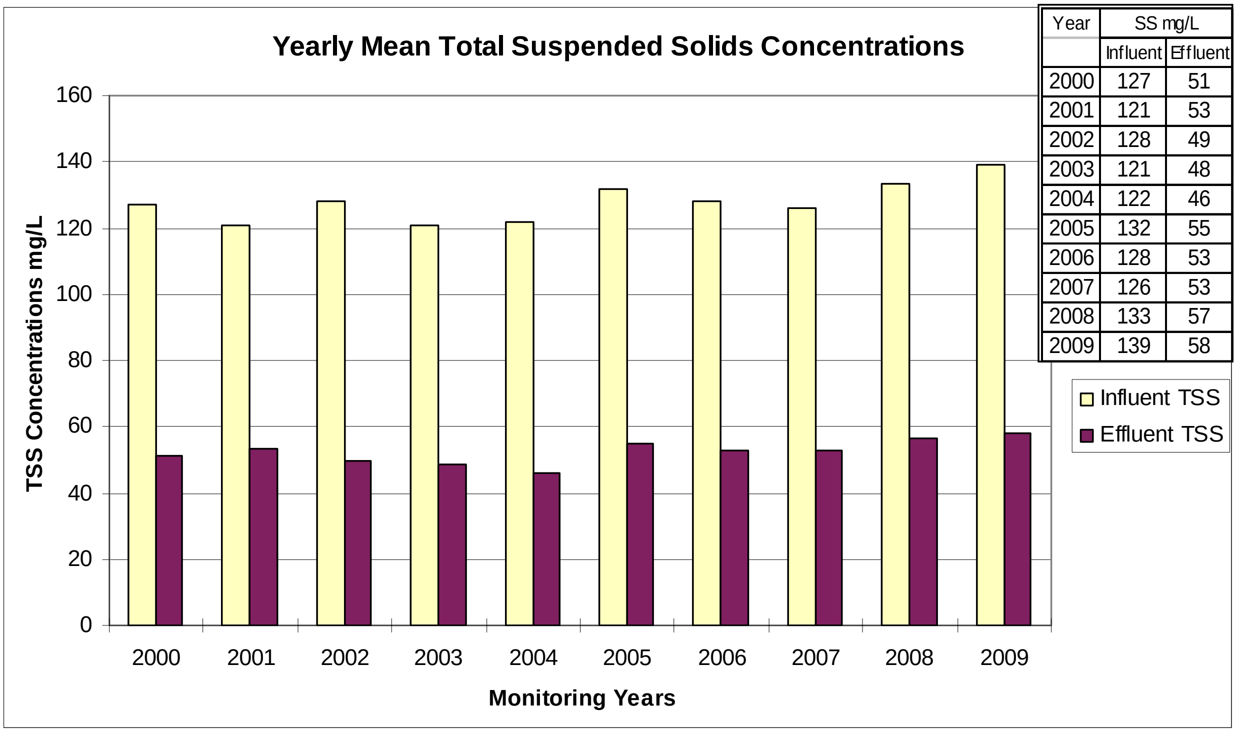
Mth	Max	Min	Ave
Jan	80	67	75
Feb	83	64	71
Mar	76	54	69
Apr	82	68	75
May	84	60	72
Jun	94	66	74
Jul	90	56	69
Aug	75	67	69
Sep	95	58	73
Oct	99	56	75
Nov	74	39	55
Dec	84	60	71



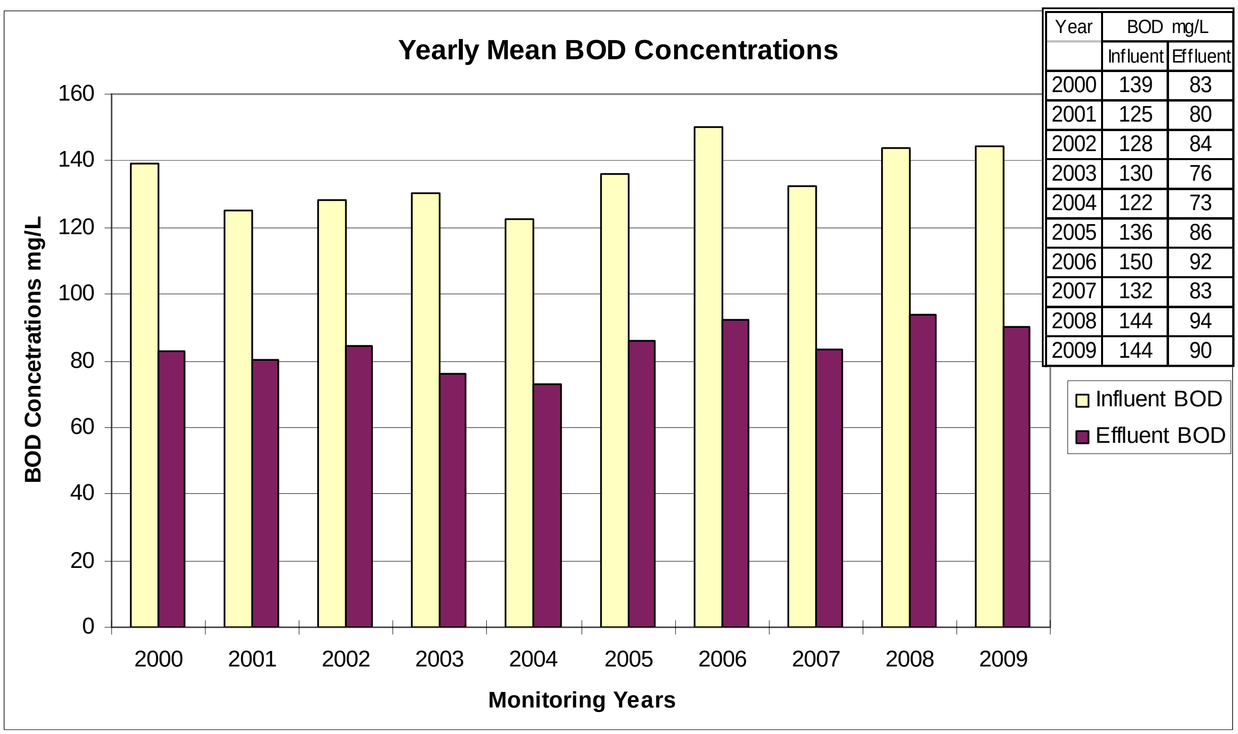
Mth	Max	Min	Ave
Jan	77	47	58
Feb	57	42	48
Mar	57	42	50
Apr	72	42	49
May	55	34	45
Jun	58	40	45
Jul	54	35	41
Aug	46	34	39
Sep	54	32	44
Oct	49	37	43
Nov	52	33	41
Dec	59	44	50



IONA WWTP – 2000 - 2009 Historical Concentrations Comparison

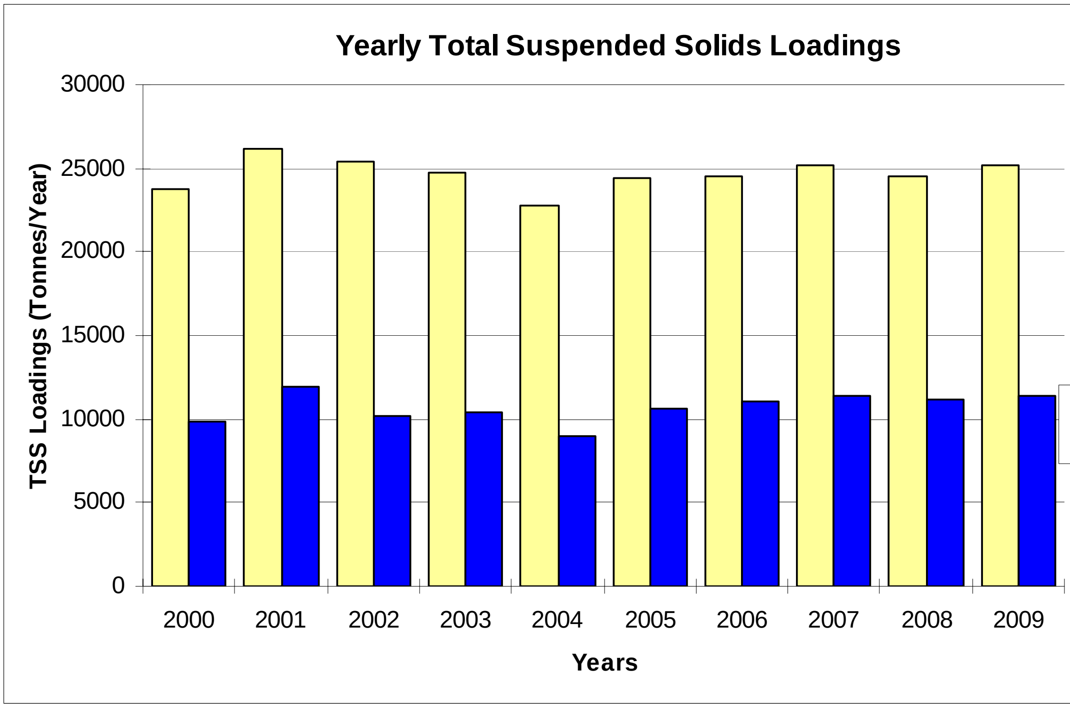


Year	SS mg/L	
	Influent	Effluent
2000	127	51
2001	121	53
2002	128	49
2003	121	48
2004	122	46
2005	132	55
2006	128	53
2007	126	53
2008	133	57
2009	139	58

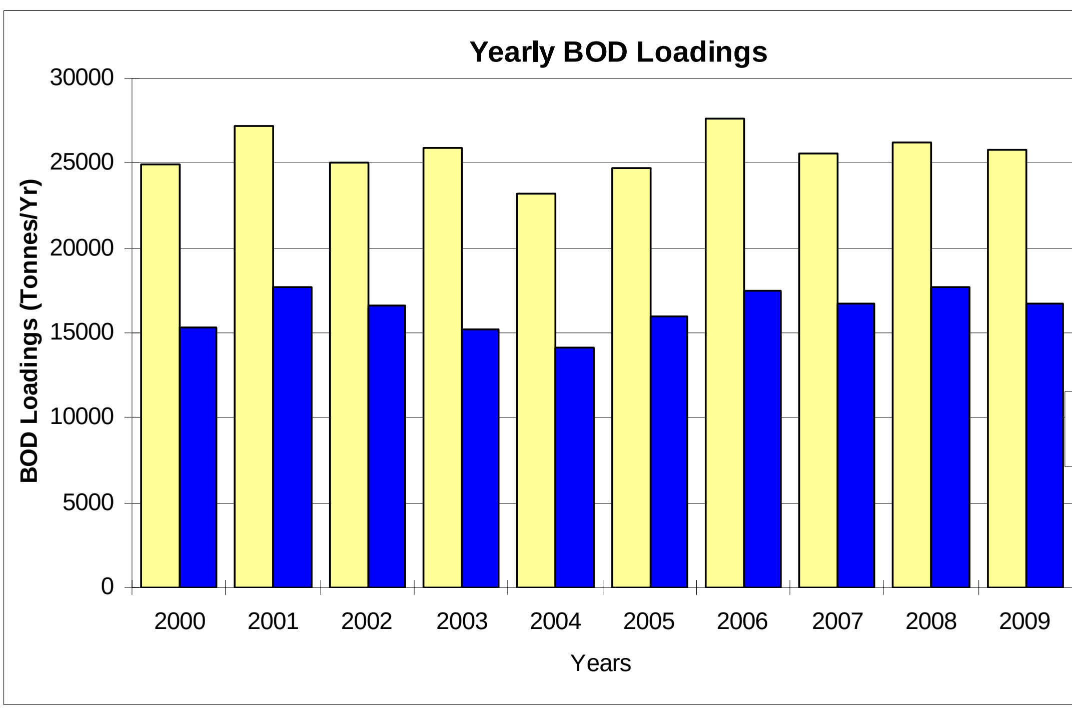


Year	BOD mg/L	
	Influent	Effluent
2000	139	83
2001	125	80
2002	128	84
2003	130	76
2004	122	73
2005	136	86
2006	150	92
2007	132	83
2008	144	94
2009	144	90

IONA WWTP – 2000 – 2009 Historical Loadings Comparisons



SS(Tonnes/Yr)		
Years	Influent	Effluent
2000	23723	9883
2001	26168	11889
2002	25371	10209
2003	24736	10358
2004	22723	9023
2005	24467	10644
2006	24553	11076
2007	25159	11441
2008	24516	11149
2009	25199	11397



BOD(Tonnes/Yr)		
Years	Influent	Effluent
2000	24982	15298
2001	27202	17650
2002	25031	16585
2003	25872	15260
2004	23171	14134
2005	24699	15966
2006	27583	17494
2007	25613	16772
2008	26179	17728
2009	25786	16764

IONA WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	14	30	24	28	28	32	30	30	29	32	27	22
NO3	Grab	1.31	0.44	0.51	0.06	0.19	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.39
NO2	Grab	0.08	0.09	0.08	0.05	0.07	0.02	<0.01	<0.01	<0.01	0.02	<0.01	0.11
NH3	Comp.	7.5	18.5	14.1	15.7	14.8	17.9	16.1	15.7	15.8	18.2	17.2	12.7
SO4	Comp.	16	25	19	22	18	21	31	17	19	20	26	23
PTot	Comp.	1.9	4.1	3.5	4.2	3.9	5.2	4.6	4.7	4.0	4.9	4.0	3.1
PDis	Comp.	0.9	1.9	1.5	2.1	1.7	2.0	1.7	1.8	1.7	2.1	1.6	1.3
MBAS	Grab	0.6	0.7	0.6	0.9	0.8	0.8	1.0	0.8	0.7	0.9	1.0	0.6
O&G	Grab	9	13	8	12	14	12	15	11	15	13	23	8
Phenol	Grab	0.01	0.02	0.01	<0.01	0.02	<0.01	0.01	0.02	0.02	<0.01	0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.39	0.55	0.86	0.53	0.79	0.66	1.11	0.65	0.68	0.65	0.69	0.51
AlDis	Comp.	0.04	0.04	0.05	0.08	0.05	0.05	0.04	0.04	0.05	0.03	0.04	0.04
AsTot	Comp.	0.001	0.001	0.002	<0.001	0.003	<0.001	0.006	0.002	0.001	0.001	0.001	<0.001
BaTot	Comp.	0.031	0.024	0.024	0.023	0.022	0.022	0.026	0.022	0.020	0.020	0.022	0.027
BaDis	Comp.	0.020	0.008	0.009	0.010	0.007	0.006	0.007	0.006	0.006	0.006	0.008	0.011
BTot	Comp.	0.05	0.08	0.07	0.09	0.07	0.10	0.10	0.09	0.09	0.09	0.09	0.08
BDis	Comp.	0.05	0.09	0.07	0.09	0.07	0.10	0.09	0.09	0.09	0.09	0.09	0.08
CaTot	Comp.	22.3	14.8	14.5	15.0	11.3	13.2	13.0	12.1	10.9	12.0	15.2	16.7
CdTot	Comp.	<0.0005	0.0006	<0.0005	0.0009	0.0010	0.0005	0.0011	0.0167	<0.0005	0.0005	0.0008	0.0012
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0037	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.002	0.003	0.003	0.003	0.004	0.003	0.006	0.002	0.003	0.002	0.002	0.002
CrDis	Comp.	<0.001	<0.001	0.001	0.001	0.002	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.053	0.103	0.095	0.100	0.094	0.126	0.127	0.131	0.139	0.128	0.102	0.072
CuDis	Comp.	0.018	0.023	0.026	0.036	0.026	0.033	0.017	0.033	0.037	0.024	0.021	0.019
FeTot	Comp.	0.65	0.88	1.04	0.85	1.14	1.15	1.54	1.11	1.20	1.16	1.01	0.88
FeDis	Comp.	0.13	0.20	0.18	0.26	0.18	0.24	0.20	0.21	0.28	0.21	0.18	0.20
PbTot	Comp.	0.002	0.005	0.005	0.003	0.004	0.005	0.009	0.09	0.006	0.004	0.003	0.002
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.56	7.06	5.35	6.68	4.03	5.91	9.18	3.87	3.82	5.23	8.27	6.29
MnTot	Comp.	0.046	0.053	0.055	0.058	0.052	0.049	0.056	0.048	0.052	0.049	0.054	0.053
MnDis	Comp.	0.034	0.034	0.034	0.039	0.029	0.029	0.031	0.028	0.032	0.029	0.036	0.039
HgTot	Comp.	0.06	0.10	0.11	0.20	0.11	0.23	0.22	0.07	0.12	0.16	0.07	<0.05
MoTot	Comp.	0.003	0.003	0.002	0.003	<0.002	0.003	0.003	0.002	0.004	0.003	0.003	<0.002
MoDis	Comp.	0.002	0.003	0.002	0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.002	0.002	<0.002
NiTot	Comp.	0.001	0.002	0.002	0.002	0.003	0.002	0.004	0.002	0.003	0.003	0.002	0.001
NiDis	Comp.	<0.001	0.001	0.001	0.001	0.001	<0.001	0.002	0.002	0.001	0.001	0.001	<0.001
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	0.001	<0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	0.010	<0.01	0.030	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.059	0.102	0.099	0.111	0.110	0.135	0.173	0.157	0.102	0.130	0.085	0.083
ZnDis	Comp.	0.028	0.036	0.045	0.051	0.050	0.042	0.032	0.052	0.032	0.039	0.029	0.035

Note: All results reported are in mg/L, except for Mercury which are reported in ug/L.

IONA WWTP – 2009 Comprehensive Effluent Data

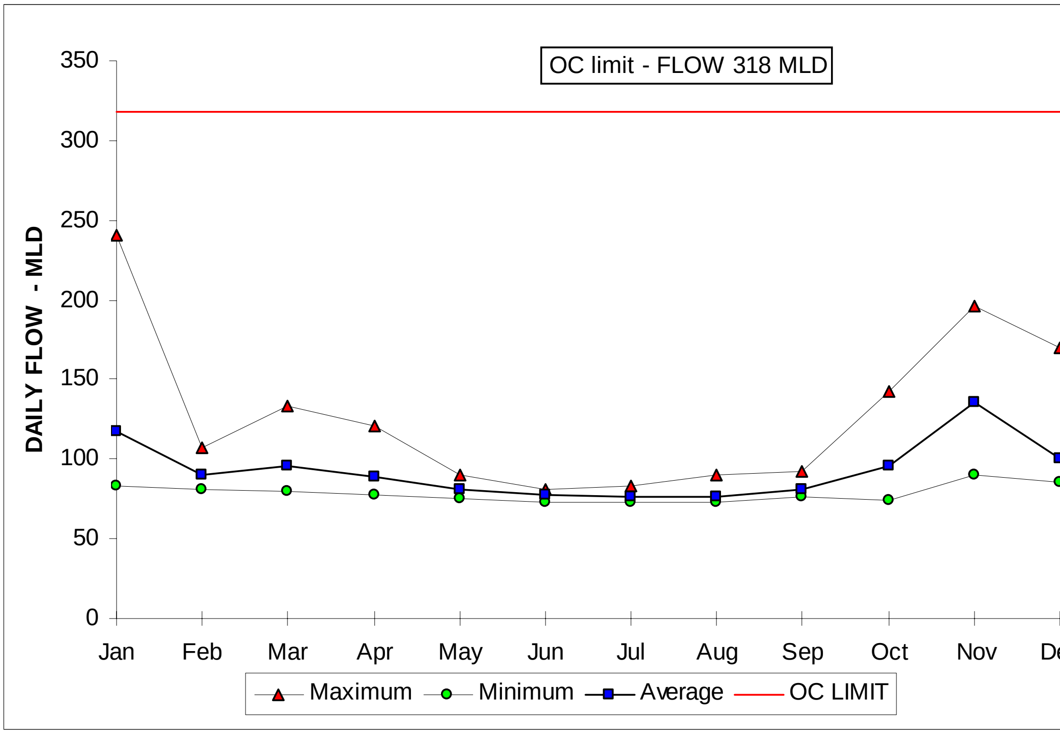
Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	12	25	22	24	26	28	25	26	24	26	26	19
NO3	Grab	1.48	0.23	0.44	0.04	0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.01	0.38
NO2	Grab	0.07	0.06	0.09	0.03	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.11
NH3	Comp.	7	17	14.0	15	16	17	16	16	15	17.2	18	12.7
SO4	Comp.	16	25	19	22	19	20	34	18	20	20	26	23
PTot	Comp.	1.6	3.2	3.0	3.7	3.5	3.9	3.5	3.6	3.0	3.5	3.2	2.3
PDis	Comp.	0.9	1.9	1.7	1.8	1.9	2.0	1.8	1.7	1.5	1.9	1.7	1.3
MBAS	Grab	0.3	1.0	0.7	1.3	1.5	1.6	1.6	1.3	1.1	1.7	0.8	0.6
O&G	Grab	<6	10	7	8	11	11	11	9	10	14	7	10
Phenol	Grab	<0.01	0.02	0.01	<0.01	0.02	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.32	0.31	0.49	0.27	0.44	0.30	0.43	0.29	0.28	0.26	0.34	0.24
AlDis	Comp.	0.03	0.05	0.05	0.04	0.09	0.05	0.05	0.04	0.05	0.03	0.04	0.05
AsTot	Comp.	0.001	<0.001	0.002	<0.001	0.002	<0.001	0.005	0.002	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.030	0.017	0.019	0.016	0.014	0.012	0.014	0.013	0.013	0.011	0.015	0.016
BaDis	Comp.	0.019	0.009	0.009	0.008	0.008	0.006	0.007	0.006	0.007	0.006	0.008	0.010
BTot	Comp.	0.05	0.09	0.07	0.09	0.08	0.10	0.10	0.09	0.09	0.09	0.09	0.09
BDis	Comp.	0.05	0.09	0.07	0.09	0.08	0.10	0.10	0.08	0.09	0.09	0.09	0.09
CaTot	Comp.	22.0	14.0	13.9	14.8	10.9	11.5	12.3	11.1	10.1	10.6	14.8	15.7
CdTot	Comp.	<0.0005	<0.0005	<0.0005	0.0006	0.0006	<0.0005	0.0005	0.0130	<0.0005	<0.0005	0.0006	0.0013
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0057	<0.0005	<0.0005	<0.0005	0.0007
CrTot	Comp.	0.002	0.002	0.002	0.002	0.002	0.001	0.004	0.001	0.002	0.001	0.001	0.001
CrDis	Comp.	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.052	0.091	0.077	0.091	0.081	0.099	0.086	0.102	0.107	0.094	0.085	0.054
CuDis	Comp.	0.026	0.036	0.031	0.030	0.023	0.032	0.020	0.041	0.050	0.030	0.027	0.023
FeTot	Comp.	0.57	0.62	0.71	0.58	0.76	0.58	0.70	0.61	0.62	0.61	0.59	0.51
FeDis	Comp.	0.14	0.22	0.18	0.19	0.18	0.21	0.18	0.22	0.23	0.20	0.19	0.21
PbTot	Comp.	0.001	0.003	0.002	0.001	0.002	0.002	0.003	0.036	0.002	0.002	0.002	0.001
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.56	7.04	5.28	6.87	3.85	5.58	10.4	3.67	3.54	5.18	7.69	5.77
MnTot	Comp.	0.043	0.048	0.046	0.049	0.042	0.039	0.040	0.038	0.040	0.038	0.047	0.046
MnDis	Comp.	0.032	0.036	0.033	0.037	0.033	0.028	0.030	0.027	0.031	0.029	0.037	0.037
HgTot	Comp.	0.08	0.09	0.06	<0.05	0.07	0.07	0.05	<0.05	<0.05	<0.05	0.06	<0.05
MoTot	Comp.	0.003	0.004	0.002	0.004	0.003	0.002	0.002	0.002	0.003	0.003	0.002	0.002
MoDis	Comp.	0.002	0.003	<0.002	0.004	0.002	0.003	<0.002	<0.002	0.002	<0.002	<0.002	0.003
NiTot	Comp.	<0.001	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001
NiDis	Comp.	<0.001	0.002	<0.001	<0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.001
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.02	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01
ZnTot	Comp.	0.051	0.071	0.066	0.083	0.068	0.079	0.084	0.083	0.081	0.070	0.058	0.052
ZnDis	Comp.	0.023	0.035	0.037	0.037	0.048	0.042	0.042	0.045	0.050	0.040	0.029	0.030

Note: All results reported are in mg/L, except for Mercury which are reported in ug/L.

APPENDIX A3

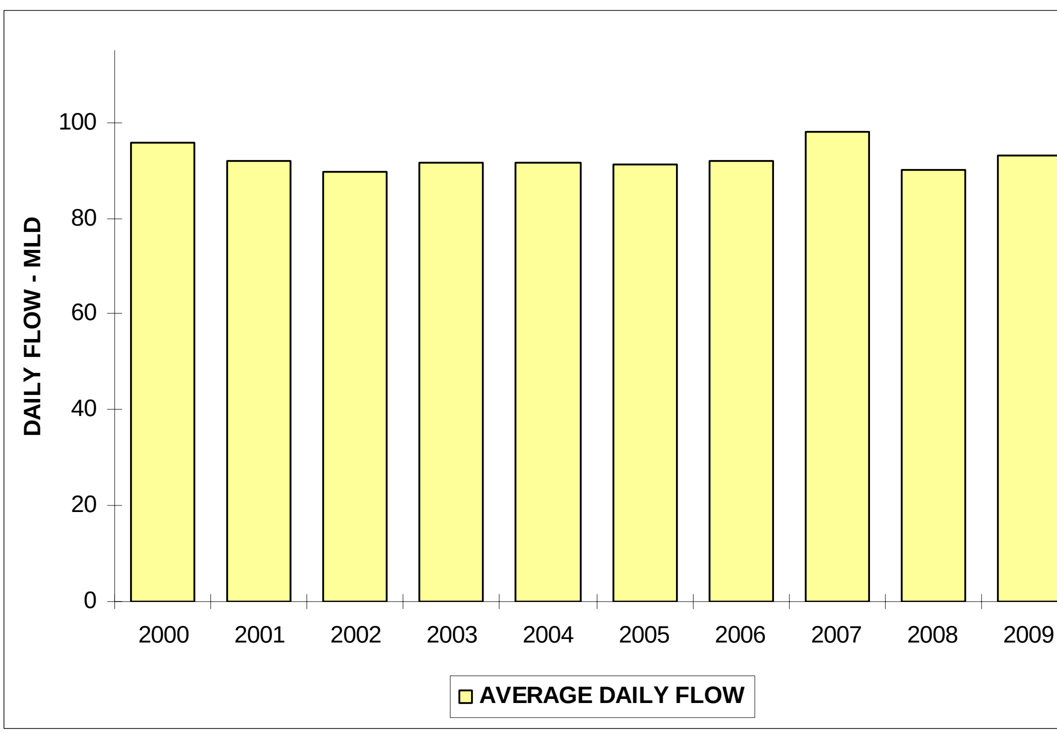
LIONS GATE WASTEWATER TREATMENT PLANT

LIONS GATE WWTP – 2009 Wastewater Flow – Monthly Summary



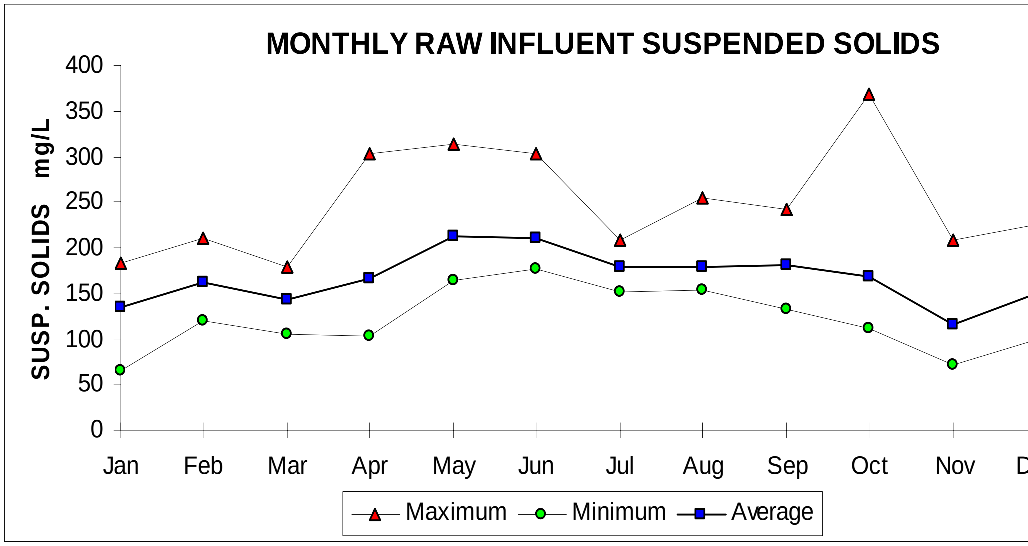
Mth	Max	Min	Ave
Jan	241	83	117
Feb	107	81	90
Mar	133	80	96
Apr	121	78	89
May	90	75	81
Jun	81	73	78
Jul	83	74	77
Aug	90	73	77
Sep	93	76	81
Oct	142	74	96
Nov	196	90	135
Dec	170	86	101

Average Daily Wastewater Flows 2000 – 2009

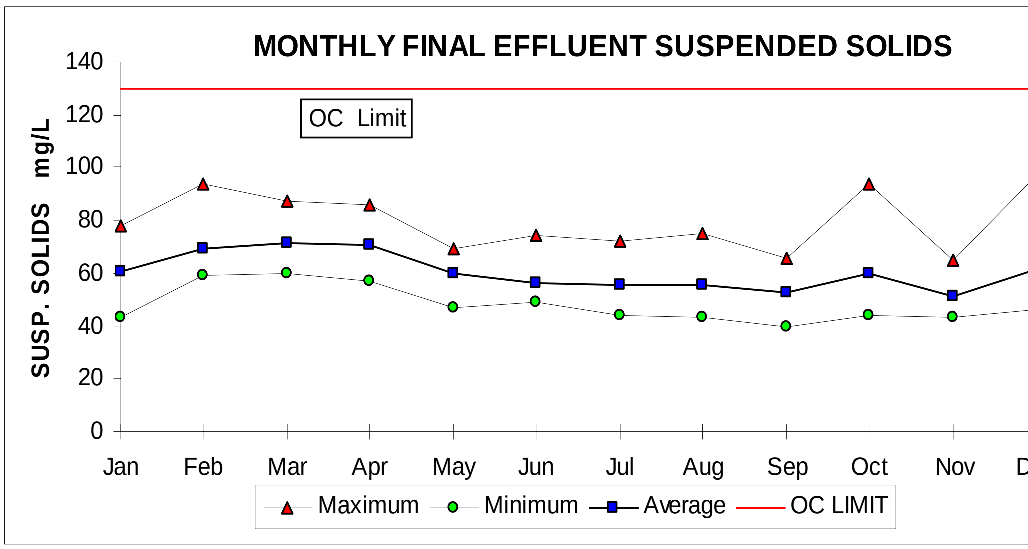


Year	Flow (MLD)
2000	96
2001	92
2002	90
2003	92
2004	92
2005	91
2006	92
2007	98
2008	90
2009	93

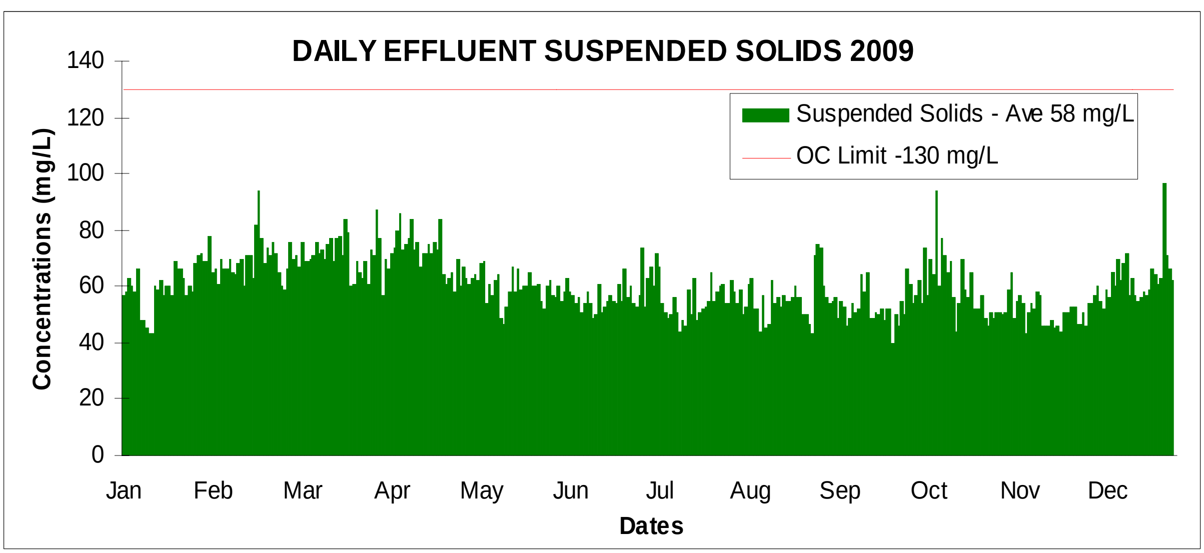
LIONS GATE WWTP – 2009 Suspended Solids Concentrations



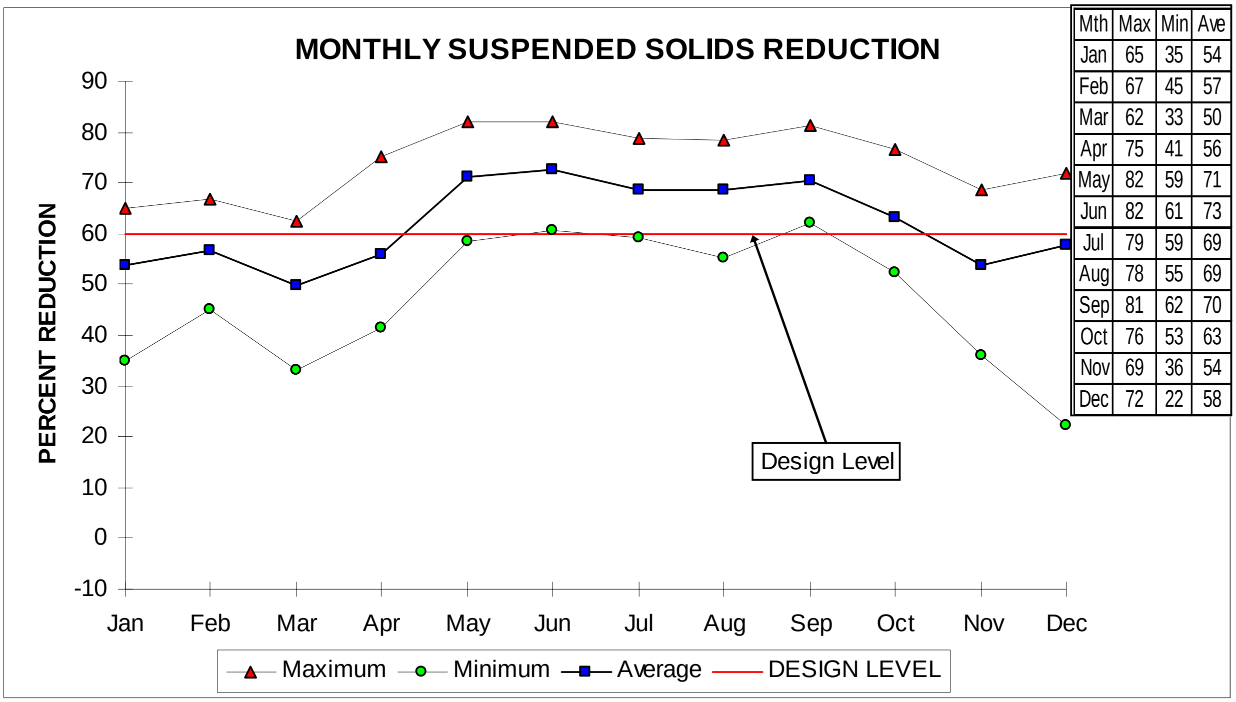
Mth	Max	Min	Ave
Jan	184	66	135
Feb	210	120	162
Mar	178	105	144
Apr	304	103	166
May	314	164	214
Jun	304	176	211
Jul	208	152	178
Aug	254	154	179
Sep	242	132	180
Oct	368	111	169
Nov	208	72	115
Dec	226	100	150



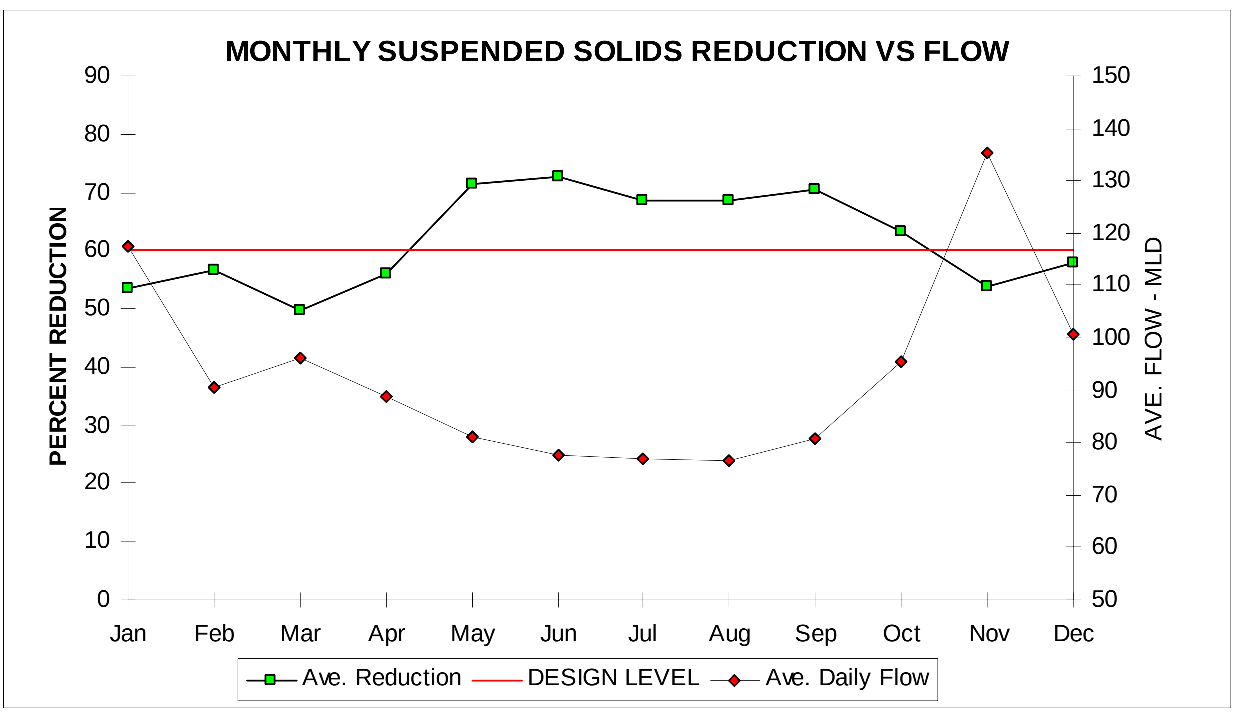
Mth	Max	Min	Ave
Jan	78	43	60
Feb	94	59	69
Mar	87	60	72
Apr	86	57	71
May	69	47	60
Jun	74	49	57
Jul	72	44	56
Aug	75	43	56
Sep	66	40	53
Oct	94	44	60
Nov	65	43	51
Dec	97	46	61



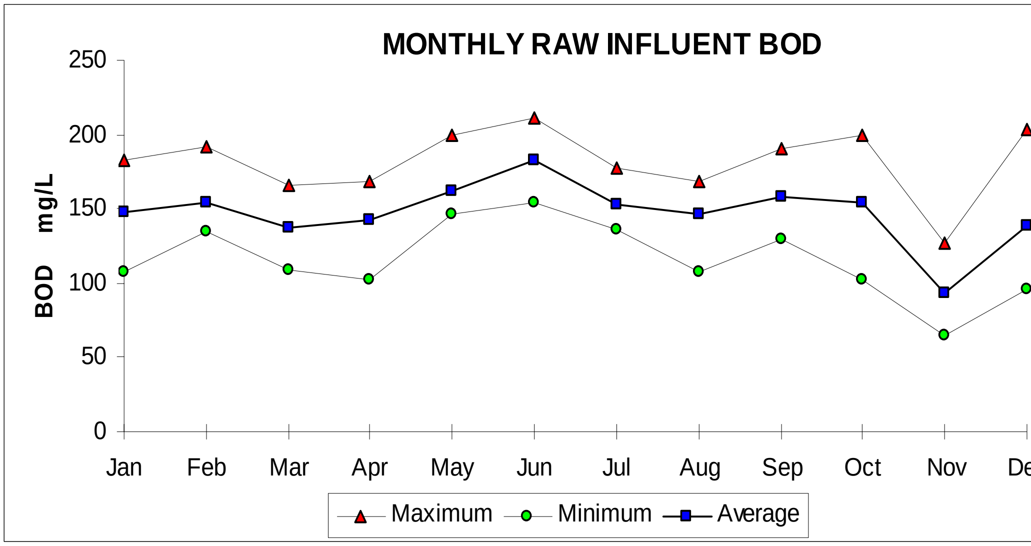
LIONS GATE WWTP – 2009 Suspended Solids Reductions



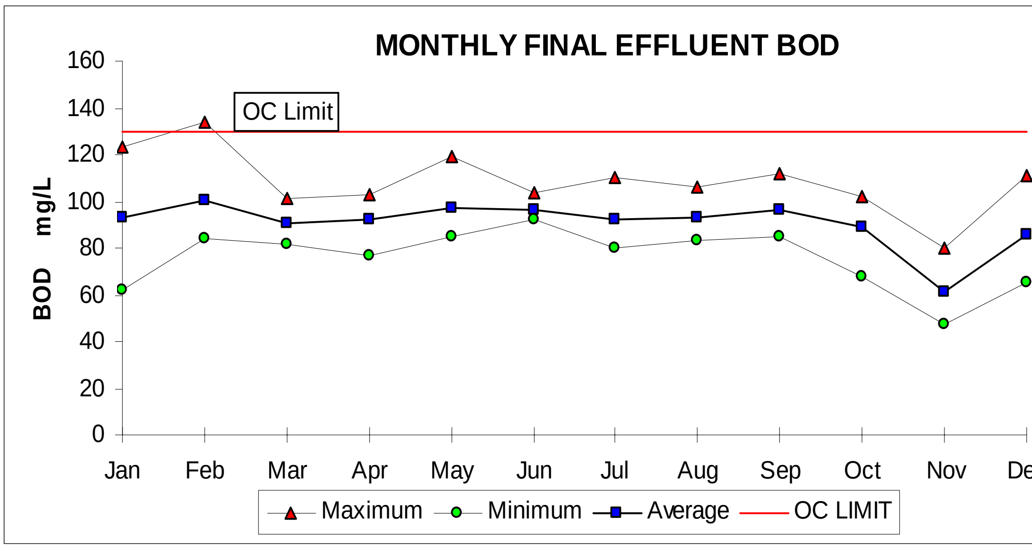
Mth	Max	Min	Ave
Jan	65	35	54
Feb	67	45	57
Mar	62	33	50
Apr	75	41	56
May	82	59	71
Jun	82	61	73
Jul	79	59	69
Aug	78	55	69
Sep	81	62	70
Oct	76	53	63
Nov	69	36	54
Dec	72	22	58



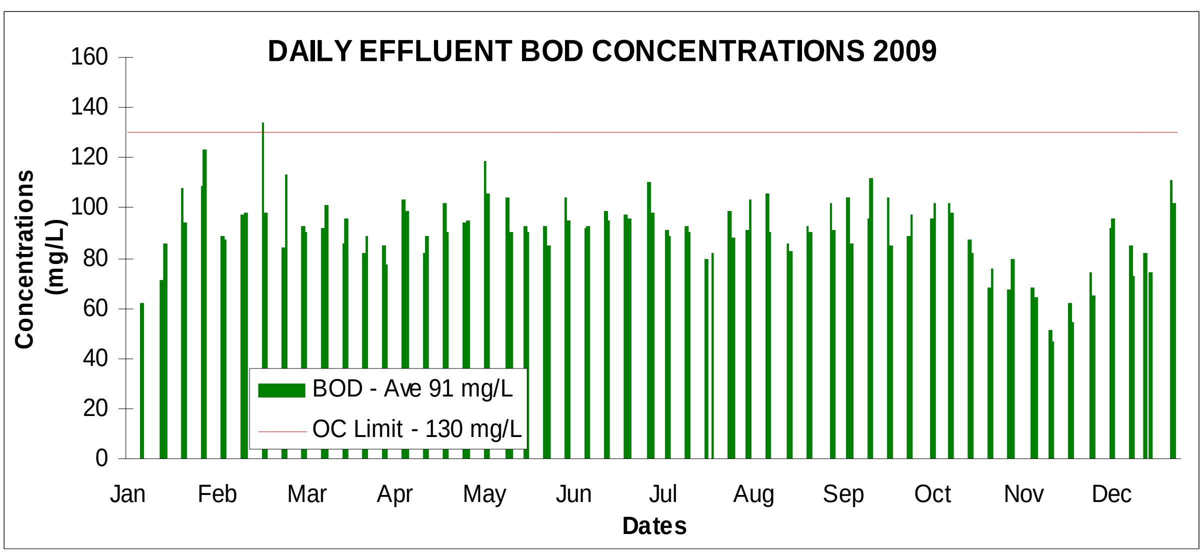
LIONS GATE WWTP – 2009 BOD Concentrations



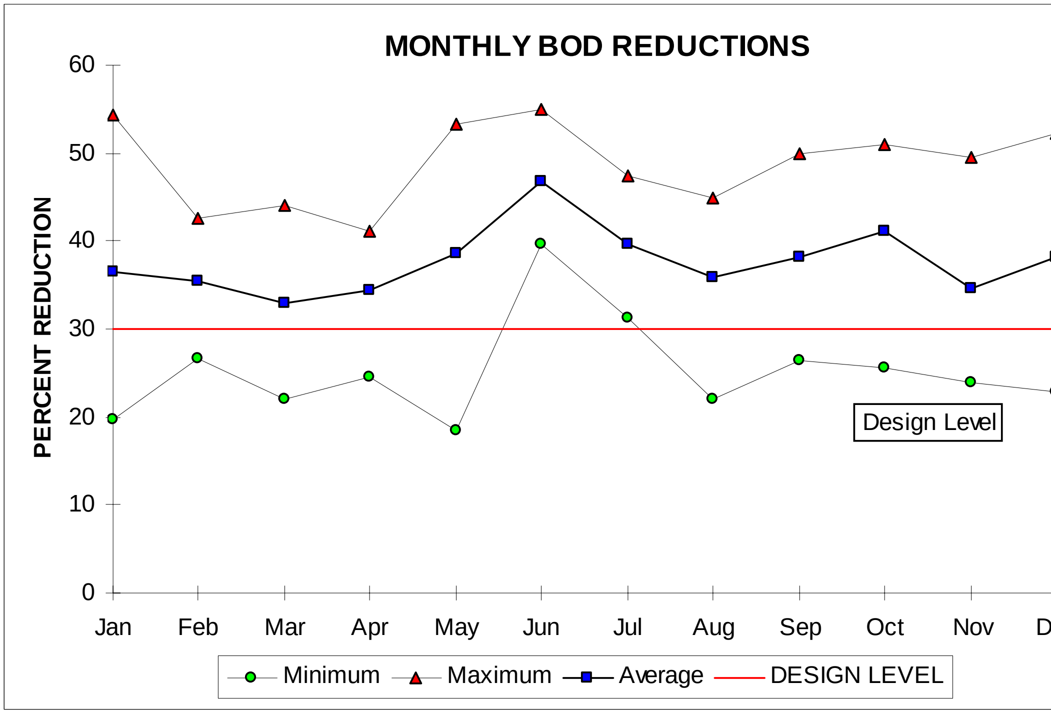
Mth	Max	Min	Ave
Jan	182	107	148
Feb	192	135	155
Mar	166	109	137
Apr	168	102	142
May	199	146	162
Jun	211	154	182
Jul	177	136	153
Aug	169	107	146
Sep	191	129	158
Oct	200	102	154
Nov	127	65	94
Dec	204	96	139



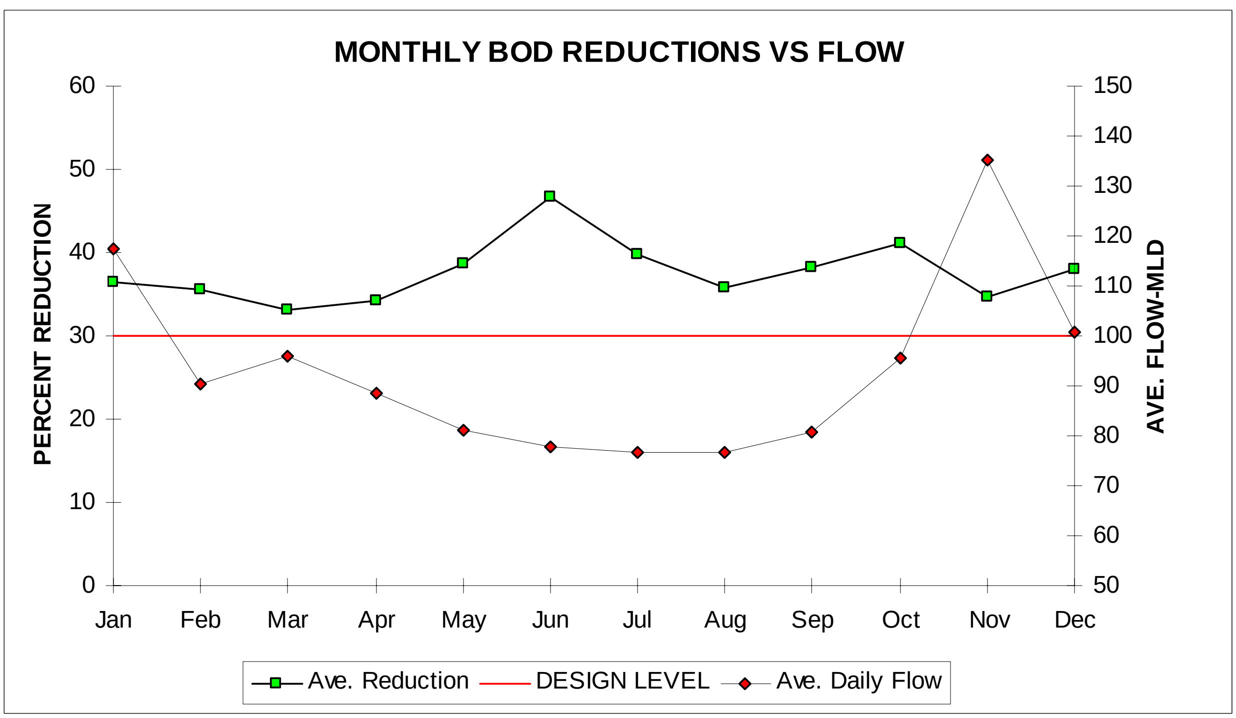
Mth	Max	Min	Ave
Jan	123	62	93
Feb	134	84	100
Mar	101	82	90
Apr	103	77	92
May	119	85	98
Jun	104	92	96
Jul	110	80	92
Aug	106	83	93
Sep	112	85	97
Oct	102	68	89
Nov	80	47	62
Dec	111	65	85



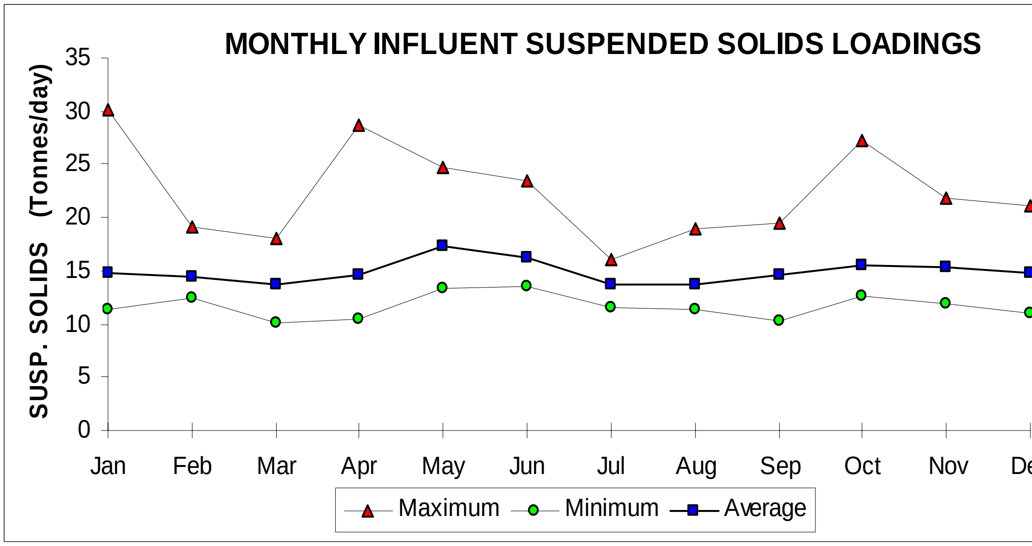
LIONS GATE WWTP – 2009 BOD Reductions



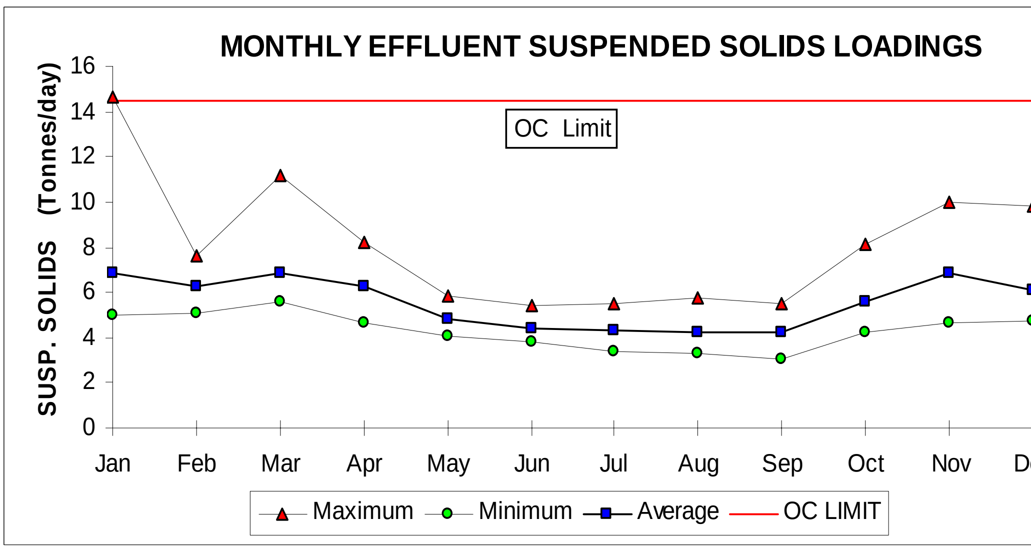
Mth	Max	Min	Ave
Jan	54	20	36
Feb	43	27	35
Mar	44	22	33
Apr	41	25	34
May	53	18	39
Jun	55	40	47
Jul	47	31	40
Aug	45	22	36
Sep	50	27	38
Oct	51	25	41
Nov	50	24	35
Dec	52	23	38



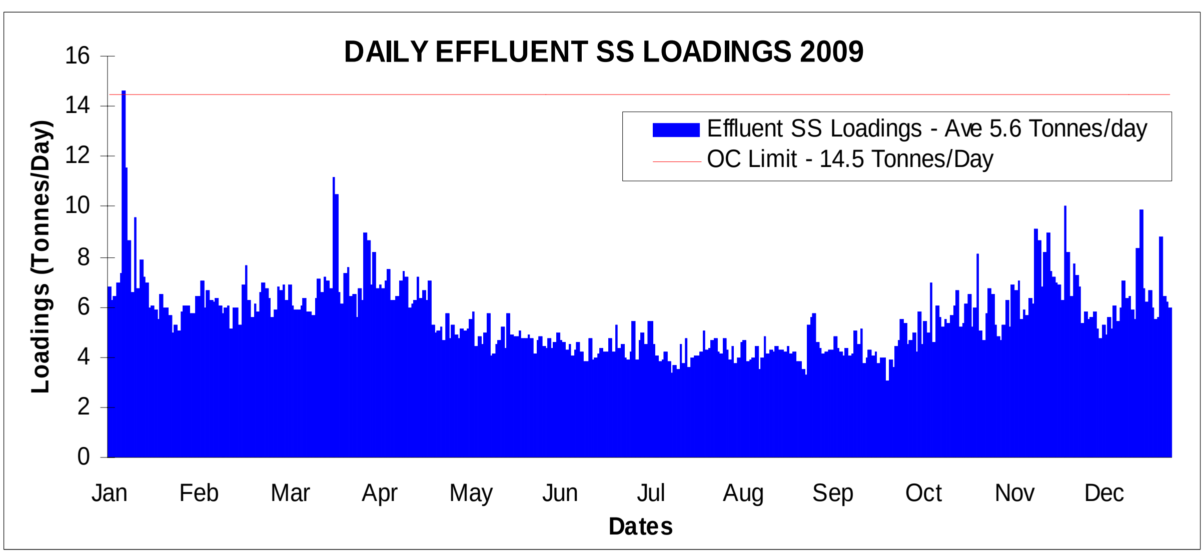
LIONS GATE WWTP – 2009 Suspended Solids Loadings Summary



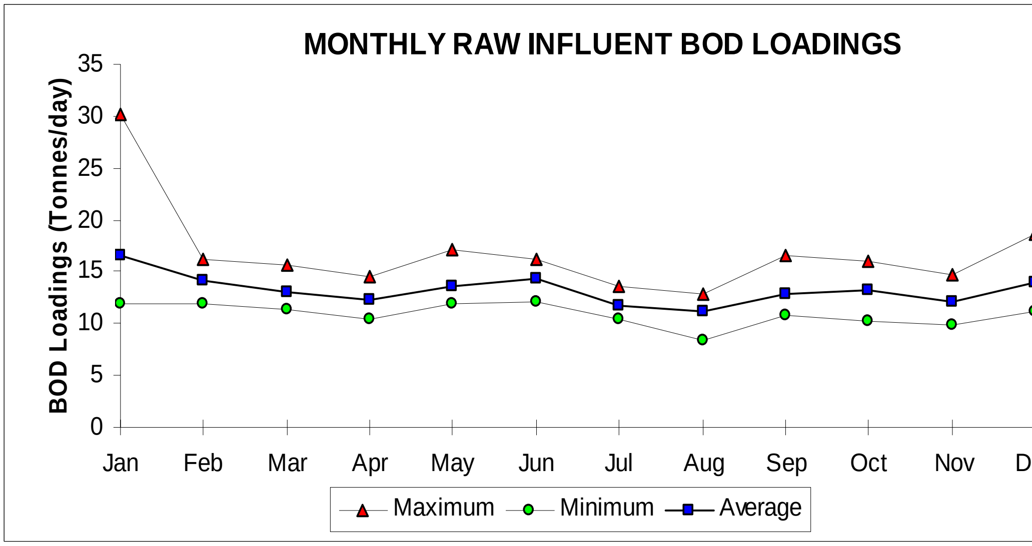
Mth	Max	Min	Ave
Jan	30.2	11	15
Feb	19.2	12	15
Mar	18.1	10	14
Apr	28.7	10	15
May	24.8	13	17
Jun	23.4	14	16
Jul	16.1	12	14
Aug	18.9	11	14
Sep	19.4	10	15
Oct	27.2	13	16
Nov	21.8	12	15
Dec	21.1	11	15



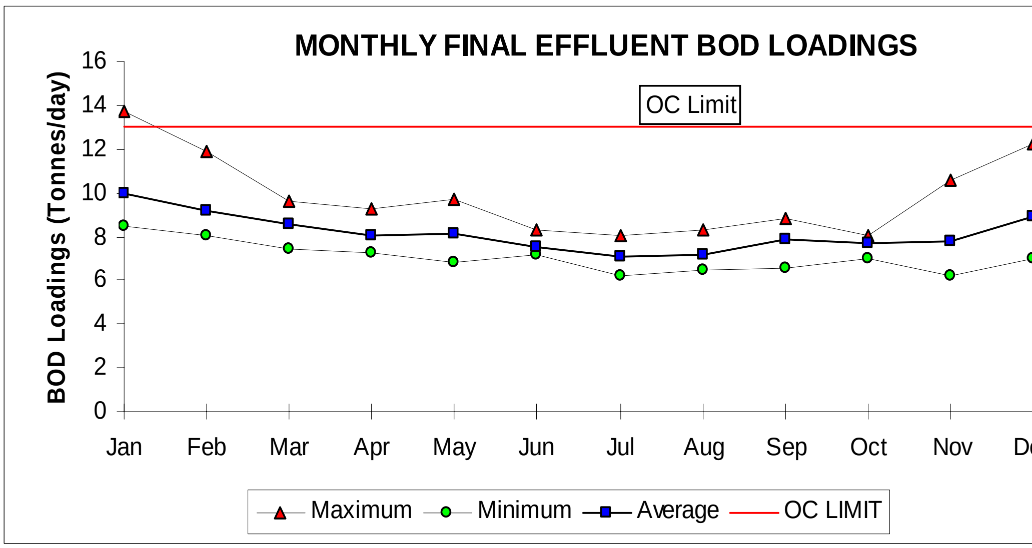
Mth	Max	Min	Ave
Jan	14.6	5.0	6.8
Feb	7.7	5.1	6.2
Mar	11.2	5.6	6.9
Apr	8.2	4.7	6.3
May	5.9	4.0	4.8
Jun	5.4	3.8	4.4
Jul	5.5	3.4	4.3
Aug	5.7	3.3	4.3
Sep	5.5	3.1	4.3
Oct	8.1	4.2	5.6
Nov	10.0	4.7	6.8
Dec	9.9	4.8	6.1



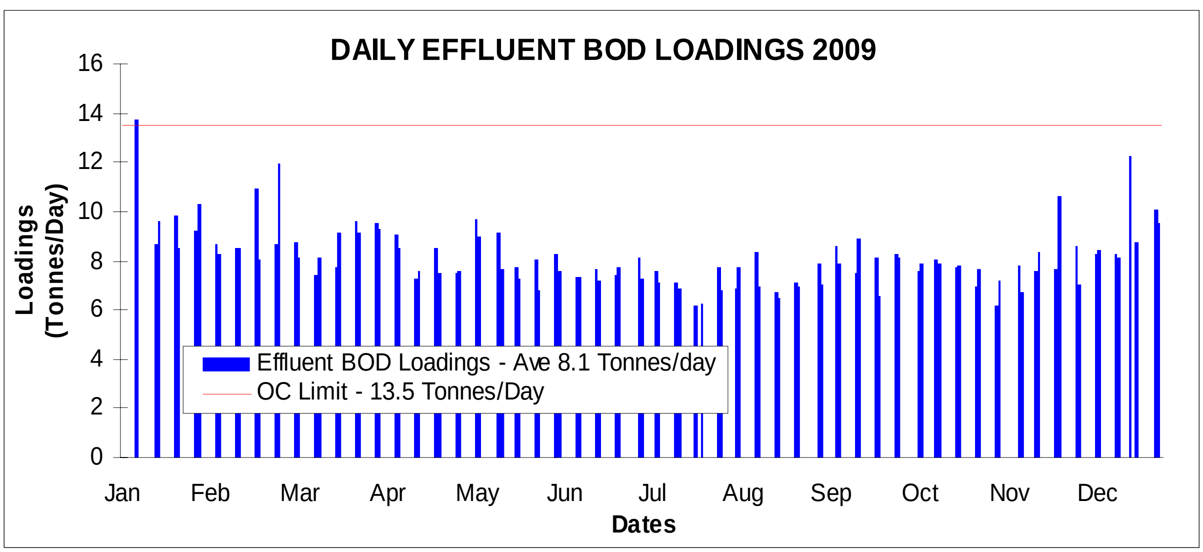
LIONS GATE WWTP – 2009 BOD Loadings Summary



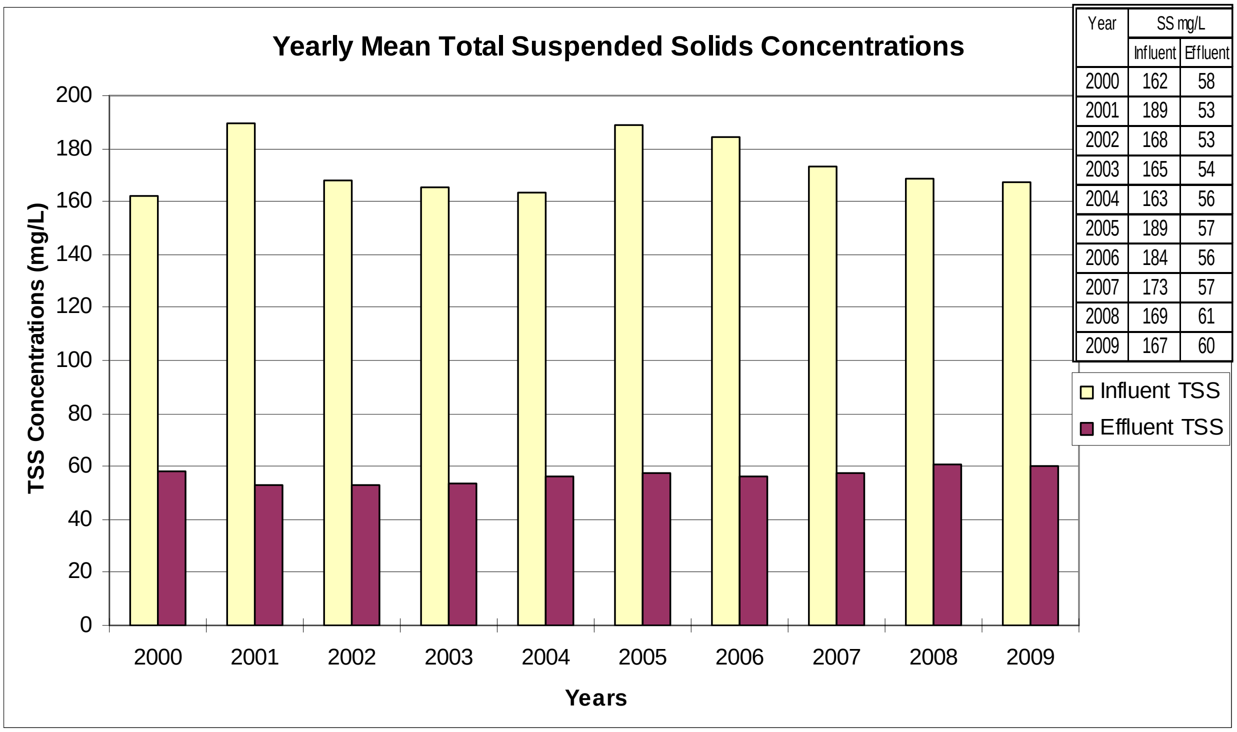
Mth	Max	Min	Ave
Jan	30	12	17
Feb	16	12	14
Mar	16	11	13
Apr	14	11	12
May	17	12	14
Jun	16	12	14
Jul	14	11	12
Aug	13	8	11
Sep	17	11	13
Oct	16	10	13
Nov	15	10	12
Dec	19	11	14



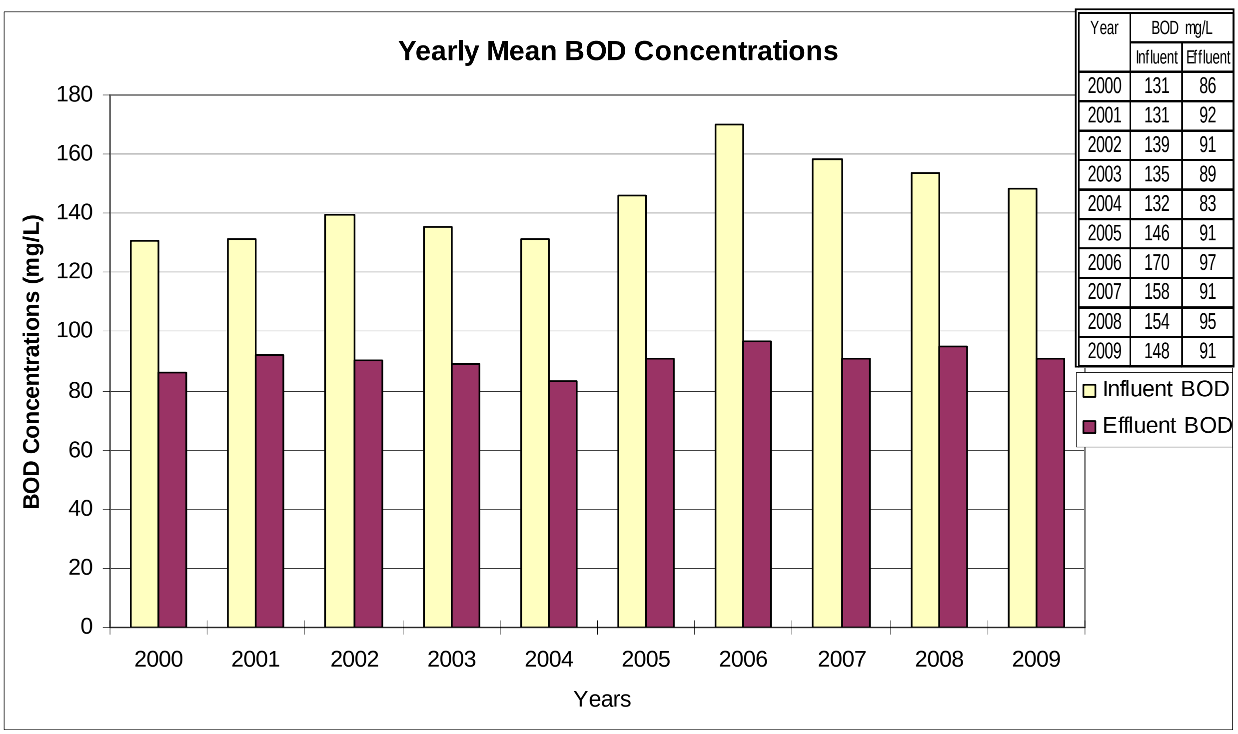
Mth	Max	Min	Ave
Jan	13.8	8.5	10.0
Feb	11.9	8.0	9.2
Mar	9.6	7.4	8.6
Apr	9.3	7.3	8.1
May	9.7	6.8	8.2
Jun	8.3	7.2	7.6
Jul	8.1	6.2	7.1
Aug	8.3	6.5	7.1
Sep	8.9	6.5	7.9
Oct	8.0	7.0	7.7
Nov	10.6	6.2	7.8
Dec	12.3	7.0	8.9



LIONS GATE WWTP – 2000 - 2009 Historical Concentrations

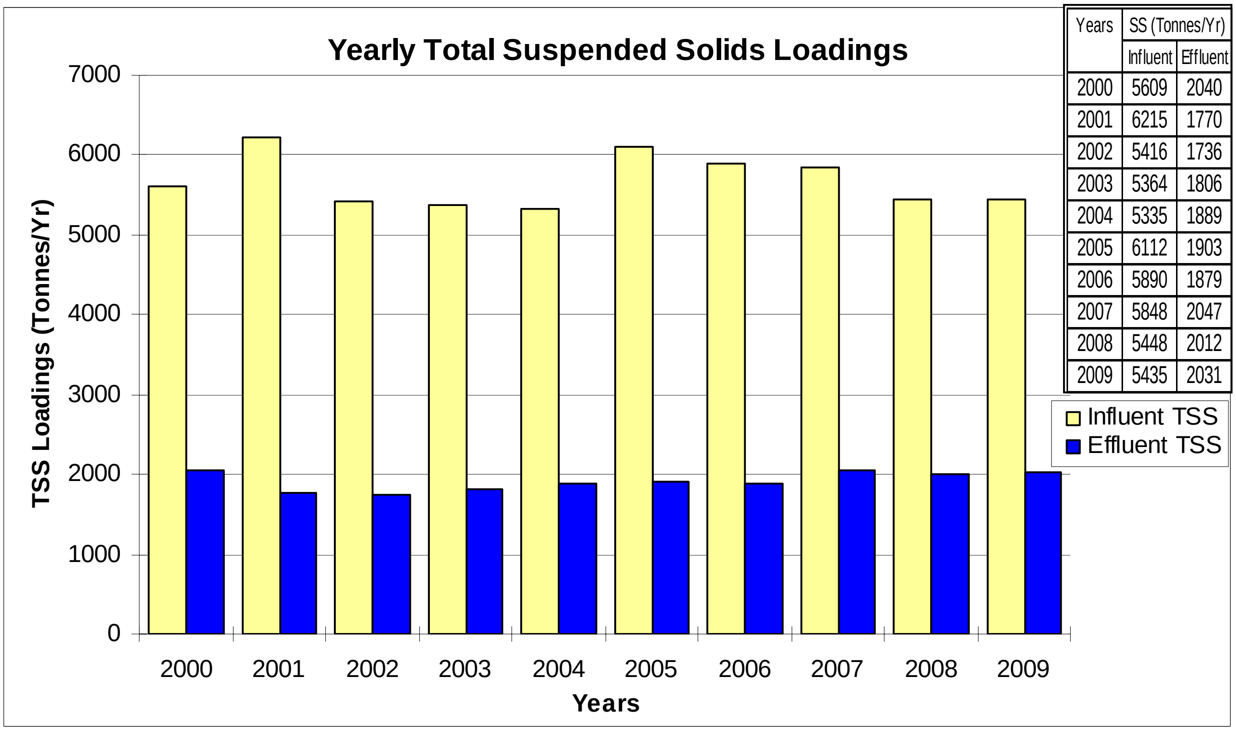


Year	SS mg/L	
	Influent	Effluent
2000	162	58
2001	189	53
2002	168	53
2003	165	54
2004	163	56
2005	189	57
2006	184	56
2007	173	57
2008	169	61
2009	167	60

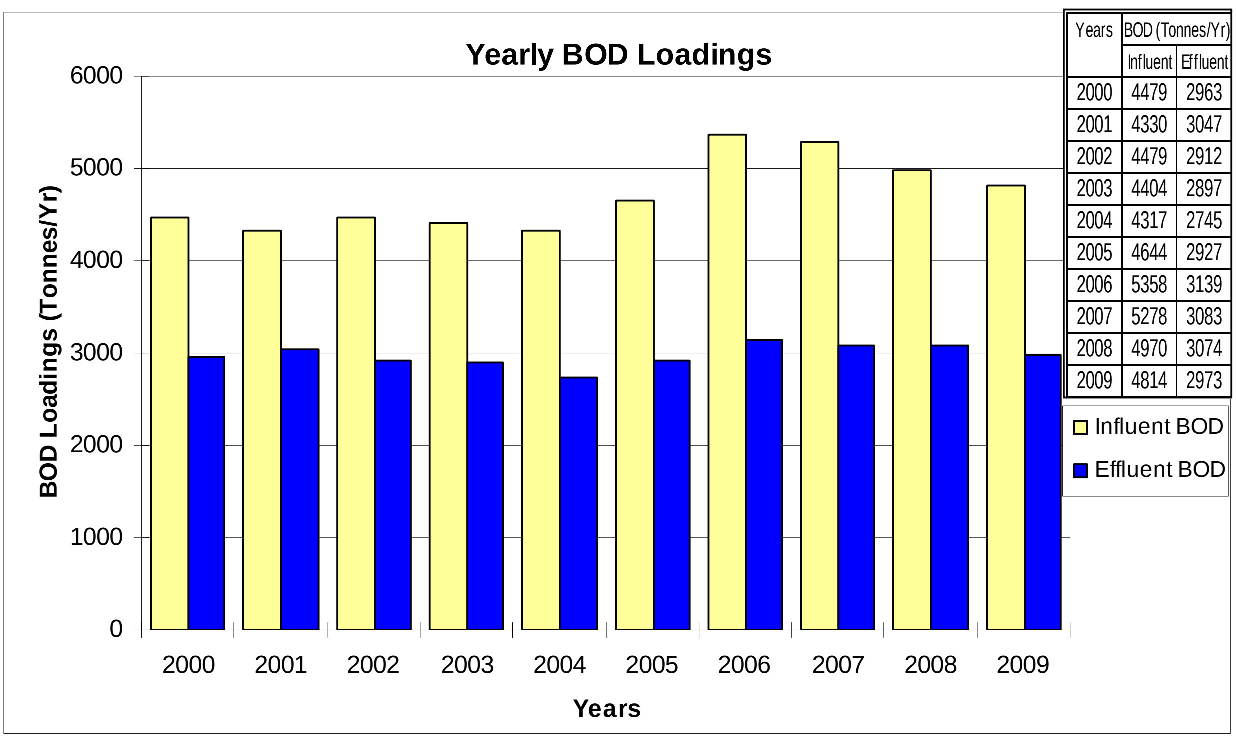


Year	BOD mg/L	
	Influent	Effluent
2000	131	86
2001	131	92
2002	139	91
2003	135	89
2004	132	83
2005	146	91
2006	170	97
2007	158	91
2008	154	95
2009	148	91

LIONS GATE WWTP – 2000 - 2009 Historical Loadings Comparison



Years	SS (Tonnes/Yr)	
	Influent	Effluent
2000	5609	2040
2001	6215	1770
2002	5416	1736
2003	5364	1806
2004	5335	1889
2005	6112	1903
2006	5890	1879
2007	5848	2047
2008	5448	2012
2009	5435	2031



Years	BOD (Tonnes/Yr)	
	Influent	Effluent
2000	4479	2963
2001	4330	3047
2002	4479	2912
2003	4404	2897
2004	4317	2745
2005	4644	2927
2006	5358	3139
2007	5278	3083
2008	4970	3074
2009	4814	2973

LIONS GATE WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.		27	24	30	29	31	29	28	27	31	20	24
NO3	Grab	0.90	0.63	0.52	0.22	<0.01	0.02		0.02	<0.01	0.12	0.34	0.44
NO2	Grab	0.05	0.06	0.04	0.04	0.09	0.02		<0.01	0.01	0.10	0.08	0.07
NH3	Comp.		18	15	18	18	18	19	18	18	19	12	15
SO4	Comp.		117	95	75	95	85	109	95	105	135	64	79
PTot	Comp.		4.2	3.5	4.4	4.3	4.9	3.8	4.4	4.0	4.6	3.3	3.4
PDis	Comp.		2.0	1.7	2.0	2.1	2.2	1.9	1.8	1.8	2.0	1.5	1.5
MBAS	Grab	1.0	1.0	0.9	1.3	1.4	1.8		1.2	1.2	1.0	0.9	1.1
O&G	Grab	13	30	20	30	31	31		26	24	28	32	19
Phenol	Grab	0.02	0.03	0.02	0.02	0.04	0.02		0.01	0.01	0.02	0.01	0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.		0.47	0.47	0.51	0.48	0.53	0.50	0.54	0.48	0.76	0.47	0.45
AlDis	Comp.		0.03	0.04	0.05	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03
AsTot	Comp.		<0.001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.		0.043	0.025	0.031	0.037	0.023	0.021	0.027	0.024	0.023	0.024	0.031
BaDis	Comp.		0.017	0.010	0.009	0.010	0.008	0.009	0.010	0.012	0.010	0.012	0.011
BTot	Comp.		0.27	0.22	0.21	0.23	0.24	0.25	0.25	0.26	0.34	0.18	0.20
BDis	Comp.		0.27	0.21	0.20	0.22	0.24	0.24	0.25	0.25	0.33	0.17	0.20
CaTot	Comp.		26.5	23.8	20.8	22.0	21.1	22.3	22.2	24.6	28.8	22.7	23.9
CdTot	Comp.		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.		0.003	0.004	0.002	0.002	0.002	0.002	0.002	0.004	0.003	0.002	0.002
CrDis	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.		0.130	0.108	0.122	0.111	0.128	0.140	0.138	0.139	0.140	0.088	0.098
CuDis	Comp.		0.019	0.015	0.022	0.013	0.014	0.012	0.013	0.015	0.007	0.016	0.015
FeTot	Comp.		1.07	1.12	1.23	1.16	1.07	1.09	1.12	0.95	1.14	1.22	1.48
FeDis	Comp.		0.19	0.19	0.27	0.18	0.16	0.16	0.15	0.15	0.15	0.14	0.24
PbTot	Comp.		0.003	0.002	0.002	0.004	0.004	0.002	0.003	0.004	<0.001	0.003	0.003
PbDis	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.		47.7	38.7	31.1	37.7	35.1	42.1	38.5	43.6	57.6	26.7	32.8
MnTot	Comp.		0.065	0.057	0.065	0.055	0.057	0.045	0.049	0.055	0.061	0.067	0.092
MnDis	Comp.		0.051	0.044	0.047	0.041	0.041	0.035	0.036	0.042	0.045	0.052	0.076
HgTot	Comp.		0.19	0.14	0.40	0.07	0.13	0.19	0.09	0.20	0.08	0.10	0.07
MoTot	Comp.		0.004	<0.002	0.002	0.003	0.002	<0.002	<0.002	0.003	0.003	<0.002	0.002
MoDis	Comp.		0.002	<0.002	<0.002	0.002	0.002	<0.002	<0.002	0.002	0.002	<0.002	<0.002
NiTot	Comp.		0.010	0.009	0.008	0.002	0.003	0.002	0.002	0.010	0.010	0.010	0.009
NiDis	Comp.		0.008	0.007	0.007	0.001	0.002	0.002	0.001	0.008	0.008	0.007	0.007
SeTot	Comp.		<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01	0.02	0.01	<0.01	0.01
AgTot	Comp.		<0.001	<0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
AgDis	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.		0.094	0.072	0.110	0.086	0.105	0.096	0.086	0.084	0.094	0.073	0.076
ZnDis	Comp.		0.039	0.031	0.033	0.034	0.030	0.039	0.027	0.034	0.027	0.024	0.029

Note: All results reported are in mg/L except for Mercury which are reported in ug/L.

LIONS GATE WWTP – 2009 Comprehensive Effluent Data

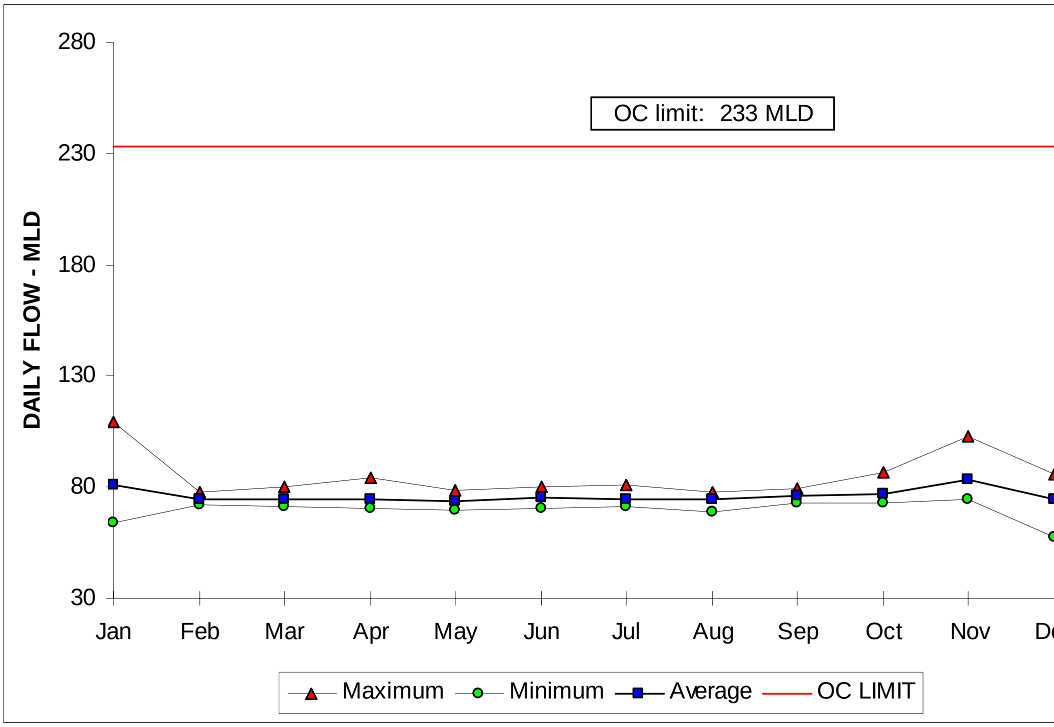
Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	17	26	24	27	28	27	29	29	27	34	18	23
NO3	Grab	1.01	0.28	0.39	0.10	0.07	0.03	0.05	0.06	0.15	<0.01	0.28	0.44
NO2	Grab	0.04	0.05	0.07	0.03	0.03	0.02	0.01	0.02	0.05	<0.01	0.05	0.06
NH3	Comp.	12	19	17	20	21	19	22	21	20	17	14	17
SO4	Comp.	56	110	96	70	90	97	111	97	100	114	65	81
PTot	Comp.	2.7	3.8	3.6	4.1	4.0	4.0	3.9	3.9	3.8	4.2	2.6	3.0
PDis	Comp.	1.6	2.2	2.0	2.2	2.6	2.5	2.5	2.9	2.5	2.5	1.4	1.6
MBAS	Grab	0.6	1.4	0.9	1.6	1.8	2	2.2	1.7	1.4	2	1.0	0.8
O&G	Grab	<6	13	10	9	13	12	9	<5	8	10	7	6
Phenol	Grab	0.01	0.01	0.01	<0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.26	0.32	0.37	0.33	0.30	0.31	0.33	0.29	0.26	0.31	0.33	0.30
AlDis	Comp.	0.06	0.04	0.04	0.03	0.03	0.03	0.03	0.09	0.03	0.02	0.03	0.03
AsTot	Comp.	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.035	0.030	0.022	0.020	0.019	0.017	0.017	0.019	0.018	0.016	0.021	0.023
BaDis	Comp.	0.025	0.018	0.010	0.008	0.010	0.008	0.009	0.012	0.011	0.009	0.013	0.011
BTot	Comp.	0.16	0.24	0.22	0.20	0.22	0.26	0.25	0.26	0.26	0.31	0.19	0.21
BDis	Comp.	0.15	0.25	0.21	0.20	0.22	0.24	0.25	0.26	0.24	0.30	0.18	0.20
CaTot	Comp.	26.0	25.6	23.9	19.8	20.9	22.0	22.6	22.0	24.4	25.5	22.6	24.2
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	<0.0005
CrTot	Comp.	0.001	0.002	0.001	0.002	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
CrDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.076	0.100	0.100	0.096	0.084	0.094	0.101	0.102	0.107	0.100	0.075	0.072
CuDis	Comp.	0.018	0.015	0.013	0.018	0.017	0.023	0.021	0.048	0.023	0.007	0.014	0.012
FeTot	Comp.	1.12	0.89	0.93	0.96	0.79	0.77	0.71	0.73	0.72	0.70	0.86	1.10
FeDis	Comp.	0.29	0.21	0.19	0.22	0.19	0.16	0.15	0.32	0.15	0.16	0.18	0.26
PbTot	Comp.	<0.001	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.002	<0.001	0.002	0.002
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	23.4	45.3	39.9	29.1	35.4	40.0	44.9	38.6	42.6	49.2	28.3	33.8
MnTot	Comp.	0.071	0.062	0.054	0.060	0.051	0.051	0.043	0.044	0.052	0.055	0.063	0.088
MnDis	Comp.	0.059	0.051	0.044	0.045	0.042	0.040	0.035	0.039	0.041	0.044	0.051	0.075
HgTot	Comp.	0.06	0.05	0.06	<0.05	0.06	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05
MoTot	Comp.	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	0.002	0.003	<0.002	<0.002
MoDis	Comp.	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002
NiTot	Comp.	0.001	0.003	0.002	0.002	0.003	0.002	0.002	0.001	0.003	0.002	0.003	0.002
NiDis	Comp.	<0.001	0.002	0.001	0.001	0.001	<0.001	0.002	0.001	0.002	0.002	0.002	0.001
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.064	0.073	0.059	0.093	0.068	0.064	0.072	0.068	0.063	0.062	0.059	0.056
ZnDis	Comp.	0.038	0.032	0.028	0.029	0.042	0.032	0.043	0.046	0.037	0.023	0.025	0.026

Note: All results reported are in mg/L except for Mercury which are reported in ug/L.

APPENDIX A4

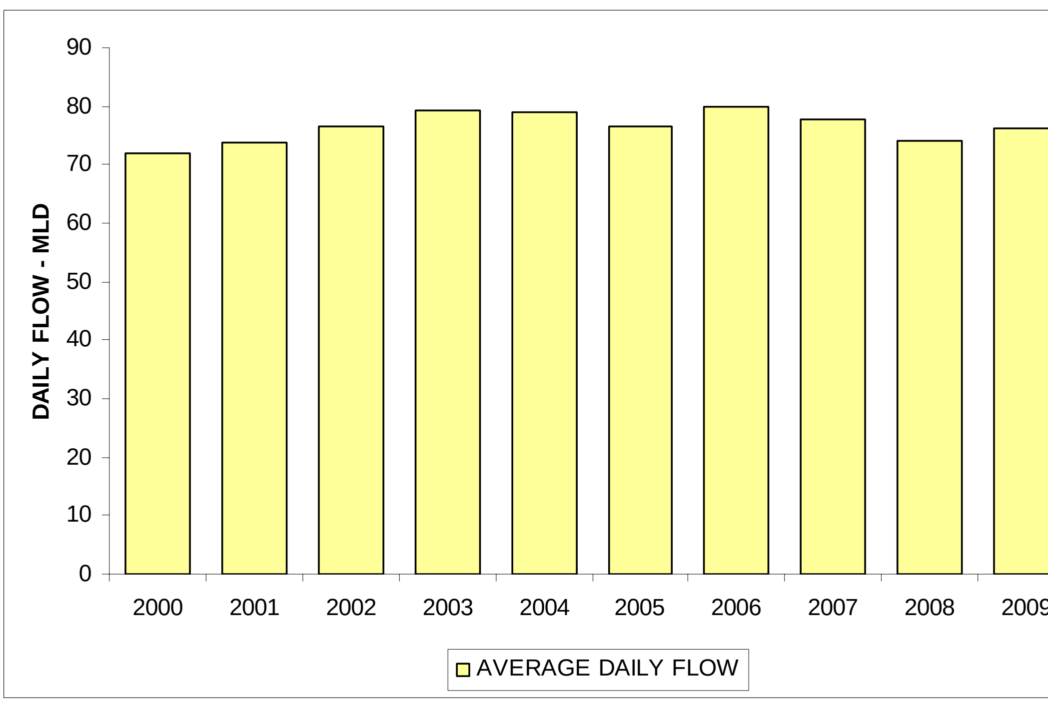
LULU ISLAND WASTEWATER TREATMENT PLANT

LULU WWTP – 2009 Wastewater Flows – Monthly Summary



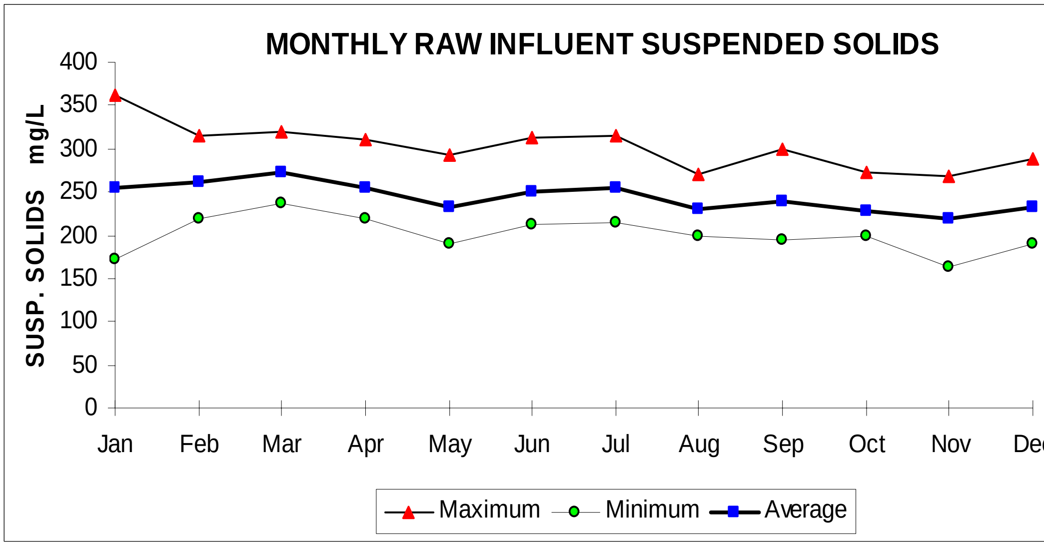
Mth	Max	Min	Ave
Jan	110	64	81
Feb	78	72	74
Mar	80	71	74
Apr	84	71	75
May	79	69	74
Jun	80	70	75
Jul	81	72	75
Aug	78	69	75
Sep	79	73	76
Oct	87	73	77
Nov	103	75	83
Dec	86	58	74

Average Daily Wastewater Flows 2000 – 2009

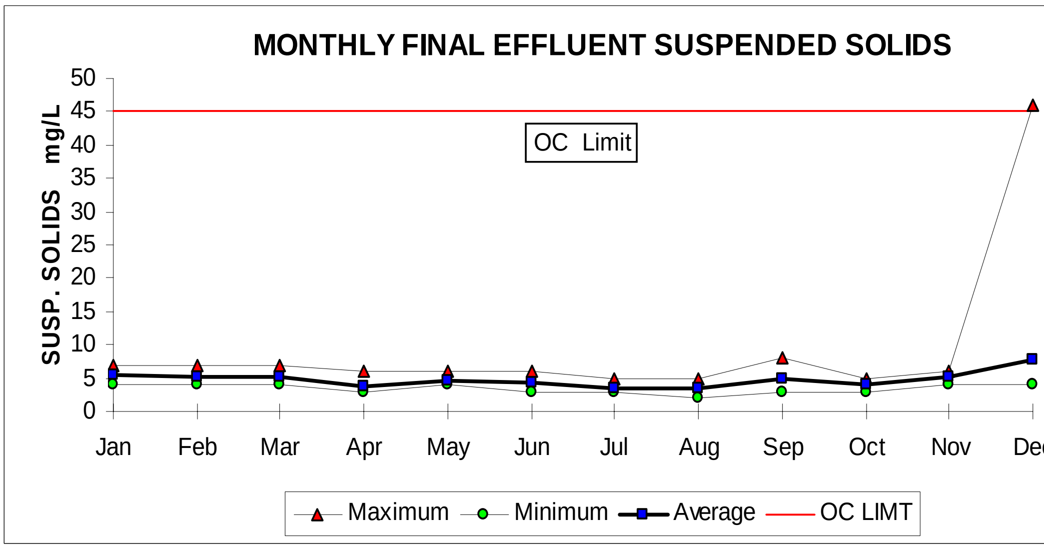


YEAR	FLOW (MLD)
2000	72
2001	74
2002	76
2003	79
2004	79
2005	77
2006	80
2007	78
2008	74
2009	76

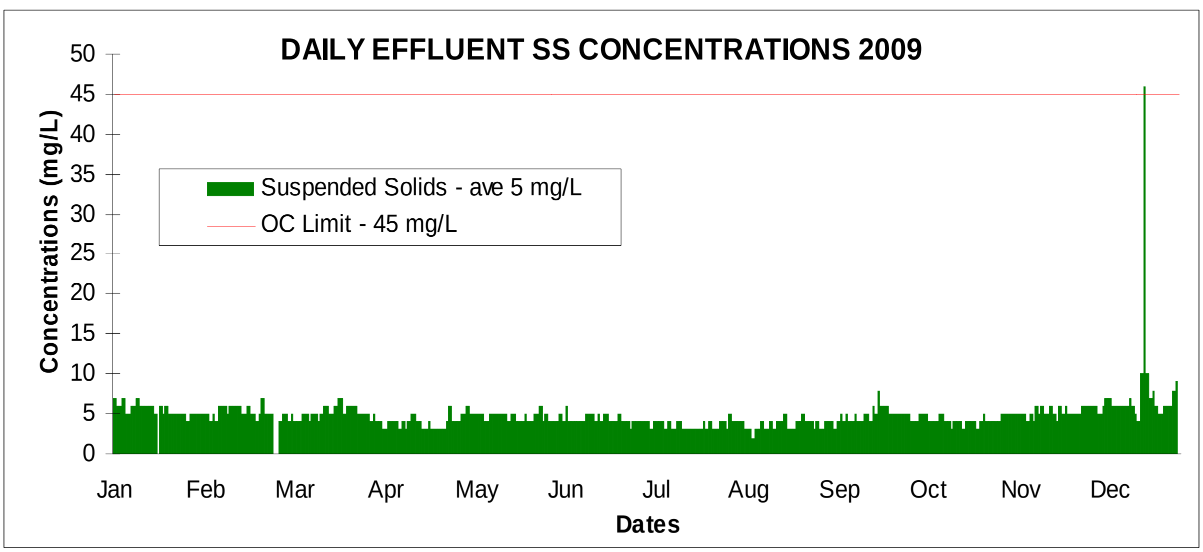
LULU WWTP – 2009 Suspended Solids Concentrations Summary



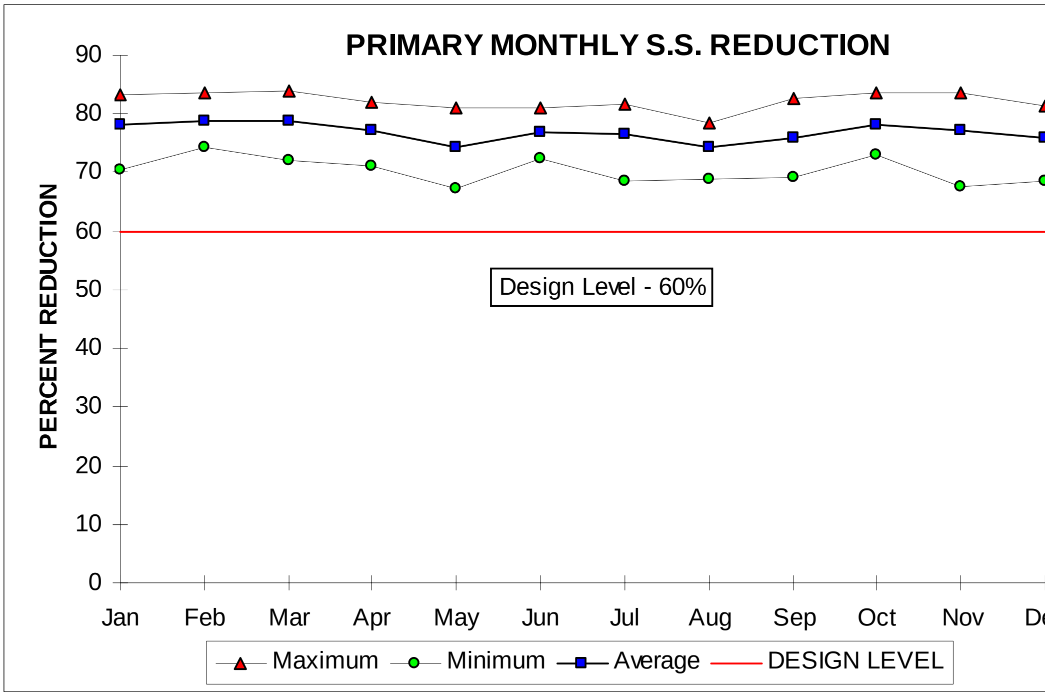
Mth	Max	Min	Ave
Jan	361	172	255
Feb	316	218	261
Mar	320	236	272
Apr	310	218	255
May	292	191	232
Jun	313	212	250
Jul	315	215	254
Aug	270	198	230
Sep	300	194	240
Oct	273	198	229
Nov	268	164	220
Dec	288	190	231



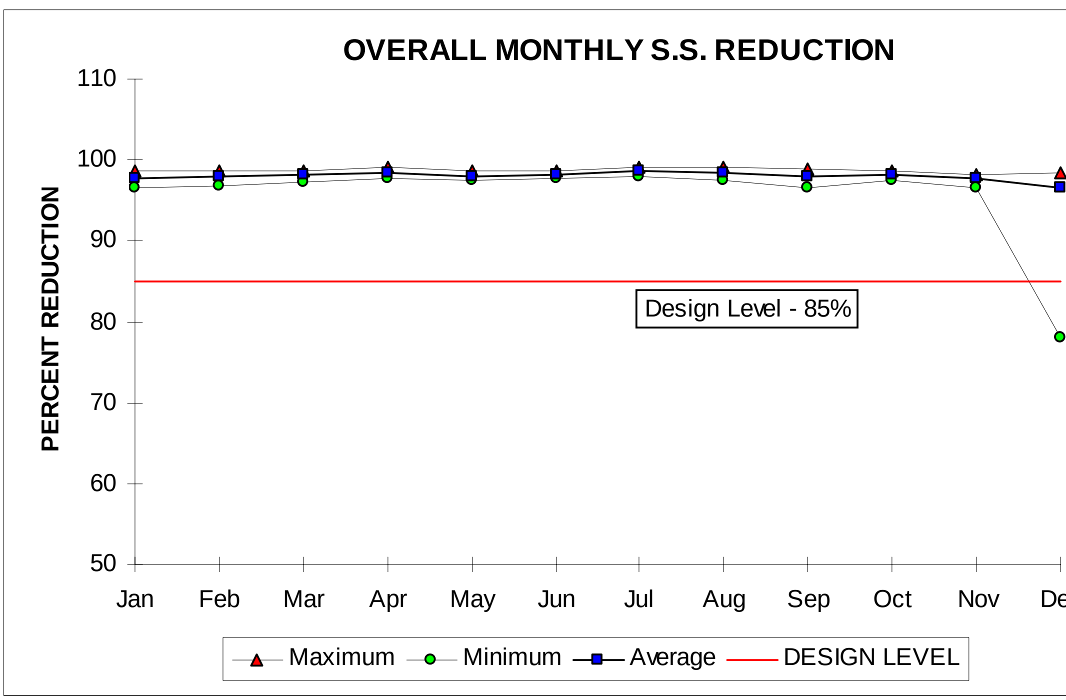
Mth	Max	Min	Ave
Jan	7	4	6
Feb	7	4	5
Mar	7	4	5
Apr	6	3	4
May	6	4	5
Jun	6	3	4
Jul	5	3	4
Aug	5	2	4
Sep	8	3	5
Oct	5	3	4
Nov	6	4	5
Dec	46	4	8



LULU WWTP – 2009 Suspended Solids Reductions

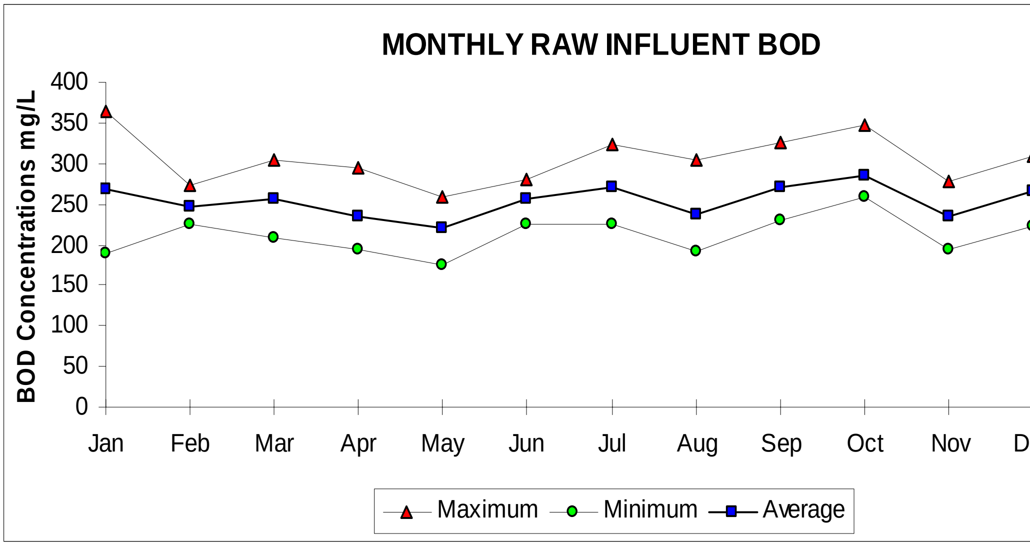


Mth	Max	Min	Ave
Jan	83	70	78
Feb	83	74	79
Mar	84	72	79
Apr	82	71	77
May	81	67	74
Jun	81	72	77
Jul	82	68	76
Aug	79	69	74
Sep	82	69	76
Oct	84	73	78
Nov	84	68	77
Dec	81	69	76

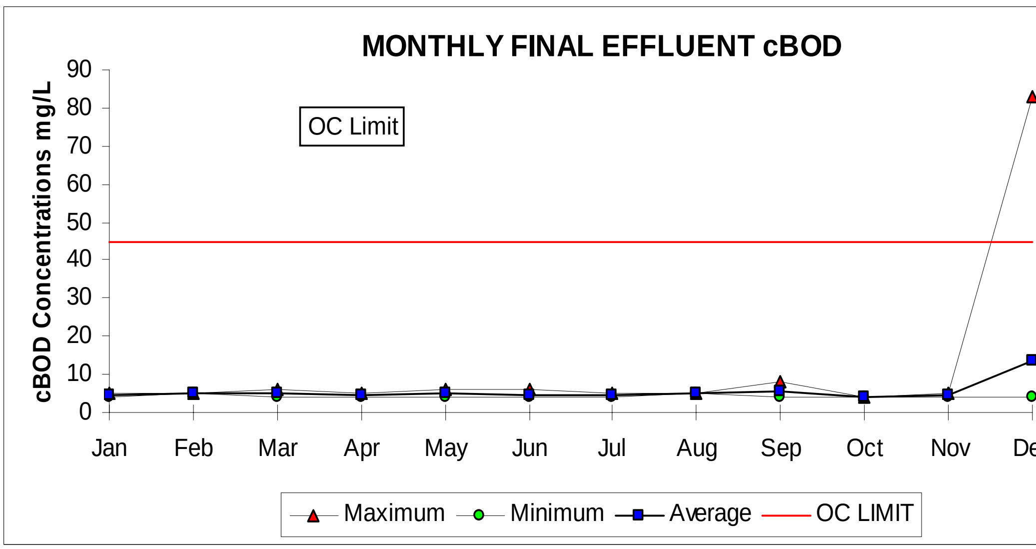


Mth	Max	Min	Ave
Jan	99	97	98
Feb	99	97	98
Mar	99	97	98
Apr	99	98	99
May	99	97	98
Jun	99	98	98
Jul	99	98	99
Aug	99	98	98
Sep	99	96	98
Oct	99	97	98
Nov	98	97	98
Dec	98	78	97

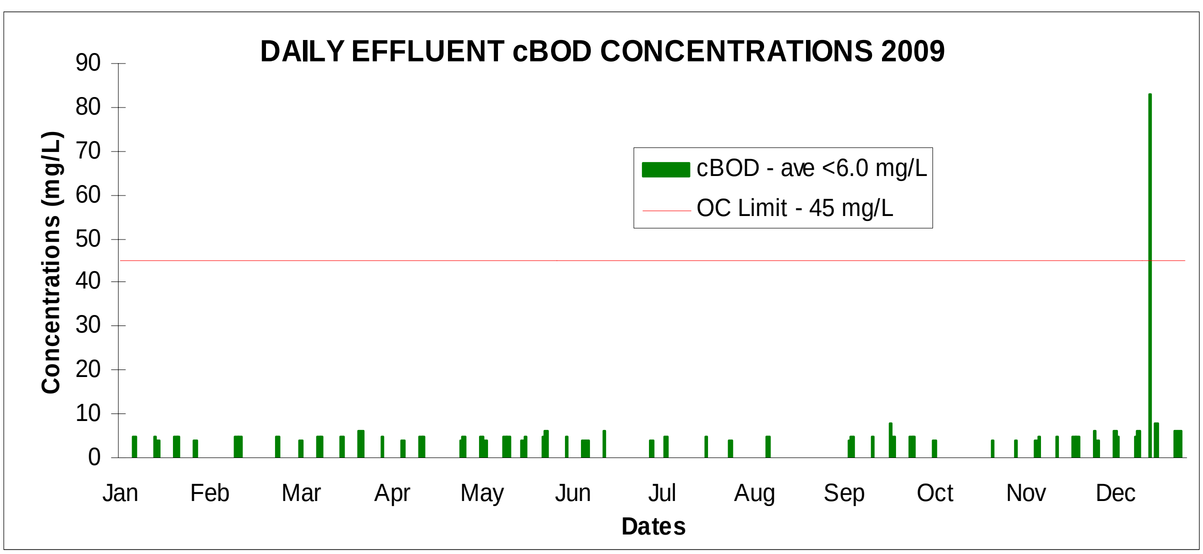
LULU WWTP – 2009 BOD Concentrations Summary



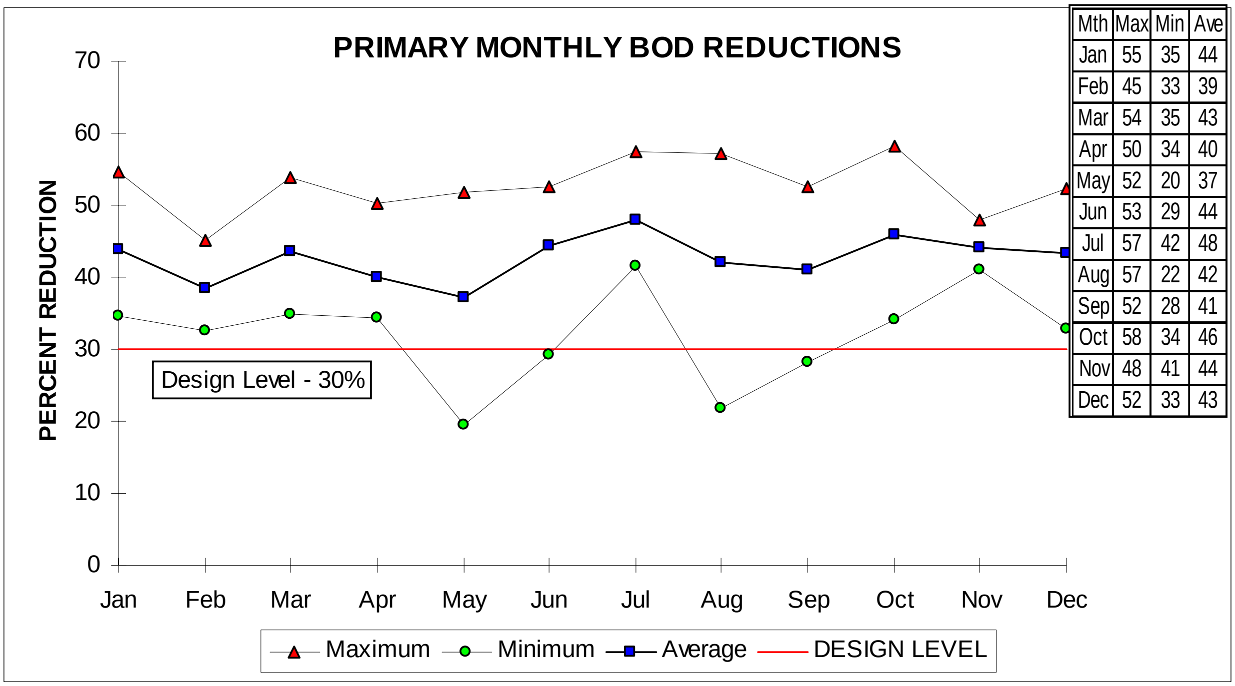
Mth	Max	Min	Ave
Jan	365	189	267
Feb	273	225	247
Mar	303	209	257
Apr	294	193	236
May	259	174	220
Jun	280	225	256
Jul	324	224	270
Aug	303	192	237
Sep	326	230	270
Oct	347	258	284
Nov	278	195	234
Dec	310	223	266



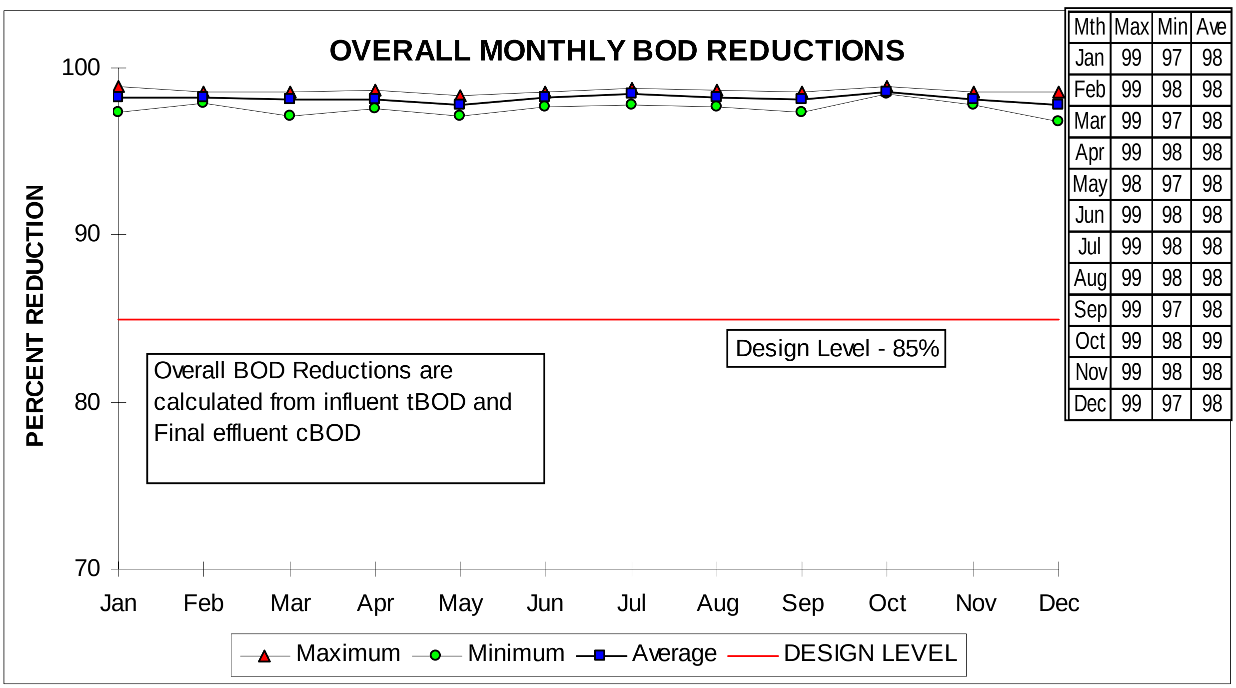
Mth	Max	Min	Ave
Jan	5	<4	<5
Feb	5	<4	<5
Mar	6	<4	<5
Apr	5	<4	<5
May	6	4	5
Jun	6	<4	<5
Jul	5	<4	<5
Aug	5	<4	<5
Sep	8	<4	<5
Oct	4	<4	<4
Nov	5	<4	<5
Dec	83	4	14



LULU WWTP – 2009 BOD Reductions

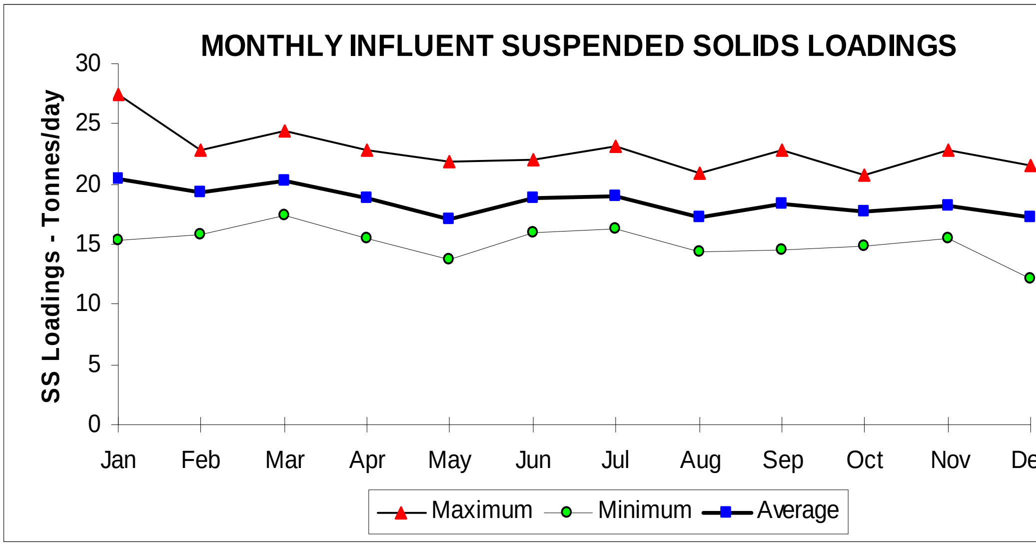


Mth	Max	Min	Ave
Jan	55	35	44
Feb	45	33	39
Mar	54	35	43
Apr	50	34	40
May	52	20	37
Jun	53	29	44
Jul	57	42	48
Aug	57	22	42
Sep	52	28	41
Oct	58	34	46
Nov	48	41	44
Dec	52	33	43

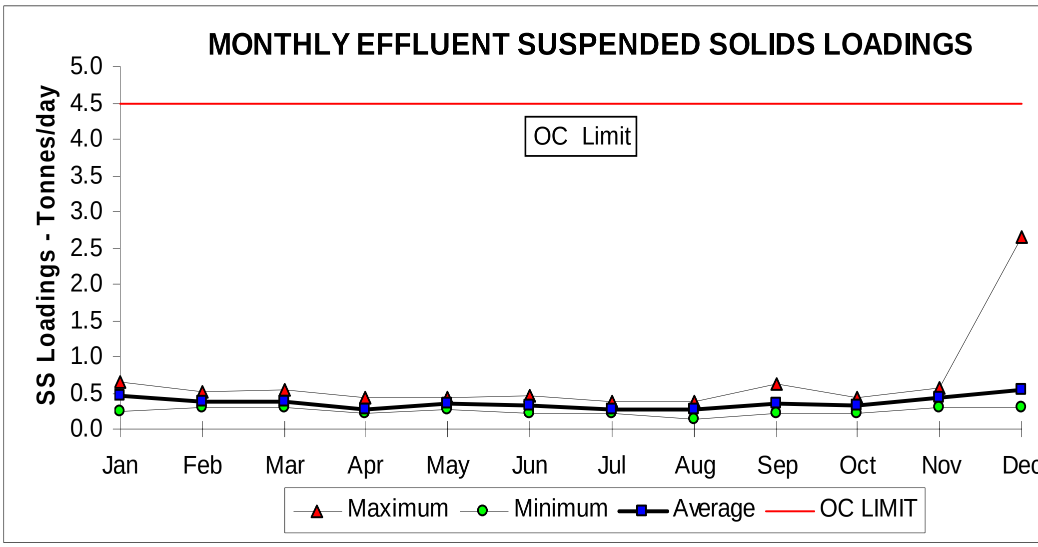


Mth	Max	Min	Ave
Jan	99	97	98
Feb	99	98	98
Mar	99	97	98
Apr	99	98	98
May	98	97	98
Jun	99	98	98
Jul	99	98	98
Aug	99	98	98
Sep	99	97	98
Oct	99	98	99
Nov	99	98	98
Dec	99	97	98

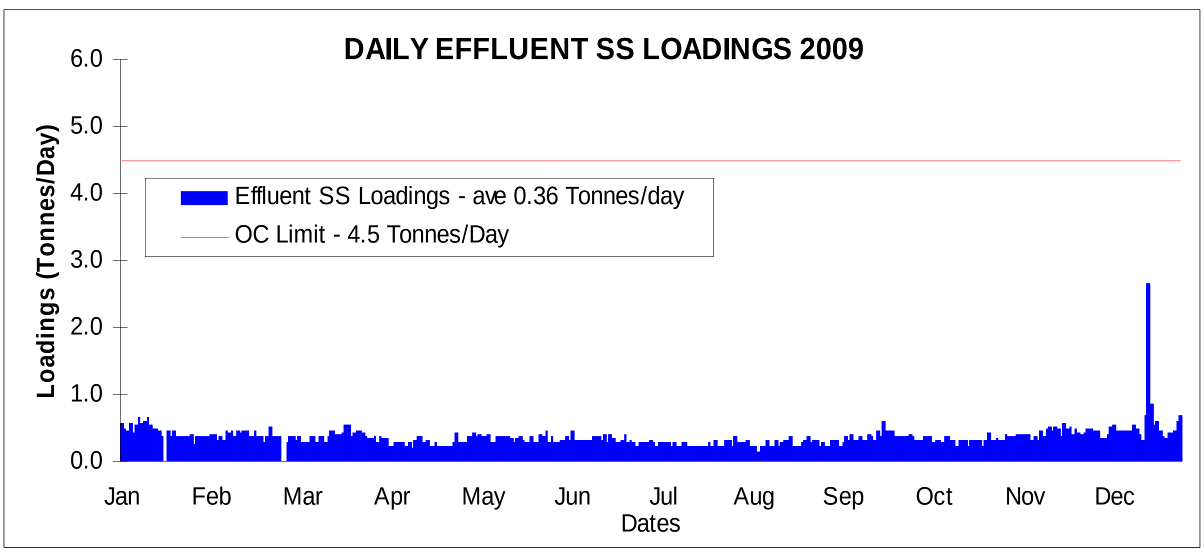
LULU WWTP – 2009 Suspended Solids Loading Summary



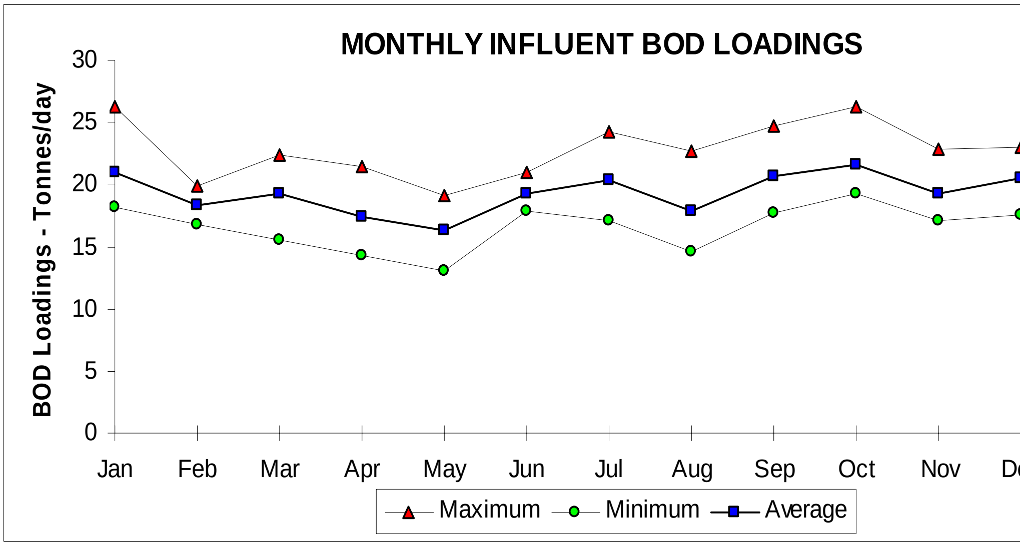
Mth	Max	Min	Ave
Jan	27	15	20
Feb	23	16	19
Mar	24	17	20
Apr	23	15	19
May	22	14	17
Jun	22	16	19
Jul	23	16	19
Aug	21	14	17
Sep	23	14	18
Oct	21	15	18
Nov	23	15	18
Dec	22	12	17



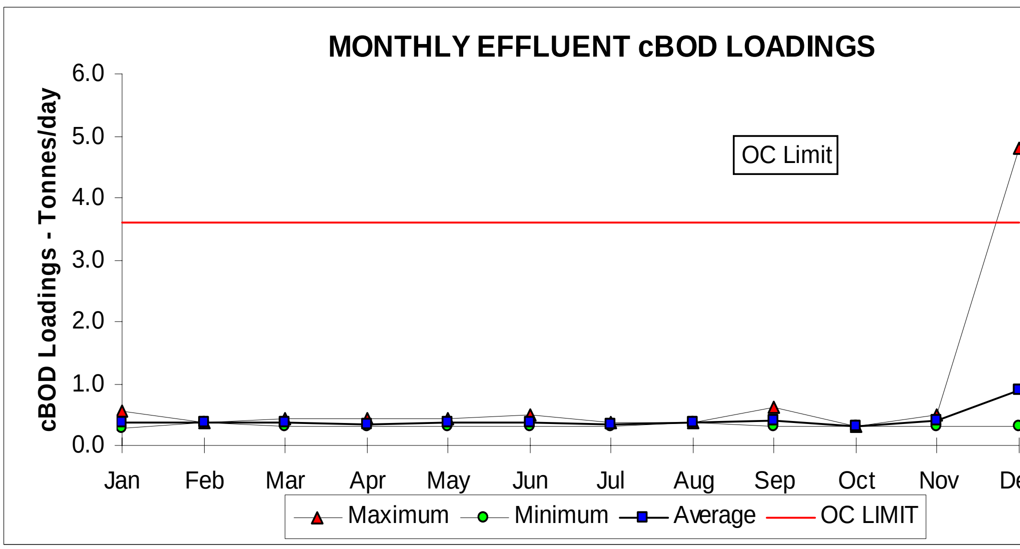
Mth	Max	Min	Ave
Jan	0.7	0.3	0.4
Feb	0.5	0.3	0.4
Mar	0.6	0.3	0.4
Apr	0.4	0.2	0.3
May	0.4	0.3	0.3
Jun	0.5	0.2	0.3
Jul	0.4	0.2	0.3
Aug	0.4	0.1	0.3
Sep	0.6	0.2	0.4
Oct	0.4	0.2	0.3
Nov	0.6	0.3	0.4
Dec	2.7	0.3	0.6



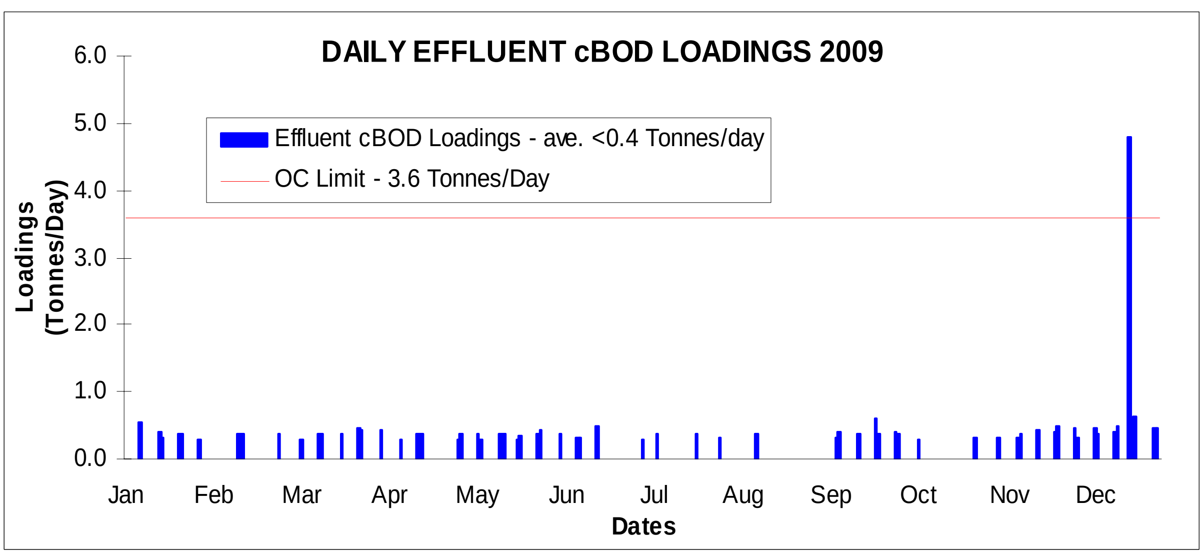
LULU WWTP – 2009 BOD Loadings Summary



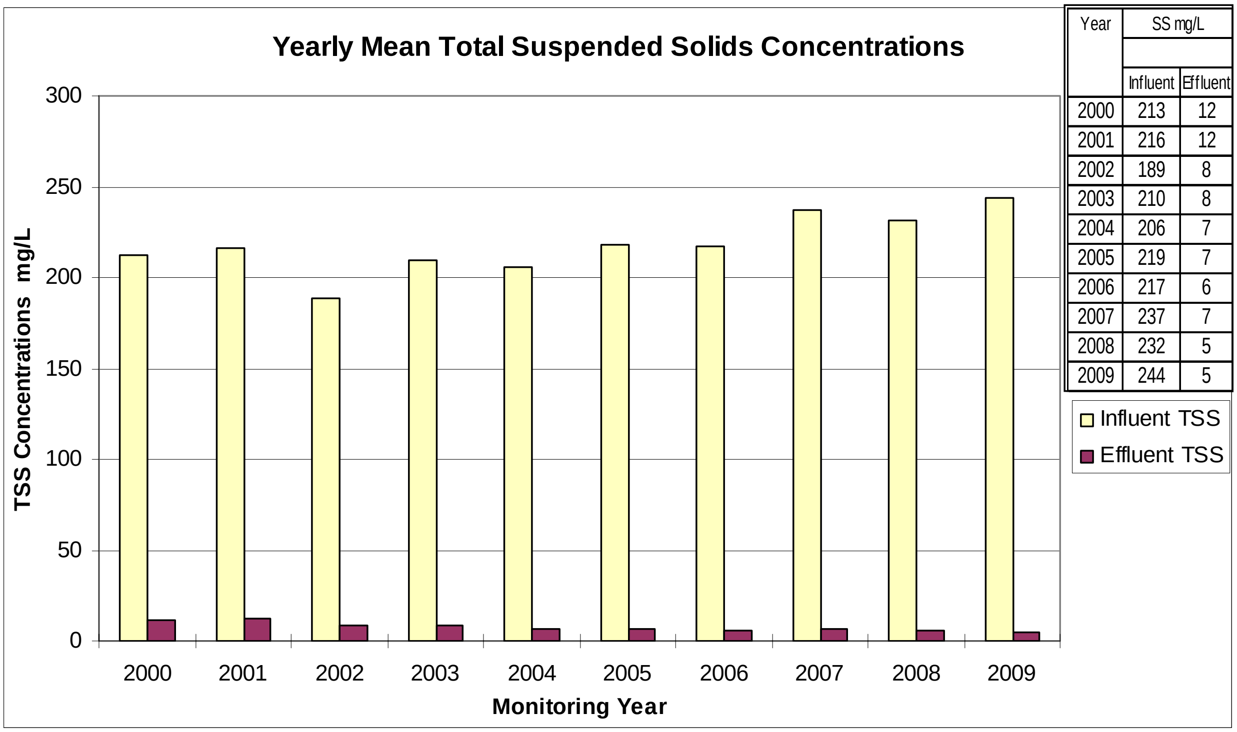
Mth	Max	Min	Ave
Jan	26	18	21
Feb	20	17	18
Mar	22	16	19
Apr	22	14	17
May	19	13	16
Jun	21	18	19
Jul	24	17	20
Aug	23	15	18
Sep	25	18	21
Oct	26	19	22
Nov	23	17	19
Dec	23	18	21



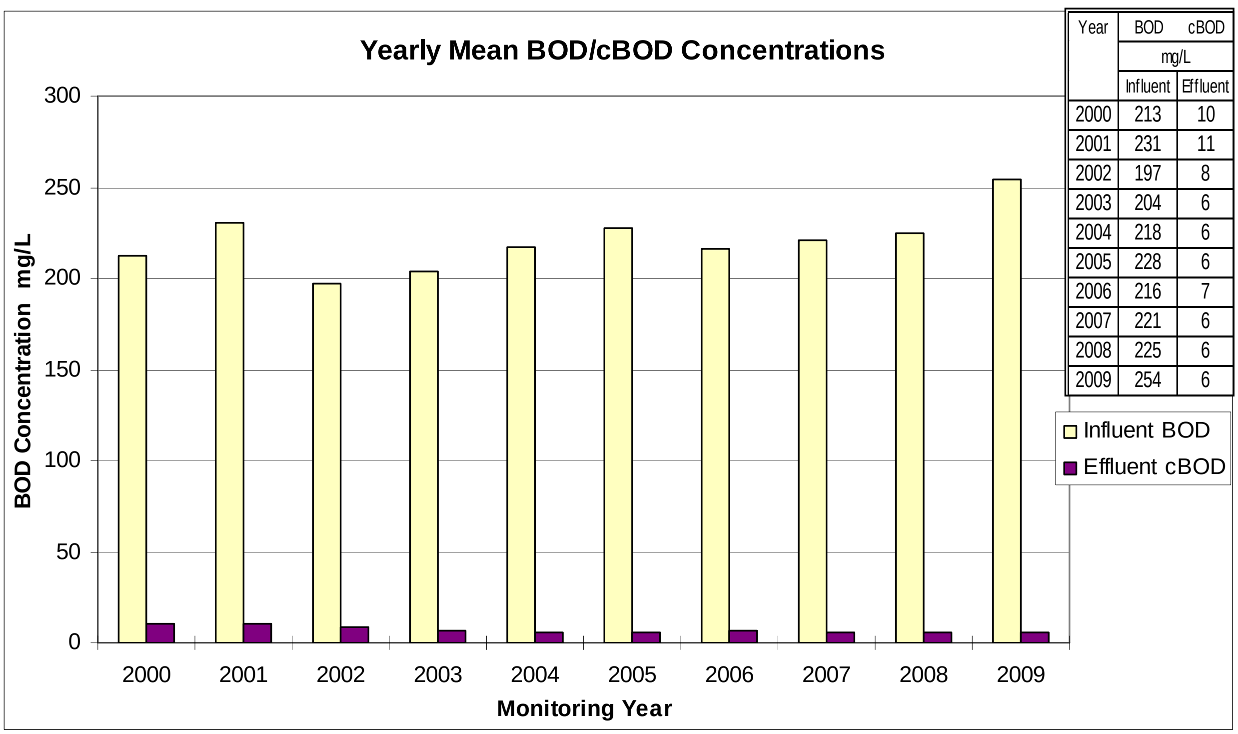
Mth	Max	Min	Ave
Jan	0.5	<0.3	<0.4
Feb	0.4	<0.3	<0.4
Mar	0.4	<0.3	<0.4
Apr	0.4	<0.3	<0.4
May	0.4	0.3	0.4
Jun	0.5	<0.3	<0.4
Jul	0.4	<0.3	<0.4
Aug	0.4	<0.3	<0.4
Sep	0.6	<0.3	<0.4
Oct	0.3	<0.3	<0.4
Nov	0.5	<0.3	<0.4
Dec	4.8	0.3	0.9



LULU WWTP – 2000 - 2009 Historical Concentrations Comparison

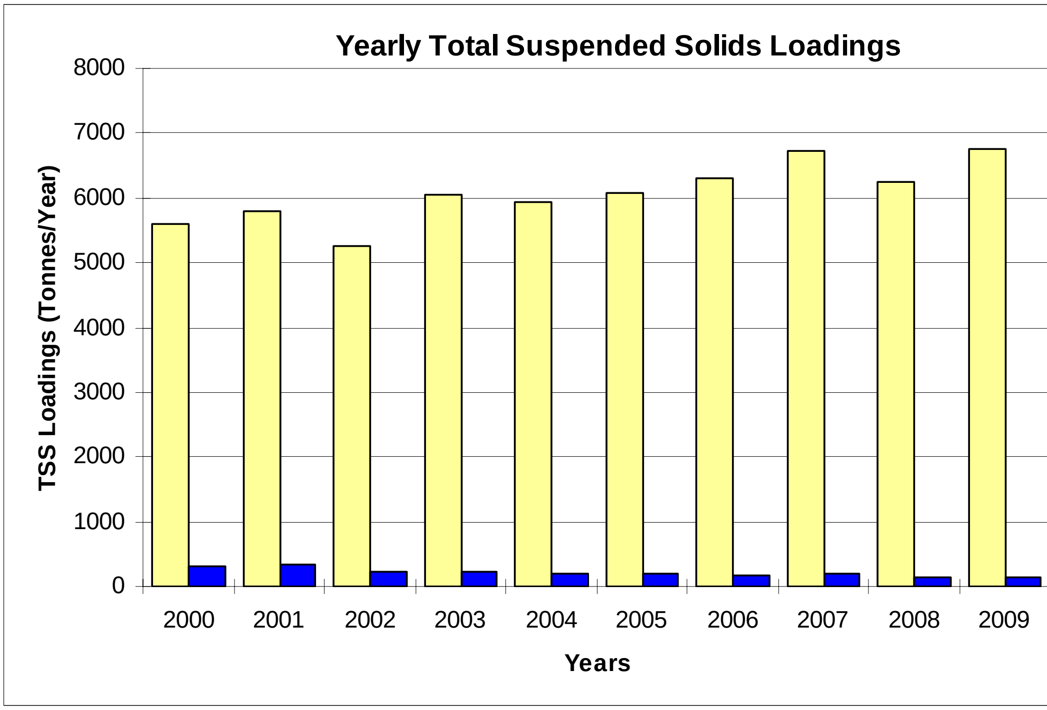


Year	SS mg/L	
	Influent	Effluent
2000	213	12
2001	216	12
2002	189	8
2003	210	8
2004	206	7
2005	219	7
2006	217	6
2007	237	7
2008	232	5
2009	244	5

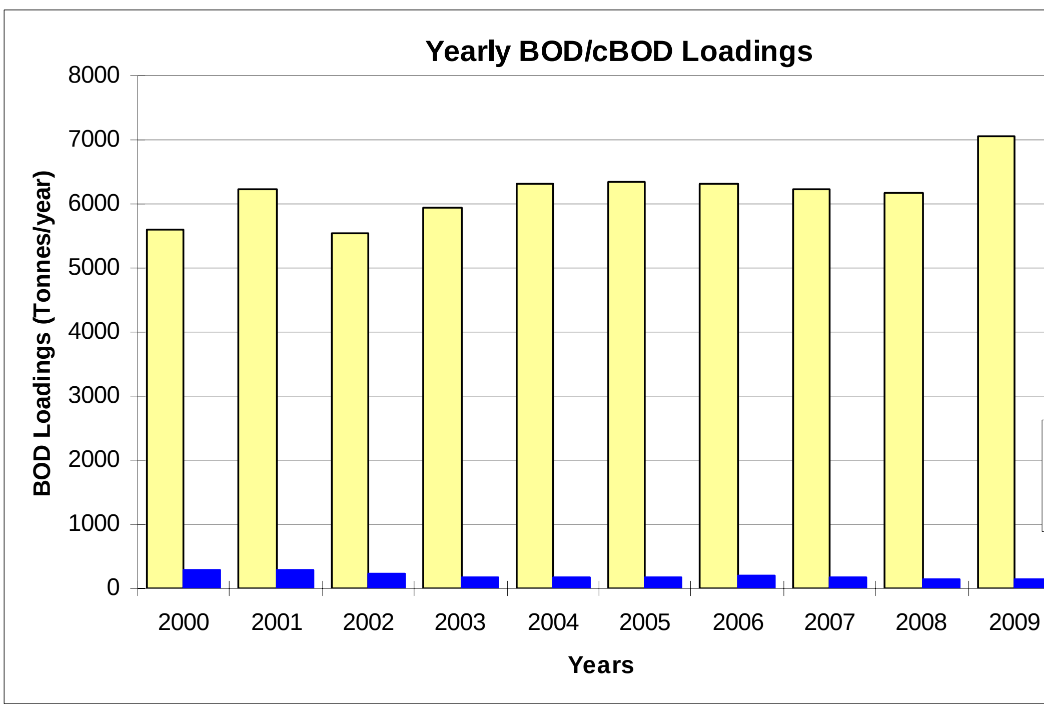


Year	BOD	cBOD
	mg/L	
	Influent	Effluent
2000	213	10
2001	231	11
2002	197	8
2003	204	6
2004	218	6
2005	228	6
2006	216	7
2007	221	6
2008	225	6
2009	254	6

LULU WWTP – 2000 - 2009 Historical Loadings Comparison



Years	SS (Tonnes/Yr)	
	Influent	Effluent
2000	5590	306
2001	5802	326
2002	5270	234
2003	6062	237
2004	5947	202
2005	6088	198
2006	6313	179
2007	6718	187
2008	6261	147
2009	6769	133



Years	BOD	cBOD
	(Tonnes/Yr)	
	Influent	Effluent
2000	5593	272
2001	6229	289
2002	5539	234
2003	5954	185
2004	6310	174
2005	6347	164
2006	6314	189
2007	6232	159
2008	6180	152
2009	7064	145

LULU WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	27	30	32	32	30	32	34	35	32	37	34	30
NO3	Grab	0.02	0.03	0.03	0.01	<0.01	0.04	0.02	<0.01	<0.01	<0.01	0.02	0.01
NO2	Grab	0.03	0.02	0.02	0.01	0.02	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
NH3	Comp.	17	20	18	18	18	18	20	21	18	22	21	18
SO4	Comp.	19	15	14	13	13	15	13	9	11	11	13	14
PTot	Comp.	4.1	4.6	4.8	4.9	4.2	5.0	4.4	4.7	5.1	4.9	4.6	4.2
PDis	Comp.	1.8	2.2	2.2	2.2	1.9	1.9	1.9	2.3	2.5	2.9	2.5	1.6
MBAS	Grab	1.7	2.0	2.2	2.5	2.5	3	2.8	2.6	2.3	2.9	2.2	3.5
O&G	Grab	27	13	42	41	28	31	49	40	28	32	49	25
Phenol	Grab	0.02	0.03	0.02	0.02	0.04	0.02	0.02	0.03	0.04	0.02	0.02	0.02
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.58	0.58	0.68	0.60	0.61	0.77	0.54	0.58	0.68	0.53	0.58	0.77
AlDis	Comp.	0.09	0.06	0.09	0.06	0.05	0.05	0.05	0.06	0.05	0.07	0.11	0.07
AsTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.019	0.021	0.024	0.025	0.019	0.027	0.019	0.019	0.020	0.018	0.017	0.021
BaDis	Comp.	0.005	0.004	0.006	0.004	0.005	0.006	0.004	0.004	0.004	0.005	0.006	0.004
BTot	Comp.	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.11	0.10	0.11	0.10	0.10
BDis	Comp.	0.10	0.10	0.10	0.11	0.10	0.10	0.09	0.11	0.10	0.10	0.10	0.10
CaTot	Comp.	11.3	9.20	9.43	9.05	8.38	9.82	7.85	7.54	7.97	8.12	8.81	9.76
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0044	<0.0005	0.0006	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0016	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.002	0.003	0.002	0.003	0.003	0.003	0.002	0.002	0.004	0.003	0.003	0.002
CrDis	Comp.	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001
CoTot	Comp.	0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.093	0.106	0.105	0.105	0.092	0.119	0.108	0.129	0.133	0.112	0.093	0.083
CuDis	Comp.	0.020	0.031	0.023	0.027	0.019	0.033	0.022	0.045	0.035	0.035	0.018	0.015
FeTot	Comp.	1.68	1.83	1.94	1.78	1.70	3.24	1.50	1.82	1.80	1.56	1.74	1.87
FeDis	Comp.	0.50	0.60	0.53	0.47	0.32	0.99	0.41	0.64	0.45	0.60	0.60	0.48
PbTot	Comp.	0.002	<0.001	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.003	0.003	0.003
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.56	4.13	4.32	3.83	3.65	5.00	3.40	3.08	3.19	3.30	3.72	4.17
MnTot	Comp.	0.073	0.068	0.074	0.075	0.071	0.105	0.059	0.058	0.064	0.060	0.071	0.077
MnDis	Comp.	0.051	0.039	0.048	0.045	0.048	0.064	0.036	0.037	0.036	0.040	0.053	0.050
HgTot	Comp.	0.48	0.59	0.21	0.16	0.32	0.41	0.24	0.13	0.30	0.18	0.17	0.19
MoTot	Comp.	0.002	<0.002	<0.002	0.002	<0.002	0.002	<0.002	0.002	0.009	0.002	<0.002	<0.002
MoDis	Comp.	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.008	<0.002	<0.002	<0.002
NiTot	Comp.	0.005	0.003	0.017	0.004	0.004	0.006	0.003	0.005	0.007	0.003	0.007	0.005
NiDis	Comp.	0.003	0.002	0.012	0.002	0.002	0.003	0.001	0.003	0.004	0.002	0.004	0.003
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	0.001	<0.001	<0.001	0.001	0.002	0.002	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.086	0.093	0.096	0.133	0.082	0.100	0.106	0.113	0.147	0.089	0.115	0.102
ZnDis	Comp.	0.031	0.024	0.029	0.028	0.021	0.015	0.017	0.024	0.033	0.016	0.034	0.021

Note: All results reported are in mg/L except for Mercury which is reported in ug/L.

LULU WWTP – 2009 Comprehensive Effluent Data

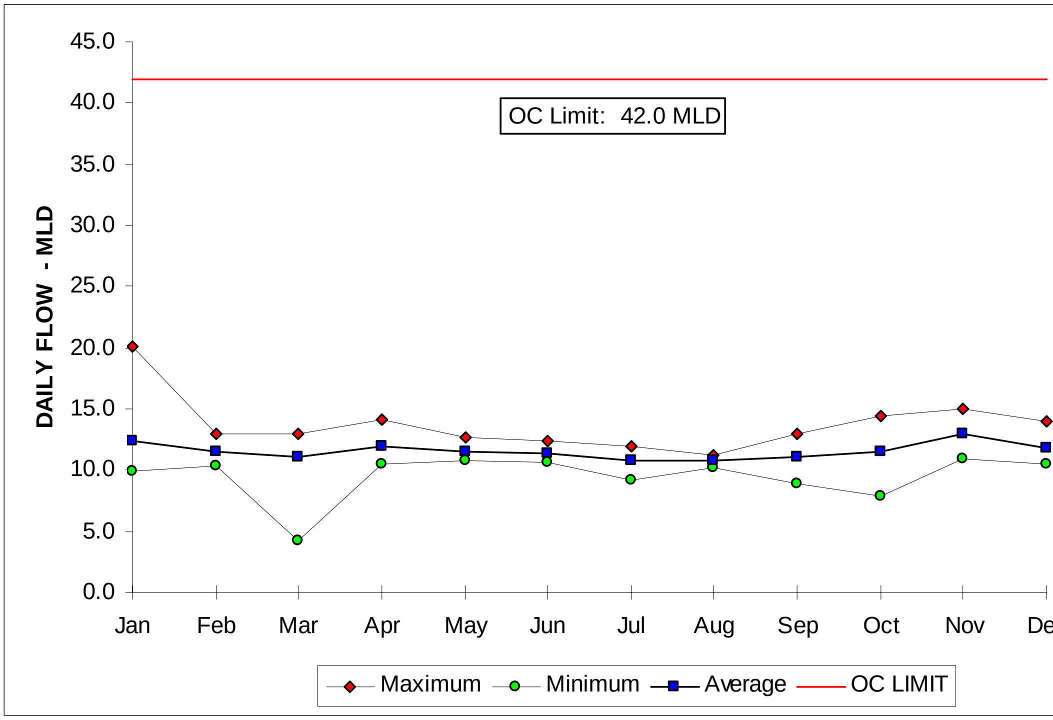
Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	29	30	31	29	32	32	34	34	28	32	32	28
NO3	Grab	0.02	0.07	0.05	0.02	0.01	0.04	0.05	0.08	0.05	0.10	0.07	0.05
NO2	Grab	0.03	0.04	0.04	0.03	0.03	0.06	0.07	0.13	0.15	0.28	0.12	0.04
NH3	Comp.	28	28	29	29	31	31	34	34	26	30	32	28
SO4	Comp.	21	17	18	17	18	21	17	18	17	17	17	18
PTot	Comp.	3.1	3.1	3.4	3.2	3.4	3.3	3.5	3.9	3.5	3.6	3.5	2.9
PDis	Comp.	2.7	2.7	2.9	2.8	3.0	3.0	3.3	3.6	3.1	3.4	3.1	2.6
MBAS	Grab	0.3	0.2	0.2	0.3	0.2	0.4	0.3	0.2	0.1	0.2	0.1	0.2
O&G	Grab	<7	<6	<6	<6	<6	<6	<6	<6	<6	<6	<7	<5
Phenol	Grab	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.08	0.06	0.10	0.05	0.09	0.08	0.07	0.07	0.07	0.06	0.08	0.10
AlDis	Comp.	0.04	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.03
AsTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.002	0.003
BaDis	Comp.	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002
BTot	Comp.	0.10	0.11	0.10	0.10	0.10	0.11	0.10	0.11	0.11	0.11	0.10	0.11
BDis	Comp.	0.10	0.10	0.10	0.10	0.10	0.11	0.09	0.11	0.11	0.11	0.10	0.10
CaTot	Comp.	10.2	7.80	7.93	7.65	7.35	7.74	6.42	6.58	7.25	6.86	7.71	8.61
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
CrDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.031	0.036	0.031	0.023	0.030	0.027	0.031	0.026	0.029	0.032	0.025	0.025
CuDis	Comp.	0.019	0.017	0.014	0.017	0.022	0.020	0.022	0.021	0.020	0.024	0.012	0.011
FeTot	Comp.	0.35	0.33	0.30	0.28	0.31	0.36	0.26	0.25	0.23	0.23	0.25	0.30
FeDis	Comp.	0.18	0.17	0.17	0.18	0.18	0.20	0.15	0.15	0.14	0.13	0.14	0.16
PbTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.37	3.89	4.15	3.67	3.50	5.02	3.11	3.02	3.17	3.21	3.73	3.98
MnTot	Comp.	0.057	0.011	0.009	0.015	0.015	0.015	0.013	0.007	0.020	0.010	0.011	0.020
MnDis	Comp.	0.048	0.005	0.005	0.011	0.011	0.011	0.010	0.005	0.016	0.005	0.006	0.009
HgTot	Comp.	<0.05	0.11	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MoTot	Comp.	<0.002	0.002	<0.002	0.004	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	0.003	<0.002
MoDis	Comp.	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	0.003	<0.002
NiTot	Comp.	0.004	0.003	0.003	0.002	0.003	0.003	0.003	0.005	0.004	0.002	0.004	0.003
NiDis	Comp.	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.003	0.002	0.004	0.002
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.032	0.035	0.038	0.038	0.026	0.026	0.033	0.058	0.052	0.029	0.030	0.053
ZnDis	Comp.	0.023	0.022	0.028	0.026	0.022	0.021	0.030	0.051	0.044	0.023	0.022	0.042

Note: All results reported are in mg/L except for Mercury which is reported in ug/L.

APPENDIX A5

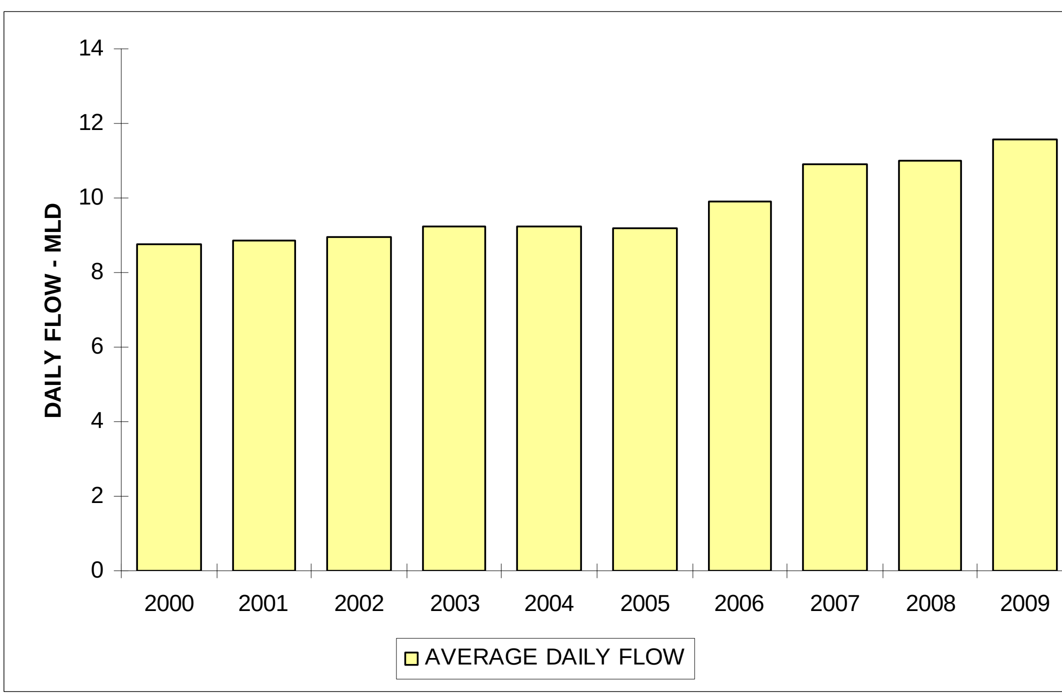
NORTHWEST LANGLEY WASTEWATER TREATMENT PLANT

NW LANGLEY WWTP – 2009 Wastewater Flow – Monthly Summary



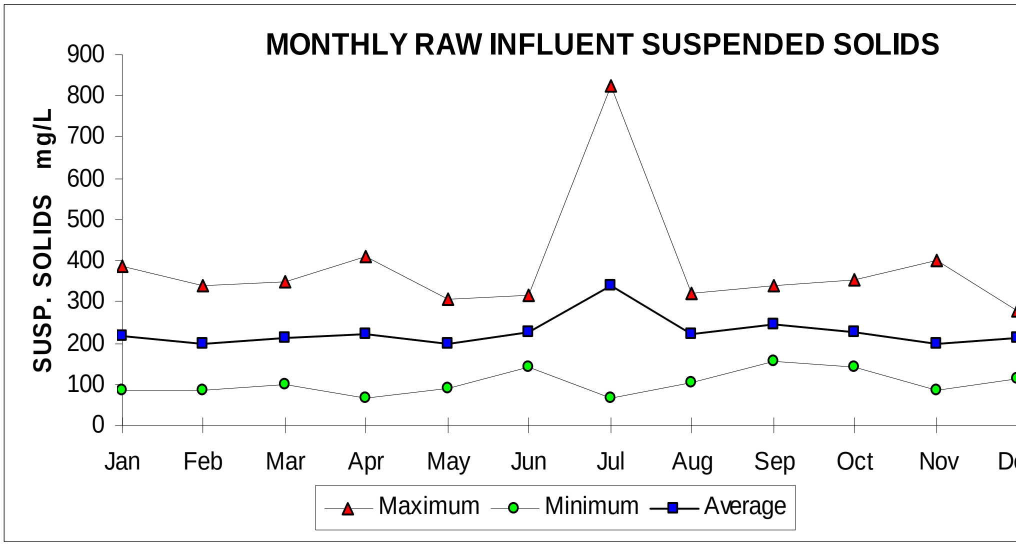
Mth	Max	Min	Ave
Jan	20.1	9.9	12.4
Feb	12.9	10.3	11.5
Mar	13.0	4.3	11.1
Apr	14.2	10.5	12.0
May	12.6	10.7	11.5
Jun	12.3	10.6	11.4
Jul	12.0	9.2	10.8
Aug	11.3	10.2	10.7
Sep	13.0	8.9	11.1
Oct	14.5	7.8	11.6
Nov	15.0	11.0	13.0
Dec	14.0	10.4	11.8

Average Daily Wastewater Flows 2000 – 2009

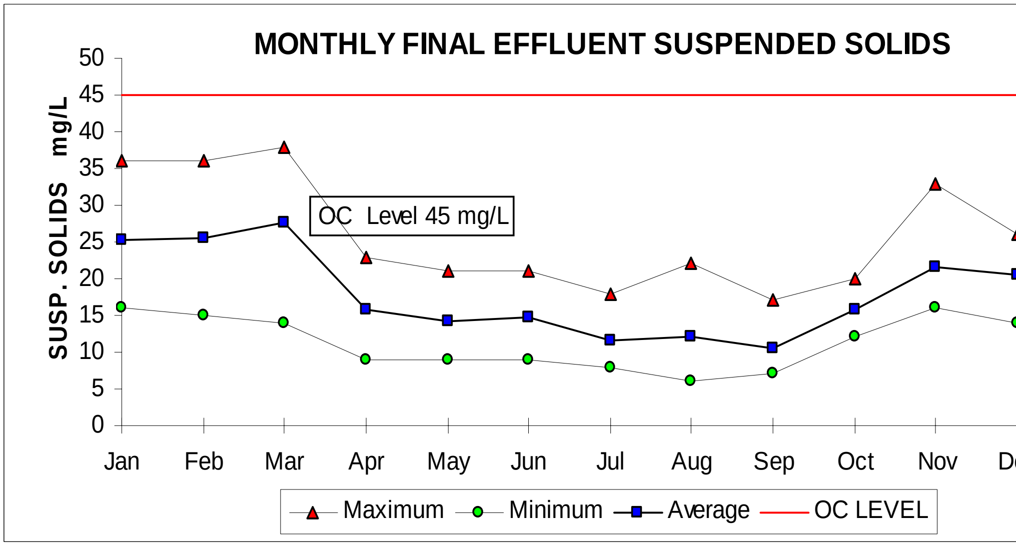


	(MLD)
2000	8.75
2001	8.84
2002	8.93
2003	9.23
2004	9.26
2005	9.20
2006	9.90
2007	10.92
2008	10.99
2009	11.58

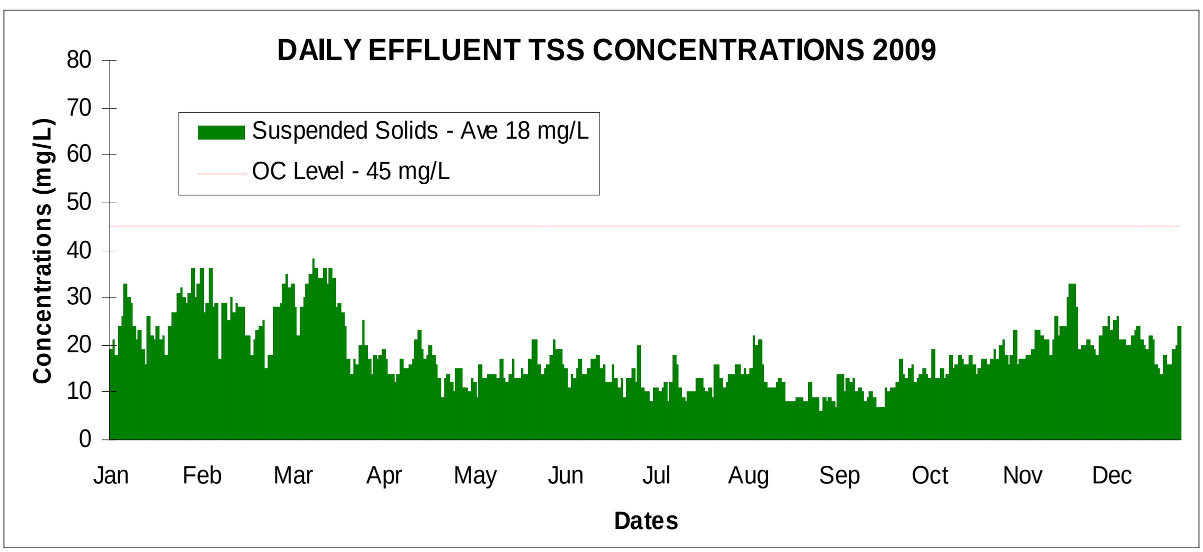
NW LANGLEY WWTP – 2009 Suspended Solids Concentrations Summary



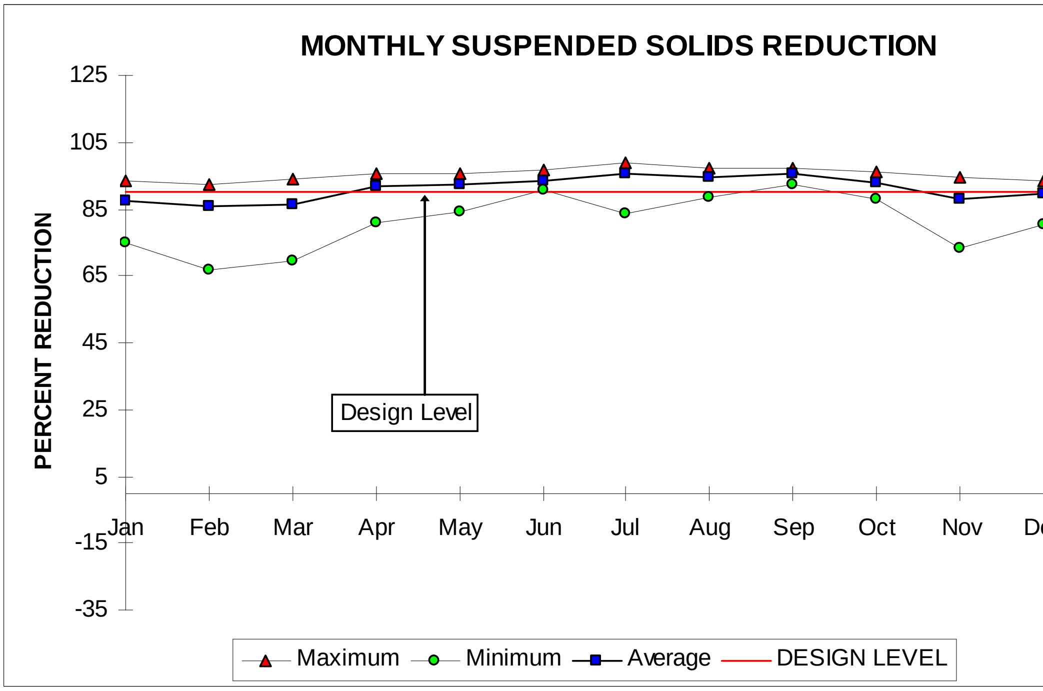
Mth	Max	Min	Ave
Jan	386	83	218
Feb	338	84	198
Mar	351	99	211
Apr	410	68	220
May	306	88	199
Jun	314	142	226
Jul	825	67	340
Aug	320	103	223
Sep	340	154	243
Oct	355	140	227
Nov	400	86	199
Dec	278	111	211



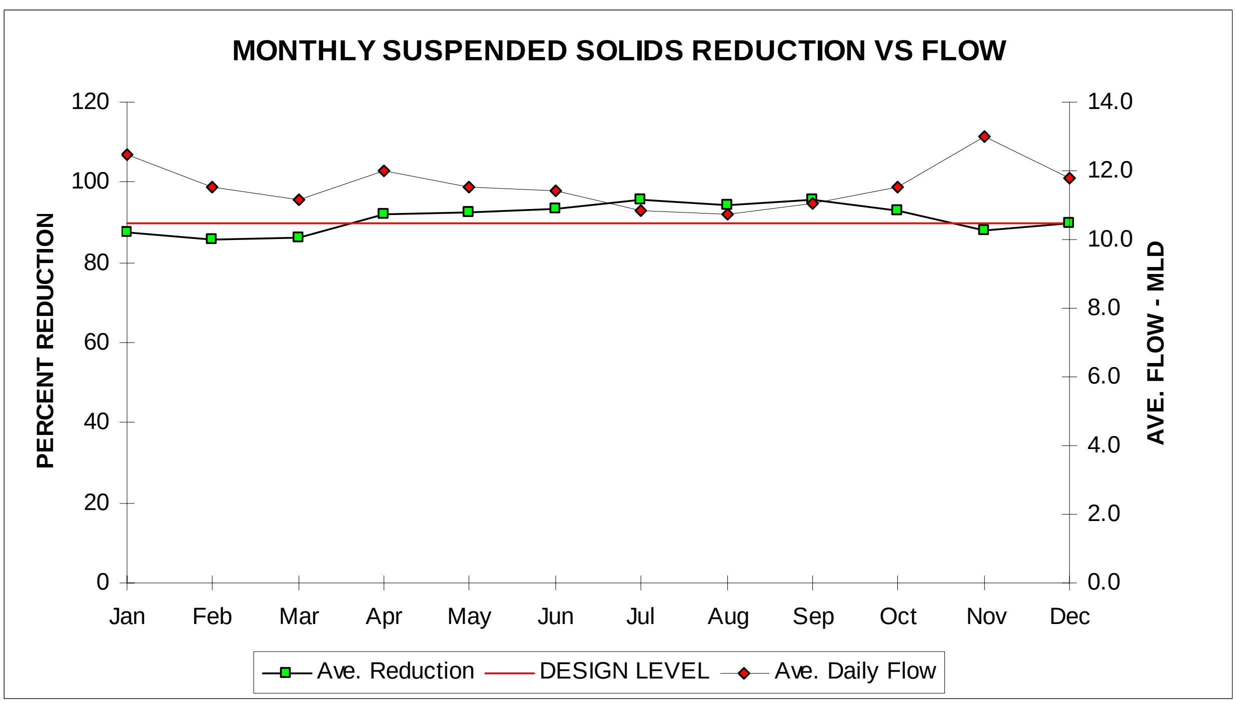
Mth	Max	Min	Ave
Jan	36	16	25
Feb	36	15	26
Mar	38	14	28
Apr	23	9	16
May	21	9	14
Jun	21	9	15
Jul	18	8	11
Aug	22	6	12
Sep	17	7	11
Oct	20	12	16
Nov	33	16	22
Dec	26	14	21



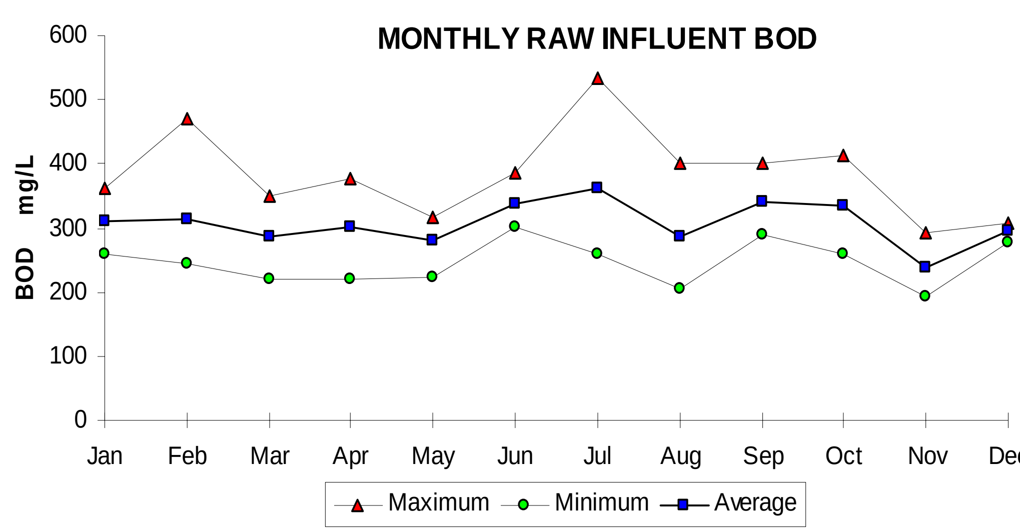
NW LANGLEY WWTP – 2009 Suspended Solids Reductions



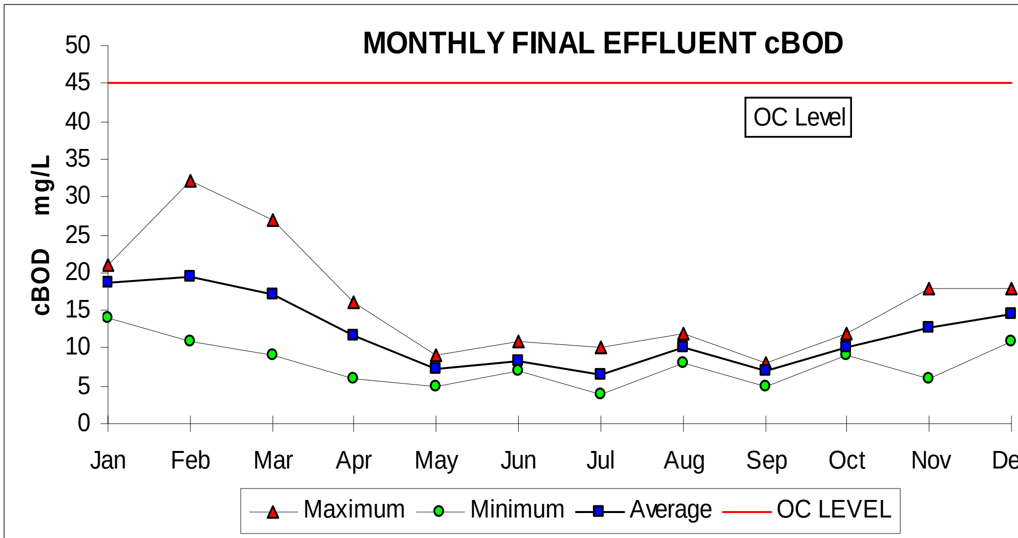
Mth	Max	Min	Ave
Jan	93	75	88
Feb	93	67	86
Mar	94	70	86
Apr	95	81	92
May	96	84	92
Jun	96	91	93
Jul	99	84	96
Aug	97	88	94
Sep	97	93	95
Oct	96	88	93
Nov	94	73	88
Dec	93	80	90



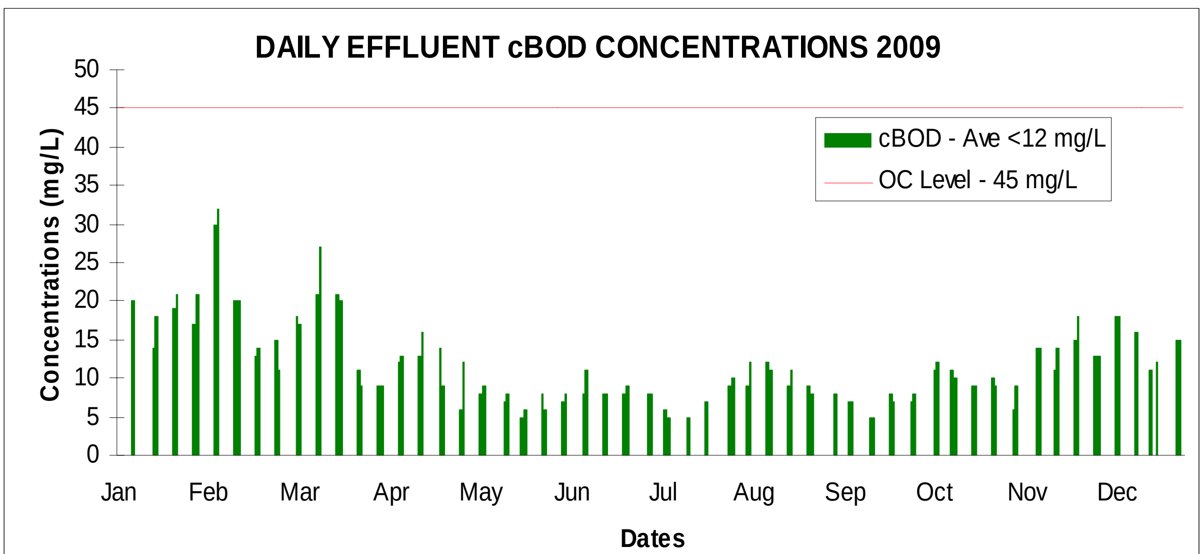
NW LANGLEY WWTP – 2009 BOD Concentrations Summary



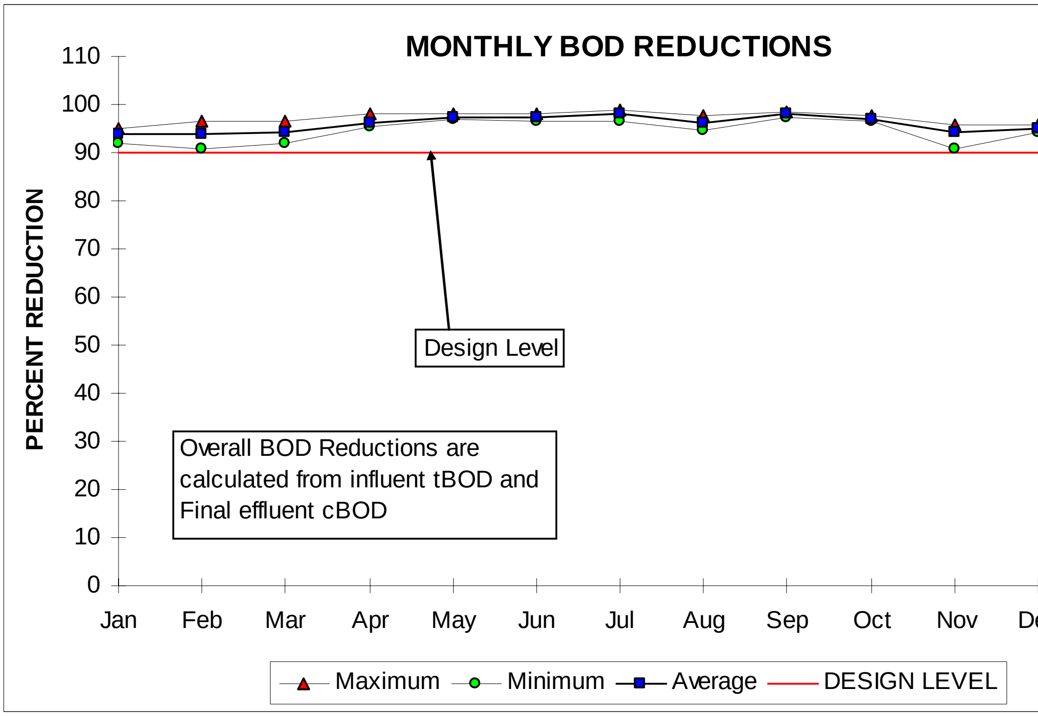
Mth	Max	Min	Ave
Jan	363	260	311
Feb	469	244	312
Mar	350	221	285
Apr	376	220	302
May	317	222	280
Jun	386	301	337
Jul	533	260	361
Aug	402	206	285
Sep	400	290	341
Oct	412	259	334
Nov	292	192	239
Dec	309	278	297



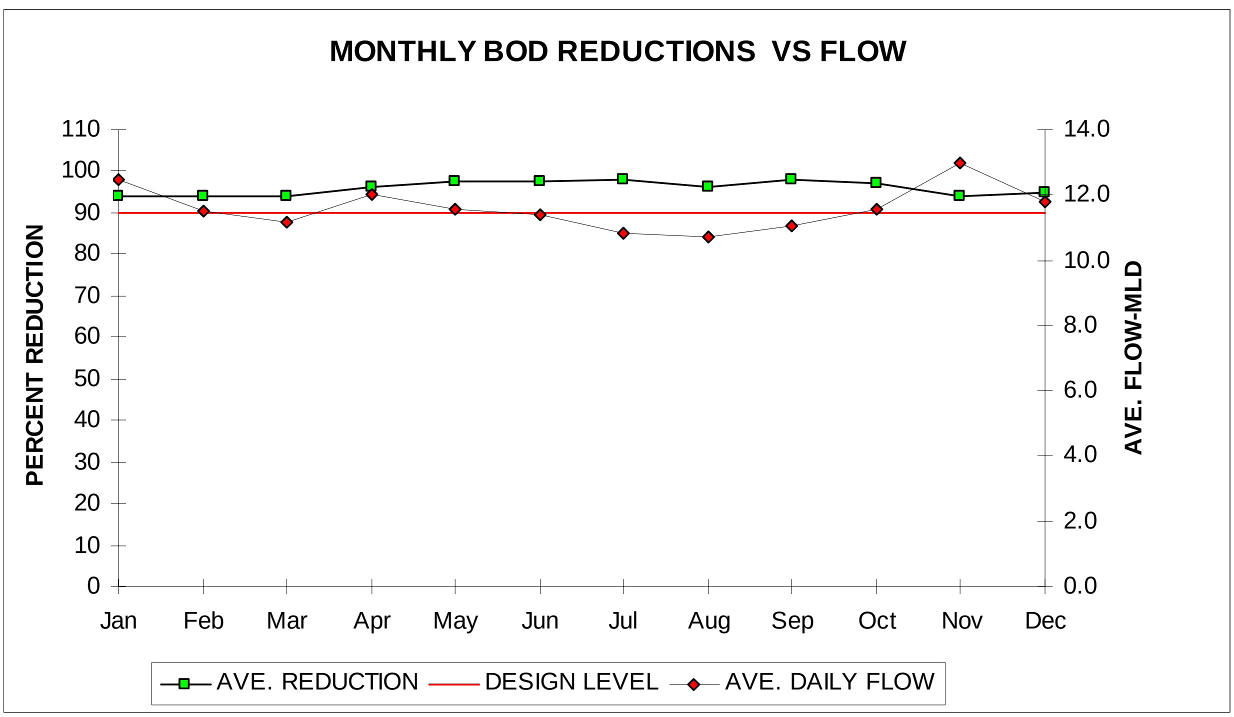
Mth	Max.	Min.	Ave.
Jan	21	14	19
Feb	32	11	19
Mar	27	9	17
Apr	16	6	12
May	9	5	7
Jun	11	7	8
Jul	10	4	7
Aug	12	8	10
Sep	8	5	7
Oct	12	9	10
Nov	18	6	13
Dec	18	11	15



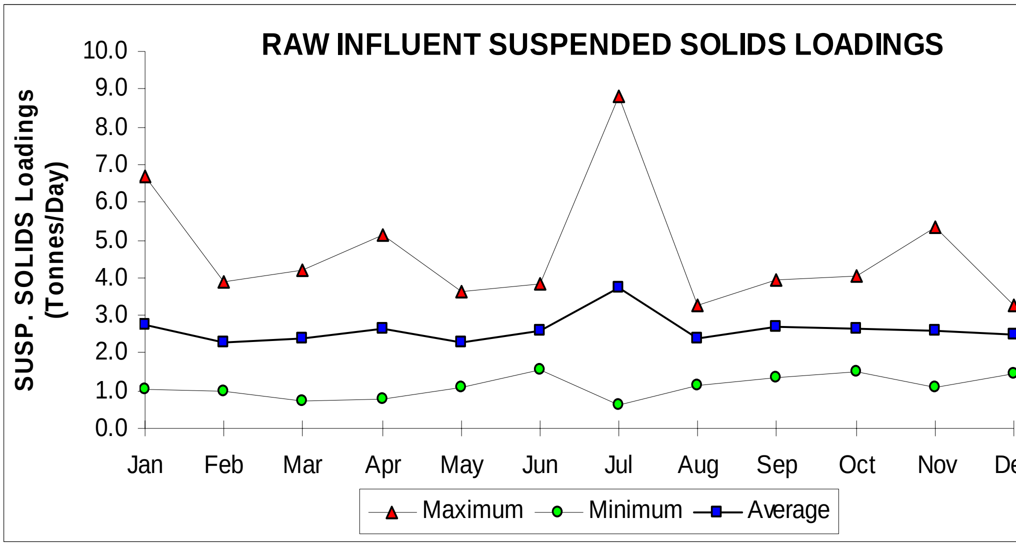
NW LANGLEY WWTP – 2009 BOD Reductions



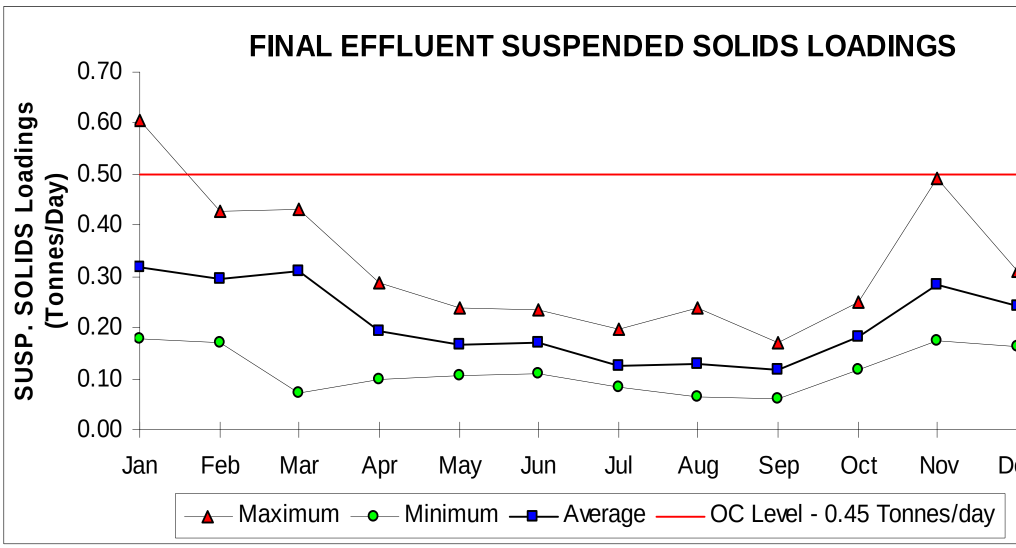
Mth	Max	Min	Ave
Jan	95	92	94
Feb	96	91	94
Mar	97	92	94
Apr	98	95	96
May	98	97	97
Jun	98	97	97
Jul	99	97	98
Aug	98	95	96
Sep	99	97	98
Oct	98	96	97
Nov	96	91	94
Dec	96	94	95



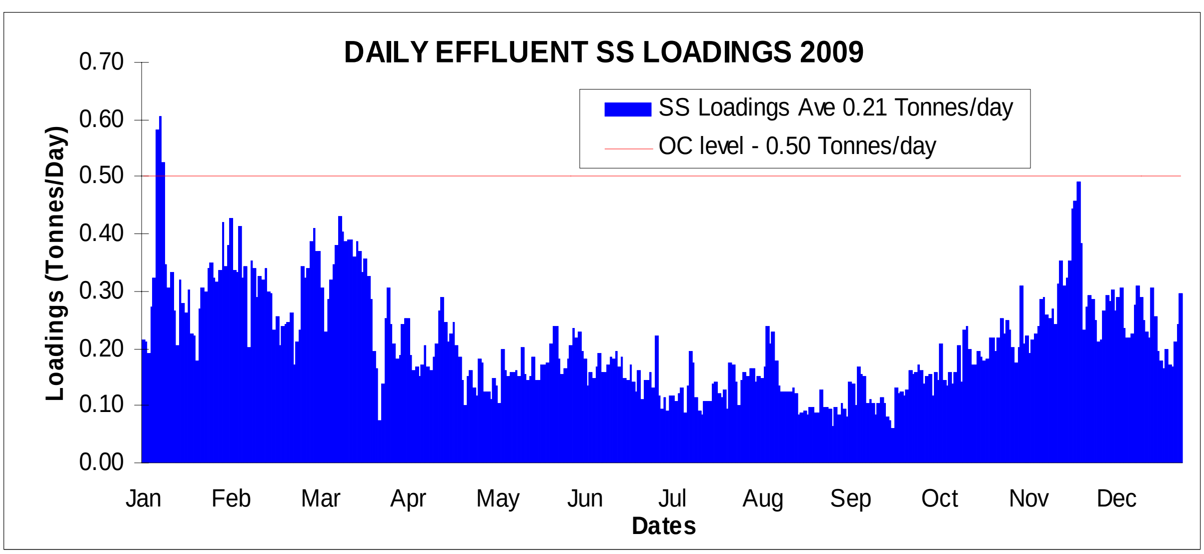
NW LANGLEY WWTP – 2009 Suspended Solids Loadings Summary



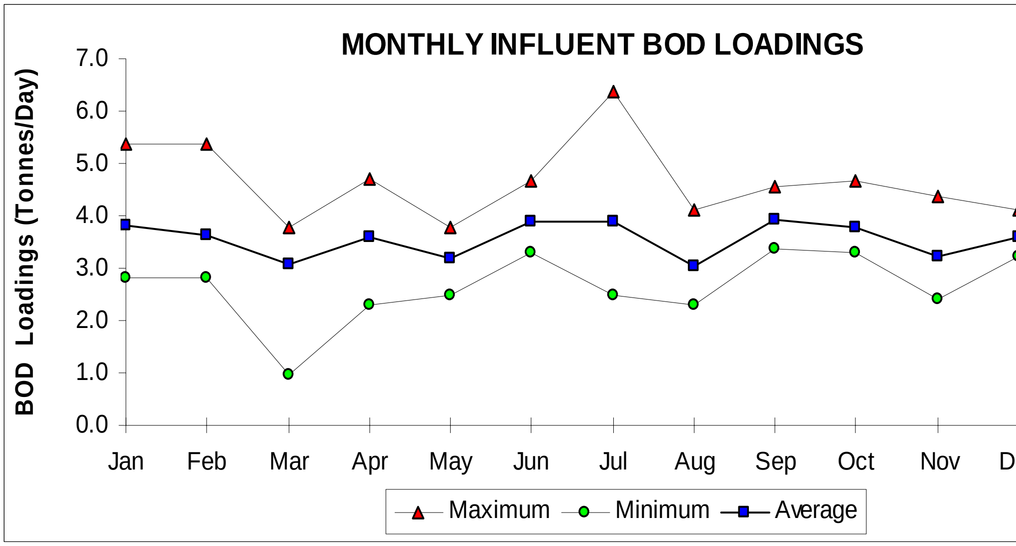
Mth	Max	Min	Ave
Jan	6.7	1.0	2.7
Feb	3.9	1.0	2.3
Mar	4.2	0.7	2.4
Apr	5.1	0.8	2.6
May	3.6	1.1	2.3
Jun	3.8	1.6	2.6
Jul	8.8	0.6	3.7
Aug	3.2	1.2	2.4
Sep	3.9	1.4	2.7
Oct	4.0	1.5	2.6
Nov	5.4	1.1	2.6
Dec	3.3	1.5	2.5



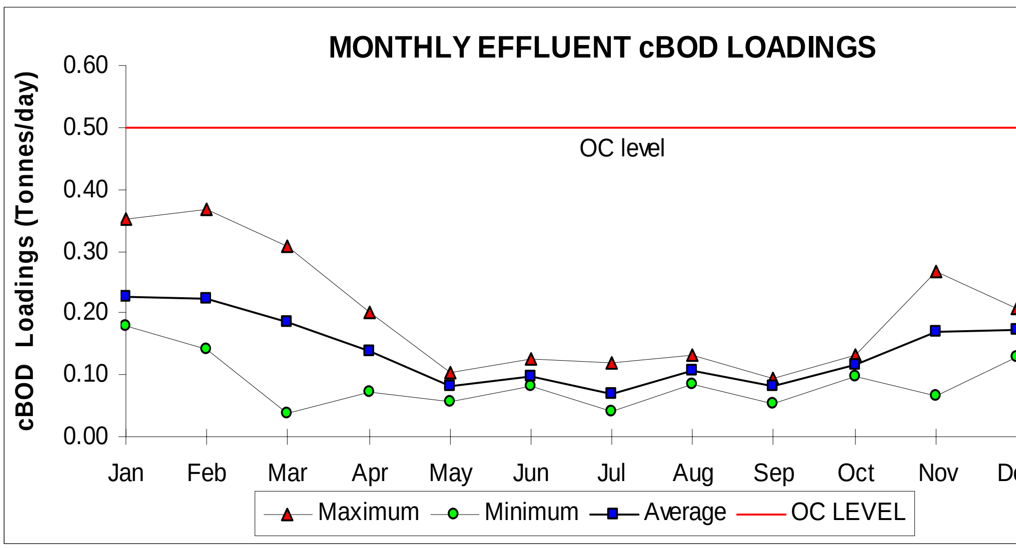
Mth	Max	Min	Ave
Jan	0.60	0.18	0.32
Feb	0.43	0.17	0.29
Mar	0.43	0.07	0.31
Apr	0.29	0.10	0.19
May	0.24	0.10	0.16
Jun	0.24	0.11	0.17
Jul	0.20	0.08	0.12
Aug	0.24	0.06	0.13
Sep	0.17	0.06	0.12
Oct	0.25	0.12	0.18
Nov	0.49	0.18	0.28
Dec	0.31	0.16	0.24



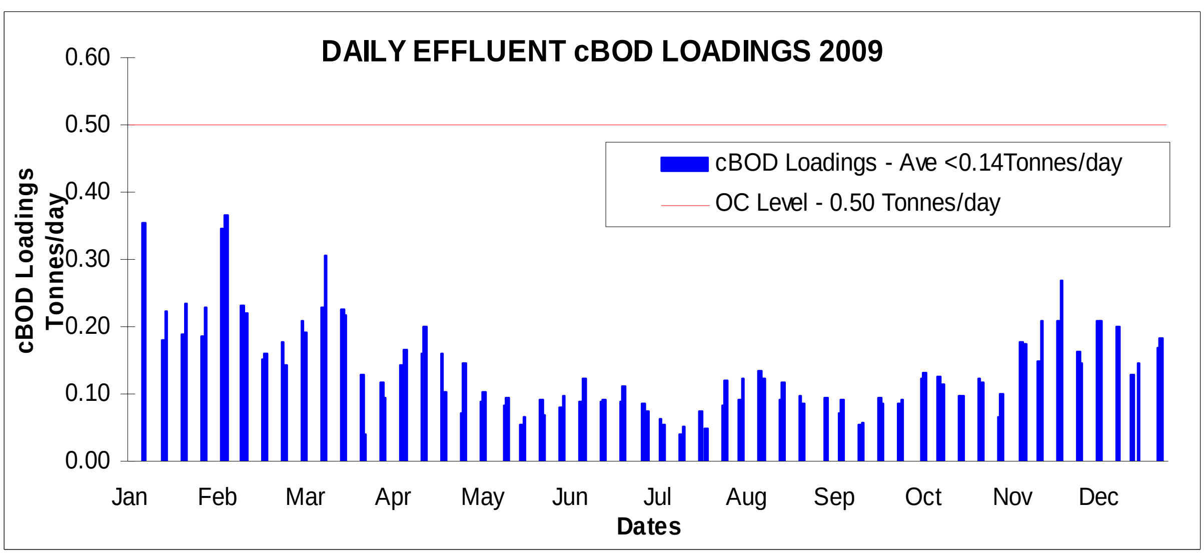
NW LANGLEY WWTP – 2009 BOD Loadings Summary



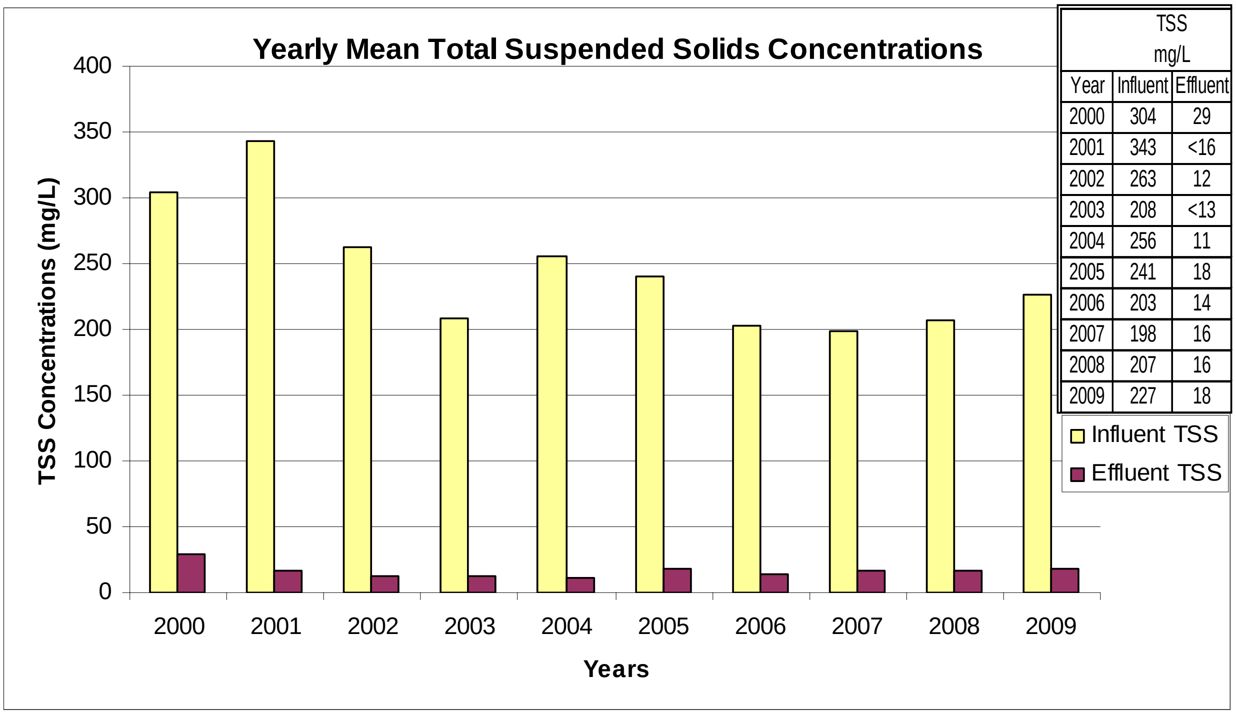
Mth	Max	Min	Ave
Jan	5.4	2.8	3.8
Feb	5.4	2.8	3.6
Mar	3.8	0.9	3.1
Apr	4.7	2.3	3.6
May	3.8	2.5	3.2
Jun	4.7	3.3	3.9
Jul	6.4	2.5	3.9
Aug	4.1	2.3	3.0
Sep	4.6	3.4	3.9
Oct	4.7	3.3	3.8
Nov	4.4	2.4	3.2
Dec	4.1	3.2	3.6



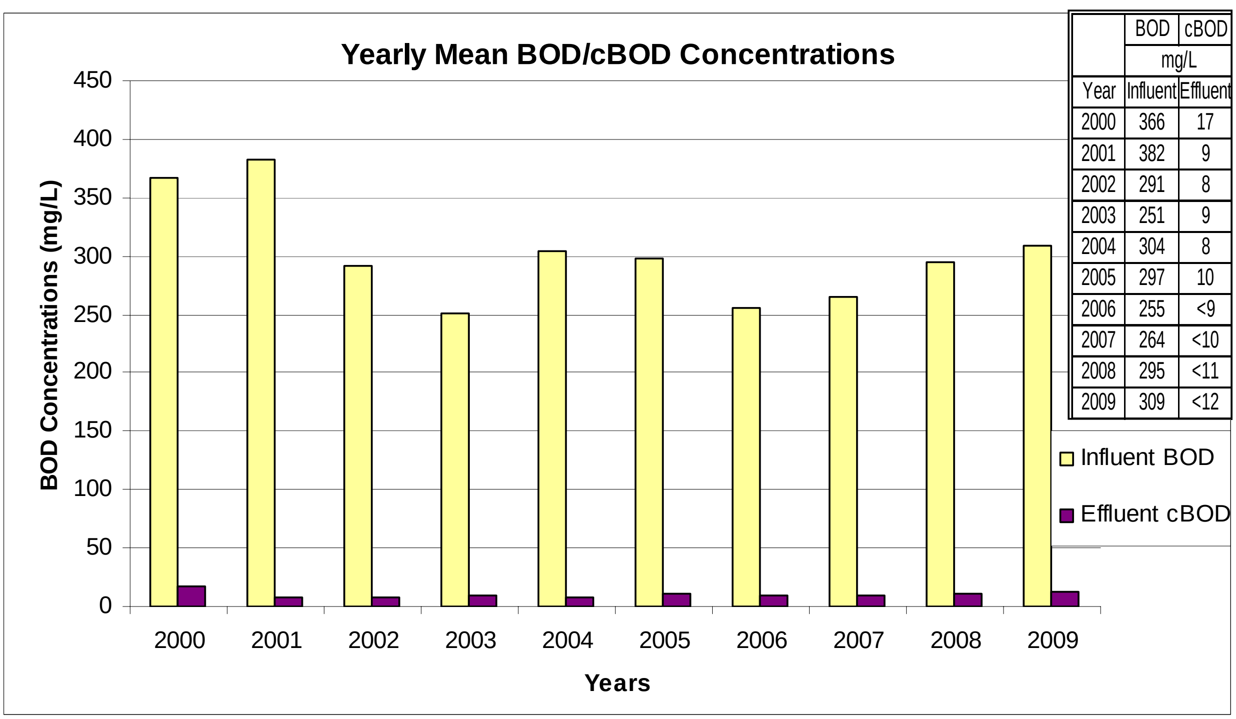
Mth	Max	Min	Ave
Jan	0.35	0.18	0.23
Feb	0.37	0.14	0.22
Mar	0.31	0.04	0.18
Apr	0.20	0.07	0.14
May	0.10	0.06	0.08
Jun	0.12	0.08	0.10
Jul	0.12	0.04	0.07
Aug	0.13	0.09	0.11
Sep	0.10	0.05	0.08
Oct	0.13	0.10	0.12
Nov	0.27	0.07	0.17
Dec	0.21	0.13	0.17



NW LANGLEY WWTP – 2000 - 2009 Historical Concentrations Comparison

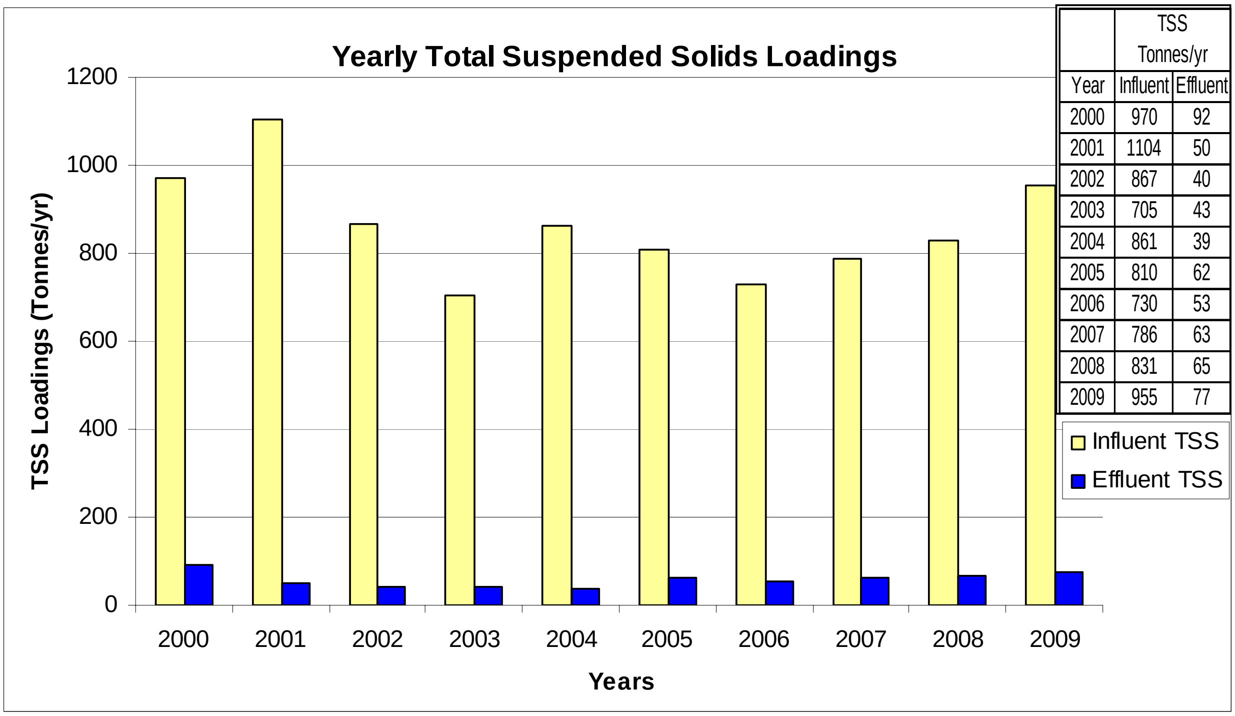


	TSS mg/L	
Year	Influent	Effluent
2000	304	29
2001	343	<16
2002	263	12
2003	208	<13
2004	256	11
2005	241	18
2006	203	14
2007	198	16
2008	207	16
2009	227	18

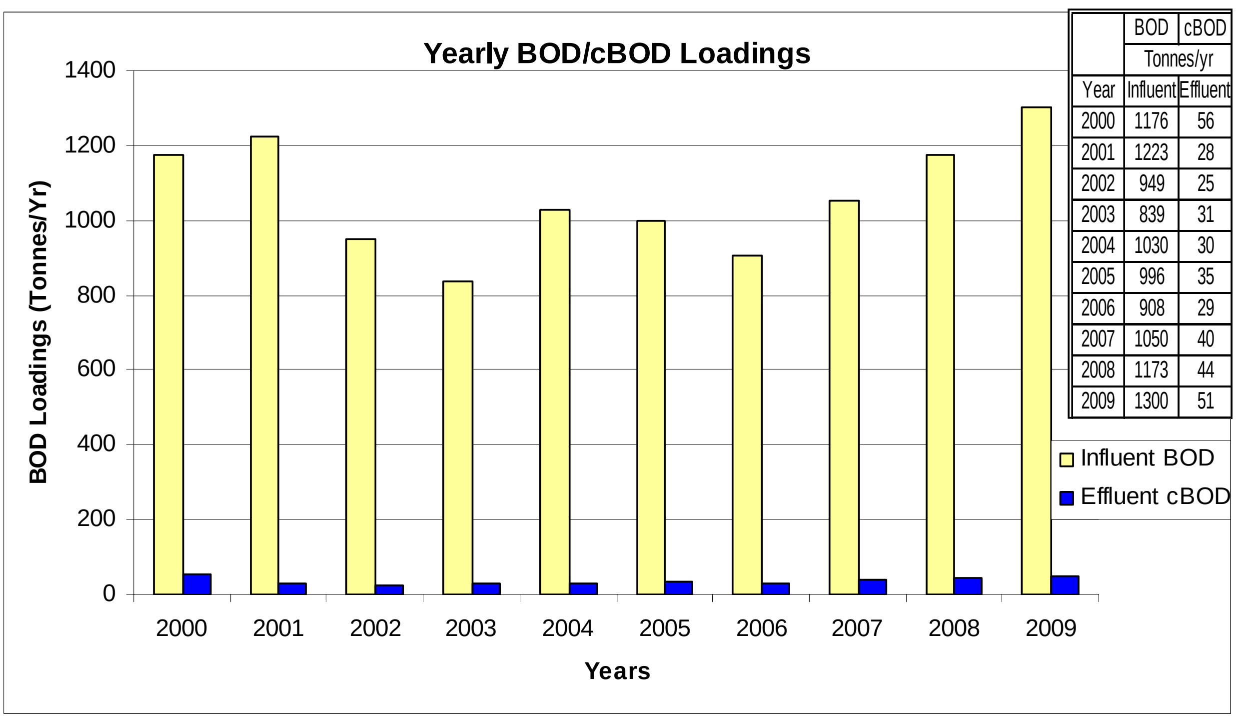


	BOD	cBOD
	mg/L	
Year	Influent	Effluent
2000	366	17
2001	382	9
2002	291	8
2003	251	9
2004	304	8
2005	297	10
2006	255	<9
2007	264	<10
2008	295	<11
2009	309	<12

NW LANGLEY WWTP –2000 - 2009 Historical Loadings Comparison



	TSS Tonnes/yr	
Year	Influent	Effluent
2000	970	92
2001	1104	50
2002	867	40
2003	705	43
2004	861	39
2005	810	62
2006	730	53
2007	786	63
2008	831	65
2009	955	77



	BOD	cBOD
	Tonnes/yr	
Year	Influent	Effluent
2000	1176	56
2001	1223	28
2002	949	25
2003	839	31
2004	1030	30
2005	996	35
2006	908	29
2007	1050	40
2008	1173	44
2009	1300	51

NW LANGLEY WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	35	43	42	41	38	40	43	41	44	39	44	38
NO3	Grab	1.08	0.22	0.36	0.29	0.23	0.02	0.12	0.02	<0.01	<0.01	0.26	0.66
NO2	Grab	0.13	0.05	0.20	0.09	0.08	0.04	0.47	0.28	0.05	<0.01	0.22	0.12
NH3	Comp.	23.0	27.0	25.2	27.7	21.8	24.0	24.6	23.4	25.5	25.1	24.3	24.3
SO4	Comp.	29.6	32.2	31.4	32.1	36.0	30.5	36.8	33.5	34.5	34.3	42.0	32.8
PTot	Comp.	6.1	11.5	10.8	11.2	8.5	8.4	11.2	11.9	11.5	7.4	11.7	6.3
PDis	Comp.	3.6	8.3	7.2	7.4	5.3	5.7	7.7	8.3	8.0	4.2	8.1	3.7
MBAS	Grab	0.8	1.3	1.0	1.5	1.2	1.8	1.4	1.2	1.3	1.5	1.2	0.7
O&G	Grab	16	37	30	44	25	45	125	45	45	35	36	78
Phenol	Grab	0.02	0.03	0.03	0.02	0.04	0.03	0.02	0.02	0.03	0.03	0.02	0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	1.12	1.42	1.91	1.55	1.23	0.90	1.34	1.12	1.16	0.85	0.88	1.00
AlDis	Comp.	0.13	0.22	0.22	0.17	0.17	0.17	0.22	0.17	0.14	0.11	0.13	0.16
AsTot	Comp.	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
BaTot	Comp.	0.039	0.037	0.049	0.045	0.037	0.032	0.040	0.033	0.026	0.034	0.030	0.042
BaDis	Comp.	0.008	0.006	0.006	0.005	0.006	0.006	0.006	0.005	0.005	0.005	0.007	0.008
BTot	Comp.	0.15	0.20	0.16	0.20	0.18	0.18	0.16	0.18	0.16	0.18	0.18	0.17
BDis	Comp.	0.14	0.20	0.15	0.20	0.17	0.18	0.16	0.19	0.15	0.18	0.17	0.17
CaTot	Comp.	20.8	11.9	16.5	15.7	14.6	12.9	14.4	14.5	15.1	15.2	16.9	16.5
CdTot	Comp.	<0.0005	0.0007	0.0005	0.0005	<0.0005	0.0006	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
CrTot	Comp.	0.014	0.013	0.018	0.016	0.016	0.013	0.011	0.011	0.011	0.010	0.011	0.013
CrDis	Comp.	0.008	0.007	0.009	0.008	0.008	0.007	0.006	0.006	0.006	0.005	0.007	0.007
CoTot	Comp.	<0.001	0.001	0.002	0.002	0.001	<0.001	0.001	<0.001	<0.001	0.002	0.001	0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.134	0.103	0.170	0.148	0.144	0.126	0.145	0.156	0.132	0.146	0.141	0.126
CuDis	Comp.	0.029	0.017	0.032	0.024	0.027	0.028	0.025	0.018	0.021	0.025	0.025	0.023
FeTot	Comp.	1.34	1.24	1.91	1.19	1.00	0.89	0.89	1.01	1.08	0.77	0.78	0.95
FeDis	Comp.	0.27	0.27	0.25	0.24	0.22	0.32	0.27	0.23	0.26	0.20	0.25	0.22
PbTot	Comp.	0.004	0.009	0.008	0.006	0.005	0.006	0.007	0.011	0.004	0.007	0.009	0.004
PbDis	Comp.	0.001	0.002	0.001	<0.001	0.001	0.002	0.002	0.002	<0.001	0.001	0.002	<0.001
MgTot	Comp.	5.95	3.28	5.31	5.38	4.63	3.83	4.74	4.26	4.99	4.94	5.73	5.20
MnTot	Comp.	0.084	0.075	0.080	0.074	0.063	0.075	0.080	0.073	0.087	0.067	0.073	0.078
MnDis	Comp.	0.054	0.047	0.042	0.040	0.039	0.052	0.054	0.048	0.056	0.041	0.051	0.054
HgTot	Comp.	0.27	0.13	0.20	0.15	0.20	0.11	0.13	0.13	0.21	0.12	0.15	0.17
MoTot	Comp.	0.004	0.003	0.003	0.005	0.004	0.005	0.003	0.003	0.005	0.005	0.004	0.003
MoDis	Comp.	0.002	<0.002	<0.002	0.003	0.003	0.003	0.002	<0.002	0.002	0.003	0.003	0.002
NiTot	Comp.	0.006	0.010	0.008	0.004	0.005	0.022	0.006	0.005	0.005	0.006	0.010	0.004
NiDis	Comp.	0.003	0.005	0.004	0.002	0.002	0.016	0.003	0.003	0.002	0.002	0.005	0.002
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.147	0.155	0.196	0.199	0.151	0.146	0.187	0.187	0.154	0.161	0.160	0.157
ZnDis	Comp.	0.068	0.071	0.068	0.063	0.071	0.054	0.081	0.071	0.067	0.064	0.072	0.077

Note: All results reported are in mg/L except for Mercury which is reported in ug/L.

NW LANGLEY WWTP – 2009 Comprehensive Effluent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	25	28	30	30	20	6	8	9	4	6	8	15
NO3	Grab	1.51	0.24	0.02	0.44	6.57	17.5	15.9	2.32	9.81	11.1	10.3	6.16
NO2	Grab	0.12	0.17	0.02	0.38	0.38	0.07	0.55	6.32	<0.01	0.06	0.79	0.36
NH3	Comp.	21.3	22.3	23.9	27.9	15.5	1.9	4.3	5.0	0.6	1.6	3.4	10.3
SO4	Comp.	33.7	31.7	34.3	37.1	35.4	28.2	36.1	33.3	35.1	37.5	34.7	36.0
PTot	Comp.	4.1	5.7	6.7	7.2	5.6	5.5	7.3	5.0	4.5	5.4	4.9	5.4
PDis	Comp.	3.4	4.3	5.2	5.8	4.8	4.8	6.2	4.5	4.0	4.8	4.0	4.7
MBAS	Grab	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	<0.1	0.2	0.1	0.2
O&G	Grab	<6	6	<7	<6	<6	<6	<6	<6	<7	<6	<7	<5
Phenol	Grab	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.15	0.14	0.20	0.13	0.12	0.18	0.16	0.13	0.10	0.11	0.14	0.13
AlDis	Comp.	0.03	0.06	0.06	0.04	0.03	0.06	0.06	0.04	0.04	0.04	0.06	0.09
AsTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.005	0.005	0.007	0.005	0.004	0.007	0.005	0.005	0.005	0.005	0.006	0.005
BaDis	Comp.	0.003	0.003	0.004	0.003	0.003	0.004	0.003	0.004	0.003	0.004	0.004	0.004
BTot	Comp.	0.14	0.17	0.17	0.18	0.18	0.19	0.19	0.17	0.18	0.21	0.18	0.16
BDis	Comp.	0.14	0.16	0.16	0.17	0.17	0.18	0.18	0.17	0.17	0.21	0.17	0.16
CaTot	Comp.	14.5	10.6	13.2	13.9	13.1	12.3	12.7	12.2	14.4	14.2	15.0	15.1
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.005	0.004	0.004	0.004	0.003	0.005	0.003	0.003	0.003	0.003	0.003	0.004
CrDis	Comp.	0.004	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.003	0.004
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.028	0.026	0.025	0.026	0.022	0.034	0.027	0.018	0.016	0.023	0.034	0.025
CuDis	Comp.	0.015	0.009	0.007	0.015	0.015	0.026	0.022	0.015	0.012	0.018	0.016	0.014
FeTot	Comp.	0.20	0.19	0.21	0.18	0.14	0.17	0.17	0.14	0.13	0.15	0.15	0.21
FeDis	Comp.	0.09	0.10	0.10	0.09	0.08	0.08	0.10	0.09	0.08	0.08	0.09	0.15
PbTot	Comp.	0.002	0.002	0.001	0.001	<0.001	<0.001	0.002	0.002	<0.001	<0.001	0.002	0.001
PbDis	Comp.	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001
MgTot	Comp.	4.37	2.88	4.49	4.65	4.25	3.79	3.95	3.48	3.89	4.60	5.03	4.72
MnTot	Comp.	0.055	0.055	0.053	0.047	0.046	0.061	0.055	0.046	0.064	0.049	0.055	0.053
MnDis	Comp.	0.049	0.047	0.046	0.039	0.041	0.055	0.048	0.043	0.058	0.044	0.049	0.049
HgTot	Comp.	0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MoTot	Comp.	<0.002	0.003	0.002	<0.002	<0.002	0.002	0.002	<0.002	0.002	0.002	0.003	<0.002
MoDis	Comp.	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	0.003	0.002	0.003	<0.002
NiTot	Comp.	0.005	0.009	0.008	0.008	0.007	0.069	0.011	0.005	0.014	0.006	0.012	0.004
NiDis	Comp.	0.004	0.007	0.007	0.006	0.005	0.063	0.010	0.005	0.013	0.006	0.011	0.004
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.058	0.086	0.066	0.080	0.069	0.081	0.114	0.071	0.069	0.069	0.084	0.074
ZnDis	Comp.	0.046	0.060	0.053	0.057	0.062	0.069	0.101	0.064	0.061	0.060	0.072	0.069

Note: All results reported are in mg/L except for Mercury which is reported in ug/L.

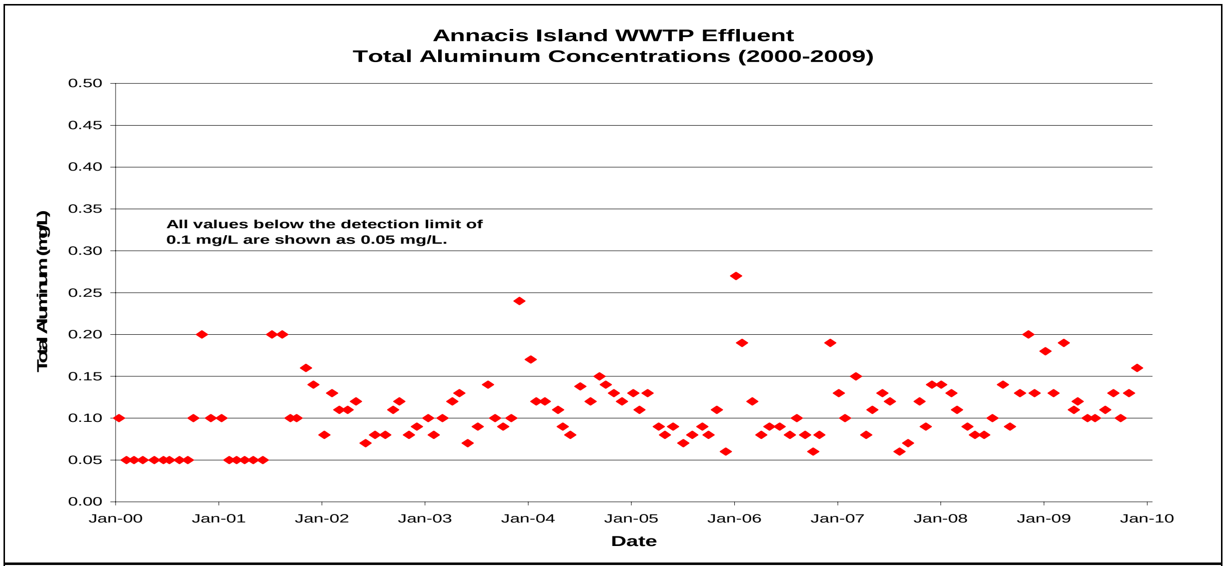
- Some metals results (eg., Nickel values) may be higher in the effluent than the influent because of long retention times in the equalization pond.

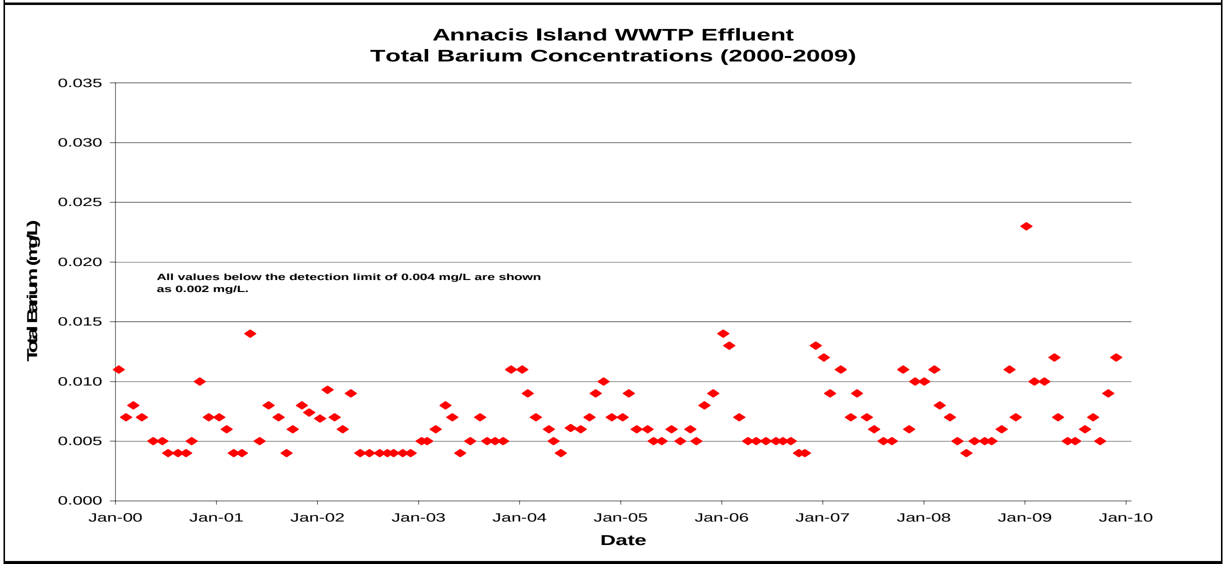
APPENDIX B

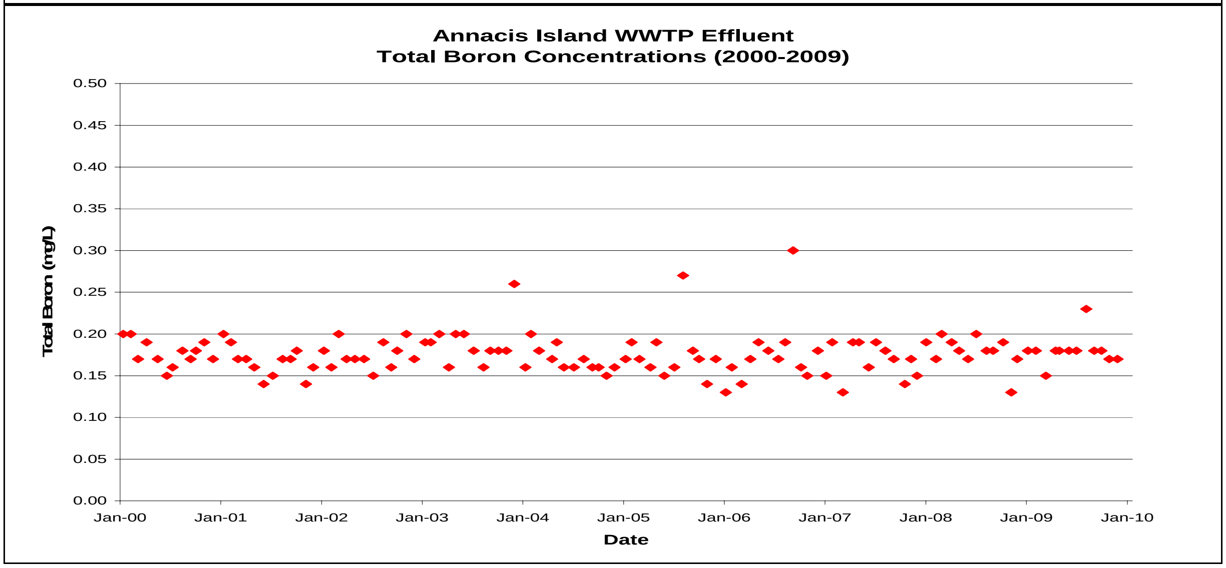
Additional Monitoring Data – Effluent Quality*

*10 year Summary - Selected Parameters based on current Operational Certificates and previous Permit Requirements.

Effluent Data Annacis WWTP







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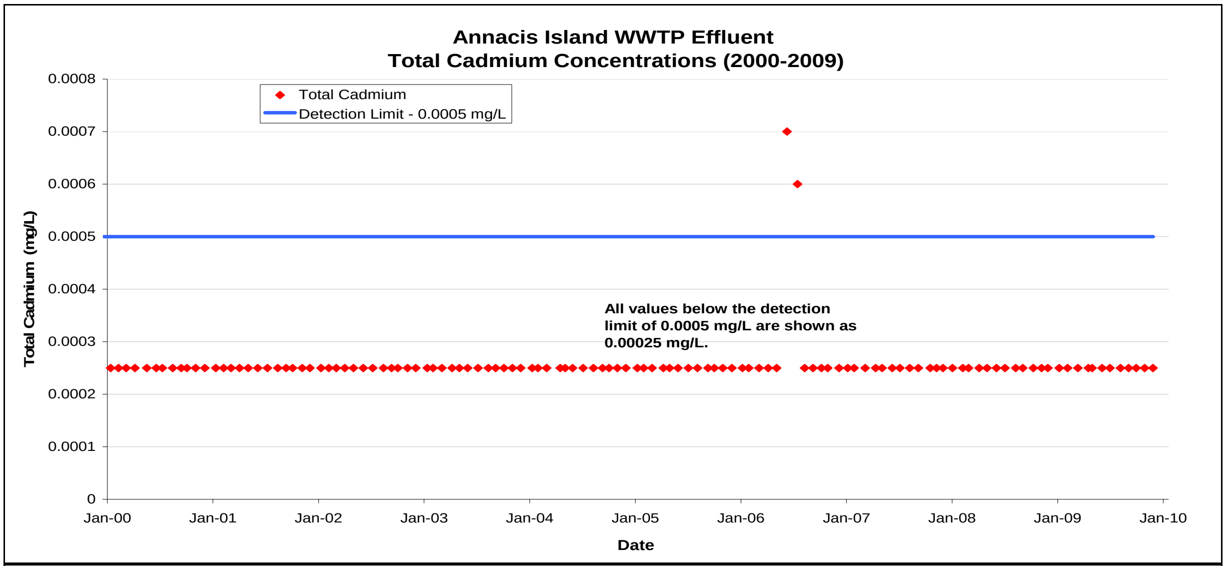

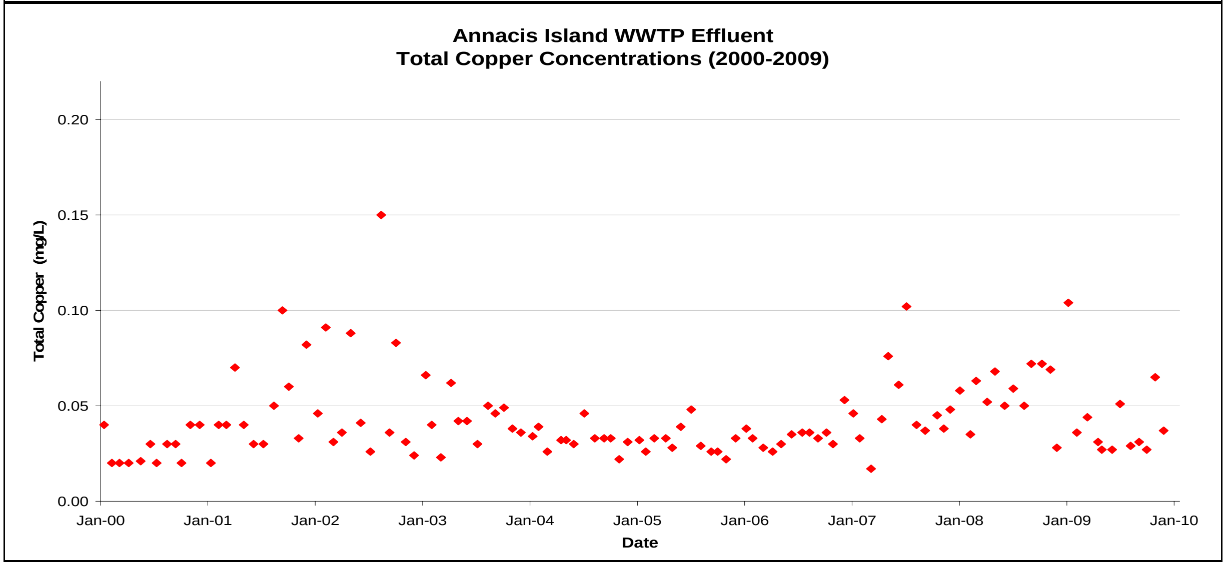

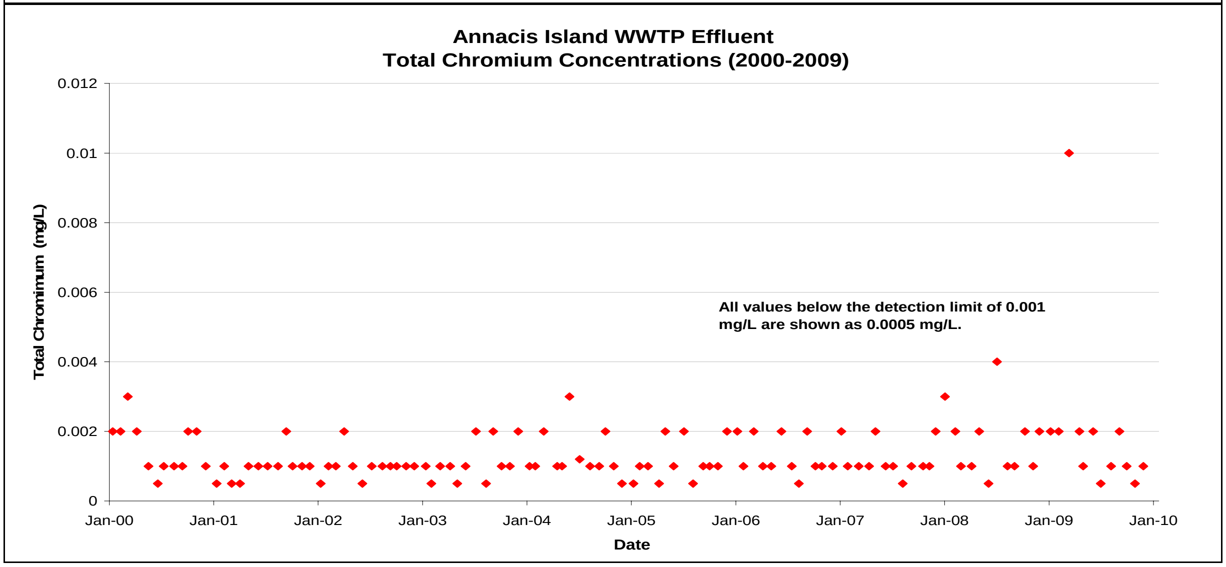

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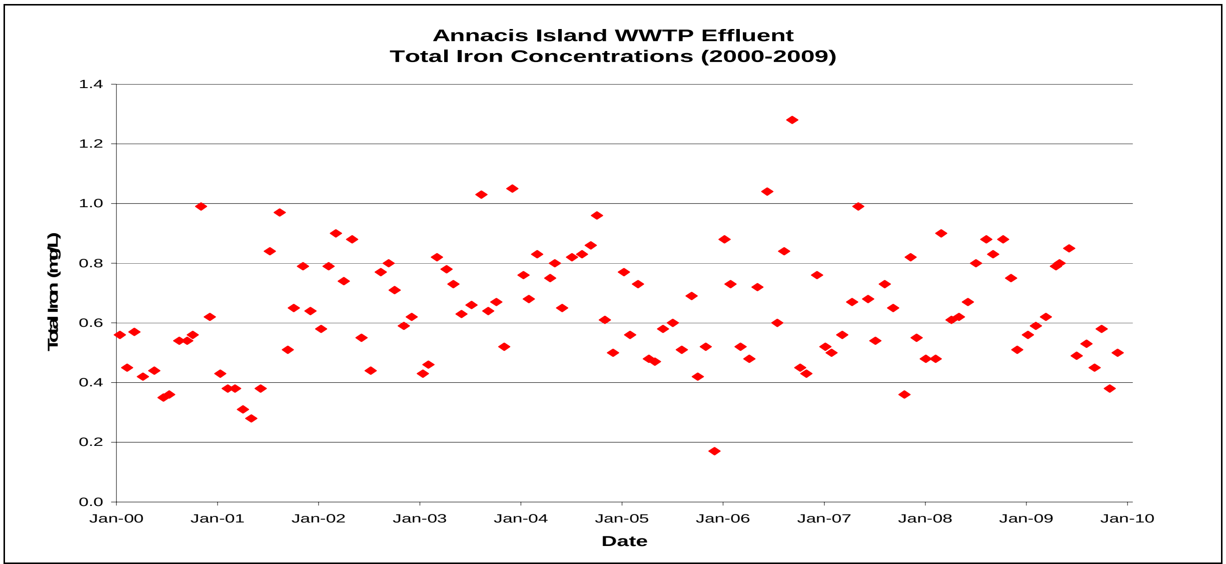

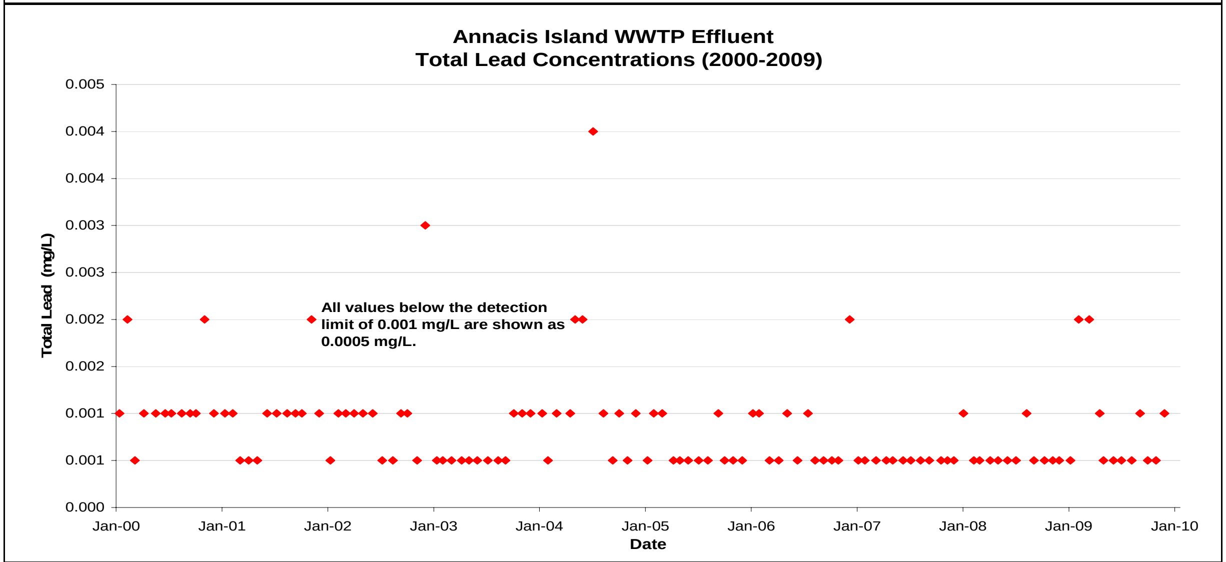

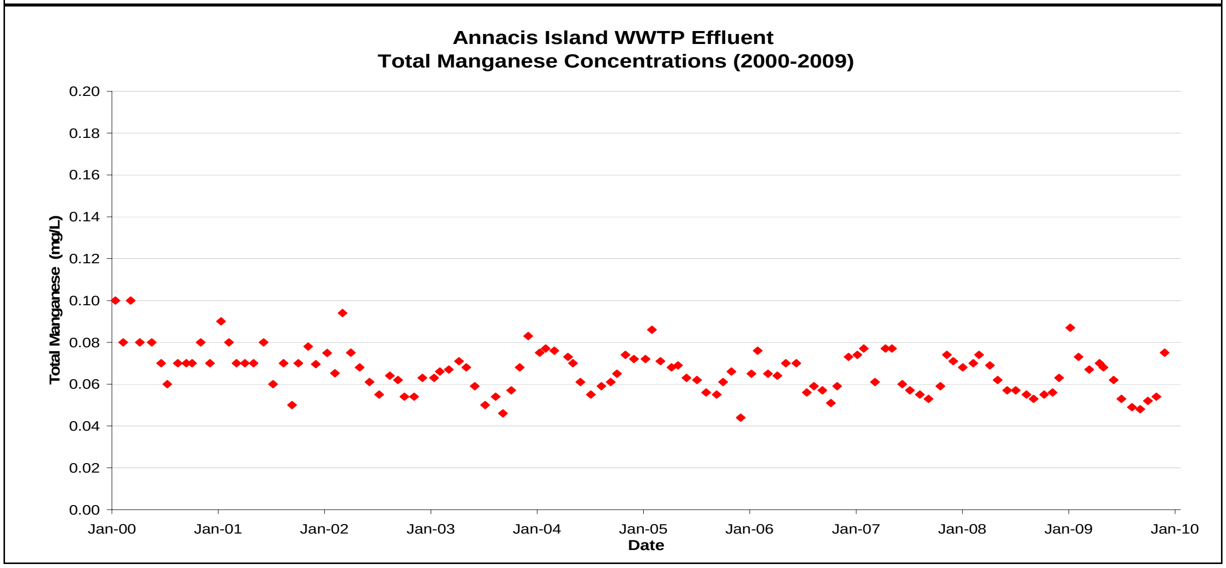

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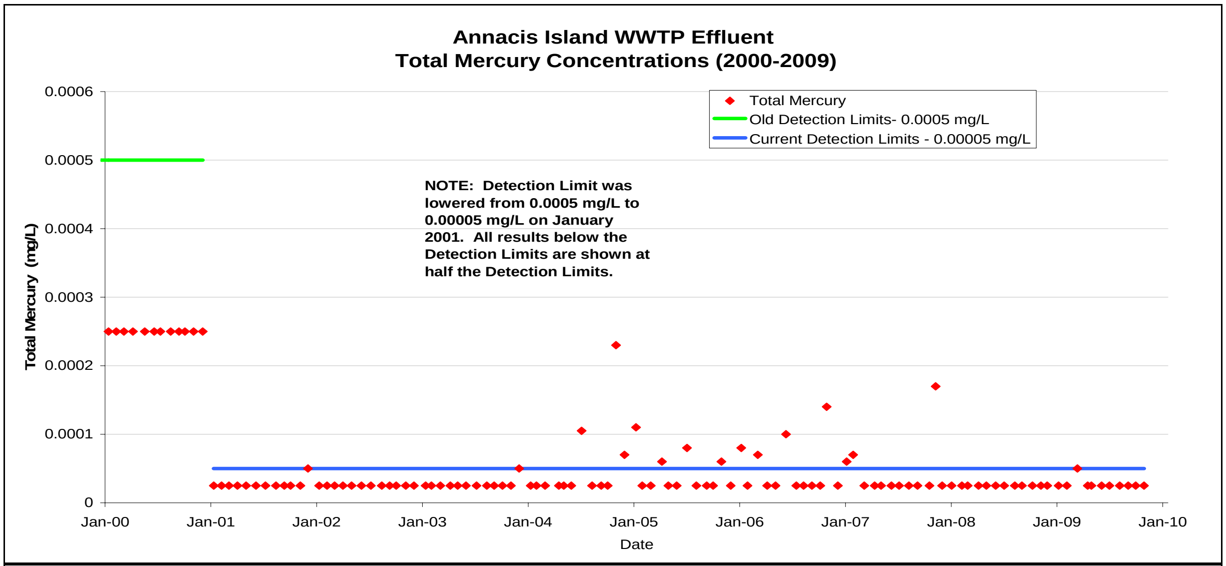

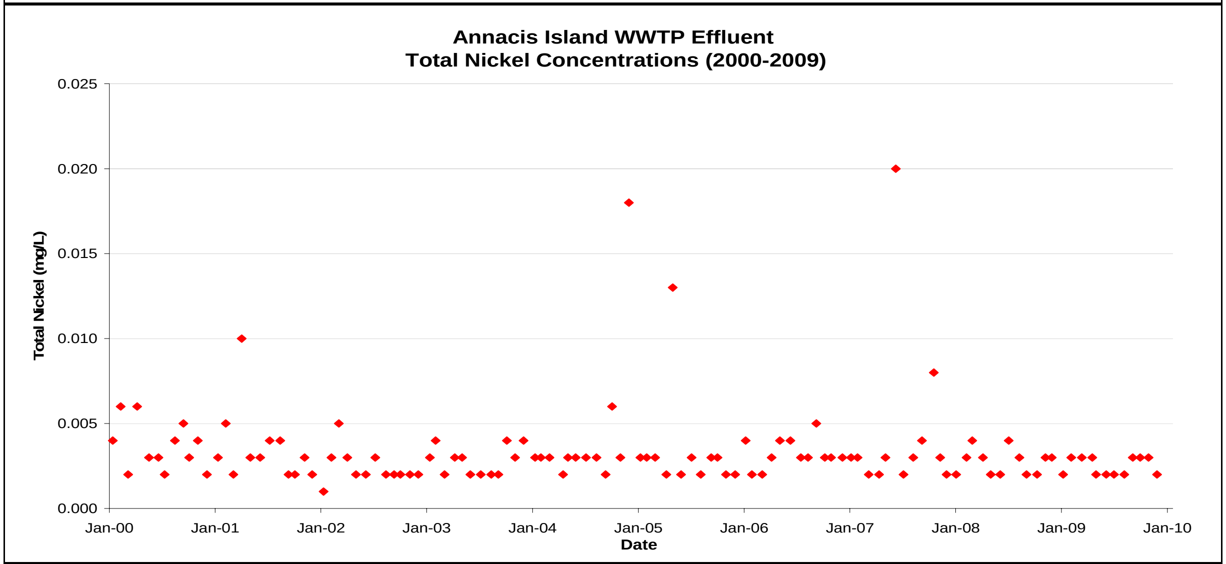

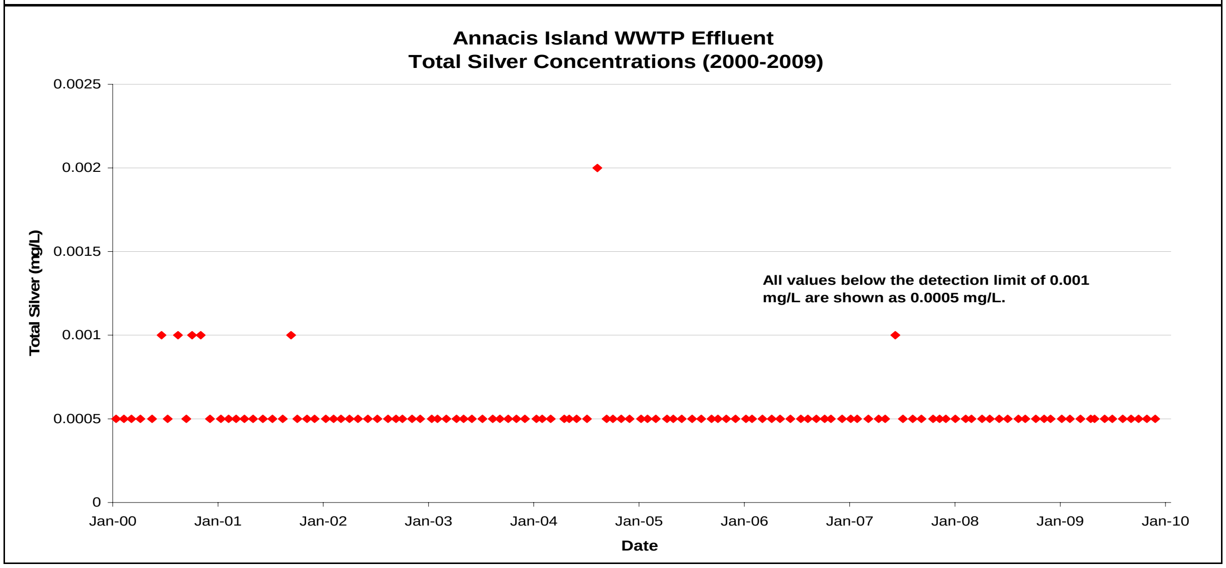

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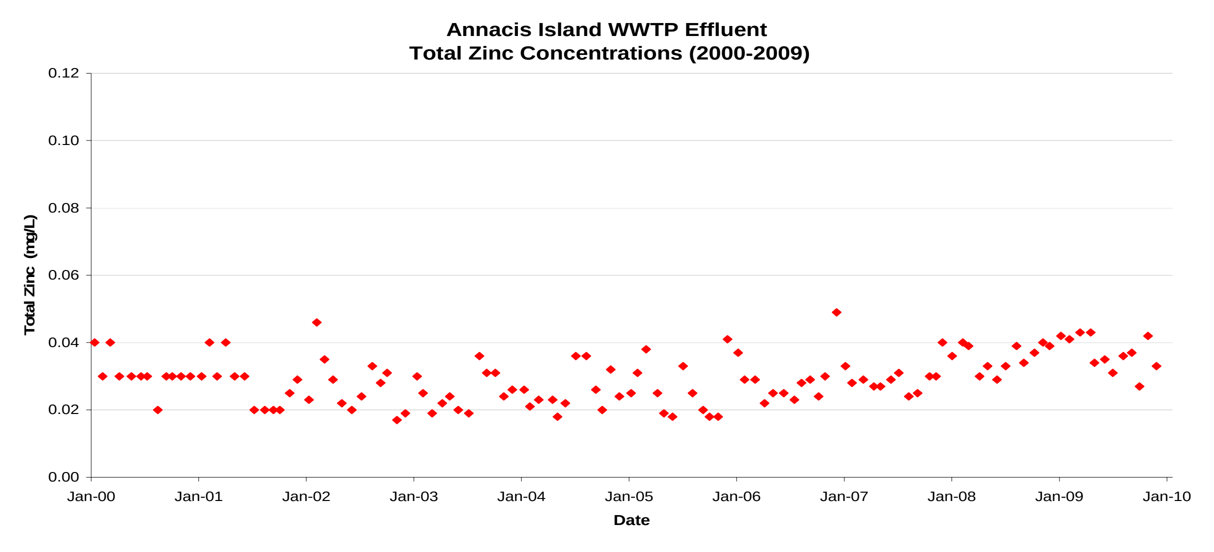
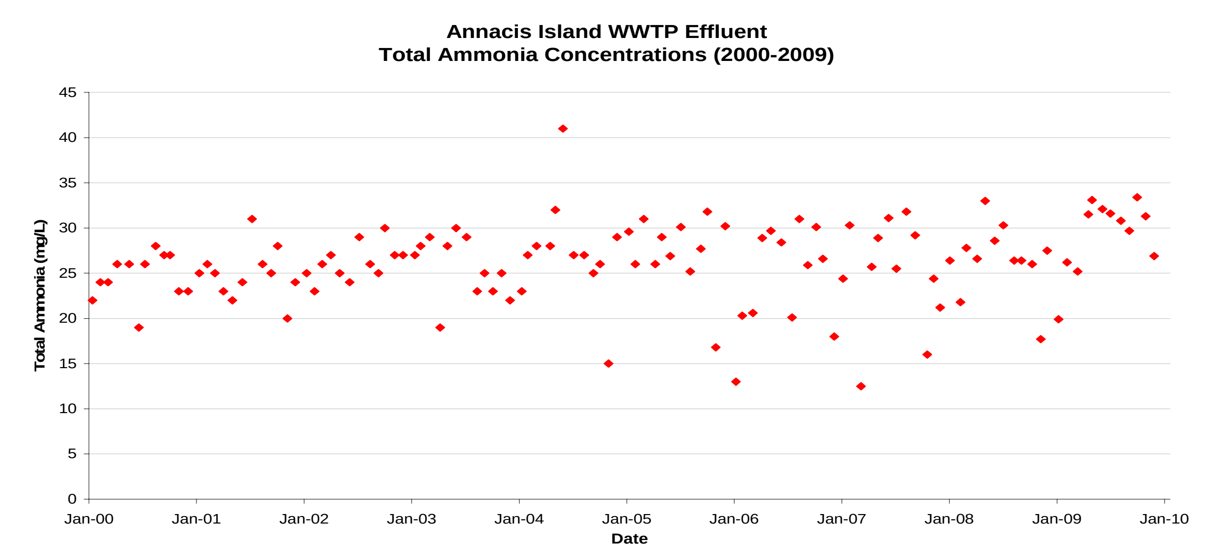
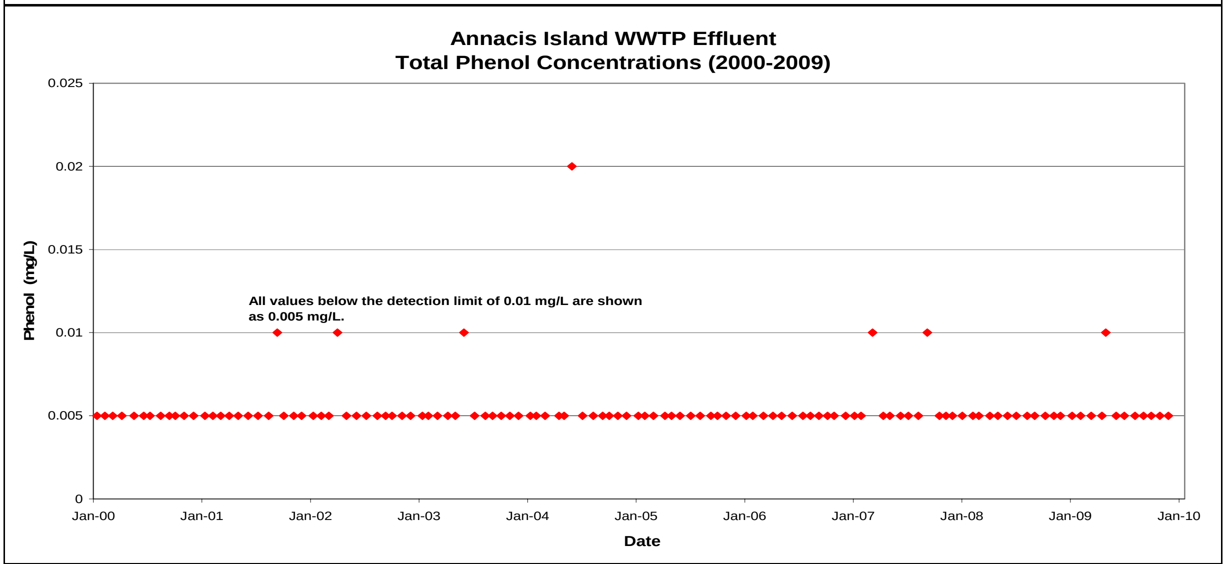
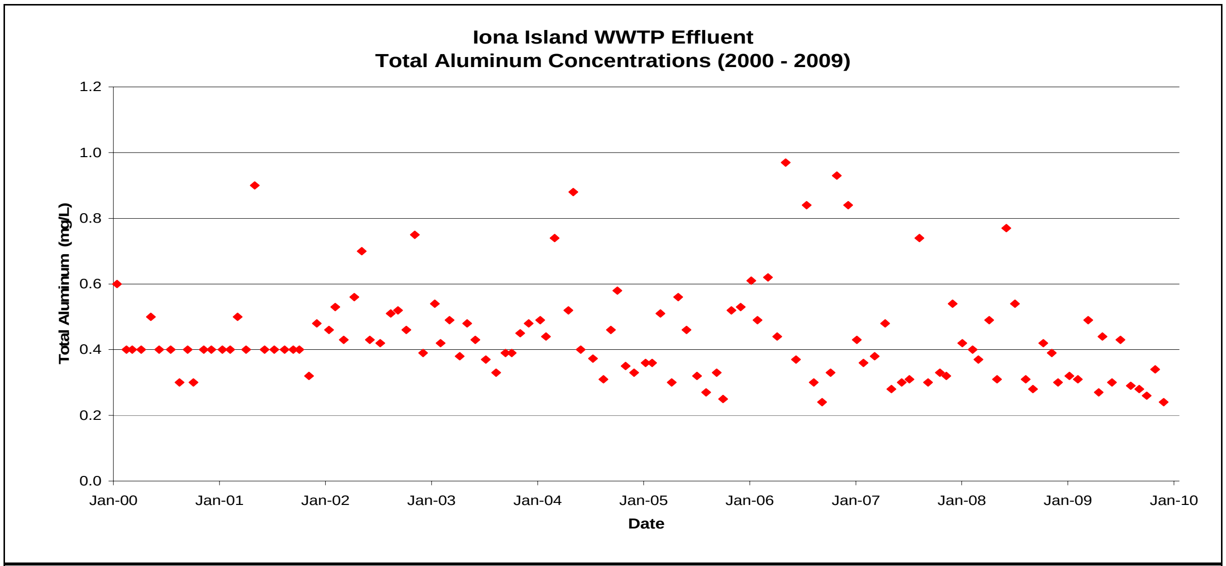
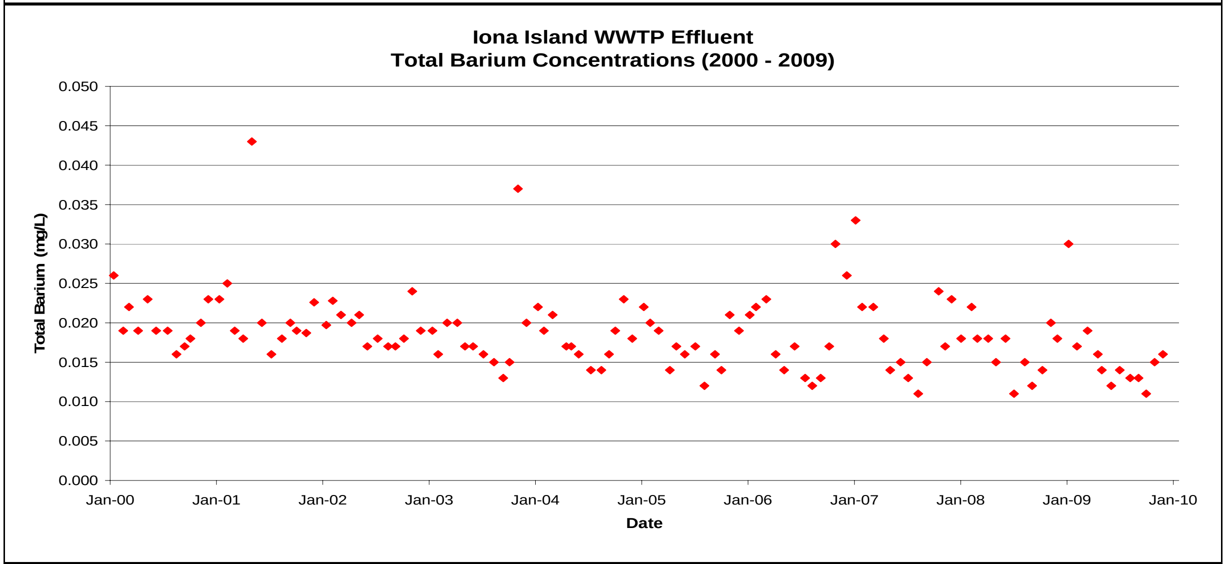


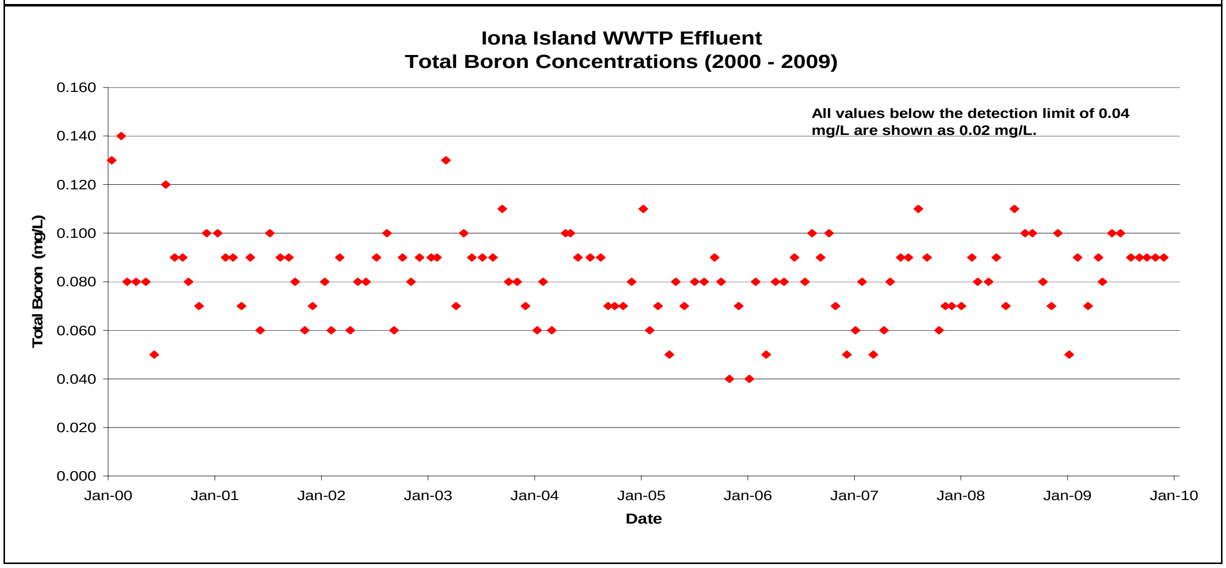




Effluent Data Iona WWTP







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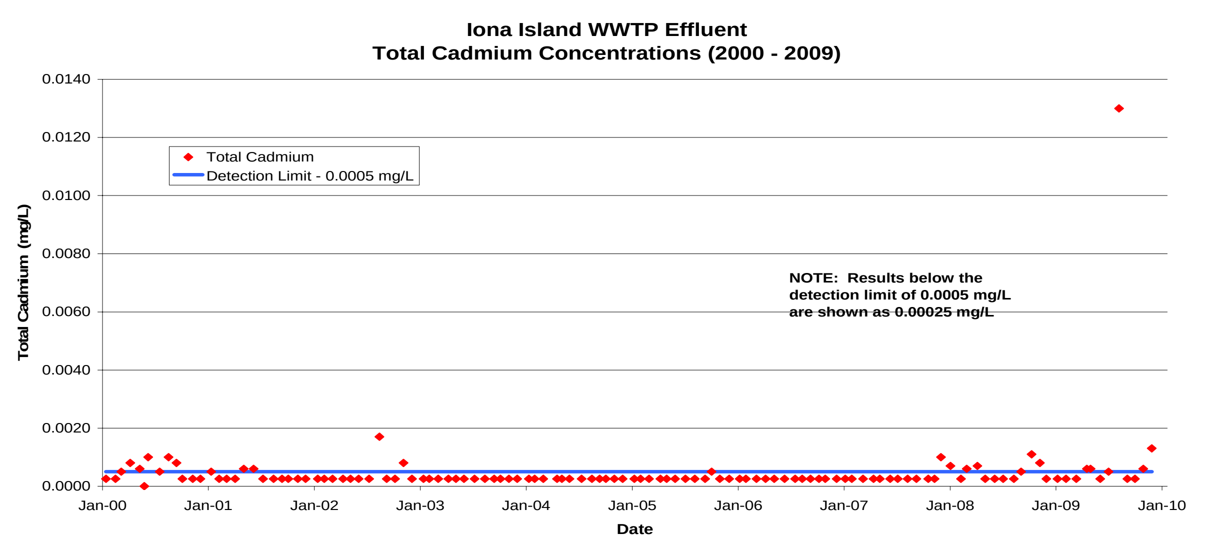

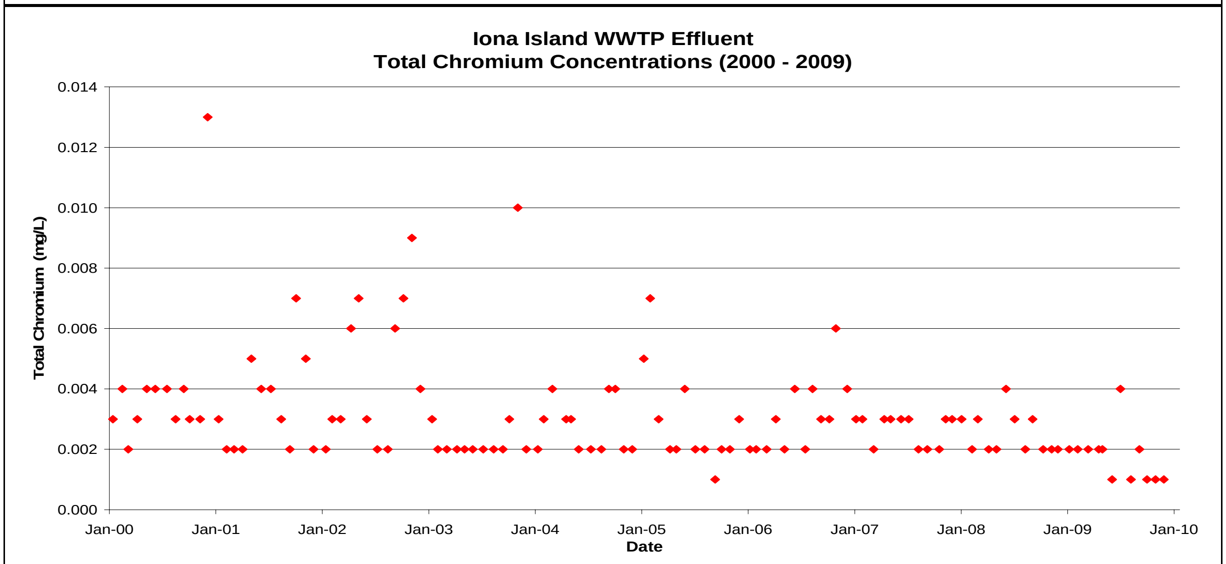

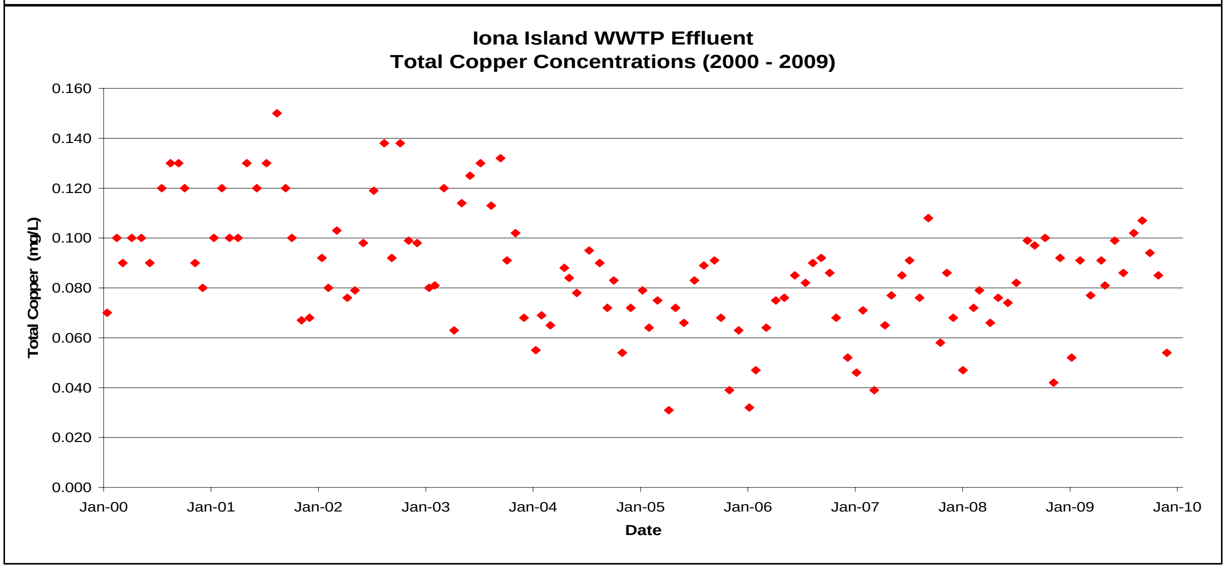

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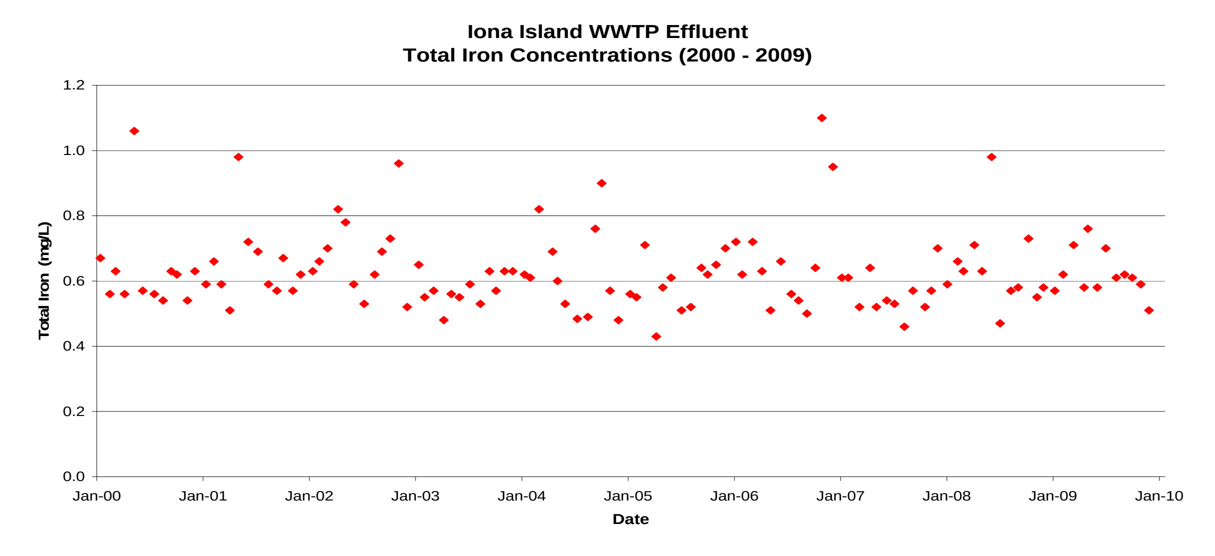

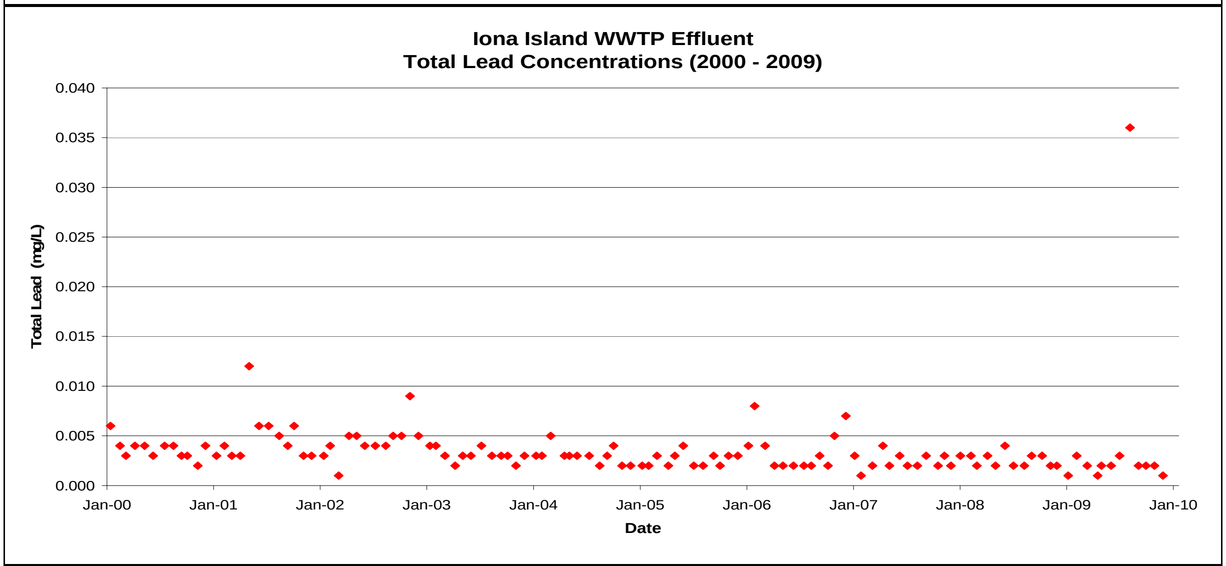

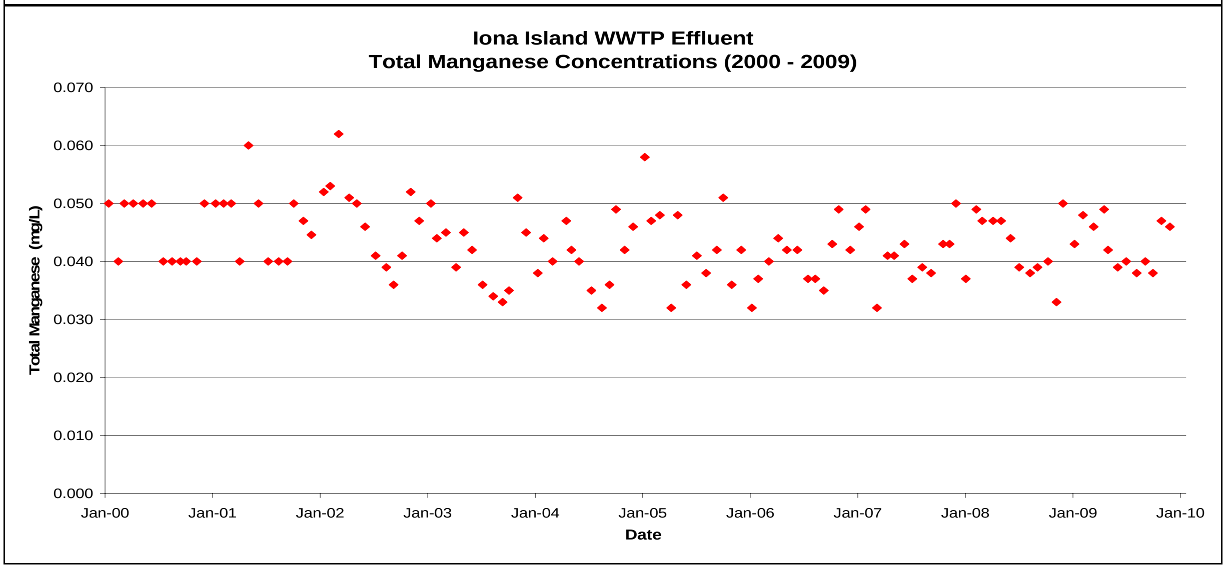

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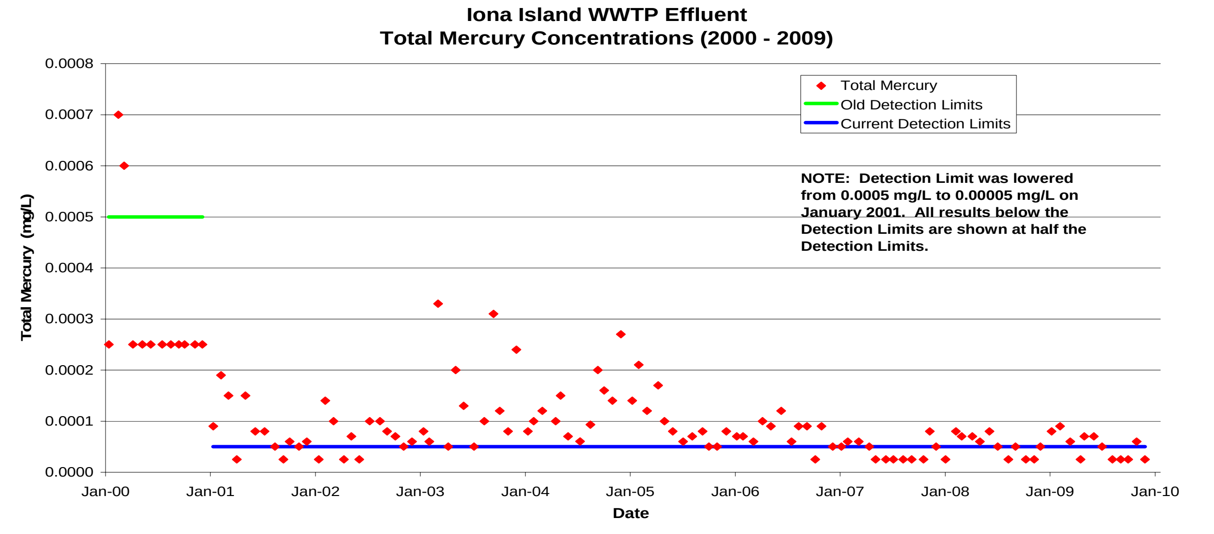

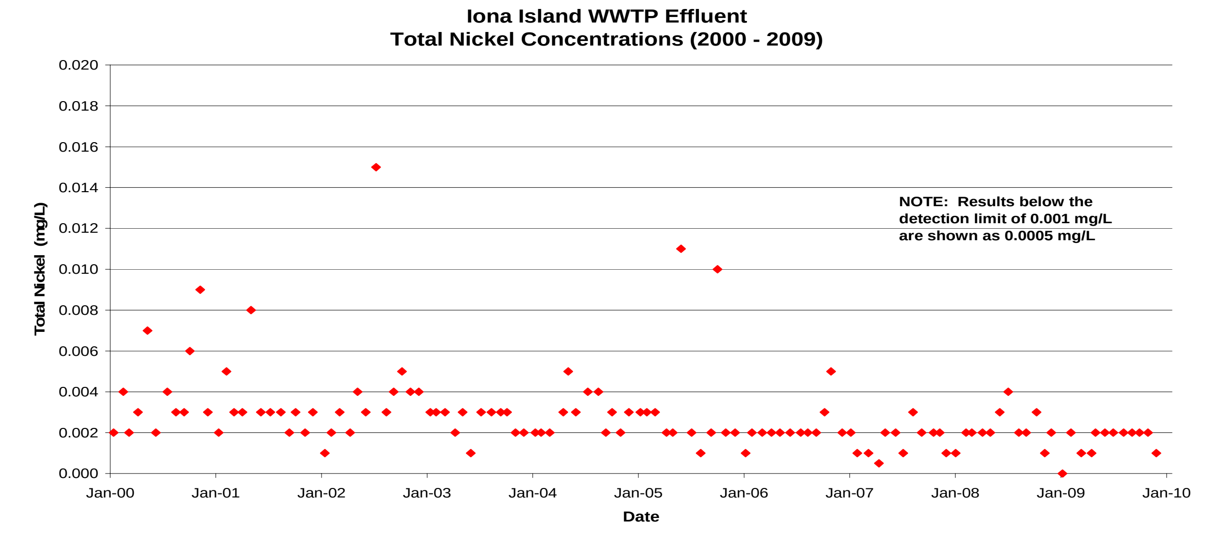

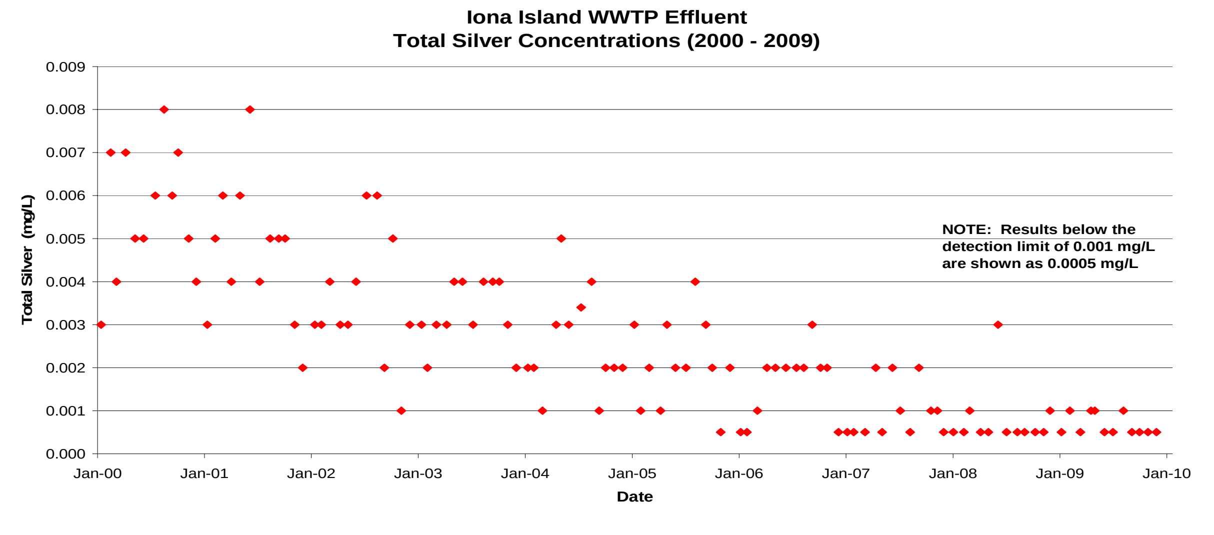

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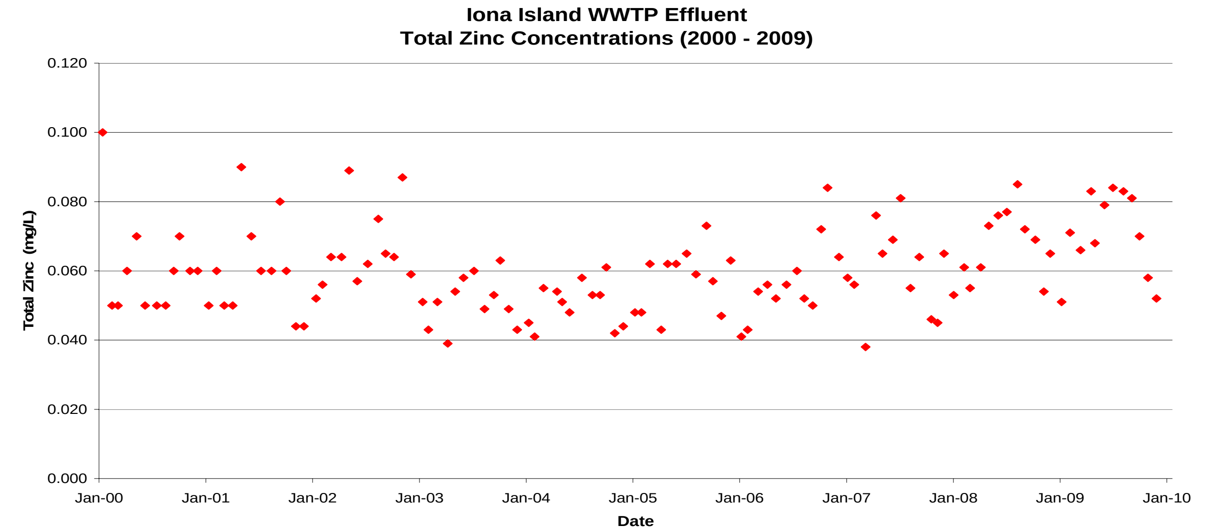

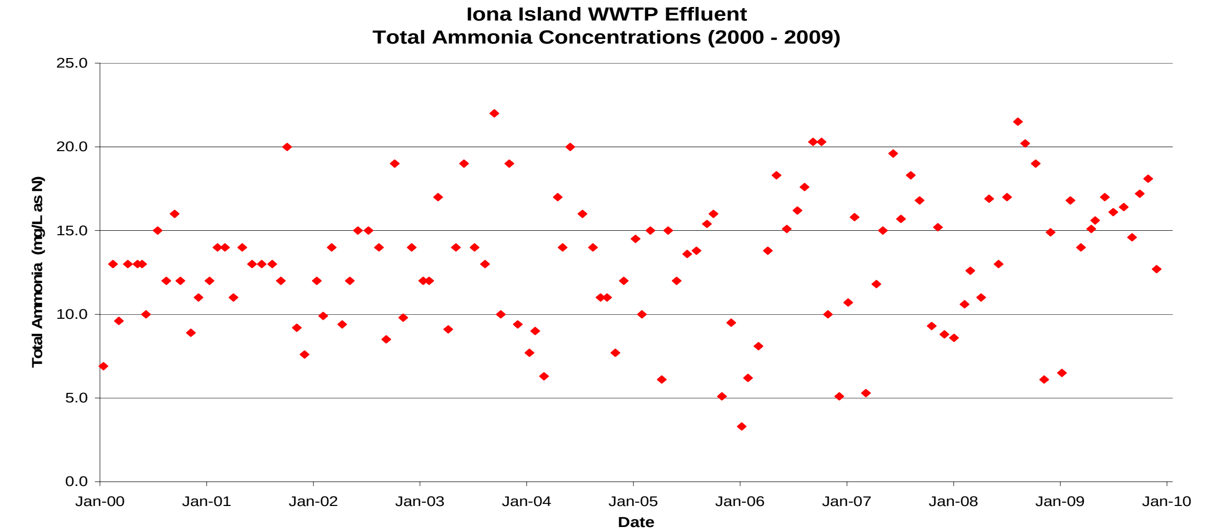

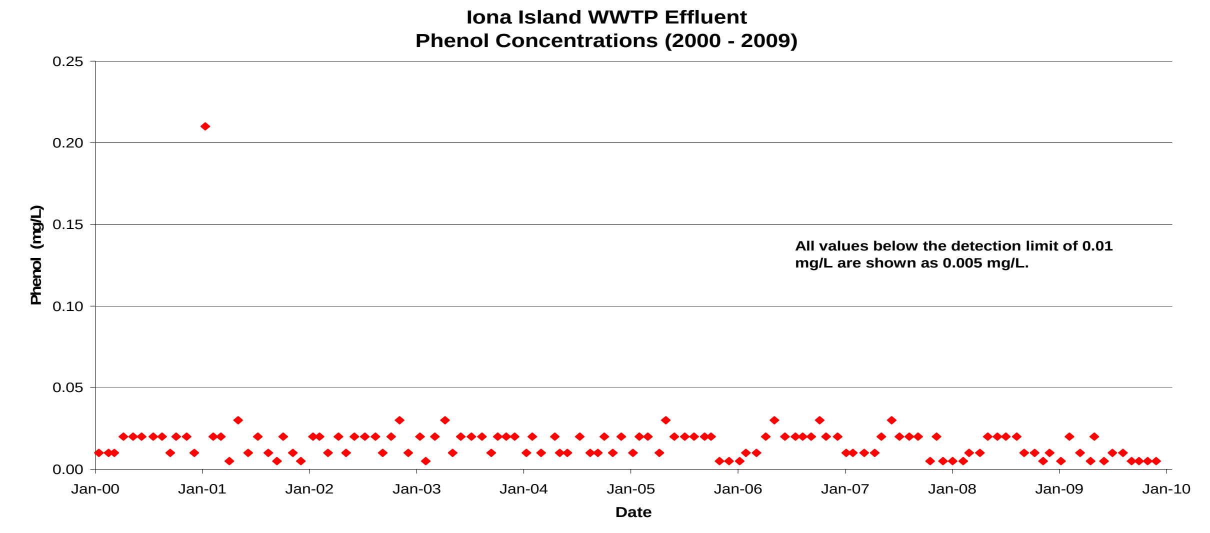

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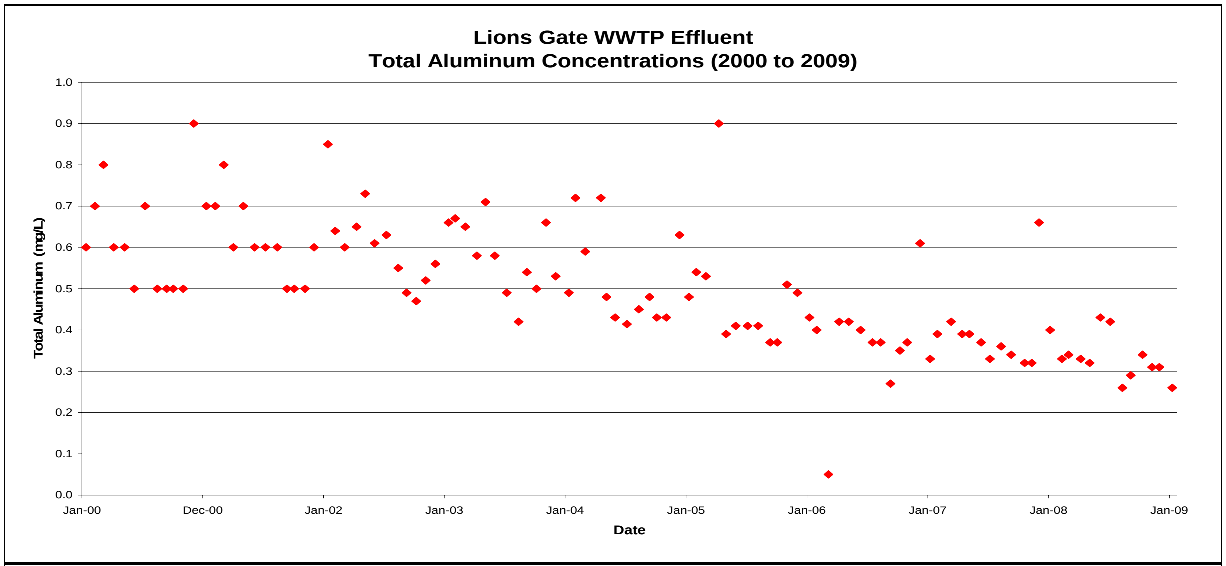

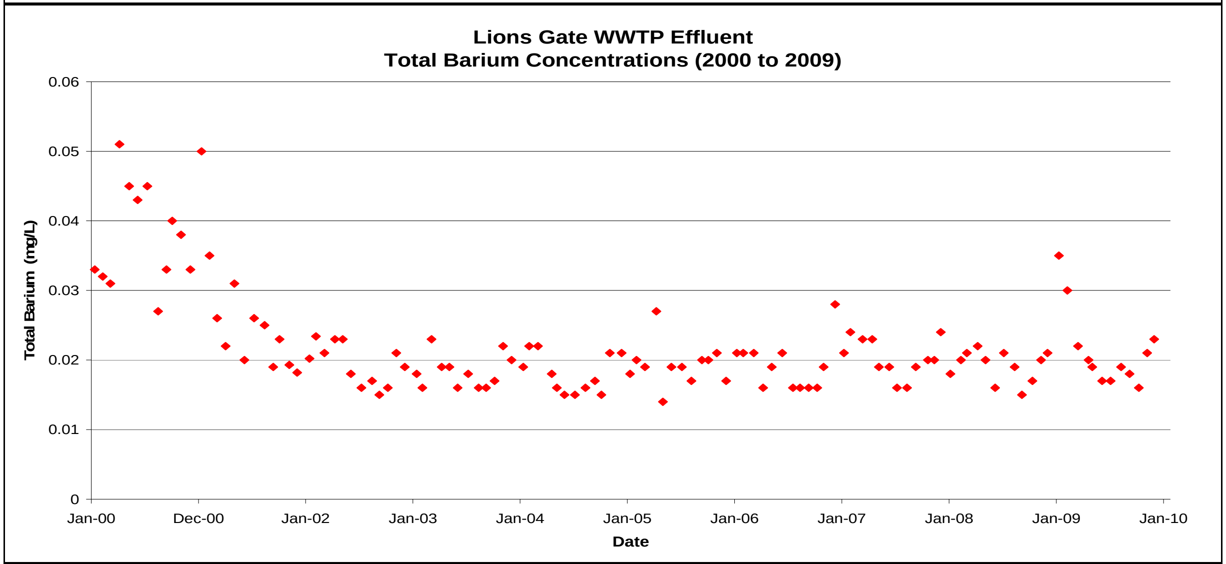

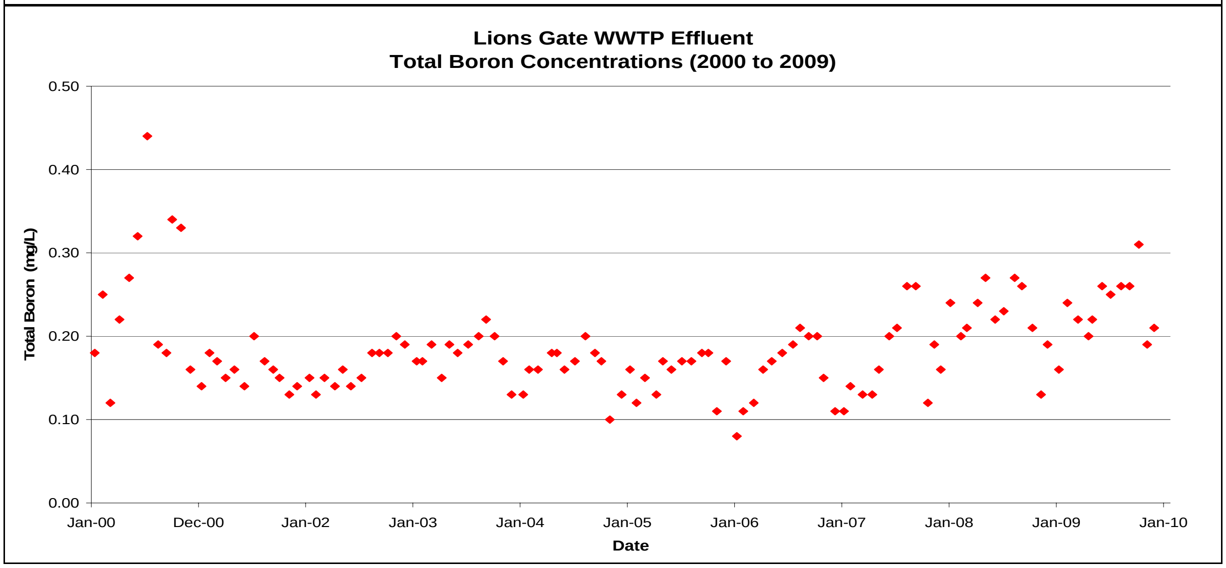

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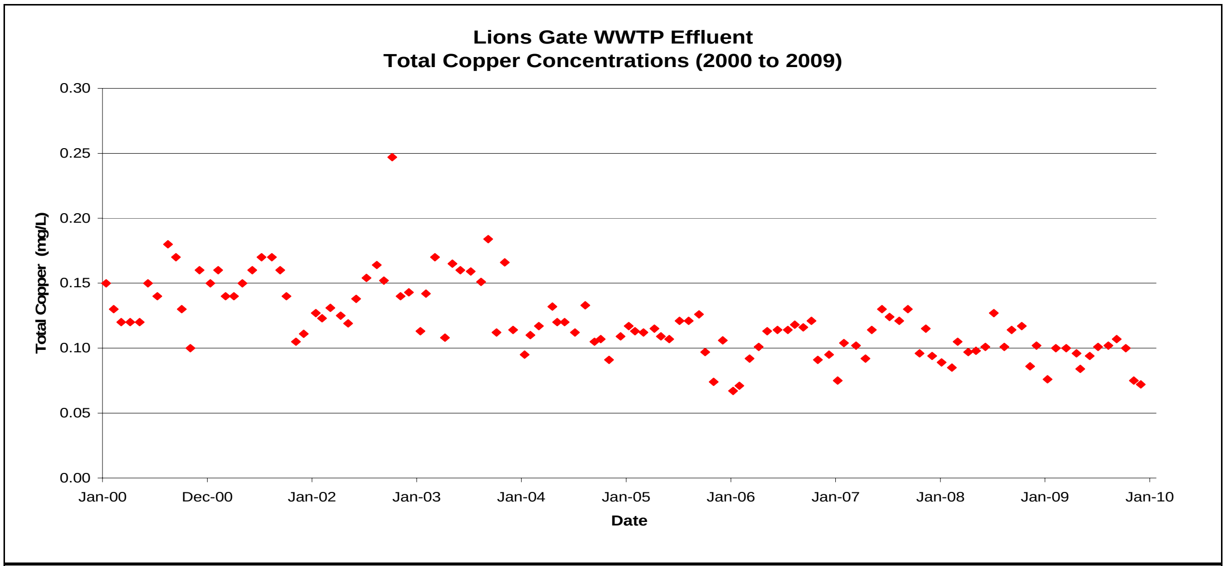

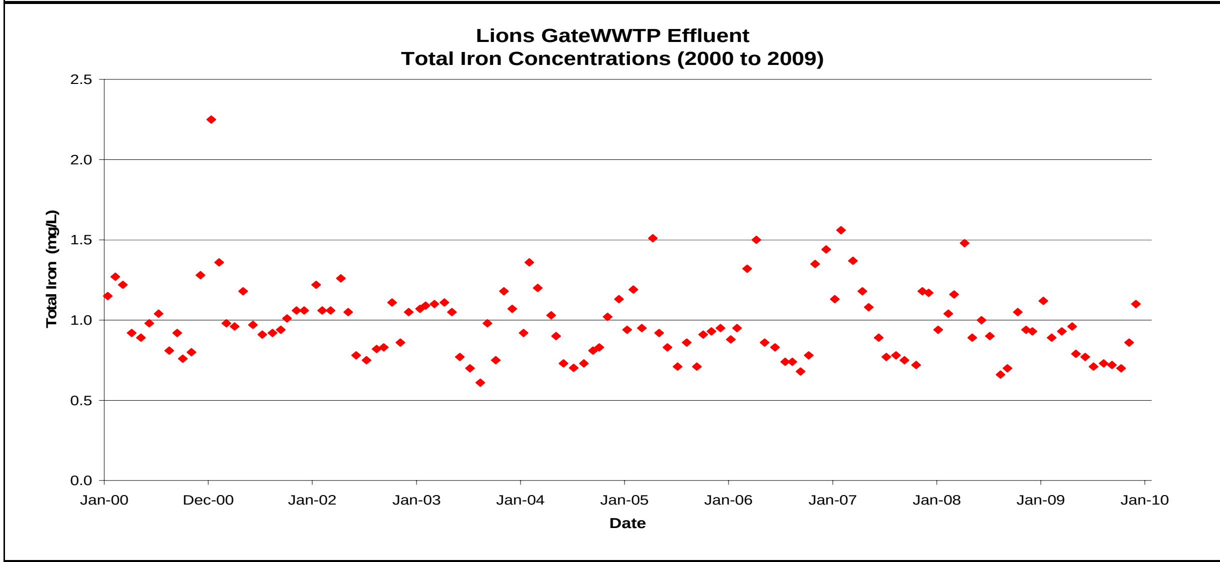

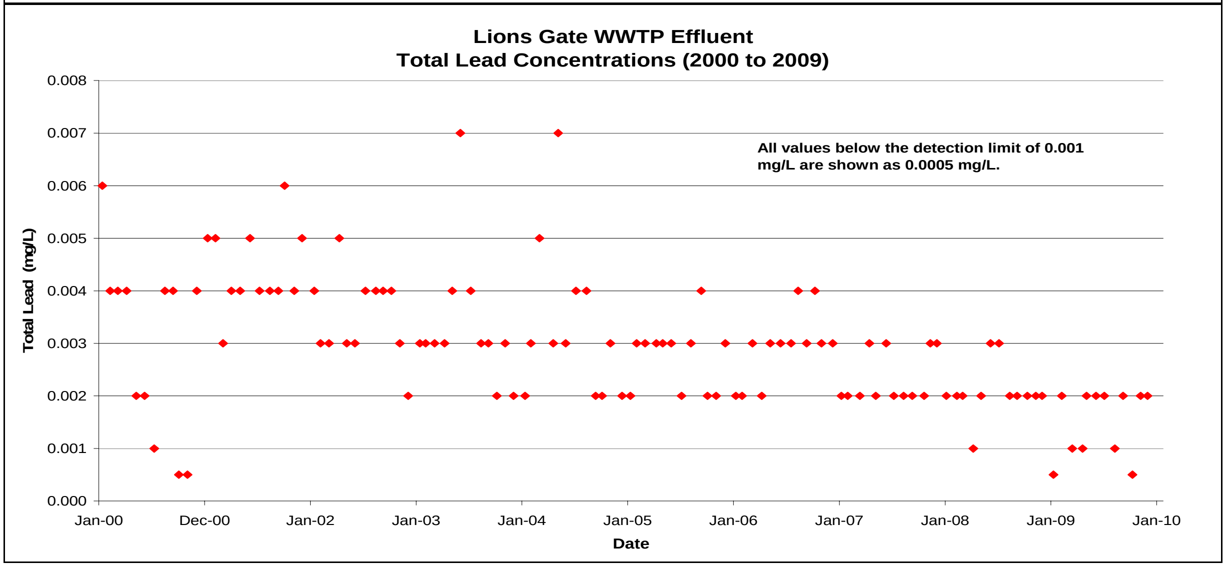

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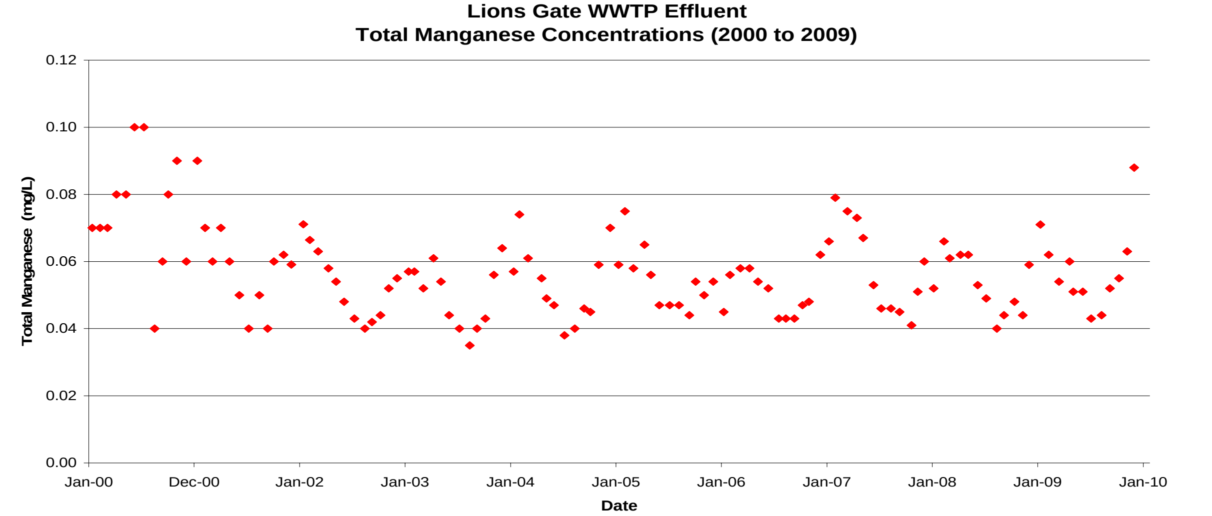

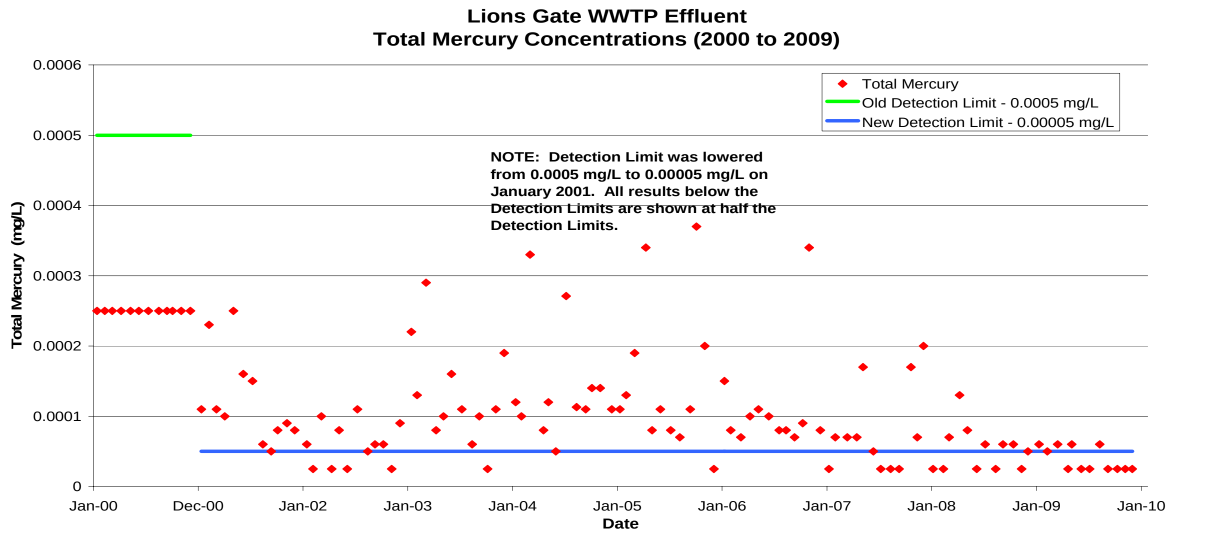

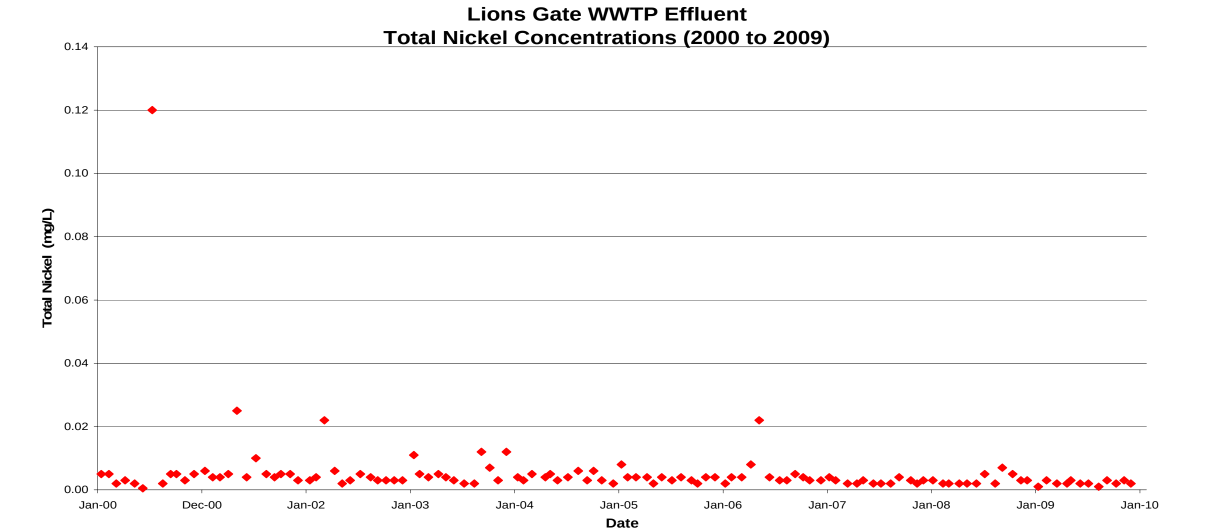

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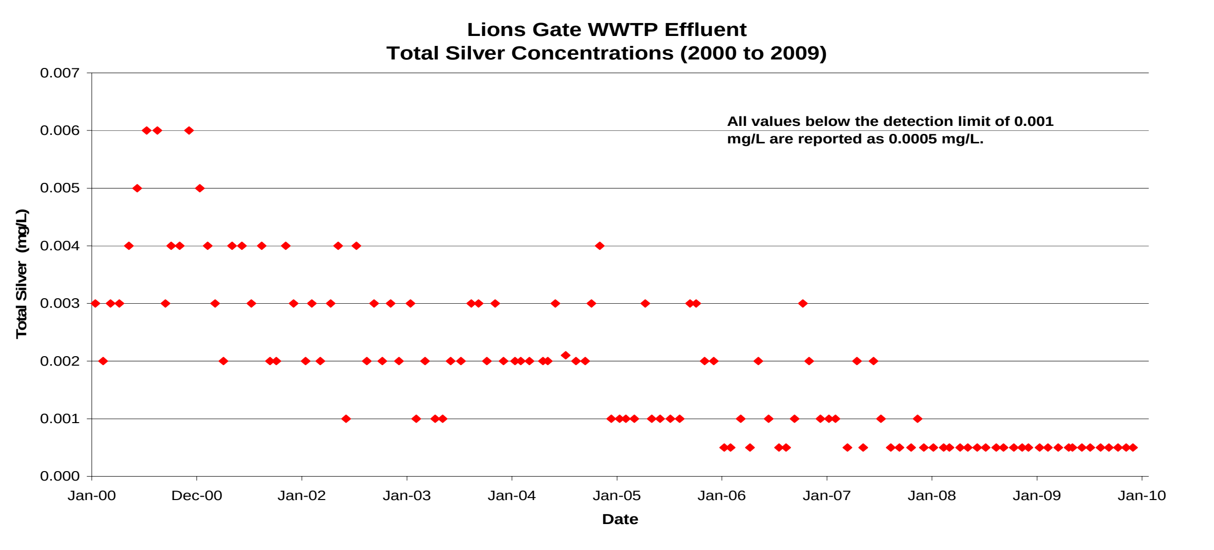

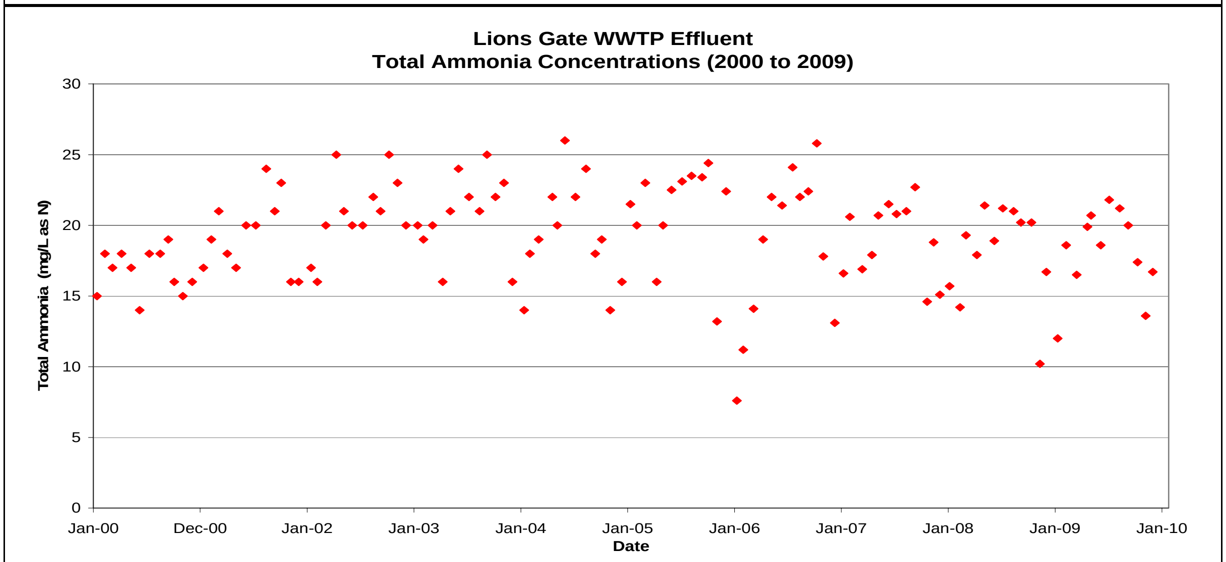

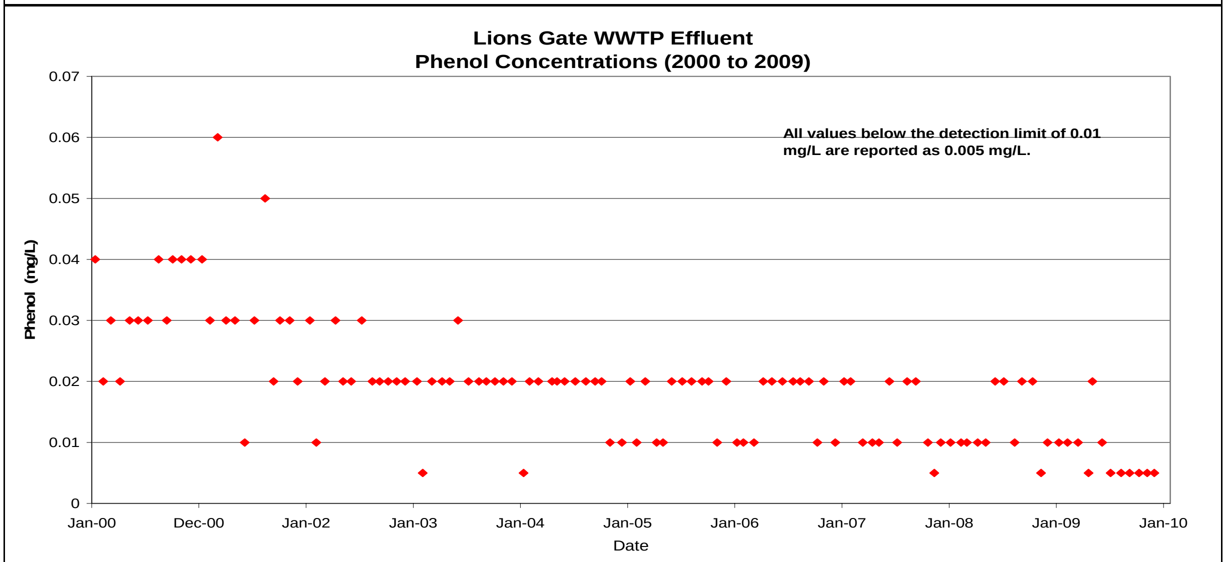

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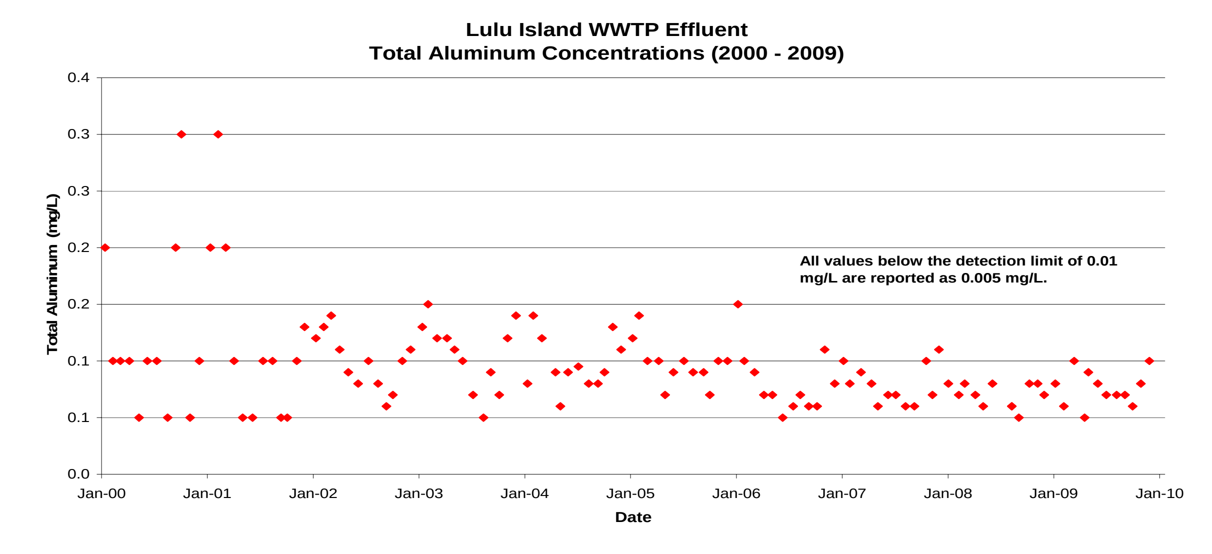

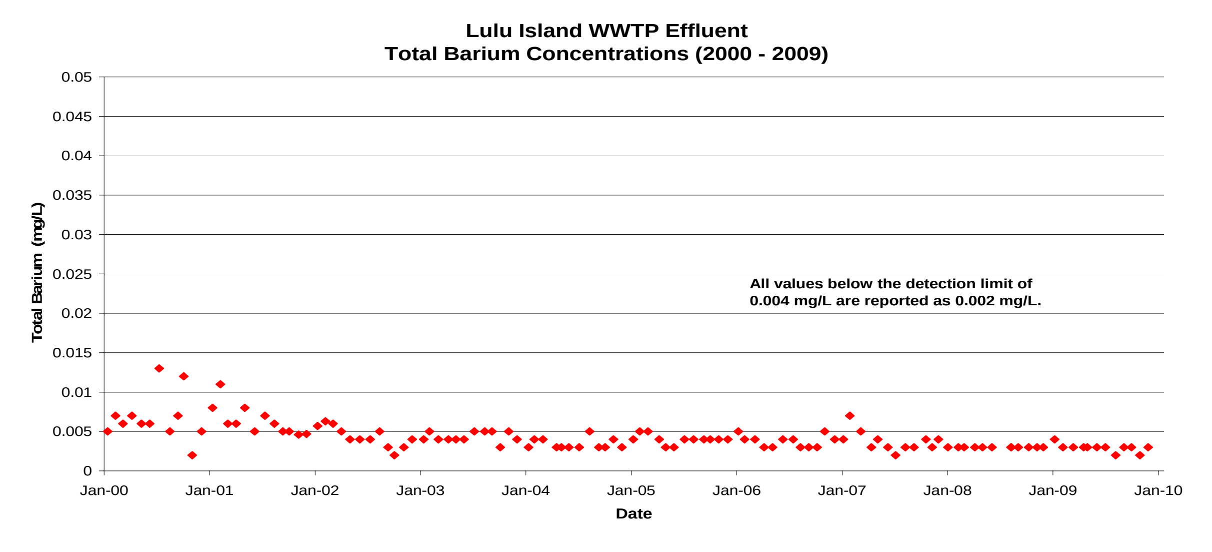

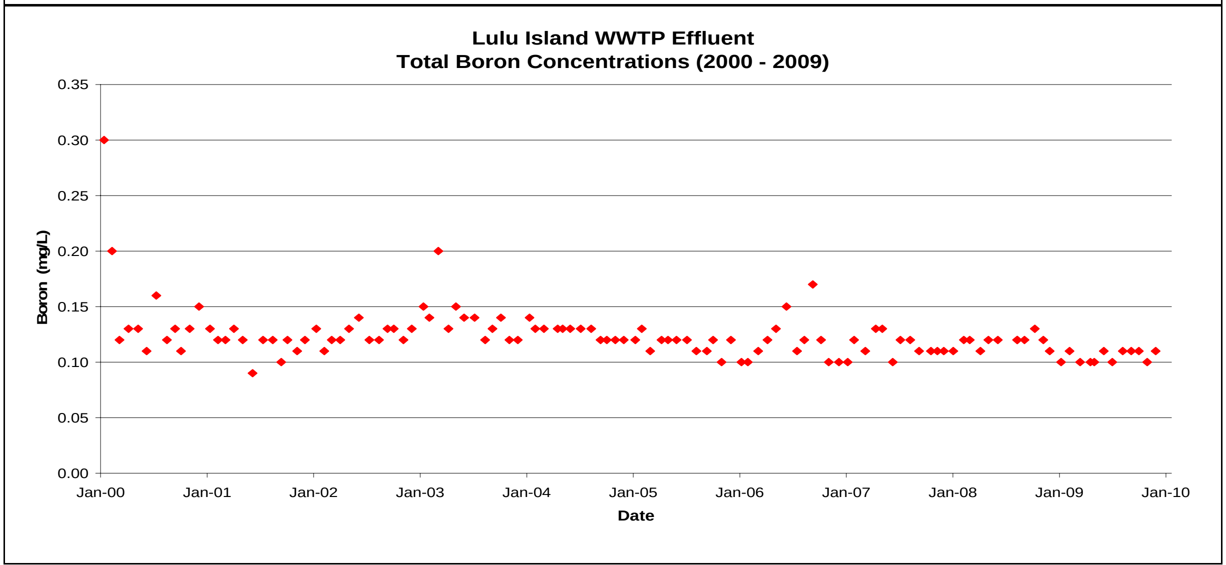

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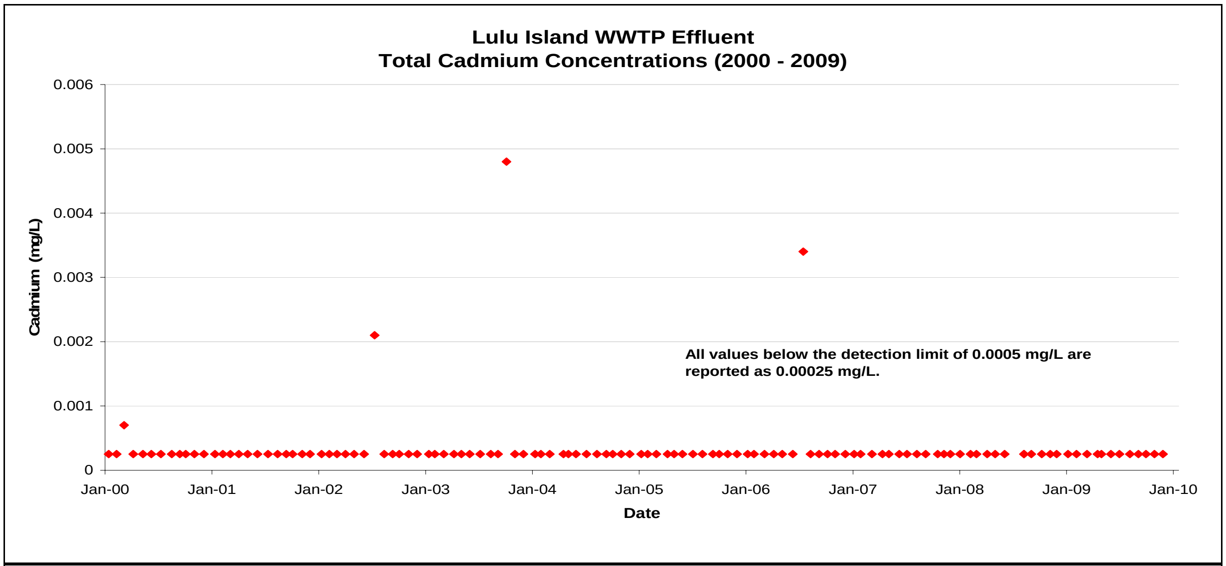

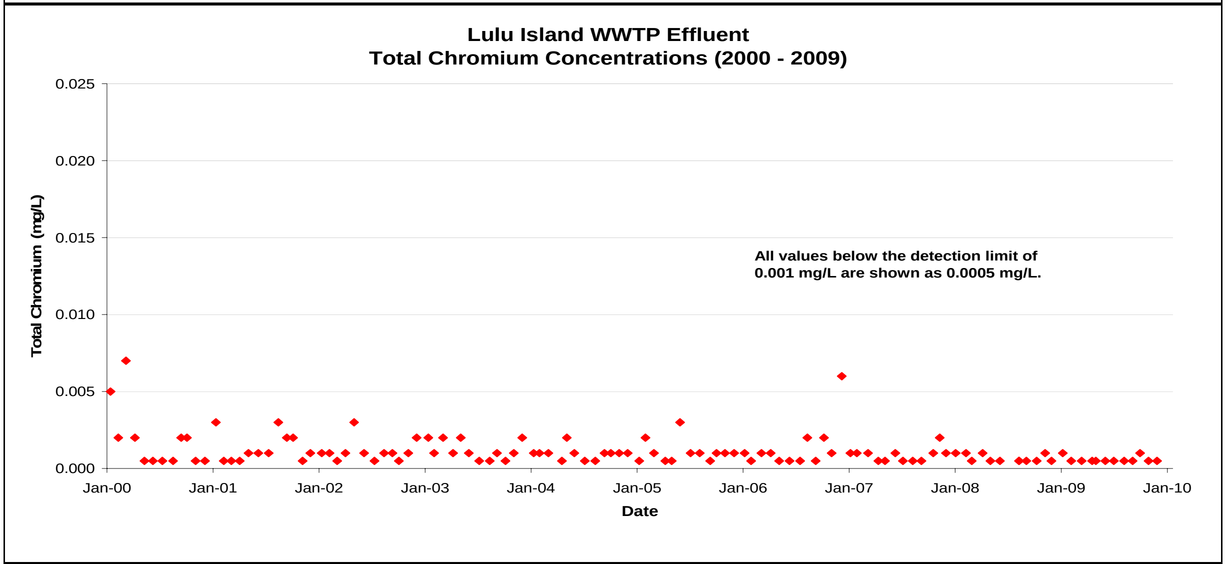

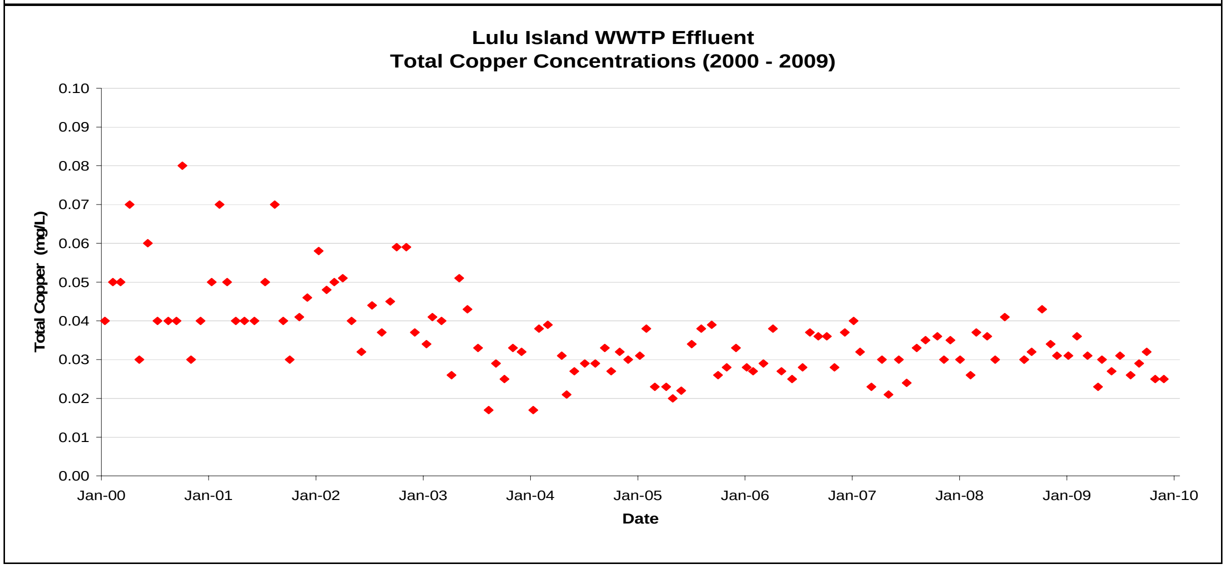

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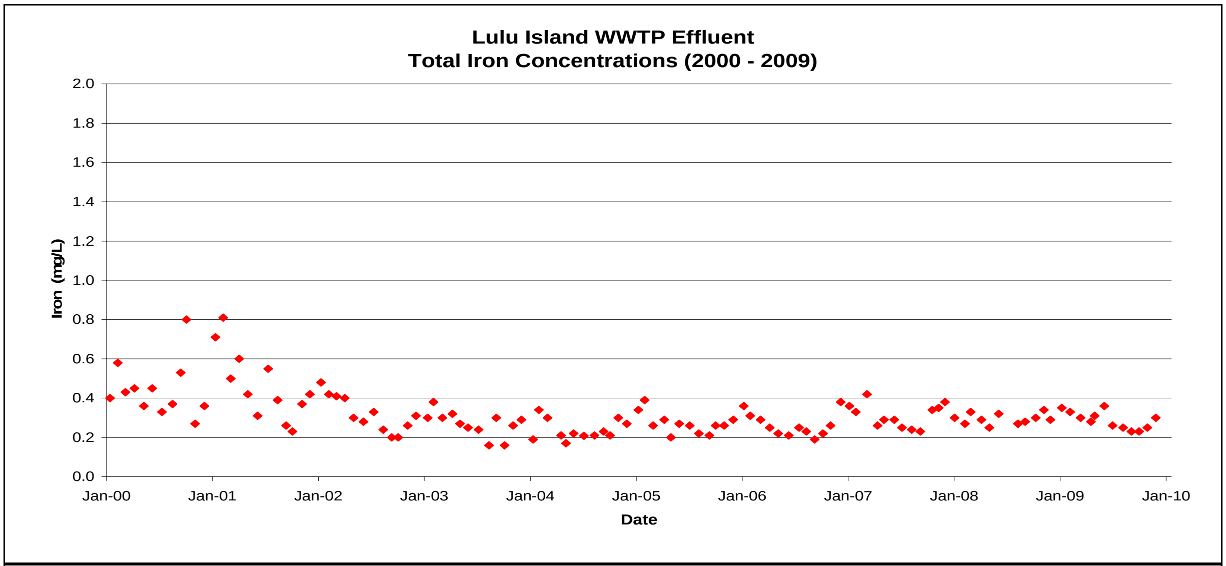

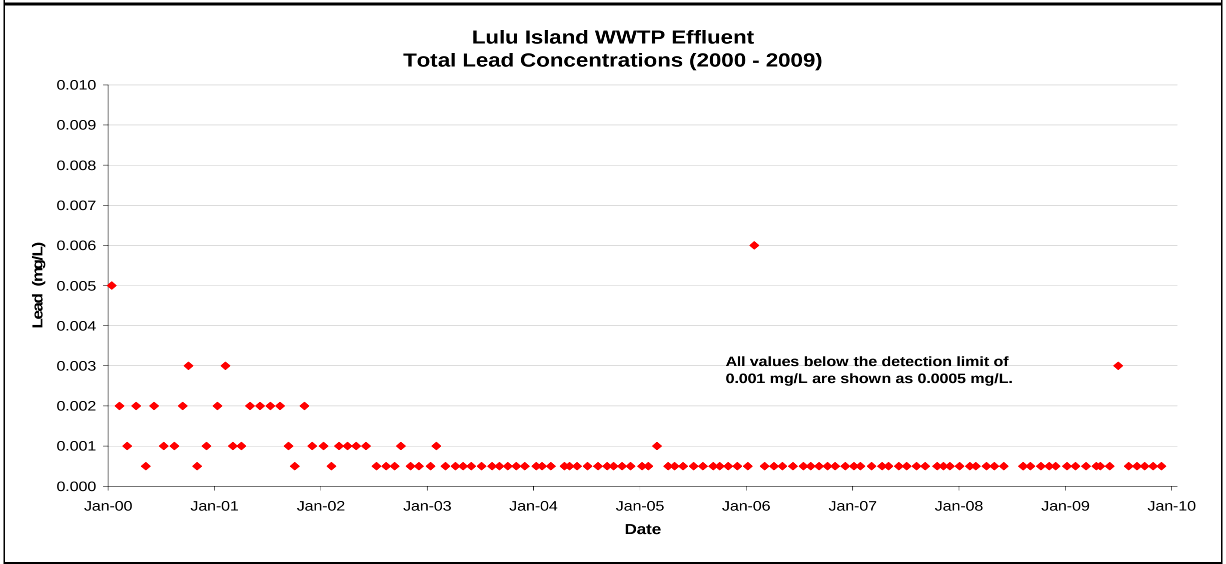

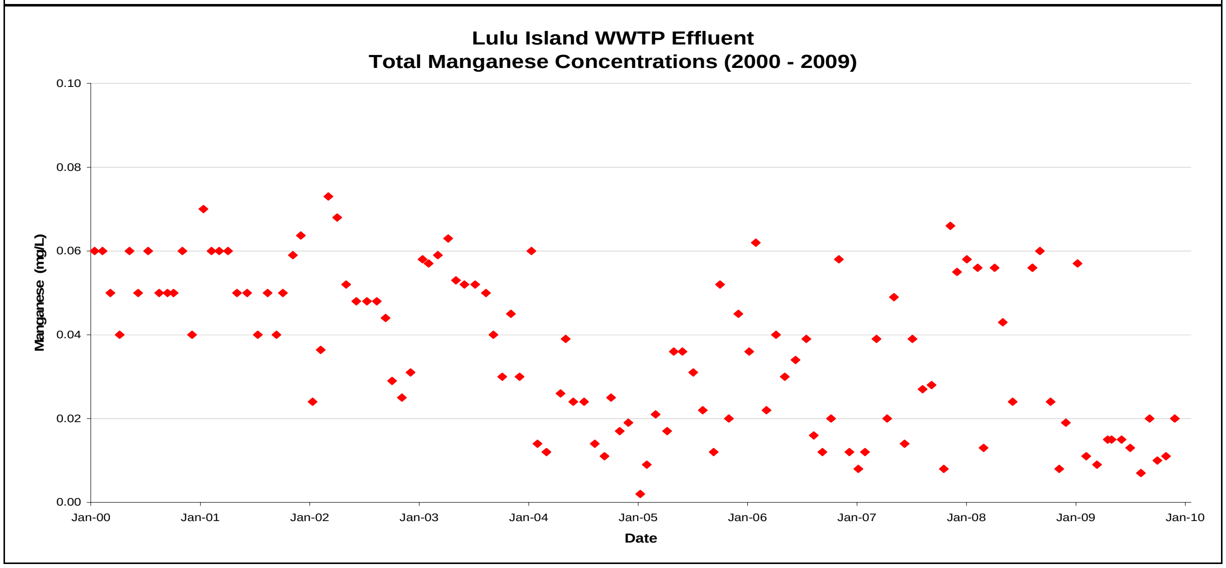

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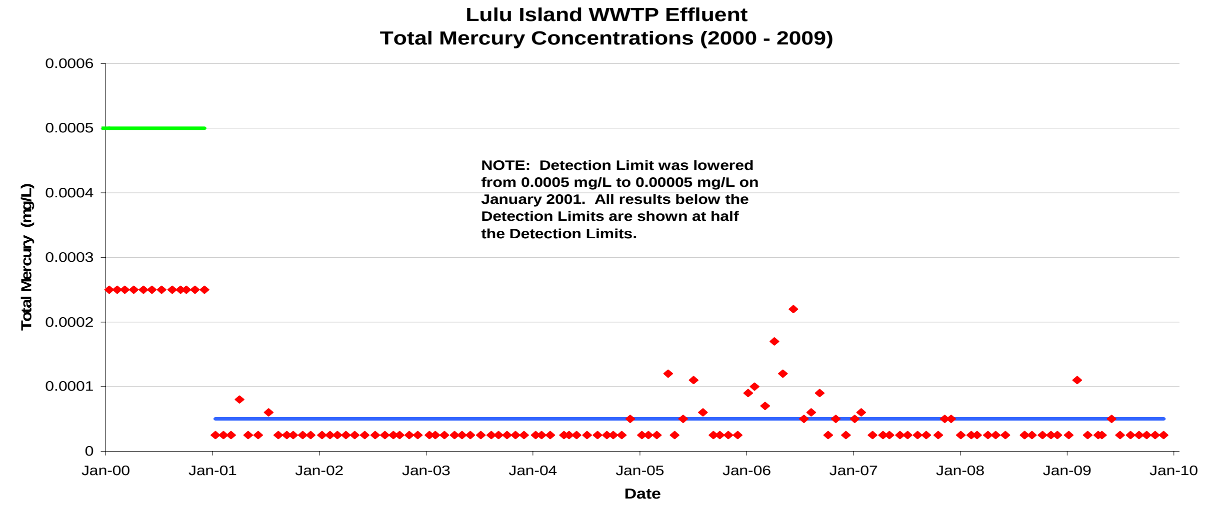

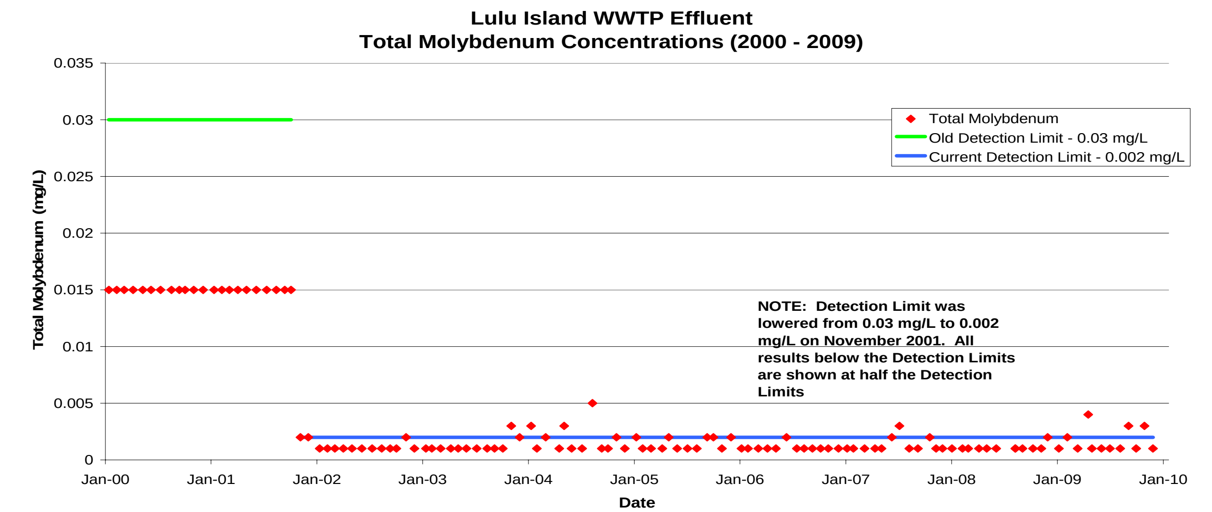

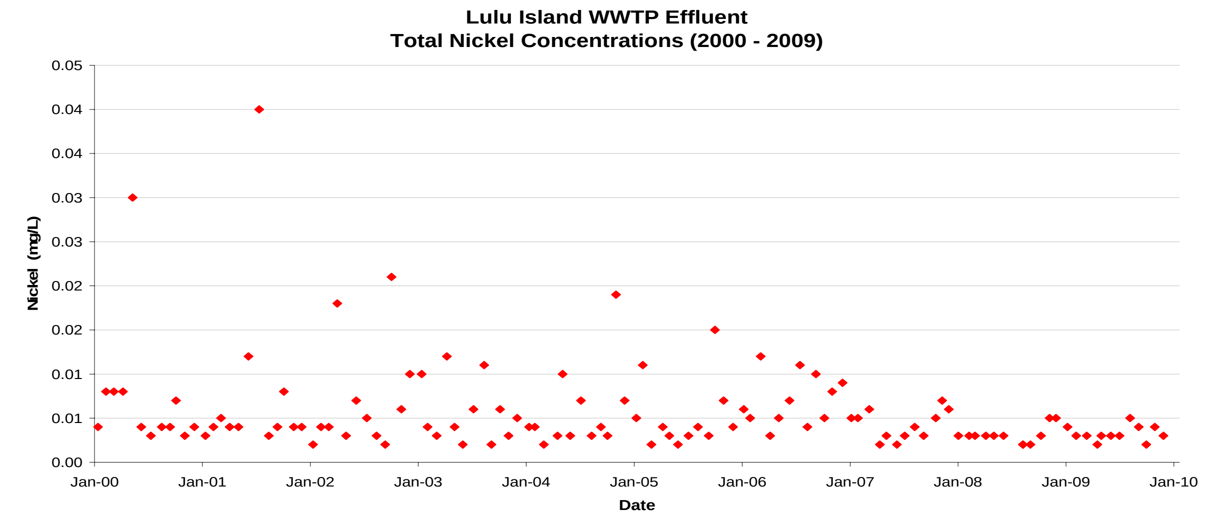

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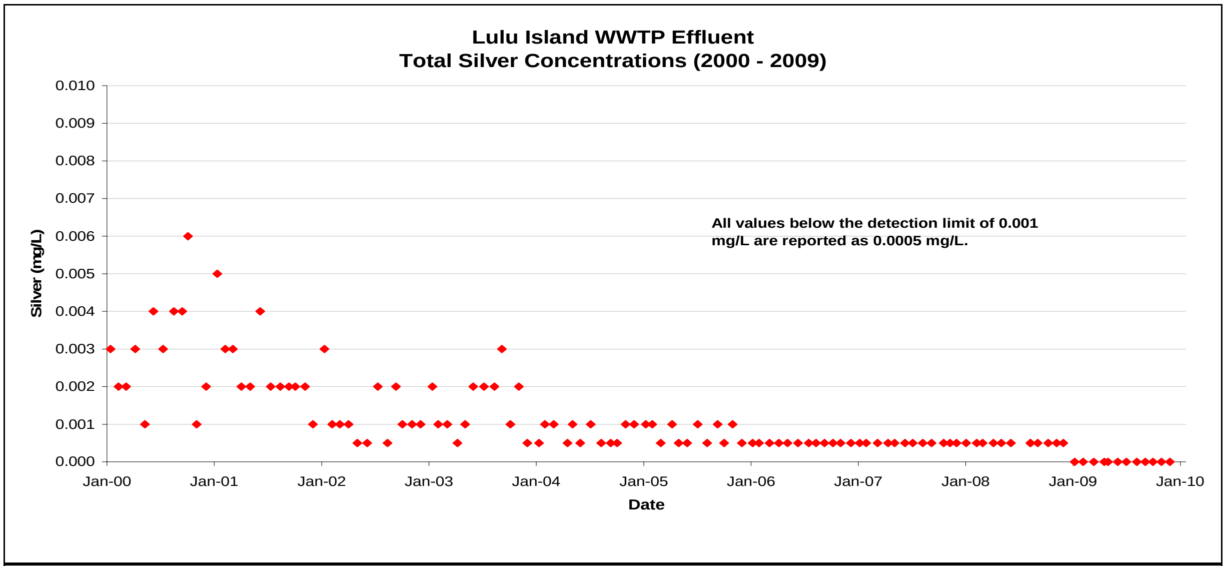

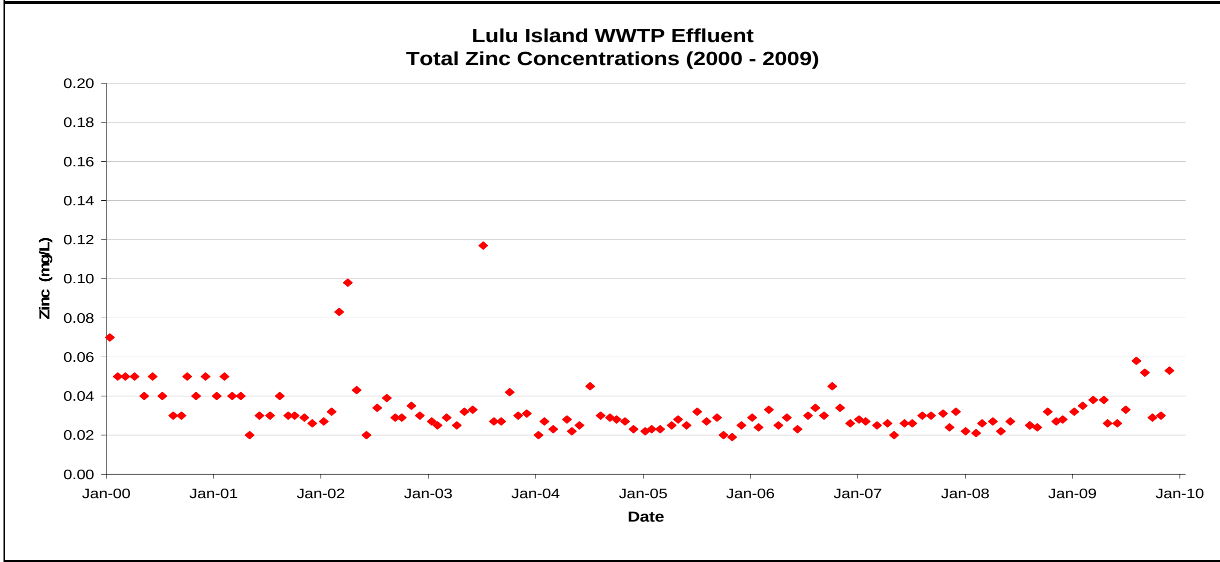

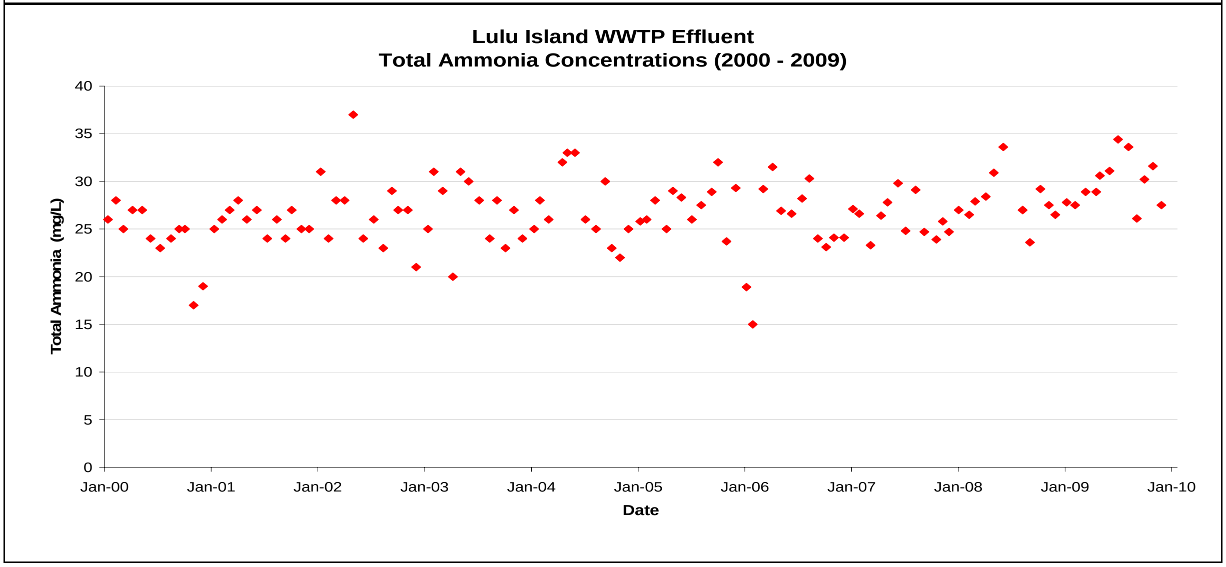

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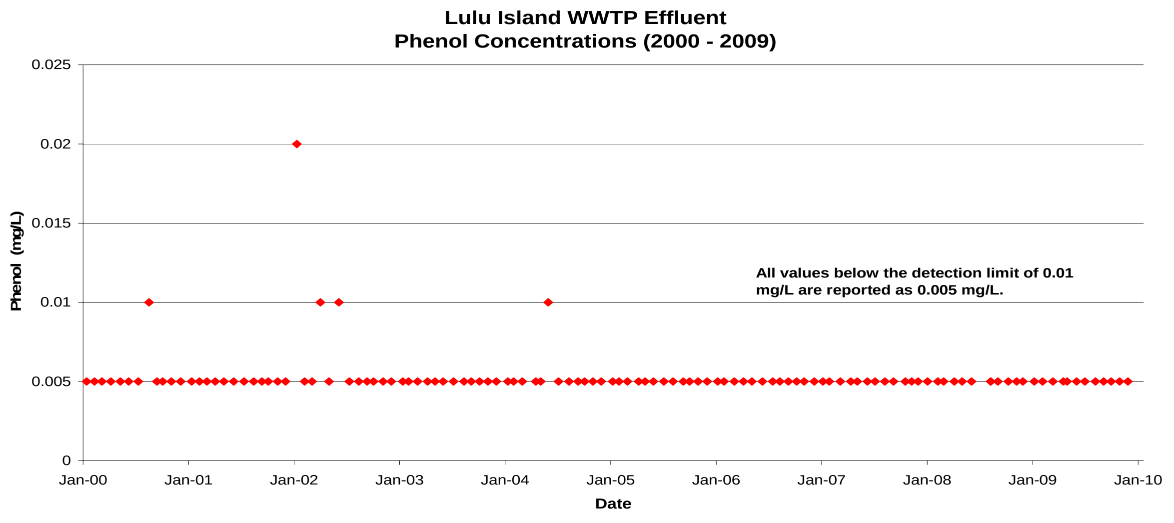

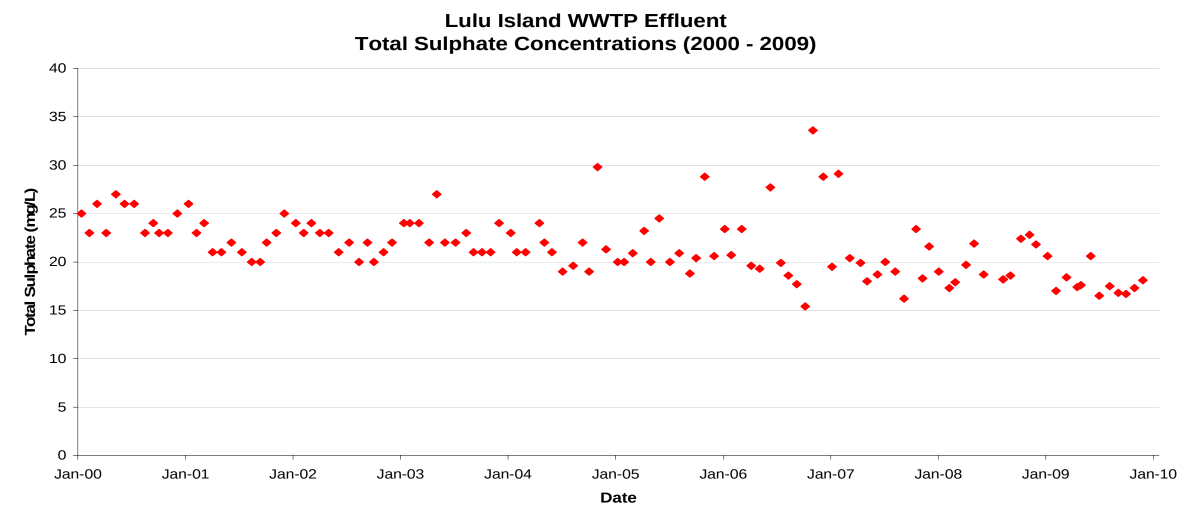

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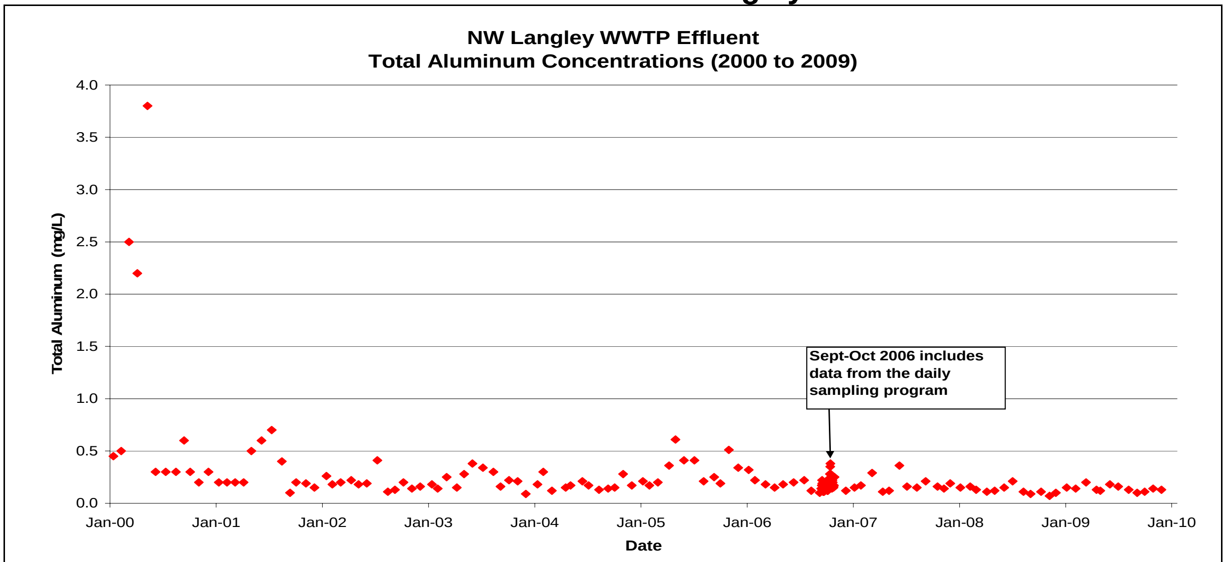

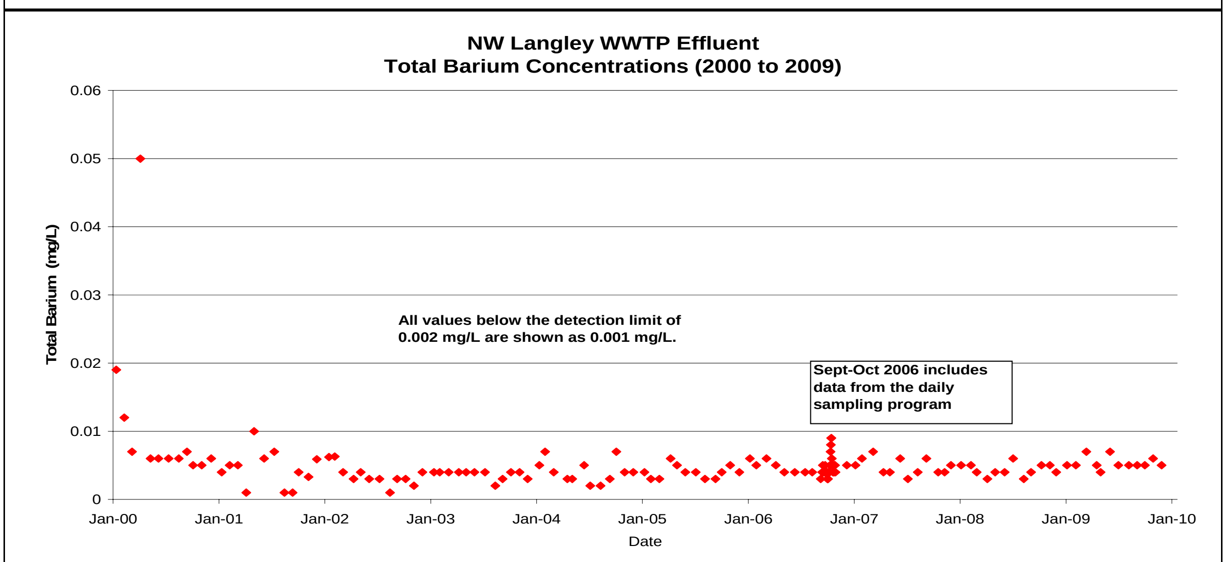

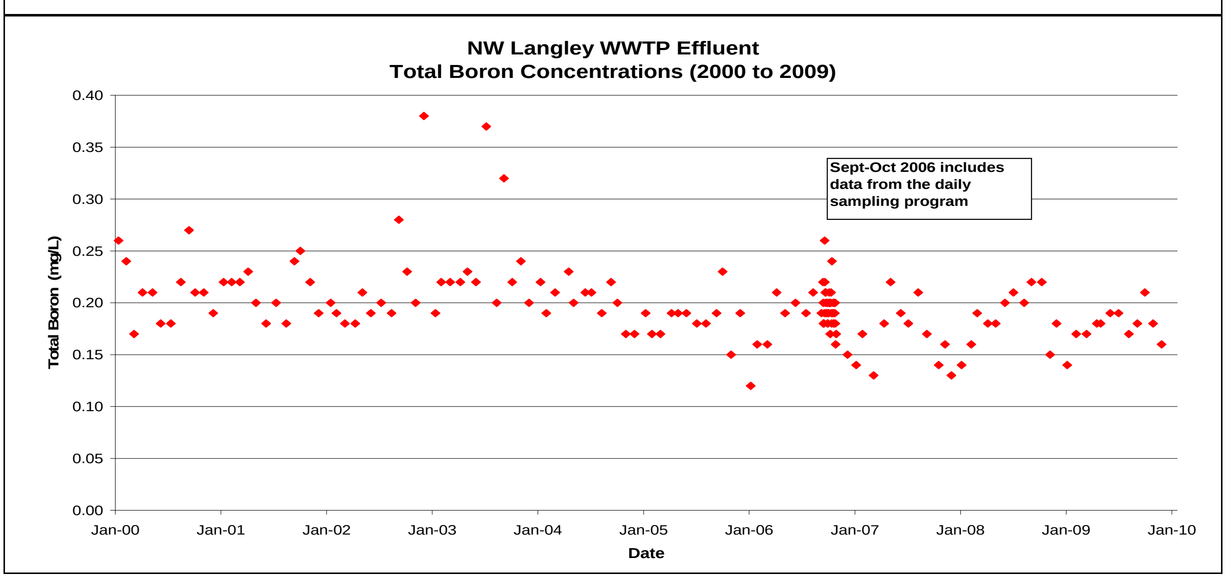

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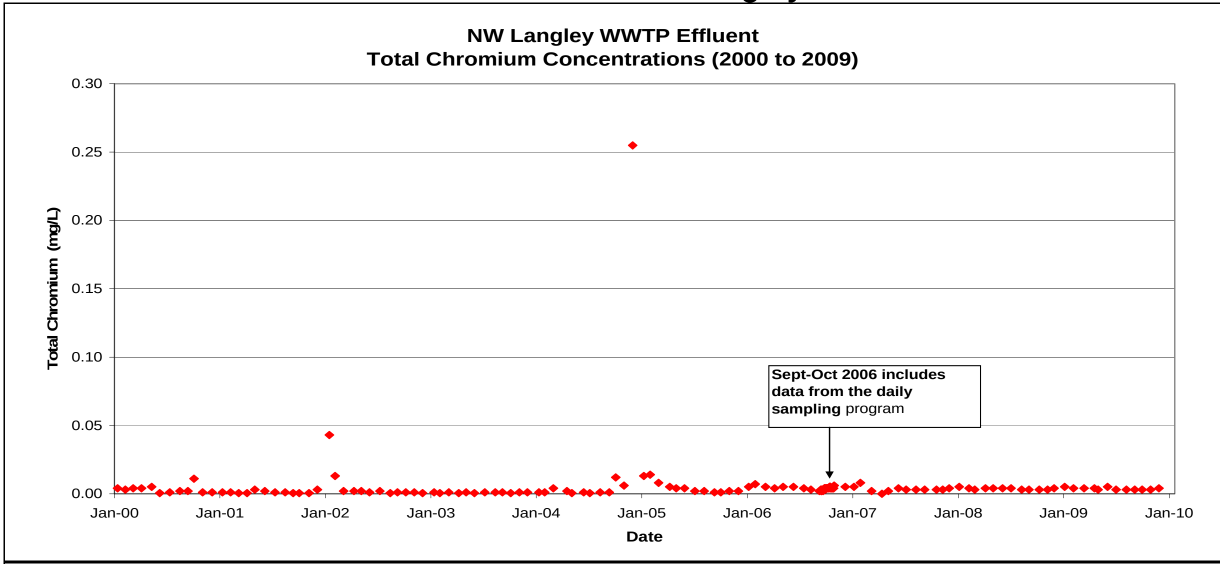

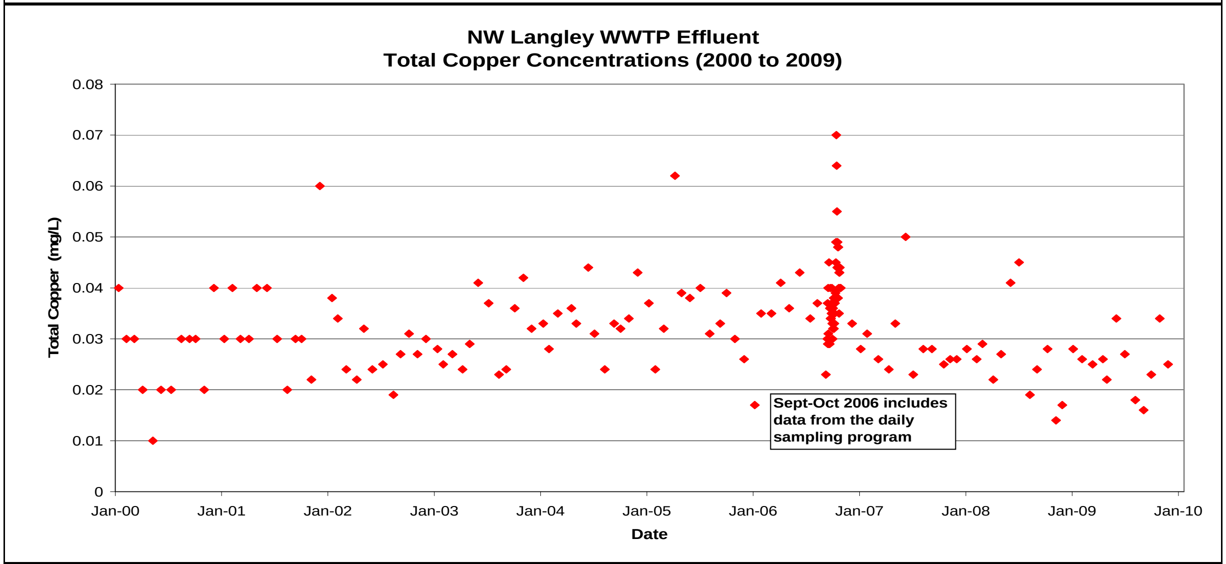

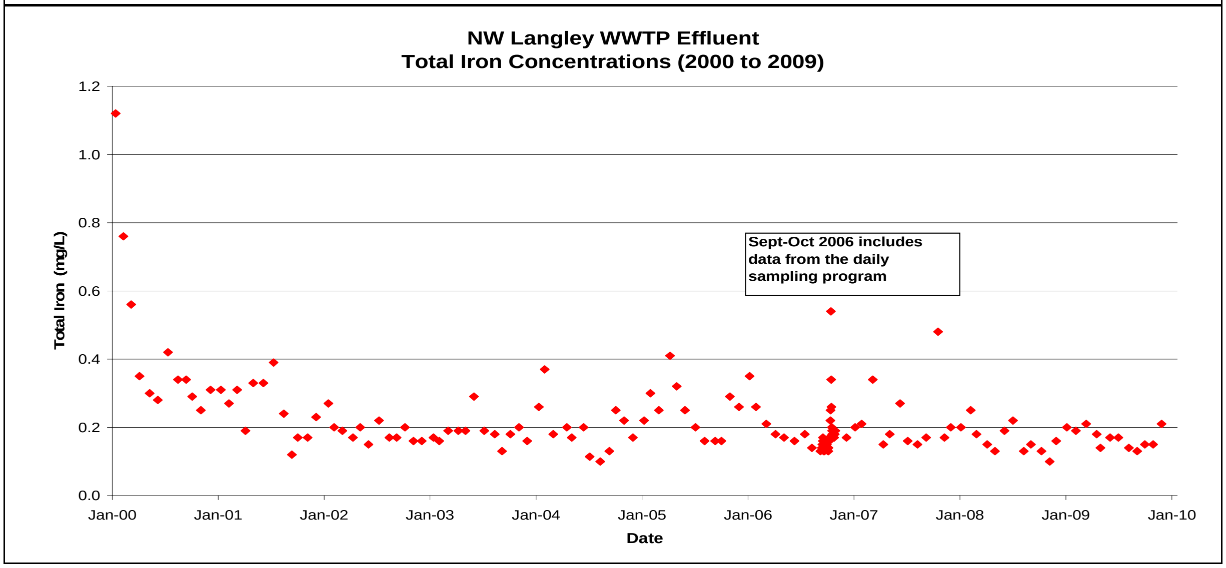

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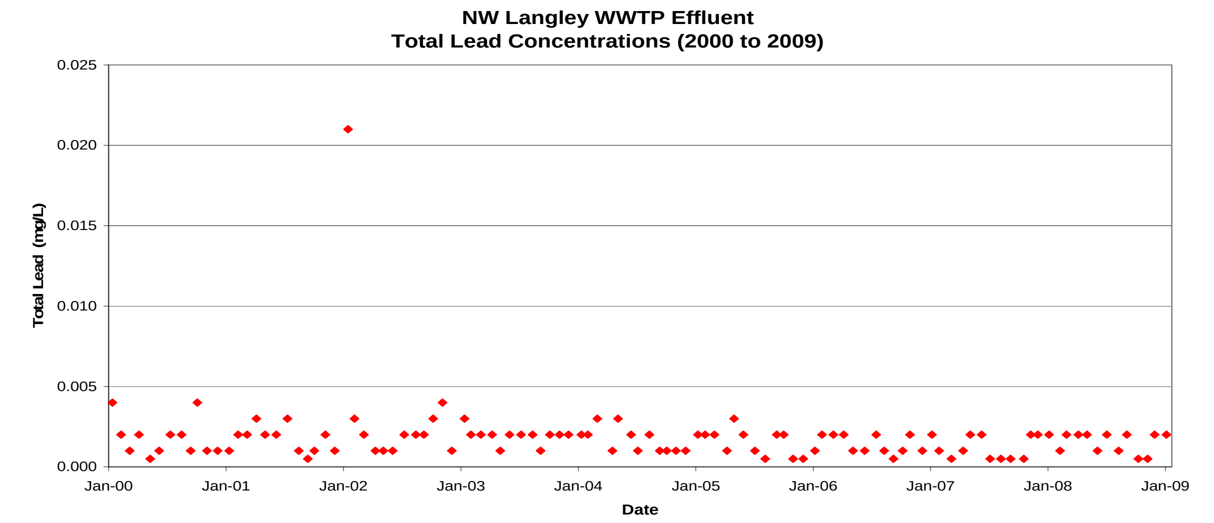

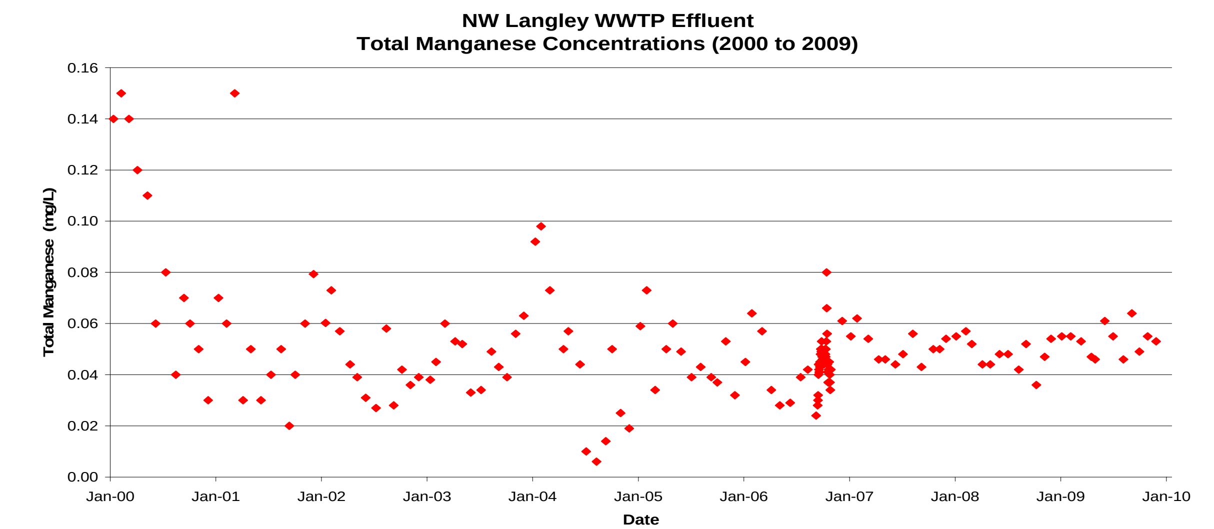

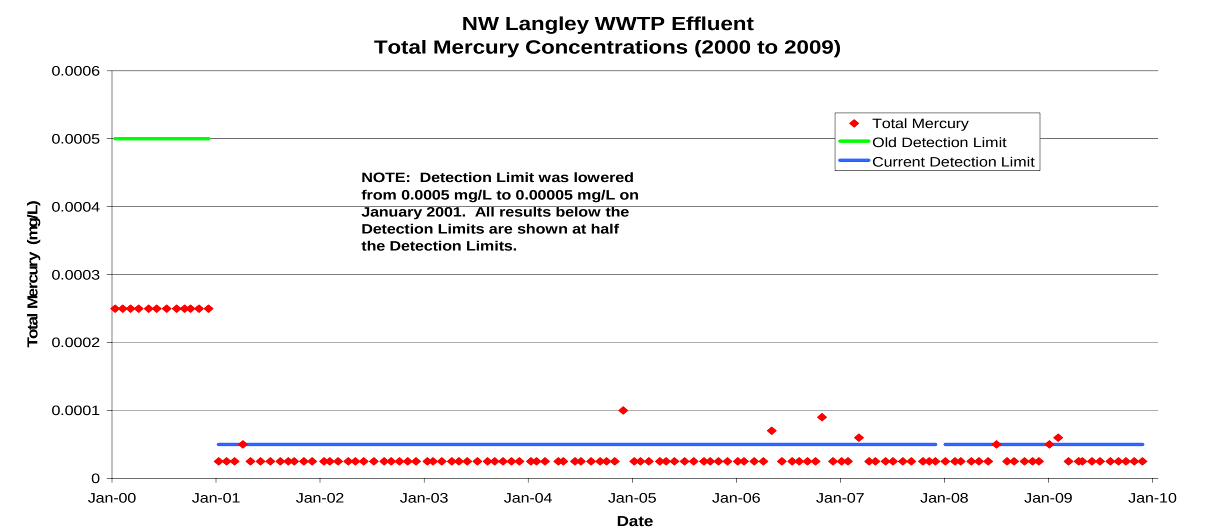

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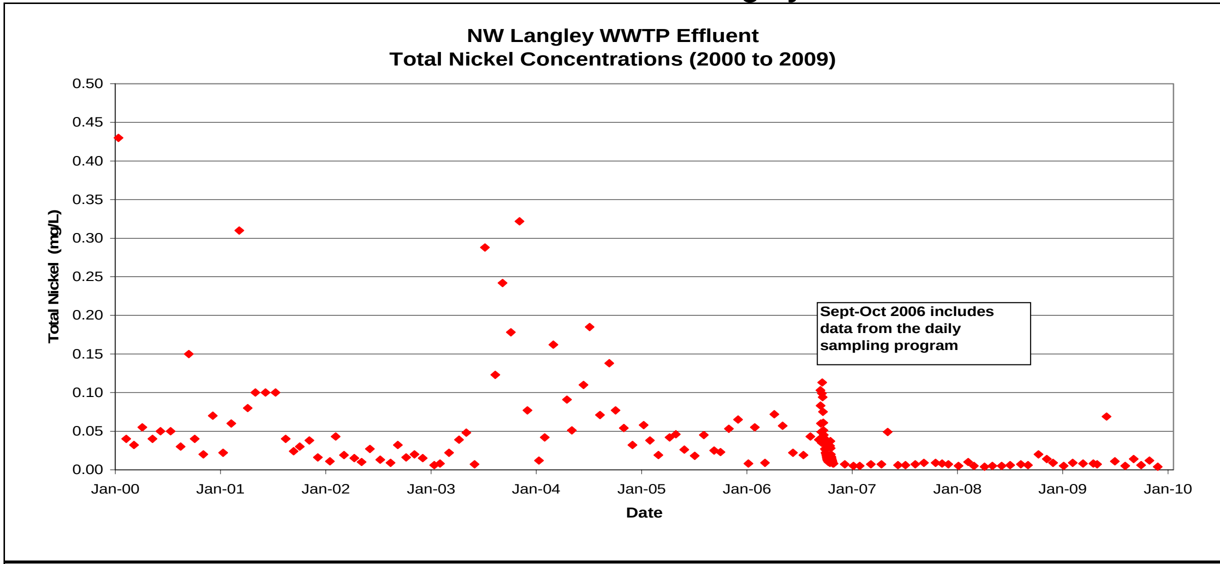

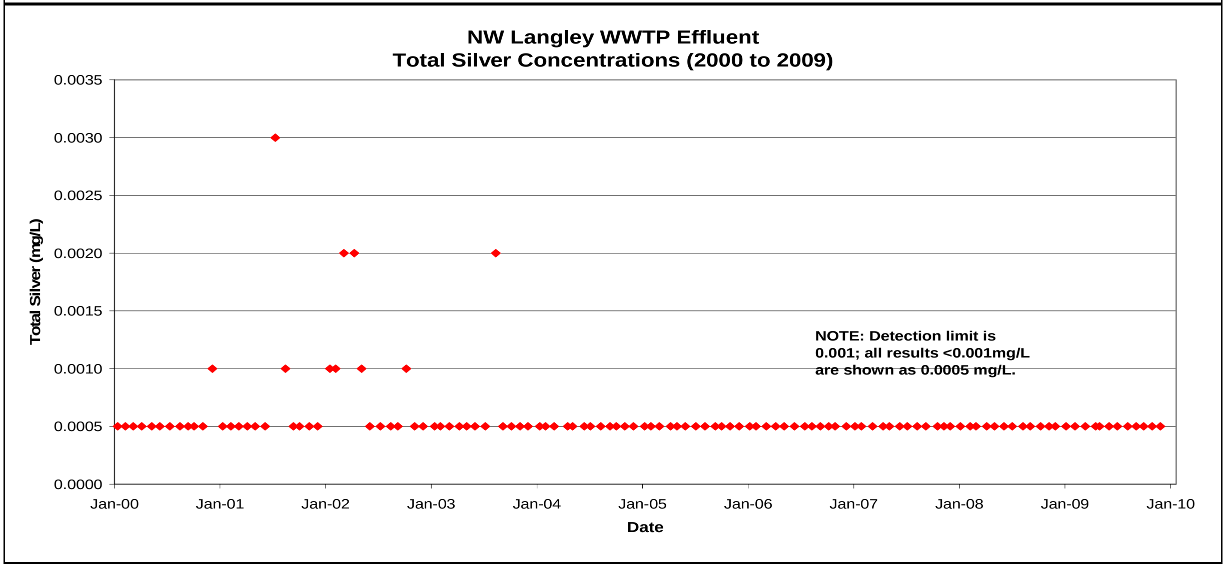

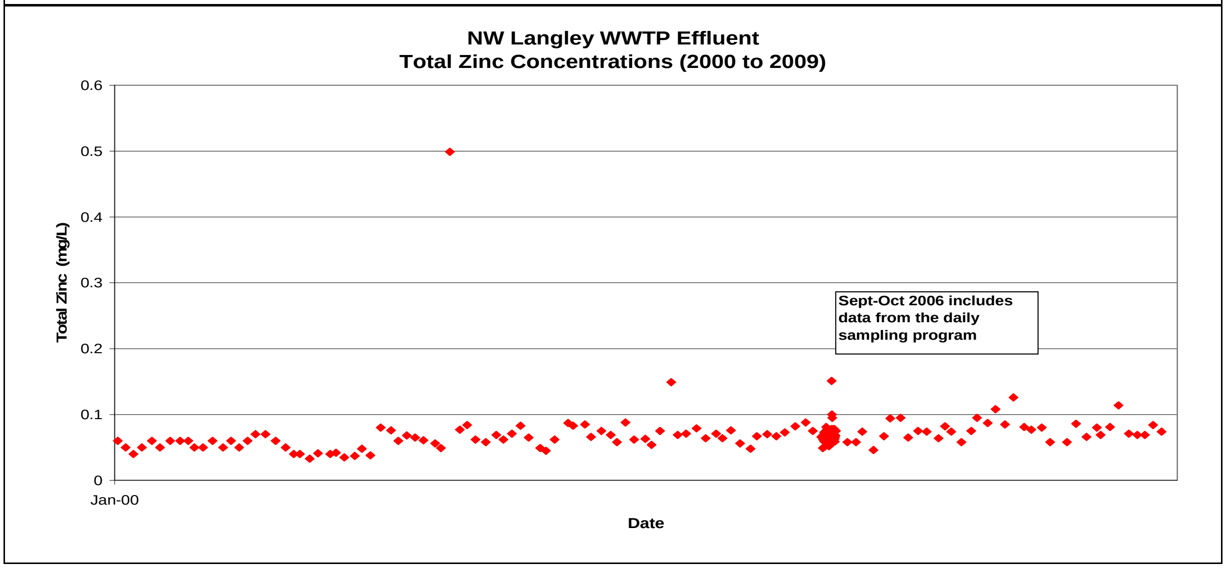

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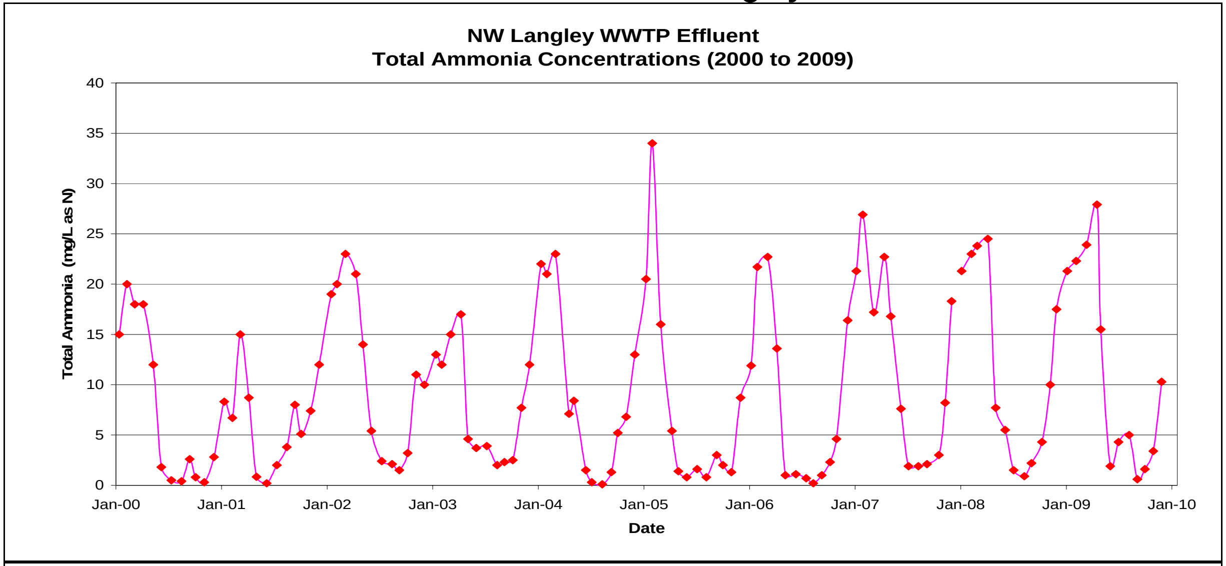
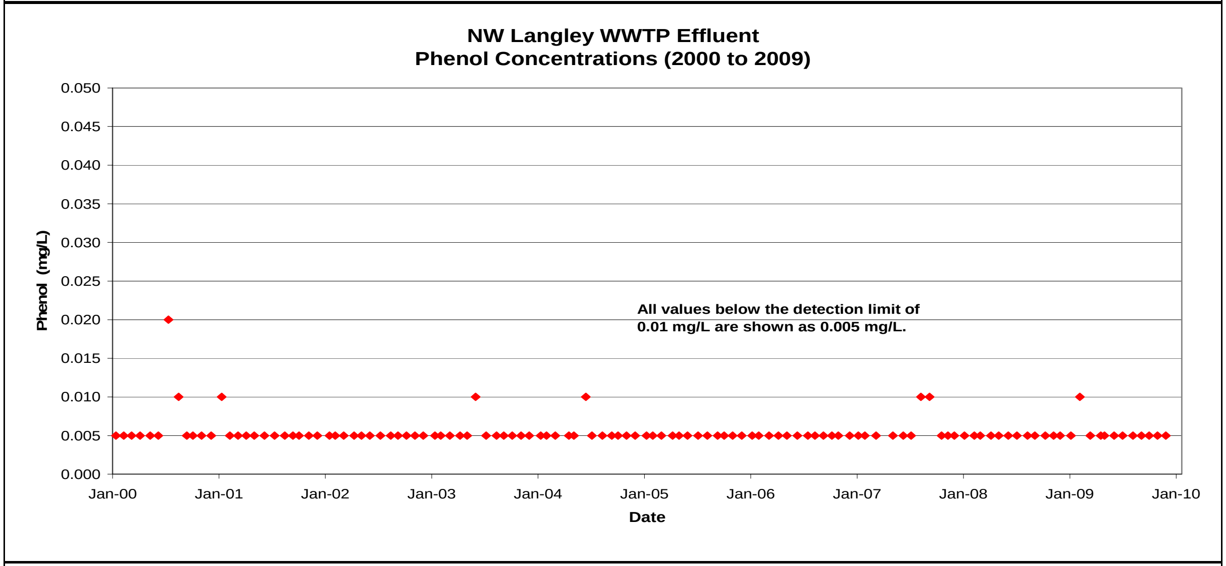
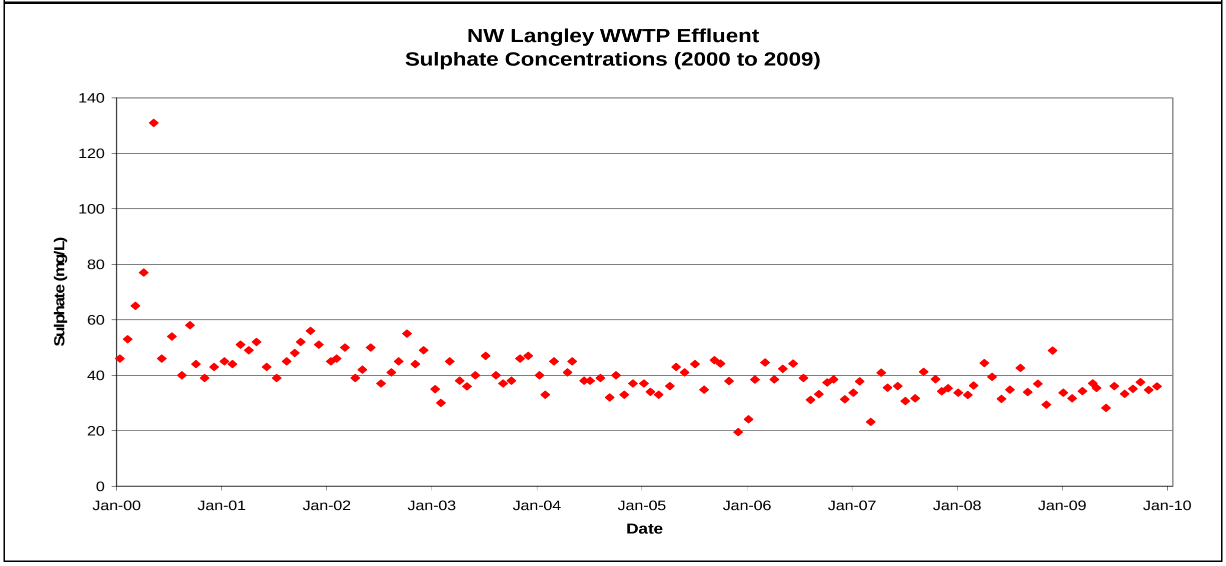






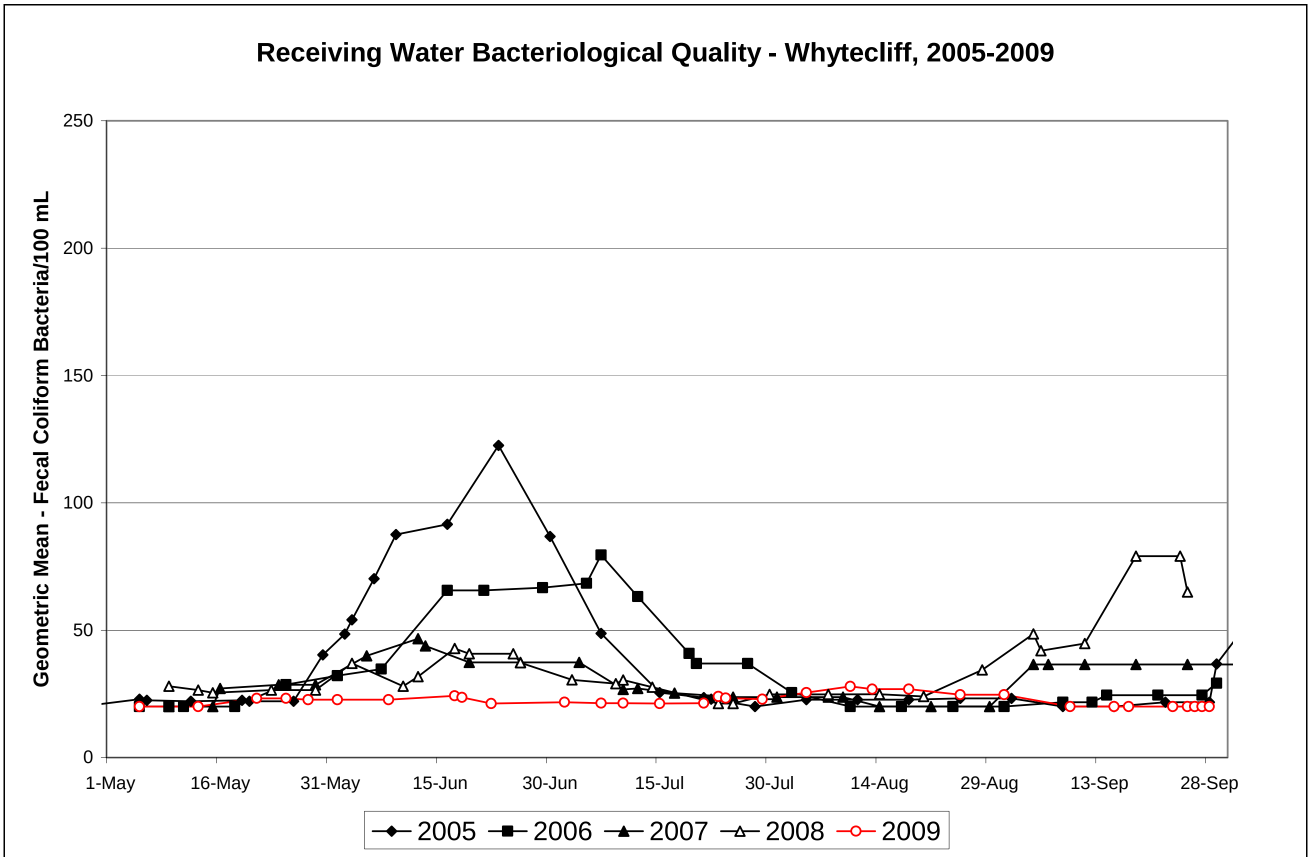
Appendix C & D

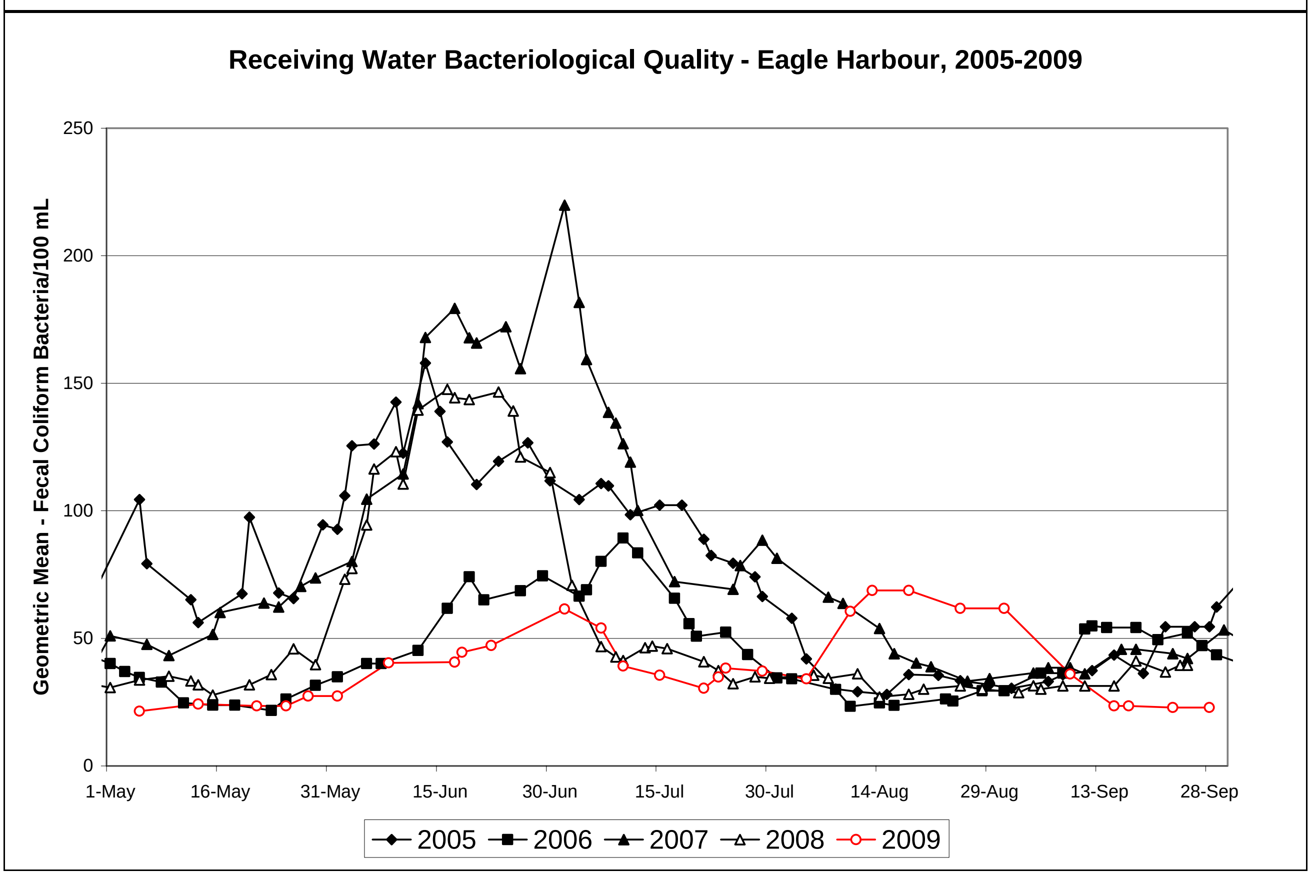
APPENDIX C

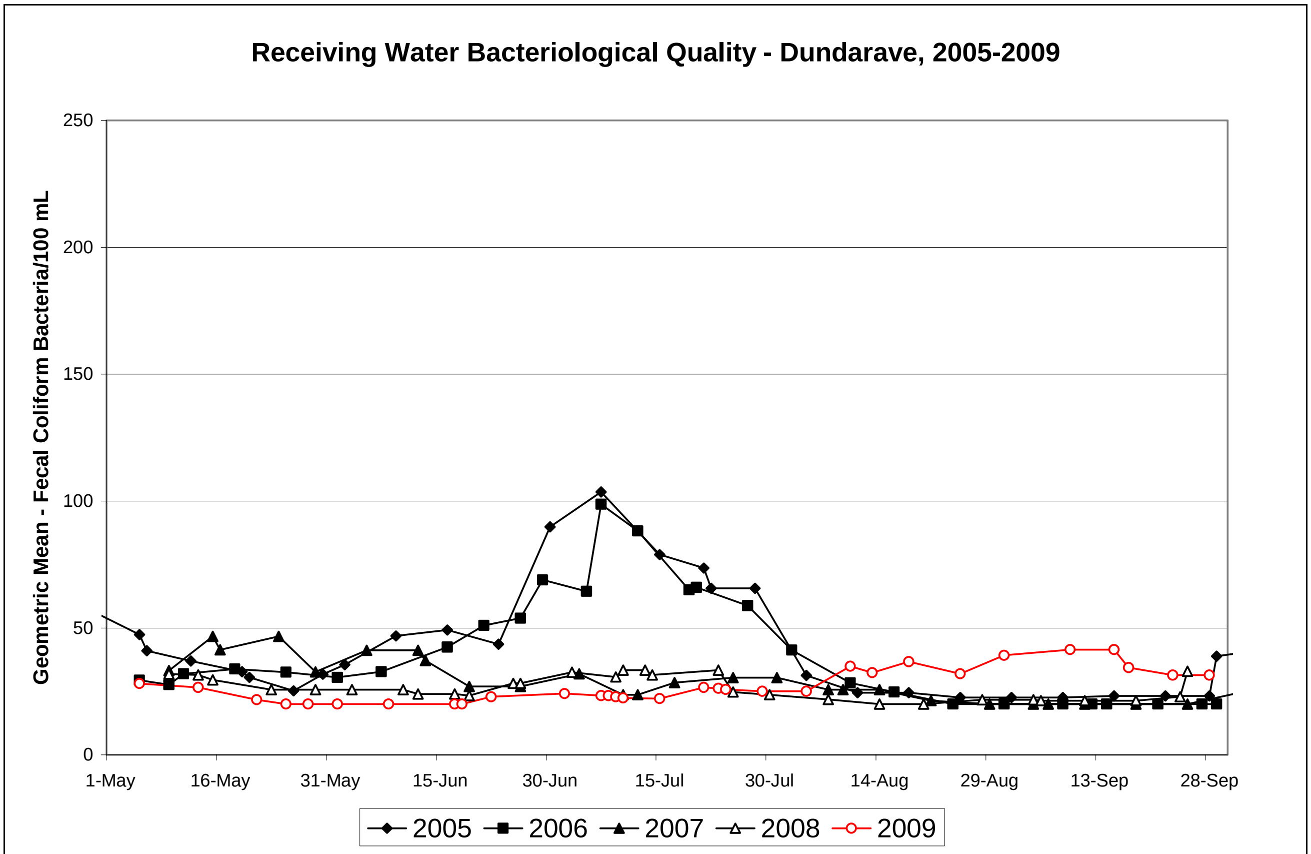
Receiving Water Bacteriological Quality
30-Day Geometric Means of Fecal Coliform Levels

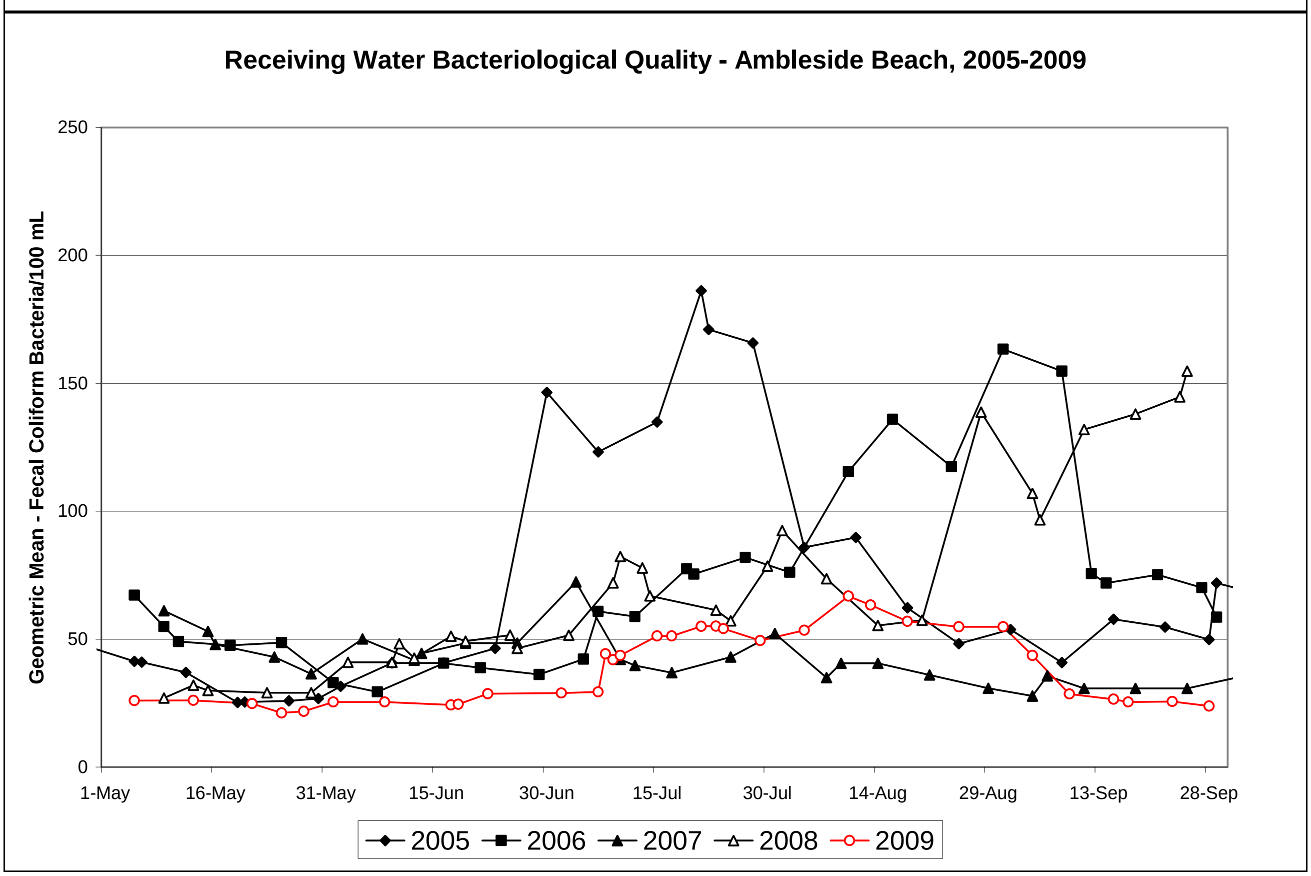
Guidelines for Beach Water Quality

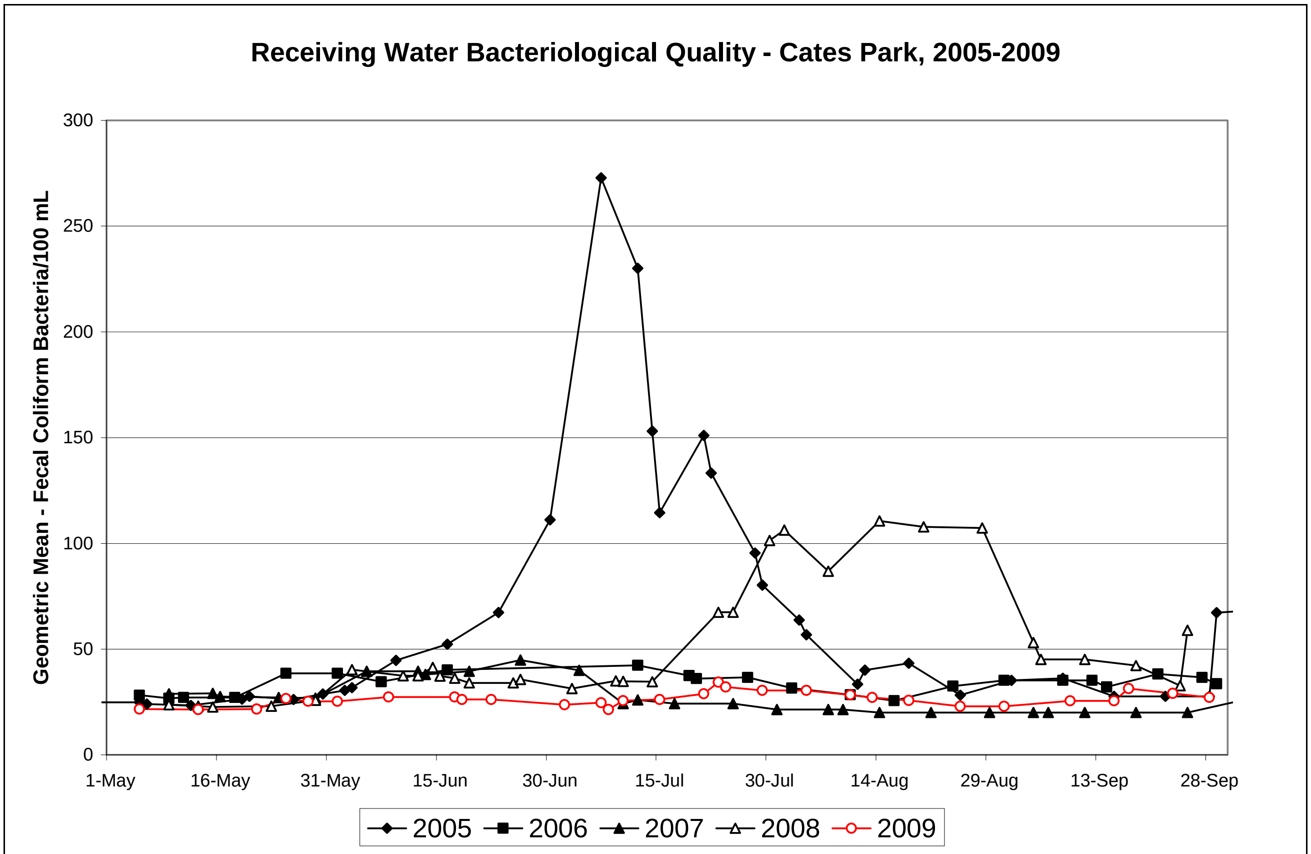
For a body of water to be considered safe for primary-contact recreation, the guidelines stipulate that the geometric mean of results of at least 5 samples collected in a 30 day period should not exceed 200 fecal coliform bacteria per 100 mL. False Creek is not classified as a primary-contact recreational water body (i.e., a beach).

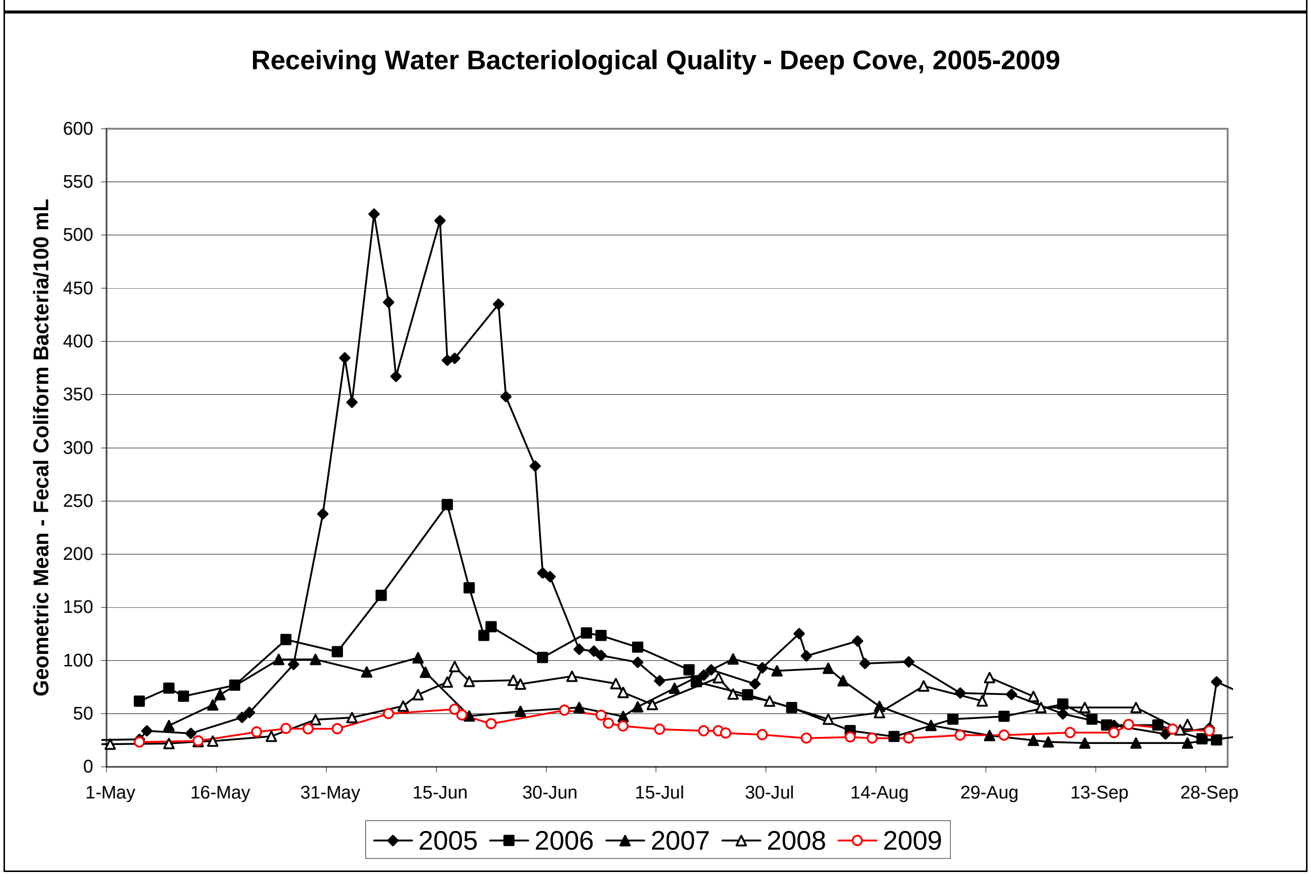

Receiving Water Bacteriological Quality - Whytecliff, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Eagle Harbour, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Dundarave, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Ambleside Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Cates Park, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Deep Cove, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
600
550
500
450
400
350
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
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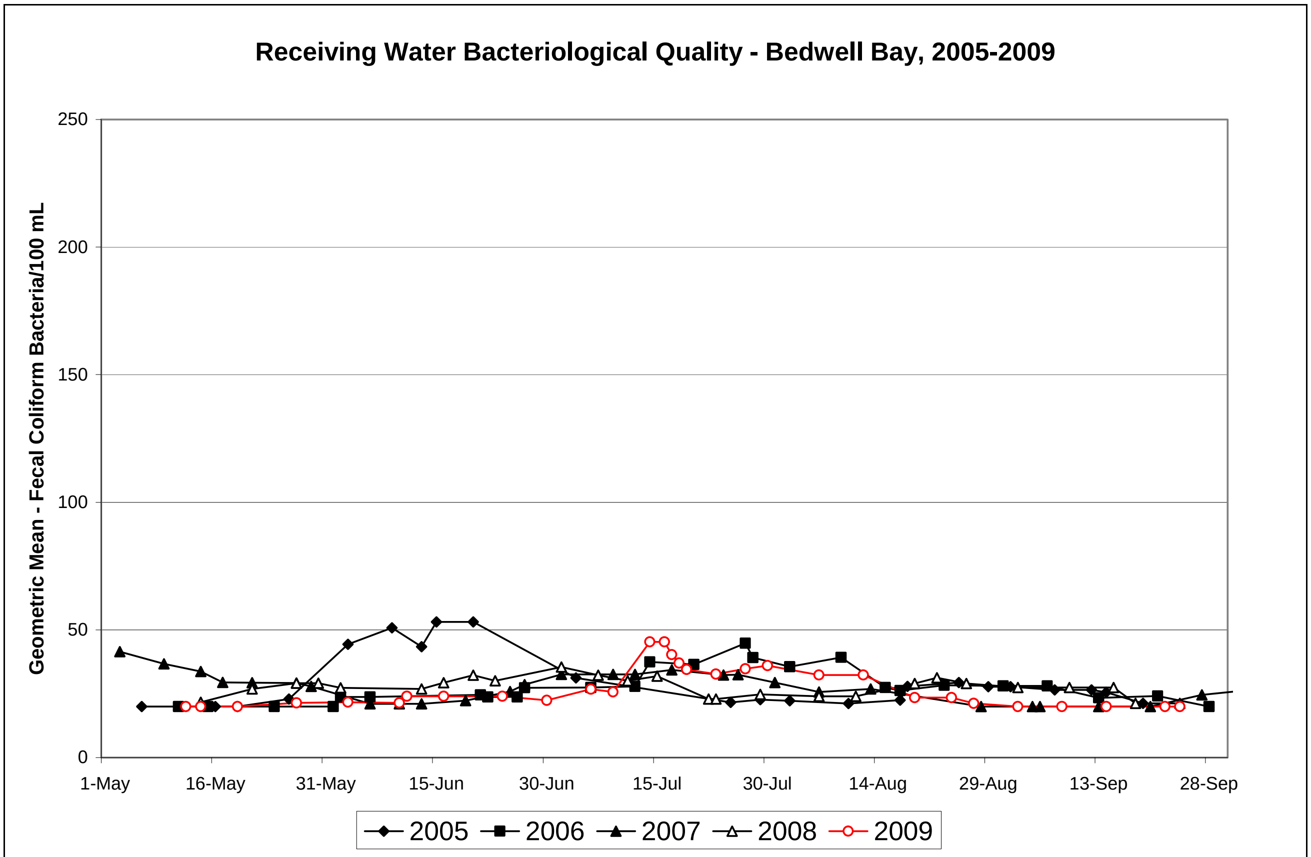
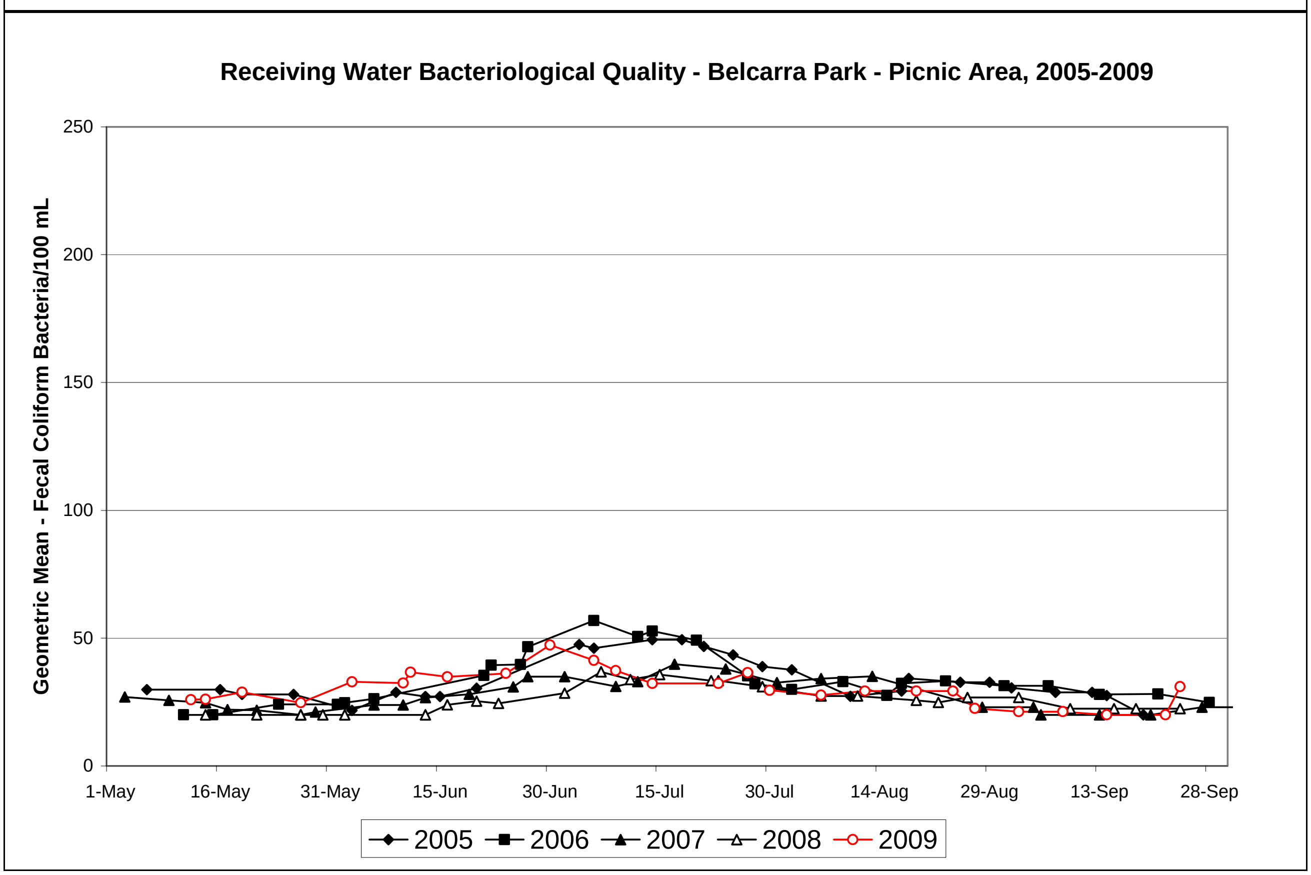
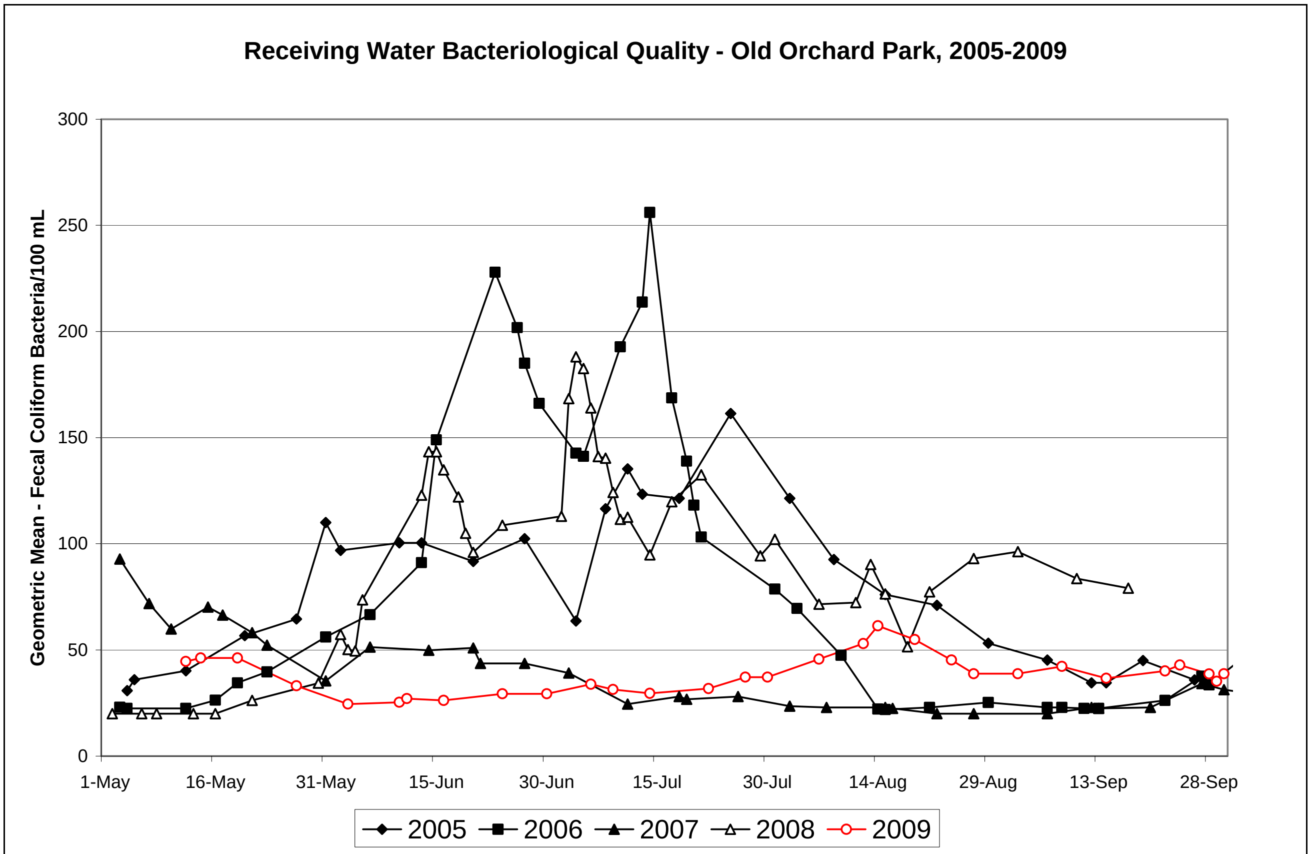
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Bedwell Bay, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Belcarra Park - Picnic Area, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Old Orchard Park, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
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14-Aug
29-Aug
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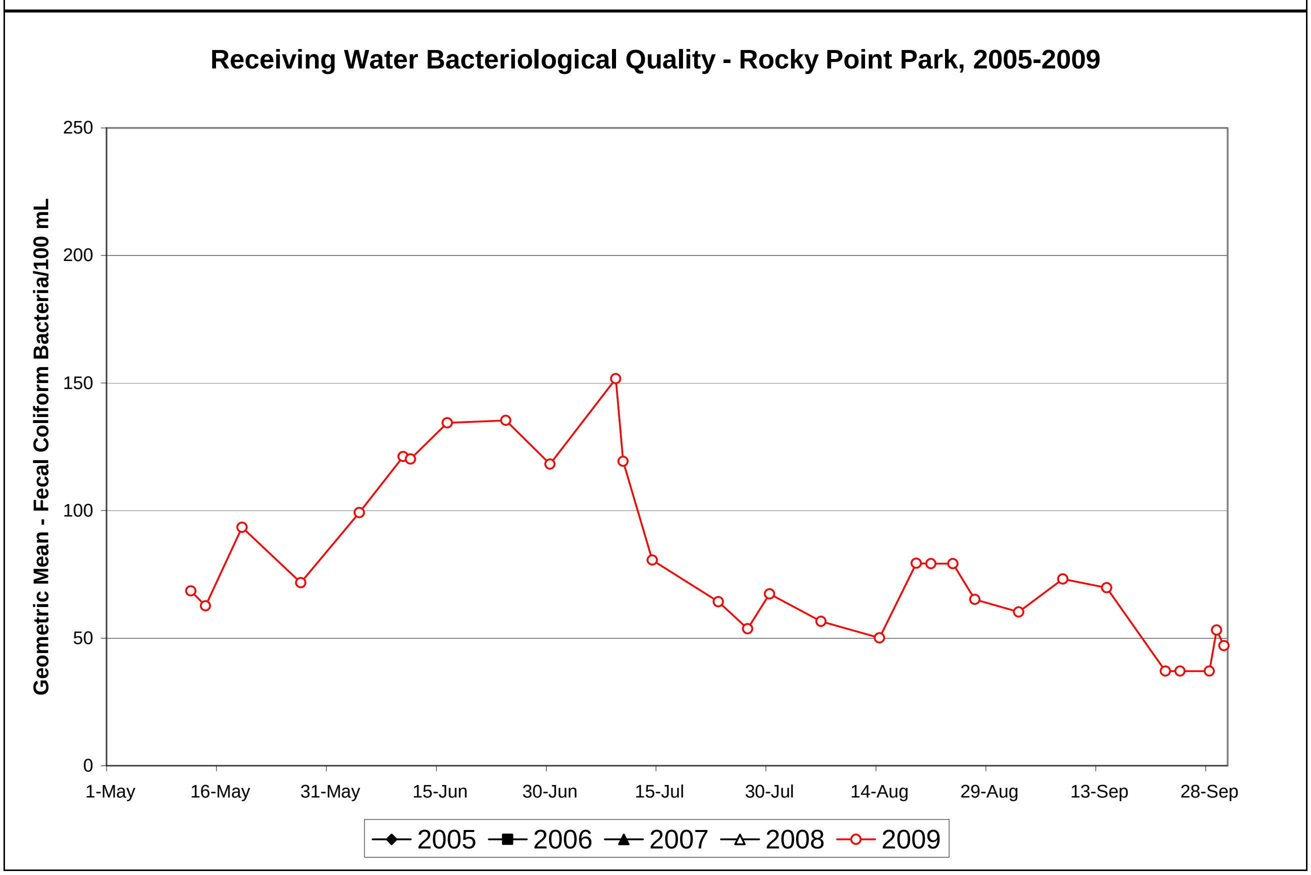
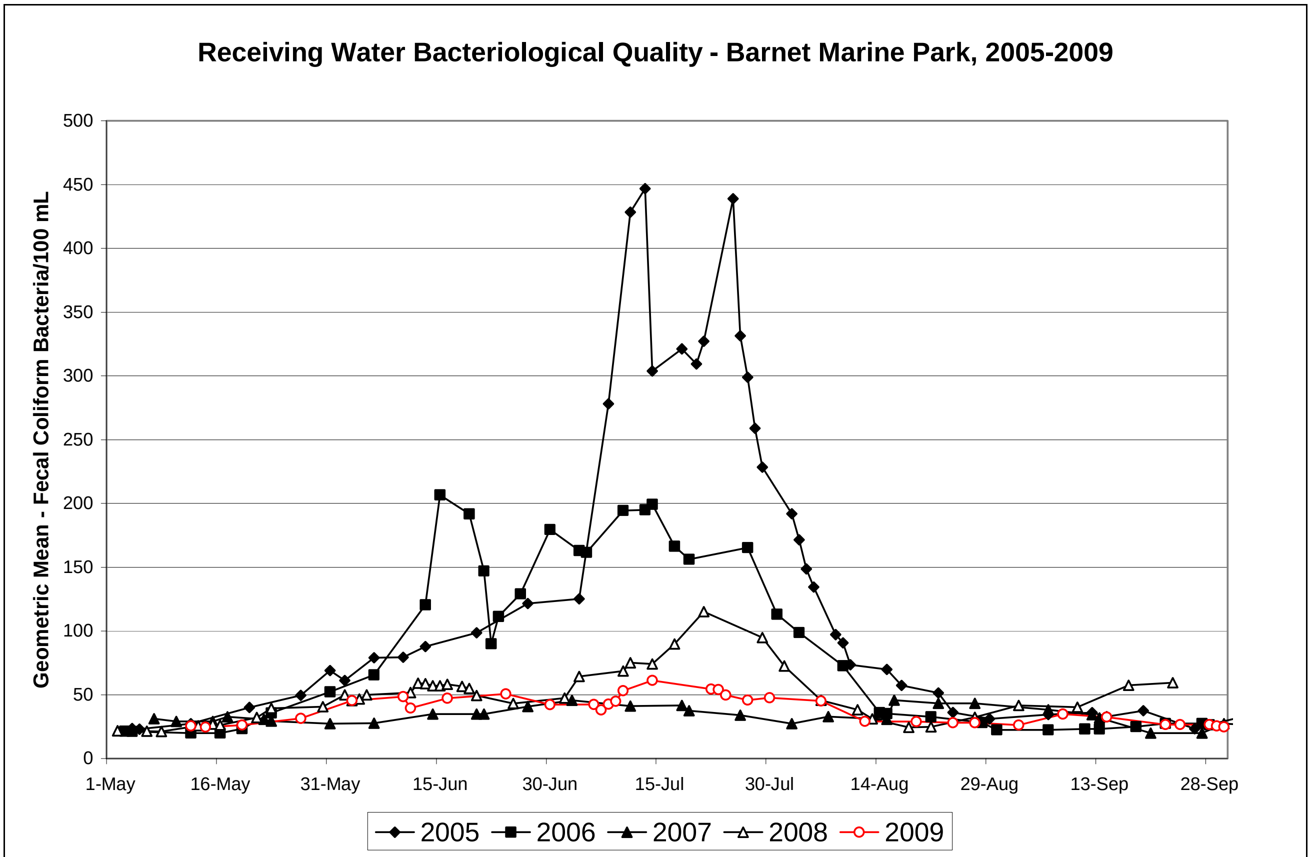
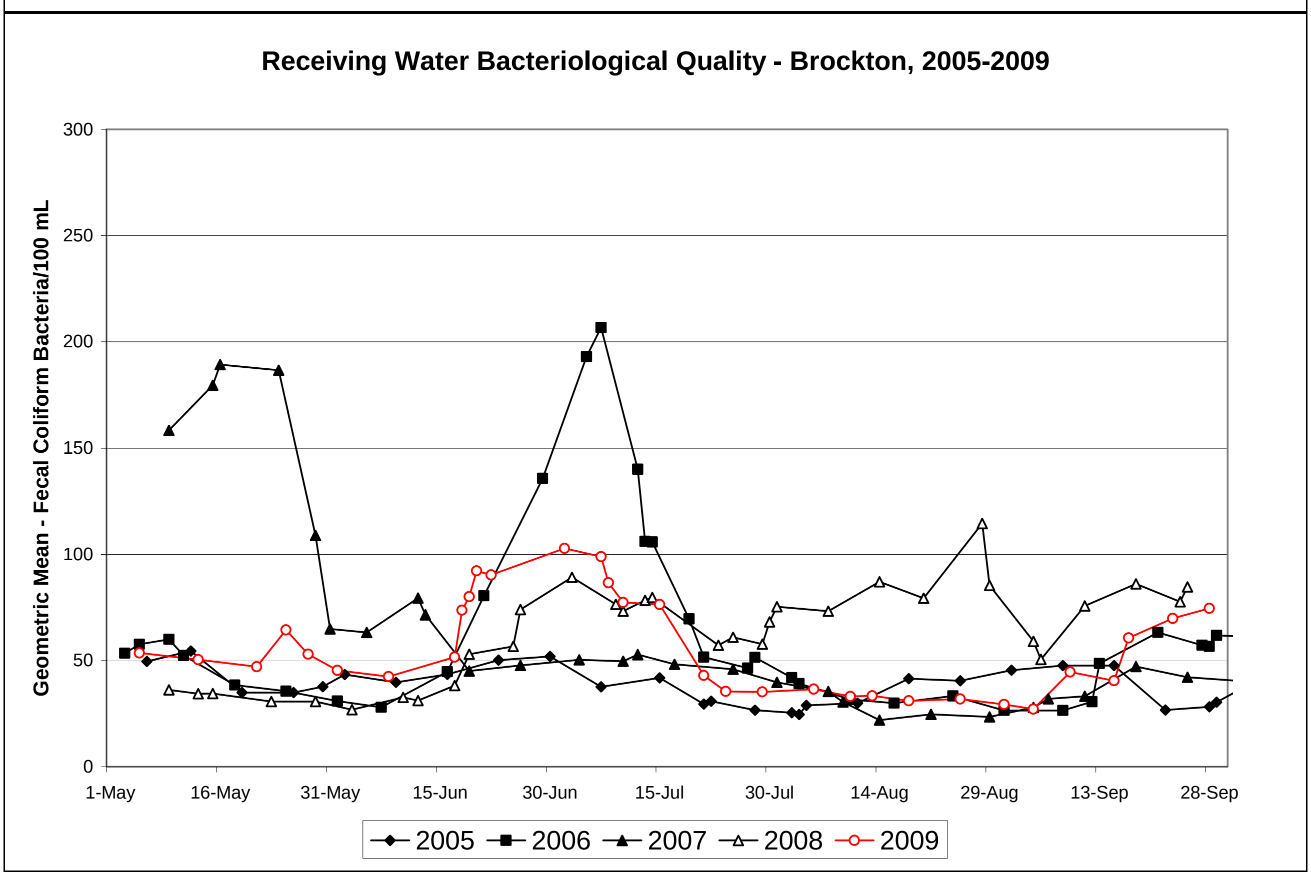
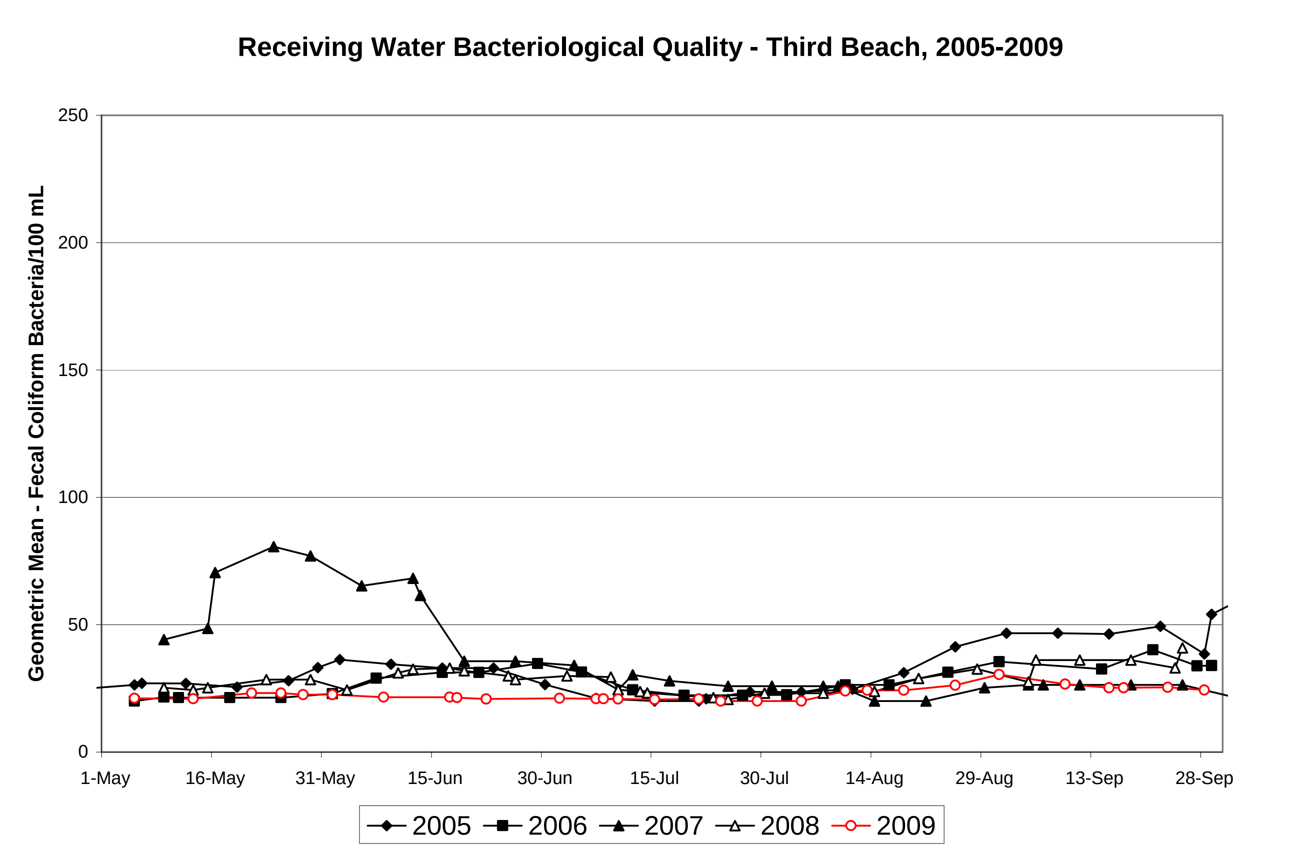
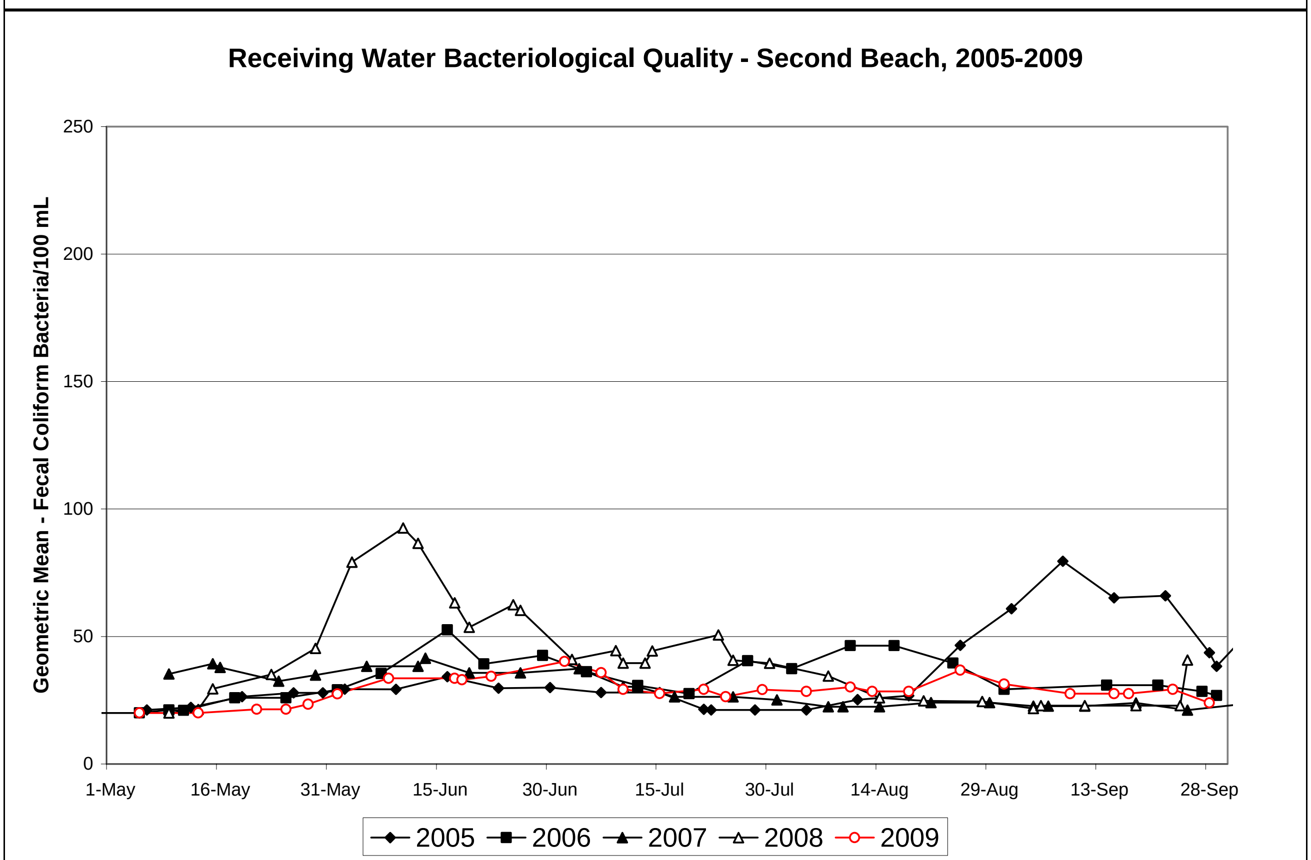
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Rocky Point Park, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

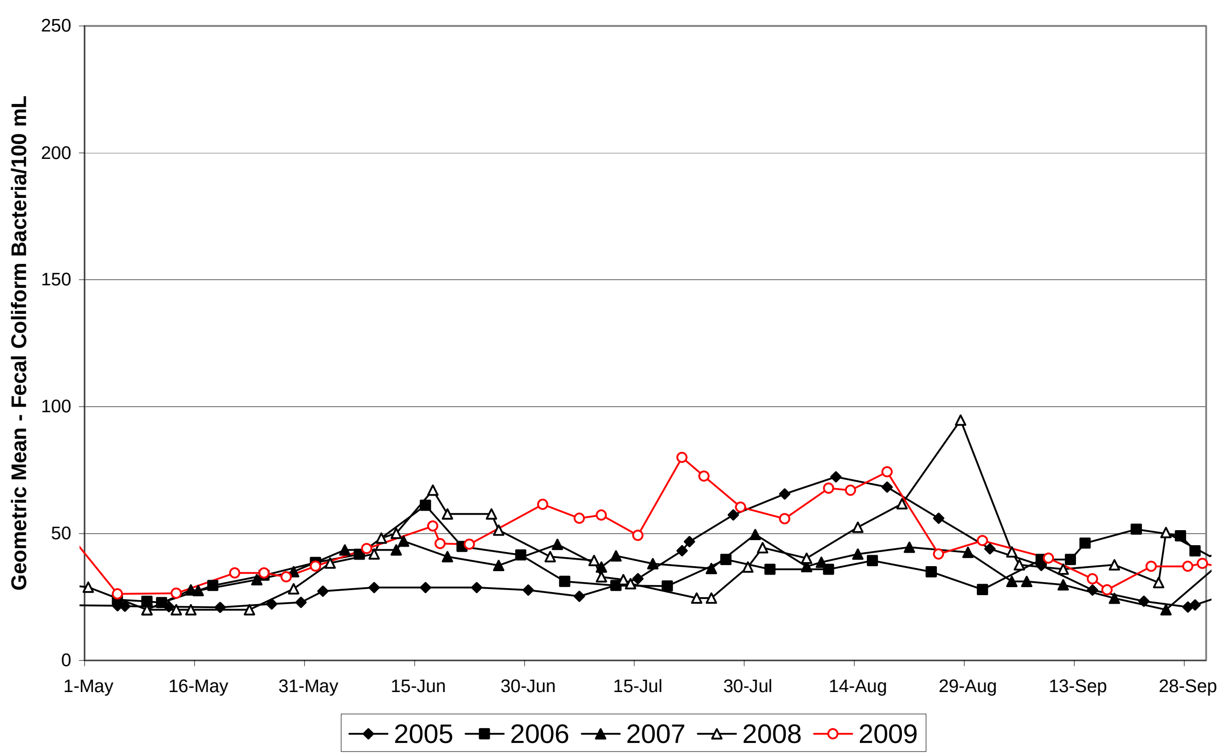

Receiving Water Bacteriological Quality - Barnet Marine Park, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
300
350
400
450
500
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Brockton, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
300
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

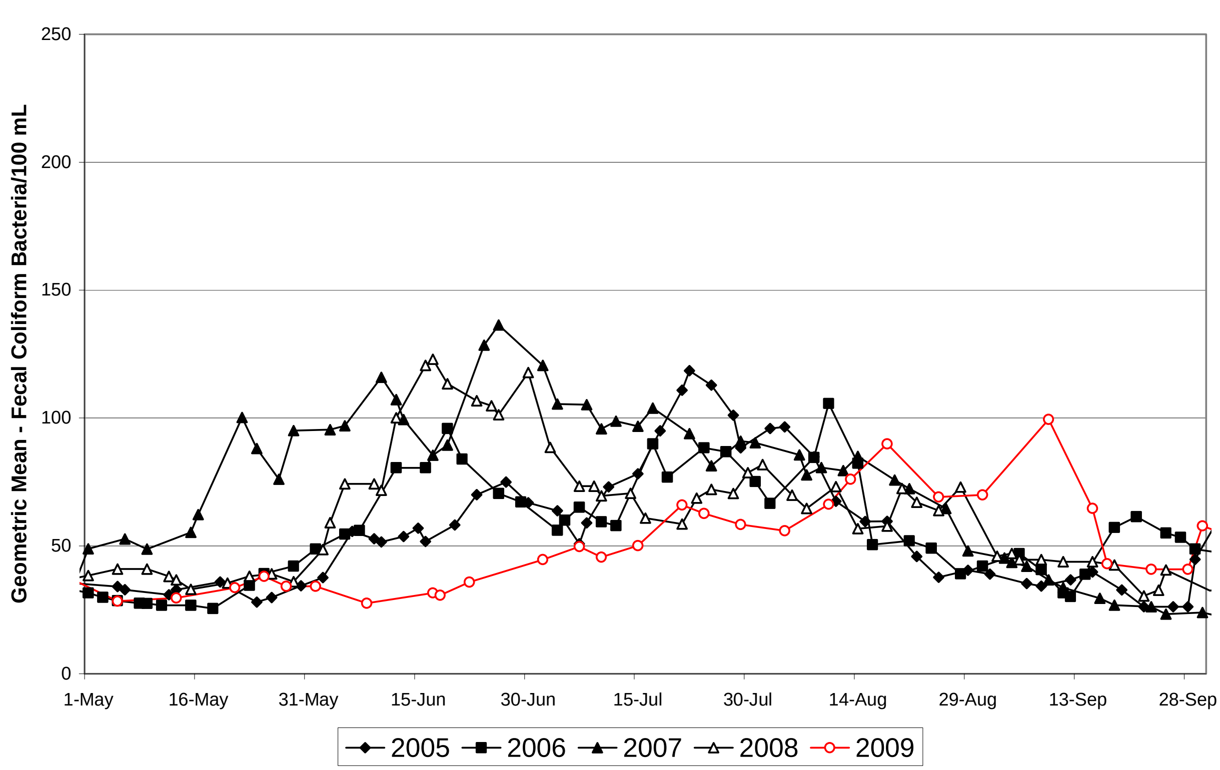

Receiving Water Bacteriological Quality - Third Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

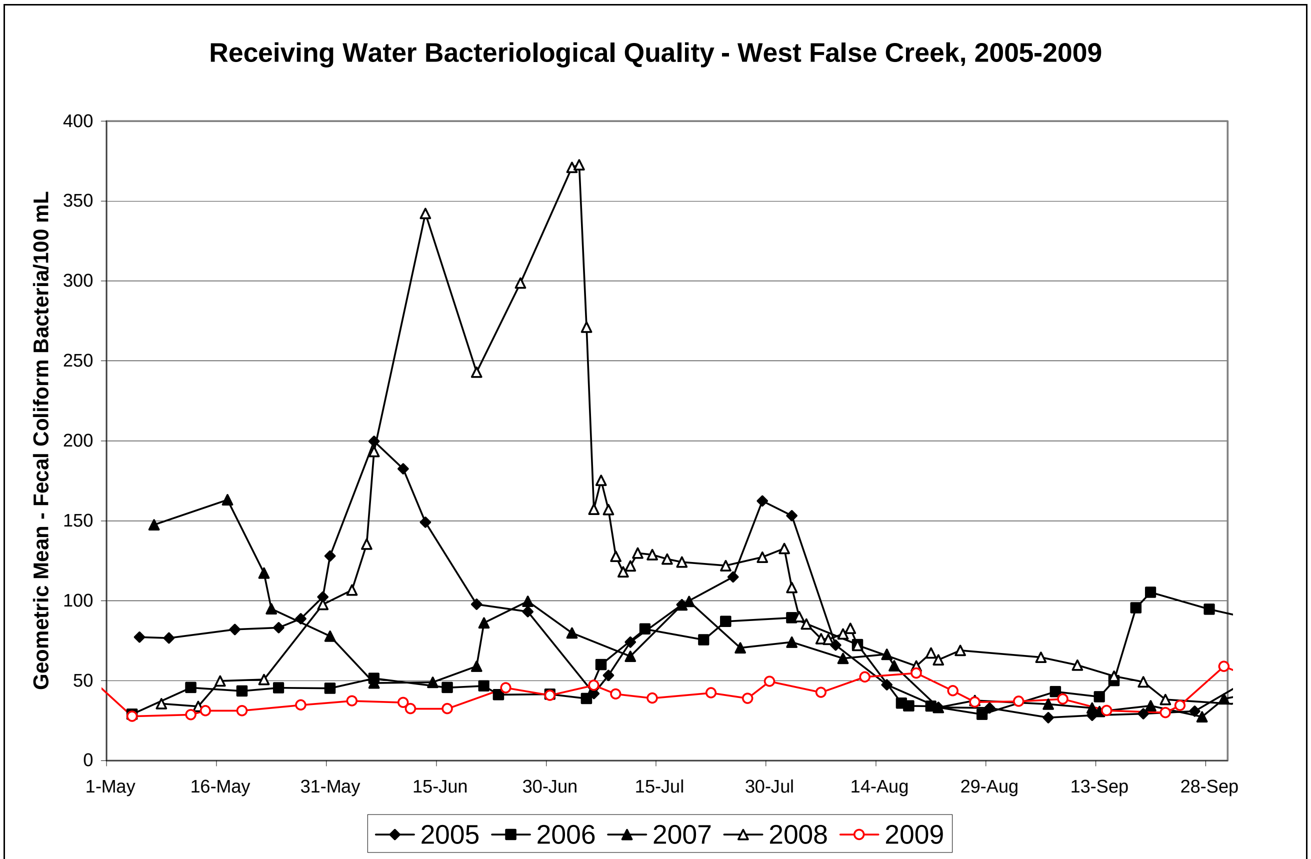

Receiving Water Bacteriological Quality - Second Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

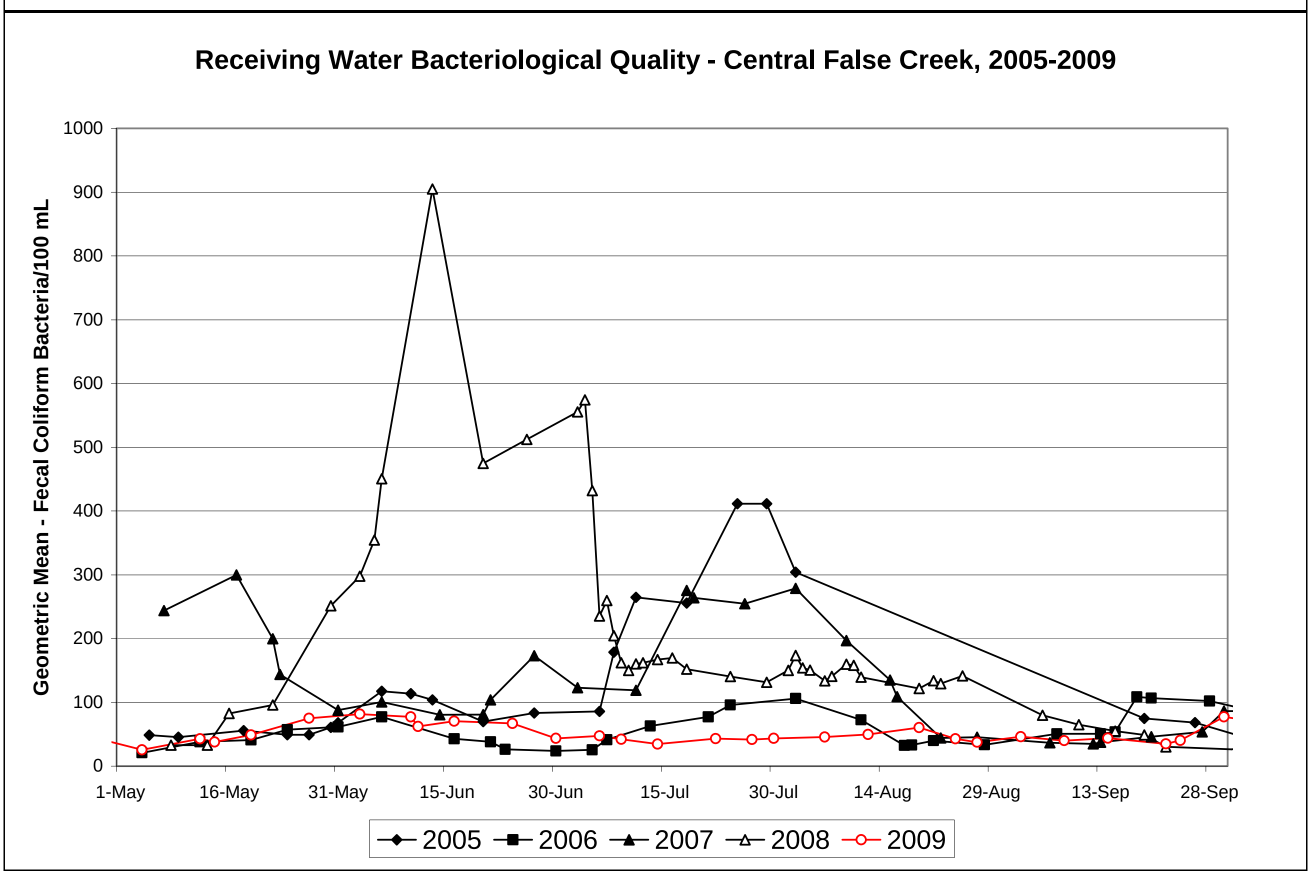
Receiving Water Bacteriological Quality - English Bay, 2005-2009



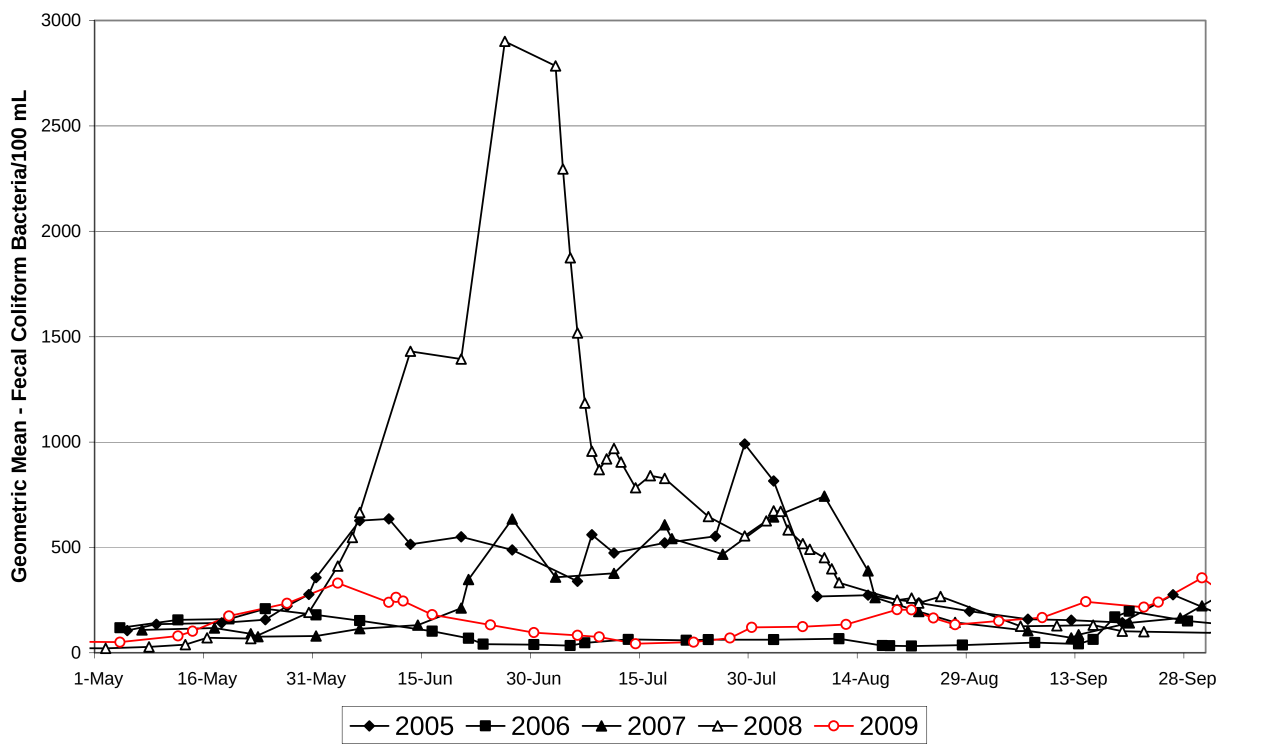
Receiving Water Bacteriological Quality - Sunset Beach, 2005-2009



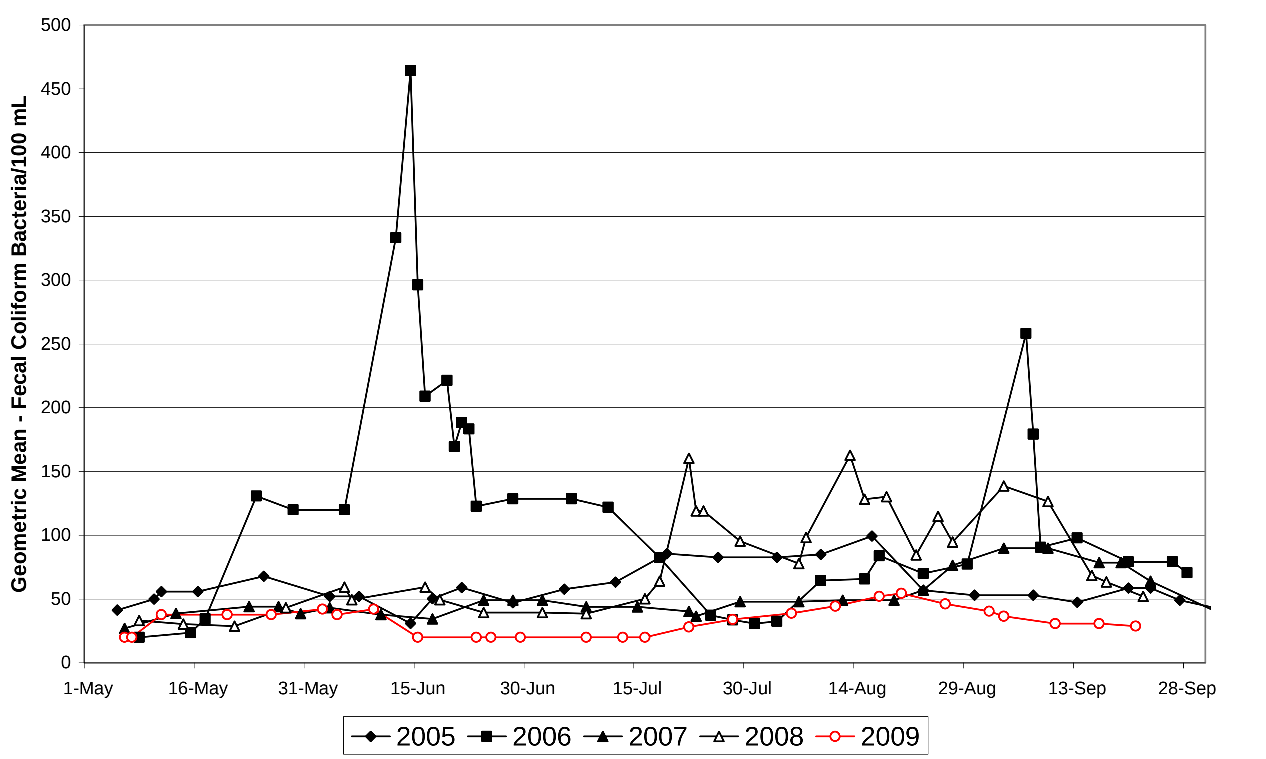

Receiving Water Bacteriological Quality - West False Creek, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
400
350
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

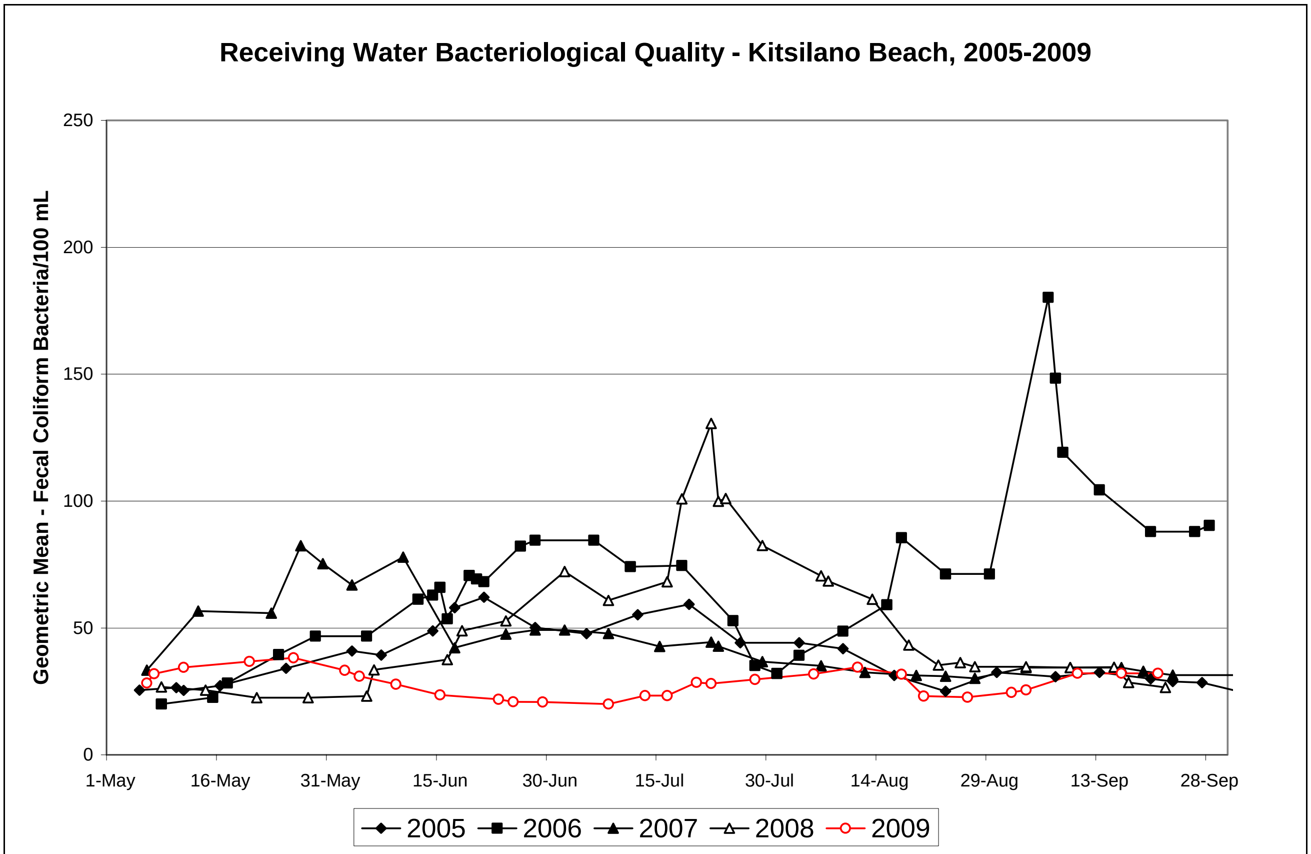

Receiving Water Bacteriological Quality - Central False Creek, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
1000
900
800
700
600
500
400
300
200
100
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

Receiving Water Bacteriological Quality - East False Creek, 2005-2009

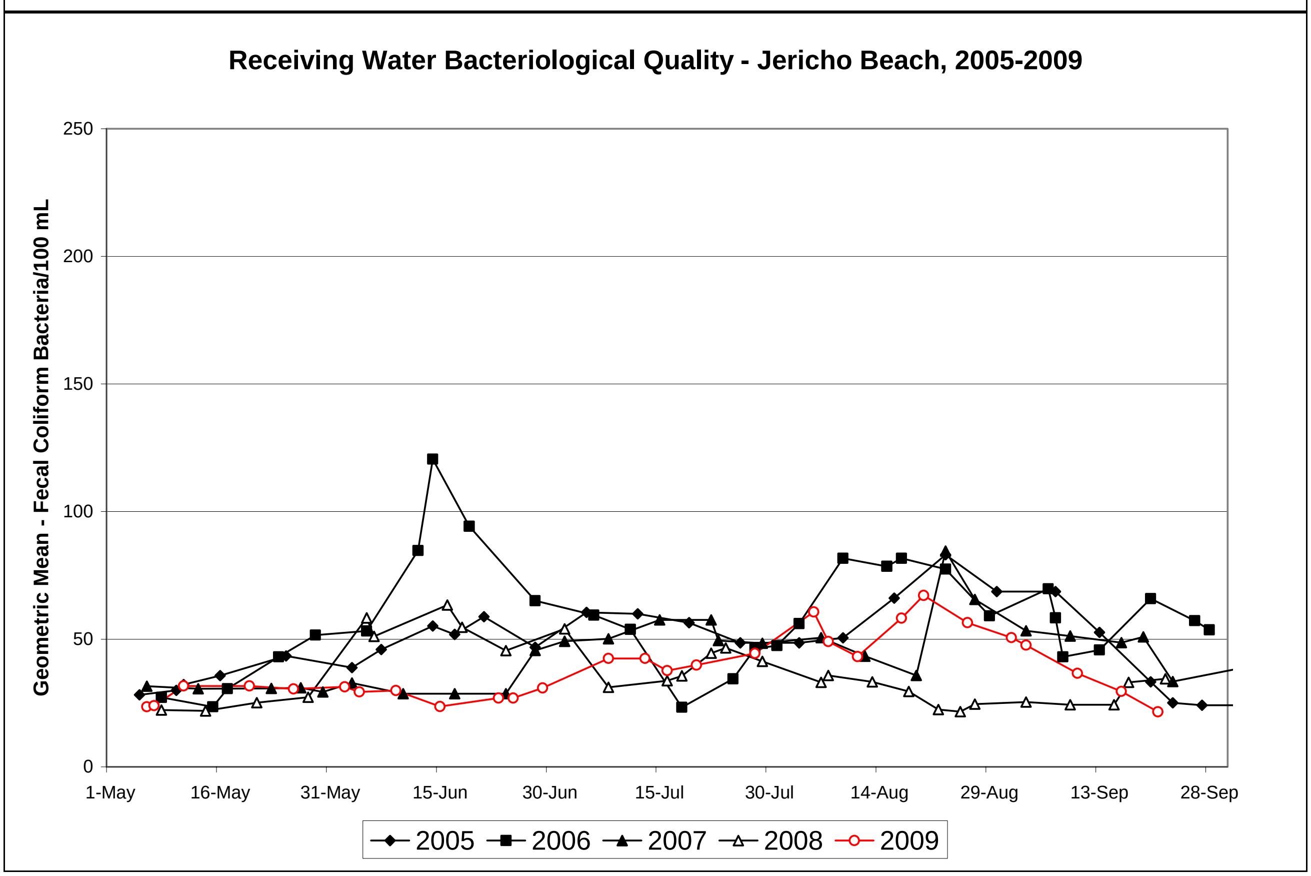


Receiving Water Bacteriological Quality - Kitsilano Point, 2005-2009

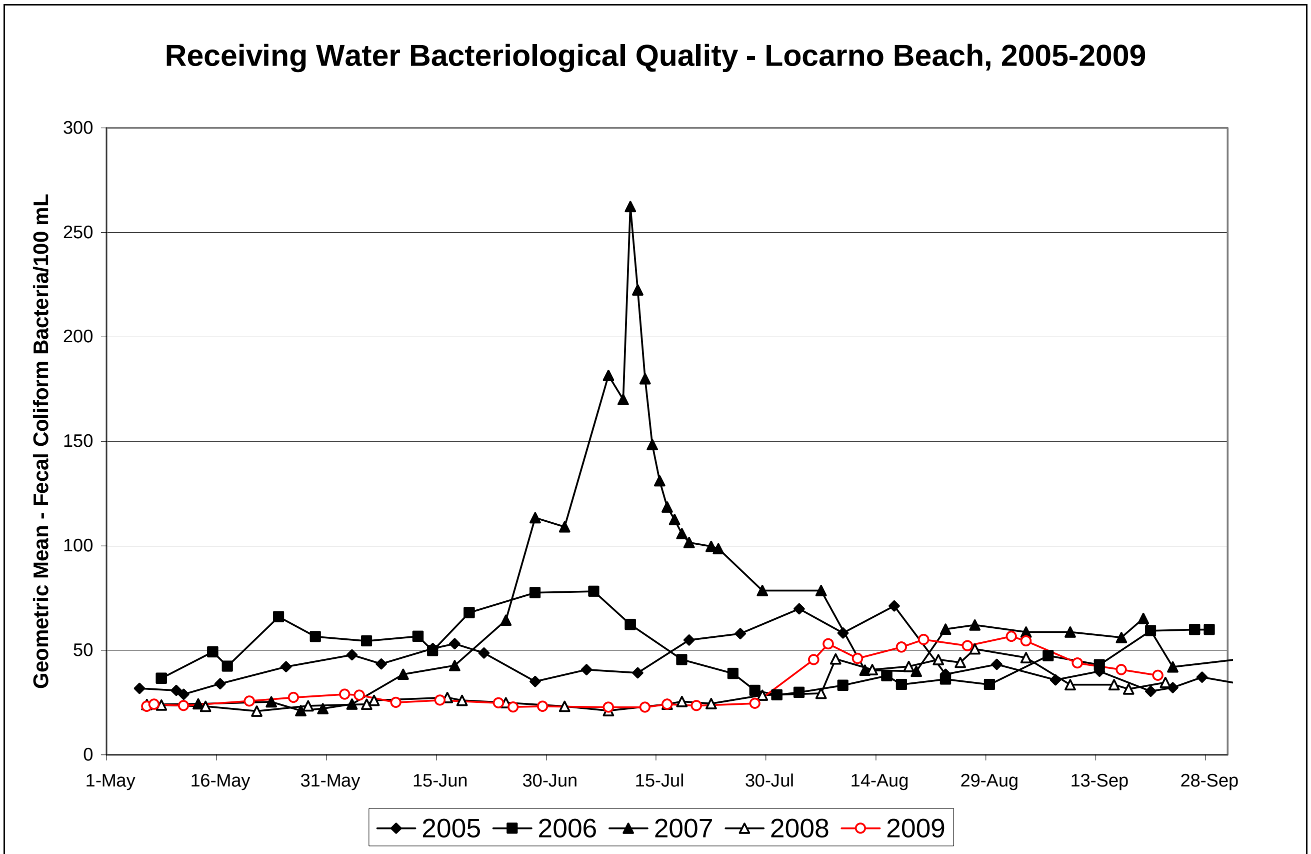




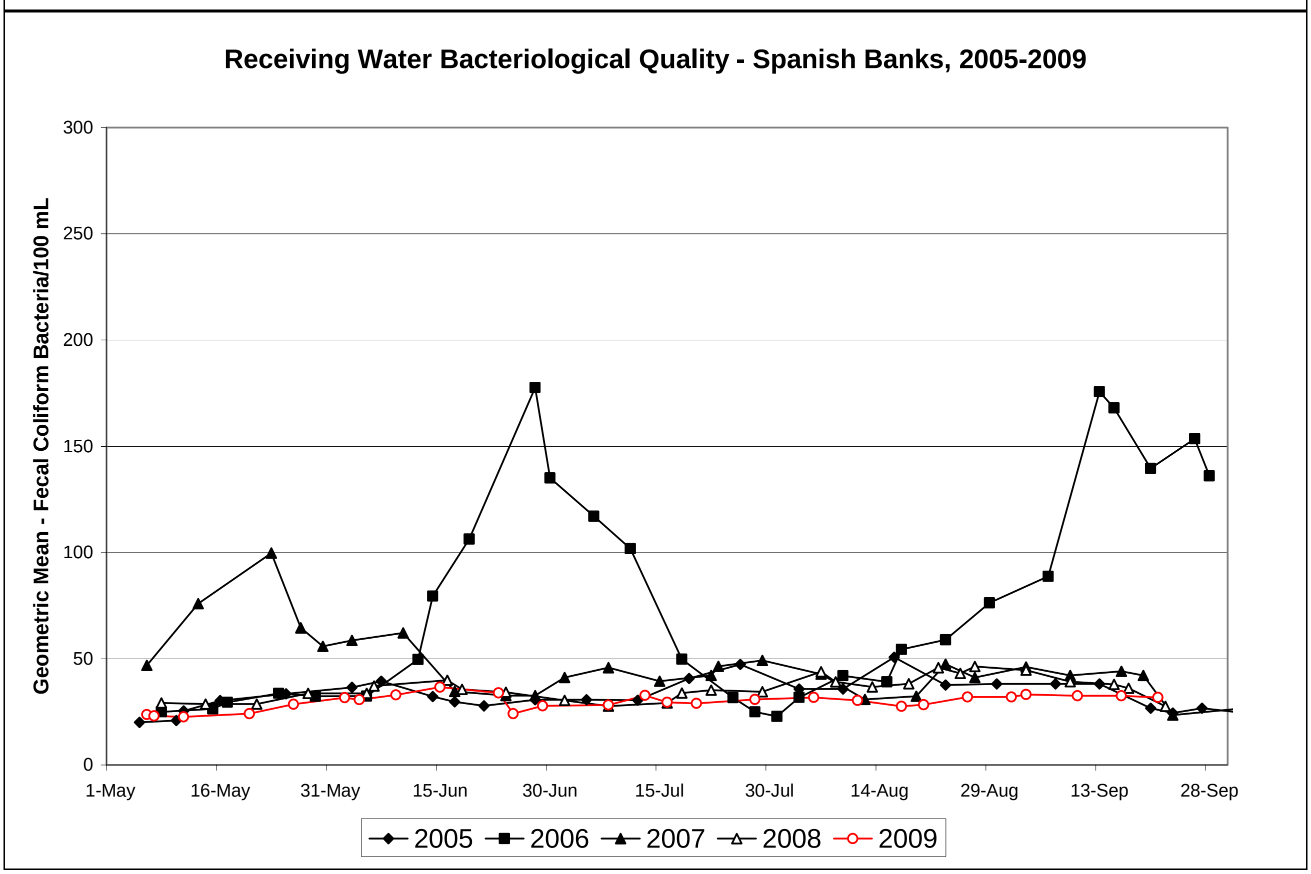
Receiving Water Bacteriological Quality - Kitsilano Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009



Receiving Water Bacteriological Quality - Jericho Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

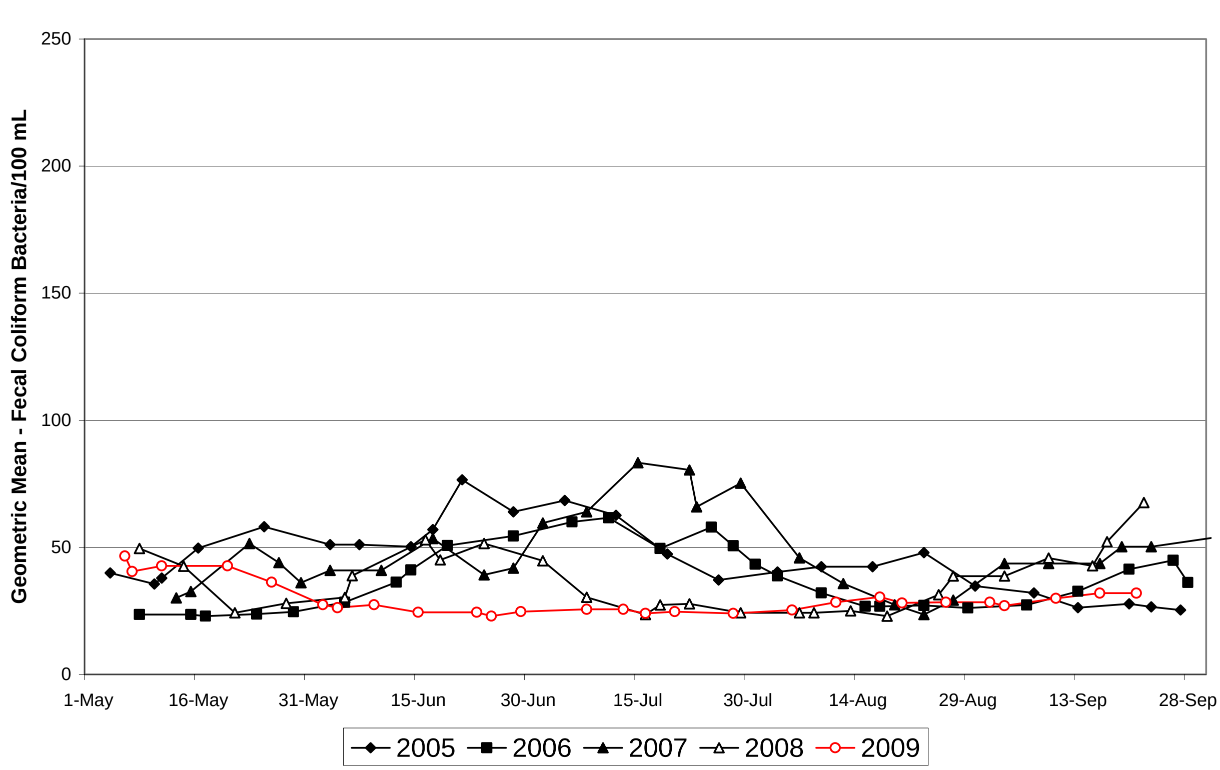


Receiving Water Bacteriological Quality - Locarno Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

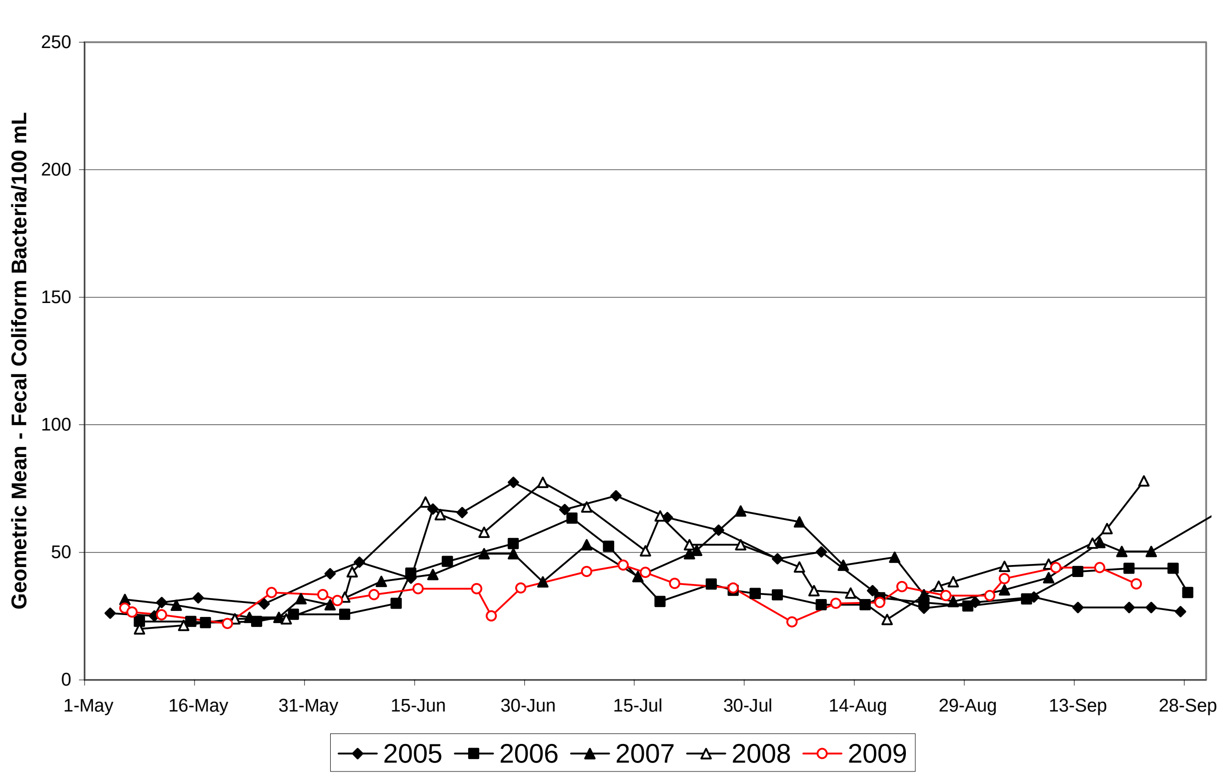


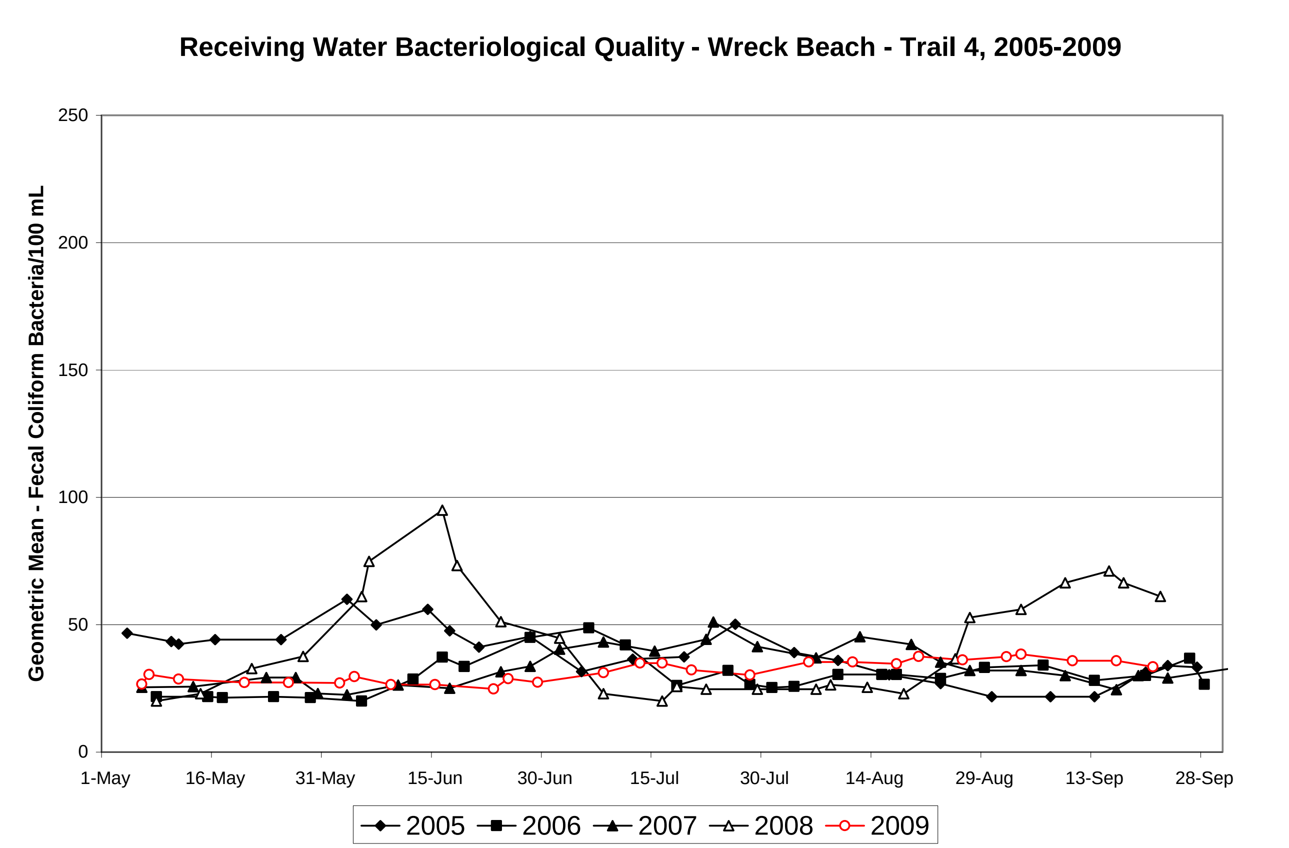
Receiving Water Bacteriological Quality - Spanish Banks, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

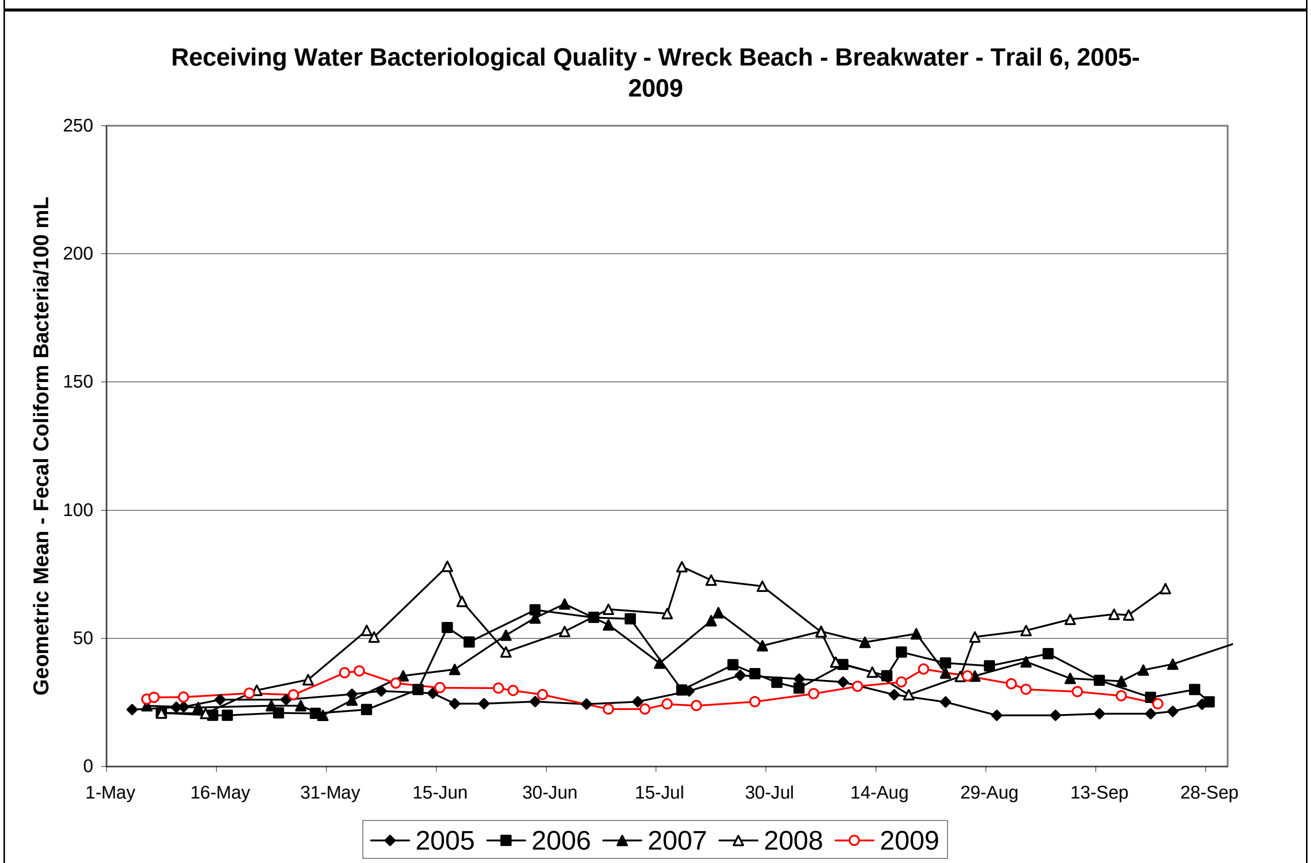
Receiving Water Bacteriological Quality - Wreck Beach - Foreshore East, 2005-2009

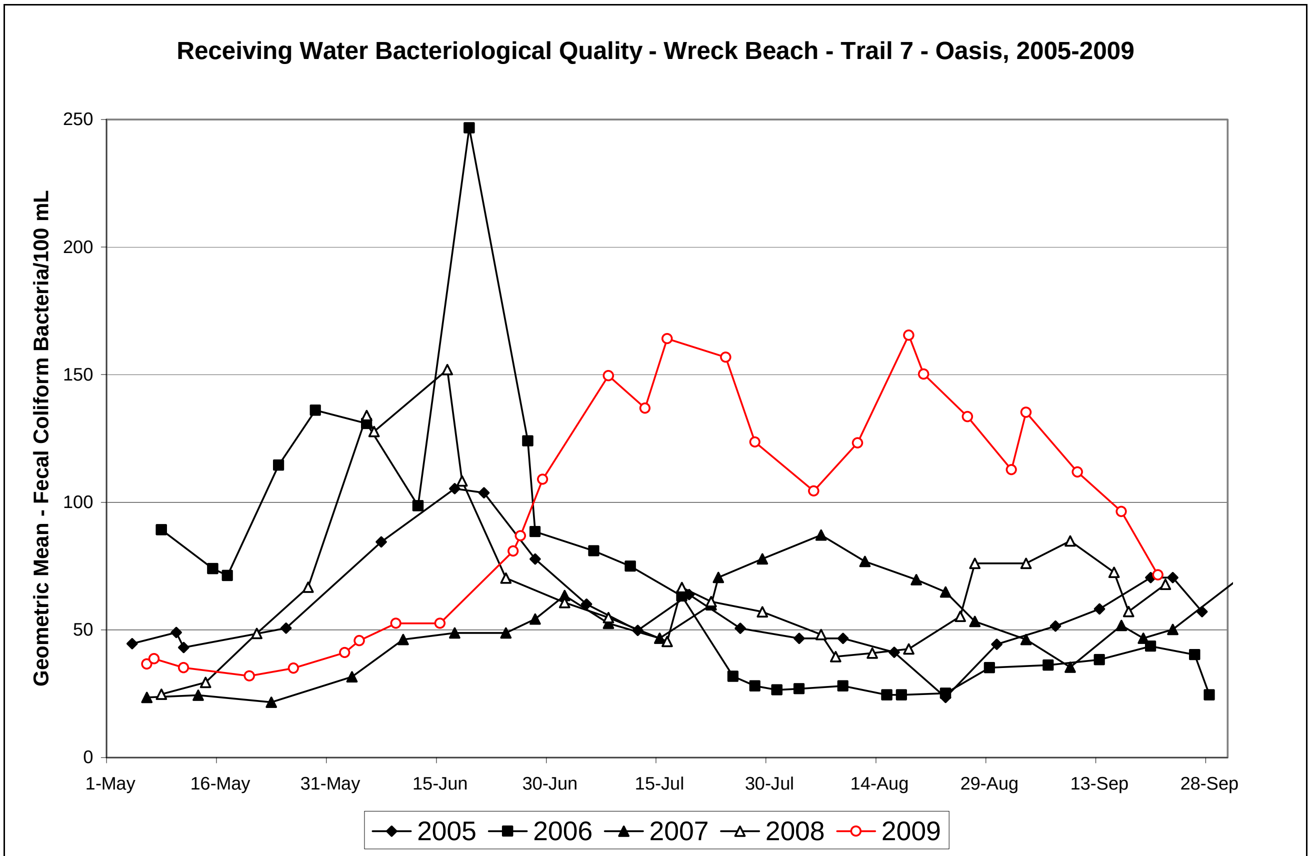


Receiving Water Bacteriological Quality - Wreck Beach - Acadia, 2009

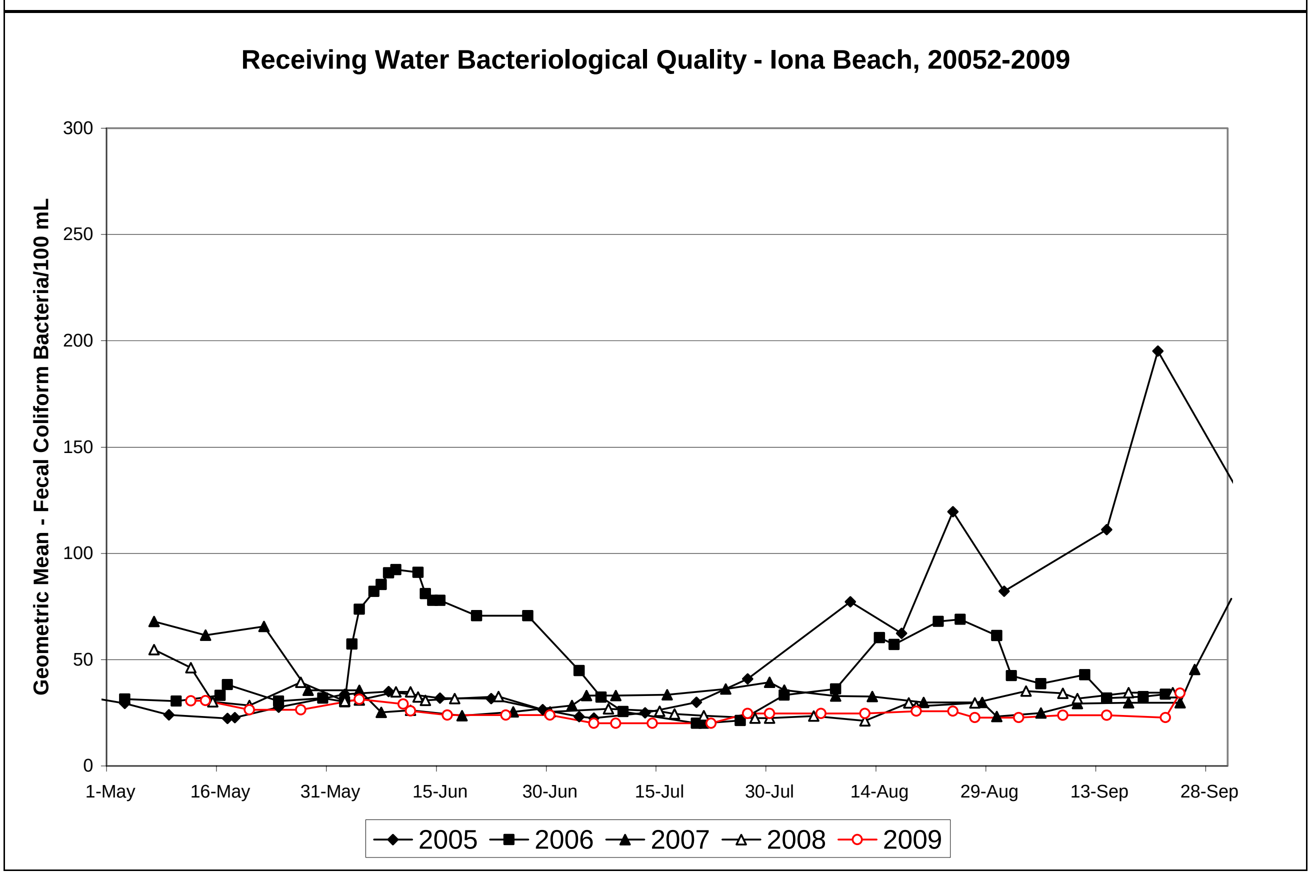



Receiving Water Bacteriological Quality - Wreck Beach - Trail 4, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

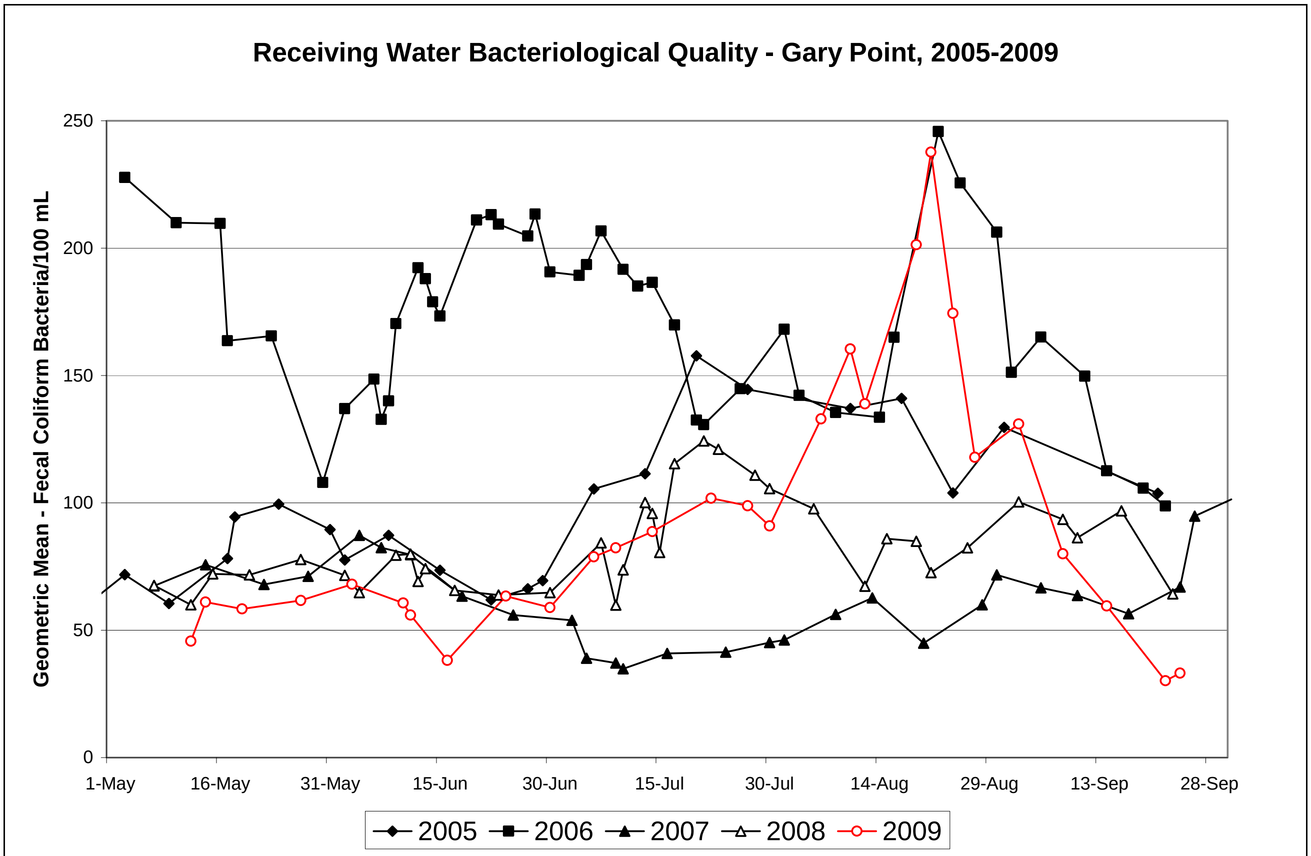

Receiving Water Bacteriological Quality - Wreck Beach - Breakwater - Trail 6, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009



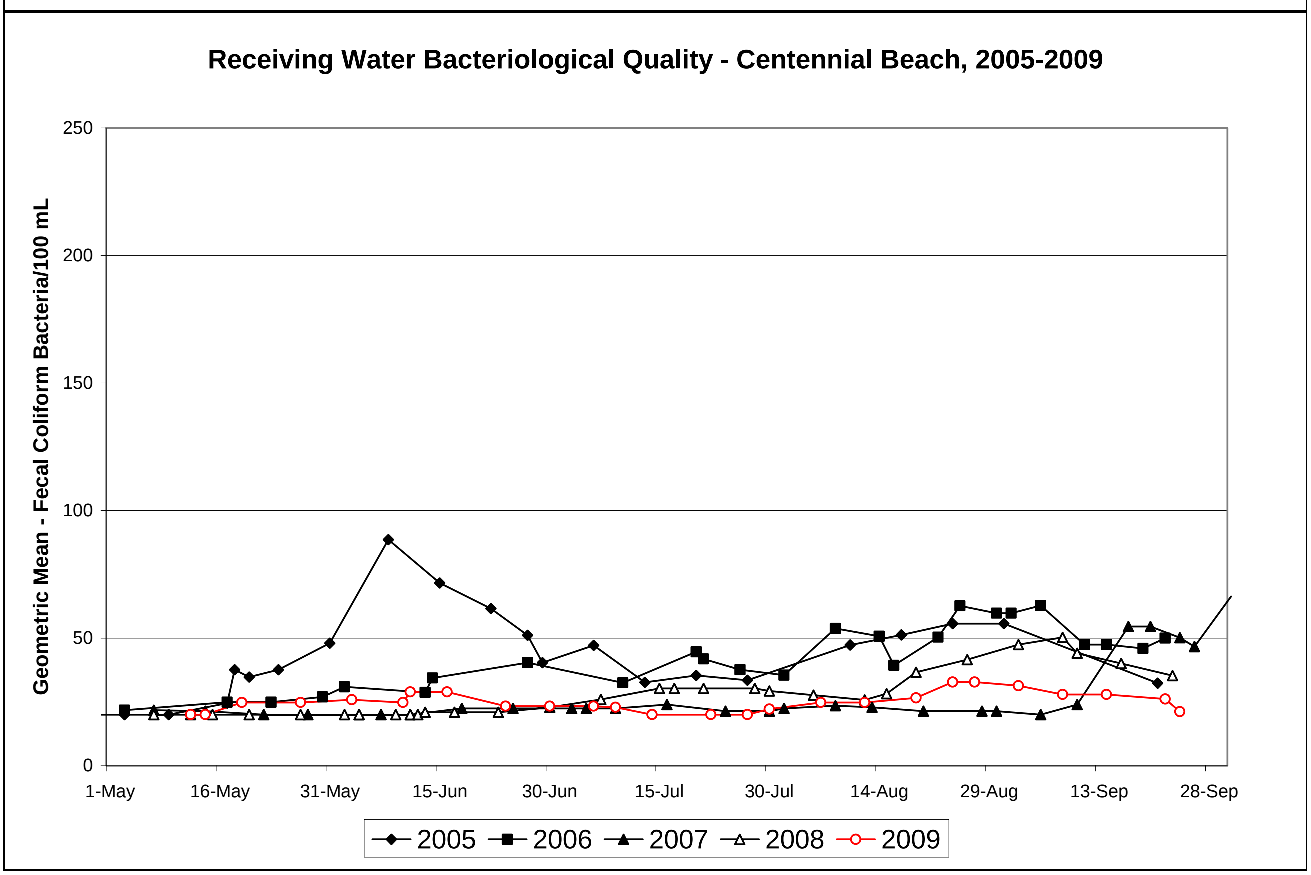
Receiving Water Bacteriological Quality - Wreck Beach - Trail 7 - Oasis, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009



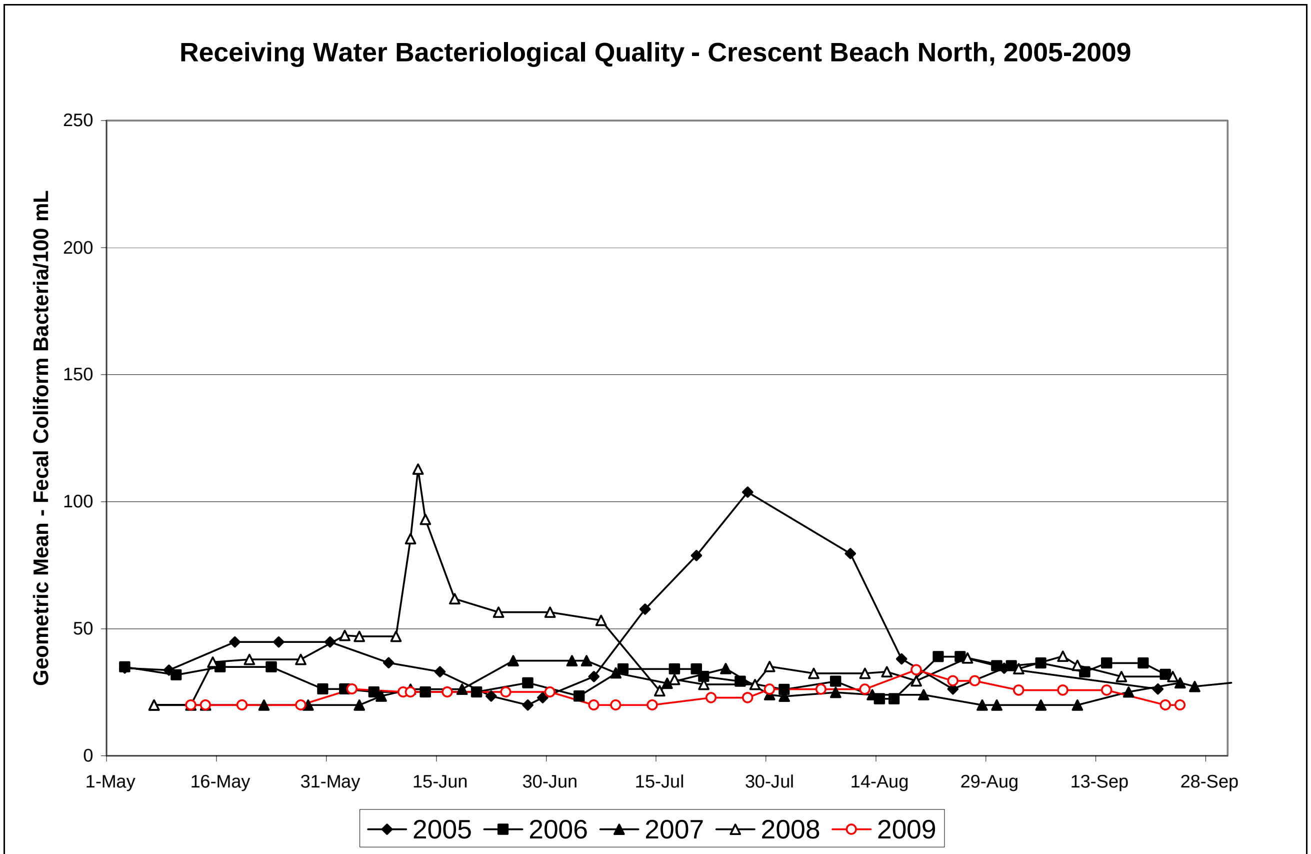
Receiving Water Bacteriological Quality - Iona Beach, 20052-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

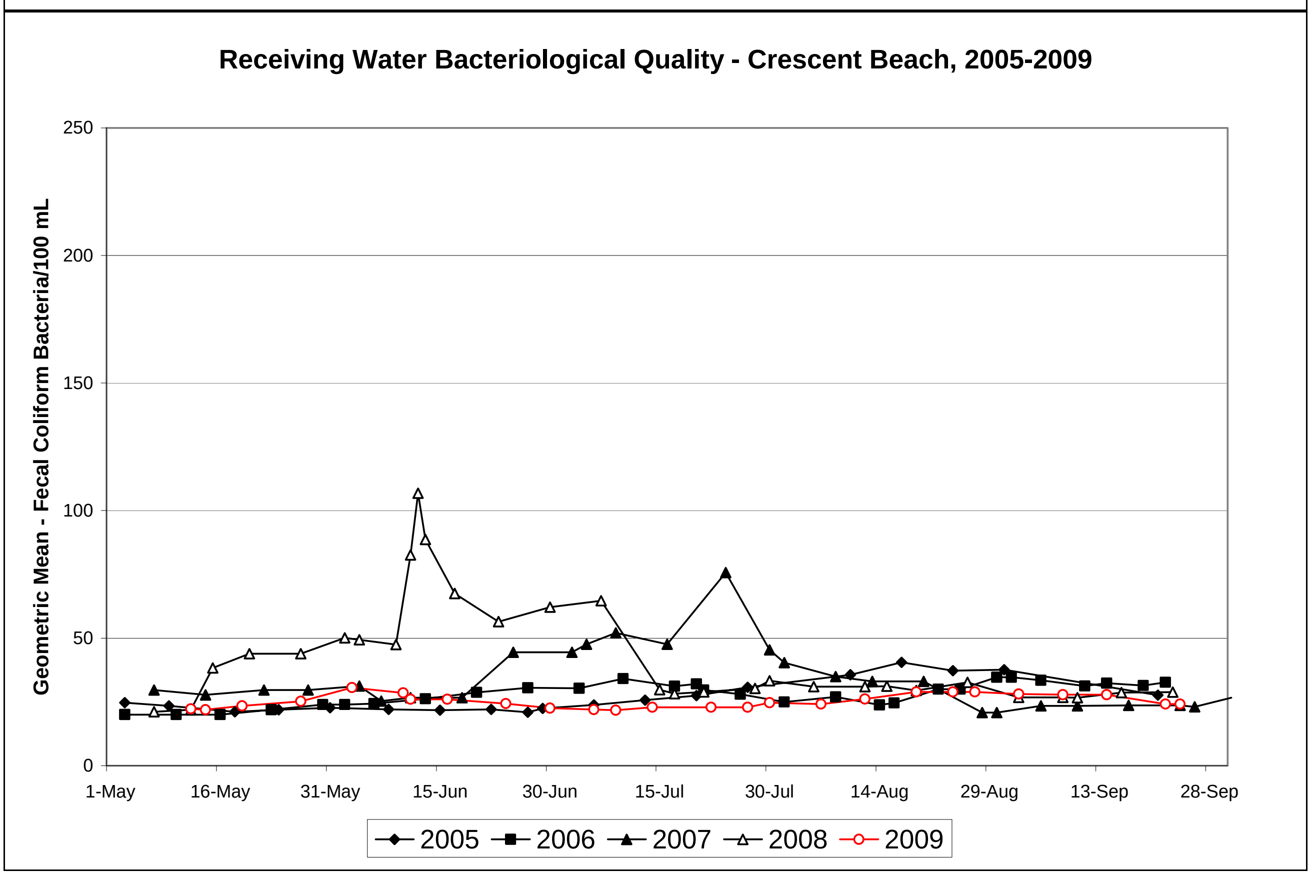


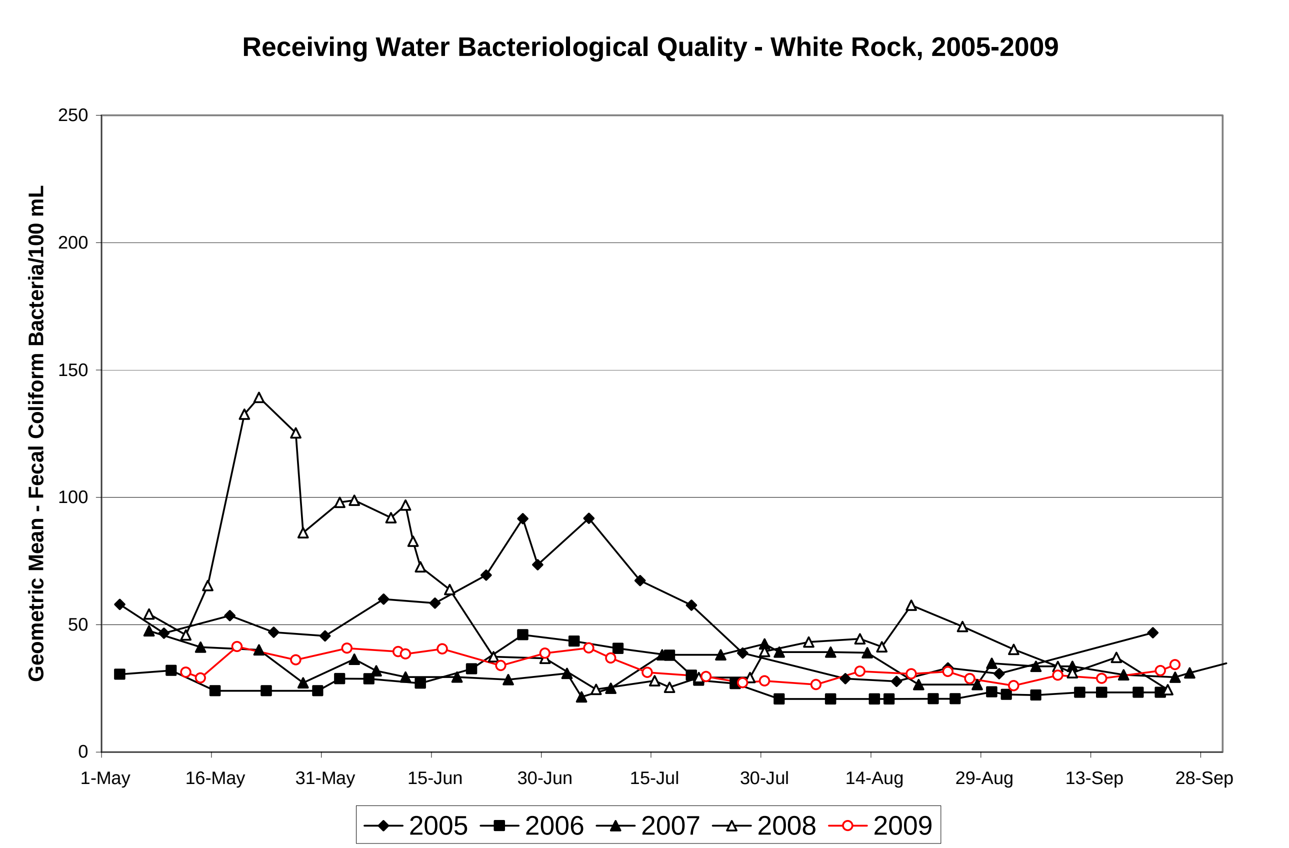
Receiving Water Bacteriological Quality - Gary Point, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

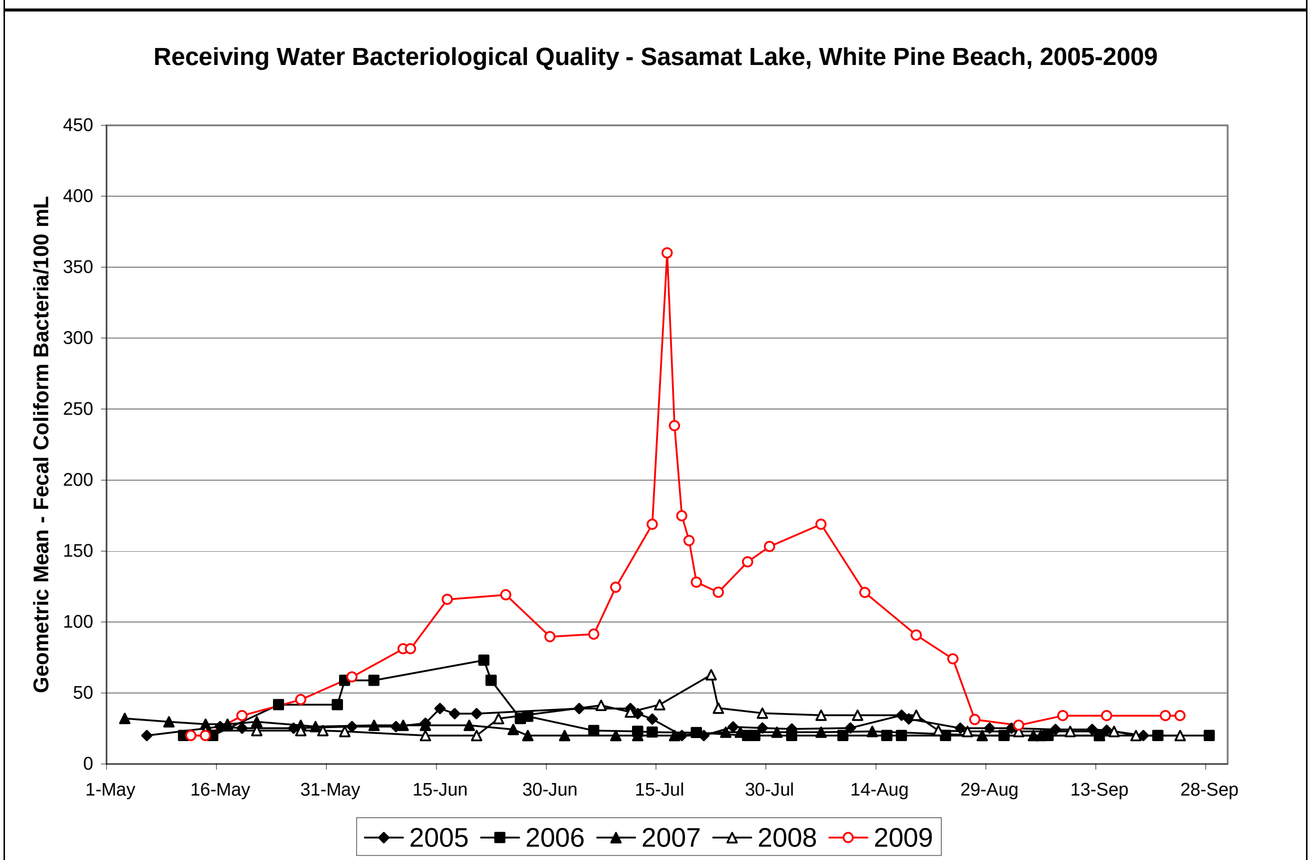


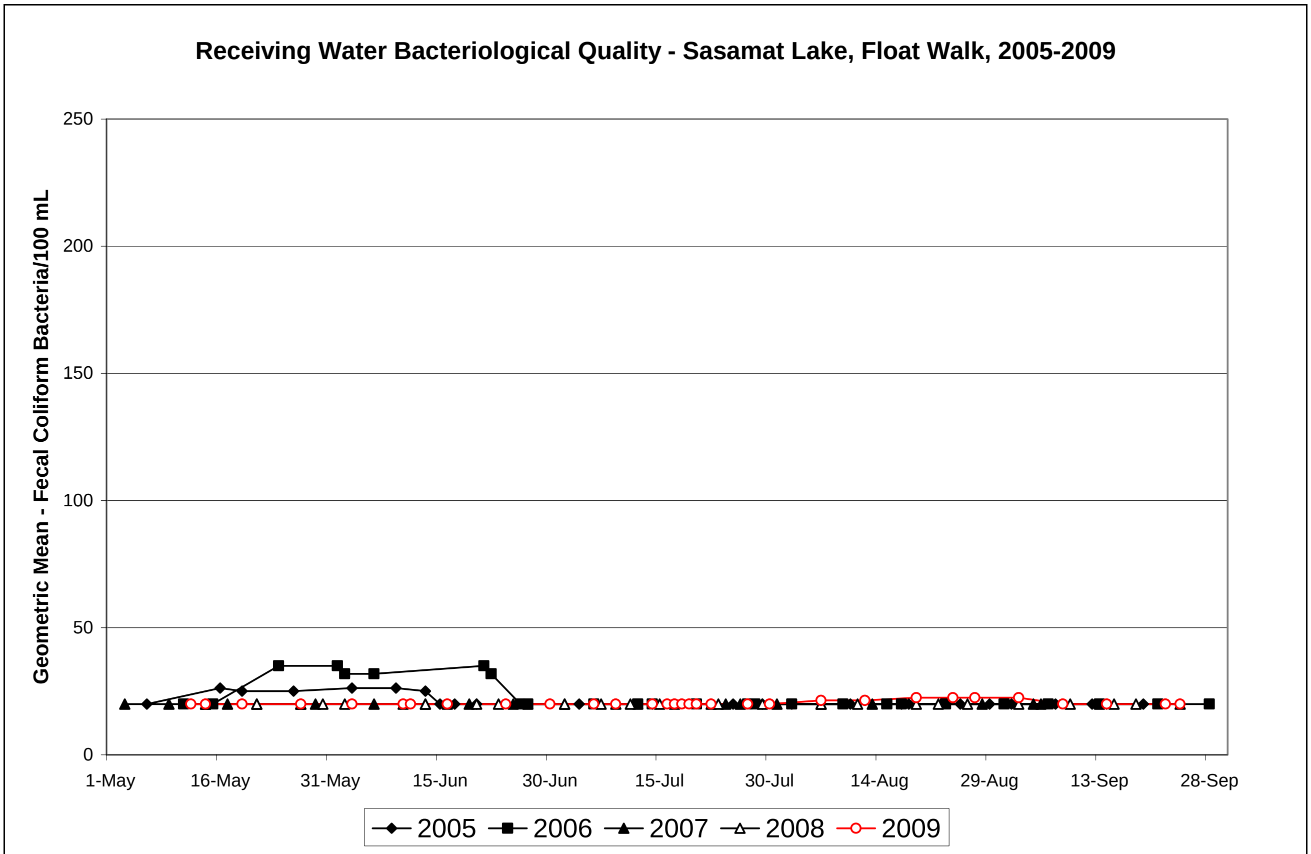
Receiving Water Bacteriological Quality - Centennial Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

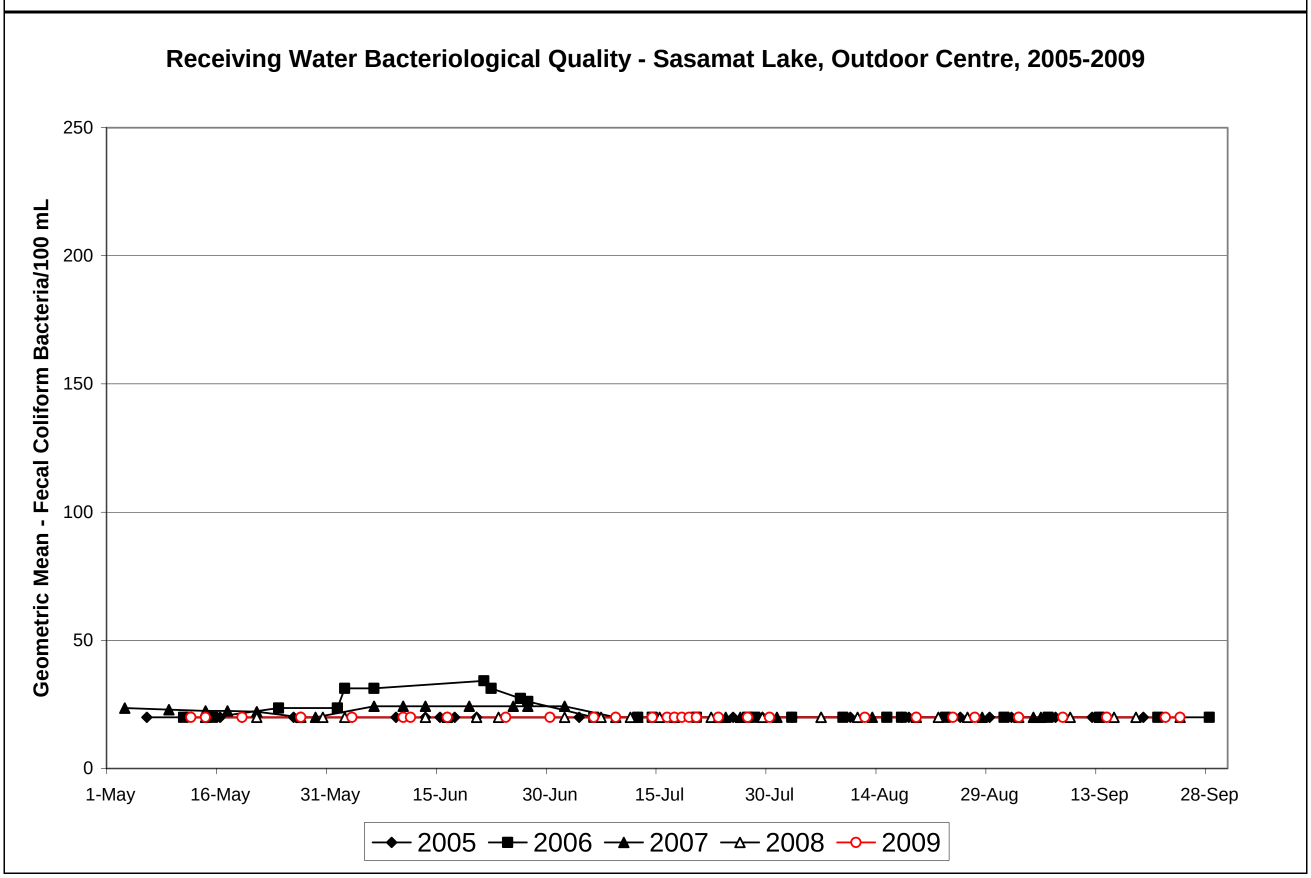

Receiving Water Bacteriological Quality - Crescent Beach North, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

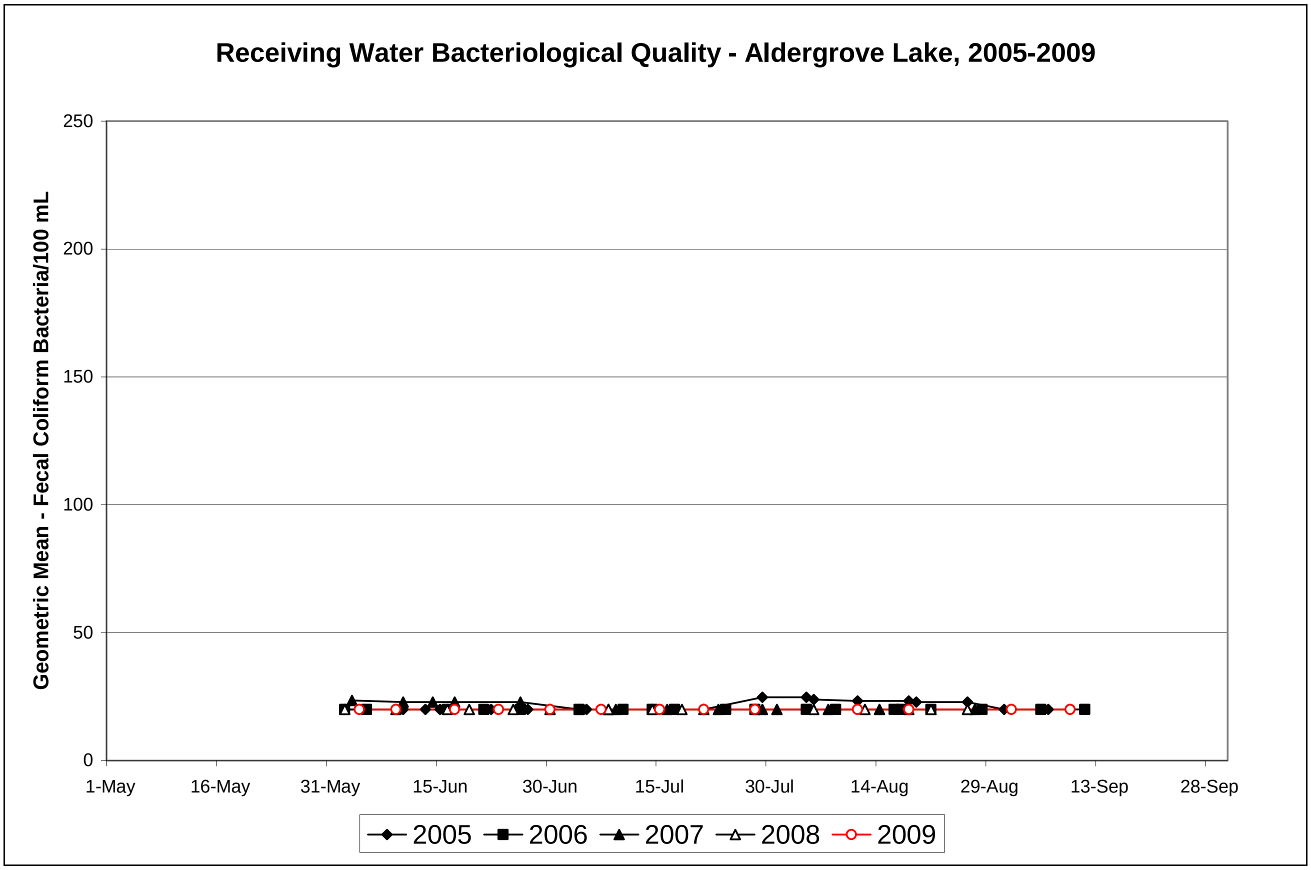

Receiving Water Bacteriological Quality - Crescent Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - White Rock, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Sasamat Lake, White Pine Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
300
350
400
450
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Sasamat Lake, Float Walk, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

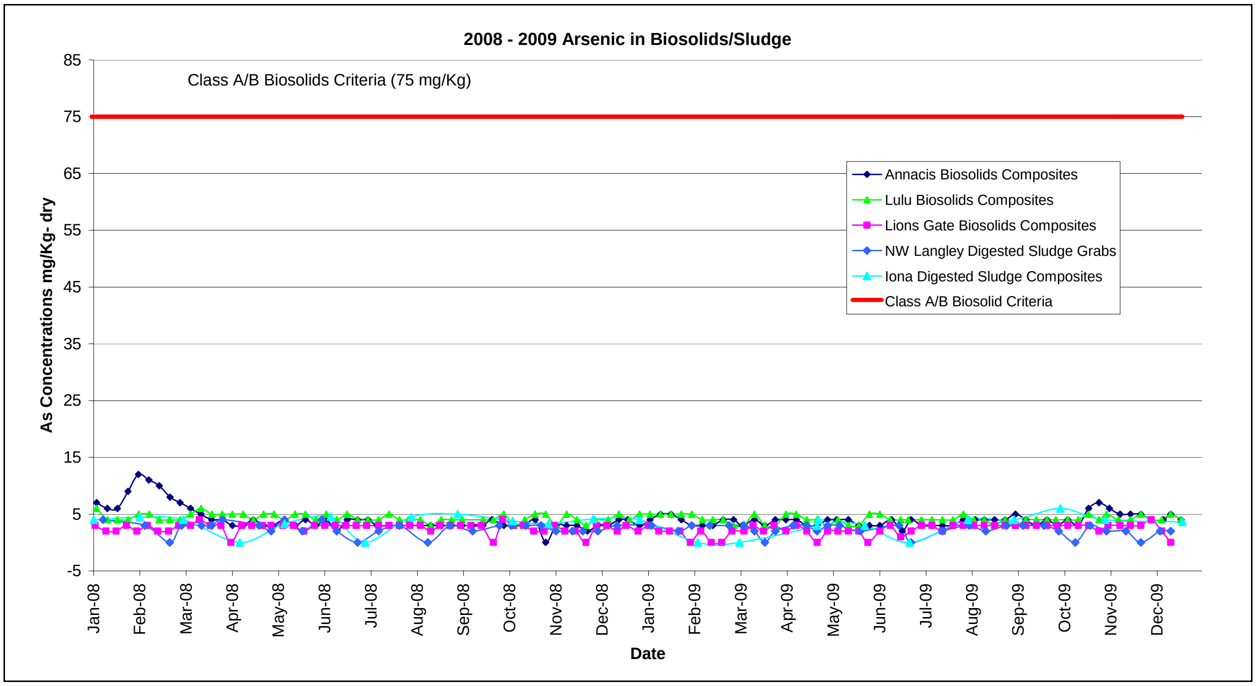

Receiving Water Bacteriological Quality - Sasamat Lake, Outdoor Centre, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

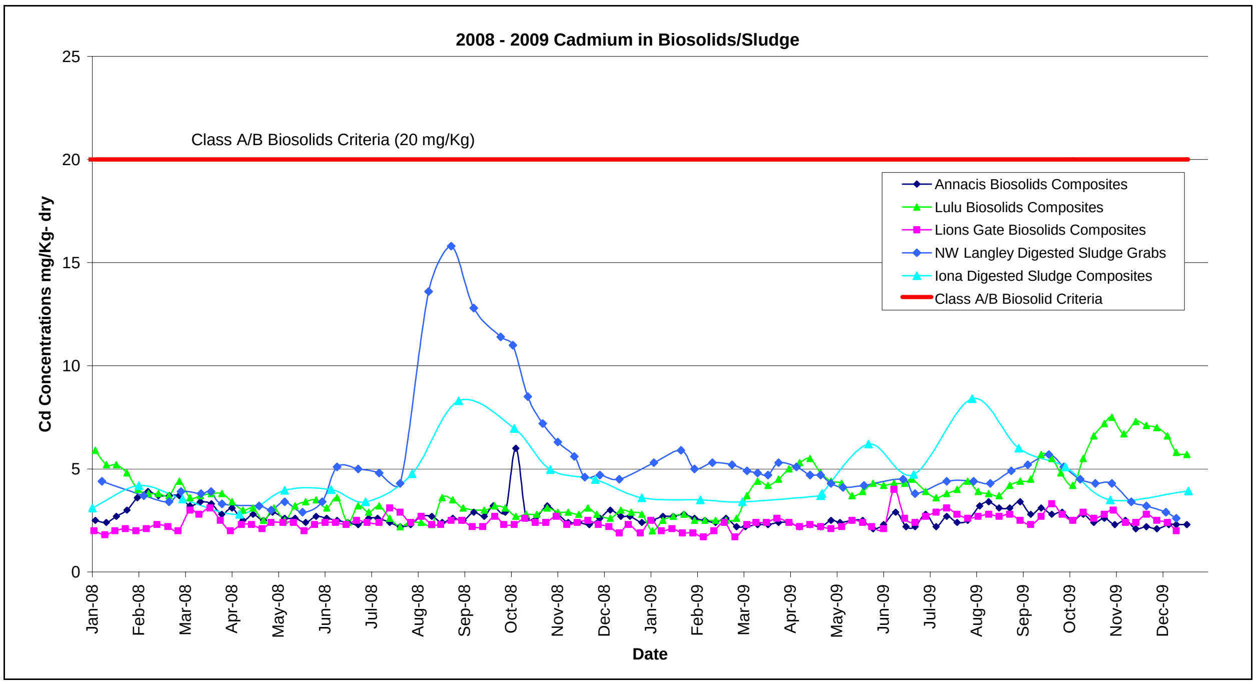


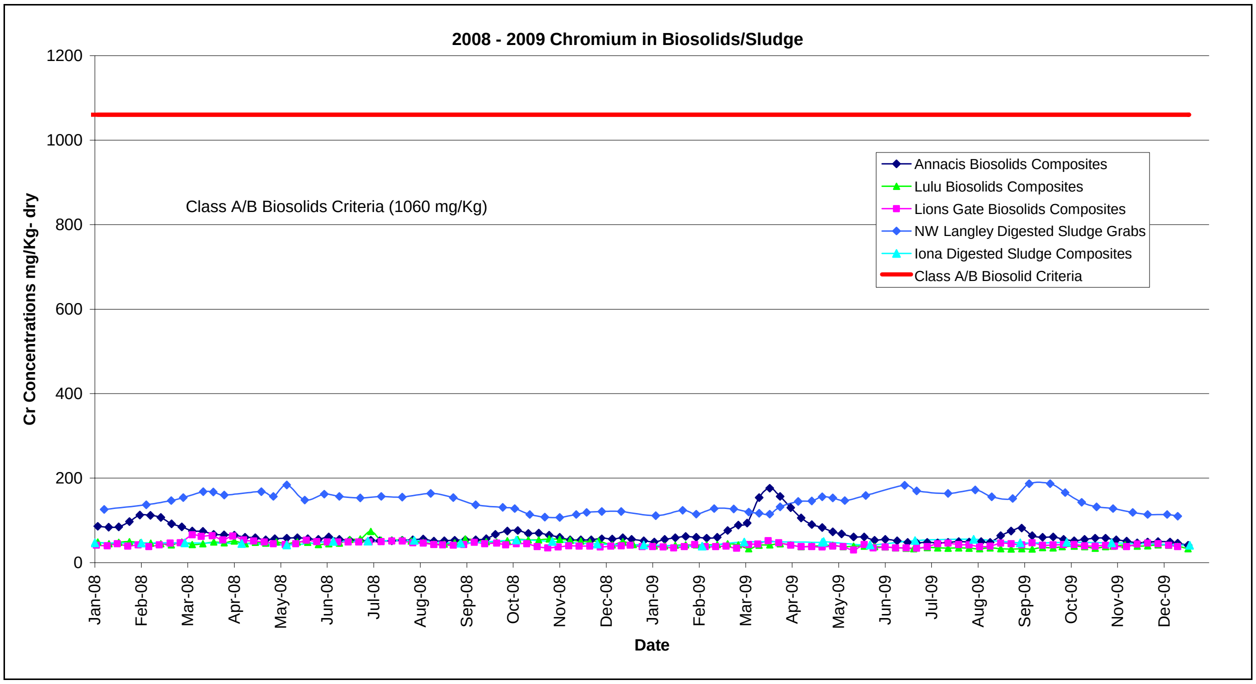
Receiving Water Bacteriological Quality - Aldergrove Lake, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

APPENDIX D

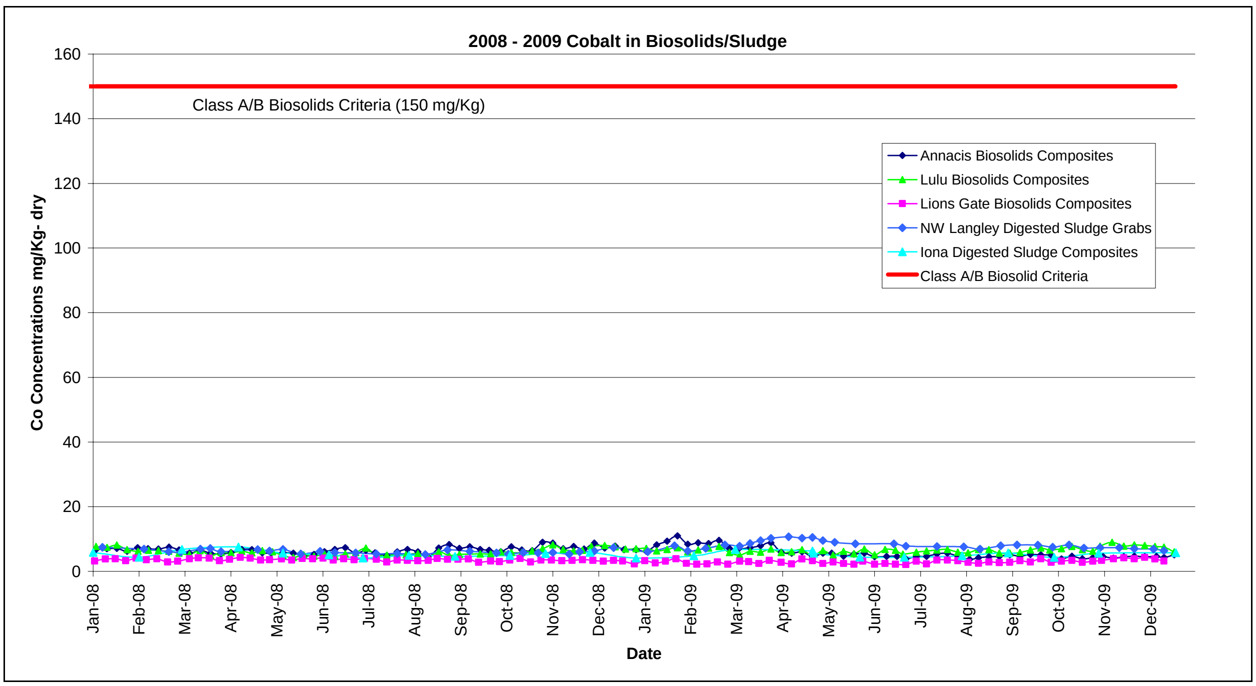
2008 TO 2009 BIOSOLIDS/SLUDGE MONITORING PROGRAMS COMPARISON OF METALS AND FECAL COLIFORM DATA WITH ORGANIC MATTER RECYCLING REGULATION, February, 2002


2008 - 2009 Arsenic in Biosolids/Sludge
Class A/B Biosolids Criteria (75 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
As Concentrations mg/Kg- dry
Date

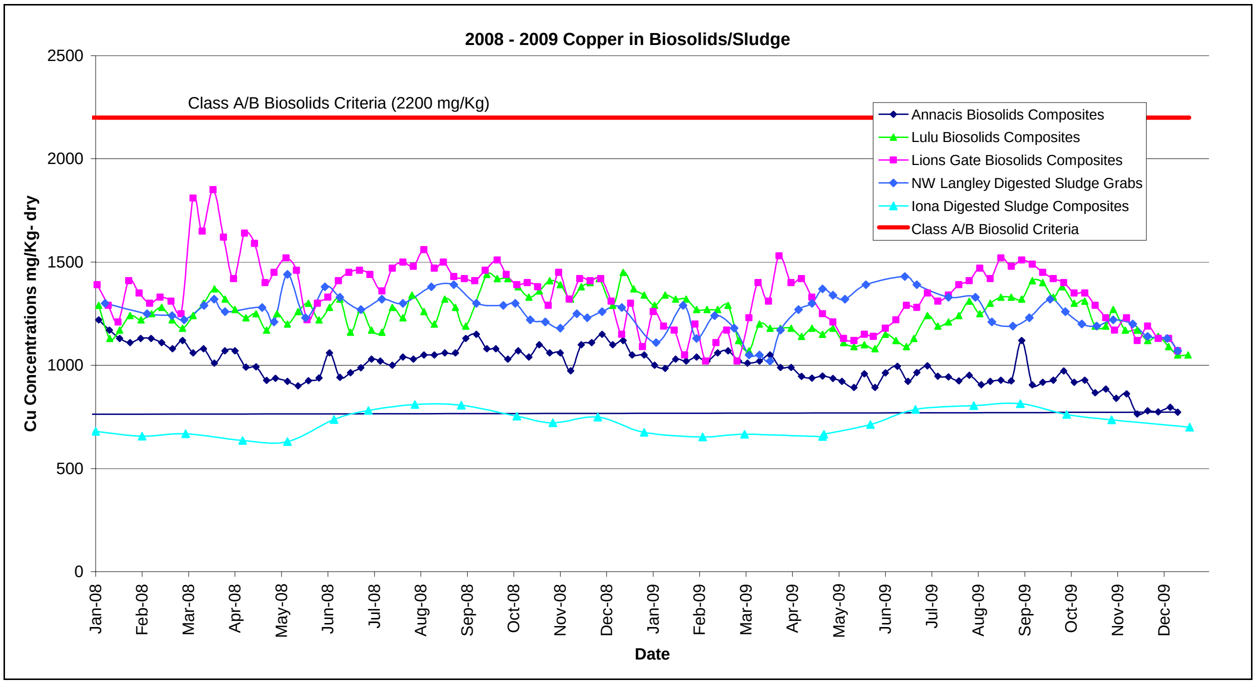

2008 - 2009 Cadmium in Biosolids/Sludge
Class A/B Biosolids Criteria (20 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Cd Concentrations mg/Kg- dry
Date



2008 - 2009 Chromium in Biosolids/Sludge
Cr Concentrations mg/Kg- dry
Class A/B Biosolids Criteria (1060 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Date



2008 - 2009 Cobalt in Biosolids/Sludge
Co Concentrations mg/Kg- dry
Class A/B Biosolids Criteria (150 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Date


2008 - 2009 Copper in Biosolids/Sludge
Class A/B Biosolids Criteria (2200 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Cu Concentrations mg/Kg- dry
2500
2000
1500
1000
500
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
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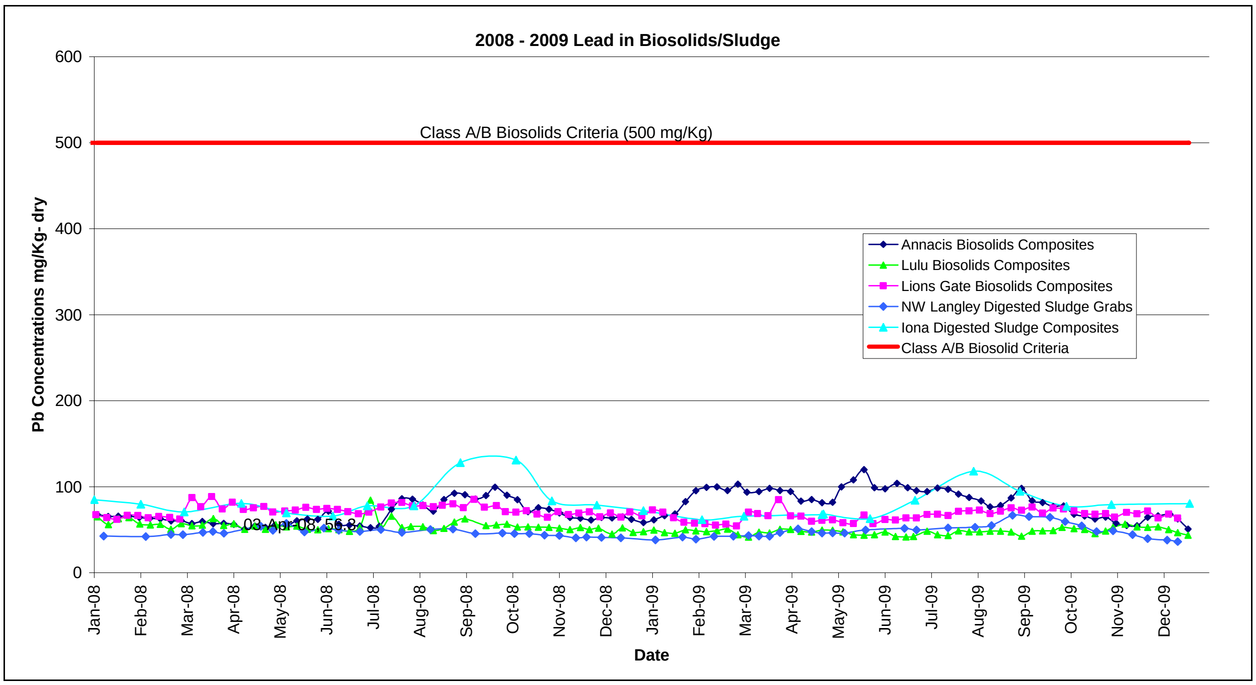
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date


2008 - 2009 Lead in Biosolids/Sludge
Class A/B Biosolids Criteria (500 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Pb Concentrations mg/Kg- dry
600
500
400
300
200
100
0
03-Apr-08, 56.8
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
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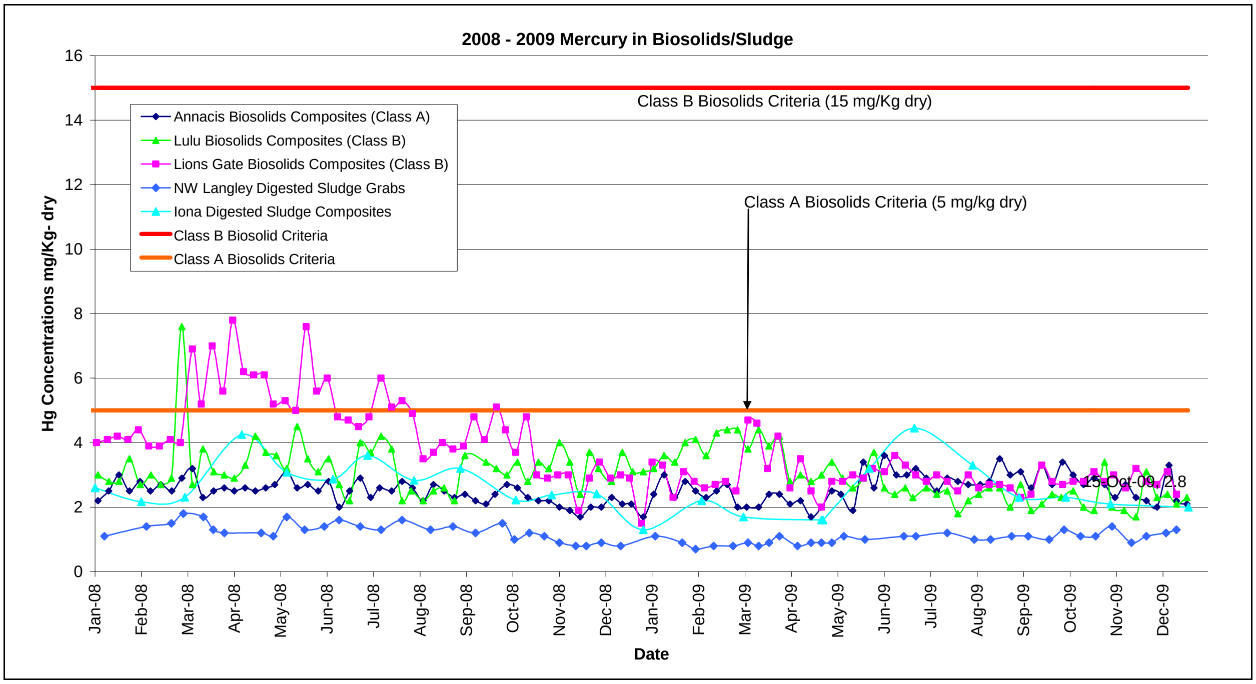
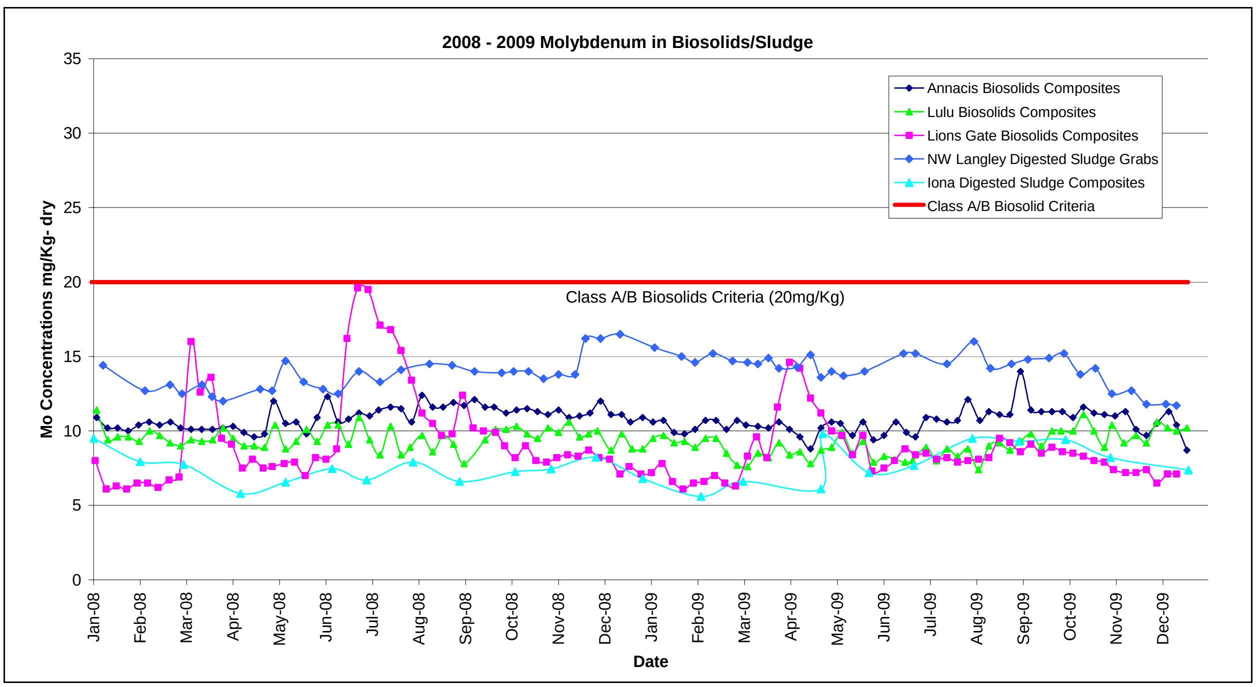
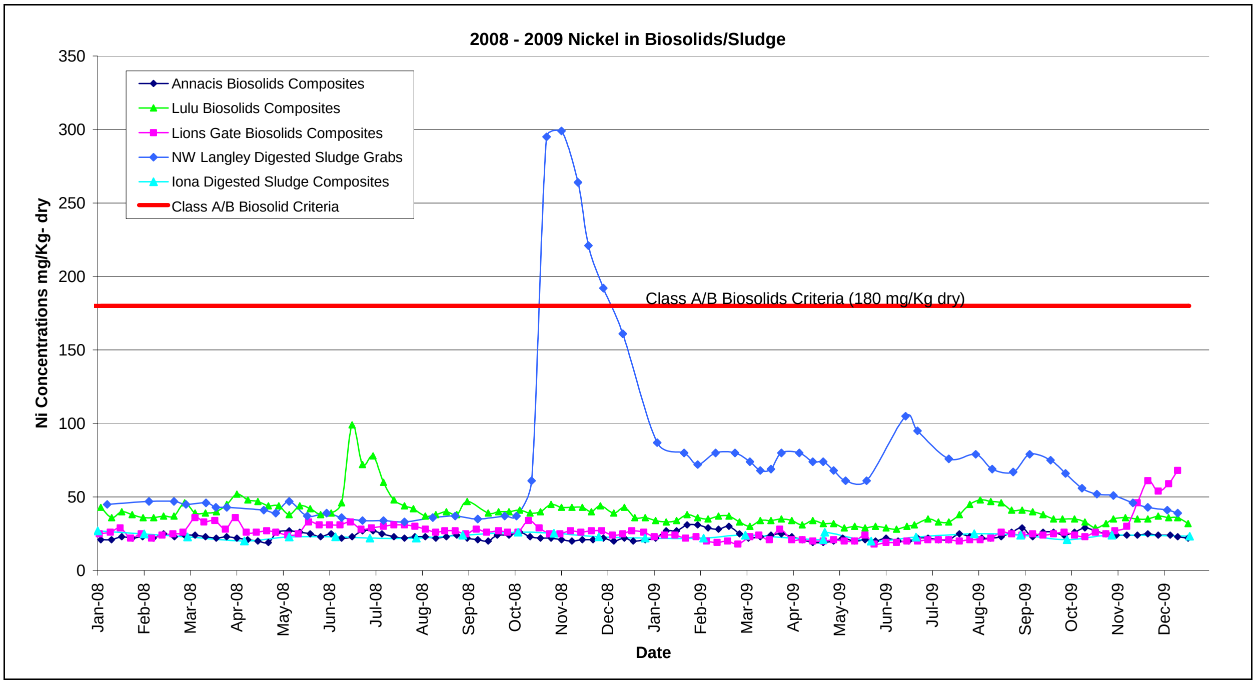
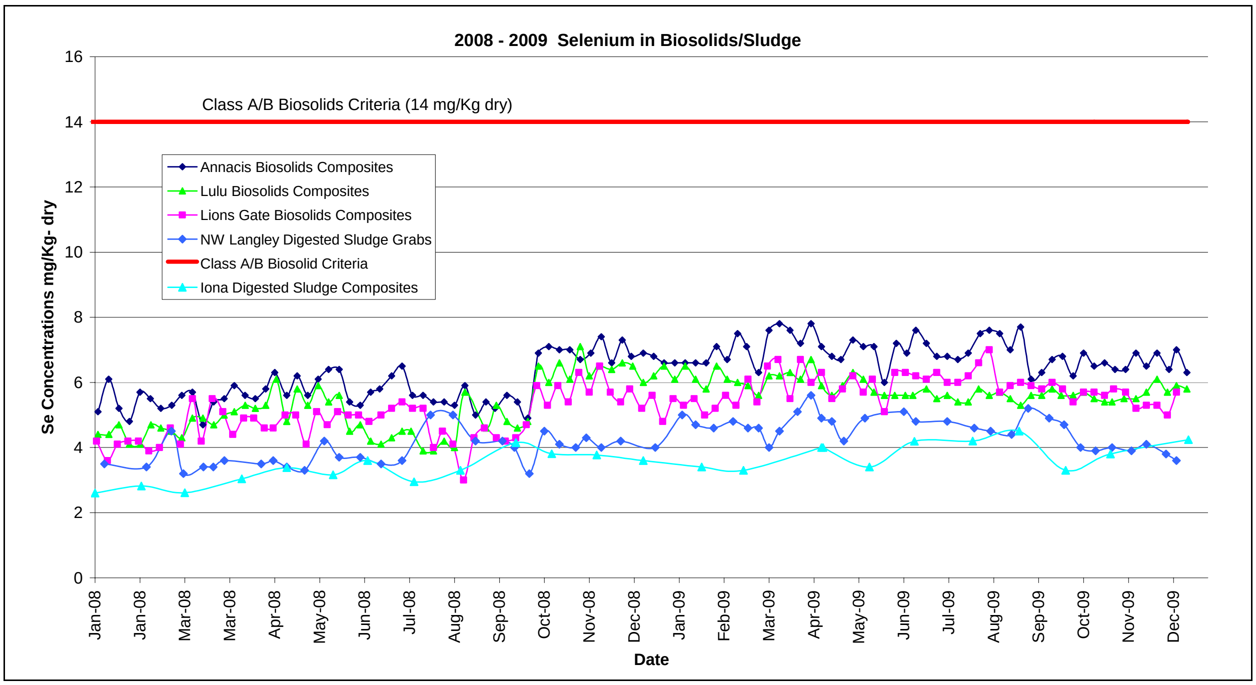
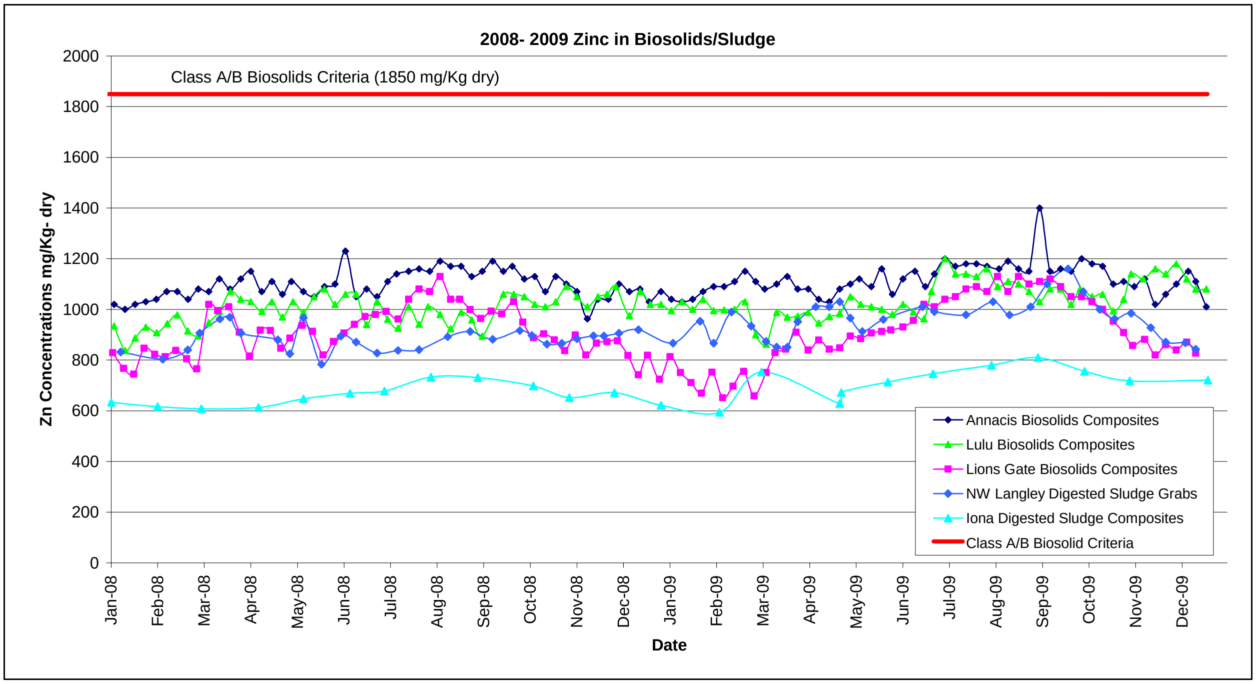
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date

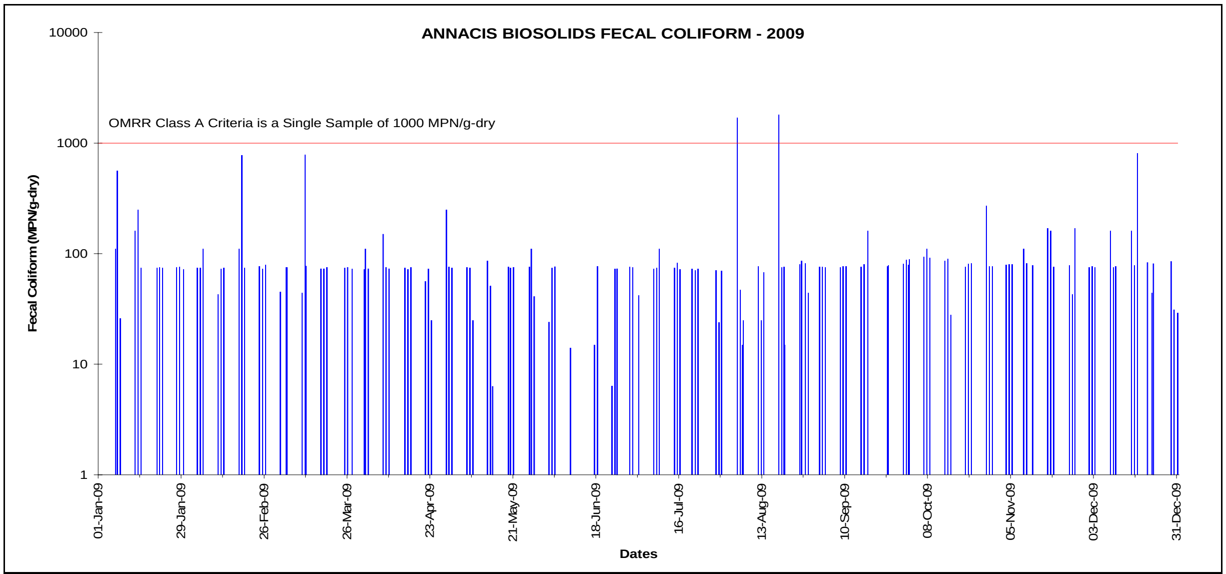

2008 - 2009 Mercury in Biosolids/Sludge
Class B Biosolids Criteria (15 mg/Kg dry)
Class A Biosolids Criteria (5 mg/kg dry)
Annacis Biosolids Composites (Class A)
Lulu Biosolids Composites (Class B)
Lions Gate Biosolids Composites (Class B)
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class B Biosolid Criteria
Class A Biosolids Criteria
15-Oct-09, 2.8
Hg Concentrations mg/Kg- dry
Date

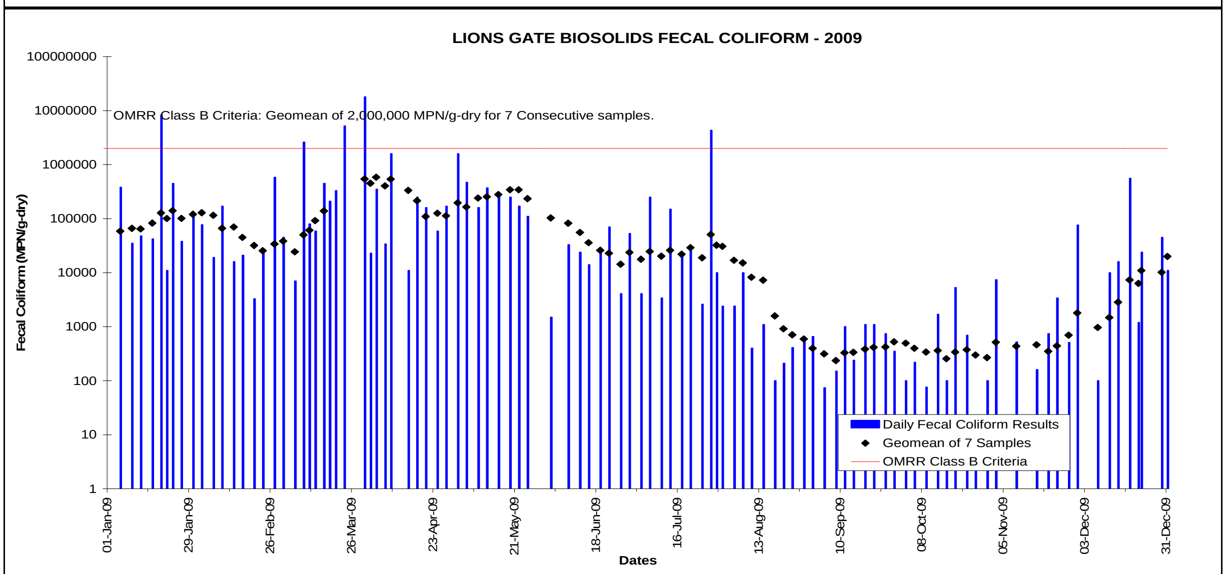

2008 - 2009 Molybdenum in Biosolids/Sludge
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Class A/B Biosolids Criteria (20mg/Kg)
Mo Concentrations mg/Kg- dry
Date

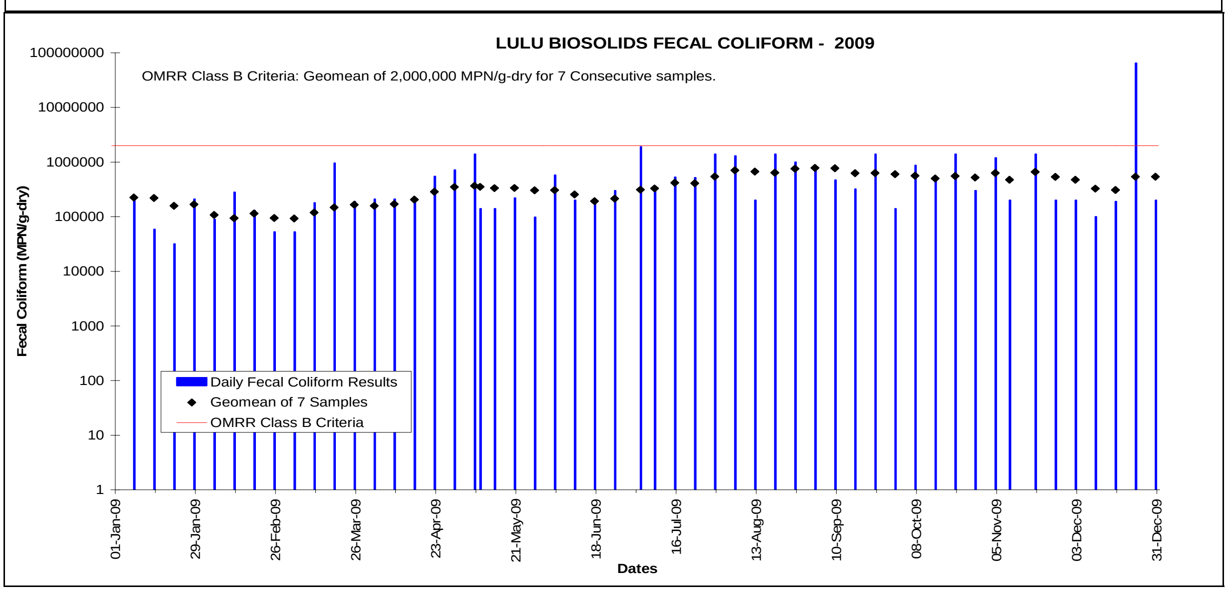

2008 - 2009 Nickel in Biosolids/Sludge
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Class A/B Biosolids Criteria (180 mg/Kg dry)
Ni Concentrations mg/Kg- dry
Date

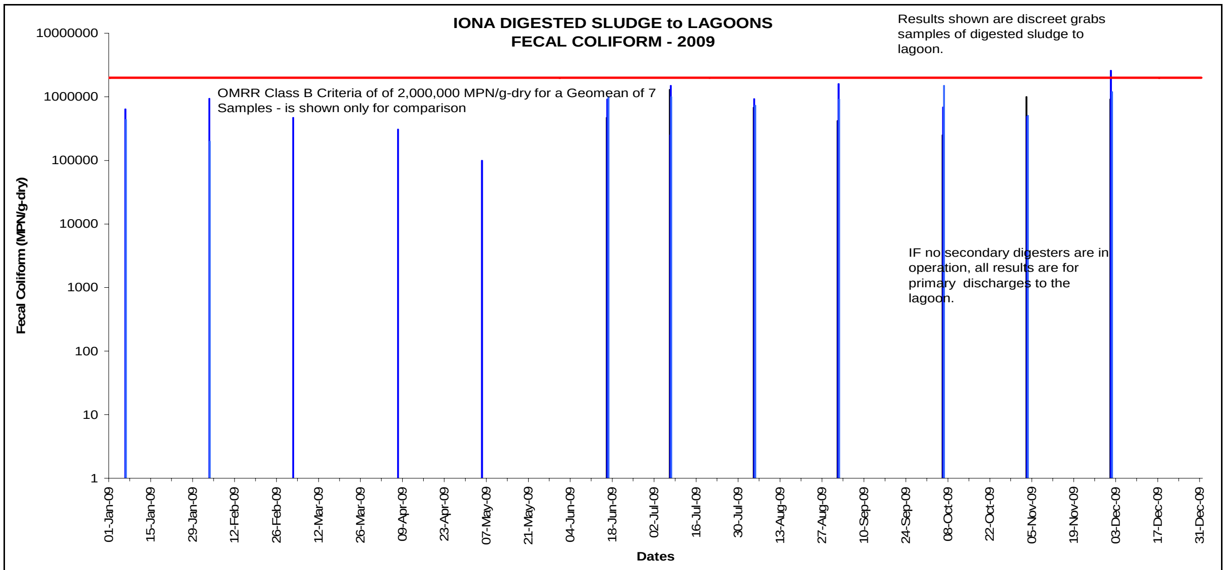

2008 - 2009 Selenium in Biosolids/Sludge
Class A/B Biosolids Criteria (14 mg/Kg dry)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Class A/B Biosolid Criteria
Iona Digested Sludge Composites
Se Concentrations mg/Kg- dry
Date

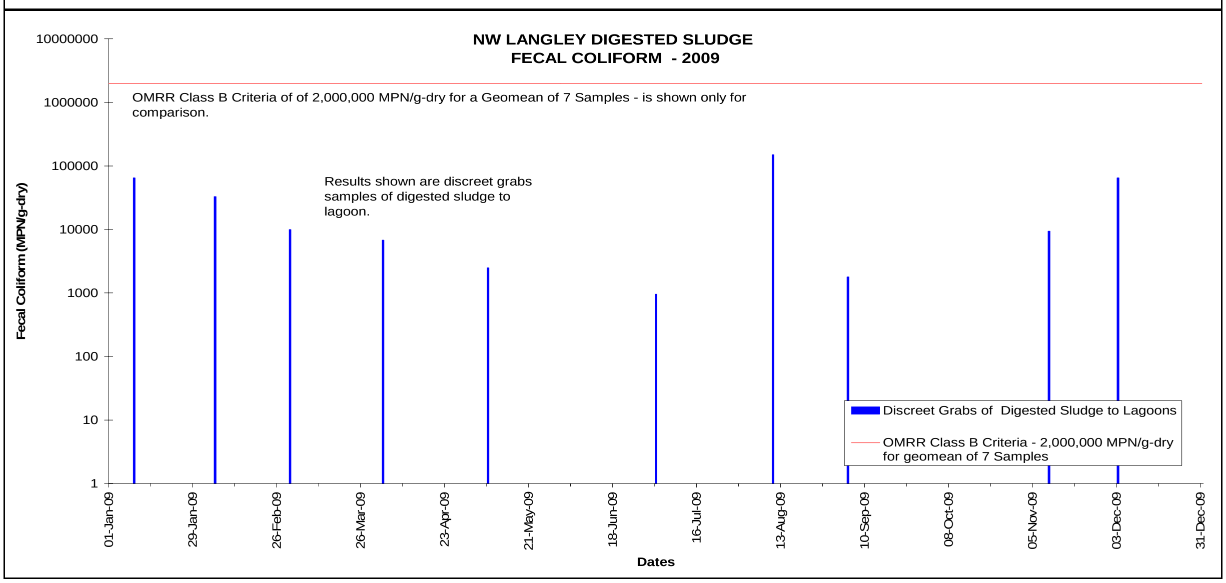

2008- 2009 Zinc in Biosolids/Sludge
Class A/B Biosolids Criteria (1850 mg/Kg dry)
Zn Concentrations mg/Kg- dry
Date
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria


ANNACIS BIOSOLIDS FECAL COLIFORM - 2009
OMRR Class A Criteria is a Single Sample of 1000 MPN/g-dry
Fecal Coliform (MPN/g-dry)
Dates


LIONS GATE BIOSOLIDS FECAL COLIFORM - 2009
OMRR Class B Criteria: Geomean of 2,000,000 MPN/g-dry for 7 Consecutive samples.
Fecal Coliform (MPN/g-dry)
Dates
Daily Fecal Coliform Results
Geomean of 7 Samples
OMRR Class B Criteria


LULU BIOSOLIDS FECAL COLIFORM - 2009
OMRR Class B Criteria: Geomean of 2,000,000 MPN/g-dry for 7 Consecutive samples.
Fecal Coliform (MPN/g-dry)
Dates
Daily Fecal Coliform Results
Geomean of 7 Samples
OMRR Class B Criteria


IONA DIGESTED SLUDGE to LAGOONS
FECAL COLIFORM - 2009
Results shown are discreet grabs samples of digested sludge to lagoon.
OMRR Class B Criteria of of 2,000,000 MPN/g-dry for a Geomean of 7 Samples - is shown only for comparison
IF no secondary digesters are in operation, all results are for primary discharges to the lagoon.
Fecal Coliform (MPN/g-dry)
10000000
1000000
100000
10000
1000
100
10
1
01-Jan-09
15-Jan-09
29-Jan-09
12-Feb-09
26-Feb-09
12-Mar-09
26-Mar-09
09-Apr-09
23-Apr-09
07-May-09
21-May-09
04-Jun-09
18-Jun-09
02-Jul-09
16-Jul-09
30-Jul-09
13-Aug-09
27-Aug-09
10-Sep-09
24-Sep-09
08-Oct-09
22-Oct-09
05-Nov-09
19-Nov-09
03-Dec-09
17-Dec-09
31-Dec-09
Dates


NW LANGLEY DIGESTED SLUDGE
FECAL COLIFORM - 2009
OMRR Class B Criteria of of 2,000,000 MPN/g-dry for a Geomean of 7 Samples - is shown only for comparison.
Results shown are discreet grabs samples of digested sludge to lagoon.
Fecal Coliform (MPN/g-dry)
10000000
1000000
100000
10000
1000
100
10
1
Discreet Grabs of Digested Sludge to Lagoons
OMRR Class B Criteria - 2,000,000 MPN/g-dry for geomean of 7 Samples
01-Jan-09
29-Jan-09
26-Feb-09
26-Mar-09
23-Apr-09
21-May-09
18-Jun-09
16-Jul-09
13-Aug-09
10-Sep-09
08-Oct-09
05-Nov-09
03-Dec-09
31-Dec-09
Dates

APPENDIX A

2009 WWTP DATA

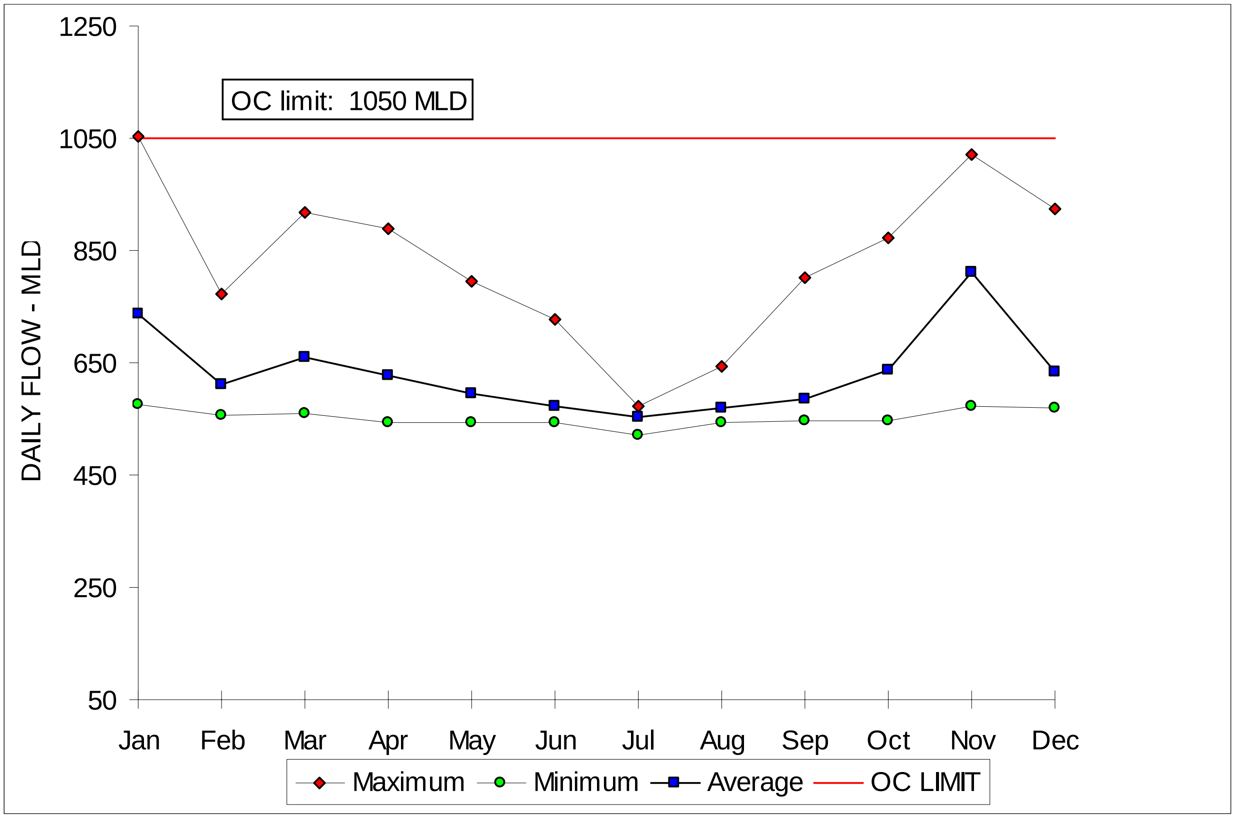
MONTHLY AND ANNUAL SUMMARIES

APPENDIX A1	ANNACIS ISLAND WWTP
APPENDIX A2	IONA ISLAND WWTP
APPENDIX A3	LIONS GATE WWTP
APPENDIX A4	LULU ISLAND WWTP
APPENDIX A5	NORTHWEST LANGLEY WWTP

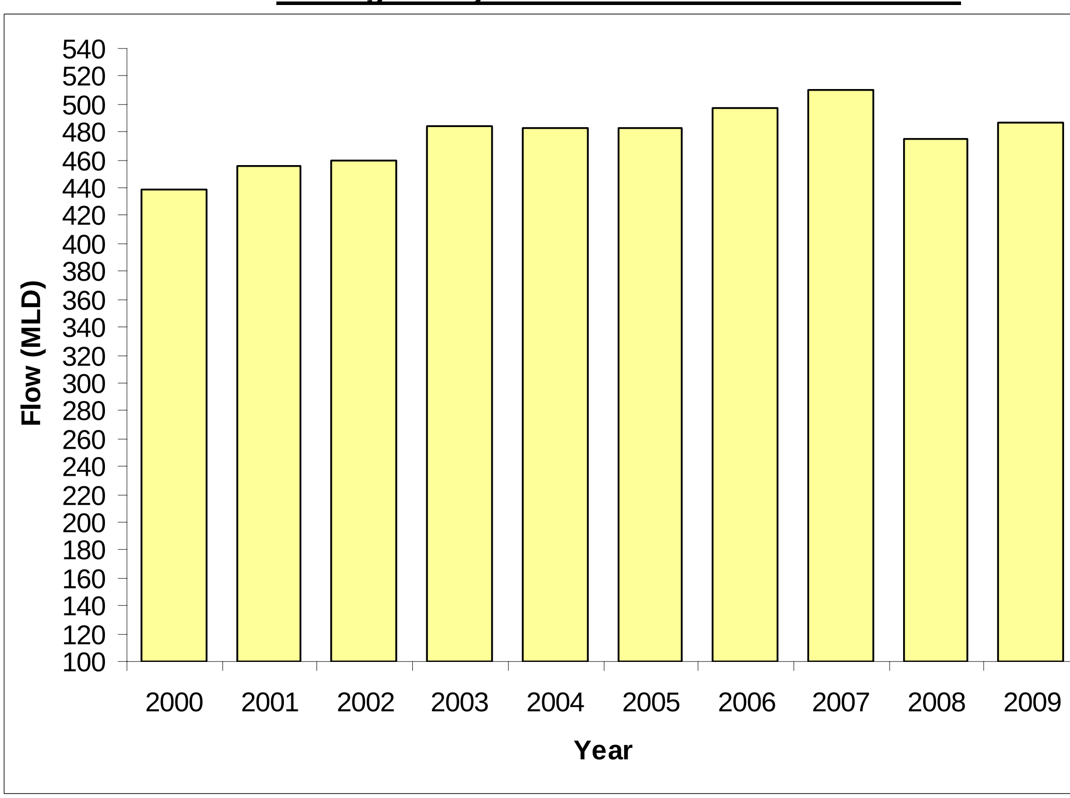
APPENDIX A1

ANNACIS ISLAND WASTEWATER TREATMENT PLANT

ANNACIS WWTP - 2009 Wastewater Flow - Monthly Summary

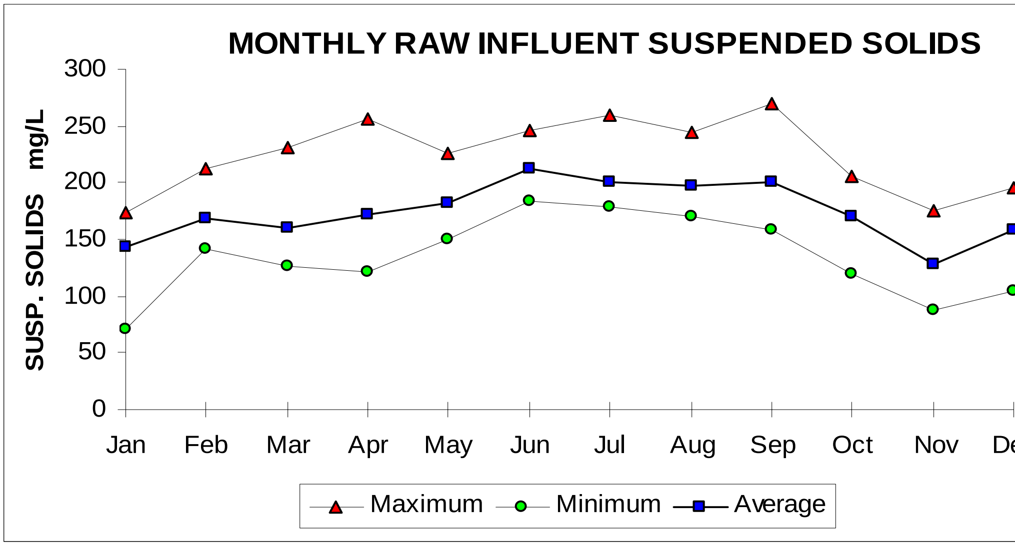


Average Daily Wastewater Flows 2000– 2009

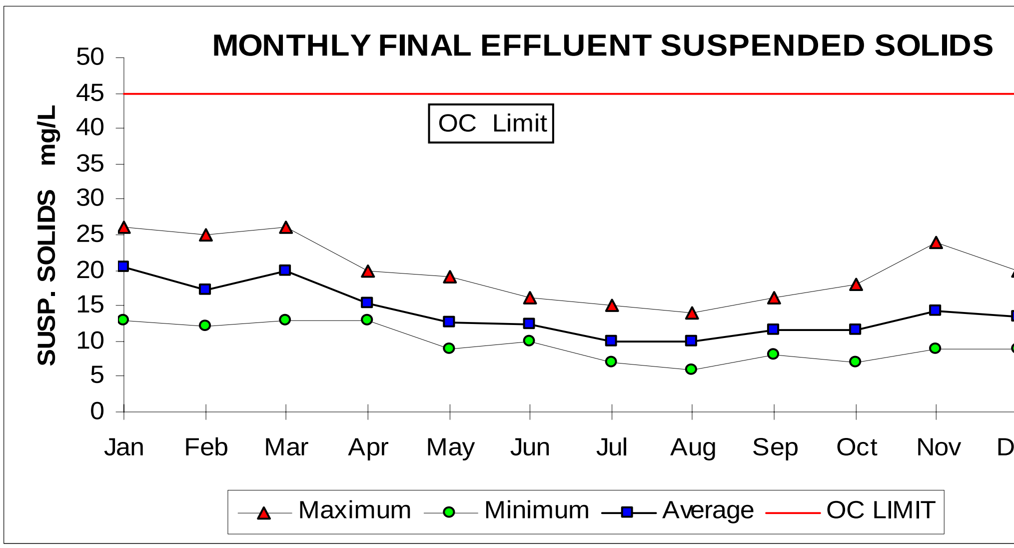


Year	Flow (MLD)
2000	439
2001	455
2002	460
2003	485
2004	497
2005	483
2006	497
2007	510
2008	475
2009	487

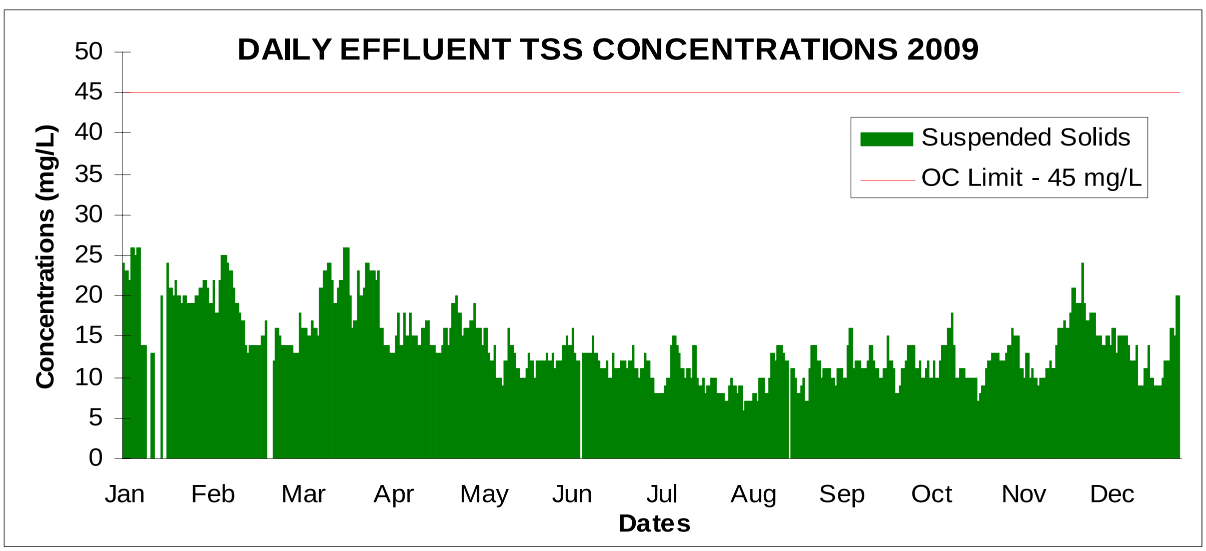
ANNACIS WWTP – 2009 Suspended Solids Concentrations Summary



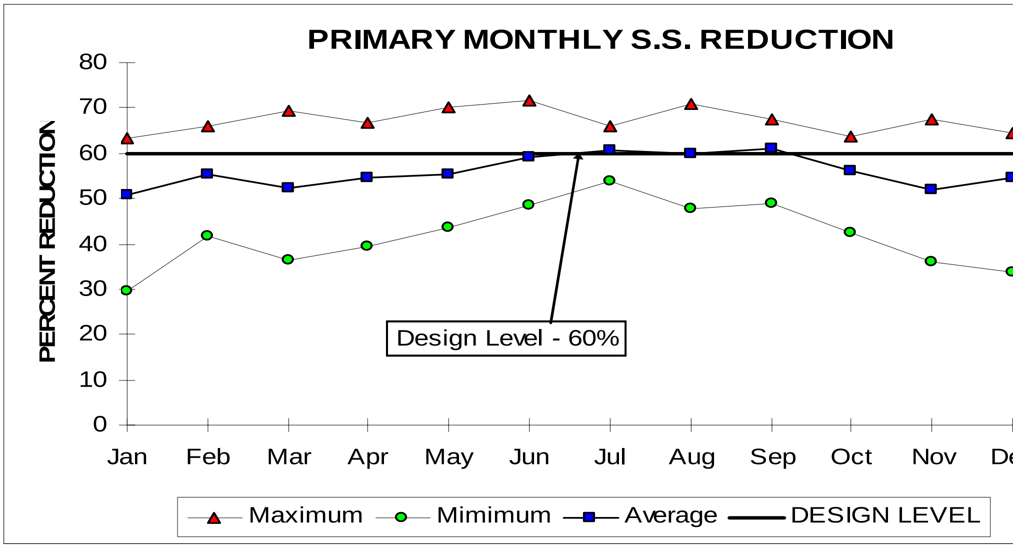
Mth	Max	Min	Ave
Jan	173	71	144
Feb	212	142	168
Mar	231	126	159
Apr	256	121	171
May	226	150	183
Jun	246	184	212
Jul	259	178	201
Aug	244	170	197
Sep	270	158	200
Oct	206	120	170
Nov	176	88	128
Dec	195	104	158



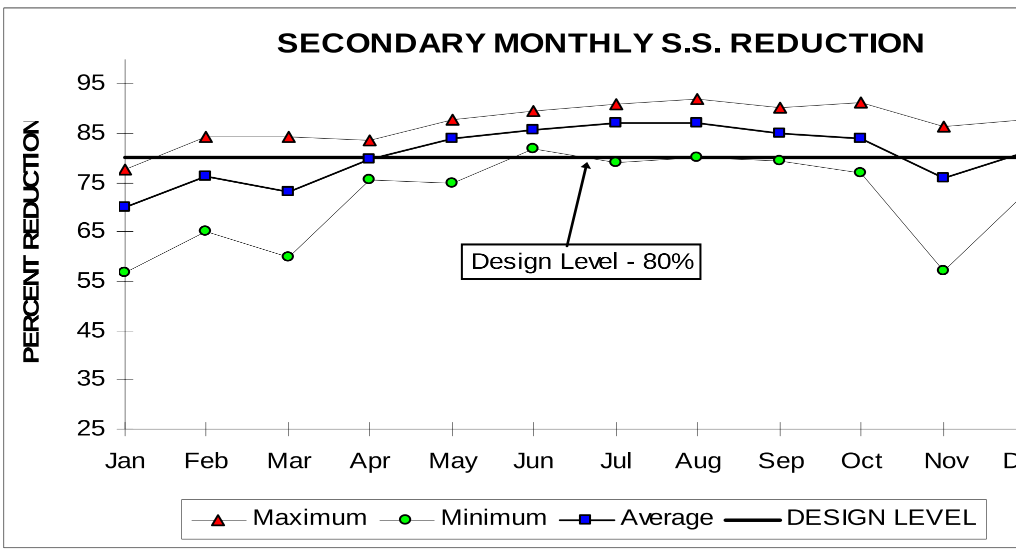
Mth	Max	Min	Ave
Jan	26	13	21
Feb	25	12	17
Mar	26	13	20
Apr	20	13	15
May	19	9	13
Jun	16	10	12
Jul	15	7	10
Aug	14	6	10
Sep	16	8	12
Oct	18	7	12
Nov	24	9	14
Dec	20	9	13



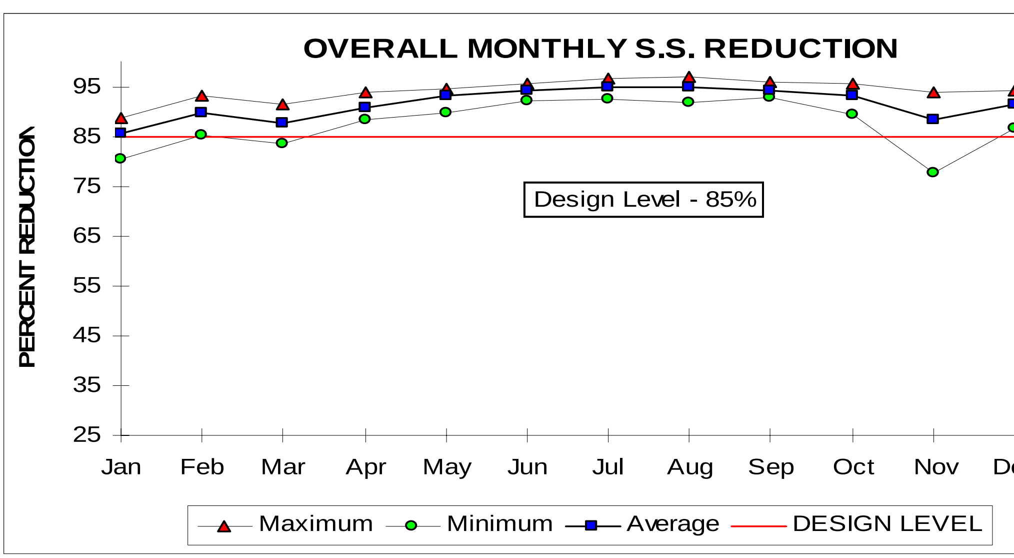
ANNACIS WWTP – 2009 Suspended Solids Reductions



Mth	Max	Min	Ave
Jan	63	30	51
Feb	66	42	55
Mar	69	36	52
Apr	67	40	55
May	70	43	56
Jun	72	49	59
Jul	66	54	60
Aug	71	48	60
Sep	67	49	61
Oct	64	43	56
Nov	68	36	52
Dec	65	34	54

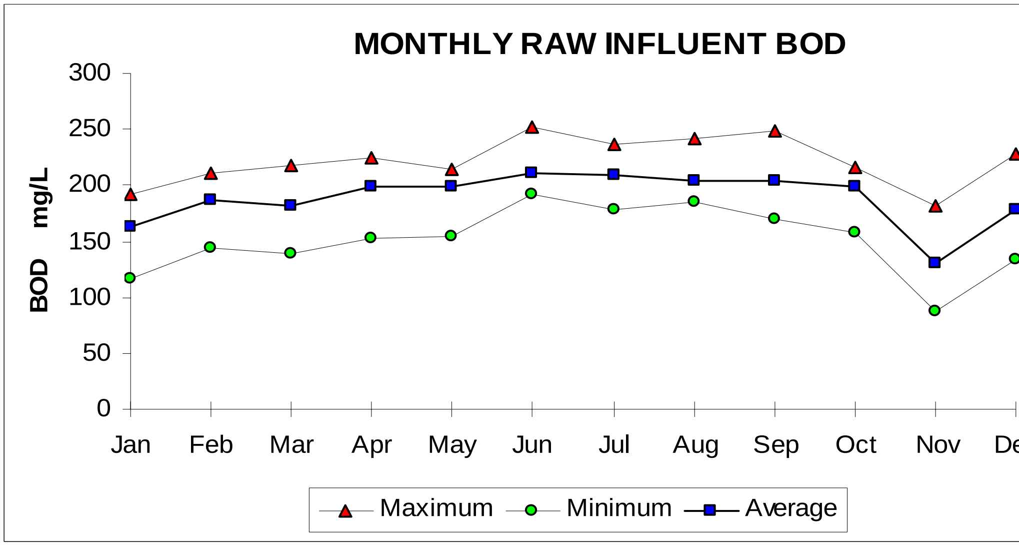


Mth	Max	Min	Ave
Jan	78	57	70
Feb	84	65	76
Mar	84	60	73
Apr	84	76	80
May	88	75	84
Jun	89	82	86
Jul	91	79	87
Aug	92	80	87
Sep	90	79	85
Oct	91	77	84
Nov	86	57	76
Dec	88	73	81

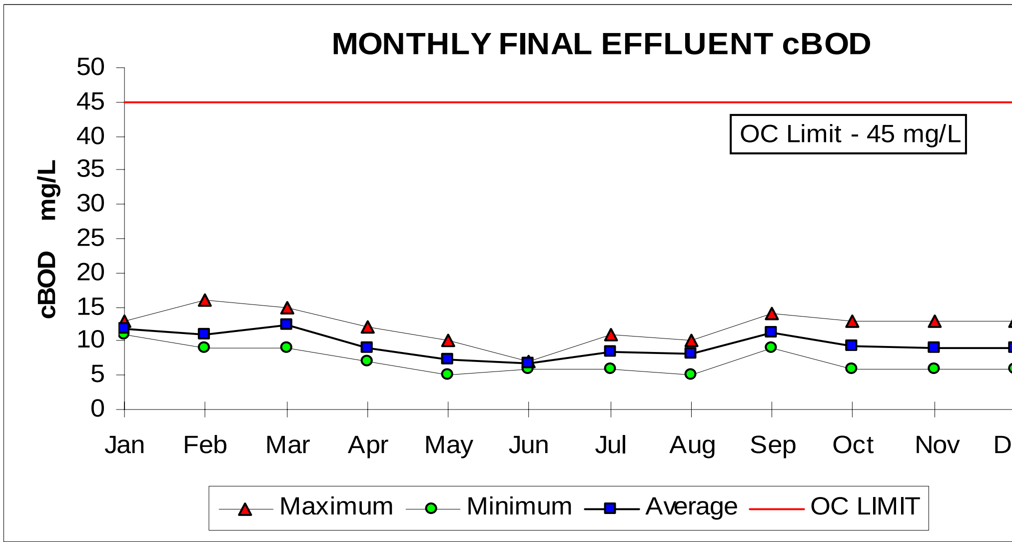


Mth	Max	Min	Ave
Jan	89	80	86
Feb	93	85	90
Mar	91	84	87
Apr	94	88	91
May	95	90	93
Jun	96	92	94
Jul	97	93	95
Aug	97	92	95
Sep	96	93	94
Oct	96	89	93
Nov	94	78	88
Dec	94	87	91

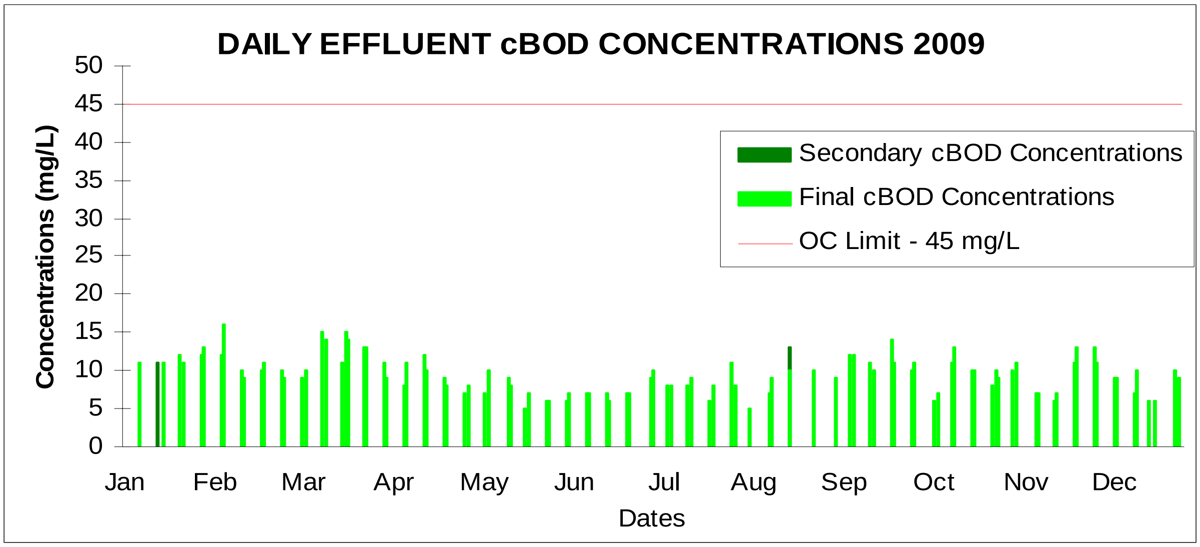
ANNACIS WWTP – 2009 BOD Concentrations Summary



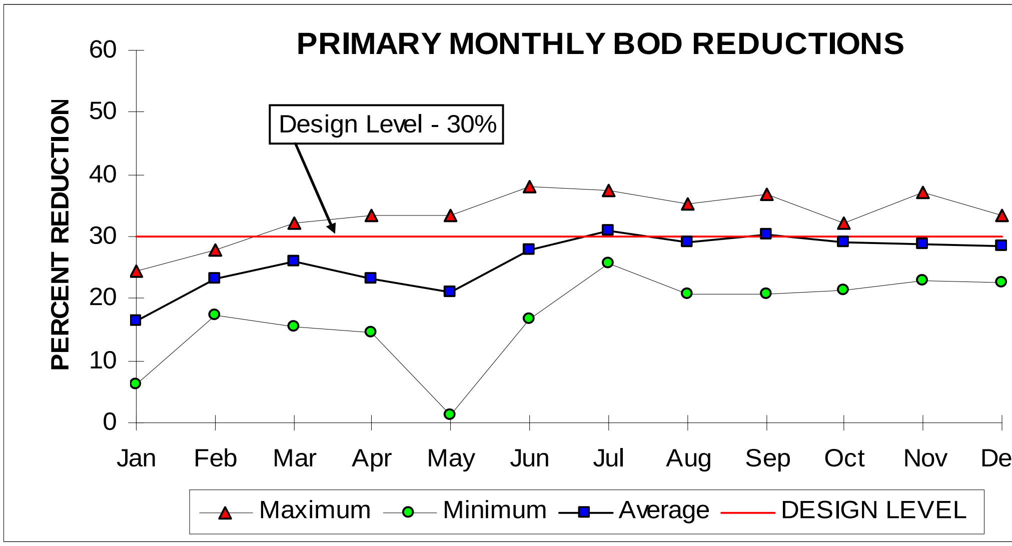
Mth	Max	Min	Ave
Jan	192	117	163
Feb	211	144	186
Mar	218	139	182
Apr	225	152	199
May	214	155	199
Jun	252	192	210
Jul	236	178	209
Aug	241	186	205
Sep	249	170	205
Oct	216	158	199
Nov	182	87	130
Dec	228	133	179



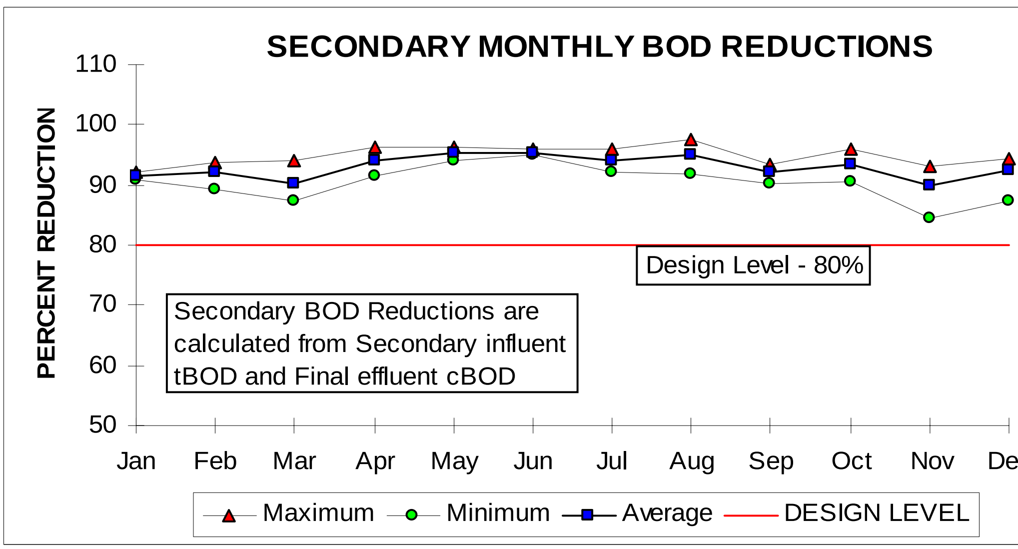
Mth	Max	Min	Ave
Jan	13	11	12
Feb	16	9	11
Mar	15	9	13
Apr	12	7	9
May	10	5	7
Jun	7	6	7
Jul	11	6	9
Aug	10	5	8
Sep	14	9	11
Oct	13	6	9
Nov	13	6	9
Dec	13	6	9



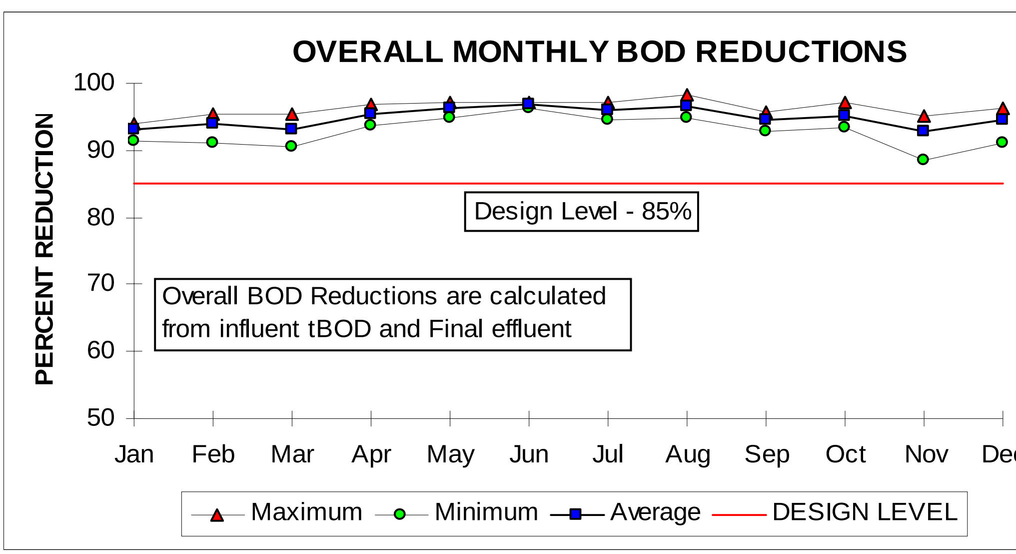
ANNACIS WWTP – 2009 BOD Reductions



Mth	Max	Min	Ave
Jan	24	6	16
Feb	28	17	23
Mar	32	16	26
Apr	33	15	23
May	34	1	21
Jun	38	17	28
Jul	37	26	31
Aug	35	21	29
Sep	37	21	30
Oct	32	21	29
Nov	37	23	29
Dec	33	23	29

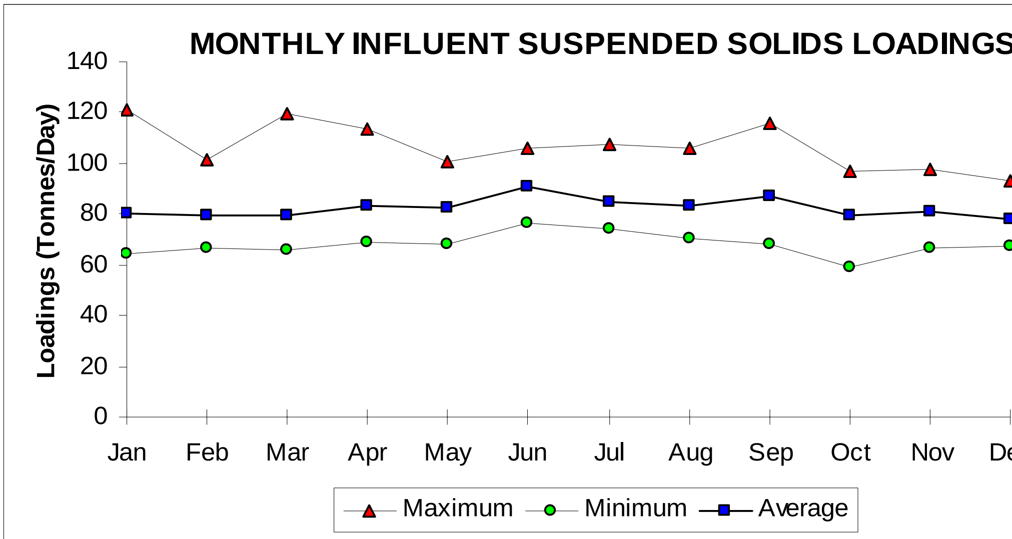


Mth	Max	Min	Ave
Jan	92	91	92
Feb	94	89	92
Mar	94	87	90
Apr	96	92	94
May	96	94	95
Jun	96	95	95
Jul	96	92	94
Aug	98	92	95
Sep	93	90	92
Oct	96	91	93
Nov	93	85	90
Dec	94	88	92

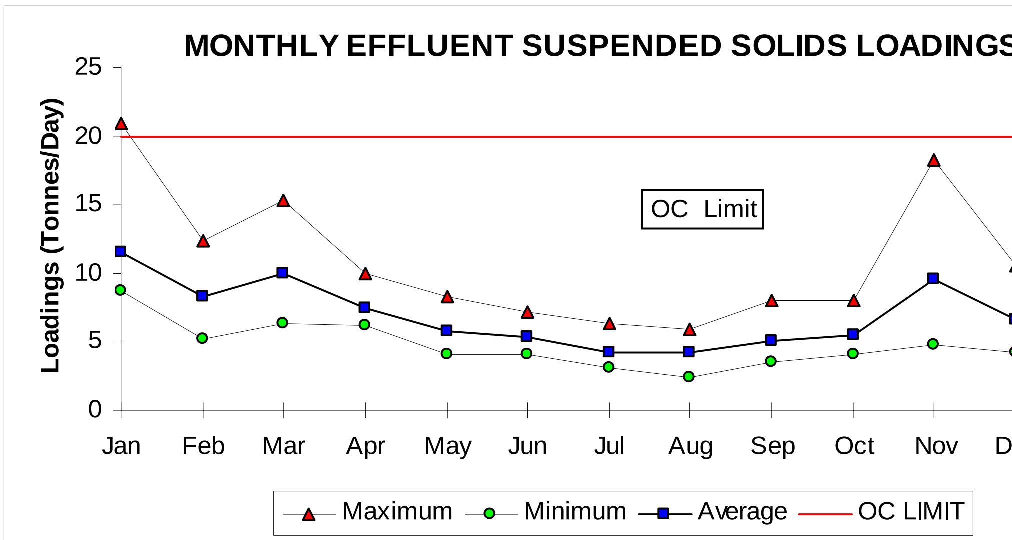


Mth	Max	Min	Ave
Jan	94	91	93
Feb	95	91	94
Mar	95	91	93
Apr	97	94	95
May	97	95	96
Jun	97	96	97
Jul	97	94	96
Aug	98	95	97
Sep	96	93	95
Oct	97	93	95
Nov	95	89	93
Dec	96	91	95

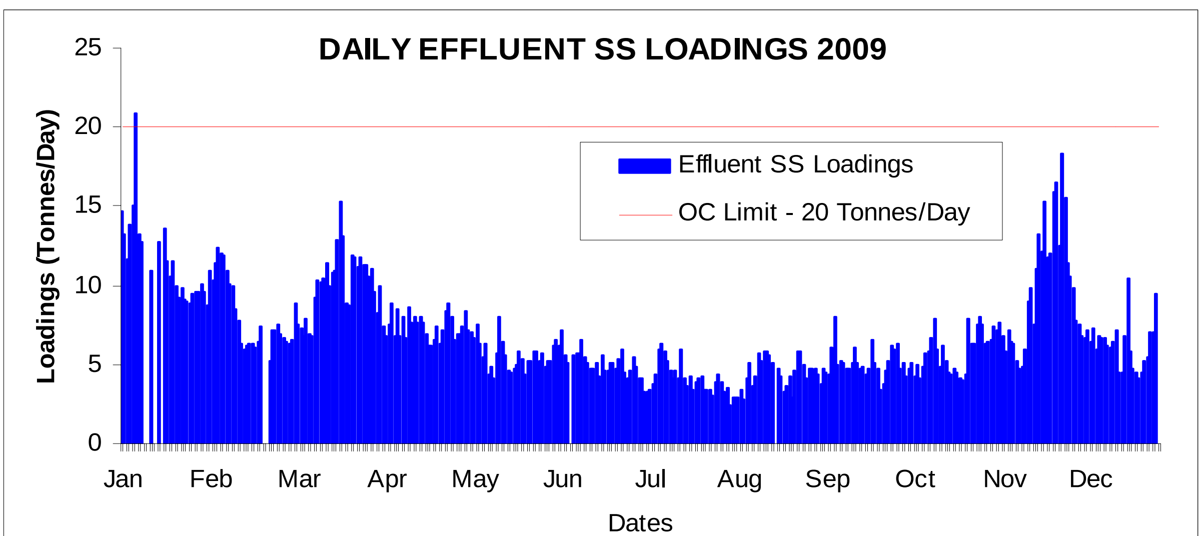
ANNACIS WWTP – 2009 Suspended Solids Loadings Summary



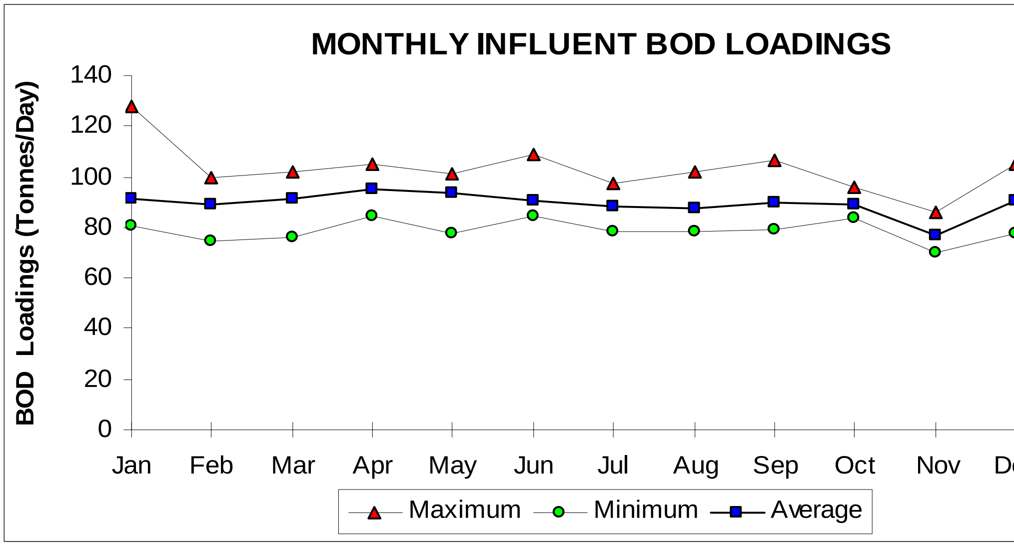
Mth	Max	Min	Ave
Jan	121	64	80
Feb	101	66	79
Mar	120	66	79
Apr	114	69	83
May	101	68	82
Jun	106	76	91
Jul	108	74	85
Aug	106	70	83
Sep	116	68	87
Oct	97	59	80
Nov	97	66	81
Dec	93	67	78



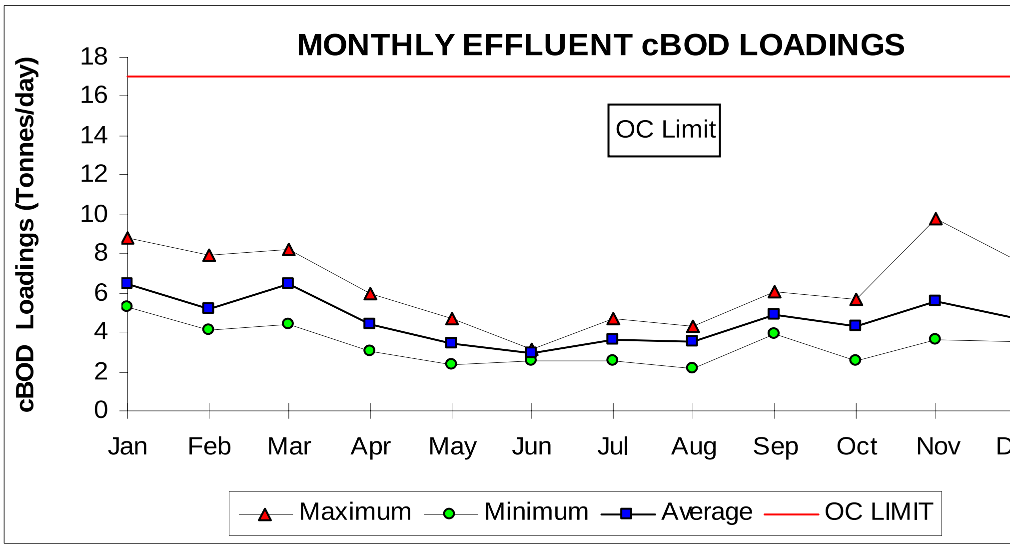
Mth	Max	Min	Ave
Jan	20.9	8.7	11.5
Feb	12.4	5.3	8.2
Mar	15.3	6.3	9.9
Apr	9.9	6.1	7.5
May	8.3	4.1	5.8
Jun	7.1	4.1	5.3
Jul	6.3	3.0	4.2
Aug	5.9	2.4	4.3
Sep	8.0	3.4	5.0
Oct	8.0	4.0	5.5
Nov	18.3	4.8	9.6
Dec	10.6	4.2	6.6



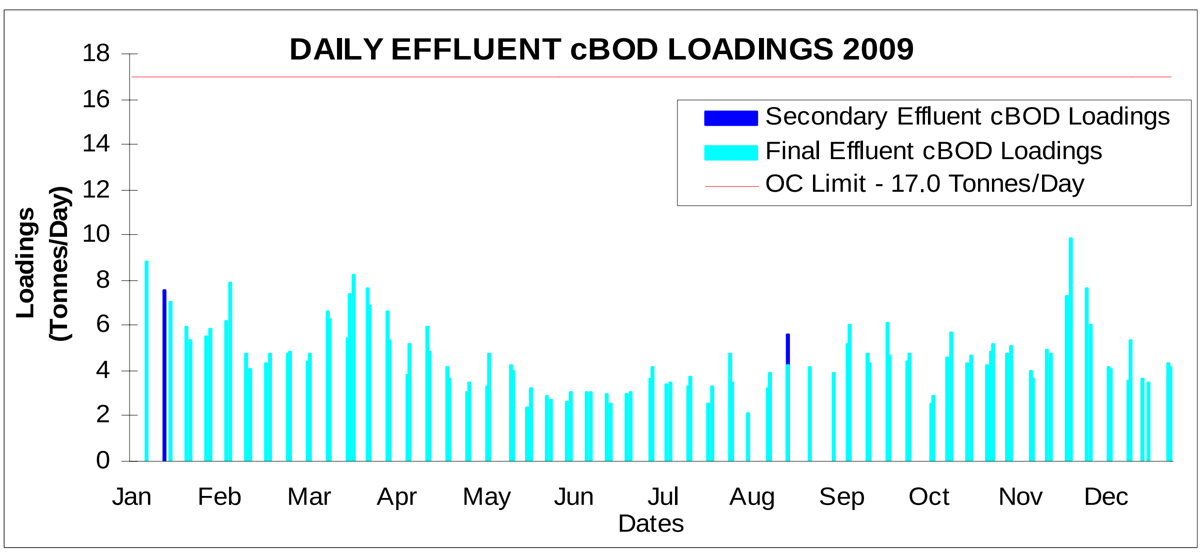
ANNACIS WWTP – 2009 BOD Loadings Summary



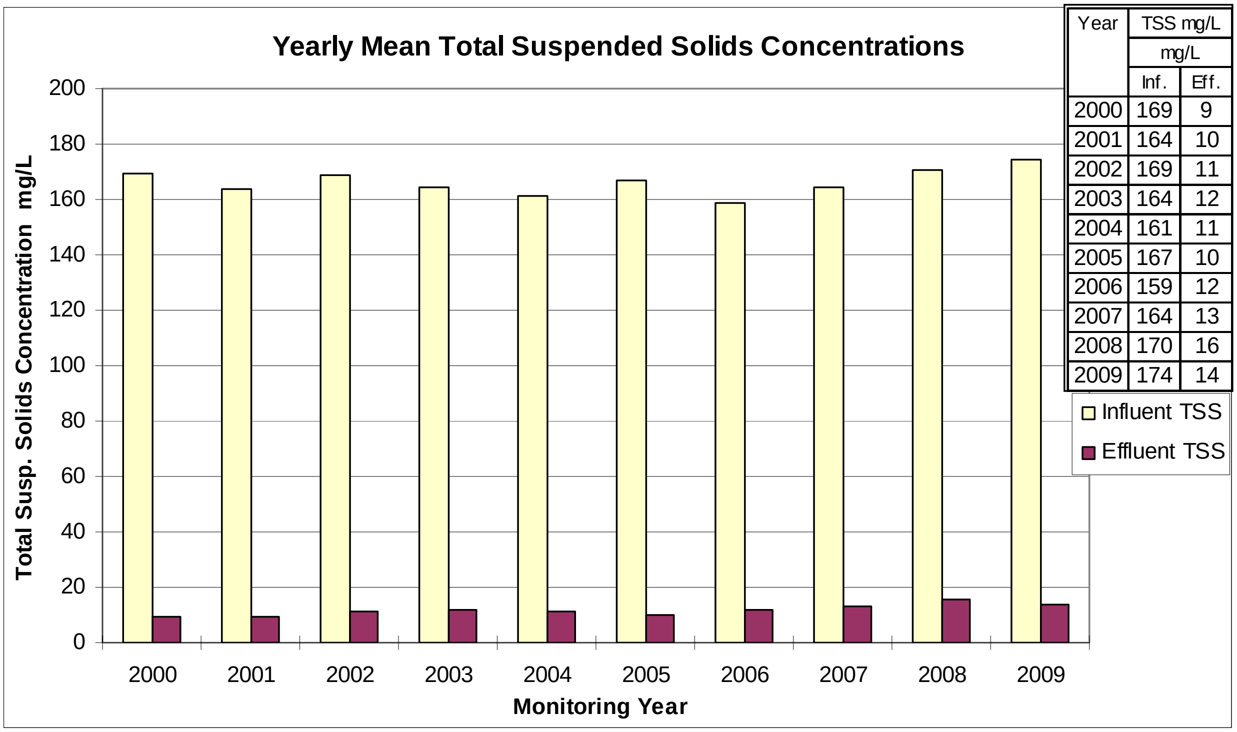
Mth	Max	Min	Ave
Jan	128	80	91
Feb	100	74	89
Mar	102	76	91
Apr	105	85	95
May	101	77	94
Jun	109	85	91
Jul	98	78	88
Aug	102	78	87
Sep	107	79	89
Oct	96	84	89
Nov	86	70	77
Dec	105	78	91



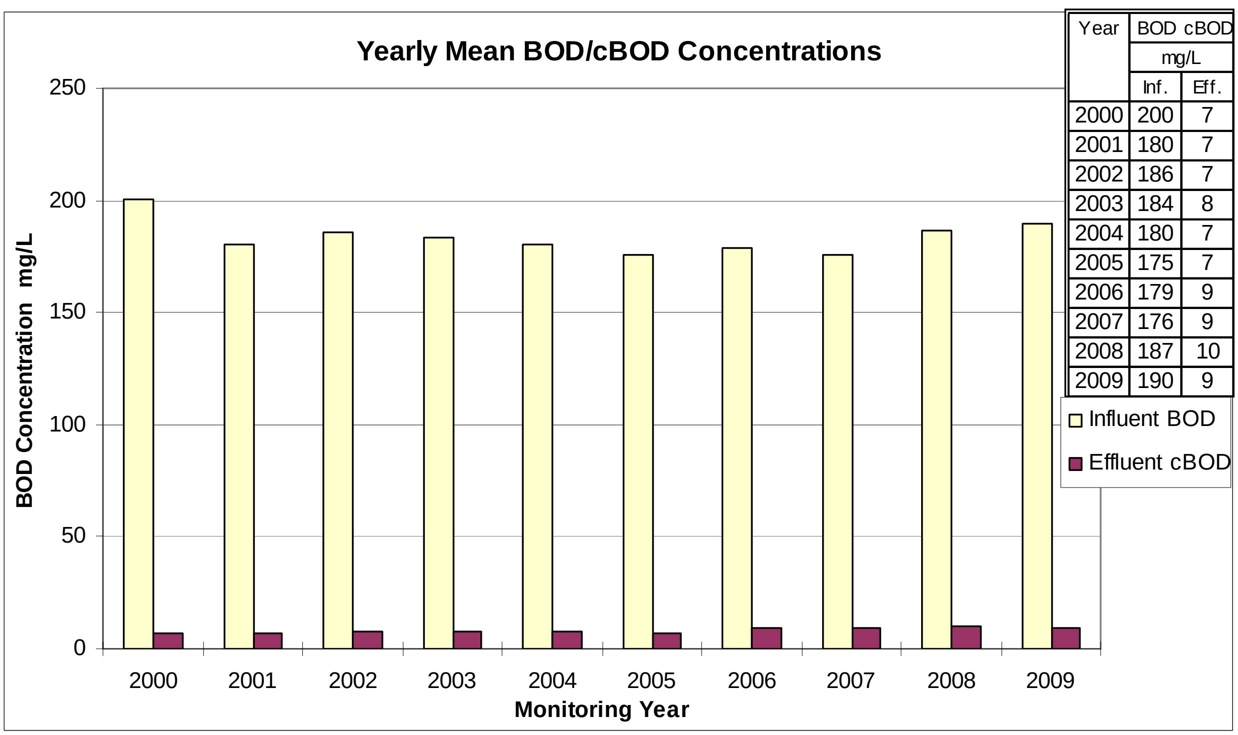
Mth	Max	Min	Ave
Jan	8.8	5.3	6.4
Feb	7.9	4.1	5.2
Mar	8.2	4.4	6.4
Apr	6.0	3.1	4.4
May	4.7	2.4	3.4
Jun	3.1	2.6	2.9
Jul	4.7	2.6	3.6
Aug	4.3	2.1	3.5
Sep	6.1	3.9	4.9
Oct	5.7	2.6	4.3
Nov	9.8	3.6	5.5
Dec	7.6	3.5	4.7



ANNACIS WWTP 2000 – 2009 Historical Concentrations Comparison

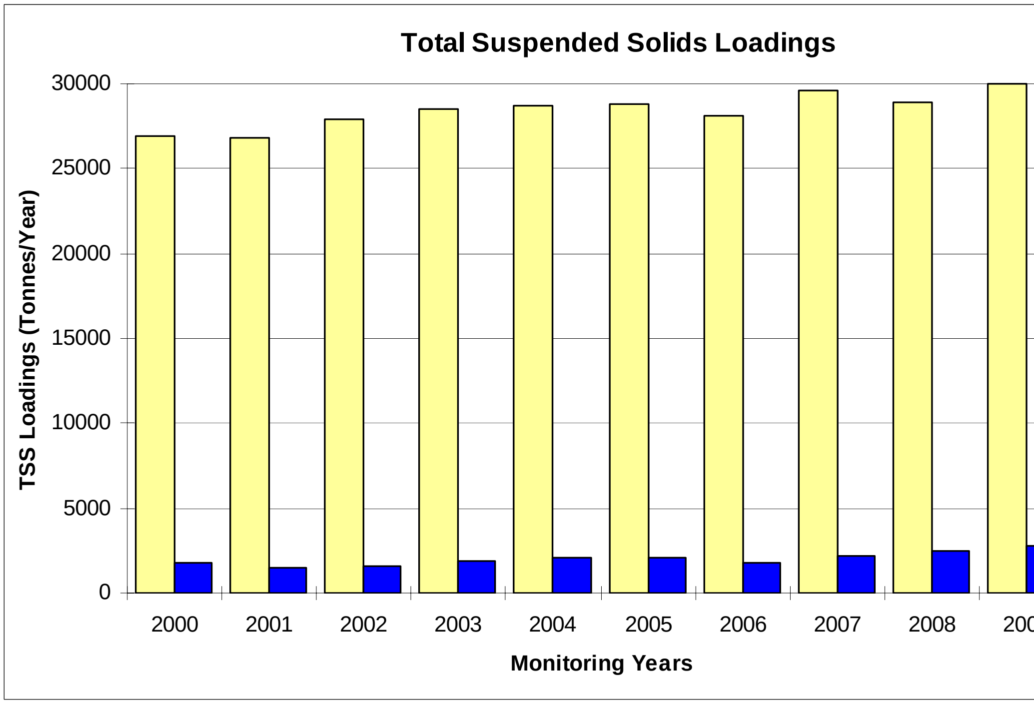


Year	TSS mg/L	
	mg/L	
	Inf.	Eff.
2000	169	9
2001	164	10
2002	169	11
2003	164	12
2004	161	11
2005	167	10
2006	159	12
2007	164	13
2008	170	16
2009	174	14

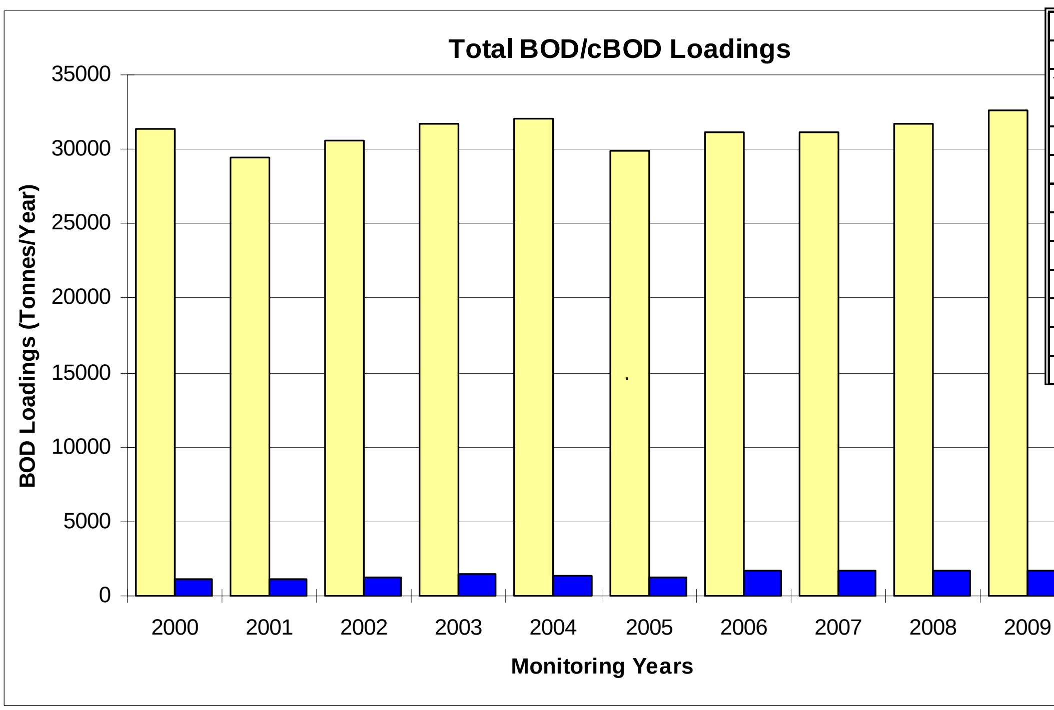


Year	BOD cBOD	
	mg/L	
	Inf.	Eff.
2000	200	7
2001	180	7
2002	186	7
2003	184	8
2004	180	7
2005	175	7
2006	179	9
2007	176	9
2008	187	10
2009	190	9

ANNACIS WWTP 2000 – 2009 Historical Loadings Comparison



TSS (Tonnes/Yr)		
Years	Influent	Effluent
2000	26884	1517
2001	26853	1606
2002	27932	1890
2003	28534	2112
2004	28697	2078
2005	28803	1777
2006	28090	2200
2007	29648	2522
2008	28921	2774
2009	30041	2514



BOD/cBOD (Tonnes/Yr)		
Years	Influent	Effluent
2000	31348	1089
2001	29496	1130
2002	30532	1256
2003	31736	1442
2004	32072	1373
2005	29945	1238
2006	31175	1675
2007	31146	1719
2008	31719	1698
2009	32611	1687

ANNACIS WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	22	30	27	32	31	33	32	30	32	33	31	28
NO3	Grab	0.68	0.22	0.01	0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	0.02	0.02
NO2	Grab	0.05	0.07	<0.01	<0.01	0.01	<0.01	0.02	0.03	<0.01	<0.01	0.02	0.04
NH3	Comp.	14	20	18.9	24	20	20	22	21	22	22	20	19
SO4	Comp.	18	21	18	19	22	22	24	24	22	26	21	18
PTot	Comp.	2.7	4.2	4.2	4.9	4.8	5.4	4.8	5.5	4.6	5.2	4.7	4.0
PDis	Comp.	1.2	1.9	2.0	2.1	2.1	2.0	2.1	2.1	2.1	2.0	2.1	1.8
MBAS	Grab	2.4	3.3	3.1	4	3.8	4.5	3.5	3.6	3.2	4.3	3.2	2.7
O&G	Grab	31	-	45	47	60	38	42	80	34	40	36	56
Phenol	Grab	0.02	0.03	0.02	0.04	0.04	0.03	0.06	0.05	0.03	0.03	0.03	0.02
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.59	0.61	0.69	0.68	0.81	0.76	0.69	0.75	0.68	0.64	0.57	0.58
AlDis	Comp.	0.05	0.05	0.09	0.05	0.07	0.05	0.06	0.06	0.06	0.04	0.06	0.06
AsTot	Comp.	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.008	0.001	0.001	<0.001	<0.001
BaTot	Comp.	0.040	0.029	0.029	0.032	0.030	0.026	0.024	0.027	0.025	0.024	0.025	0.026
BaDis	Comp.	0.021	0.009	0.012	0.008	0.008	0.006	0.006	0.006	0.007	0.005	0.008	0.012
BTot	Comp.	0.15	0.17	0.13	0.17	0.17	0.17	0.15	0.22	0.17	0.16	0.15	0.15
BDis	Comp.	0.15	0.16	0.13	0.16	0.16	0.17	0.16	0.21	0.18	0.16	0.15	0.15
CaTot	Comp.	22.5	16.6	15.2	16.4	15.3	15.3	13.5	15.2	13.2	13.7	14.7	15.4
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.003	0.003	0.009	0.004	0.005	0.007	0.004	0.006	0.005	0.004	0.002	0.004
CrDis	Comp.	0.001	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.002	<0.001	<0.001	0.001
CoTot	Comp.	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.059	0.093	0.083	0.091	0.084	0.112	0.096	0.095	0.086	0.101	0.159	0.069
CuDis	Comp.	0.015	0.030	0.010	0.023	0.019	0.019	0.023	0.024	0.024	0.014	0.047	0.017
FeTot	Comp.	1.33	1.73	1.62	1.88	3.02	3.21	2.09	2.37	1.22	3.20	1.10	1.50
FeDis	Comp.	0.42	0.65	0.39	0.62	0.92	1.10	0.78	0.82	0.39	0.62	0.36	0.53
PbTot	Comp.	0.004	0.010	0.003	0.005	0.005	0.008	0.006	0.008	0.007	0.006	0.003	0.004
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	3.85	3.19	3.00	3.08	3.29	3.33	2.57	2.66	3.19	2.98	2.95	3.10
MnTot	Comp.	0.091	0.086	0.078	0.084	0.091	0.089	0.069	0.070	0.062	0.072	0.072	0.086
MnDis	Comp.	0.069	0.059	0.062	0.057	0.064	0.058	0.046	0.042	0.041	0.044	0.047	0.066
HgTot	Comp.	0.11	0.09	0.14	0.11	0.17	0.53	0.17	0.11	0.20	0.11	0.28	0.13
MoTot	Comp.	0.003	0.002	0.002	0.002	0.002	0.002	<0.002	0.003	0.004	0.003	0.003	0.003
MoDis	Comp.	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	0.003	0.002
NiTot	Comp.	0.002	0.002	0.002	0.003	0.003	0.004	0.003	0.003	0.004	0.004	0.003	0.002
NiDis	Comp.	0.002	0.002	0.001	0.002	0.001	0.001	0.002	0.002	0.003	0.002	0.001	0.002
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.072	0.090	0.095	0.142	0.097	0.134	0.099	0.115	0.100	0.099	0.088	0.084
ZnDis	Comp.	0.030	0.023	0.039	0.019	0.025	0.011	0.015	0.016	0.018	0.011	0.021	0.024

Note: All results reported are in mg/L; except for Mercury which is reported as ug/L.

ANNACIS WWTP – 2009 Comprehensive Effluent Data

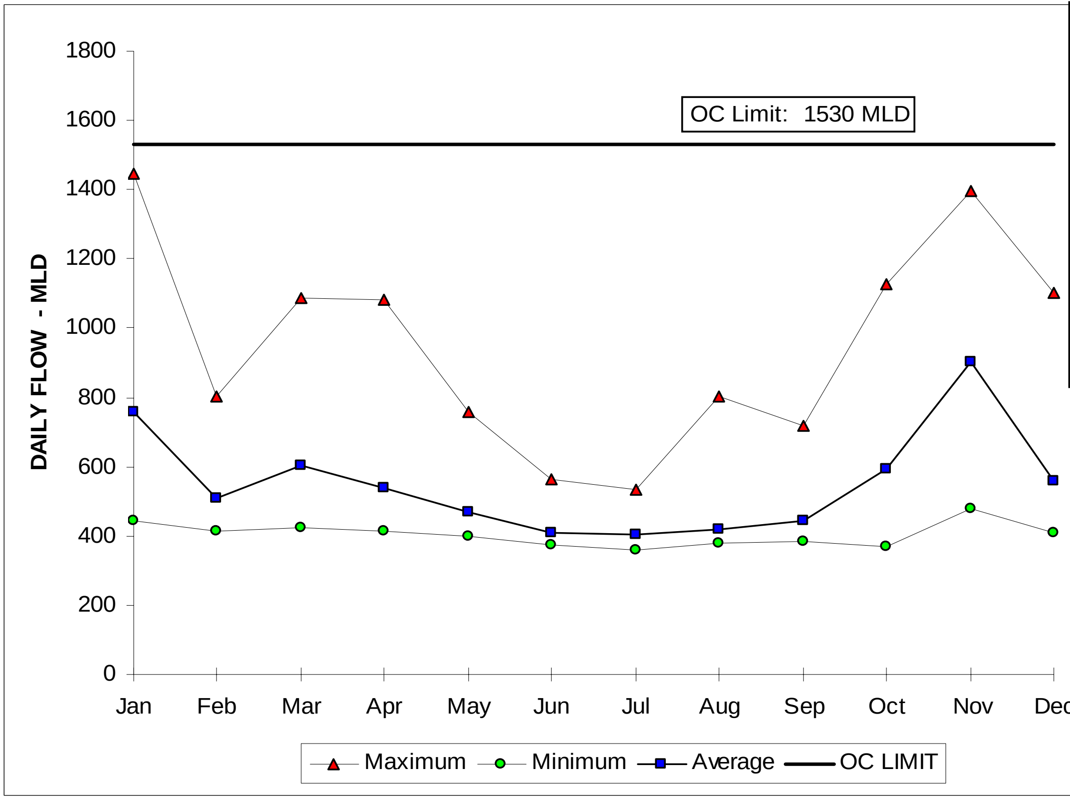
Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	20	28	29	32	35	34	31	34	34	35	33	28
NO3	Grab	0.01	0.02	0.01	<0.01	<0.01	0.02	0.02	0.02	<0.01	<0.01	0.02	0.01
NO2	Grab	0.02	0.02	0.02	0.01	0.02	0.03	0.05	0.05	0.03	0.03	0.03	0.02
NH3	Comp.	20	26	25	32	33	32	32	31	30	33	31	27
SO4	Comp.	19	21	20	23	25	29	25	29	25	29	23	19
PTot	Comp.	2.5	2.5	3.1	3.0	3.1	3.6	3.2	3.6	3.6	3.4	3.7	2.6
PDis	Comp.	1.9	1.8	2.2	2.3	2.4	3.0	2.6	3.0	3.0	2.9	3.1	2.1
MBAS	Grab	0.3	0.2	0.2	0.3	0.3	0.4	0.4	0.3	0.4	0.3	0.2	0.3
O&G	Grab	<6	<6	<6	<7	<6	<6	<6	<6	<6	<6	<6	<5
Phenol	Grab	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.18	0.13	0.19	0.11	0.12	0.10	0.10	0.11	0.13	0.10	0.13	0.16
AlDis	Comp.	0.03	0.03	0.03	0.02	0.02	0.02	0.03	0.03	0.04	0.02	0.04	0.04
AsTot	Comp.	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.023	0.010	0.010	0.012	0.007	0.005	0.005	0.006	0.007	0.005	0.009	0.012
BaDis	Comp.	0.015	0.005	0.004	0.003	0.002	0.002	0.002	0.003	0.004	0.003	0.006	0.008
BTot	Comp.	0.18	0.18	0.15	0.18	0.18	0.18	0.18	0.23	0.18	0.18	0.17	0.17
BDis	Comp.	0.18	0.18	0.15	0.17	0.18	0.18	0.17	0.21	0.17	0.17	0.16	0.17
CaTot	Comp.	22.6	15.2	14.0	15.1	13.3	13.4	11.4	12.9	11.7	12.3	13.4	14.9
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.002	0.002	0.010	0.002	0.001	0.002	<0.001	0.001	0.002	0.001	<0.001	0.001
CrDis	Comp.	<0.001	0.001	0.004	<0.001	<0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.104	0.036	0.044	0.031	0.027	0.027	0.051	0.029	0.031	0.027	0.065	0.037
CuDis	Comp.	0.058	0.010	0.015	0.022	0.019	0.021	0.039	0.021	0.023	0.020	0.036	0.017
FeTot	Comp.	0.56	0.59	0.62	0.79	0.80	0.85	0.49	0.53	0.45	0.58	0.38	0.50
FeDis	Comp.	0.15	0.13	0.15	0.13	0.14	0.13	0.18	0.17	0.16	0.16	0.17	0.16
PbTot	Comp.	<0.001	0.002	0.002	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.001
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.35	3.24	3.02	3.00	3.35	2.92	2.38	2.36	2.65	2.91	2.83	3.18
MnTot	Comp.	0.087	0.073	0.067	0.070	0.068	0.062	0.053	0.049	0.048	0.052	0.054	0.075
MnDis	Comp.	0.078	0.061	0.056	0.065	0.059	0.054	0.045	0.042	0.042	0.046	0.047	0.066
HgTot	Comp.	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MoTot	Comp.	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.002	0.003	<0.002	<0.002
MoDis	Comp.	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	0.002	<0.002
NiTot	Comp.	0.002	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.002
NiDis	Comp.	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.042	0.041	0.043	0.043	0.034	0.035	0.031	0.036	0.037	0.027	0.042	0.033
ZnDis	Comp.	0.024	0.018	0.024	0.022	0.022	0.024	0.021	0.024	0.028	0.020	0.028	0.022

Note: All results reported are in mg/L; except for Mercury which is reported as ug/L.

APPENDIX A2

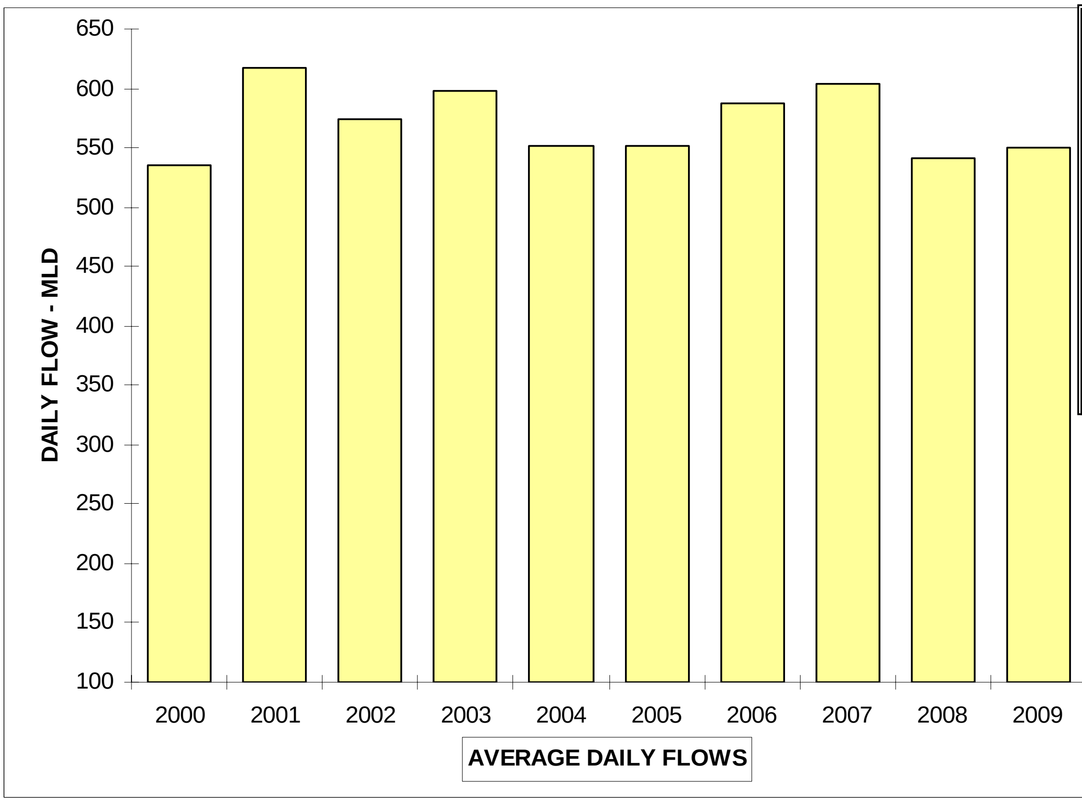
IONA ISLAND WASTEWATER TREATMENT PLANT

IONA WWTP – 2009 Wastewater Flows – Monthly Summary



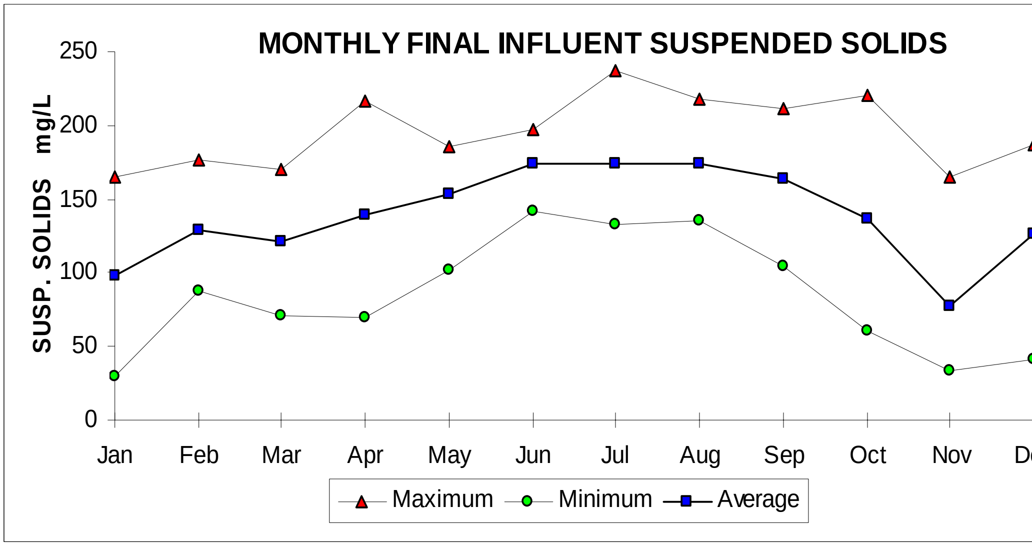
Mth	Max	Min	Ave
Jan	1445	445	757
Feb	802	414	511
Mar	1089	422	604
Apr	1083	412	538
May	760	397	468
Jun	562	376	407
Jul	535	358	402
Aug	805	378	417
Sep	716	382	442
Oct	1127	369	591
Nov	1398	479	904
Dec	1104	409	556

Average Daily Wastewater Flows 2000 – 2009

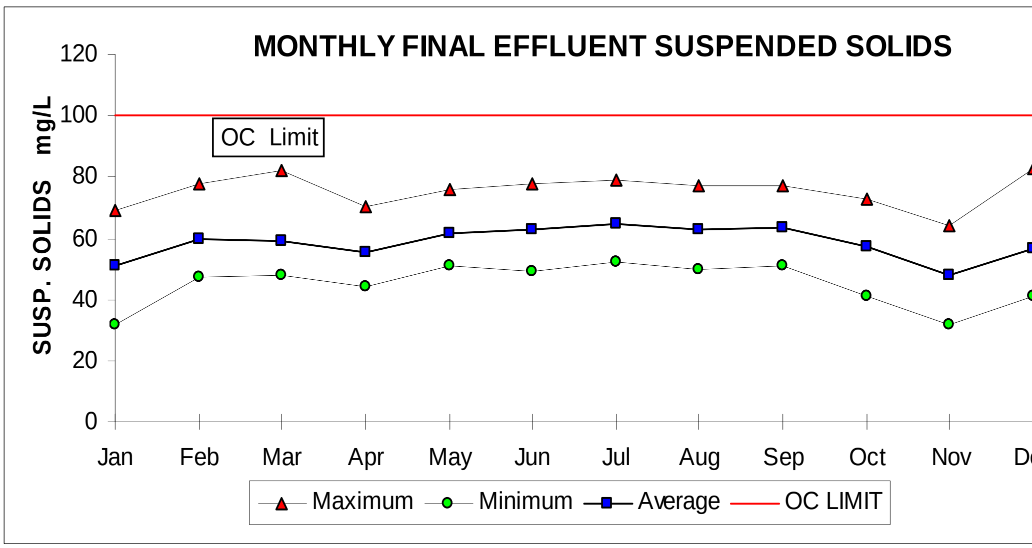


Year	Flow (MLD)
2000	535
2001	617
2002	574
2003	597
2004	551
2005	552
2006	587
2007	603
2008	541
2009	550

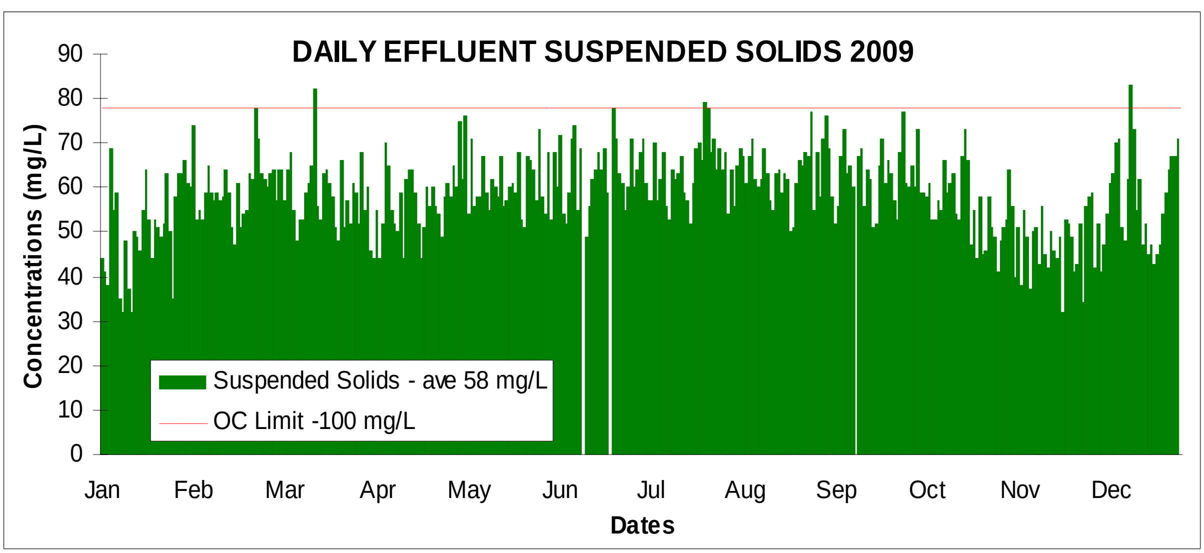
IONA WWTP – 2009 Suspended Solids Concentrations



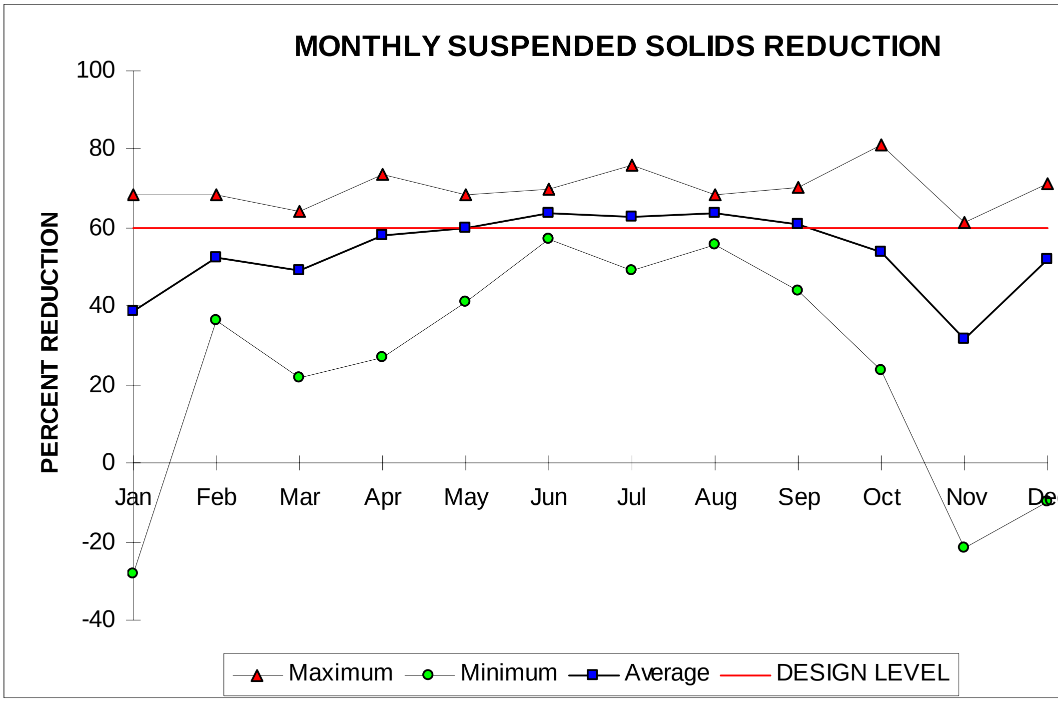
Mth	Max	Min	Ave
Jan	165	29	97
Feb	176	87	129
Mar	170	71	122
Apr	216	70	139
May	185	102	154
Jun	197	142	173
Jul	237	133	175
Aug	218	135	174
Sep	211	104	164
Oct	220	60	137
Nov	165	33	77
Dec	187	41	126



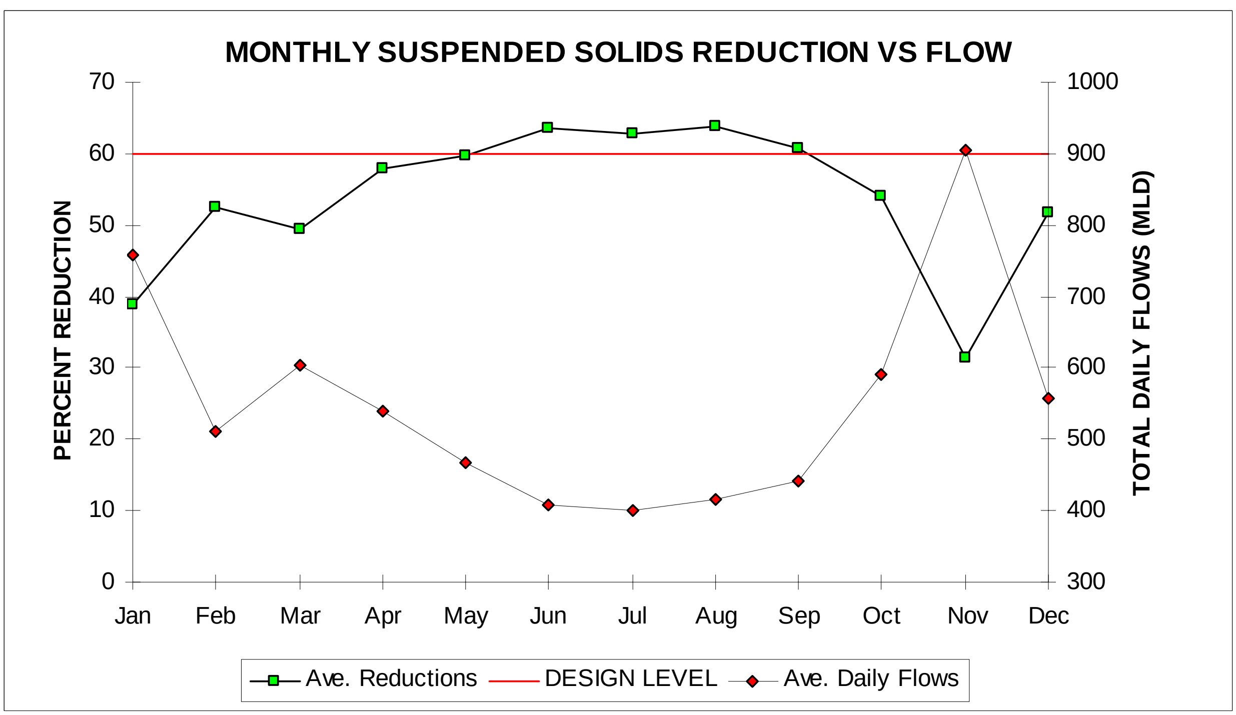
Mth	Max	Min	Ave
Jan	69	32	51
Feb	78	47	60
Mar	82	48	59
Apr	70	44	56
May	76	51	61
Jun	78	49	63
Jul	79	52	64
Aug	77	50	63
Sep	77	51	63
Oct	73	41	57
Nov	64	32	48
Dec	83	41	57



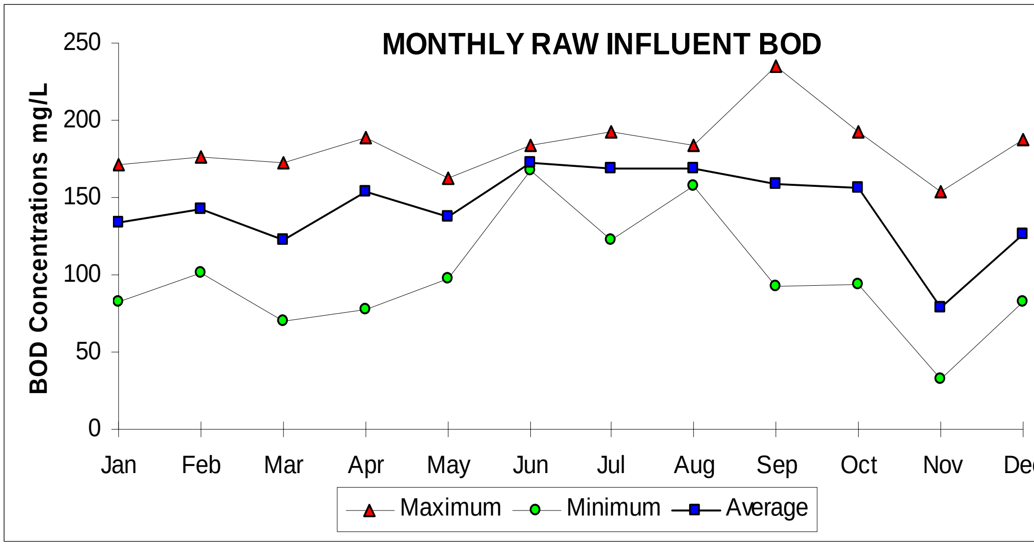
IONA WWTP – 2009 Suspended Solids Reductions



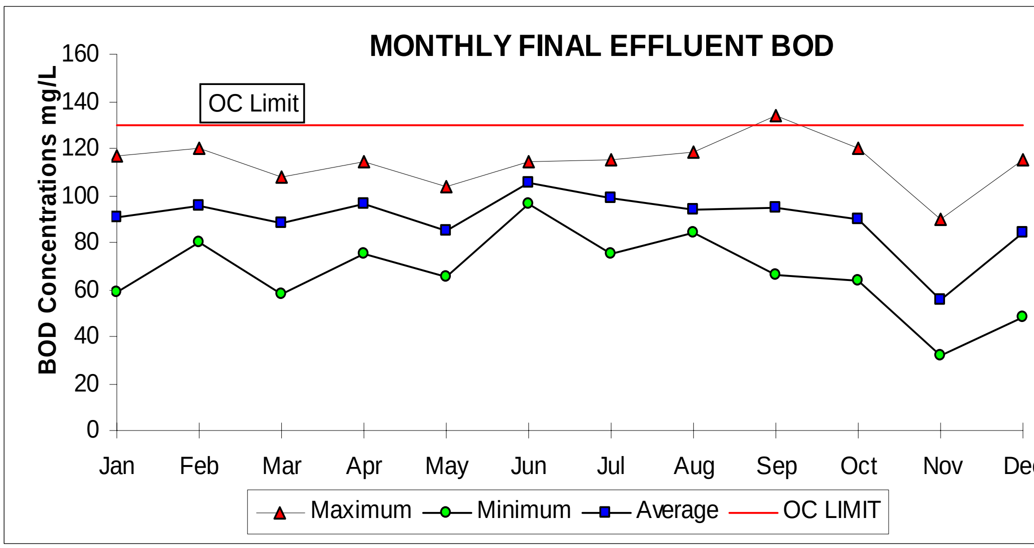
Mth	Max	Min	Ave
Jan	68	-28	39
Feb	68	37	53
Mar	64	22	49
Apr	74	27	58
May	69	41	60
Jun	70	57	64
Jul	76	49	63
Aug	68	56	64
Sep	71	44	61
Oct	81	24	54
Nov	61	-21	31
Dec	71	-10	52



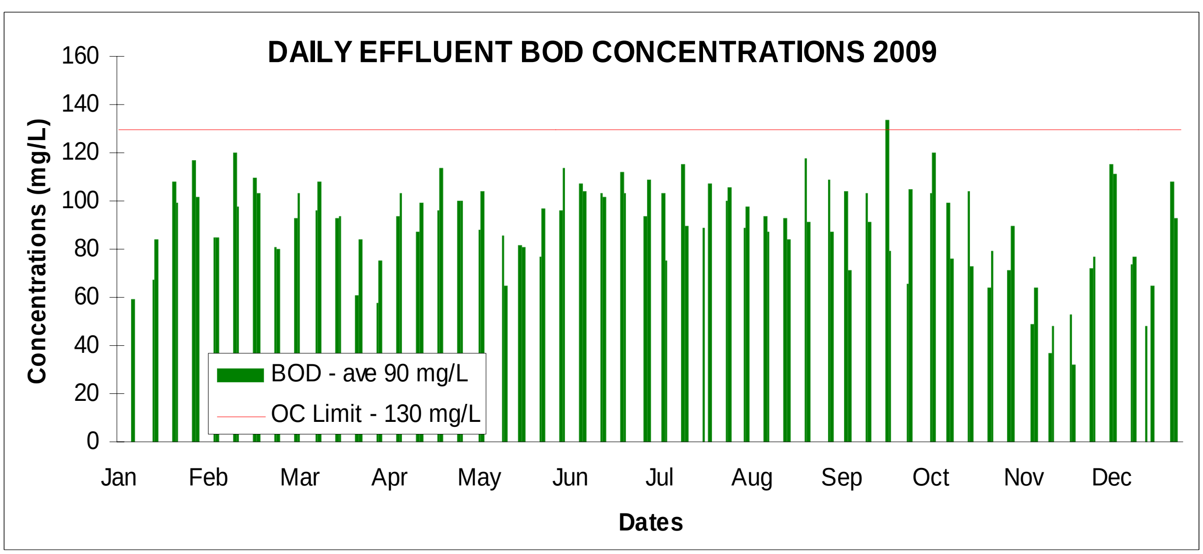
IONA WWTP – 2009 BOD Concentrations



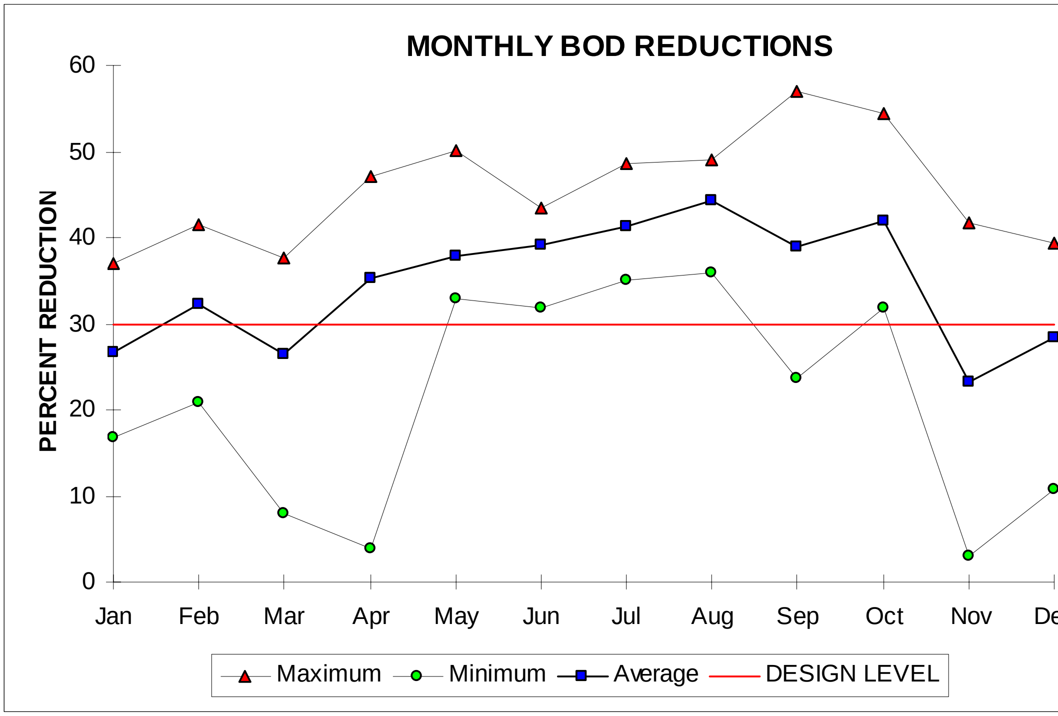
Mth	Max	Min	Ave
Jan	171	83	134
Feb	176	101	142
Mar	173	70	123
Apr	189	78	154
May	162	97	138
Jun	184	167	173
Jul	193	123	169
Aug	184	158	169
Sep	235	93	159
Oct	193	94	157
Nov	154	33	79
Dec	187	83	127



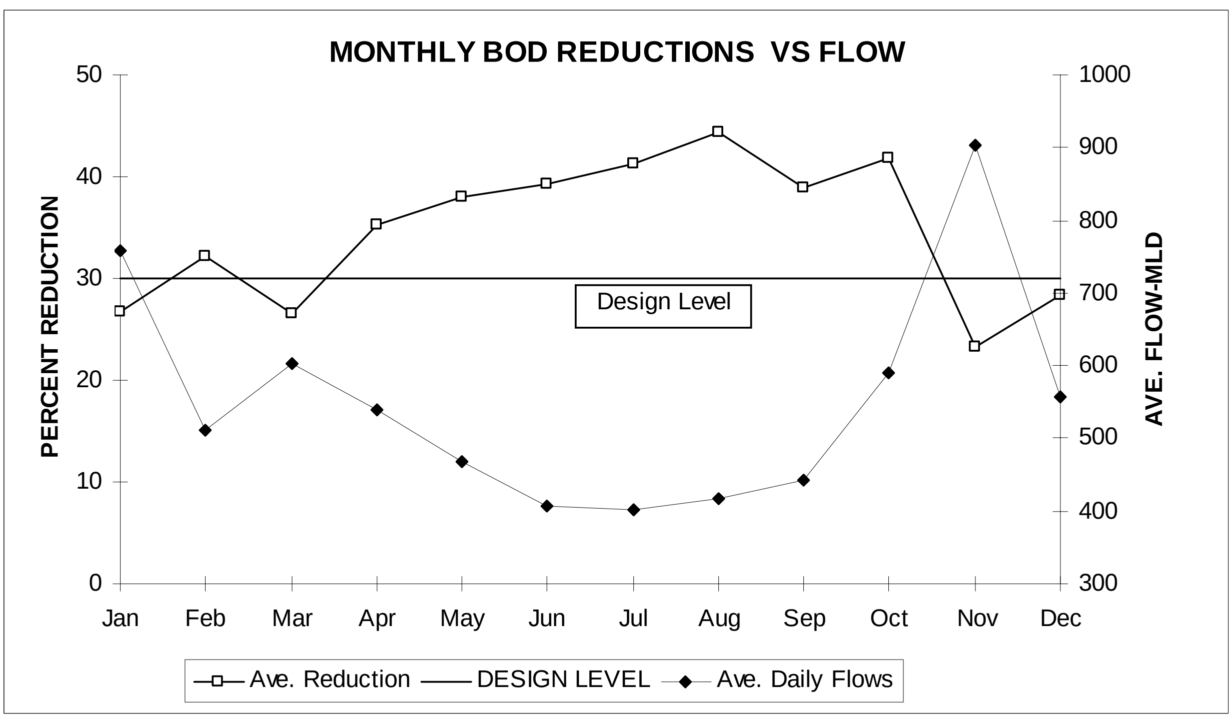
Mth	Max	Min	Ave
Jan	117	59	91
Feb	120	80	95
Mar	108	58	88
Apr	114	75	96
May	104	65	85
Jun	114	96	105
Jul	115	75	99
Aug	118	84	94
Sep	134	66	95
Oct	120	64	90
Nov	90	32	56
Dec	115	48	84



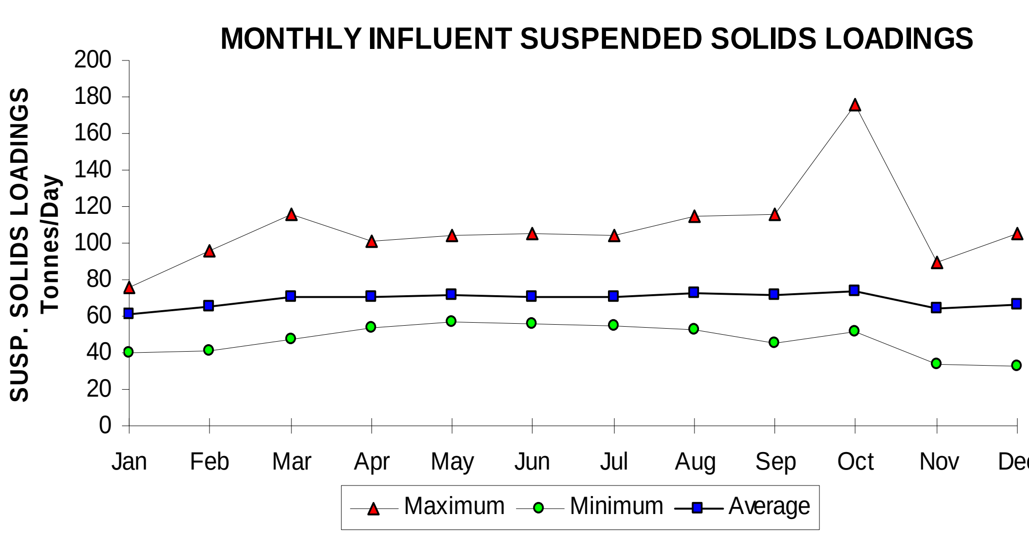
IONA WWTP - 2009 BOD Reductions



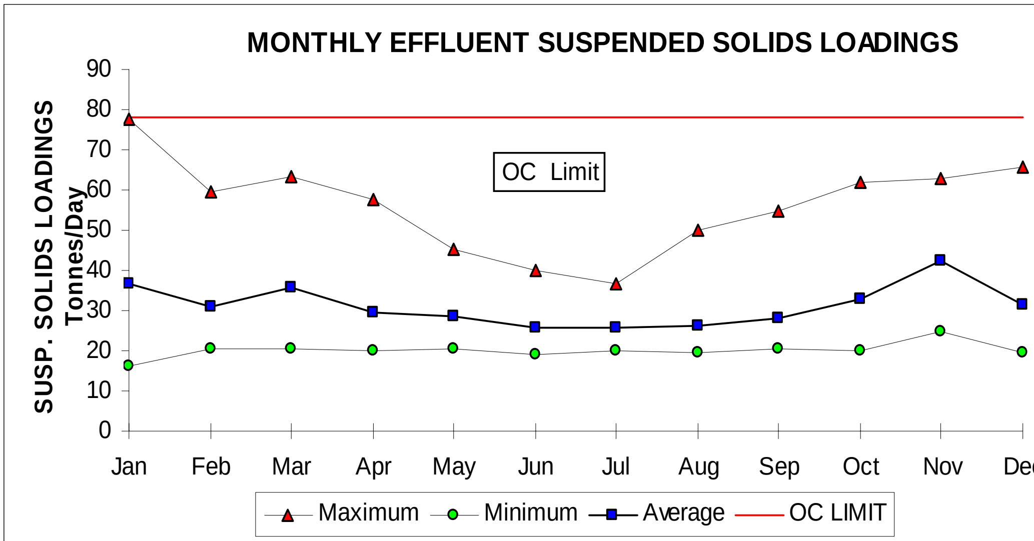
Mth	Max	Min	Ave
Jan	37	17	27
Feb	41	21	32
Mar	38	8	26
Apr	47	4	35
May	50	33	38
Jun	44	32	39
Jul	49	35	41
Aug	49	36	44
Sep	57	24	39
Oct	54	32	42
Nov	42	3	23
Dec	39	11	28



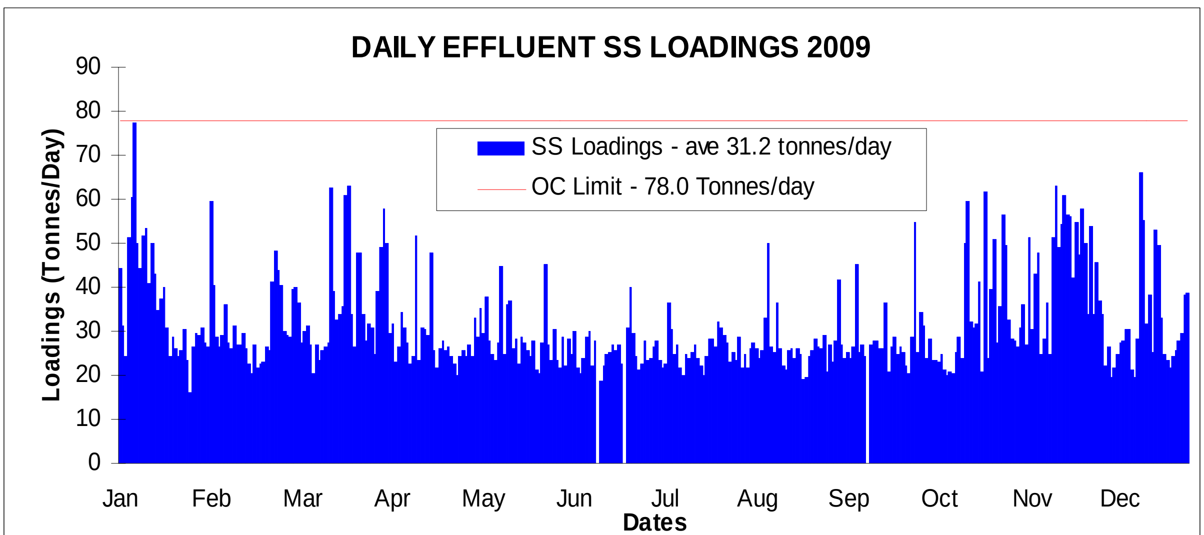
IONA WWTP – 2009 Suspended Solids Loadings Summary



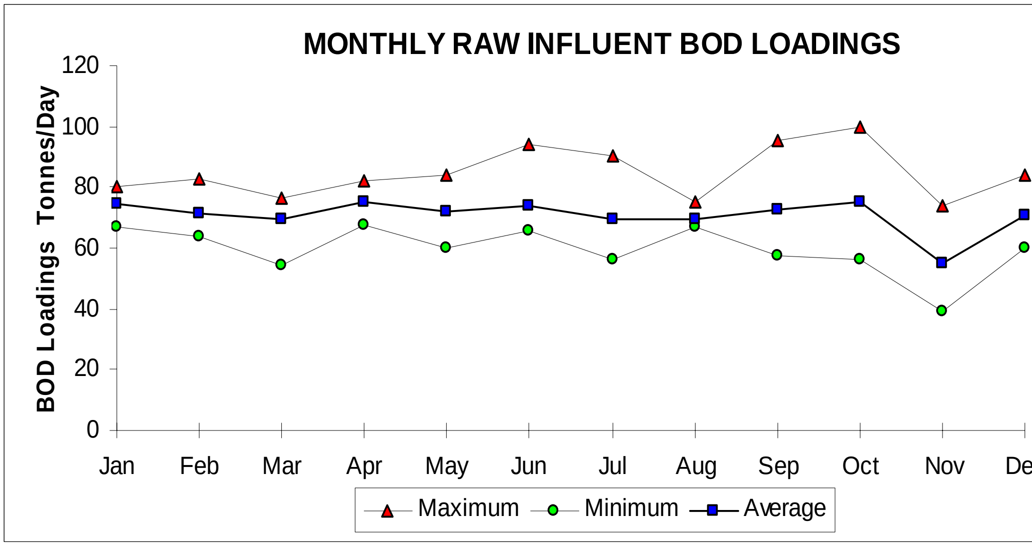
Mth	Max	Min	Ave
Jan	76	40	62
Feb	95	41	65
Mar	116	47	70
Apr	101	54	71
May	104	57	71
Jun	105	56	71
Jul	105	55	70
Aug	115	53	72
Sep	116	46	72
Oct	176	51	74
Nov	89	34	64
Dec	105	32	67



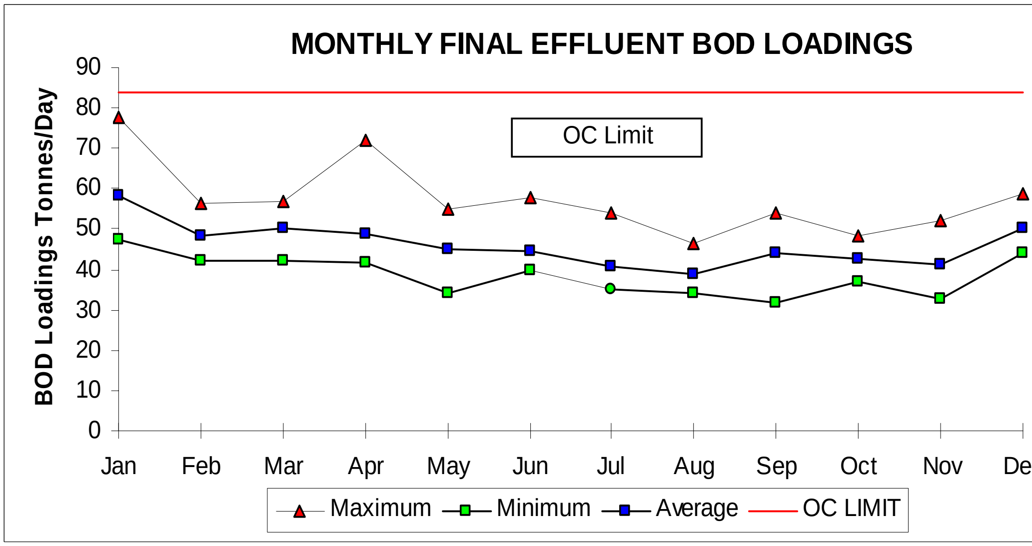
Mth	Max	Min	Ave
Jan	77	16	37
Feb	59	20	31
Mar	63	21	36
Apr	58	20	30
May	45	20	29
Jun	40	19	26
Jul	37	20	26
Aug	50	19	26
Sep	55	20	28
Oct	62	20	33
Nov	63	25	42
Dec	66	20	32



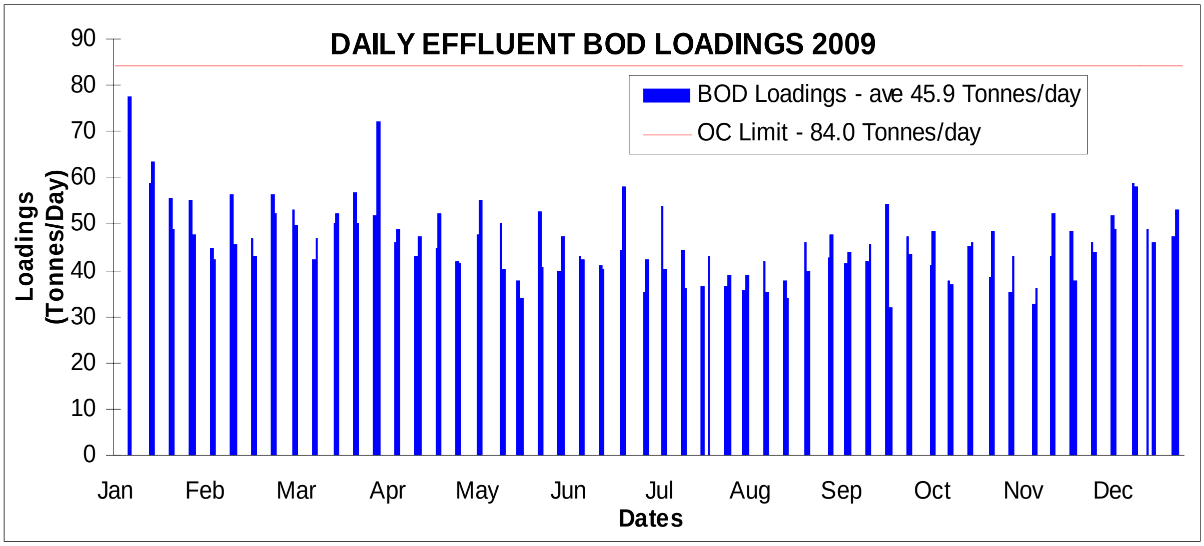
IONA WWTP – 2009 BOD Loadings Summary



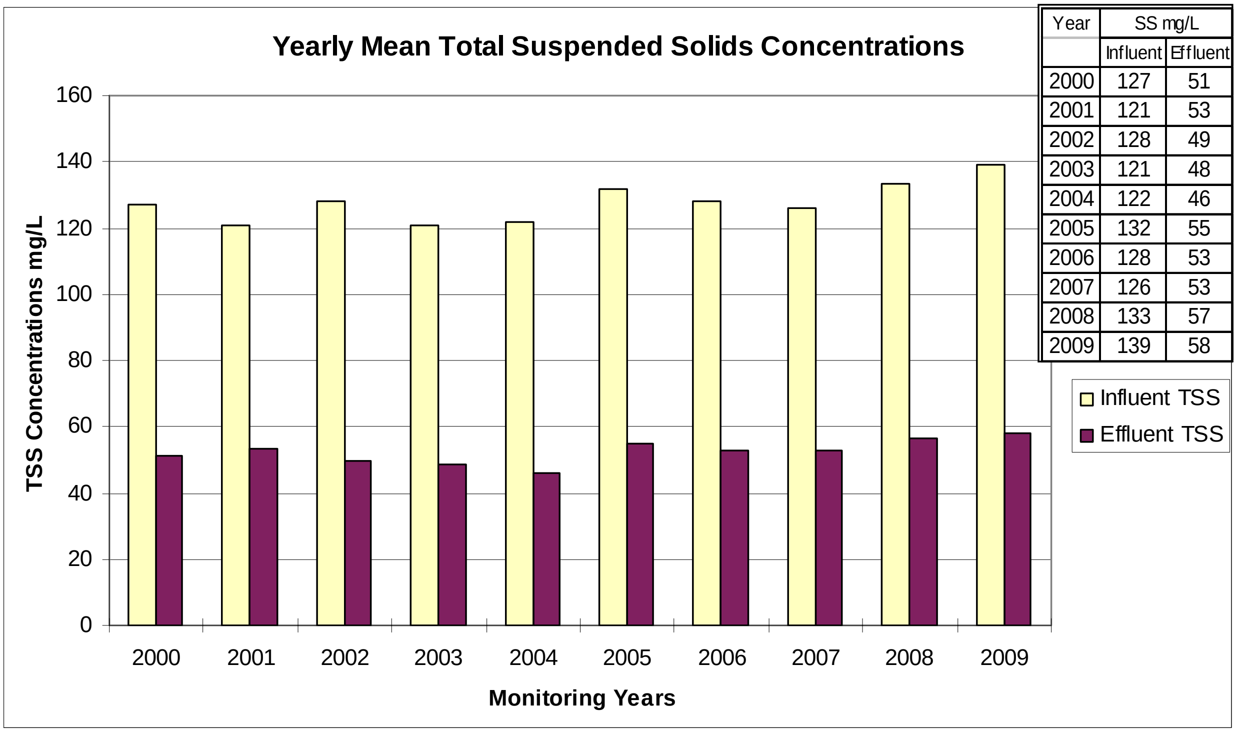
Mth	Max	Min	Ave
Jan	80	67	75
Feb	83	64	71
Mar	76	54	69
Apr	82	68	75
May	84	60	72
Jun	94	66	74
Jul	90	56	69
Aug	75	67	69
Sep	95	58	73
Oct	99	56	75
Nov	74	39	55
Dec	84	60	71



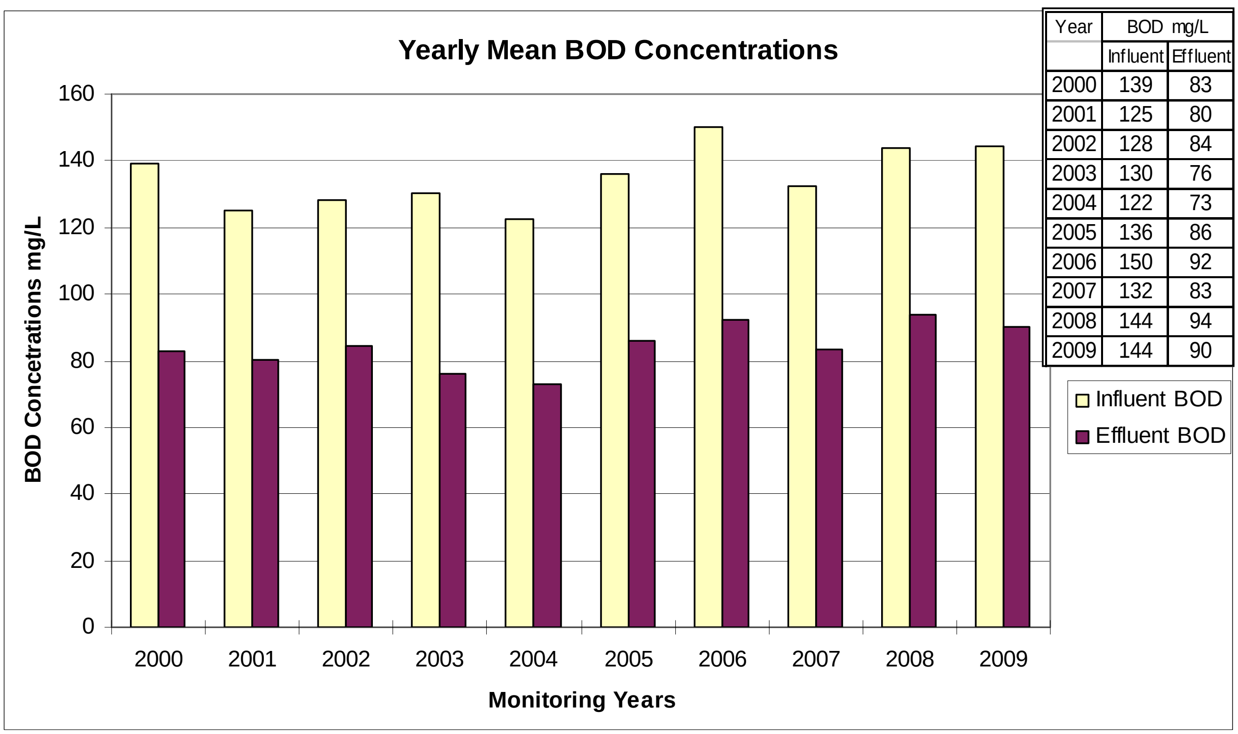
Mth	Max	Min	Ave
Jan	77	47	58
Feb	57	42	48
Mar	57	42	50
Apr	72	42	49
May	55	34	45
Jun	58	40	45
Jul	54	35	41
Aug	46	34	39
Sep	54	32	44
Oct	49	37	43
Nov	52	33	41
Dec	59	44	50



IONA WWTP – 2000 - 2009 Historical Concentrations Comparison

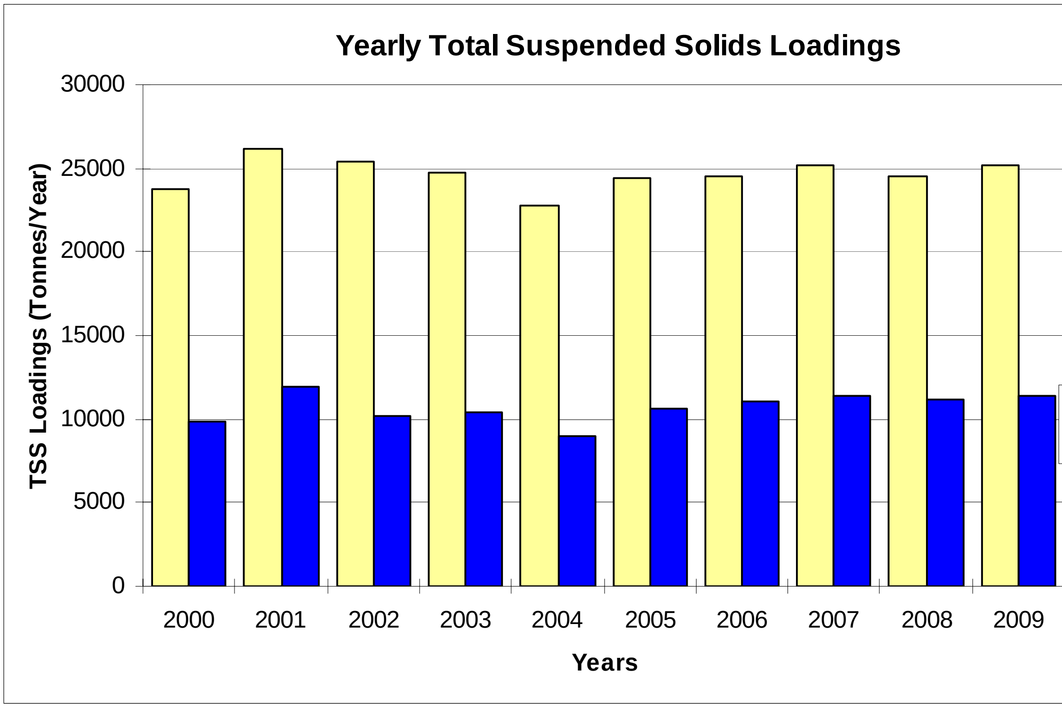


Year	SS mg/L	
	Influent	Effluent
2000	127	51
2001	121	53
2002	128	49
2003	121	48
2004	122	46
2005	132	55
2006	128	53
2007	126	53
2008	133	57
2009	139	58

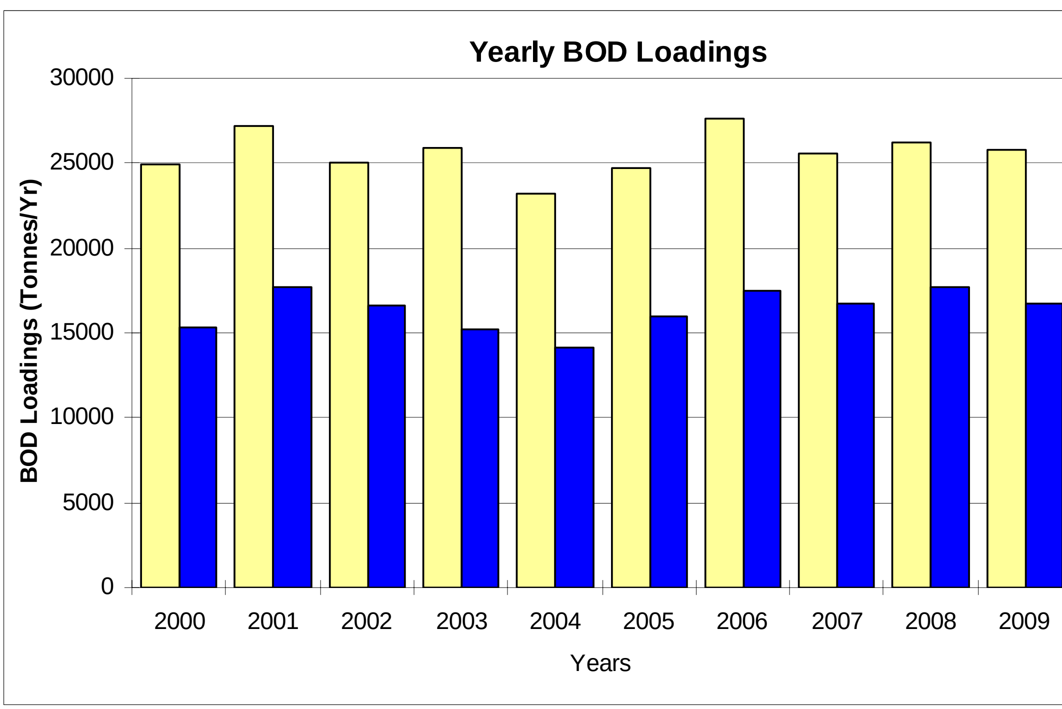


Year	BOD mg/L	
	Influent	Effluent
2000	139	83
2001	125	80
2002	128	84
2003	130	76
2004	122	73
2005	136	86
2006	150	92
2007	132	83
2008	144	94
2009	144	90

IONA WWTP – 2000 – 2009 Historical Loadings Comparisons



SS(Tonnes/Yr)		
Years	Influent	Effluent
2000	23723	9883
2001	26168	11889
2002	25371	10209
2003	24736	10358
2004	22723	9023
2005	24467	10644
2006	24553	11076
2007	25159	11441
2008	24516	11149
2009	25199	11397



BOD(Tonnes/Yr)		
Years	Influent	Effluent
2000	24982	15298
2001	27202	17650
2002	25031	16585
2003	25872	15260
2004	23171	14134
2005	24699	15966
2006	27583	17494
2007	25613	16772
2008	26179	17728
2009	25786	16764

IONA WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	14	30	24	28	28	32	30	30	29	32	27	22
NO3	Grab	1.31	0.44	0.51	0.06	0.19	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.39
NO2	Grab	0.08	0.09	0.08	0.05	0.07	0.02	<0.01	<0.01	<0.01	0.02	<0.01	0.11
NH3	Comp.	7.5	18.5	14.1	15.7	14.8	17.9	16.1	15.7	15.8	18.2	17.2	12.7
SO4	Comp.	16	25	19	22	18	21	31	17	19	20	26	23
PTot	Comp.	1.9	4.1	3.5	4.2	3.9	5.2	4.6	4.7	4.0	4.9	4.0	3.1
PDis	Comp.	0.9	1.9	1.5	2.1	1.7	2.0	1.7	1.8	1.7	2.1	1.6	1.3
MBAS	Grab	0.6	0.7	0.6	0.9	0.8	0.8	1.0	0.8	0.7	0.9	1.0	0.6
O&G	Grab	9	13	8	12	14	12	15	11	15	13	23	8
Phenol	Grab	0.01	0.02	0.01	<0.01	0.02	<0.01	0.01	0.02	0.02	<0.01	0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.39	0.55	0.86	0.53	0.79	0.66	1.11	0.65	0.68	0.65	0.69	0.51
AlDis	Comp.	0.04	0.04	0.05	0.08	0.05	0.05	0.04	0.04	0.05	0.03	0.04	0.04
AsTot	Comp.	0.001	0.001	0.002	<0.001	0.003	<0.001	0.006	0.002	0.001	0.001	0.001	<0.001
BaTot	Comp.	0.031	0.024	0.024	0.023	0.022	0.022	0.026	0.022	0.020	0.020	0.022	0.027
BaDis	Comp.	0.020	0.008	0.009	0.010	0.007	0.006	0.007	0.006	0.006	0.006	0.008	0.011
BTot	Comp.	0.05	0.08	0.07	0.09	0.07	0.10	0.10	0.09	0.09	0.09	0.09	0.08
BDis	Comp.	0.05	0.09	0.07	0.09	0.07	0.10	0.09	0.09	0.09	0.09	0.09	0.08
CaTot	Comp.	22.3	14.8	14.5	15.0	11.3	13.2	13.0	12.1	10.9	12.0	15.2	16.7
CdTot	Comp.	<0.0005	0.0006	<0.0005	0.0009	0.0010	0.0005	0.0011	0.0167	<0.0005	0.0005	0.0008	0.0012
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0037	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.002	0.003	0.003	0.003	0.004	0.003	0.006	0.002	0.003	0.002	0.002	0.002
CrDis	Comp.	<0.001	<0.001	0.001	0.001	0.002	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.053	0.103	0.095	0.100	0.094	0.126	0.127	0.131	0.139	0.128	0.102	0.072
CuDis	Comp.	0.018	0.023	0.026	0.036	0.026	0.033	0.017	0.033	0.037	0.024	0.021	0.019
FeTot	Comp.	0.65	0.88	1.04	0.85	1.14	1.15	1.54	1.11	1.20	1.16	1.01	0.88
FeDis	Comp.	0.13	0.20	0.18	0.26	0.18	0.24	0.20	0.21	0.28	0.21	0.18	0.20
PbTot	Comp.	0.002	0.005	0.005	0.003	0.004	0.005	0.009	0.09	0.006	0.004	0.003	0.002
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.56	7.06	5.35	6.68	4.03	5.91	9.18	3.87	3.82	5.23	8.27	6.29
MnTot	Comp.	0.046	0.053	0.055	0.058	0.052	0.049	0.056	0.048	0.052	0.049	0.054	0.053
MnDis	Comp.	0.034	0.034	0.034	0.039	0.029	0.029	0.031	0.028	0.032	0.029	0.036	0.039
HgTot	Comp.	0.06	0.10	0.11	0.20	0.11	0.23	0.22	0.07	0.12	0.16	0.07	<0.05
MoTot	Comp.	0.003	0.003	0.002	0.003	<0.002	0.003	0.003	0.002	0.004	0.003	0.003	<0.002
MoDis	Comp.	0.002	0.003	0.002	0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.002	0.002	<0.002
NiTot	Comp.	0.001	0.002	0.002	0.002	0.003	0.002	0.004	0.002	0.003	0.003	0.002	0.001
NiDis	Comp.	<0.001	0.001	0.001	0.001	0.001	<0.001	0.002	0.002	0.001	0.001	0.001	<0.001
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	0.001	<0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	0.010	<0.01	0.030	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.059	0.102	0.099	0.111	0.110	0.135	0.173	0.157	0.102	0.130	0.085	0.083
ZnDis	Comp.	0.028	0.036	0.045	0.051	0.050	0.042	0.032	0.052	0.032	0.039	0.029	0.035

Note: All results reported are in mg/L, except for Mercury which are reported in ug/L.

IONA WWTP – 2009 Comprehensive Effluent Data

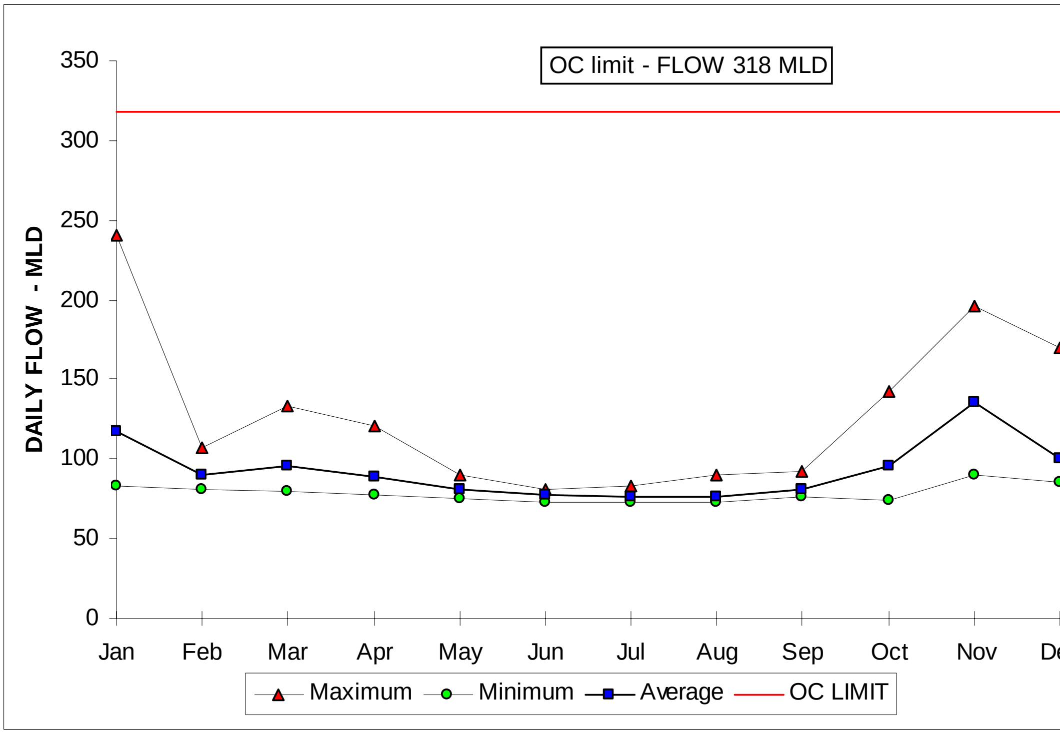
Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	12	25	22	24	26	28	25	26	24	26	26	19
NO3	Grab	1.48	0.23	0.44	0.04	0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.01	0.38
NO2	Grab	0.07	0.06	0.09	0.03	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.11
NH3	Comp.	7	17	14.0	15	16	17	16	16	15	17.2	18	12.7
SO4	Comp.	16	25	19	22	19	20	34	18	20	20	26	23
PTot	Comp.	1.6	3.2	3.0	3.7	3.5	3.9	3.5	3.6	3.0	3.5	3.2	2.3
PDis	Comp.	0.9	1.9	1.7	1.8	1.9	2.0	1.8	1.7	1.5	1.9	1.7	1.3
MBAS	Grab	0.3	1.0	0.7	1.3	1.5	1.6	1.6	1.3	1.1	1.7	0.8	0.6
O&G	Grab	<6	10	7	8	11	11	11	9	10	14	7	10
Phenol	Grab	<0.01	0.02	0.01	<0.01	0.02	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.32	0.31	0.49	0.27	0.44	0.30	0.43	0.29	0.28	0.26	0.34	0.24
AlDis	Comp.	0.03	0.05	0.05	0.04	0.09	0.05	0.05	0.04	0.05	0.03	0.04	0.05
AsTot	Comp.	0.001	<0.001	0.002	<0.001	0.002	<0.001	0.005	0.002	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.030	0.017	0.019	0.016	0.014	0.012	0.014	0.013	0.013	0.011	0.015	0.016
BaDis	Comp.	0.019	0.009	0.009	0.008	0.008	0.006	0.007	0.006	0.007	0.006	0.008	0.010
BTot	Comp.	0.05	0.09	0.07	0.09	0.08	0.10	0.10	0.09	0.09	0.09	0.09	0.09
BDis	Comp.	0.05	0.09	0.07	0.09	0.08	0.10	0.10	0.08	0.09	0.09	0.09	0.09
CaTot	Comp.	22.0	14.0	13.9	14.8	10.9	11.5	12.3	11.1	10.1	10.6	14.8	15.7
CdTot	Comp.	<0.0005	<0.0005	<0.0005	0.0006	0.0006	<0.0005	0.0005	0.0130	<0.0005	<0.0005	0.0006	0.0013
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0057	<0.0005	<0.0005	<0.0005	0.0007
CrTot	Comp.	0.002	0.002	0.002	0.002	0.002	0.001	0.004	0.001	0.002	0.001	0.001	0.001
CrDis	Comp.	0.001	<0.001	0.001	<0.001	0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.052	0.091	0.077	0.091	0.081	0.099	0.086	0.102	0.107	0.094	0.085	0.054
CuDis	Comp.	0.026	0.036	0.031	0.030	0.023	0.032	0.020	0.041	0.050	0.030	0.027	0.023
FeTot	Comp.	0.57	0.62	0.71	0.58	0.76	0.58	0.70	0.61	0.62	0.61	0.59	0.51
FeDis	Comp.	0.14	0.22	0.18	0.19	0.18	0.21	0.18	0.22	0.23	0.20	0.19	0.21
PbTot	Comp.	0.001	0.003	0.002	0.001	0.002	0.002	0.003	0.036	0.002	0.002	0.002	0.001
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.56	7.04	5.28	6.87	3.85	5.58	10.4	3.67	3.54	5.18	7.69	5.77
MnTot	Comp.	0.043	0.048	0.046	0.049	0.042	0.039	0.040	0.038	0.040	0.038	0.047	0.046
MnDis	Comp.	0.032	0.036	0.033	0.037	0.033	0.028	0.030	0.027	0.031	0.029	0.037	0.037
HgTot	Comp.	0.08	0.09	0.06	<0.05	0.07	0.07	0.05	<0.05	<0.05	<0.05	0.06	<0.05
MoTot	Comp.	0.003	0.004	0.002	0.004	0.003	0.002	0.002	0.002	0.003	0.003	0.002	0.002
MoDis	Comp.	0.002	0.003	<0.002	0.004	0.002	0.003	<0.002	<0.002	0.002	<0.002	<0.002	0.003
NiTot	Comp.	<0.001	0.002	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001
NiDis	Comp.	<0.001	0.002	<0.001	<0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.001
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.02	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01	<0.01
ZnTot	Comp.	0.051	0.071	0.066	0.083	0.068	0.079	0.084	0.083	0.081	0.070	0.058	0.052
ZnDis	Comp.	0.023	0.035	0.037	0.037	0.048	0.042	0.042	0.045	0.050	0.040	0.029	0.030

Note: All results reported are in mg/L, except for Mercury which are reported in ug/L.

APPENDIX A3

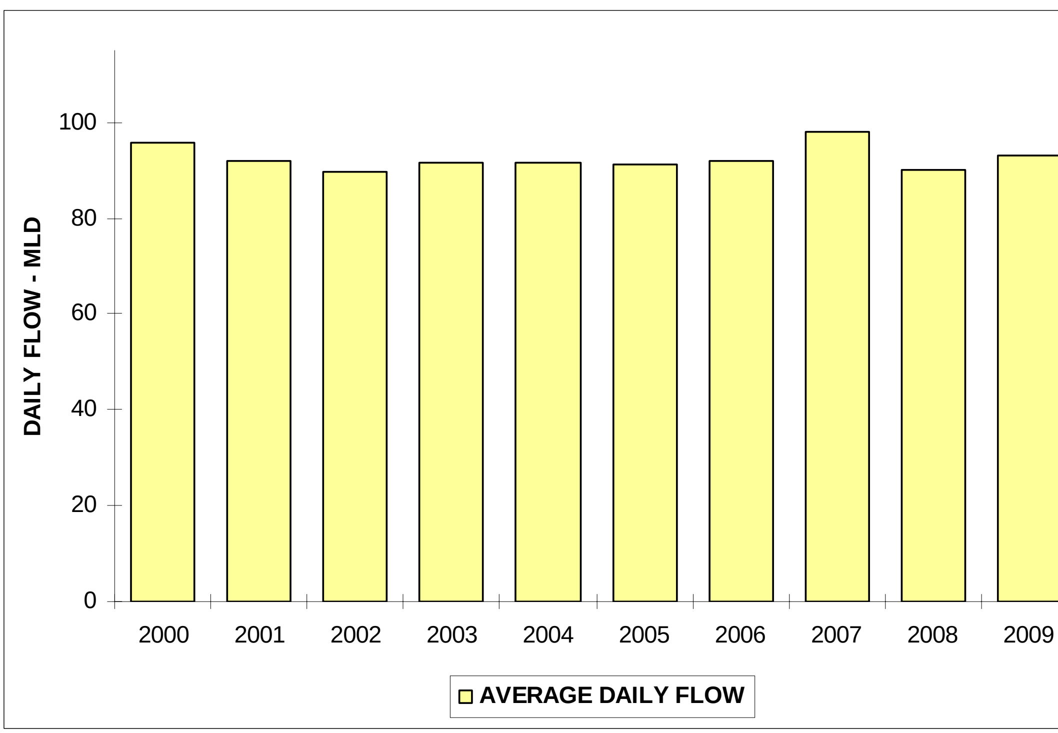
LIONS GATE WASTEWATER TREATMENT PLANT

LIONS GATE WWTP – 2009 Wastewater Flow – Monthly Summary



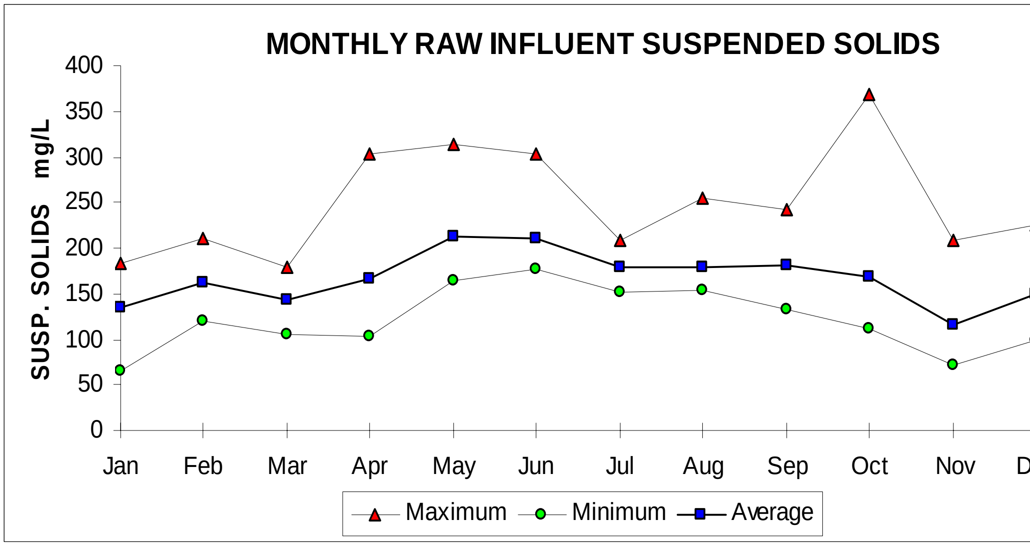
Mth	Max	Min	Ave
Jan	241	83	117
Feb	107	81	90
Mar	133	80	96
Apr	121	78	89
May	90	75	81
Jun	81	73	78
Jul	83	74	77
Aug	90	73	77
Sep	93	76	81
Oct	142	74	96
Nov	196	90	135
Dec	170	86	101

Average Daily Wastewater Flows 2000 – 2009

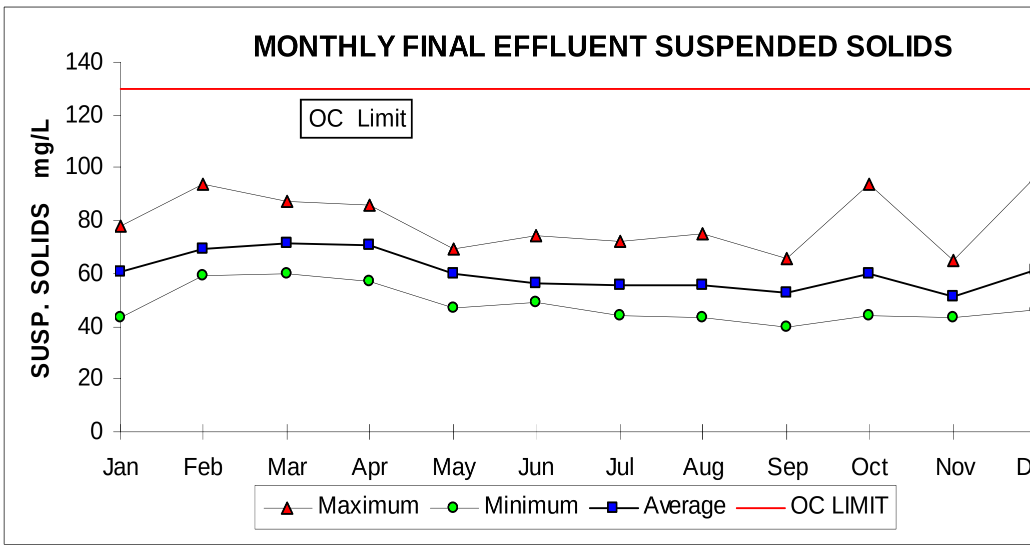


Year	Flow (MLD)
2000	96
2001	92
2002	90
2003	92
2004	92
2005	91
2006	92
2007	98
2008	90
2009	93

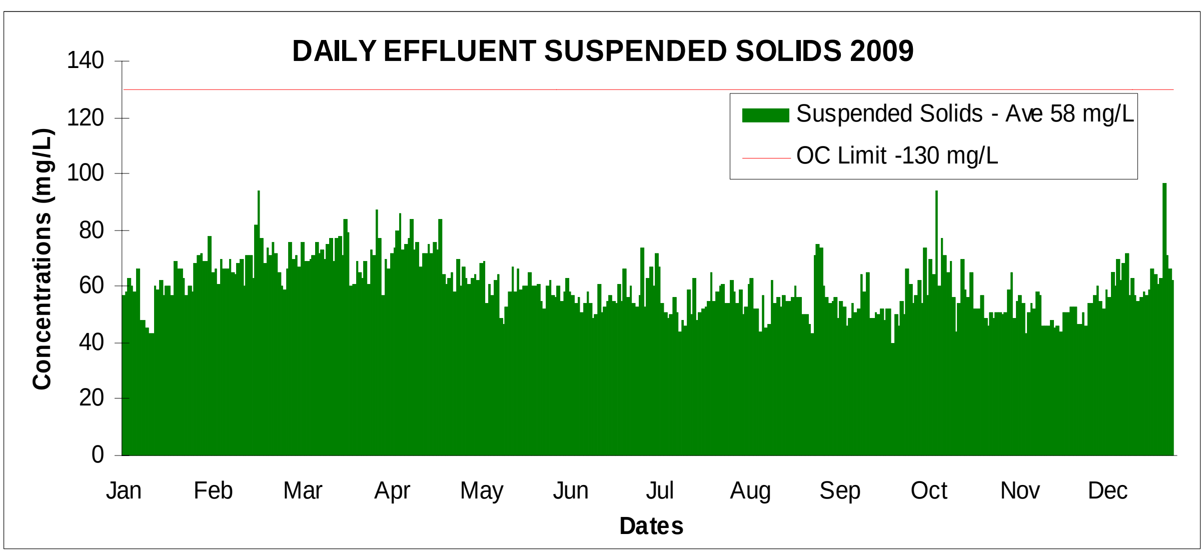
LIONS GATE WWTP – 2009 Suspended Solids Concentrations



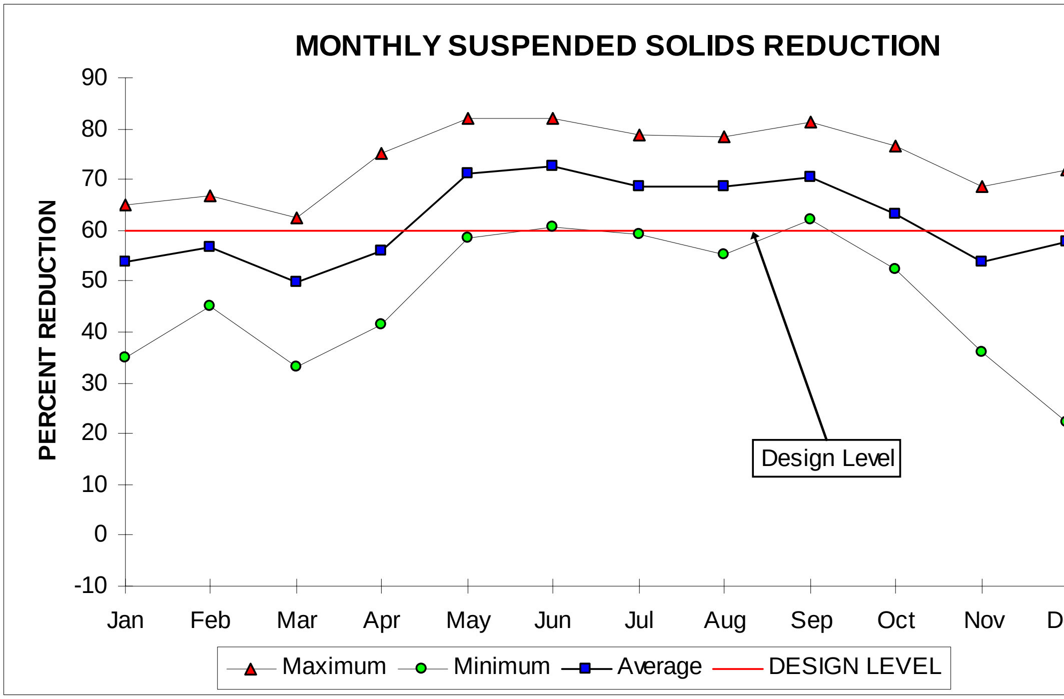
Mth	Max	Min	Ave
Jan	184	66	135
Feb	210	120	162
Mar	178	105	144
Apr	304	103	166
May	314	164	214
Jun	304	176	211
Jul	208	152	178
Aug	254	154	179
Sep	242	132	180
Oct	368	111	169
Nov	208	72	115
Dec	226	100	150



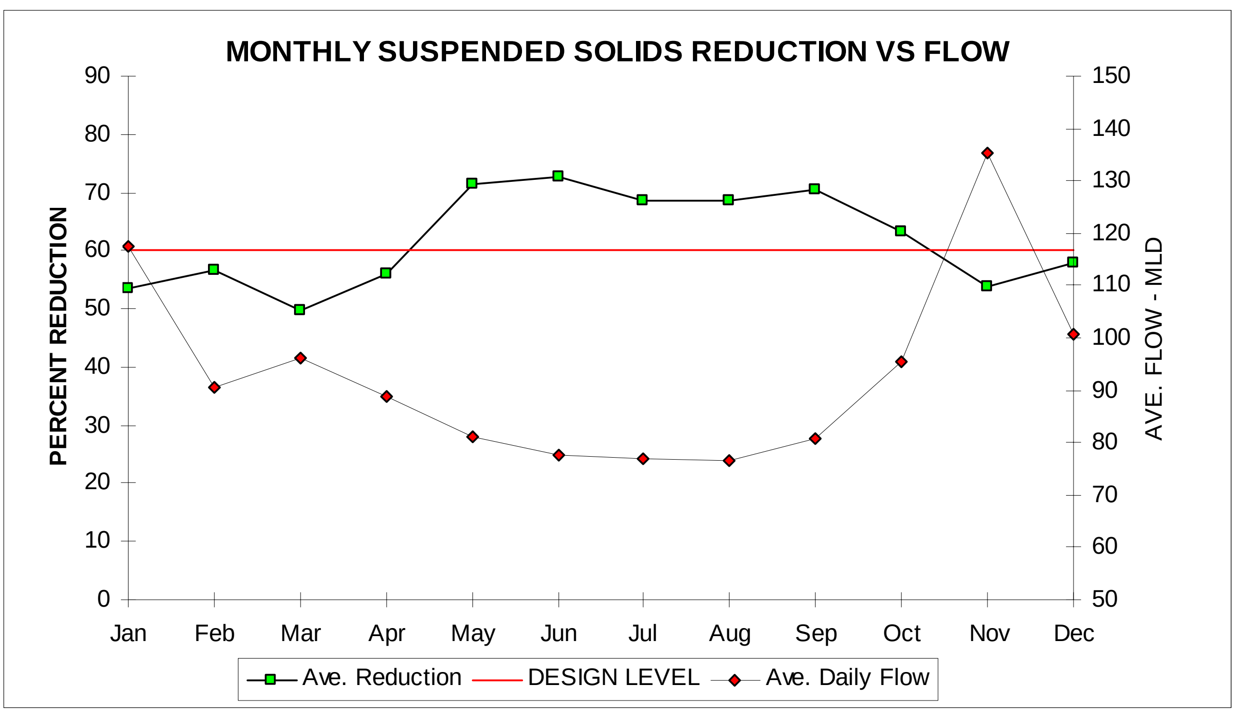
Mth	Max	Min	Ave
Jan	78	43	60
Feb	94	59	69
Mar	87	60	72
Apr	86	57	71
May	69	47	60
Jun	74	49	57
Jul	72	44	56
Aug	75	43	56
Sep	66	40	53
Oct	94	44	60
Nov	65	43	51
Dec	97	46	61



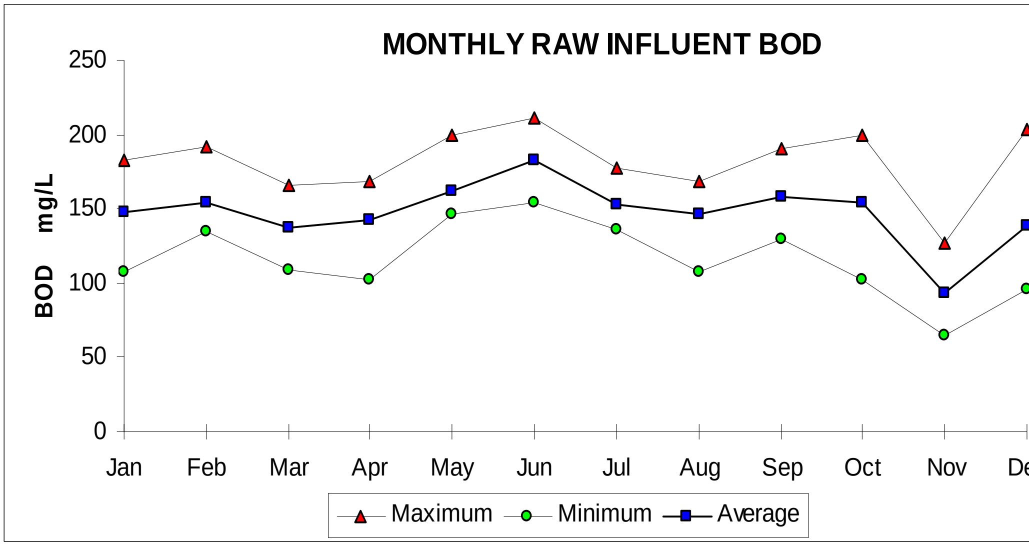
LIONS GATE WWTP – 2009 Suspended Solids Reductions



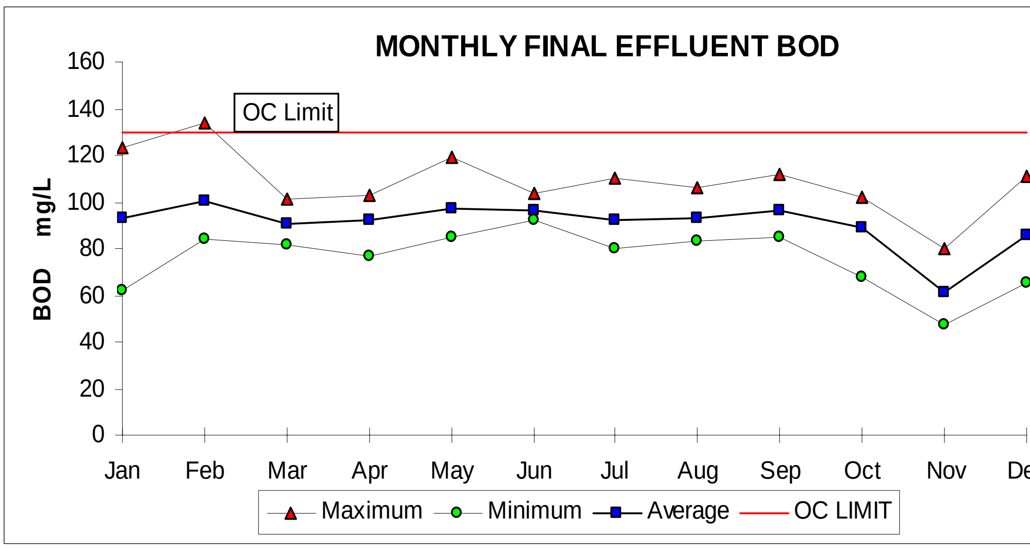
Mth	Max	Min	Ave
Jan	65	35	54
Feb	67	45	57
Mar	62	33	50
Apr	75	41	56
May	82	59	71
Jun	82	61	73
Jul	79	59	69
Aug	78	55	69
Sep	81	62	70
Oct	76	53	63
Nov	69	36	54
Dec	72	22	58



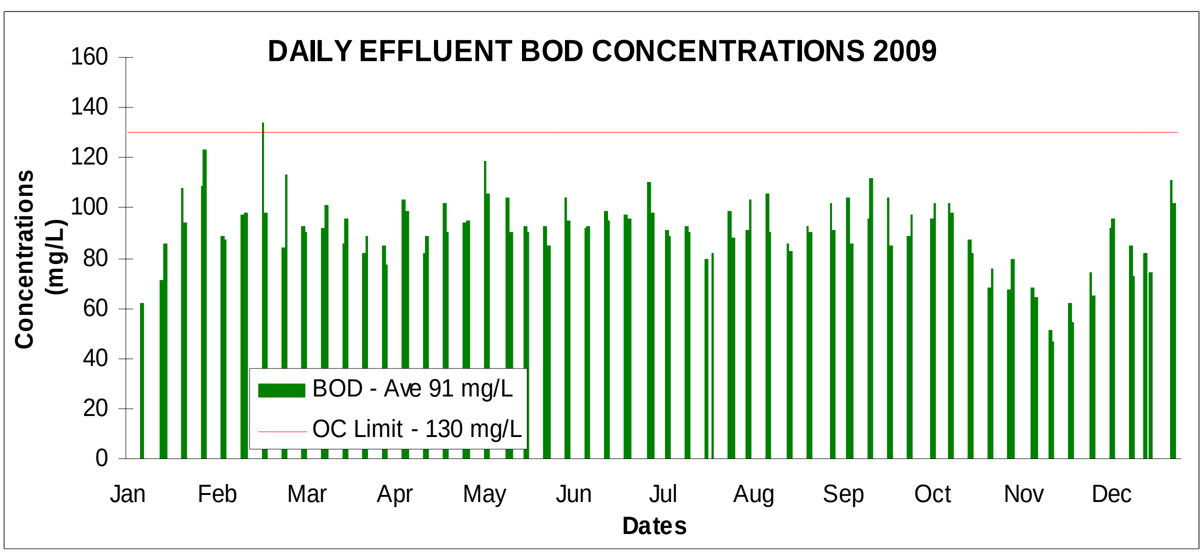
LIONS GATE WWTP – 2009 BOD Concentrations



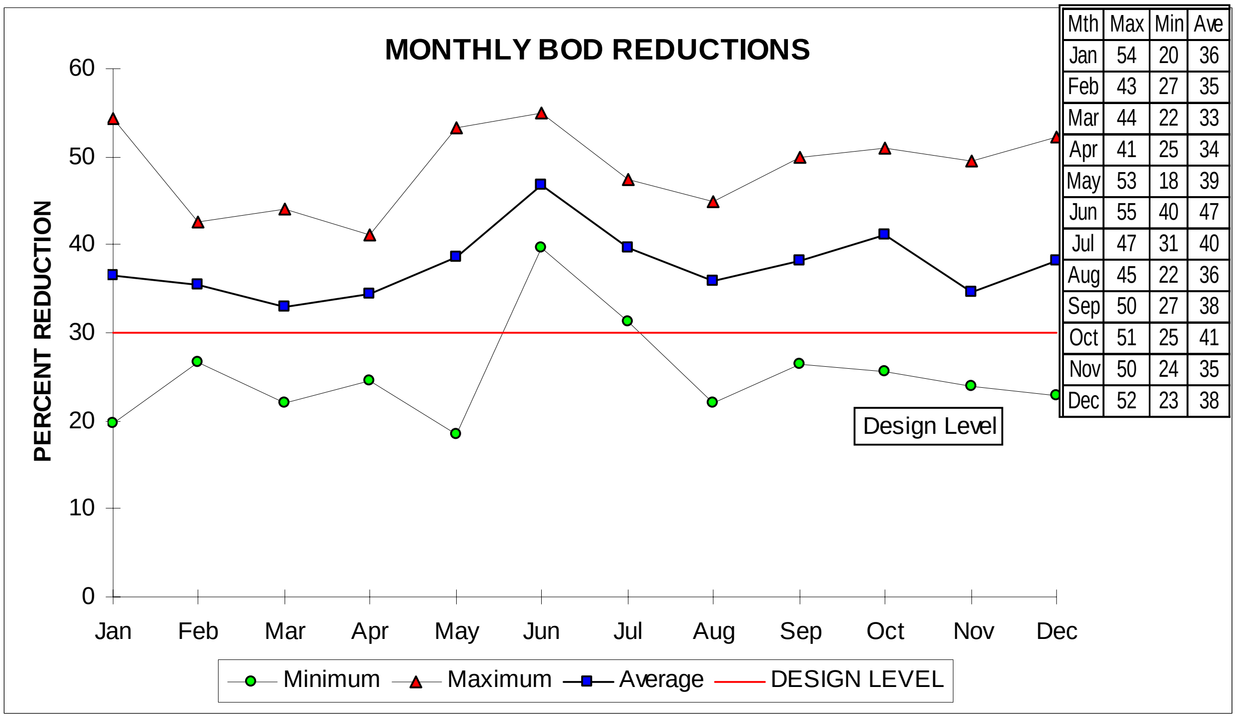
Mth	Max	Min	Ave
Jan	182	107	148
Feb	192	135	155
Mar	166	109	137
Apr	168	102	142
May	199	146	162
Jun	211	154	182
Jul	177	136	153
Aug	169	107	146
Sep	191	129	158
Oct	200	102	154
Nov	127	65	94
Dec	204	96	139



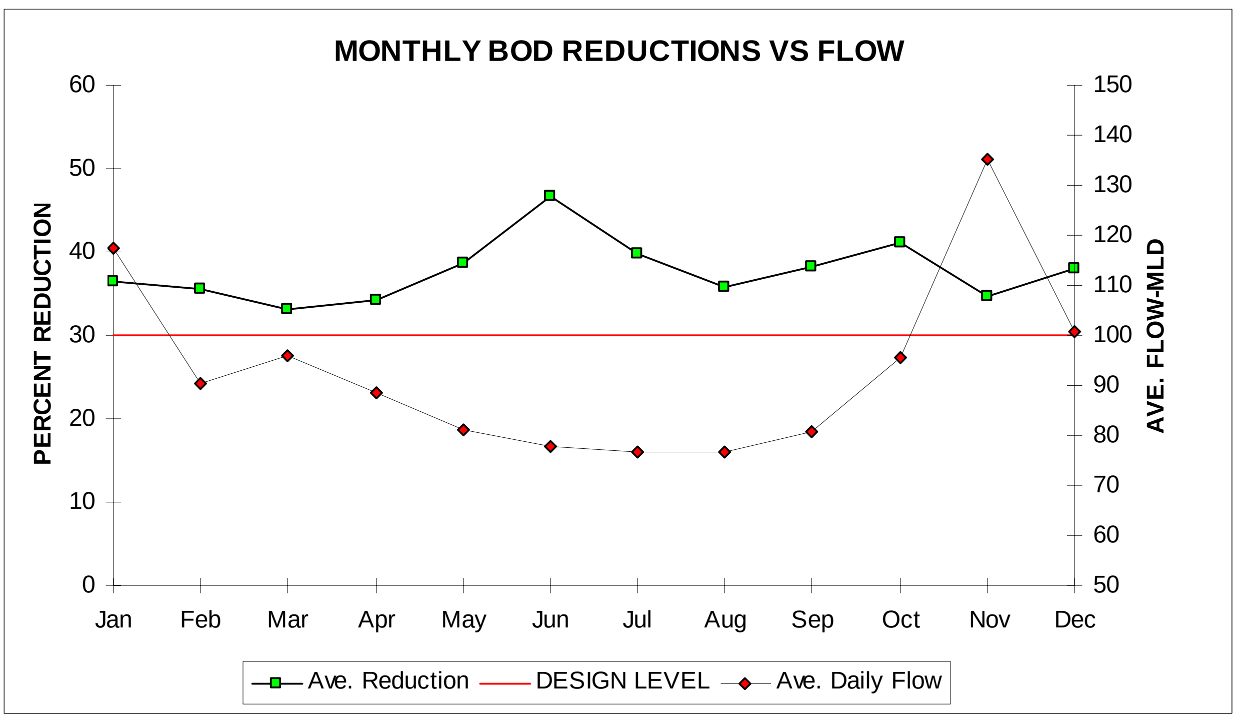
Mth	Max	Min	Ave
Jan	123	62	93
Feb	134	84	100
Mar	101	82	90
Apr	103	77	92
May	119	85	98
Jun	104	92	96
Jul	110	80	92
Aug	106	83	93
Sep	112	85	97
Oct	102	68	89
Nov	80	47	62
Dec	111	65	85



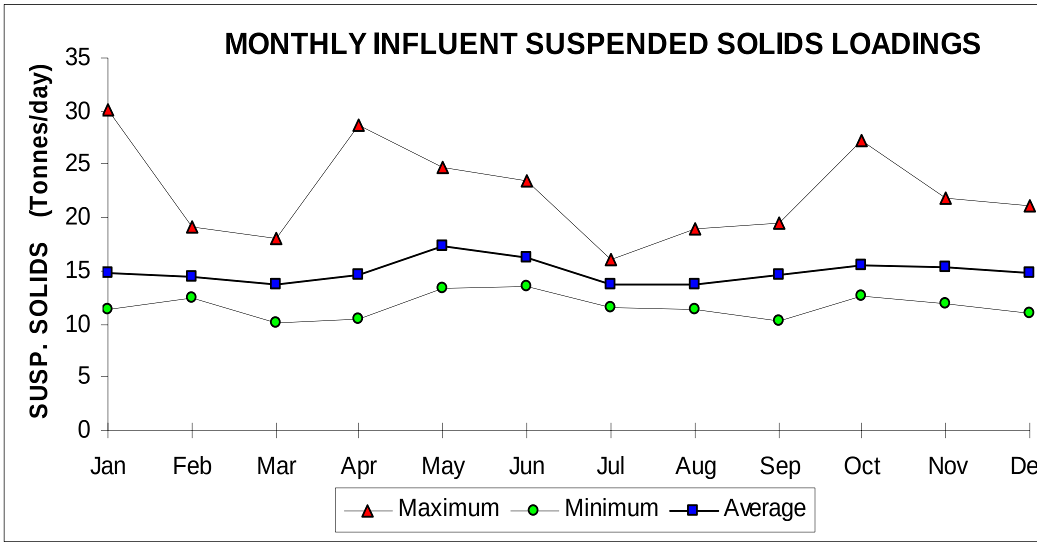
LIONS GATE WWTP – 2009 BOD Reductions



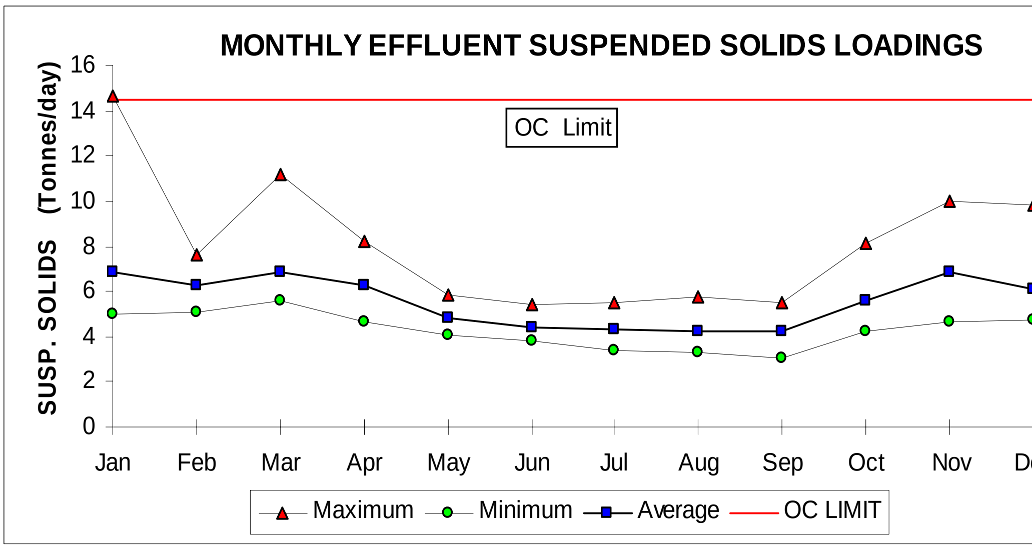
Mth	Max	Min	Ave
Jan	54	20	36
Feb	43	27	35
Mar	44	22	33
Apr	41	25	34
May	53	18	39
Jun	55	40	47
Jul	47	31	40
Aug	45	22	36
Sep	50	27	38
Oct	51	25	41
Nov	50	24	35
Dec	52	23	38



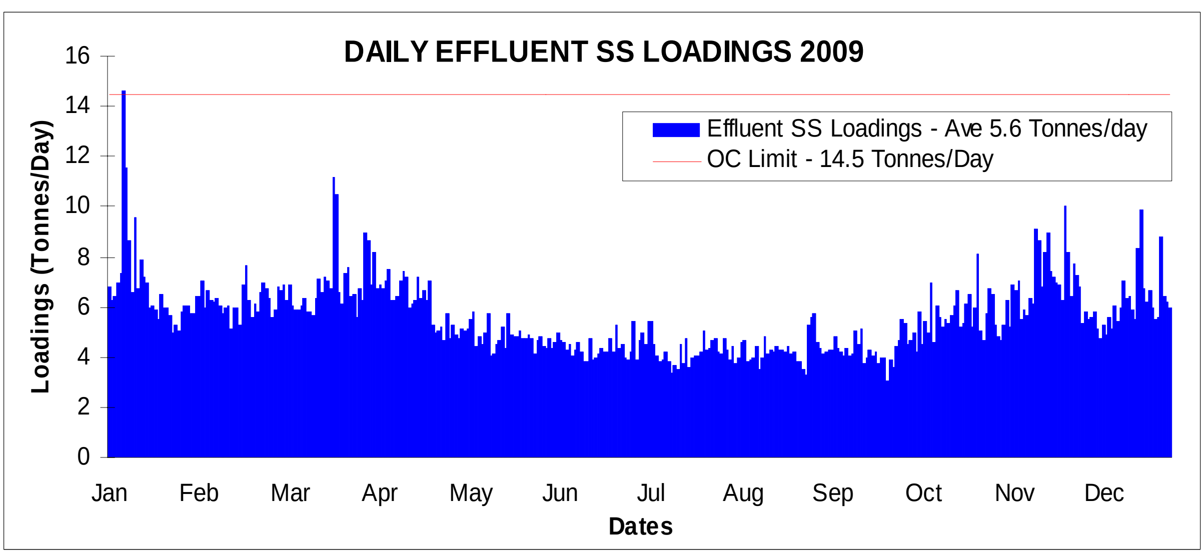
LIONS GATE WWTP – 2009 Suspended Solids Loadings Summary



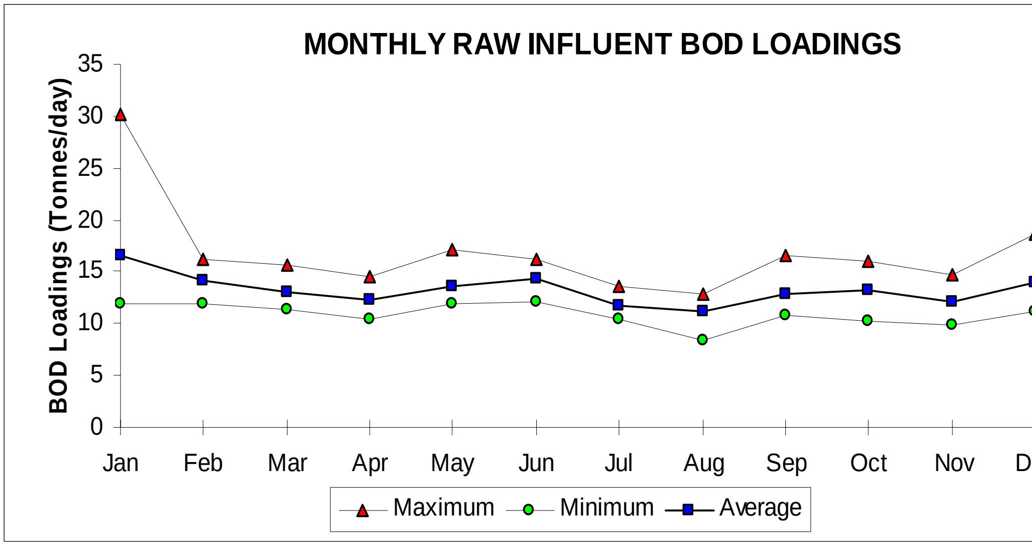
Mth	Max	Min	Ave
Jan	30.2	11	15
Feb	19.2	12	15
Mar	18.1	10	14
Apr	28.7	10	15
May	24.8	13	17
Jun	23.4	14	16
Jul	16.1	12	14
Aug	18.9	11	14
Sep	19.4	10	15
Oct	27.2	13	16
Nov	21.8	12	15
Dec	21.1	11	15



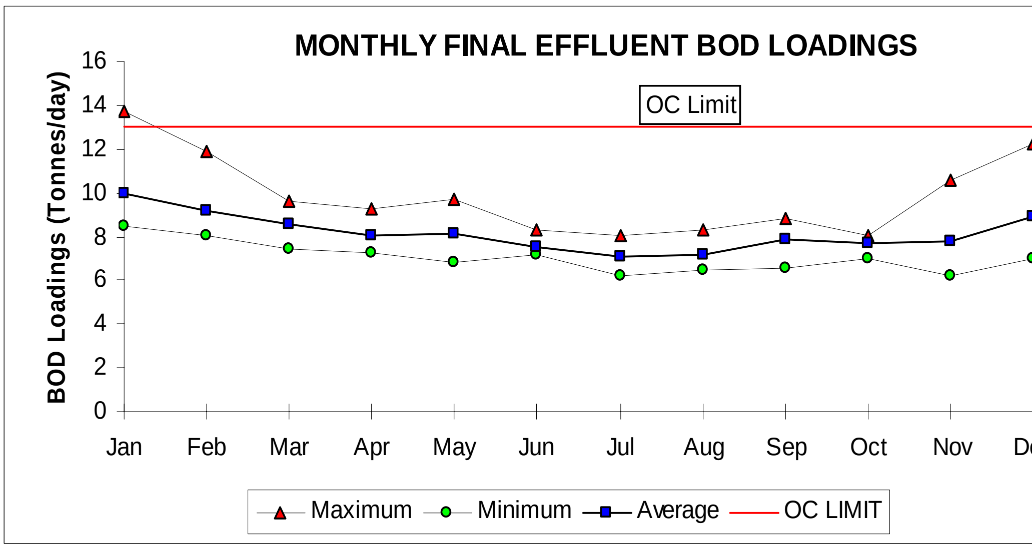
Mth	Max	Min	Ave
Jan	14.6	5.0	6.8
Feb	7.7	5.1	6.2
Mar	11.2	5.6	6.9
Apr	8.2	4.7	6.3
May	5.9	4.0	4.8
Jun	5.4	3.8	4.4
Jul	5.5	3.4	4.3
Aug	5.7	3.3	4.3
Sep	5.5	3.1	4.3
Oct	8.1	4.2	5.6
Nov	10.0	4.7	6.8
Dec	9.9	4.8	6.1



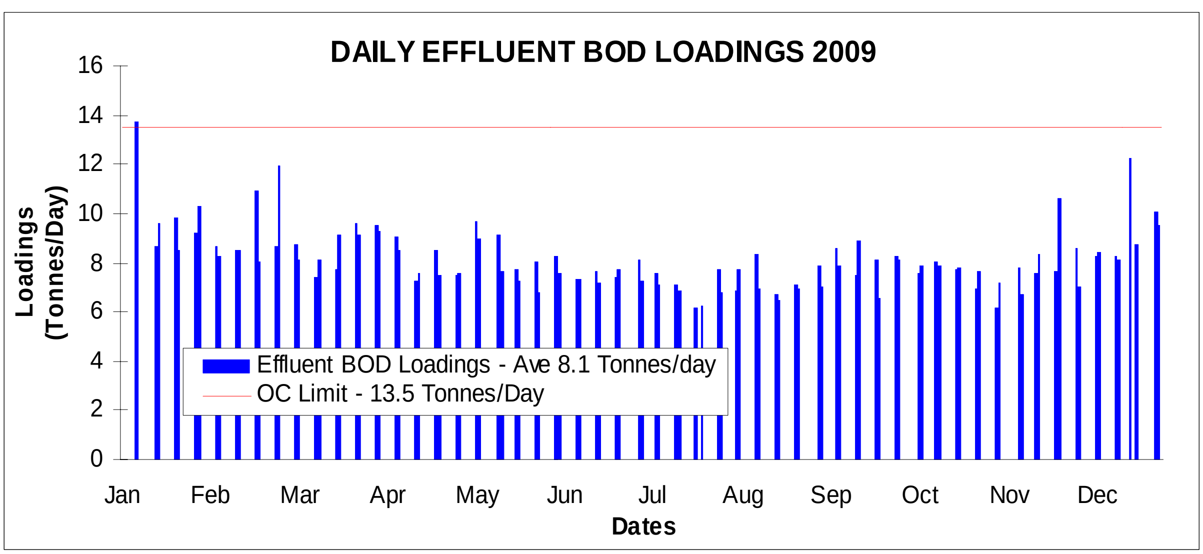
LIONS GATE WWTP – 2009 BOD Loadings Summary



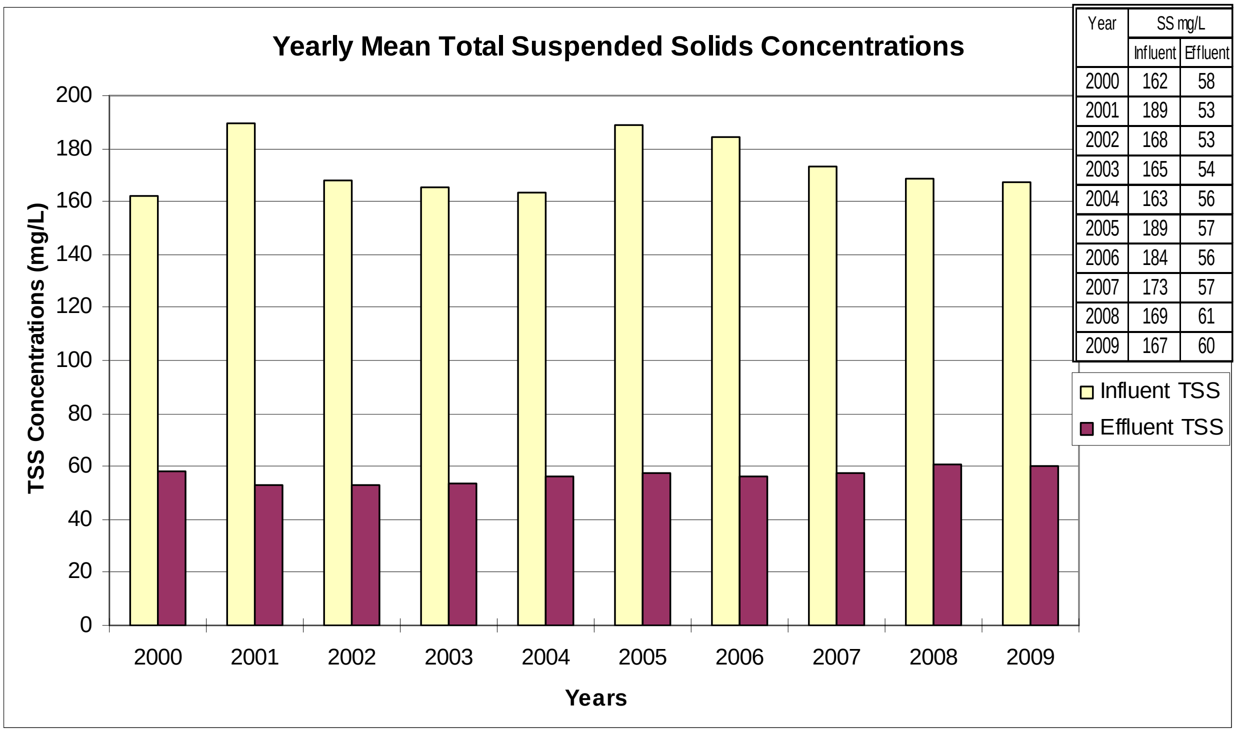
Mth	Max	Min	Ave
Jan	30	12	17
Feb	16	12	14
Mar	16	11	13
Apr	14	11	12
May	17	12	14
Jun	16	12	14
Jul	14	11	12
Aug	13	8	11
Sep	17	11	13
Oct	16	10	13
Nov	15	10	12
Dec	19	11	14



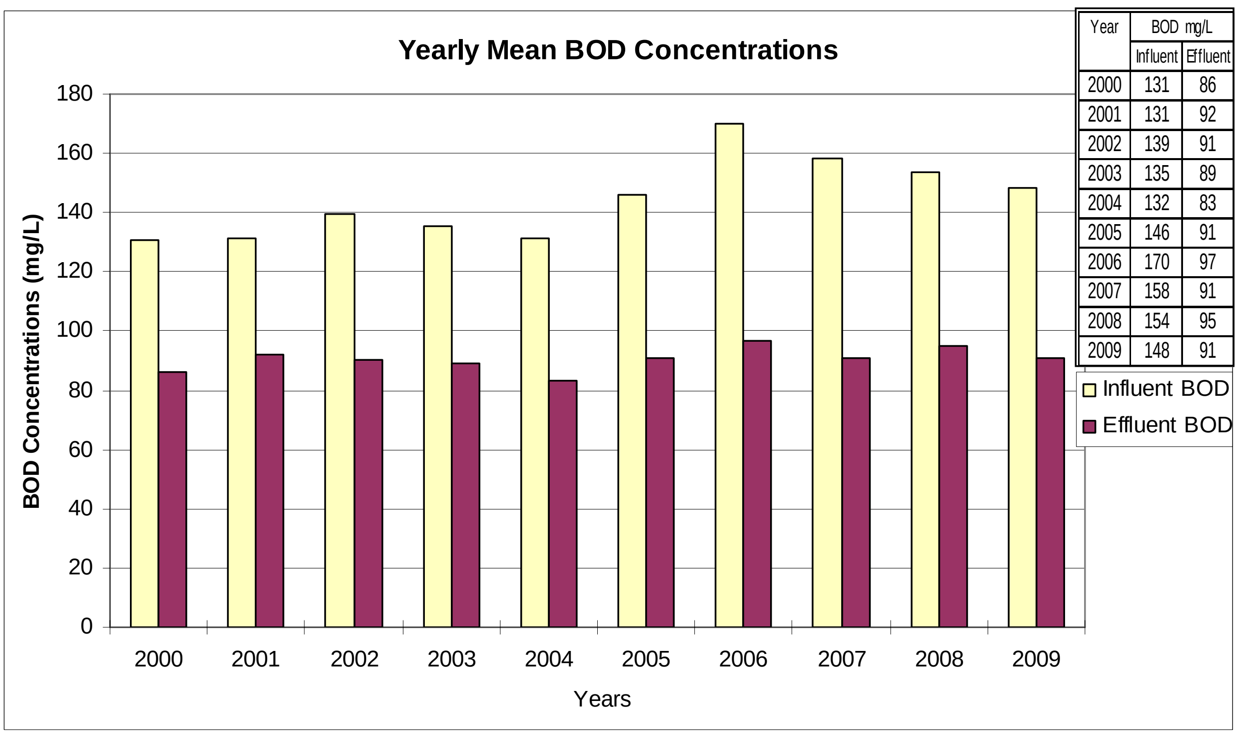
Mth	Max	Min	Ave
Jan	13.8	8.5	10.0
Feb	11.9	8.0	9.2
Mar	9.6	7.4	8.6
Apr	9.3	7.3	8.1
May	9.7	6.8	8.2
Jun	8.3	7.2	7.6
Jul	8.1	6.2	7.1
Aug	8.3	6.5	7.1
Sep	8.9	6.5	7.9
Oct	8.0	7.0	7.7
Nov	10.6	6.2	7.8
Dec	12.3	7.0	8.9



LIONS GATE WWTP – 2000 - 2009 Historical Concentrations

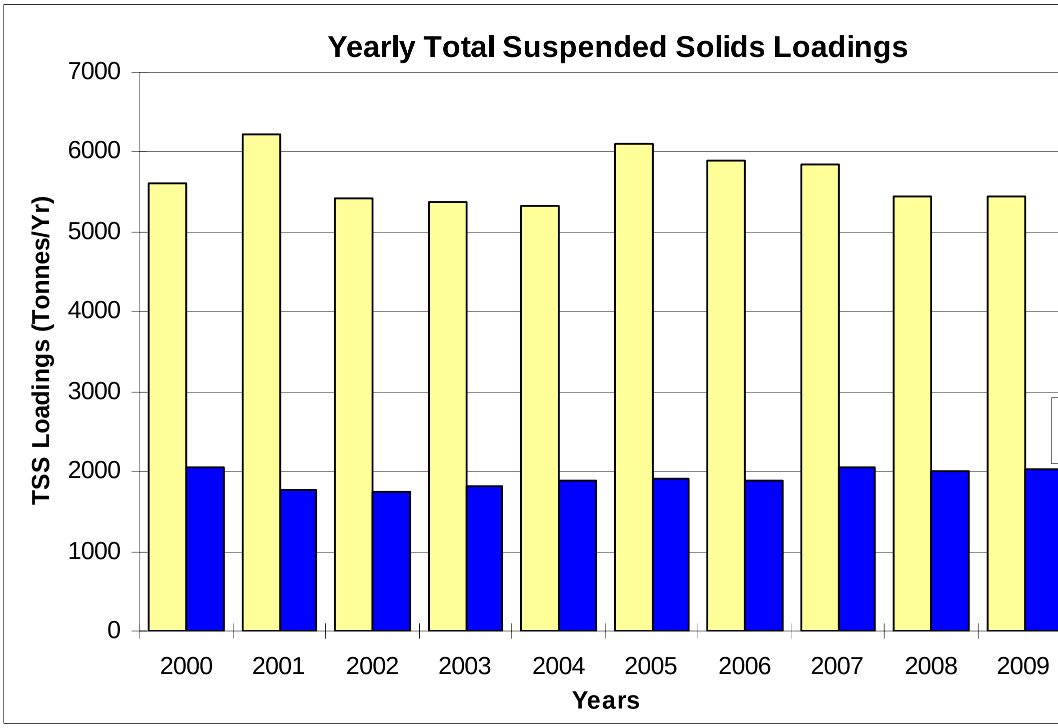


Year	SS mg/L	
	Influent	Effluent
2000	162	58
2001	189	53
2002	168	53
2003	165	54
2004	163	56
2005	189	57
2006	184	56
2007	173	57
2008	169	61
2009	167	60

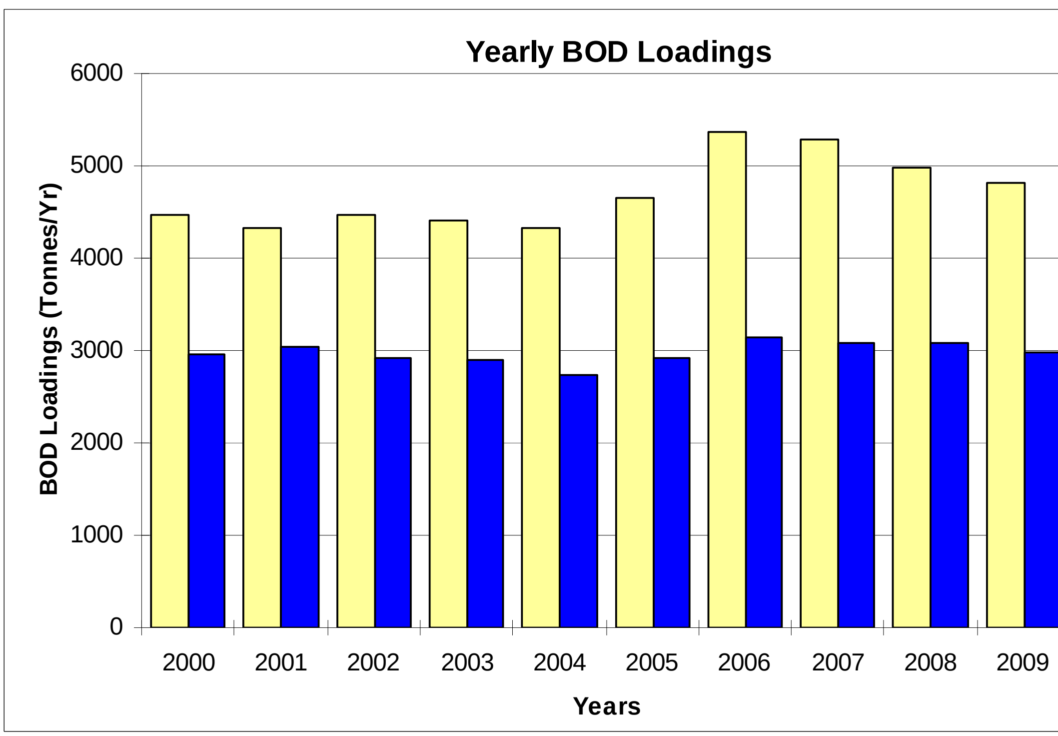


Year	BOD mg/L	
	Influent	Effluent
2000	131	86
2001	131	92
2002	139	91
2003	135	89
2004	132	83
2005	146	91
2006	170	97
2007	158	91
2008	154	95
2009	148	91

LIONS GATE WWTP – 2000 - 2009 Historical Loadings Comparison



Years	SS (Tonnes/Yr)	
	Influent	Effluent
2000	5609	2040
2001	6215	1770
2002	5416	1736
2003	5364	1806
2004	5335	1889
2005	6112	1903
2006	5890	1879
2007	5848	2047
2008	5448	2012
2009	5435	2031



Years	BOD (Tonnes/Yr)	
	Influent	Effluent
2000	4479	2963
2001	4330	3047
2002	4479	2912
2003	4404	2897
2004	4317	2745
2005	4644	2927
2006	5358	3139
2007	5278	3083
2008	4970	3074
2009	4814	2973

LIONS GATE WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.		27	24	30	29	31	29	28	27	31	20	24
NO3	Grab	0.90	0.63	0.52	0.22	<0.01	0.02		0.02	<0.01	0.12	0.34	0.44
NO2	Grab	0.05	0.06	0.04	0.04	0.09	0.02		<0.01	0.01	0.10	0.08	0.07
NH3	Comp.		18	15	18	18	18	19	18	18	19	12	15
SO4	Comp.		117	95	75	95	85	109	95	105	135	64	79
PTot	Comp.		4.2	3.5	4.4	4.3	4.9	3.8	4.4	4.0	4.6	3.3	3.4
PDis	Comp.		2.0	1.7	2.0	2.1	2.2	1.9	1.8	1.8	2.0	1.5	1.5
MBAS	Grab	1.0	1.0	0.9	1.3	1.4	1.8		1.2	1.2	1.0	0.9	1.1
O&G	Grab	13	30	20	30	31	31		26	24	28	32	19
Phenol	Grab	0.02	0.03	0.02	0.02	0.04	0.02		0.01	0.01	0.02	0.01	0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.		0.47	0.47	0.51	0.48	0.53	0.50	0.54	0.48	0.76	0.47	0.45
AlDis	Comp.		0.03	0.04	0.05	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.03
AsTot	Comp.		<0.001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.		0.043	0.025	0.031	0.037	0.023	0.021	0.027	0.024	0.023	0.024	0.031
BaDis	Comp.		0.017	0.010	0.009	0.010	0.008	0.009	0.010	0.012	0.010	0.012	0.011
BTot	Comp.		0.27	0.22	0.21	0.23	0.24	0.25	0.25	0.26	0.34	0.18	0.20
BDis	Comp.		0.27	0.21	0.20	0.22	0.24	0.24	0.25	0.25	0.33	0.17	0.20
CaTot	Comp.		26.5	23.8	20.8	22.0	21.1	22.3	22.2	24.6	28.8	22.7	23.9
CdTot	Comp.		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.		0.003	0.004	0.002	0.002	0.002	0.002	0.002	0.004	0.003	0.002	0.002
CrDis	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.		0.130	0.108	0.122	0.111	0.128	0.140	0.138	0.139	0.140	0.088	0.098
CuDis	Comp.		0.019	0.015	0.022	0.013	0.014	0.012	0.013	0.015	0.007	0.016	0.015
FeTot	Comp.		1.07	1.12	1.23	1.16	1.07	1.09	1.12	0.95	1.14	1.22	1.48
FeDis	Comp.		0.19	0.19	0.27	0.18	0.16	0.16	0.15	0.15	0.15	0.14	0.24
PbTot	Comp.		0.003	0.002	0.002	0.004	0.004	0.002	0.003	0.004	<0.001	0.003	0.003
PbDis	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.		47.7	38.7	31.1	37.7	35.1	42.1	38.5	43.6	57.6	26.7	32.8
MnTot	Comp.		0.065	0.057	0.065	0.055	0.057	0.045	0.049	0.055	0.061	0.067	0.092
MnDis	Comp.		0.051	0.044	0.047	0.041	0.041	0.035	0.036	0.042	0.045	0.052	0.076
HgTot	Comp.		0.19	0.14	0.40	0.07	0.13	0.19	0.09	0.20	0.08	0.10	0.07
MoTot	Comp.		0.004	<0.002	0.002	0.003	0.002	<0.002	<0.002	0.003	0.003	<0.002	0.002
MoDis	Comp.		0.002	<0.002	<0.002	0.002	0.002	<0.002	<0.002	0.002	0.002	<0.002	<0.002
NiTot	Comp.		0.010	0.009	0.008	0.002	0.003	0.002	0.002	0.010	0.010	0.010	0.009
NiDis	Comp.		0.008	0.007	0.007	0.001	0.002	0.002	0.001	0.008	0.008	0.007	0.007
SeTot	Comp.		<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01	0.02	0.01	<0.01	0.01
AgTot	Comp.		<0.001	<0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
AgDis	Comp.		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.		0.094	0.072	0.110	0.086	0.105	0.096	0.086	0.084	0.094	0.073	0.076
ZnDis	Comp.		0.039	0.031	0.033	0.034	0.030	0.039	0.027	0.034	0.027	0.024	0.029

Note: All results reported are in mg/L except for Mercury which are reported in ug/L.

LIONS GATE WWTP – 2009 Comprehensive Effluent Data

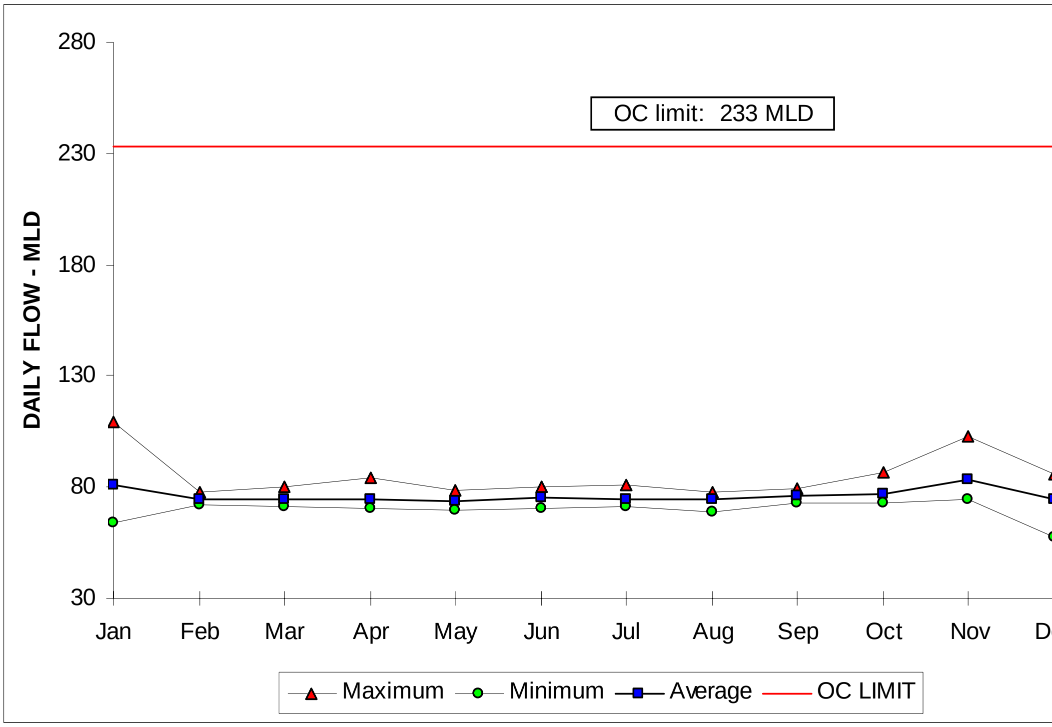
Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	17	26	24	27	28	27	29	29	27	34	18	23
NO3	Grab	1.01	0.28	0.39	0.10	0.07	0.03	0.05	0.06	0.15	<0.01	0.28	0.44
NO2	Grab	0.04	0.05	0.07	0.03	0.03	0.02	0.01	0.02	0.05	<0.01	0.05	0.06
NH3	Comp.	12	19	17	20	21	19	22	21	20	17	14	17
SO4	Comp.	56	110	96	70	90	97	111	97	100	114	65	81
PTot	Comp.	2.7	3.8	3.6	4.1	4.0	4.0	3.9	3.9	3.8	4.2	2.6	3.0
PDis	Comp.	1.6	2.2	2.0	2.2	2.6	2.5	2.5	2.9	2.5	2.5	1.4	1.6
MBAS	Grab	0.6	1.4	0.9	1.6	1.8	2	2.2	1.7	1.4	2	1.0	0.8
O&G	Grab	<6	13	10	9	13	12	9	<5	8	10	7	6
Phenol	Grab	0.01	0.01	0.01	<0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.26	0.32	0.37	0.33	0.30	0.31	0.33	0.29	0.26	0.31	0.33	0.30
AlDis	Comp.	0.06	0.04	0.04	0.03	0.03	0.03	0.03	0.09	0.03	0.02	0.03	0.03
AsTot	Comp.	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.035	0.030	0.022	0.020	0.019	0.017	0.017	0.019	0.018	0.016	0.021	0.023
BaDis	Comp.	0.025	0.018	0.010	0.008	0.010	0.008	0.009	0.012	0.011	0.009	0.013	0.011
BTot	Comp.	0.16	0.24	0.22	0.20	0.22	0.26	0.25	0.26	0.26	0.31	0.19	0.21
BDis	Comp.	0.15	0.25	0.21	0.20	0.22	0.24	0.25	0.26	0.24	0.30	0.18	0.20
CaTot	Comp.	26.0	25.6	23.9	19.8	20.9	22.0	22.6	22.0	24.4	25.5	22.6	24.2
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	<0.0005
CrTot	Comp.	0.001	0.002	0.001	0.002	0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
CrDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.076	0.100	0.100	0.096	0.084	0.094	0.101	0.102	0.107	0.100	0.075	0.072
CuDis	Comp.	0.018	0.015	0.013	0.018	0.017	0.023	0.021	0.048	0.023	0.007	0.014	0.012
FeTot	Comp.	1.12	0.89	0.93	0.96	0.79	0.77	0.71	0.73	0.72	0.70	0.86	1.10
FeDis	Comp.	0.29	0.21	0.19	0.22	0.19	0.16	0.15	0.32	0.15	0.16	0.18	0.26
PbTot	Comp.	<0.001	0.002	0.001	0.001	0.002	0.002	0.002	0.001	0.002	<0.001	0.002	0.002
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	23.4	45.3	39.9	29.1	35.4	40.0	44.9	38.6	42.6	49.2	28.3	33.8
MnTot	Comp.	0.071	0.062	0.054	0.060	0.051	0.051	0.043	0.044	0.052	0.055	0.063	0.088
MnDis	Comp.	0.059	0.051	0.044	0.045	0.042	0.040	0.035	0.039	0.041	0.044	0.051	0.075
HgTot	Comp.	0.06	0.05	0.06	<0.05	0.06	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05
MoTot	Comp.	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	0.002	0.003	<0.002	<0.002
MoDis	Comp.	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002
NiTot	Comp.	0.001	0.003	0.002	0.002	0.003	0.002	0.002	0.001	0.003	0.002	0.003	0.002
NiDis	Comp.	<0.001	0.002	0.001	0.001	0.001	<0.001	0.002	0.001	0.002	0.002	0.002	0.001
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.064	0.073	0.059	0.093	0.068	0.064	0.072	0.068	0.063	0.062	0.059	0.056
ZnDis	Comp.	0.038	0.032	0.028	0.029	0.042	0.032	0.043	0.046	0.037	0.023	0.025	0.026

Note: All results reported are in mg/L except for Mercury which are reported in ug/L.

APPENDIX A4

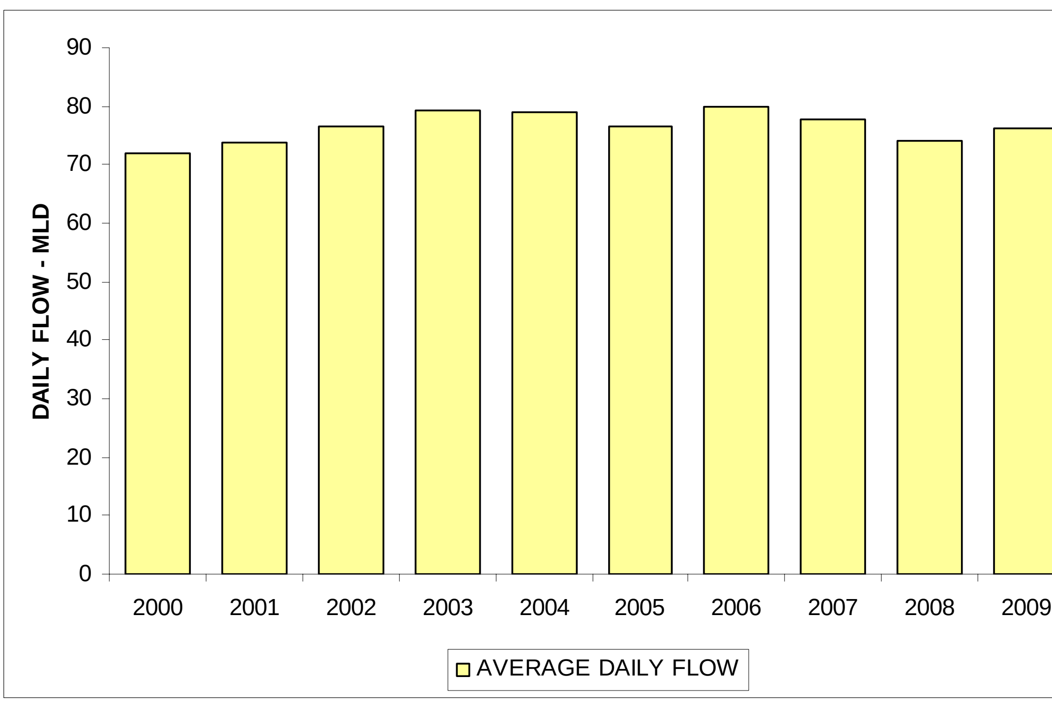
LULU ISLAND WASTEWATER TREATMENT PLANT

LULU WWTP – 2009 Wastewater Flows – Monthly Summary



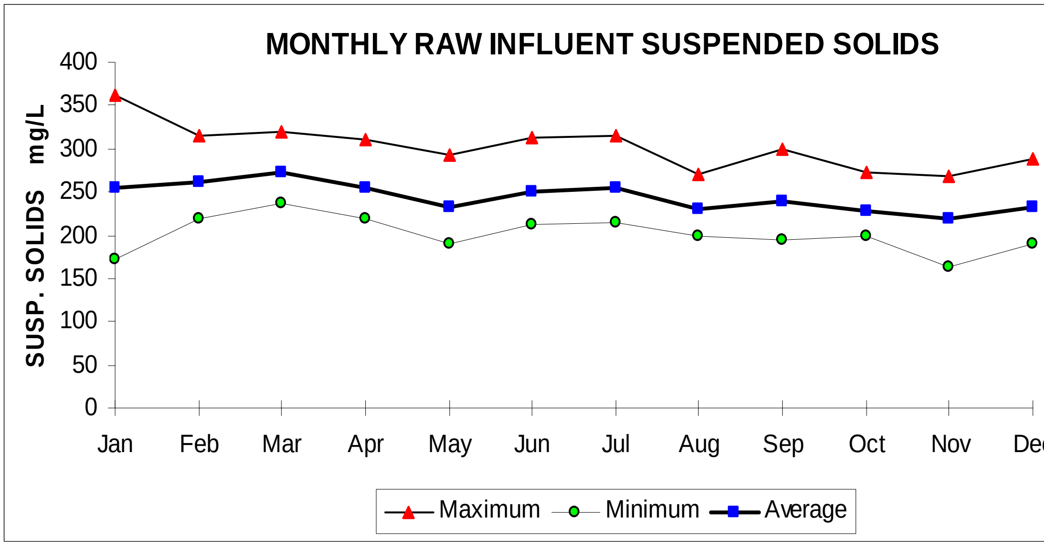
Mth	Max	Min	Ave
Jan	110	64	81
Feb	78	72	74
Mar	80	71	74
Apr	84	71	75
May	79	69	74
Jun	80	70	75
Jul	81	72	75
Aug	78	69	75
Sep	79	73	76
Oct	87	73	77
Nov	103	75	83
Dec	86	58	74

Average Daily Wastewater Flows 2000 – 2009

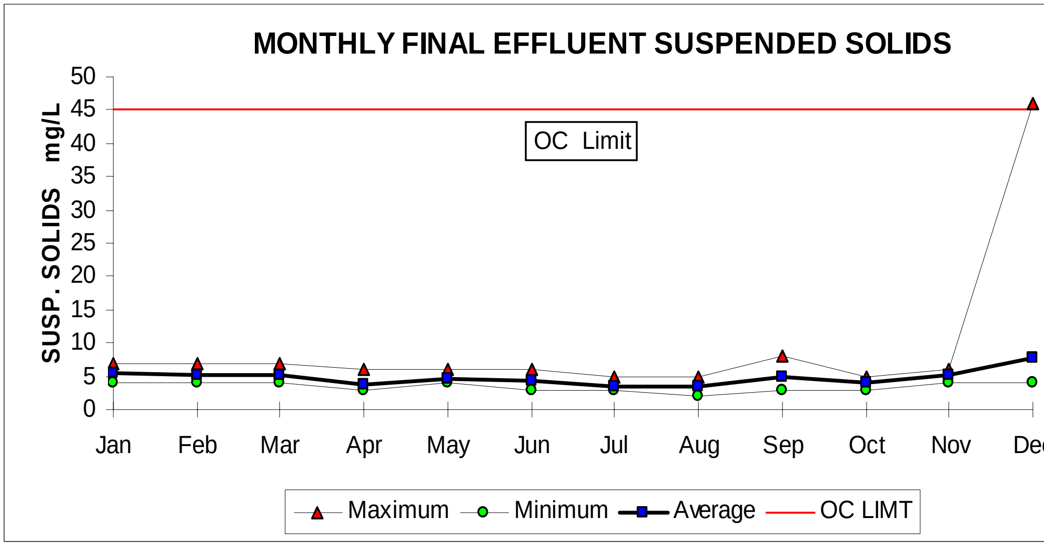


YEAR	FLOW (MLD)
2000	72
2001	74
2002	76
2003	79
2004	79
2005	77
2006	80
2007	78
2008	74
2009	76

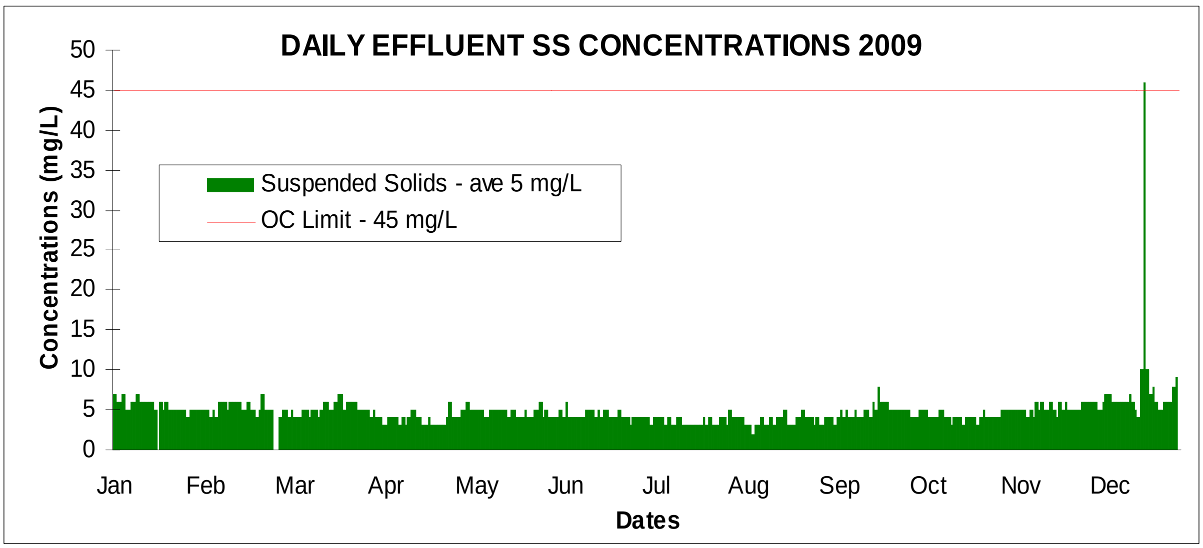
LULU WWTP – 2009 Suspended Solids Concentrations Summary



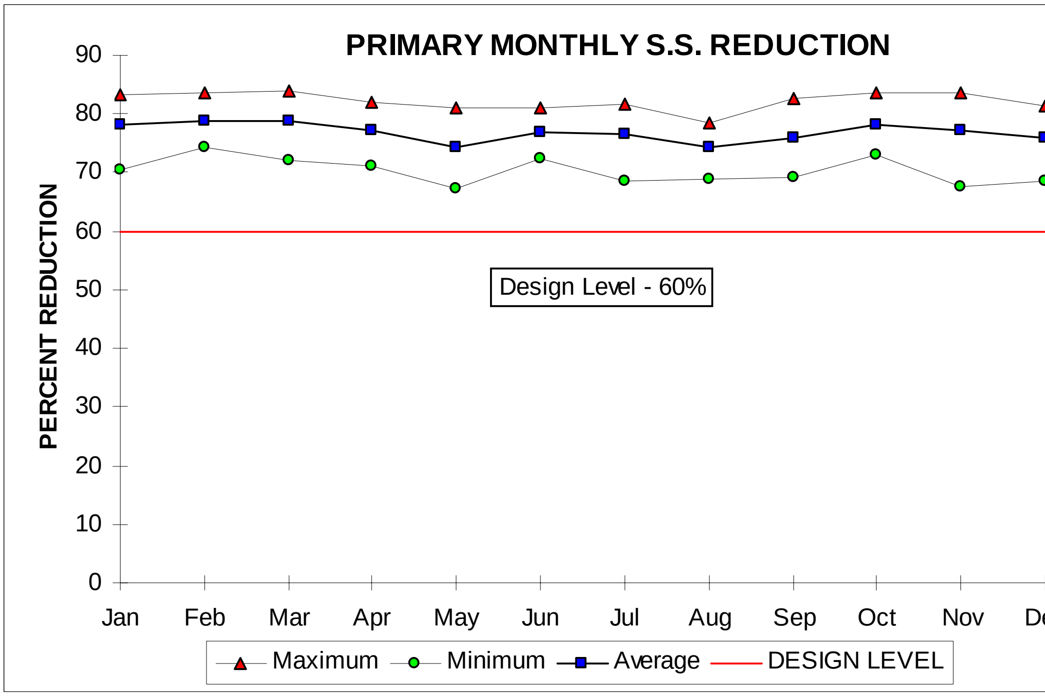
Mth	Max	Min	Ave
Jan	361	172	255
Feb	316	218	261
Mar	320	236	272
Apr	310	218	255
May	292	191	232
Jun	313	212	250
Jul	315	215	254
Aug	270	198	230
Sep	300	194	240
Oct	273	198	229
Nov	268	164	220
Dec	288	190	231



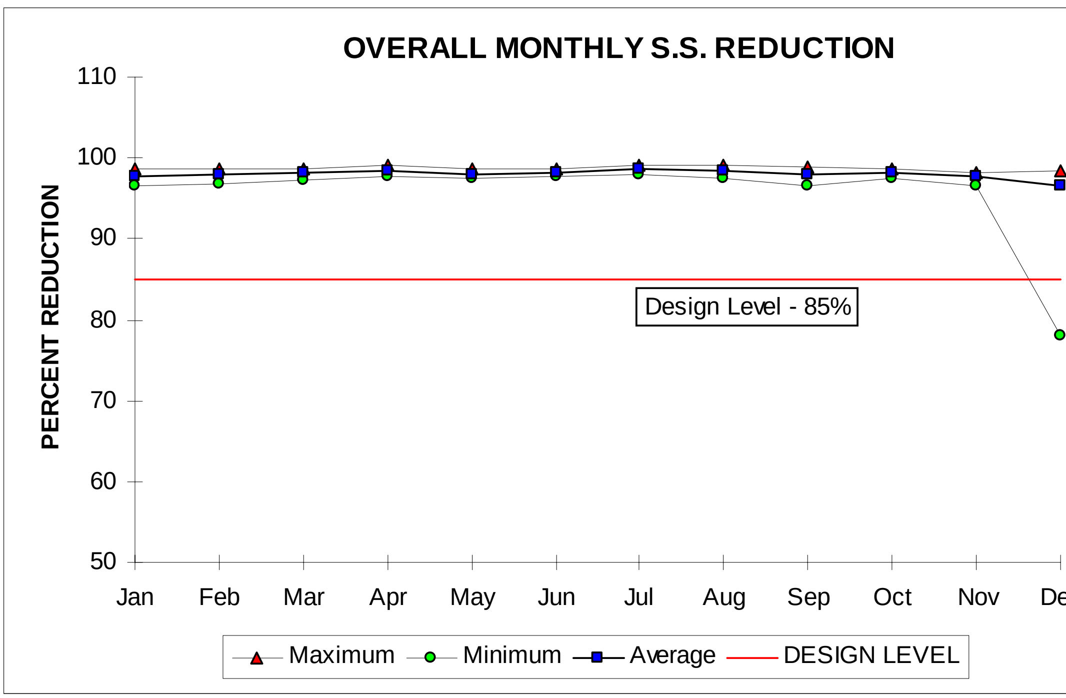
Mth	Max	Min	Ave
Jan	7	4	6
Feb	7	4	5
Mar	7	4	5
Apr	6	3	4
May	6	4	5
Jun	6	3	4
Jul	5	3	4
Aug	5	2	4
Sep	8	3	5
Oct	5	3	4
Nov	6	4	5
Dec	46	4	8



LULU WWTP – 2009 Suspended Solids Reductions

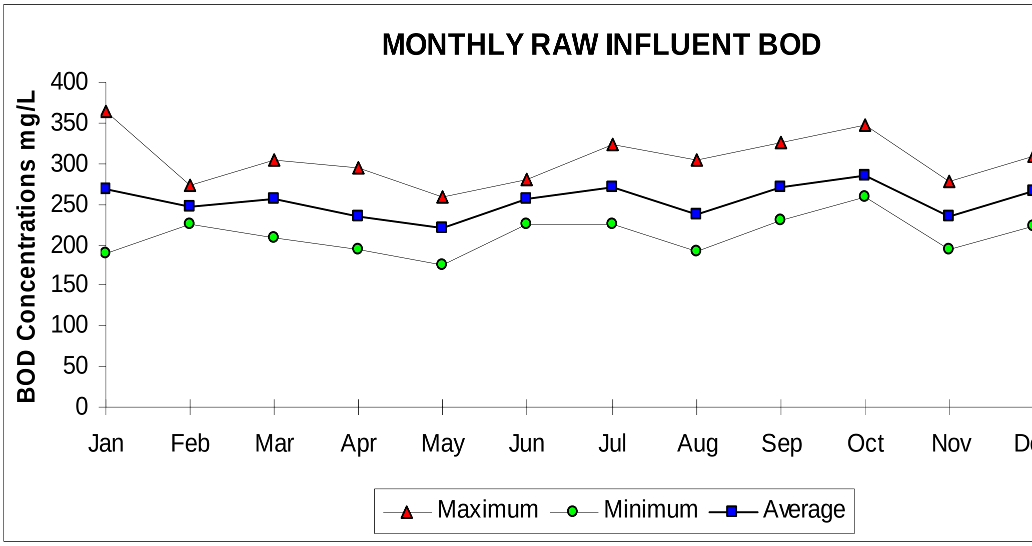


Mth	Max	Min	Ave
Jan	83	70	78
Feb	83	74	79
Mar	84	72	79
Apr	82	71	77
May	81	67	74
Jun	81	72	77
Jul	82	68	76
Aug	79	69	74
Sep	82	69	76
Oct	84	73	78
Nov	84	68	77
Dec	81	69	76

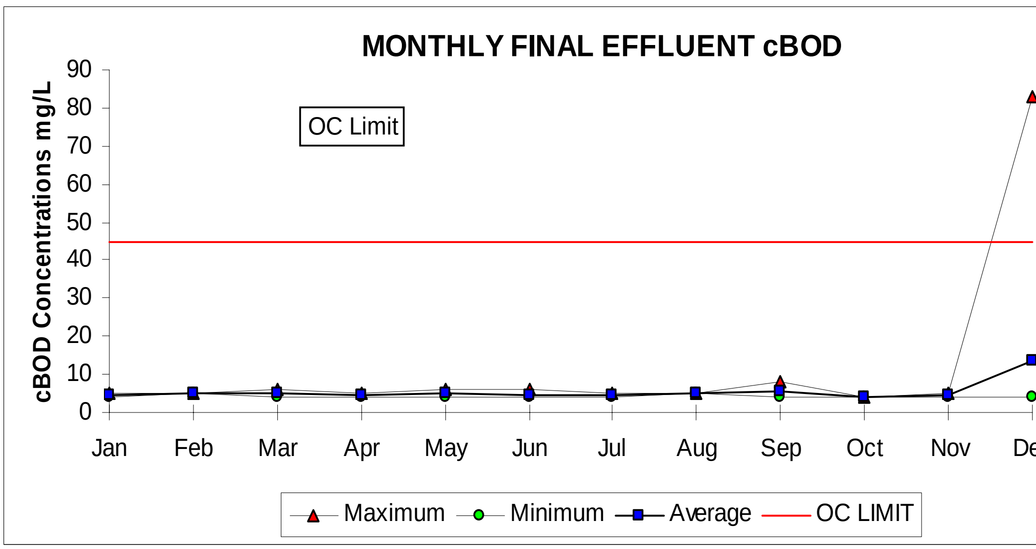


Mth	Max	Min	Ave
Jan	99	97	98
Feb	99	97	98
Mar	99	97	98
Apr	99	98	99
May	99	97	98
Jun	99	98	98
Jul	99	98	99
Aug	99	98	98
Sep	99	96	98
Oct	99	97	98
Nov	98	97	98
Dec	98	78	97

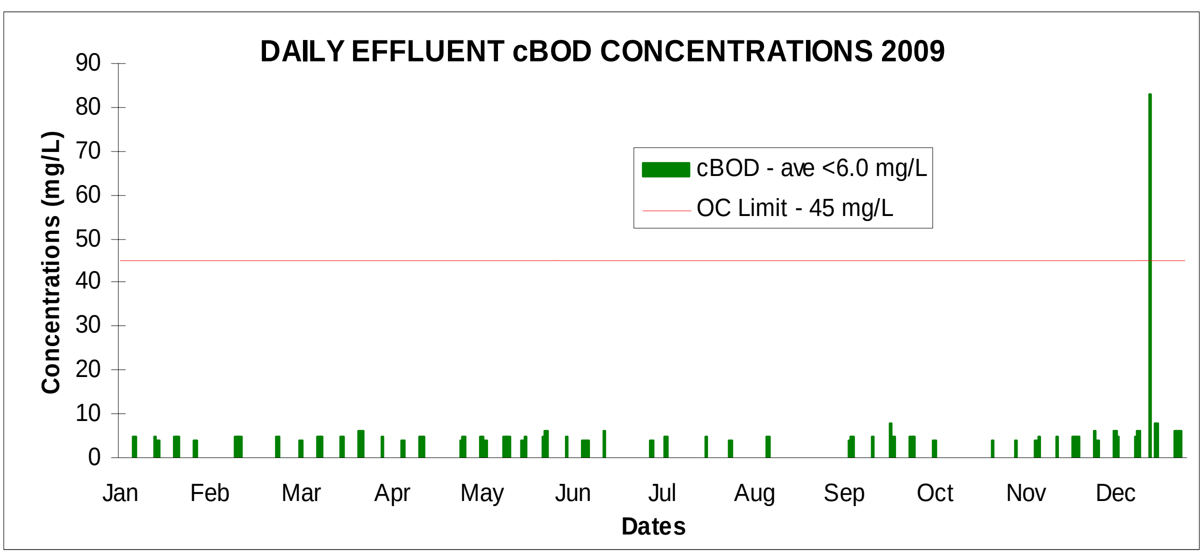
LULU WWTP – 2009 BOD Concentrations Summary



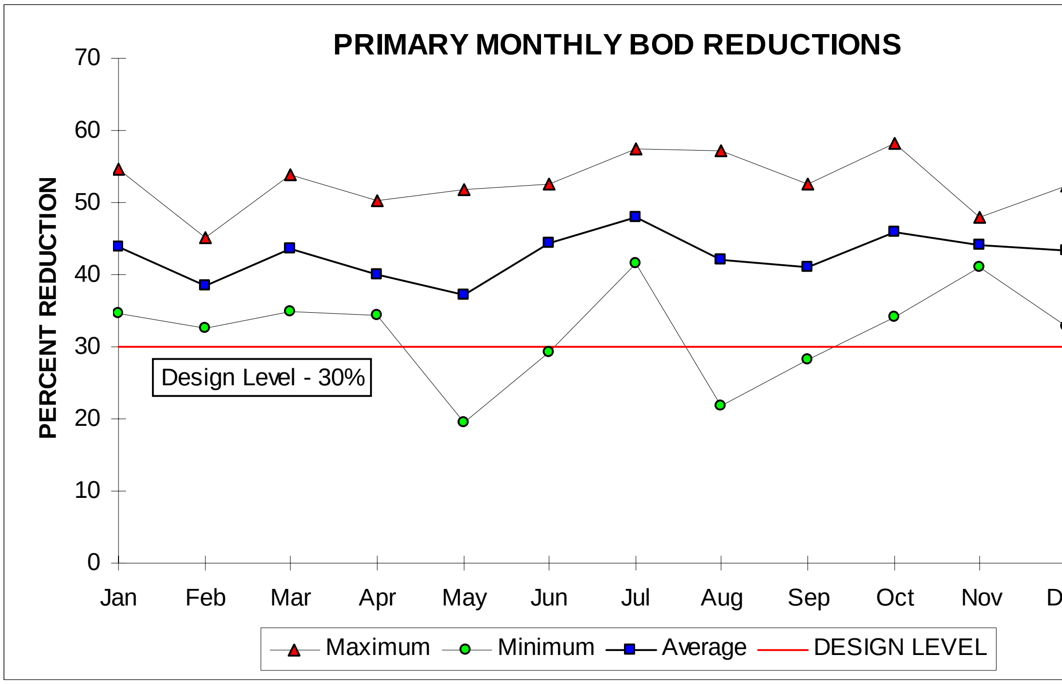
Mth	Max	Min	Ave
Jan	365	189	267
Feb	273	225	247
Mar	303	209	257
Apr	294	193	236
May	259	174	220
Jun	280	225	256
Jul	324	224	270
Aug	303	192	237
Sep	326	230	270
Oct	347	258	284
Nov	278	195	234
Dec	310	223	266



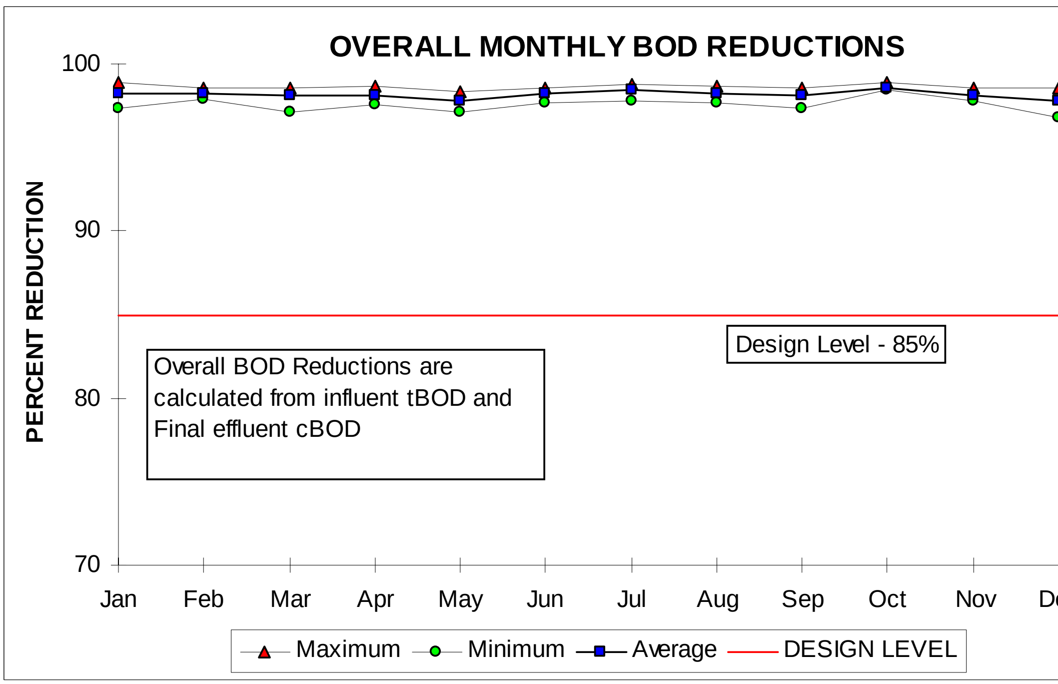
Mth	Max	Min	Ave
Jan	5	<4	<5
Feb	5	<4	<5
Mar	6	<4	<5
Apr	5	<4	<5
May	6	4	5
Jun	6	<4	<5
Jul	5	<4	<5
Aug	5	<4	<5
Sep	8	<4	<5
Oct	4	<4	<4
Nov	5	<4	<5
Dec	83	4	14



LULU WWTP – 2009 BOD Reductions

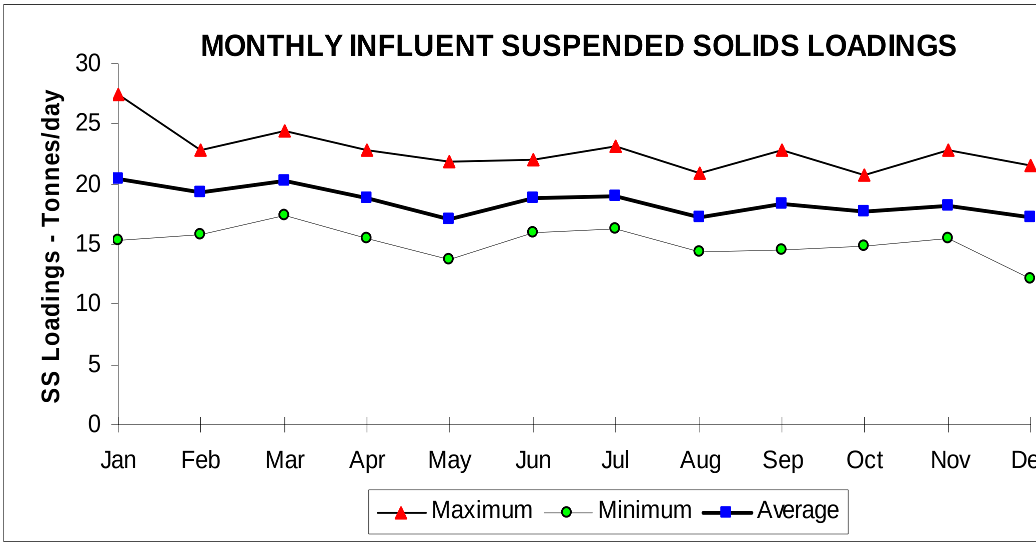


Mth	Max	Min	Ave
Jan	55	35	44
Feb	45	33	39
Mar	54	35	43
Apr	50	34	40
May	52	20	37
Jun	53	29	44
Jul	57	42	48
Aug	57	22	42
Sep	52	28	41
Oct	58	34	46
Nov	48	41	44
Dec	52	33	43

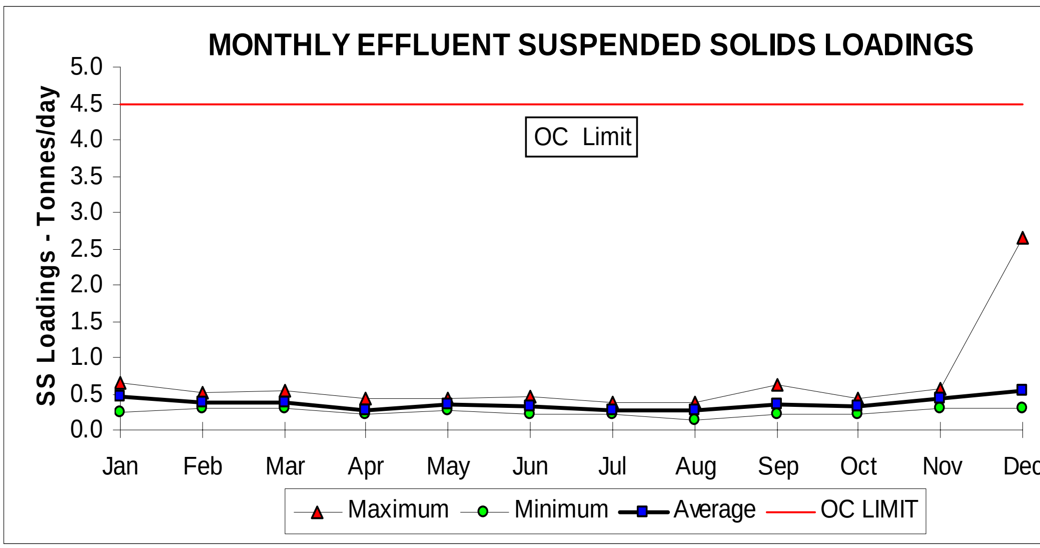


Mth	Max	Min	Ave
Jan	99	97	98
Feb	99	98	98
Mar	99	97	98
Apr	99	98	98
May	98	97	98
Jun	99	98	98
Jul	99	98	98
Aug	99	98	98
Sep	99	97	98
Oct	99	98	99
Nov	99	98	98
Dec	99	97	98

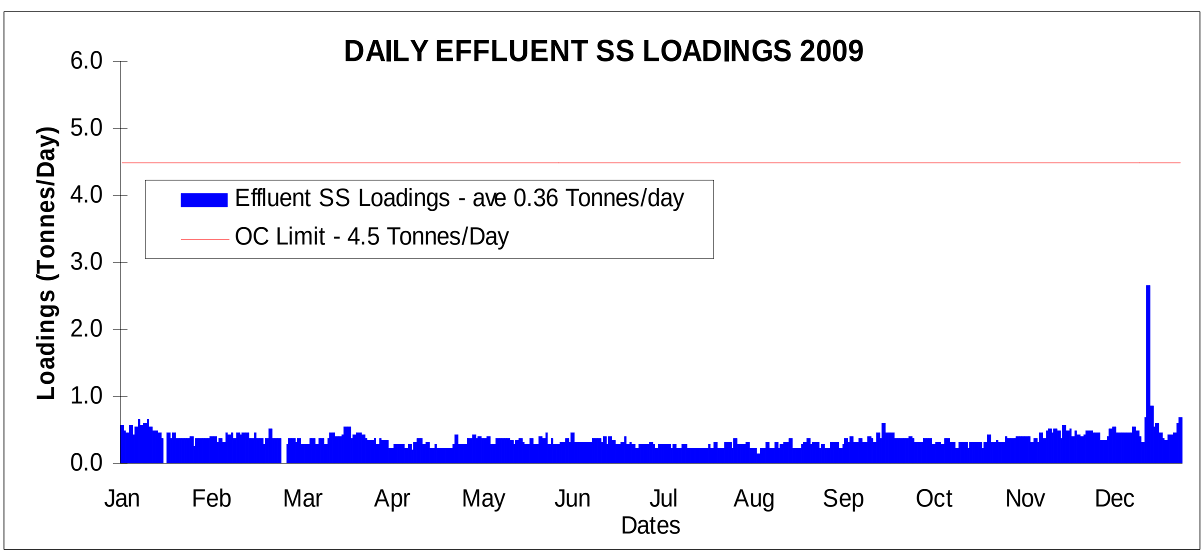
LULU WWTP – 2009 Suspended Solids Loading Summary



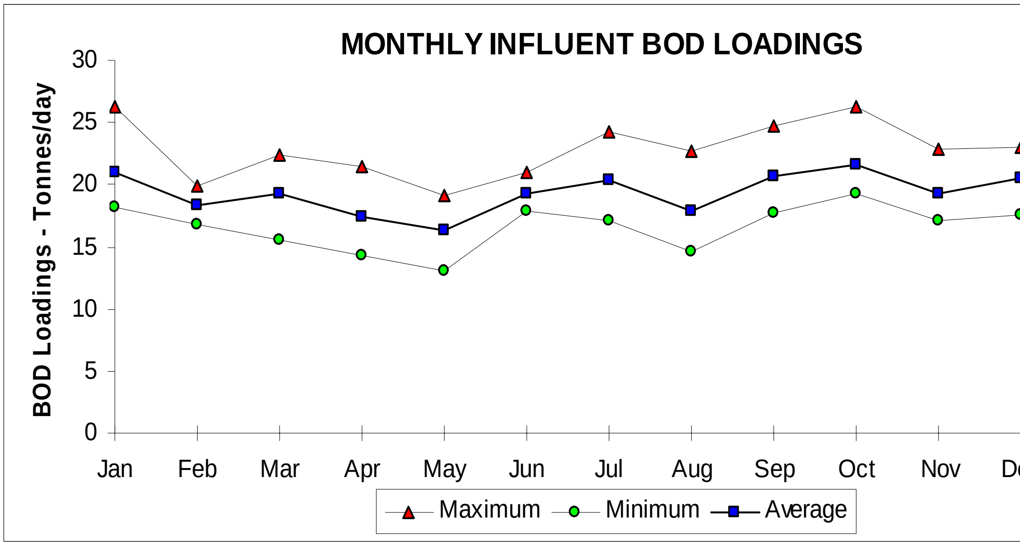
Mth	Max	Min	Ave
Jan	27	15	20
Feb	23	16	19
Mar	24	17	20
Apr	23	15	19
May	22	14	17
Jun	22	16	19
Jul	23	16	19
Aug	21	14	17
Sep	23	14	18
Oct	21	15	18
Nov	23	15	18
Dec	22	12	17



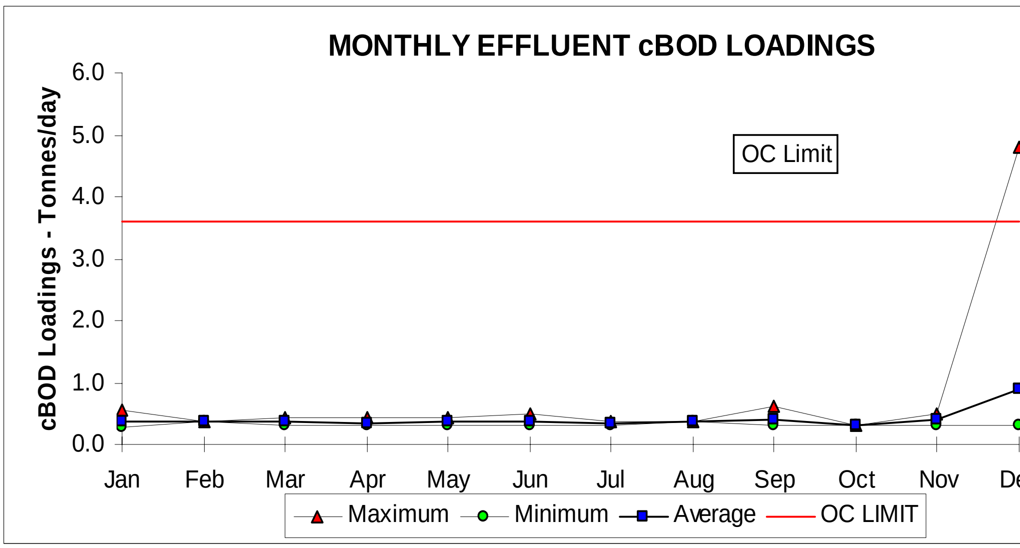
Mth	Max	Min	Ave
Jan	0.7	0.3	0.4
Feb	0.5	0.3	0.4
Mar	0.6	0.3	0.4
Apr	0.4	0.2	0.3
May	0.4	0.3	0.3
Jun	0.5	0.2	0.3
Jul	0.4	0.2	0.3
Aug	0.4	0.1	0.3
Sep	0.6	0.2	0.4
Oct	0.4	0.2	0.3
Nov	0.6	0.3	0.4
Dec	2.7	0.3	0.6



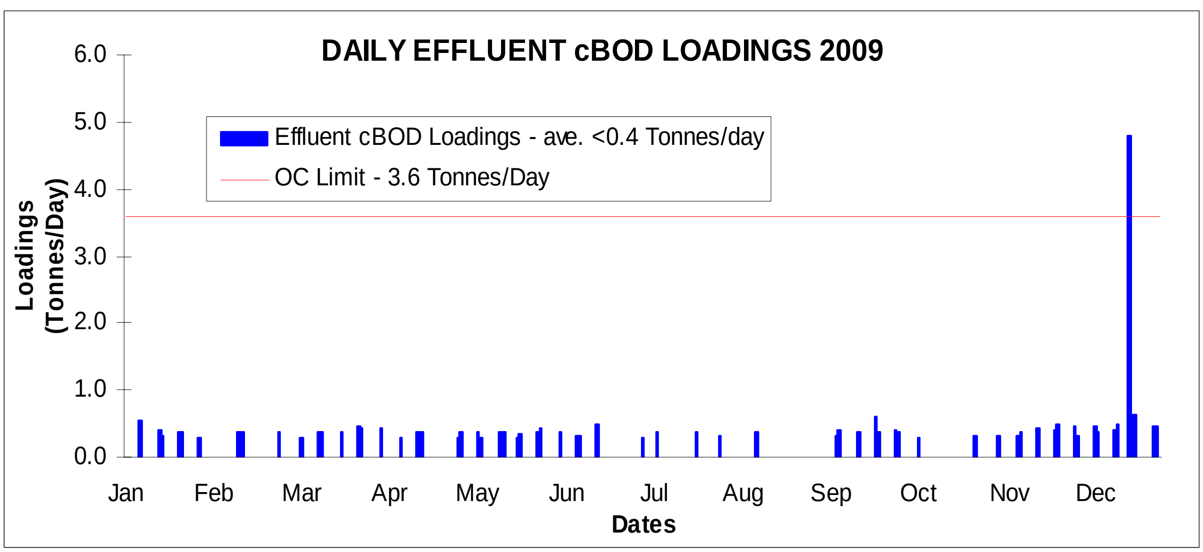
LULU WWTP – 2009 BOD Loadings Summary



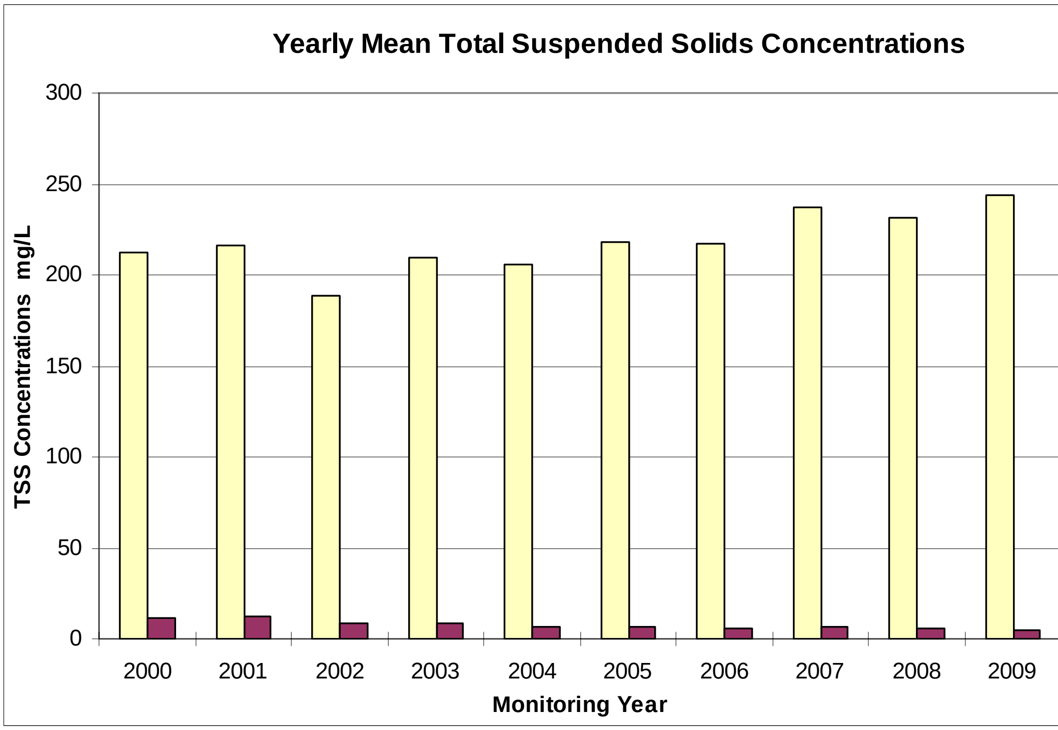
Mth	Max	Min	Ave
Jan	26	18	21
Feb	20	17	18
Mar	22	16	19
Apr	22	14	17
May	19	13	16
Jun	21	18	19
Jul	24	17	20
Aug	23	15	18
Sep	25	18	21
Oct	26	19	22
Nov	23	17	19
Dec	23	18	21



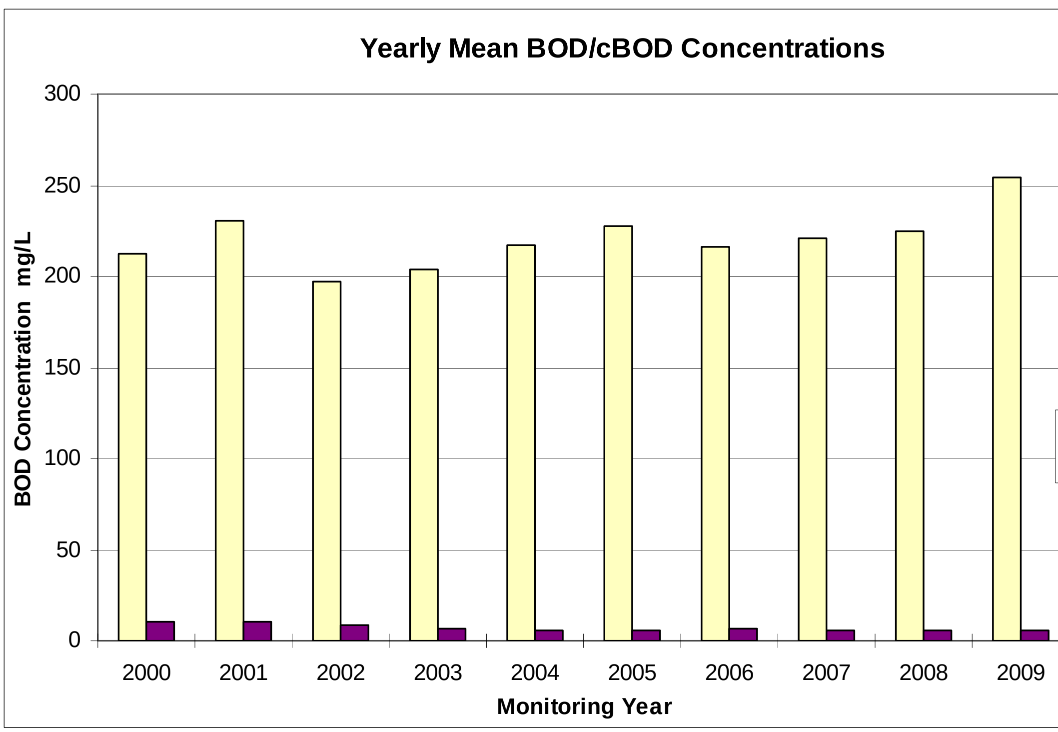
Mth	Max	Min	Ave
Jan	0.5	<0.3	<0.4
Feb	0.4	<0.3	<0.4
Mar	0.4	<0.3	<0.4
Apr	0.4	<0.3	<0.4
May	0.4	0.3	0.4
Jun	0.5	<0.3	<0.4
Jul	0.4	<0.3	<0.4
Aug	0.4	<0.3	<0.4
Sep	0.6	<0.3	<0.4
Oct	0.3	<0.3	<0.4
Nov	0.5	<0.3	<0.4
Dec	4.8	0.3	0.9



LULU WWTP – 2000 - 2009 Historical Concentrations Comparison

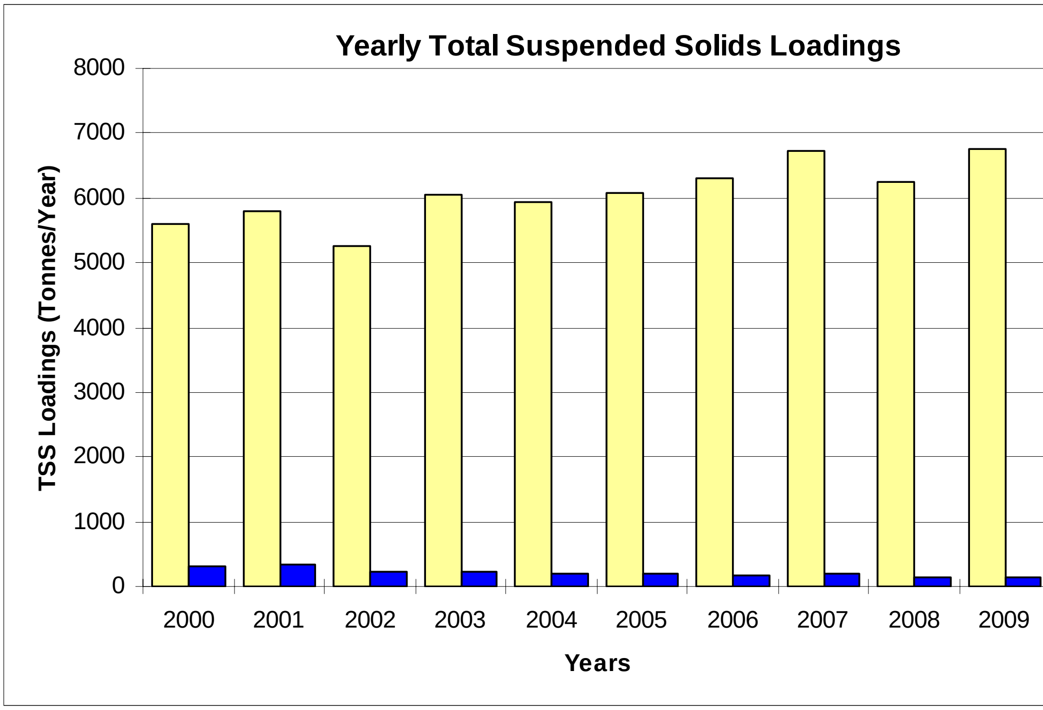


Year	SS mg/L	
	Influent	Effluent
2000	213	12
2001	216	12
2002	189	8
2003	210	8
2004	206	7
2005	219	7
2006	217	6
2007	237	7
2008	232	5
2009	244	5

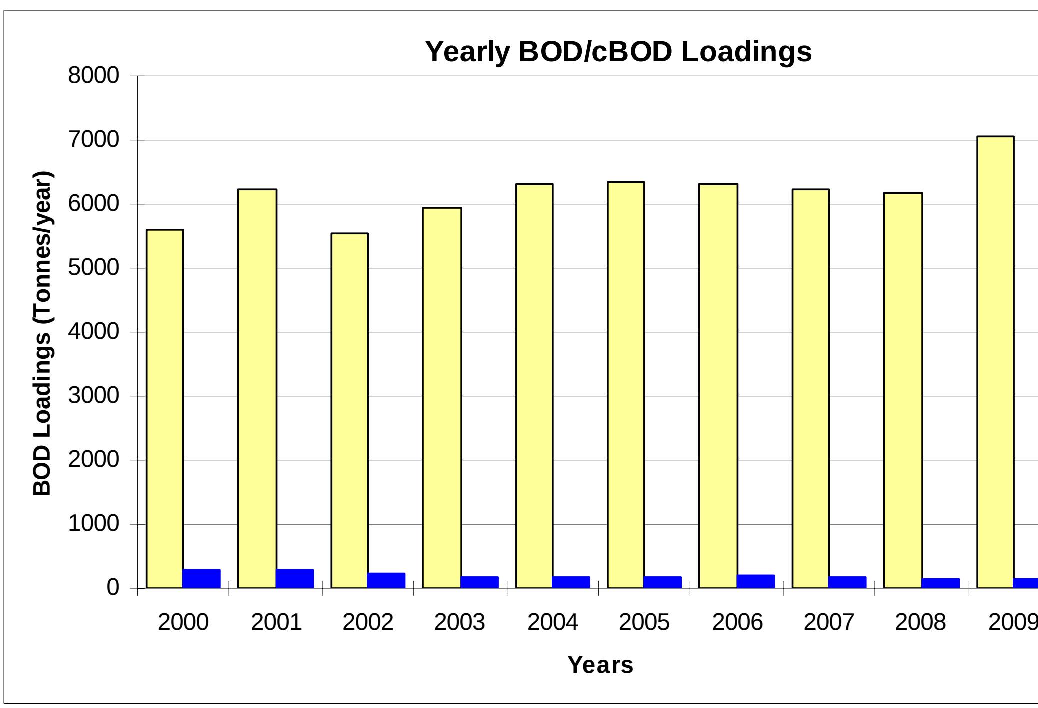


Year	BOD	cBOD
	mg/L	
	Influent	Effluent
2000	213	10
2001	231	11
2002	197	8
2003	204	6
2004	218	6
2005	228	6
2006	216	7
2007	221	6
2008	225	6
2009	254	6

LULU WWTP – 2000 - 2009 Historical Loadings Comparison



Years	SS (Tonnes/Yr)	
	Influent	Effluent
2000	5590	306
2001	5802	326
2002	5270	234
2003	6062	237
2004	5947	202
2005	6088	198
2006	6313	179
2007	6718	187
2008	6261	147
2009	6769	133



Years	BOD	cBOD
	(Tonnes/Yr)	
	Influent	Effluent
2000	5593	272
2001	6229	289
2002	5539	234
2003	5954	185
2004	6310	174
2005	6347	164
2006	6314	189
2007	6232	159
2008	6180	152
2009	7064	145

LULU WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	27	30	32	32	30	32	34	35	32	37	34	30
NO3	Grab	0.02	0.03	0.03	0.01	<0.01	0.04	0.02	<0.01	<0.01	<0.01	0.02	0.01
NO2	Grab	0.03	0.02	0.02	0.01	0.02	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
NH3	Comp.	17	20	18	18	18	18	20	21	18	22	21	18
SO4	Comp.	19	15	14	13	13	15	13	9	11	11	13	14
PTot	Comp.	4.1	4.6	4.8	4.9	4.2	5.0	4.4	4.7	5.1	4.9	4.6	4.2
PDis	Comp.	1.8	2.2	2.2	2.2	1.9	1.9	1.9	2.3	2.5	2.9	2.5	1.6
MBAS	Grab	1.7	2.0	2.2	2.5	2.5	3	2.8	2.6	2.3	2.9	2.2	3.5
O&G	Grab	27	13	42	41	28	31	49	40	28	32	49	25
Phenol	Grab	0.02	0.03	0.02	0.02	0.04	0.02	0.02	0.03	0.04	0.02	0.02	0.02
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.58	0.58	0.68	0.60	0.61	0.77	0.54	0.58	0.68	0.53	0.58	0.77
AlDis	Comp.	0.09	0.06	0.09	0.06	0.05	0.05	0.05	0.06	0.05	0.07	0.11	0.07
AsTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.019	0.021	0.024	0.025	0.019	0.027	0.019	0.019	0.020	0.018	0.017	0.021
BaDis	Comp.	0.005	0.004	0.006	0.004	0.005	0.006	0.004	0.004	0.004	0.005	0.006	0.004
BTot	Comp.	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.11	0.10	0.11	0.10	0.10
BDis	Comp.	0.10	0.10	0.10	0.11	0.10	0.10	0.09	0.11	0.10	0.10	0.10	0.10
CaTot	Comp.	11.3	9.20	9.43	9.05	8.38	9.82	7.85	7.54	7.97	8.12	8.81	9.76
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0044	<0.0005	0.0006	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0016	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.002	0.003	0.002	0.003	0.003	0.003	0.002	0.002	0.004	0.003	0.003	0.002
CrDis	Comp.	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001
CoTot	Comp.	0.001	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.093	0.106	0.105	0.105	0.092	0.119	0.108	0.129	0.133	0.112	0.093	0.083
CuDis	Comp.	0.020	0.031	0.023	0.027	0.019	0.033	0.022	0.045	0.035	0.035	0.018	0.015
FeTot	Comp.	1.68	1.83	1.94	1.78	1.70	3.24	1.50	1.82	1.80	1.56	1.74	1.87
FeDis	Comp.	0.50	0.60	0.53	0.47	0.32	0.99	0.41	0.64	0.45	0.60	0.60	0.48
PbTot	Comp.	0.002	<0.001	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.003	0.003	0.003
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.56	4.13	4.32	3.83	3.65	5.00	3.40	3.08	3.19	3.30	3.72	4.17
MnTot	Comp.	0.073	0.068	0.074	0.075	0.071	0.105	0.059	0.058	0.064	0.060	0.071	0.077
MnDis	Comp.	0.051	0.039	0.048	0.045	0.048	0.064	0.036	0.037	0.036	0.040	0.053	0.050
HgTot	Comp.	0.48	0.59	0.21	0.16	0.32	0.41	0.24	0.13	0.30	0.18	0.17	0.19
MoTot	Comp.	0.002	<0.002	<0.002	0.002	<0.002	0.002	<0.002	0.002	0.009	0.002	<0.002	<0.002
MoDis	Comp.	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.008	<0.002	<0.002	<0.002
NiTot	Comp.	0.005	0.003	0.017	0.004	0.004	0.006	0.003	0.005	0.007	0.003	0.007	0.005
NiDis	Comp.	0.003	0.002	0.012	0.002	0.002	0.003	0.001	0.003	0.004	0.002	0.004	0.003
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	0.001	<0.001	<0.001	0.001	0.002	0.002	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.086	0.093	0.096	0.133	0.082	0.100	0.106	0.113	0.147	0.089	0.115	0.102
ZnDis	Comp.	0.031	0.024	0.029	0.028	0.021	0.015	0.017	0.024	0.033	0.016	0.034	0.021

Note: All results reported are in mg/L except for Mercury which is reported in ug/L.

LULU WWTP – 2009 Comprehensive Effluent Data

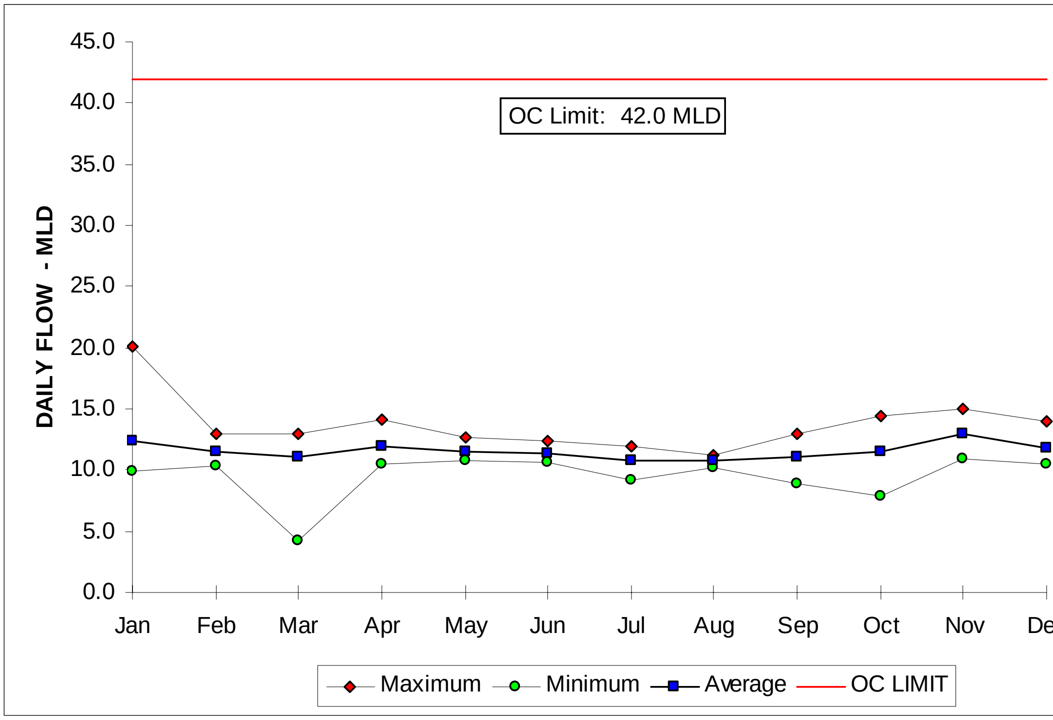
Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	29	30	31	29	32	32	34	34	28	32	32	28
NO3	Grab	0.02	0.07	0.05	0.02	0.01	0.04	0.05	0.08	0.05	0.10	0.07	0.05
NO2	Grab	0.03	0.04	0.04	0.03	0.03	0.06	0.07	0.13	0.15	0.28	0.12	0.04
NH3	Comp.	28	28	29	29	31	31	34	34	26	30	32	28
SO4	Comp.	21	17	18	17	18	21	17	18	17	17	17	18
PTot	Comp.	3.1	3.1	3.4	3.2	3.4	3.3	3.5	3.9	3.5	3.6	3.5	2.9
PDis	Comp.	2.7	2.7	2.9	2.8	3.0	3.0	3.3	3.6	3.1	3.4	3.1	2.6
MBAS	Grab	0.3	0.2	0.2	0.3	0.2	0.4	0.3	0.2	0.1	0.2	0.1	0.2
O&G	Grab	<7	<6	<6	<6	<6	<6	<6	<6	<6	<6	<7	<5
Phenol	Grab	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.08	0.06	0.10	0.05	0.09	0.08	0.07	0.07	0.07	0.06	0.08	0.10
AlDis	Comp.	0.04	0.03	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.03
AsTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.003	0.003	0.002	0.003
BaDis	Comp.	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002
BTot	Comp.	0.10	0.11	0.10	0.10	0.10	0.11	0.10	0.11	0.11	0.11	0.10	0.11
BDis	Comp.	0.10	0.10	0.10	0.10	0.10	0.11	0.09	0.11	0.11	0.11	0.10	0.10
CaTot	Comp.	10.2	7.80	7.93	7.65	7.35	7.74	6.42	6.58	7.25	6.86	7.71	8.61
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
CrDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoTot	Comp.	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.031	0.036	0.031	0.023	0.030	0.027	0.031	0.026	0.029	0.032	0.025	0.025
CuDis	Comp.	0.019	0.017	0.014	0.017	0.022	0.020	0.022	0.021	0.020	0.024	0.012	0.011
FeTot	Comp.	0.35	0.33	0.30	0.28	0.31	0.36	0.26	0.25	0.23	0.23	0.25	0.30
FeDis	Comp.	0.18	0.17	0.17	0.18	0.18	0.20	0.15	0.15	0.14	0.13	0.14	0.16
PbTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001
PbDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
MgTot	Comp.	4.37	3.89	4.15	3.67	3.50	5.02	3.11	3.02	3.17	3.21	3.73	3.98
MnTot	Comp.	0.057	0.011	0.009	0.015	0.015	0.015	0.013	0.007	0.020	0.010	0.011	0.020
MnDis	Comp.	0.048	0.005	0.005	0.011	0.011	0.011	0.010	0.005	0.016	0.005	0.006	0.009
HgTot	Comp.	<0.05	0.11	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MoTot	Comp.	<0.002	0.002	<0.002	0.004	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	0.003	<0.002
MoDis	Comp.	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	0.003	<0.002
NiTot	Comp.	0.004	0.003	0.003	0.002	0.003	0.003	0.003	0.005	0.004	0.002	0.004	0.003
NiDis	Comp.	0.004	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.003	0.002	0.004	0.002
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.032	0.035	0.038	0.038	0.026	0.026	0.033	0.058	0.052	0.029	0.030	0.053
ZnDis	Comp.	0.023	0.022	0.028	0.026	0.022	0.021	0.030	0.051	0.044	0.023	0.022	0.042

Note: All results reported are in mg/L except for Mercury which is reported in ug/L.

APPENDIX A5

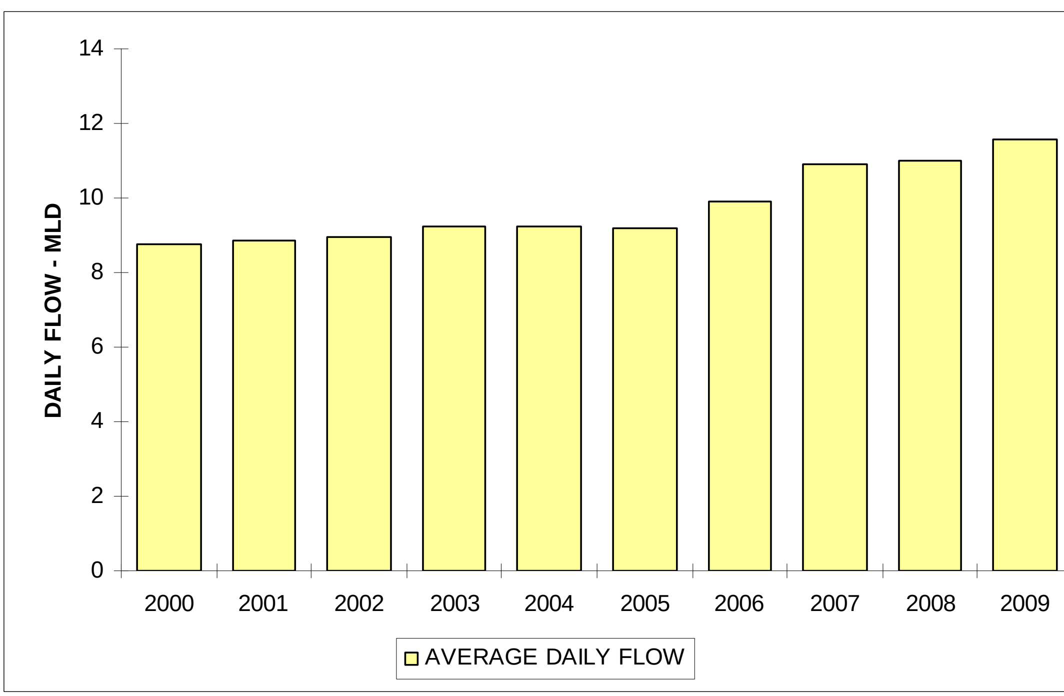
NORTHWEST LANGLEY WASTEWATER TREATMENT PLANT

NW LANGLEY WWTP – 2009 Wastewater Flow – Monthly Summary



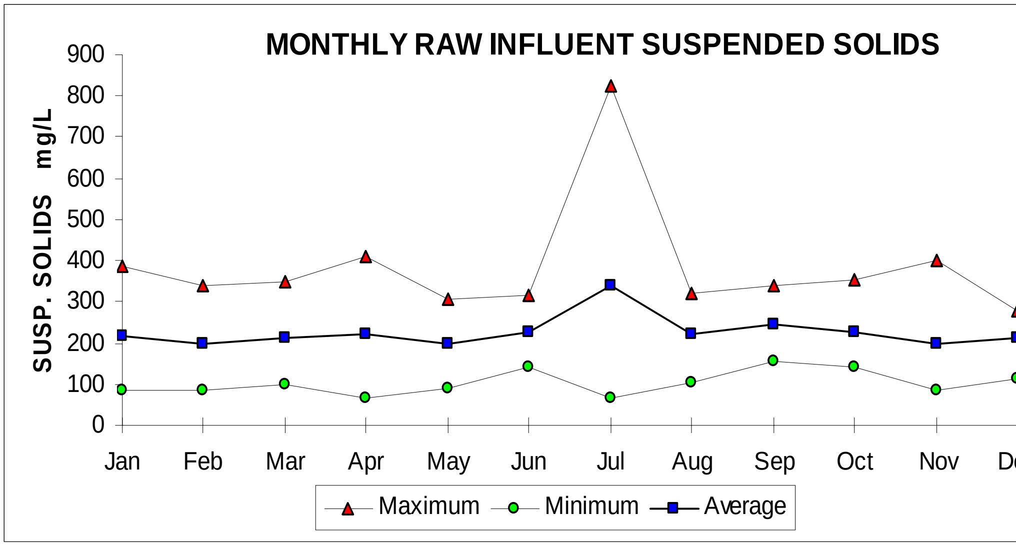
Mth	Max	Min	Ave
Jan	20.1	9.9	12.4
Feb	12.9	10.3	11.5
Mar	13.0	4.3	11.1
Apr	14.2	10.5	12.0
May	12.6	10.7	11.5
Jun	12.3	10.6	11.4
Jul	12.0	9.2	10.8
Aug	11.3	10.2	10.7
Sep	13.0	8.9	11.1
Oct	14.5	7.8	11.6
Nov	15.0	11.0	13.0
Dec	14.0	10.4	11.8

Average Daily Wastewater Flows 2000 – 2009

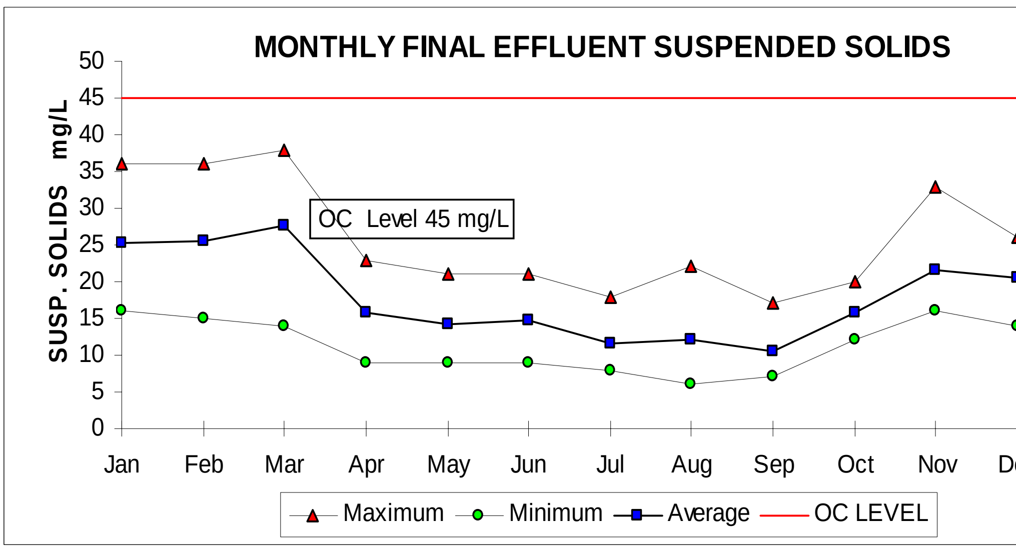


	(MLD)
2000	8.75
2001	8.84
2002	8.93
2003	9.23
2004	9.26
2005	9.20
2006	9.90
2007	10.92
2008	10.99
2009	11.58

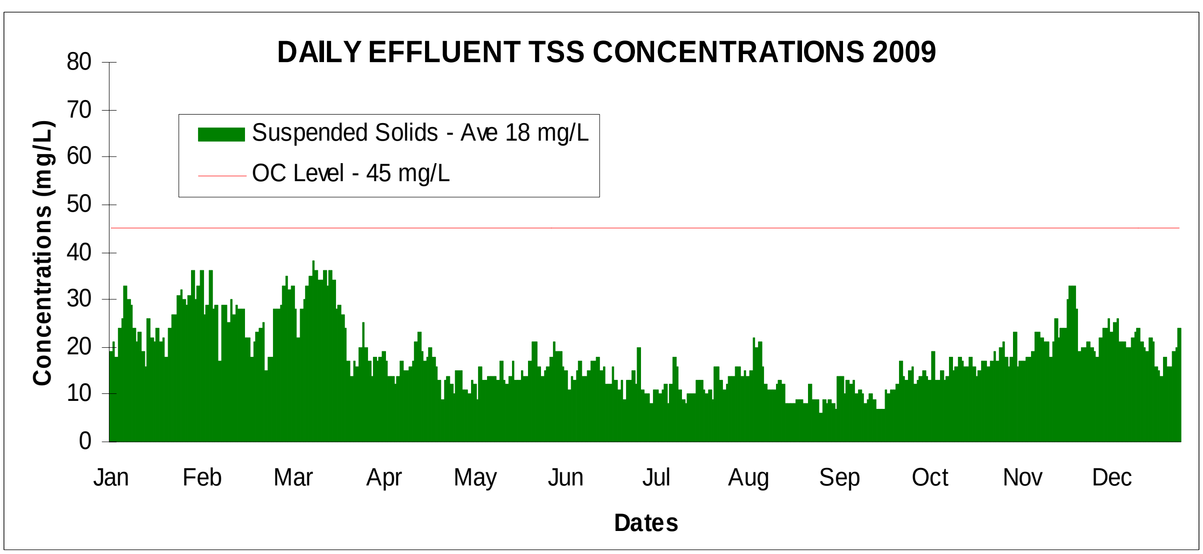
NW LANGLEY WWTP – 2009 Suspended Solids Concentrations Summary



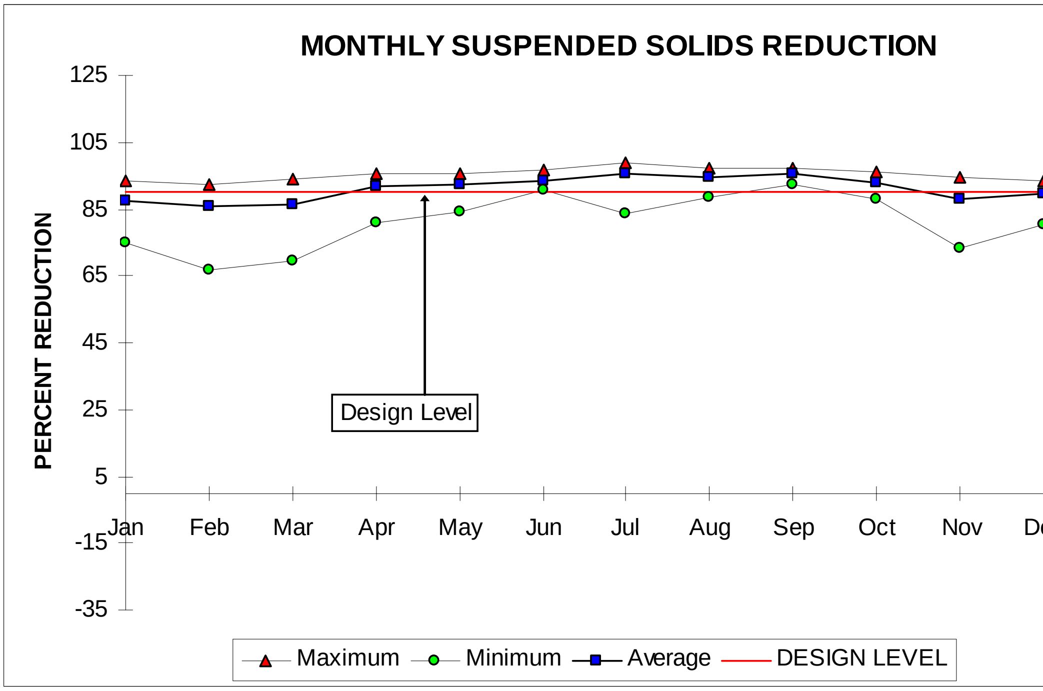
Mth	Max	Min	Ave
Jan	386	83	218
Feb	338	84	198
Mar	351	99	211
Apr	410	68	220
May	306	88	199
Jun	314	142	226
Jul	825	67	340
Aug	320	103	223
Sep	340	154	243
Oct	355	140	227
Nov	400	86	199
Dec	278	111	211



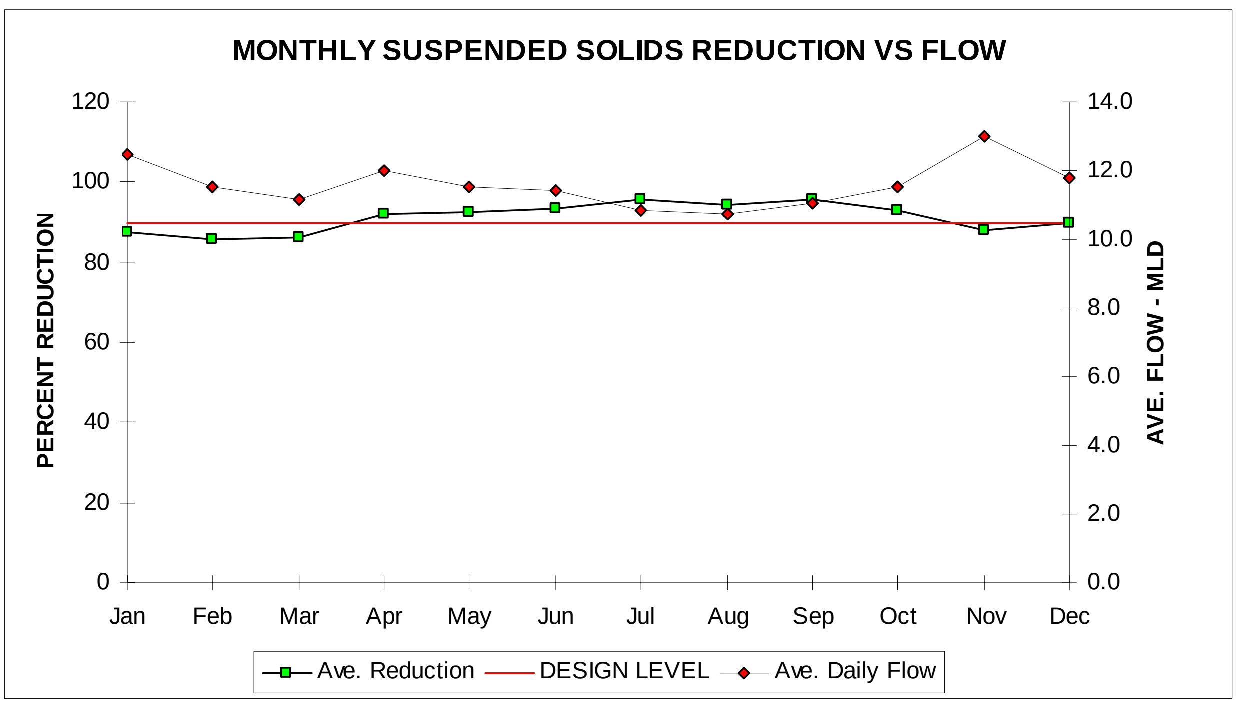
Mth	Max	Min	Ave
Jan	36	16	25
Feb	36	15	26
Mar	38	14	28
Apr	23	9	16
May	21	9	14
Jun	21	9	15
Jul	18	8	11
Aug	22	6	12
Sep	17	7	11
Oct	20	12	16
Nov	33	16	22
Dec	26	14	21



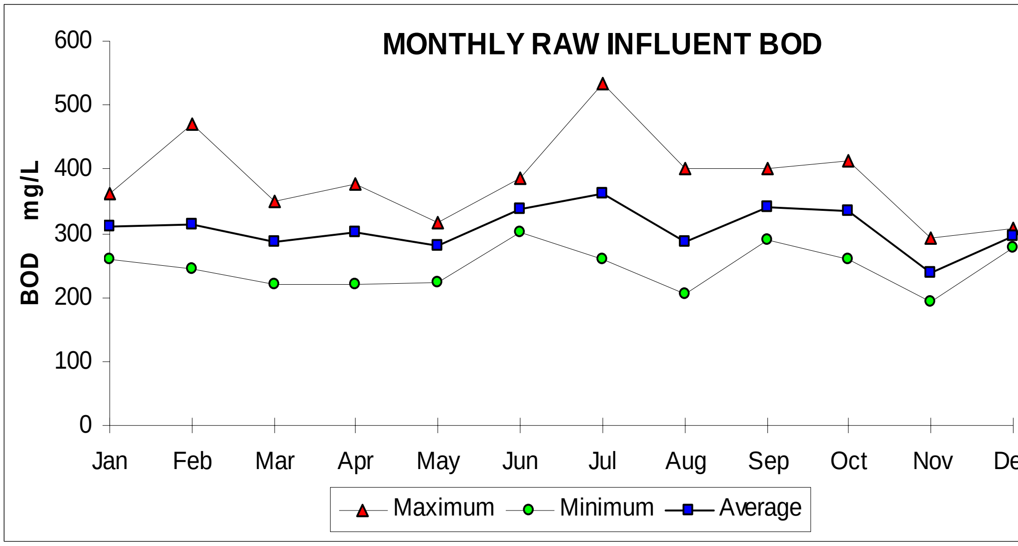
NW LANGLEY WWTP – 2009 Suspended Solids Reductions



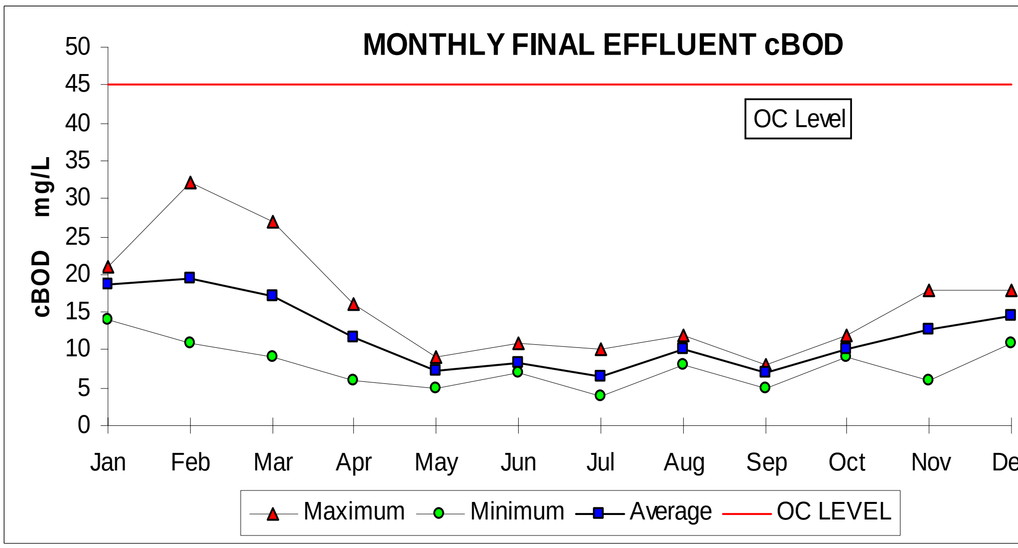
Mth	Max	Min	Ave
Jan	93	75	88
Feb	93	67	86
Mar	94	70	86
Apr	95	81	92
May	96	84	92
Jun	96	91	93
Jul	99	84	96
Aug	97	88	94
Sep	97	93	95
Oct	96	88	93
Nov	94	73	88
Dec	93	80	90



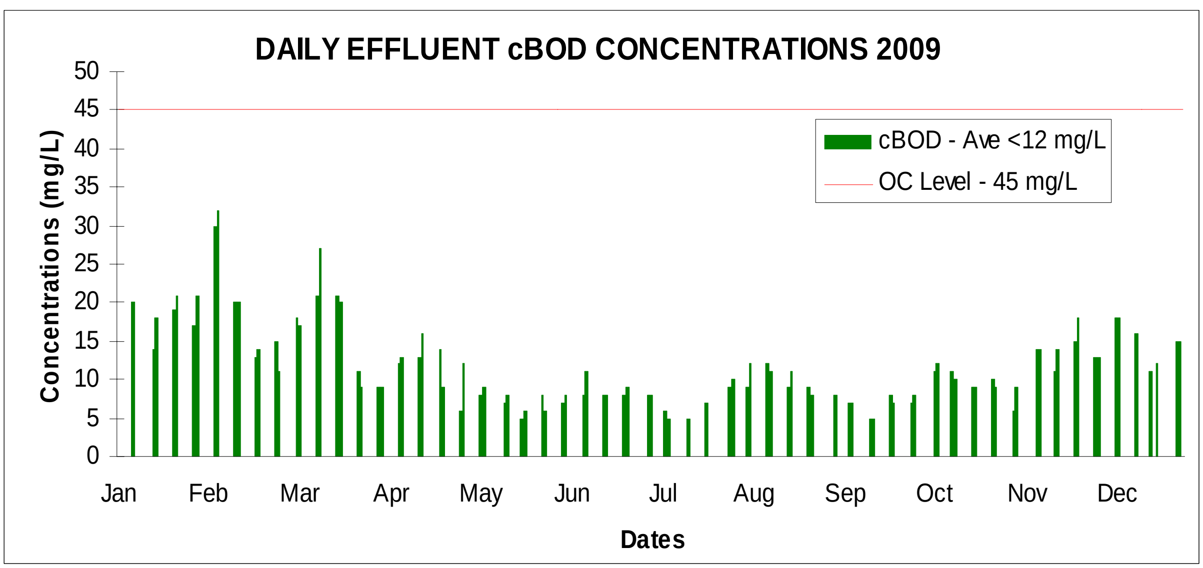
NW LANGLEY WWTP – 2009 BOD Concentrations Summary



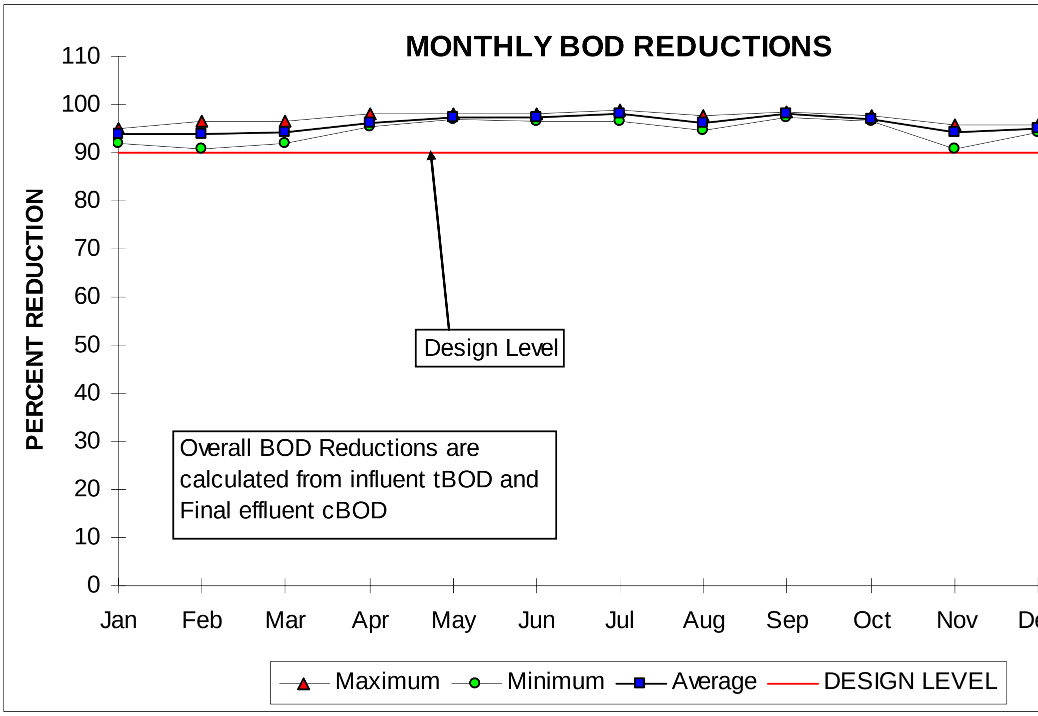
Mth	Max	Min	Ave
Jan	363	260	311
Feb	469	244	312
Mar	350	221	285
Apr	376	220	302
May	317	222	280
Jun	386	301	337
Jul	533	260	361
Aug	402	206	285
Sep	400	290	341
Oct	412	259	334
Nov	292	192	239
Dec	309	278	297



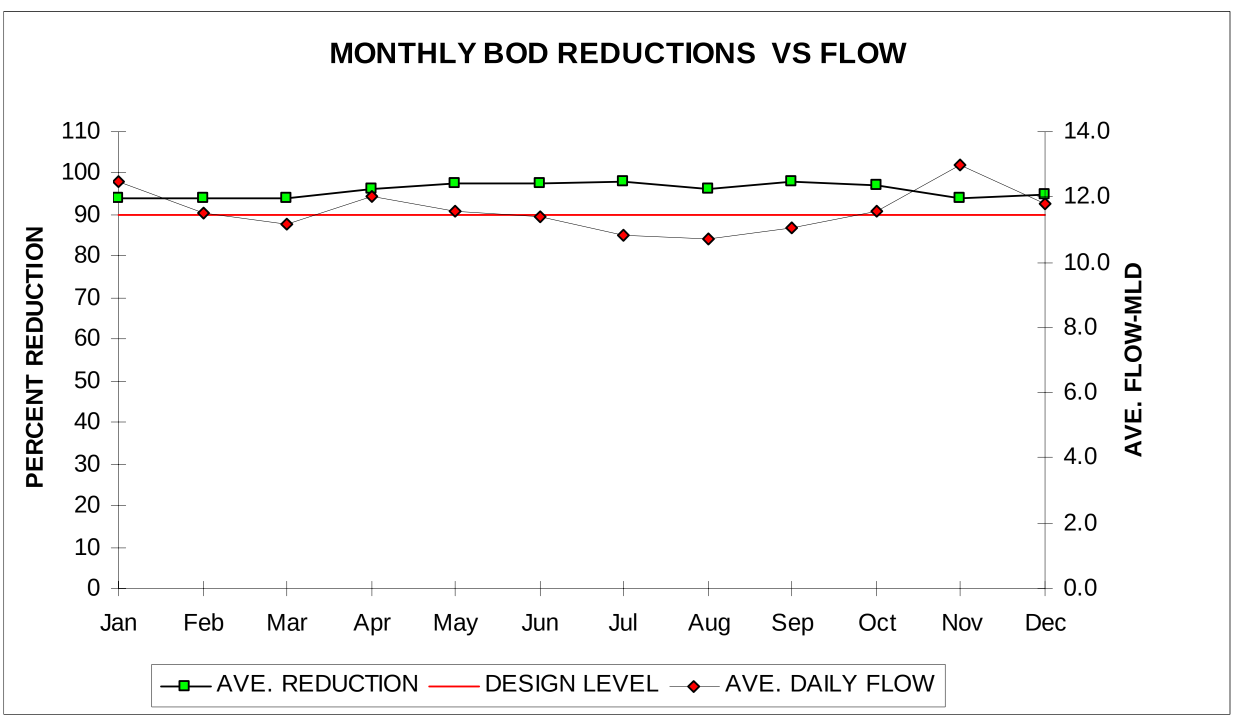
Mth	Max.	Min.	Ave.
Jan	21	14	19
Feb	32	11	19
Mar	27	9	17
Apr	16	6	12
May	9	5	7
Jun	11	7	8
Jul	10	4	7
Aug	12	8	10
Sep	8	5	7
Oct	12	9	10
Nov	18	6	13
Dec	18	11	15



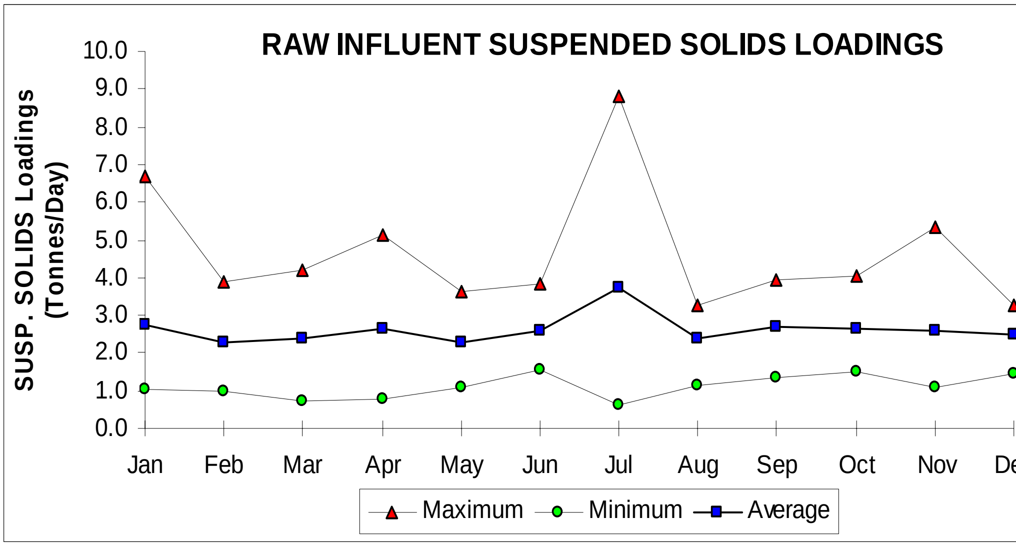
NW LANGLEY WWTP – 2009 BOD Reductions



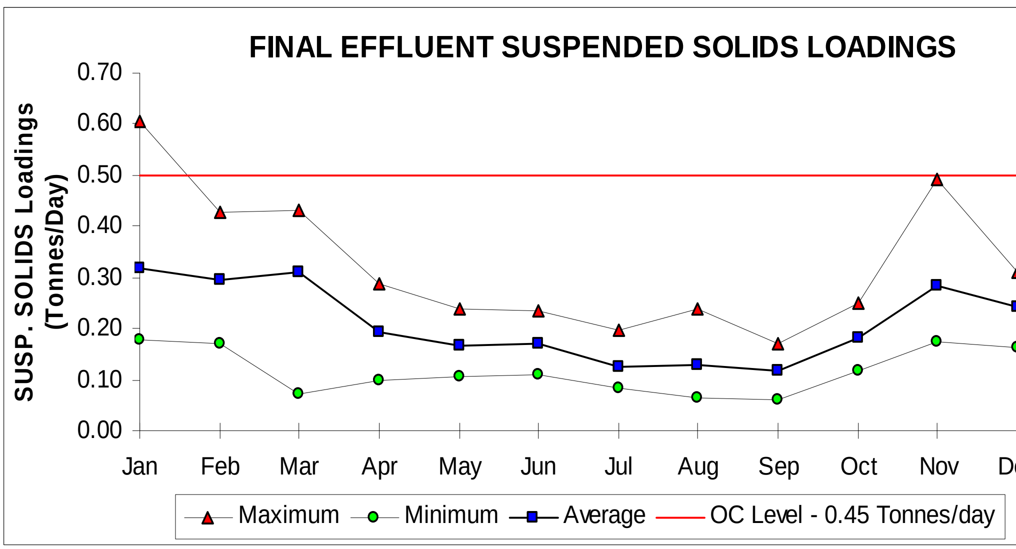
Mth	Max	Min	Ave
Jan	95	92	94
Feb	96	91	94
Mar	97	92	94
Apr	98	95	96
May	98	97	97
Jun	98	97	97
Jul	99	97	98
Aug	98	95	96
Sep	99	97	98
Oct	98	96	97
Nov	96	91	94
Dec	96	94	95



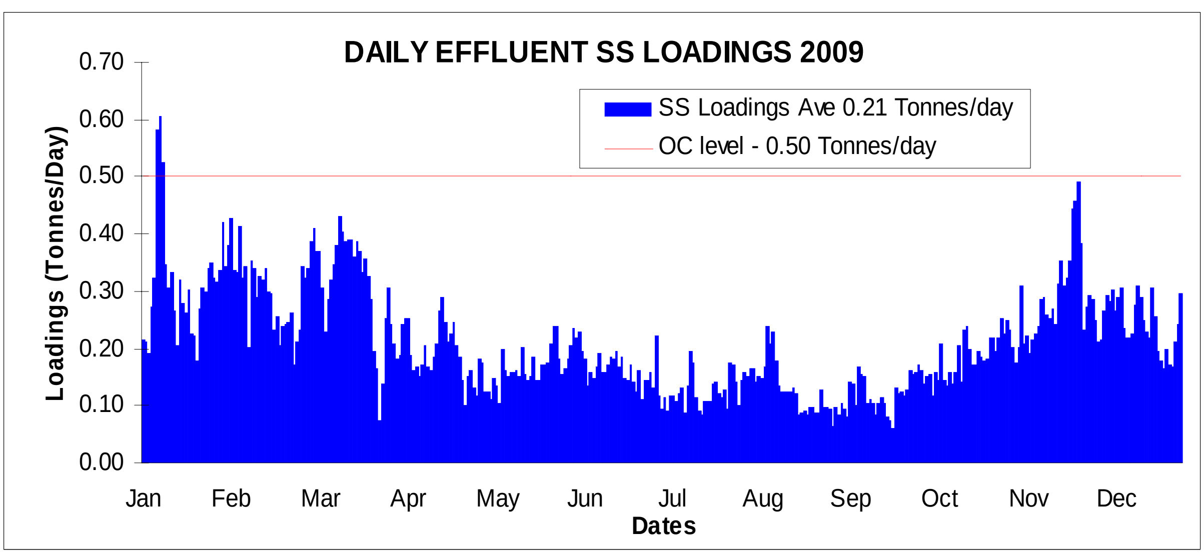
NW LANGLEY WWTP – 2009 Suspended Solids Loadings Summary



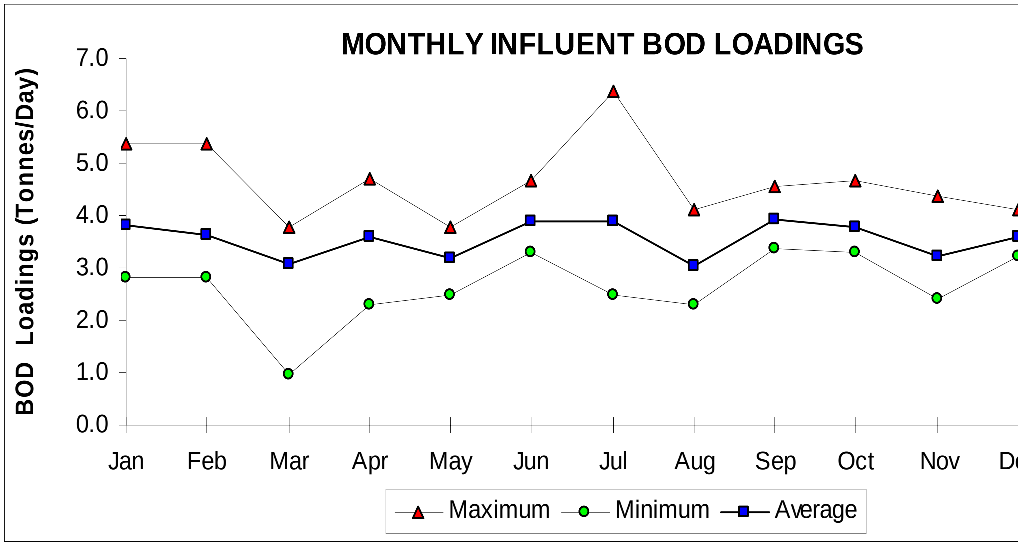
Mth	Max	Min	Ave
Jan	6.7	1.0	2.7
Feb	3.9	1.0	2.3
Mar	4.2	0.7	2.4
Apr	5.1	0.8	2.6
May	3.6	1.1	2.3
Jun	3.8	1.6	2.6
Jul	8.8	0.6	3.7
Aug	3.2	1.2	2.4
Sep	3.9	1.4	2.7
Oct	4.0	1.5	2.6
Nov	5.4	1.1	2.6
Dec	3.3	1.5	2.5



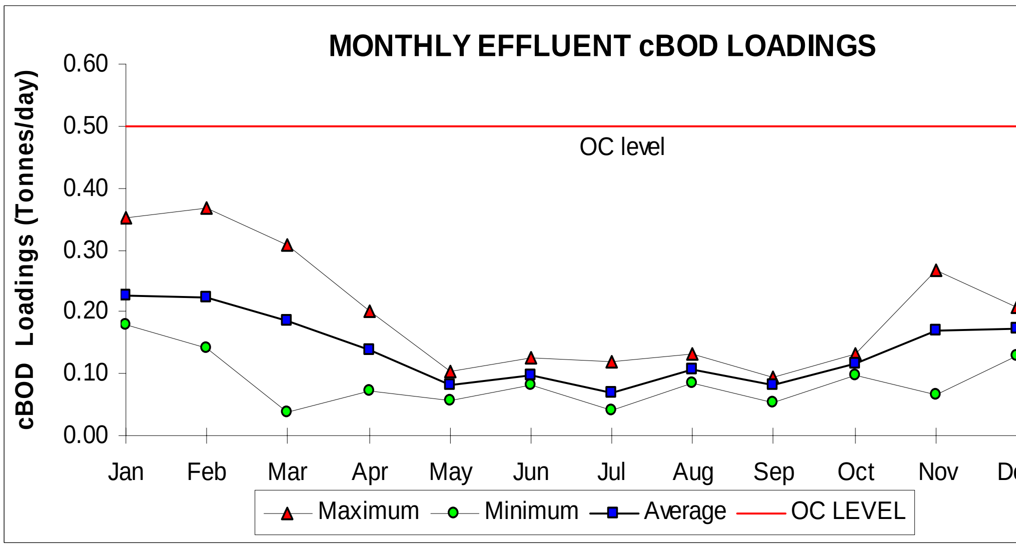
Mth	Max	Min	Ave
Jan	0.60	0.18	0.32
Feb	0.43	0.17	0.29
Mar	0.43	0.07	0.31
Apr	0.29	0.10	0.19
May	0.24	0.10	0.16
Jun	0.24	0.11	0.17
Jul	0.20	0.08	0.12
Aug	0.24	0.06	0.13
Sep	0.17	0.06	0.12
Oct	0.25	0.12	0.18
Nov	0.49	0.18	0.28
Dec	0.31	0.16	0.24



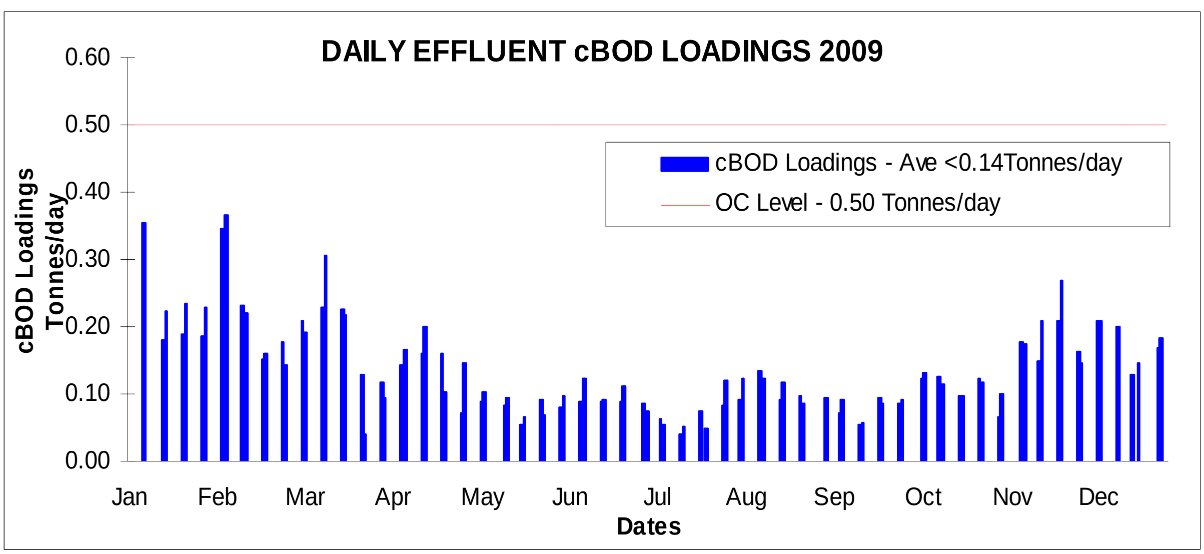
NW LANGLEY WWTP – 2009 BOD Loadings Summary



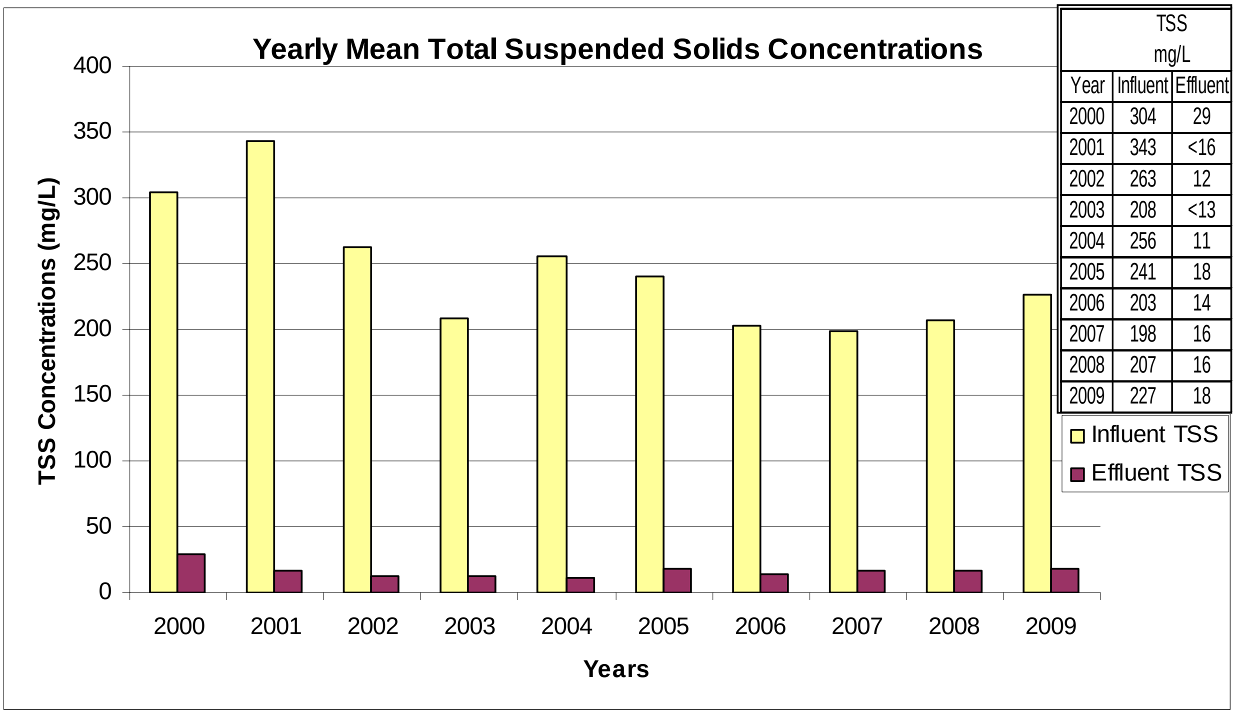
Mth	Max	Min	Ave
Jan	5.4	2.8	3.8
Feb	5.4	2.8	3.6
Mar	3.8	0.9	3.1
Apr	4.7	2.3	3.6
May	3.8	2.5	3.2
Jun	4.7	3.3	3.9
Jul	6.4	2.5	3.9
Aug	4.1	2.3	3.0
Sep	4.6	3.4	3.9
Oct	4.7	3.3	3.8
Nov	4.4	2.4	3.2
Dec	4.1	3.2	3.6



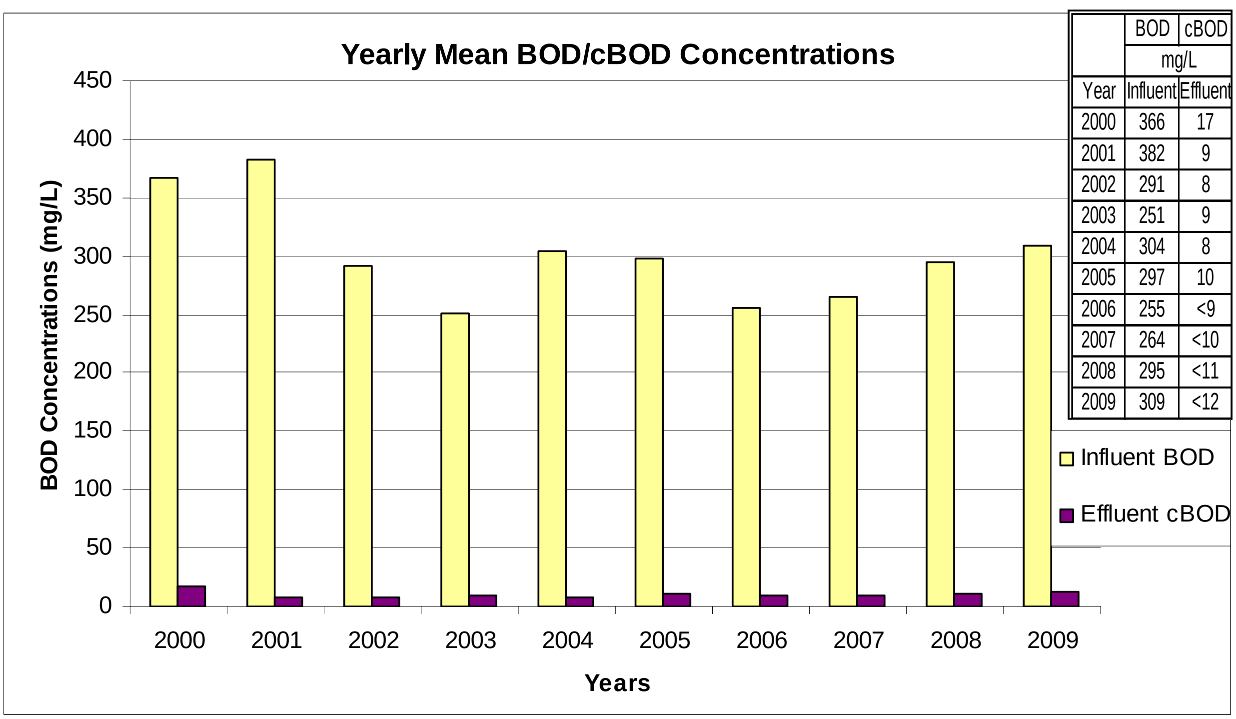
Mth	Max	Min	Ave
Jan	0.35	0.18	0.23
Feb	0.37	0.14	0.22
Mar	0.31	0.04	0.18
Apr	0.20	0.07	0.14
May	0.10	0.06	0.08
Jun	0.12	0.08	0.10
Jul	0.12	0.04	0.07
Aug	0.13	0.09	0.11
Sep	0.10	0.05	0.08
Oct	0.13	0.10	0.12
Nov	0.27	0.07	0.17
Dec	0.21	0.13	0.17



NW LANGLEY WWTP – 2000 - 2009 Historical Concentrations Comparison

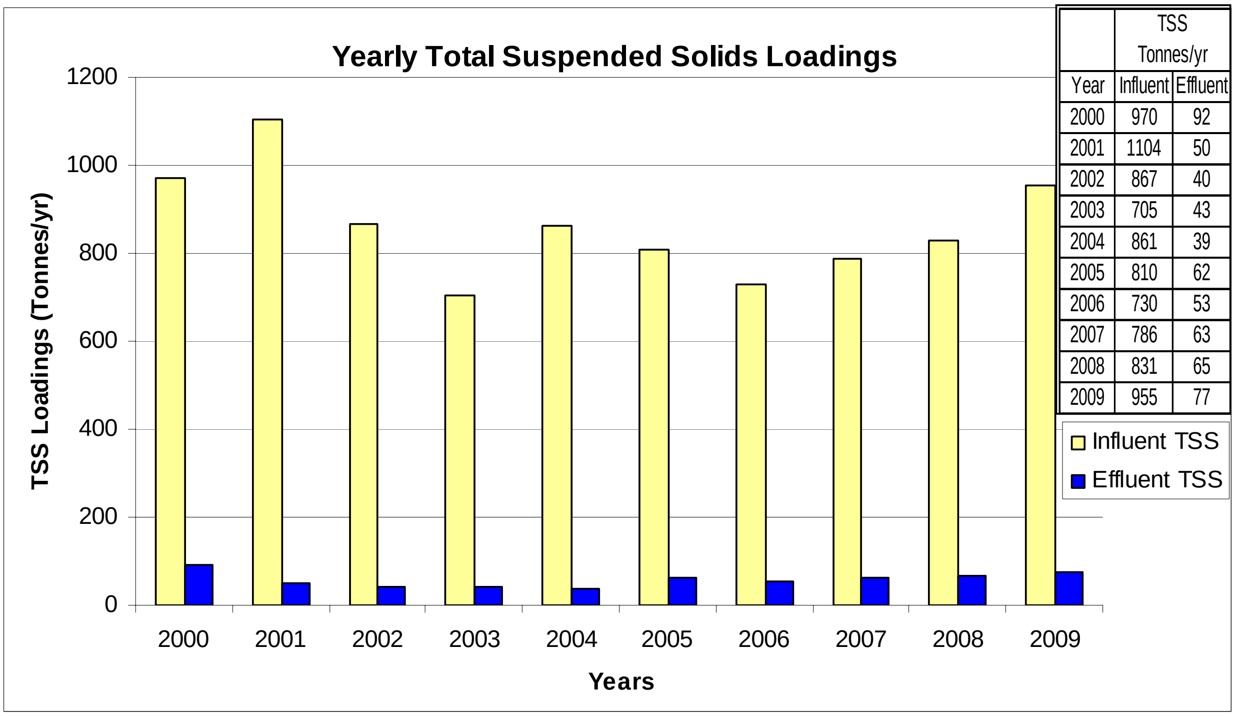


	TSS mg/L	
Year	Influent	Effluent
2000	304	29
2001	343	<16
2002	263	12
2003	208	<13
2004	256	11
2005	241	18
2006	203	14
2007	198	16
2008	207	16
2009	227	18

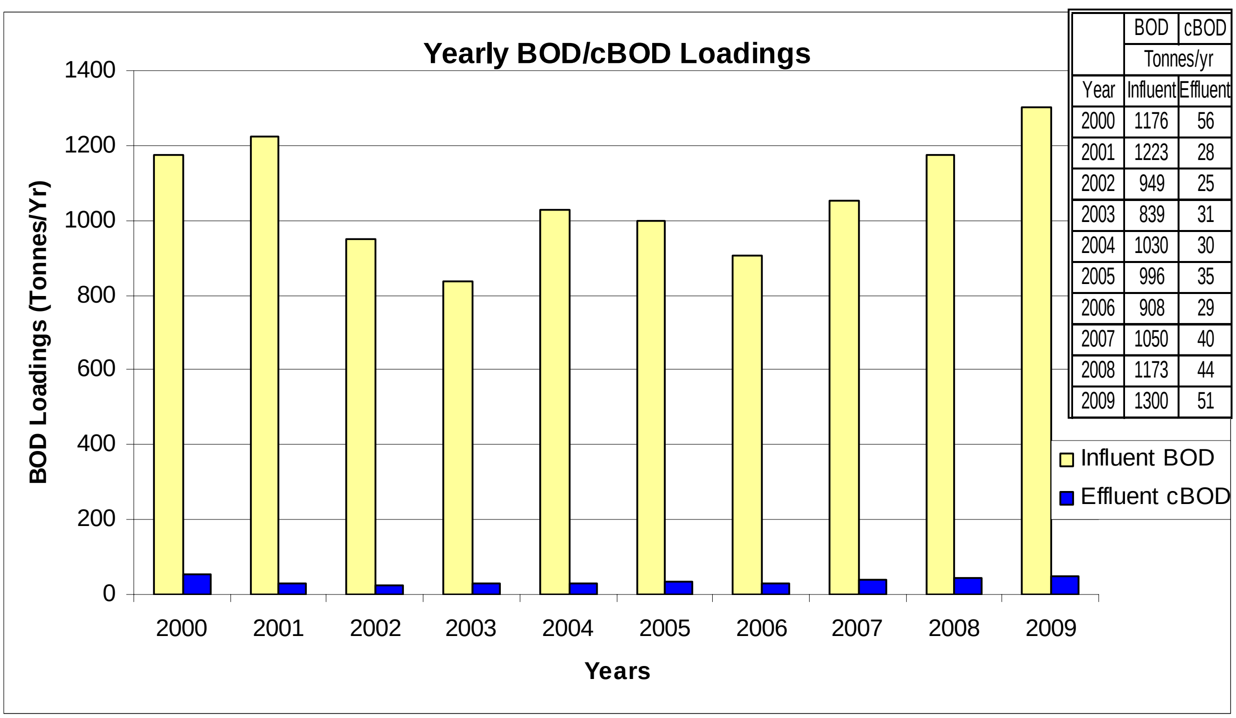


	BOD	cBOD
	mg/L	
Year	Influent	Effluent
2000	366	17
2001	382	9
2002	291	8
2003	251	9
2004	304	8
2005	297	10
2006	255	<9
2007	264	<10
2008	295	<11
2009	309	<12

NW LANGLEY WWTP –2000 - 2009 Historical Loadings Comparison



	TSS Tonnes/yr	
Year	Influent	Effluent
2000	970	92
2001	1104	50
2002	867	40
2003	705	43
2004	861	39
2005	810	62
2006	730	53
2007	786	63
2008	831	65
2009	955	77



	BOD	cBOD
	Tonnes/yr	
Year	Influent	Effluent
2000	1176	56
2001	1223	28
2002	949	25
2003	839	31
2004	1030	30
2005	996	35
2006	908	29
2007	1050	40
2008	1173	44
2009	1300	51

NW LANGLEY WWTP – 2009 Comprehensive Influent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	35	43	42	41	38	40	43	41	44	39	44	38
NO3	Grab	1.08	0.22	0.36	0.29	0.23	0.02	0.12	0.02	<0.01	<0.01	0.26	0.66
NO2	Grab	0.13	0.05	0.20	0.09	0.08	0.04	0.47	0.28	0.05	<0.01	0.22	0.12
NH3	Comp.	23.0	27.0	25.2	27.7	21.8	24.0	24.6	23.4	25.5	25.1	24.3	24.3
SO4	Comp.	29.6	32.2	31.4	32.1	36.0	30.5	36.8	33.5	34.5	34.3	42.0	32.8
PTot	Comp.	6.1	11.5	10.8	11.2	8.5	8.4	11.2	11.9	11.5	7.4	11.7	6.3
PDis	Comp.	3.6	8.3	7.2	7.4	5.3	5.7	7.7	8.3	8.0	4.2	8.1	3.7
MBAS	Grab	0.8	1.3	1.0	1.5	1.2	1.8	1.4	1.2	1.3	1.5	1.2	0.7
O&G	Grab	16	37	30	44	25	45	125	45	45	35	36	78
Phenol	Grab	0.02	0.03	0.03	0.02	0.04	0.03	0.02	0.02	0.03	0.03	0.02	0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	1.12	1.42	1.91	1.55	1.23	0.90	1.34	1.12	1.16	0.85	0.88	1.00
AlDis	Comp.	0.13	0.22	0.22	0.17	0.17	0.17	0.22	0.17	0.14	0.11	0.13	0.16
AsTot	Comp.	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
BaTot	Comp.	0.039	0.037	0.049	0.045	0.037	0.032	0.040	0.033	0.026	0.034	0.030	0.042
BaDis	Comp.	0.008	0.006	0.006	0.005	0.006	0.006	0.006	0.005	0.005	0.005	0.007	0.008
BTot	Comp.	0.15	0.20	0.16	0.20	0.18	0.18	0.16	0.18	0.16	0.18	0.18	0.17
BDis	Comp.	0.14	0.20	0.15	0.20	0.17	0.18	0.16	0.19	0.15	0.18	0.17	0.17
CaTot	Comp.	20.8	11.9	16.5	15.7	14.6	12.9	14.4	14.5	15.1	15.2	16.9	16.5
CdTot	Comp.	<0.0005	0.0007	0.0005	0.0005	<0.0005	0.0006	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
CrTot	Comp.	0.014	0.013	0.018	0.016	0.016	0.013	0.011	0.011	0.011	0.010	0.011	0.013
CrDis	Comp.	0.008	0.007	0.009	0.008	0.008	0.007	0.006	0.006	0.006	0.005	0.007	0.007
CoTot	Comp.	<0.001	0.001	0.002	0.002	0.001	<0.001	0.001	<0.001	<0.001	0.002	0.001	0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.134	0.103	0.170	0.148	0.144	0.126	0.145	0.156	0.132	0.146	0.141	0.126
CuDis	Comp.	0.029	0.017	0.032	0.024	0.027	0.028	0.025	0.018	0.021	0.025	0.025	0.023
FeTot	Comp.	1.34	1.24	1.91	1.19	1.00	0.89	0.89	1.01	1.08	0.77	0.78	0.95
FeDis	Comp.	0.27	0.27	0.25	0.24	0.22	0.32	0.27	0.23	0.26	0.20	0.25	0.22
PbTot	Comp.	0.004	0.009	0.008	0.006	0.005	0.006	0.007	0.011	0.004	0.007	0.009	0.004
PbDis	Comp.	0.001	0.002	0.001	<0.001	0.001	0.002	0.002	0.002	<0.001	0.001	0.002	<0.001
MgTot	Comp.	5.95	3.28	5.31	5.38	4.63	3.83	4.74	4.26	4.99	4.94	5.73	5.20
MnTot	Comp.	0.084	0.075	0.080	0.074	0.063	0.075	0.080	0.073	0.087	0.067	0.073	0.078
MnDis	Comp.	0.054	0.047	0.042	0.040	0.039	0.052	0.054	0.048	0.056	0.041	0.051	0.054
HgTot	Comp.	0.27	0.13	0.20	0.15	0.20	0.11	0.13	0.13	0.21	0.12	0.15	0.17
MoTot	Comp.	0.004	0.003	0.003	0.005	0.004	0.005	0.003	0.003	0.005	0.005	0.004	0.003
MoDis	Comp.	0.002	<0.002	<0.002	0.003	0.003	0.003	0.002	<0.002	0.002	0.003	0.003	0.002
NiTot	Comp.	0.006	0.010	0.008	0.004	0.005	0.022	0.006	0.005	0.005	0.006	0.010	0.004
NiDis	Comp.	0.003	0.005	0.004	0.002	0.002	0.016	0.003	0.003	0.002	0.002	0.005	0.002
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.147	0.155	0.196	0.199	0.151	0.146	0.187	0.187	0.154	0.161	0.160	0.157
ZnDis	Comp.	0.068	0.071	0.068	0.063	0.071	0.054	0.081	0.071	0.067	0.064	0.072	0.077

Note: All results reported are in mg/L except for Mercury which is reported in ug/L.

NW LANGLEY WWTP – 2009 Comprehensive Effluent Data

Parameter	Sample Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TKN	Comp.	25	28	30	30	20	6	8	9	4	6	8	15
NO3	Grab	1.51	0.24	0.02	0.44	6.57	17.5	15.9	2.32	9.81	11.1	10.3	6.16
NO2	Grab	0.12	0.17	0.02	0.38	0.38	0.07	0.55	6.32	<0.01	0.06	0.79	0.36
NH3	Comp.	21.3	22.3	23.9	27.9	15.5	1.9	4.3	5.0	0.6	1.6	3.4	10.3
SO4	Comp.	33.7	31.7	34.3	37.1	35.4	28.2	36.1	33.3	35.1	37.5	34.7	36.0
PTot	Comp.	4.1	5.7	6.7	7.2	5.6	5.5	7.3	5.0	4.5	5.4	4.9	5.4
PDis	Comp.	3.4	4.3	5.2	5.8	4.8	4.8	6.2	4.5	4.0	4.8	4.0	4.7
MBAS	Grab	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	<0.1	0.2	0.1	0.2
O&G	Grab	<6	6	<7	<6	<6	<6	<6	<6	<7	<6	<7	<5
Phenol	Grab	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CNTot	Grab	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
AlTot	Comp.	0.15	0.14	0.20	0.13	0.12	0.18	0.16	0.13	0.10	0.11	0.14	0.13
AlDis	Comp.	0.03	0.06	0.06	0.04	0.03	0.06	0.06	0.04	0.04	0.04	0.06	0.09
AsTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
BaTot	Comp.	0.005	0.005	0.007	0.005	0.004	0.007	0.005	0.005	0.005	0.005	0.006	0.005
BaDis	Comp.	0.003	0.003	0.004	0.003	0.003	0.004	0.003	0.004	0.003	0.004	0.004	0.004
BTot	Comp.	0.14	0.17	0.17	0.18	0.18	0.19	0.19	0.17	0.18	0.21	0.18	0.16
BDis	Comp.	0.14	0.16	0.16	0.17	0.17	0.18	0.18	0.17	0.17	0.21	0.17	0.16
CaTot	Comp.	14.5	10.6	13.2	13.9	13.1	12.3	12.7	12.2	14.4	14.2	15.0	15.1
CdTot	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CdDis	Comp.	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
CrTot	Comp.	0.005	0.004	0.004	0.004	0.003	0.005	0.003	0.003	0.003	0.003	0.003	0.004
CrDis	Comp.	0.004	0.003	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.003	0.004
CoTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CoDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
CuTot	Comp.	0.028	0.026	0.025	0.026	0.022	0.034	0.027	0.018	0.016	0.023	0.034	0.025
CuDis	Comp.	0.015	0.009	0.007	0.015	0.015	0.026	0.022	0.015	0.012	0.018	0.016	0.014
FeTot	Comp.	0.20	0.19	0.21	0.18	0.14	0.17	0.17	0.14	0.13	0.15	0.15	0.21
FeDis	Comp.	0.09	0.10	0.10	0.09	0.08	0.08	0.10	0.09	0.08	0.08	0.09	0.15
PbTot	Comp.	0.002	0.002	0.001	0.001	<0.001	<0.001	0.002	0.002	<0.001	<0.001	0.002	0.001
PbDis	Comp.	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	<0.001
MgTot	Comp.	4.37	2.88	4.49	4.65	4.25	3.79	3.95	3.48	3.89	4.60	5.03	4.72
MnTot	Comp.	0.055	0.055	0.053	0.047	0.046	0.061	0.055	0.046	0.064	0.049	0.055	0.053
MnDis	Comp.	0.049	0.047	0.046	0.039	0.041	0.055	0.048	0.043	0.058	0.044	0.049	0.049
HgTot	Comp.	0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MoTot	Comp.	<0.002	0.003	0.002	<0.002	<0.002	0.002	0.002	<0.002	0.002	0.002	0.003	<0.002
MoDis	Comp.	<0.002	0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	0.003	0.002	0.003	<0.002
NiTot	Comp.	0.005	0.009	0.008	0.008	0.007	0.069	0.011	0.005	0.014	0.006	0.012	0.004
NiDis	Comp.	0.004	0.007	0.007	0.006	0.005	0.063	0.010	0.005	0.013	0.006	0.011	0.004
SeTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
AgTot	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
AgDis	Comp.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SnTot	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SnDis	Comp.	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
ZnTot	Comp.	0.058	0.086	0.066	0.080	0.069	0.081	0.114	0.071	0.069	0.069	0.084	0.074
ZnDis	Comp.	0.046	0.060	0.053	0.057	0.062	0.069	0.101	0.064	0.061	0.060	0.072	0.069

Note: All results reported are in mg/L except for Mercury which is reported in ug/L.

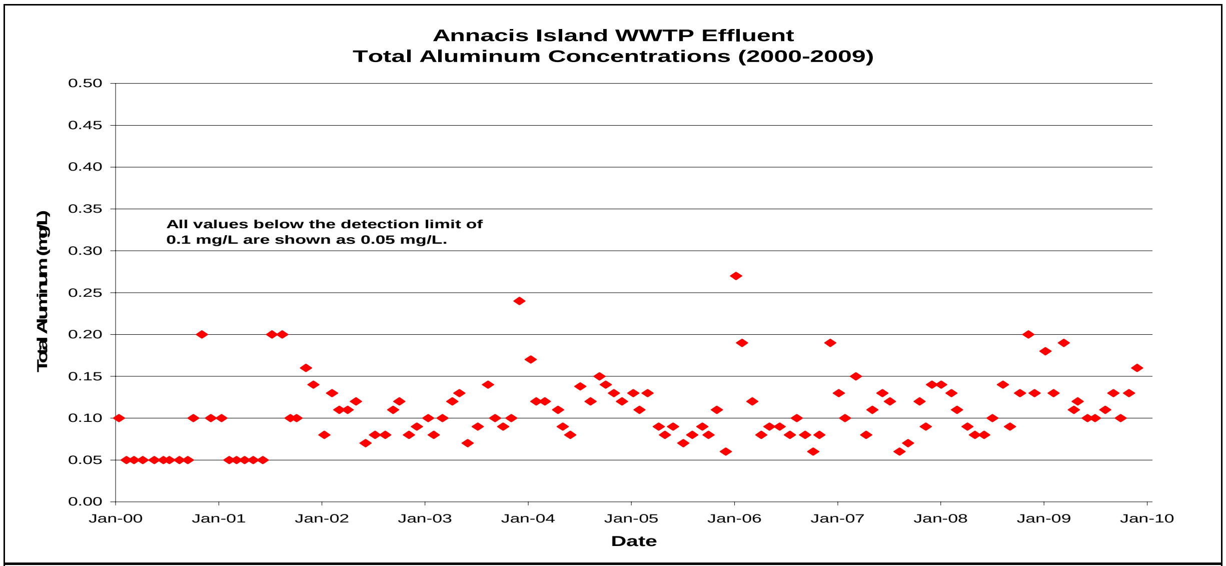
- Some metals results (eg., Nickel values) may be higher in the effluent than the influent because of long retention times in the equalization pond.

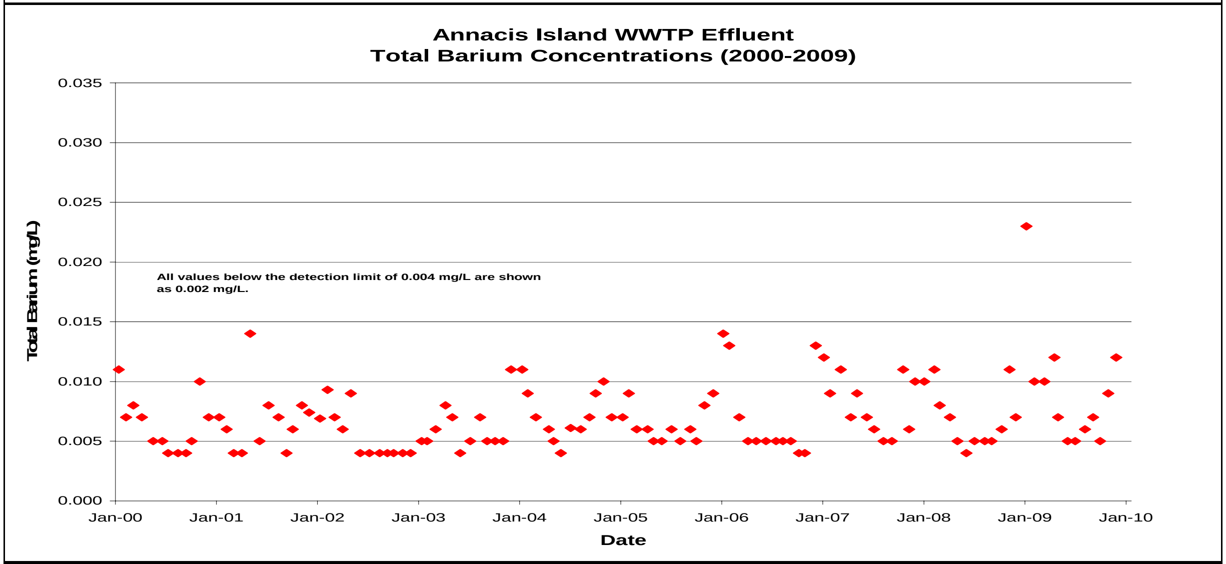
APPENDIX B

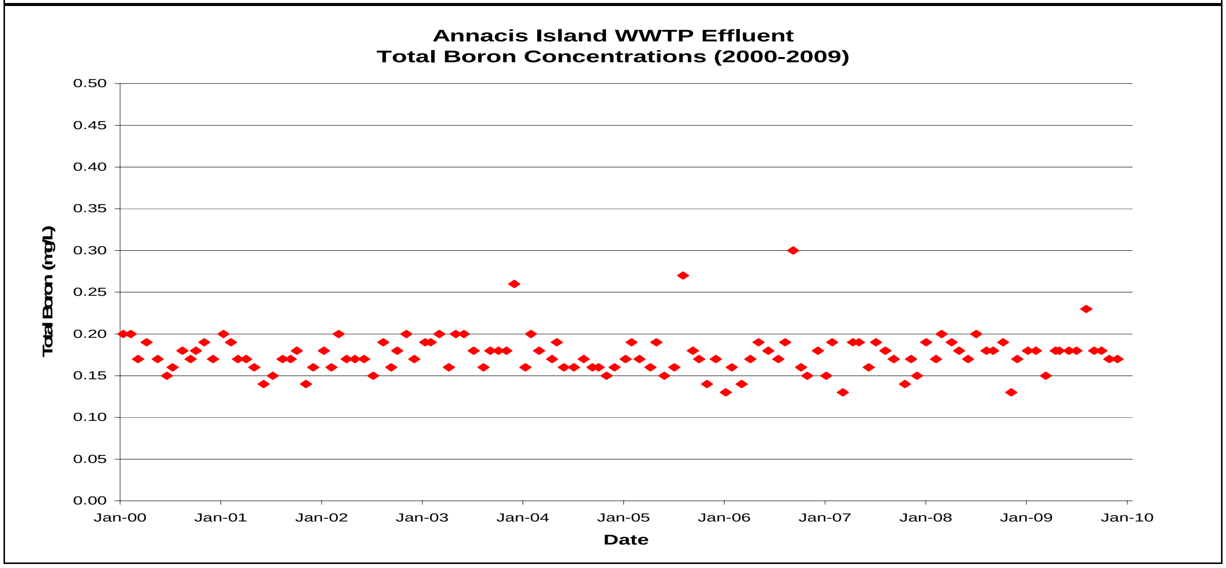
Additional Monitoring Data – Effluent Quality*

*10 year Summary - Selected Parameters based on current Operational Certificates and previous Permit Requirements.

Effluent Data Annacis WWTP







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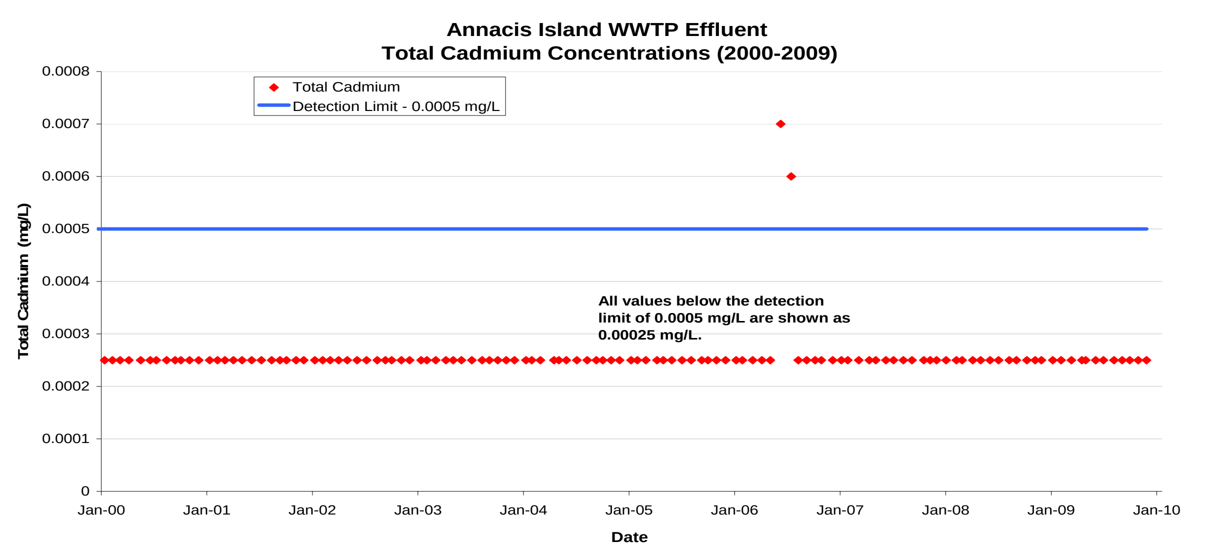

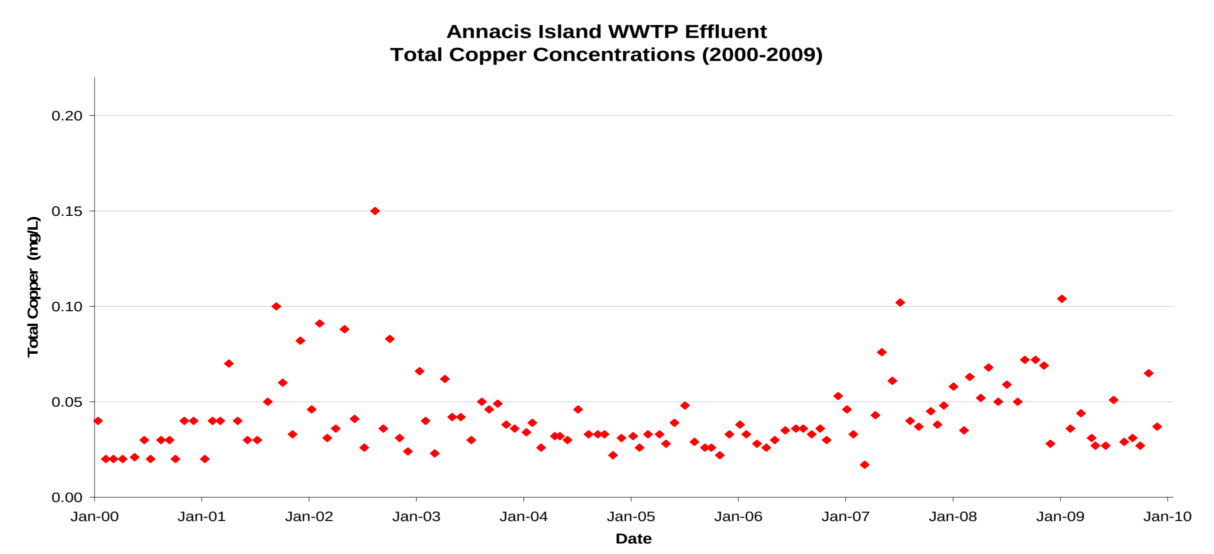

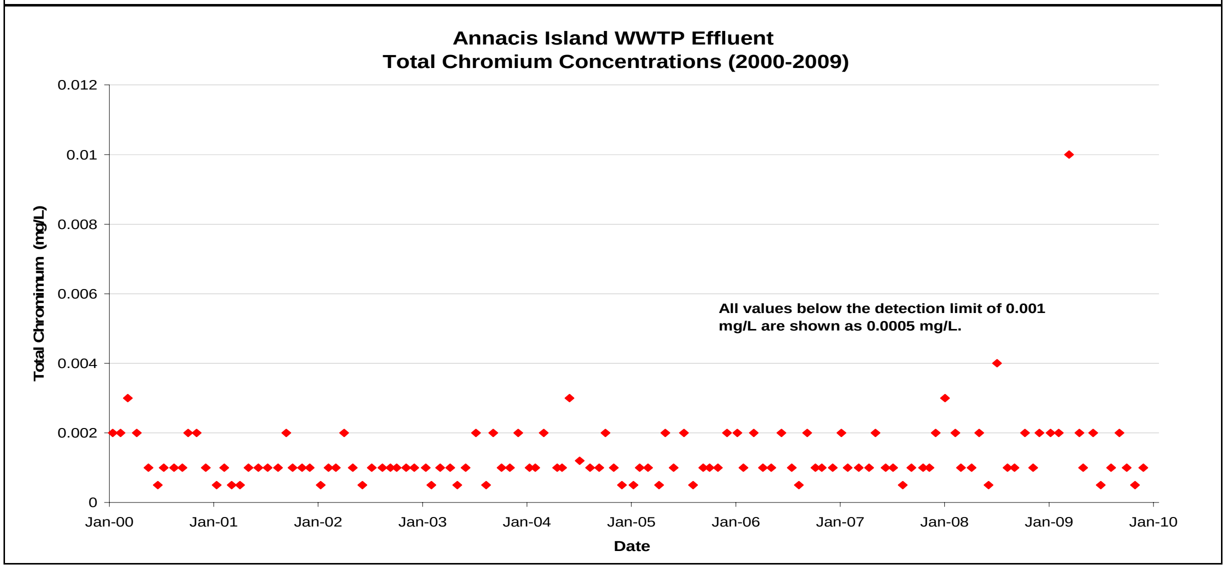

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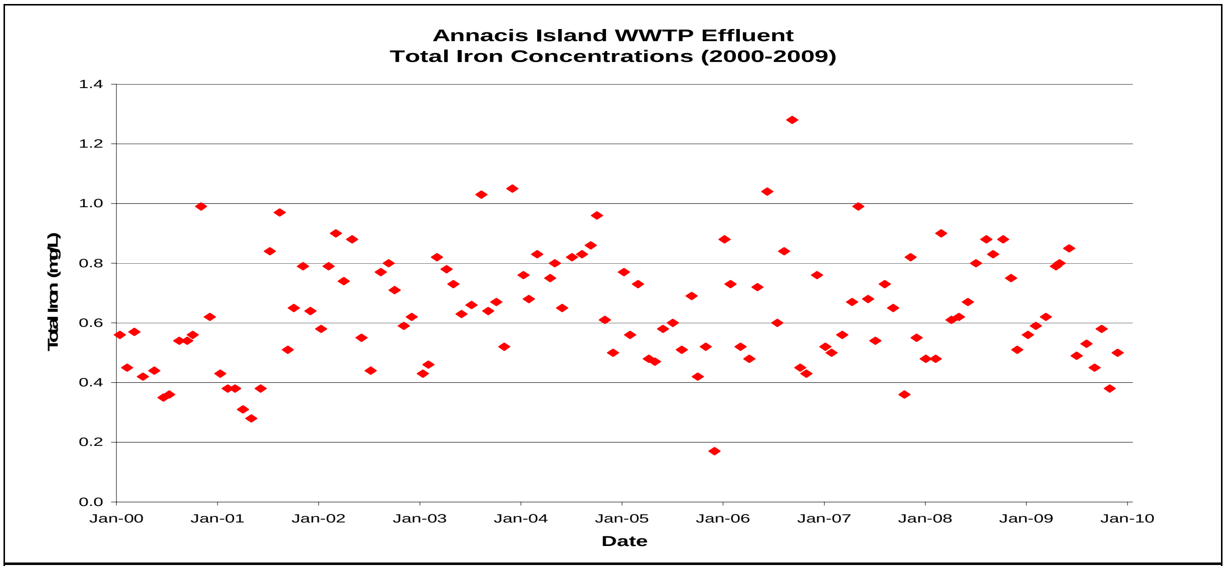

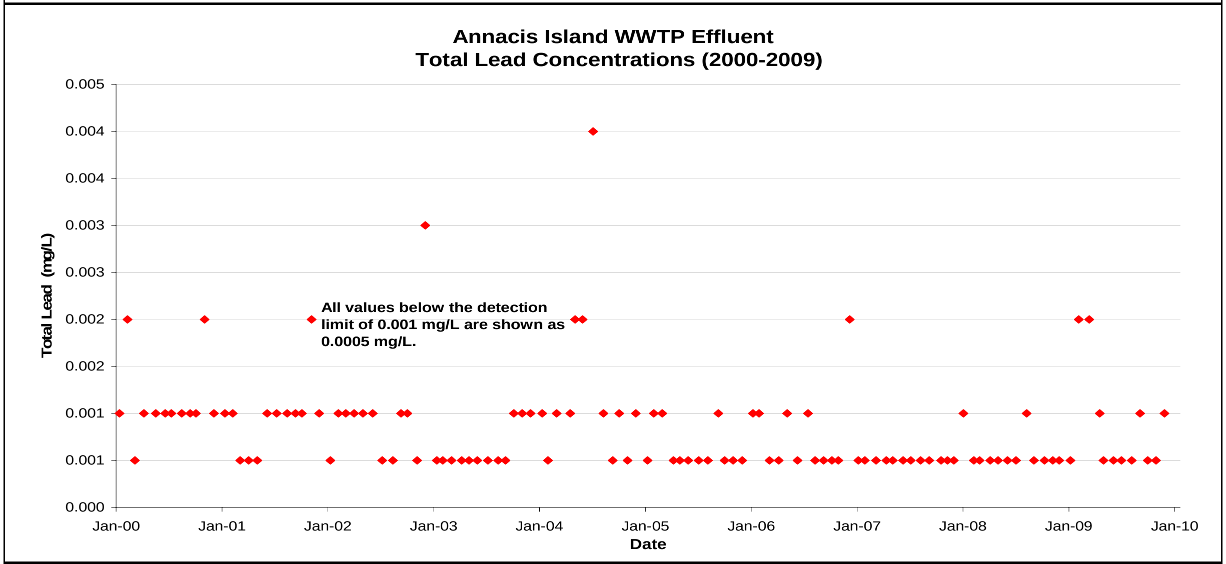

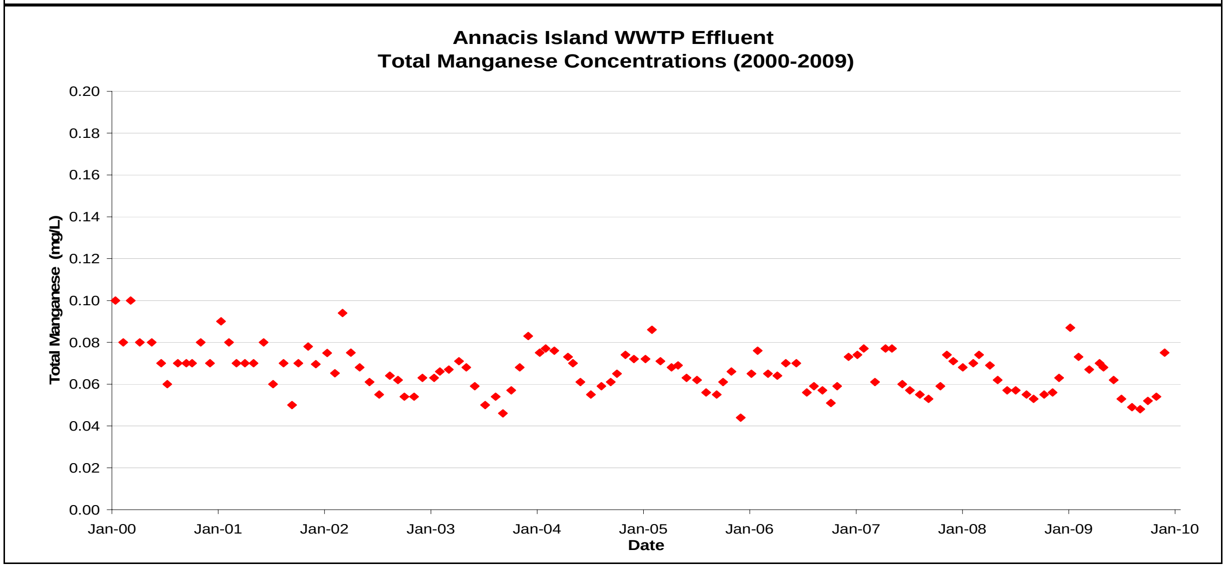

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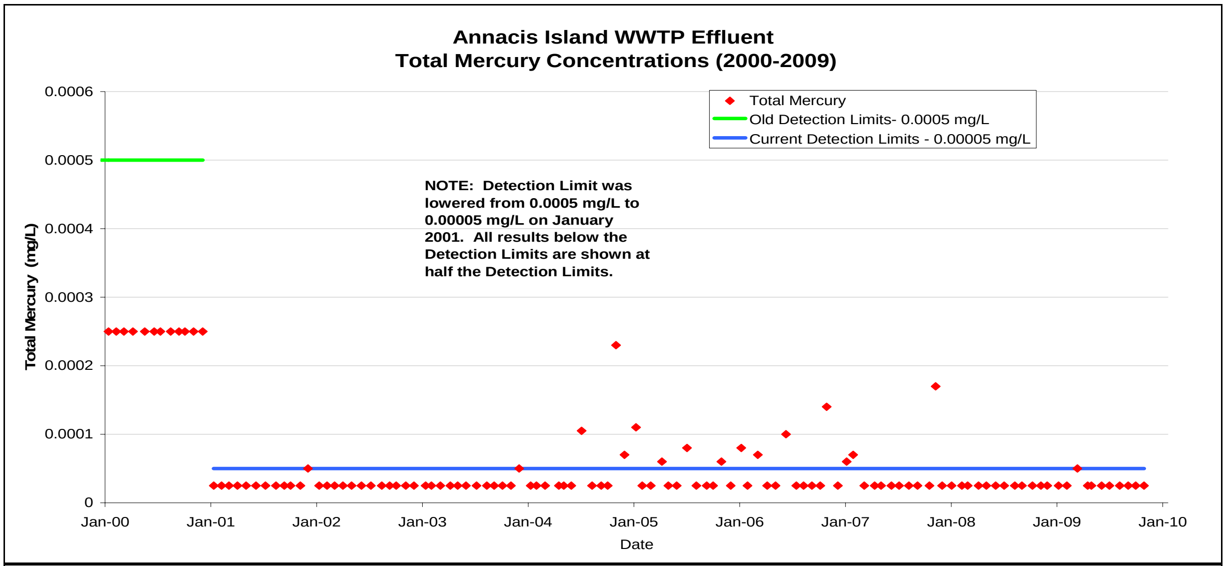

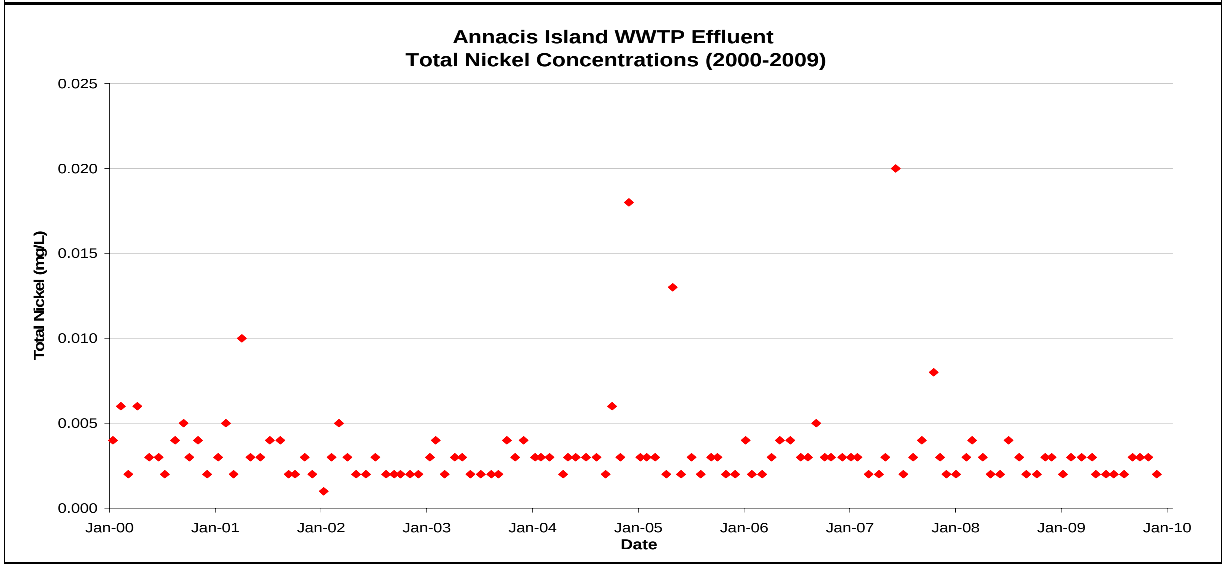

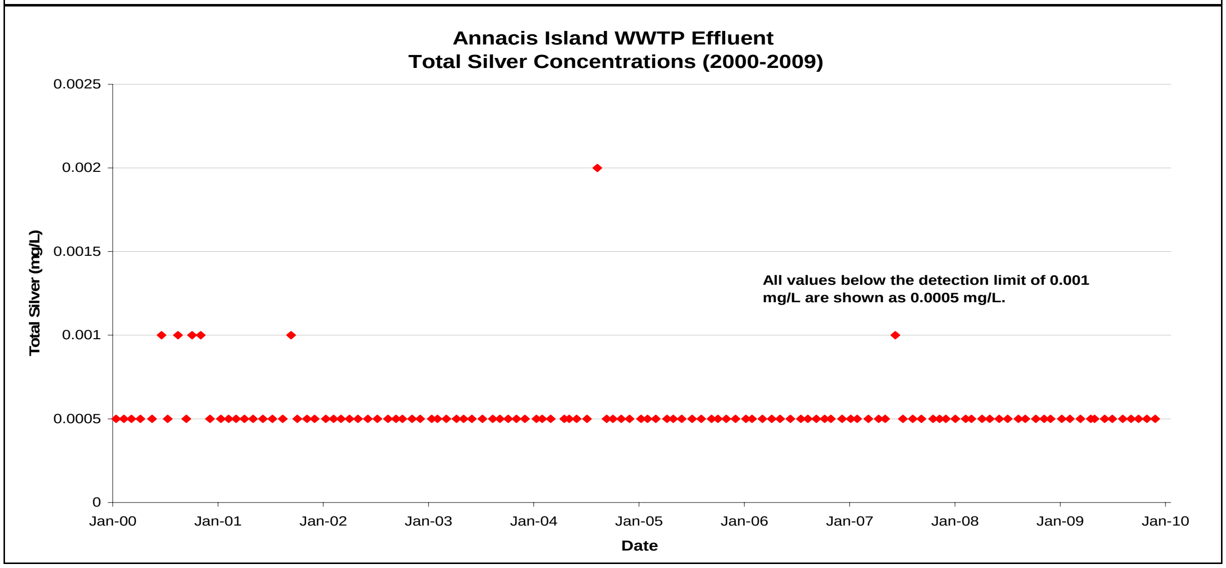

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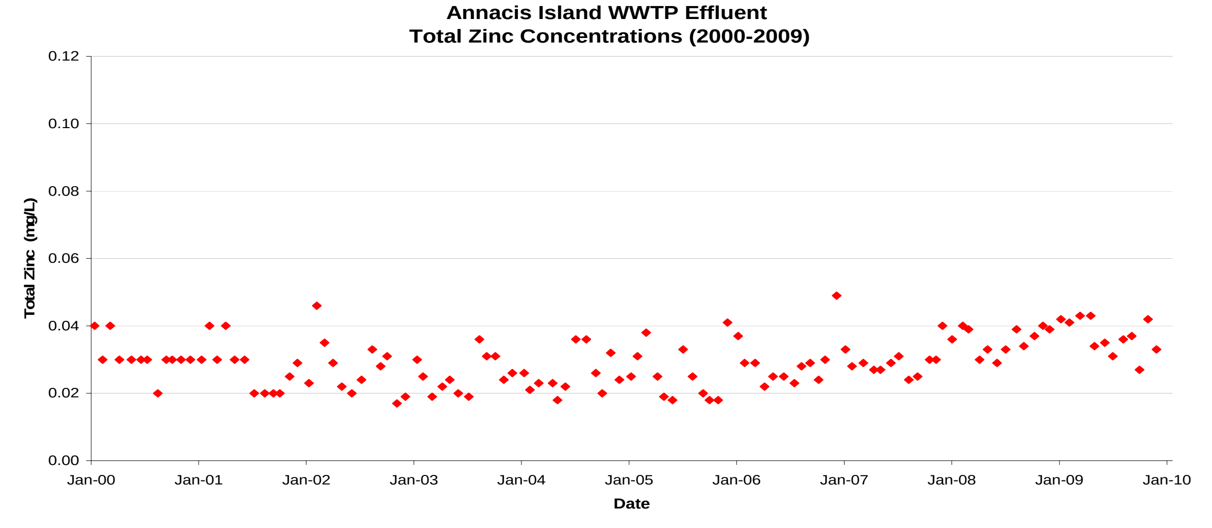

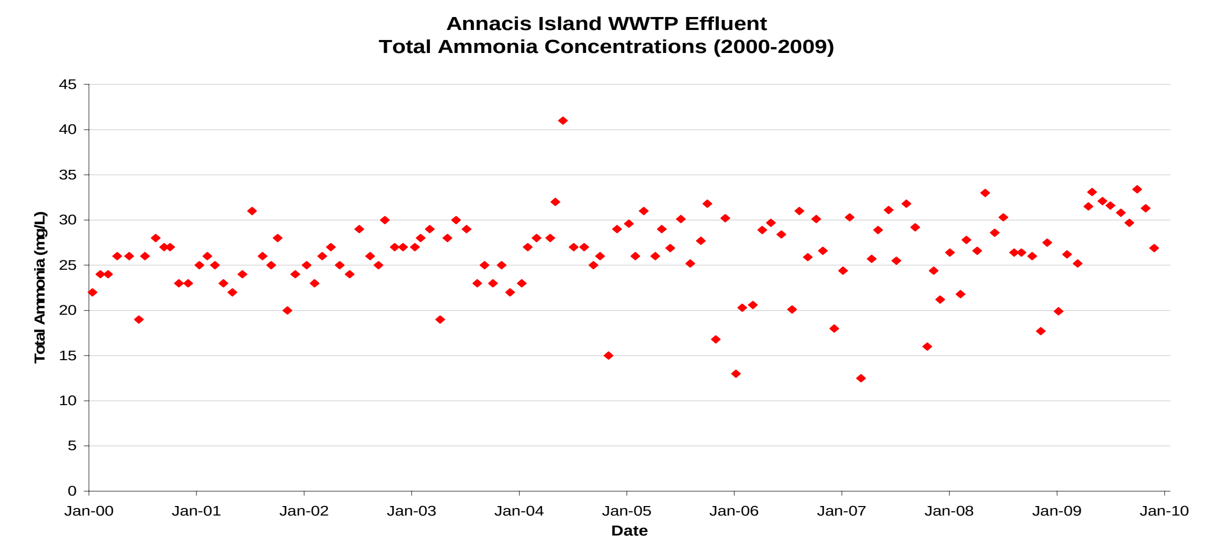

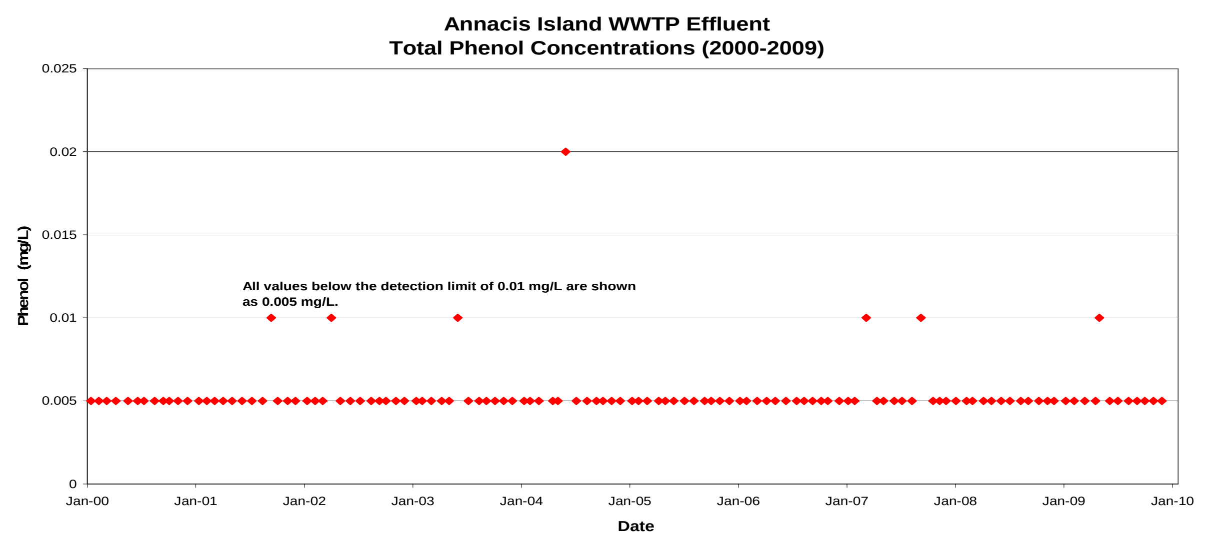

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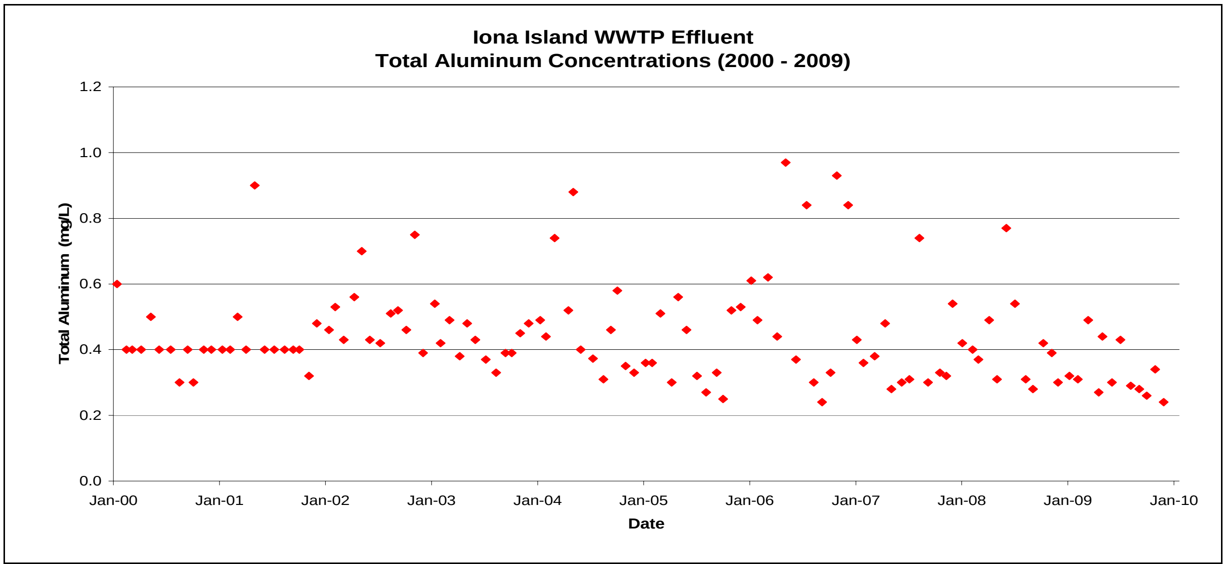

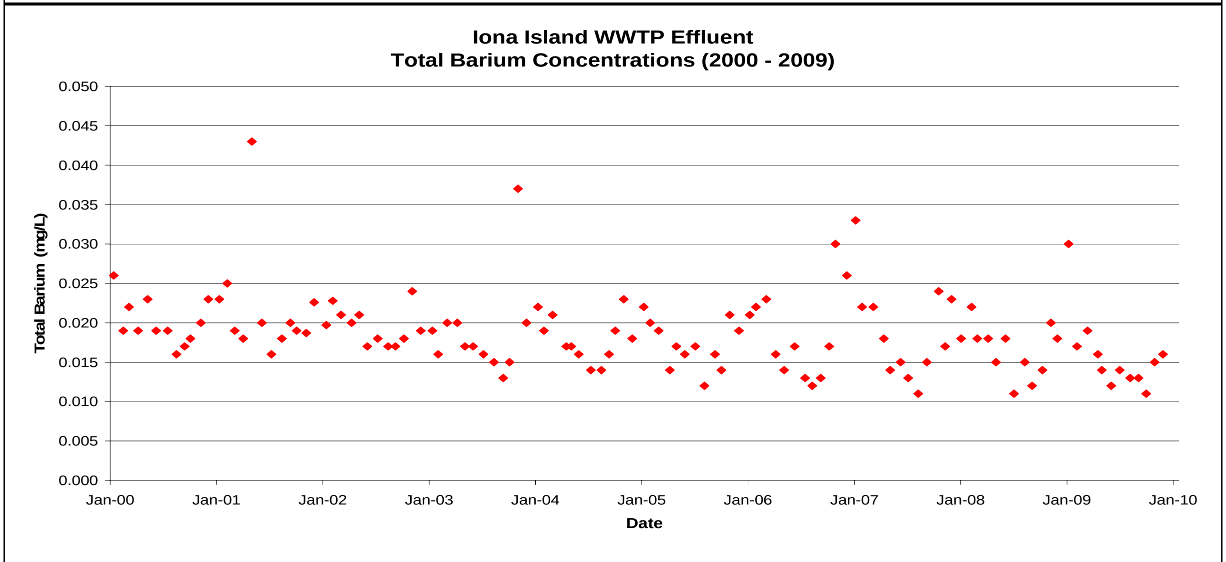

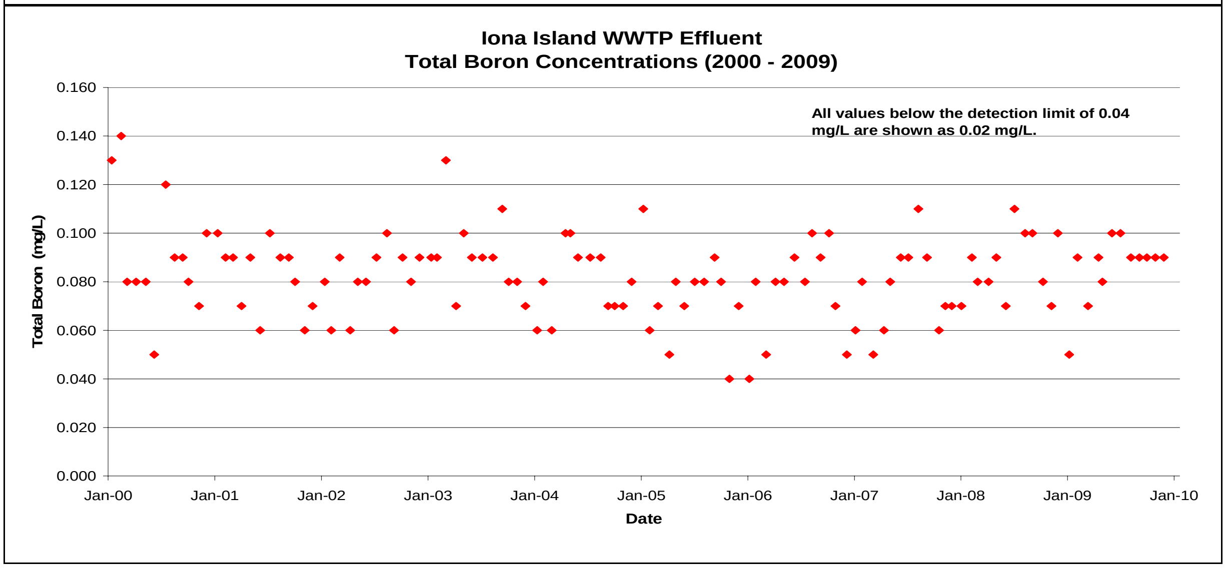

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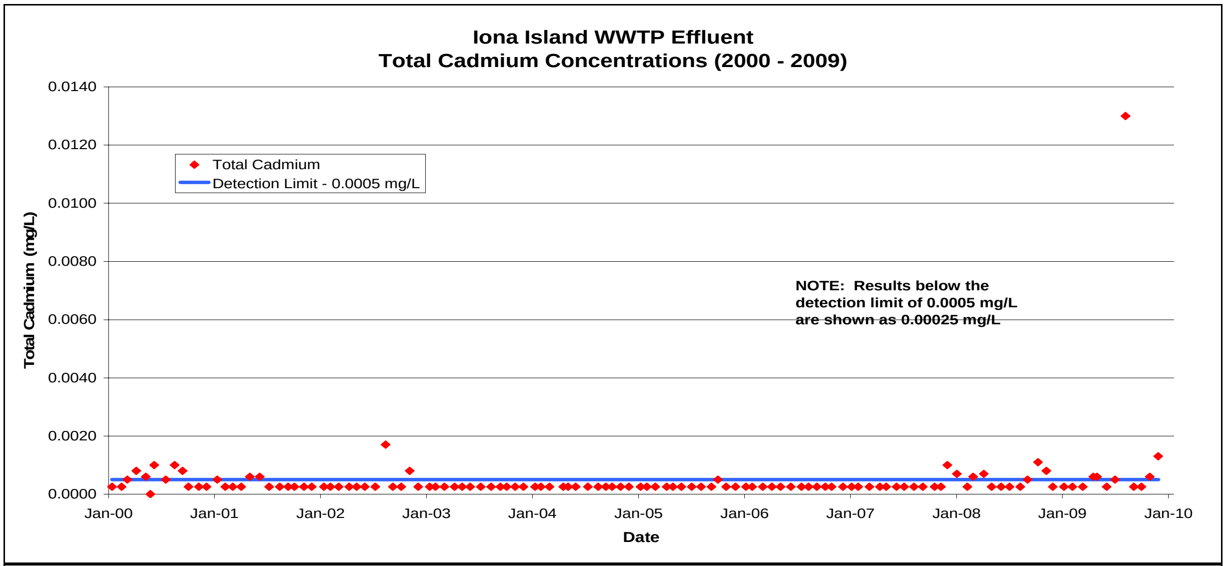

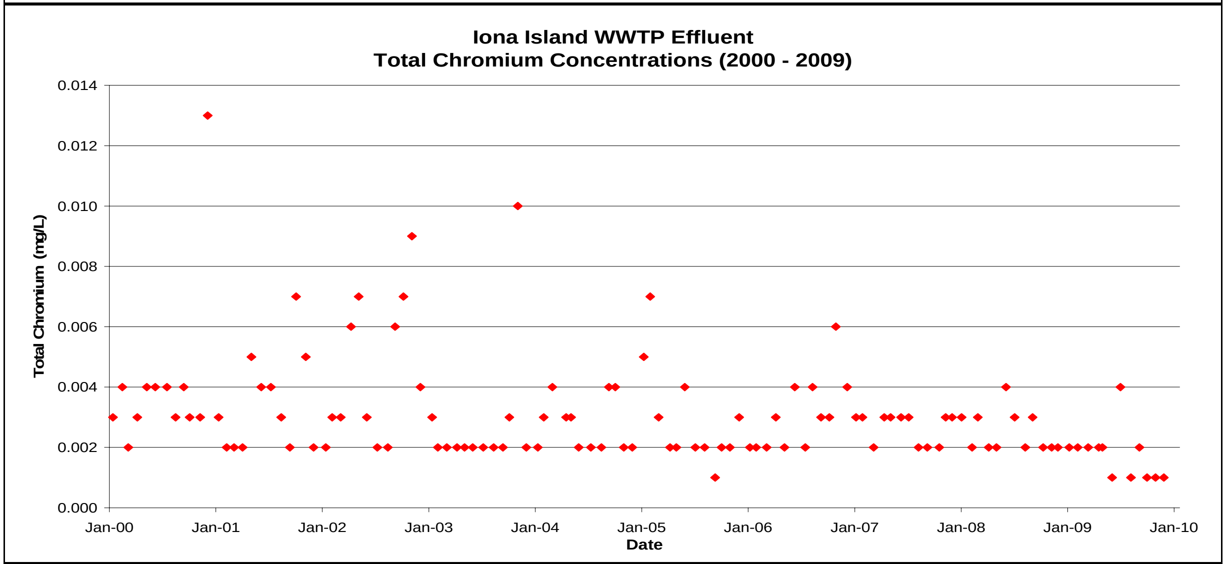

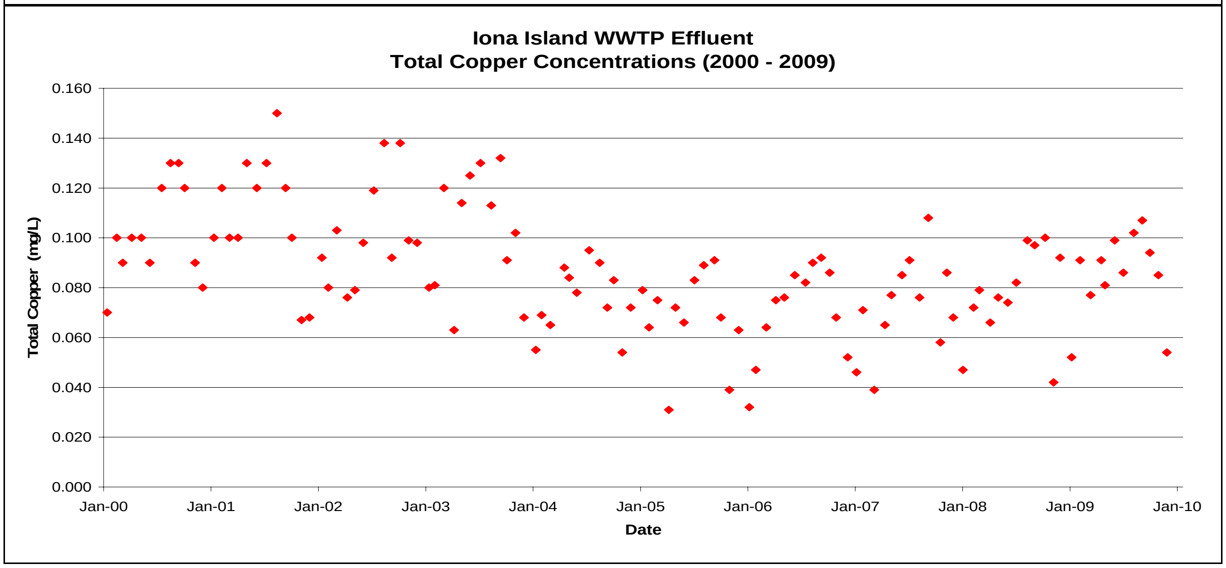

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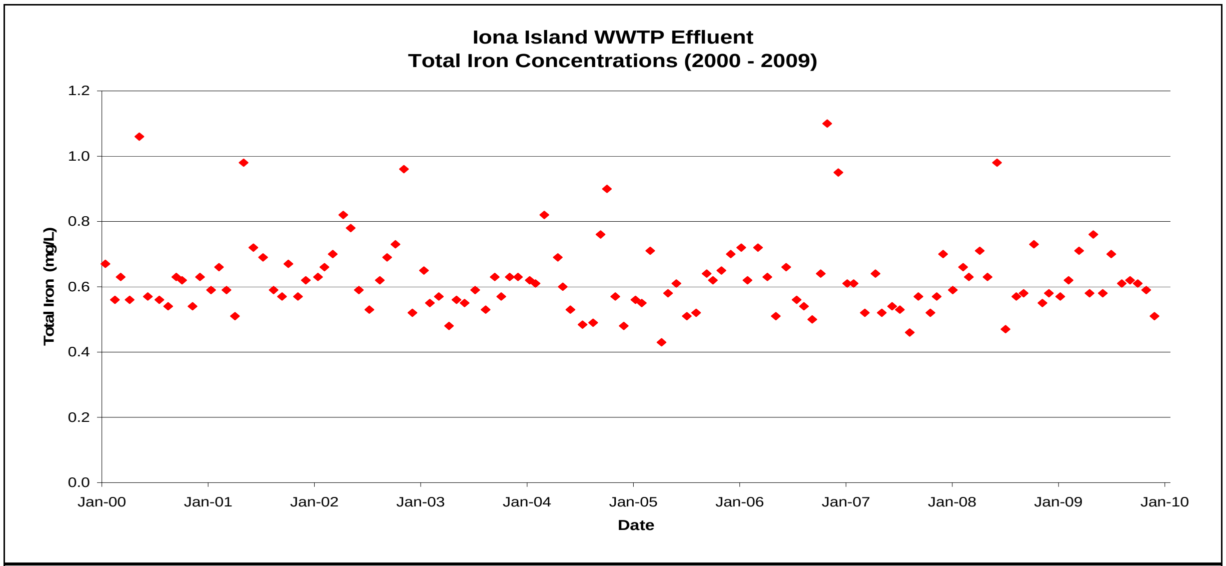

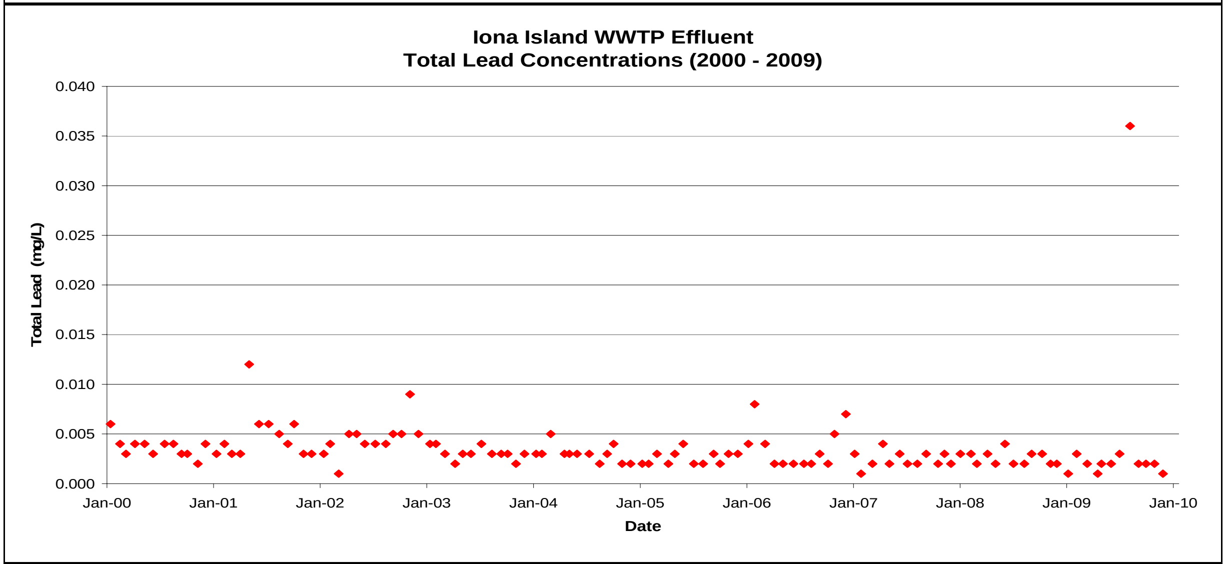

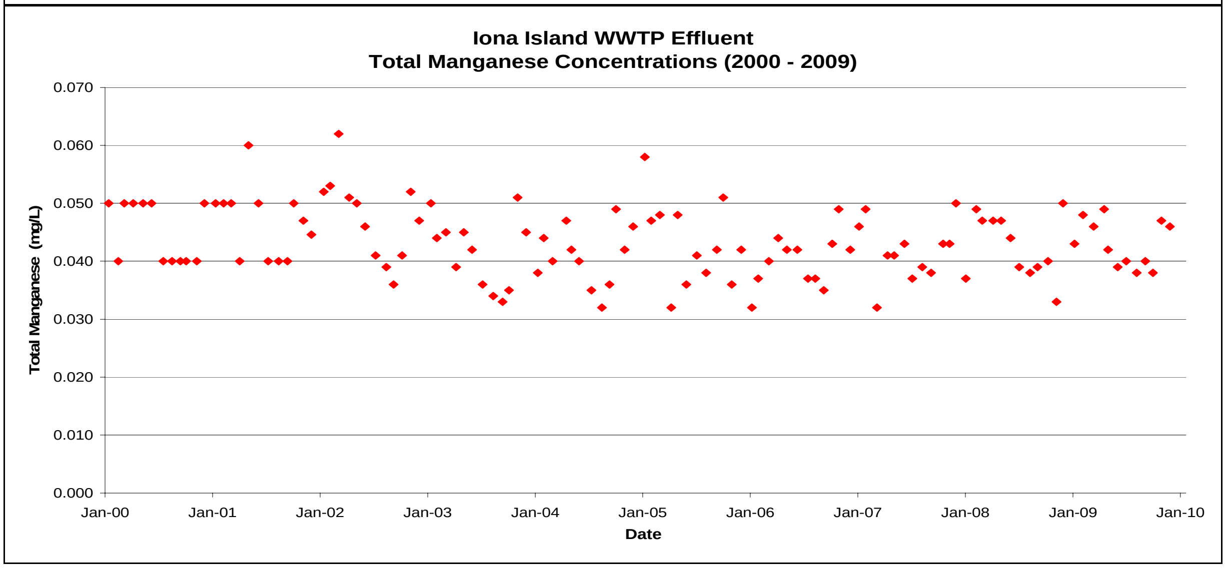

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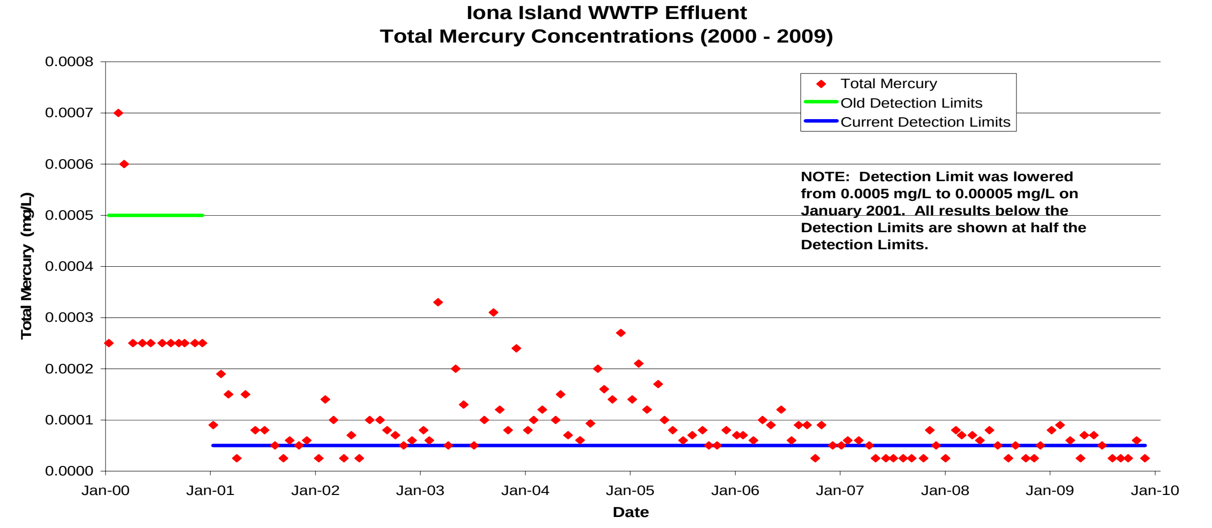

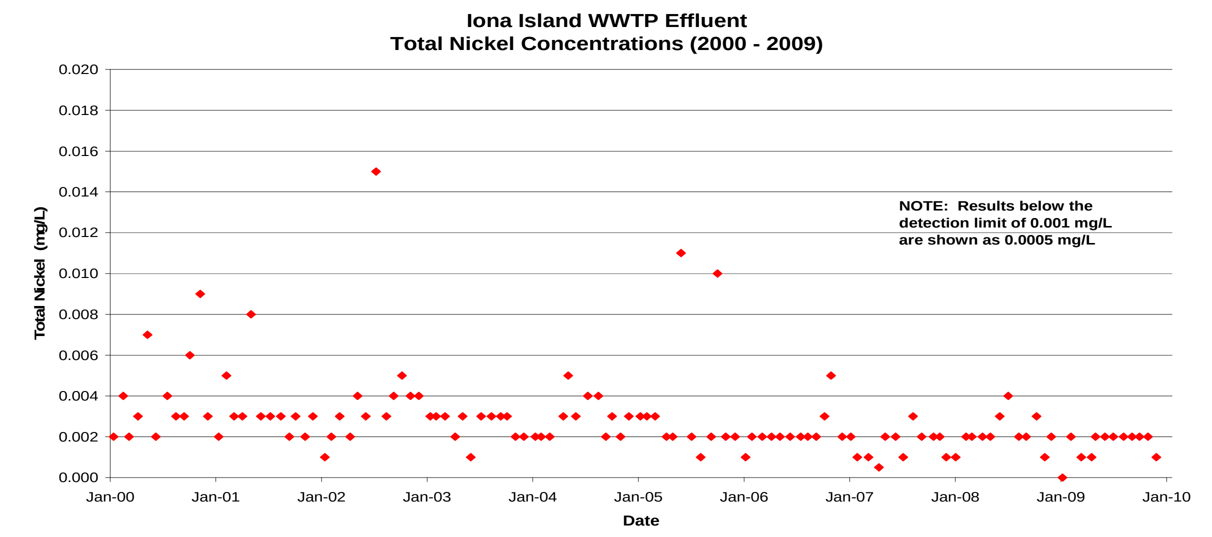

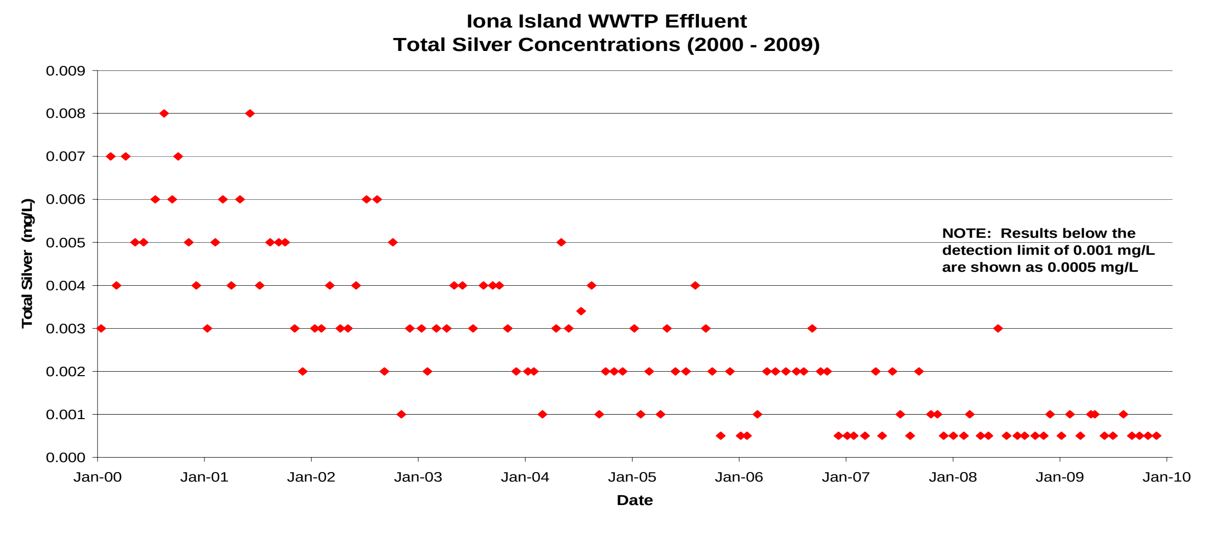

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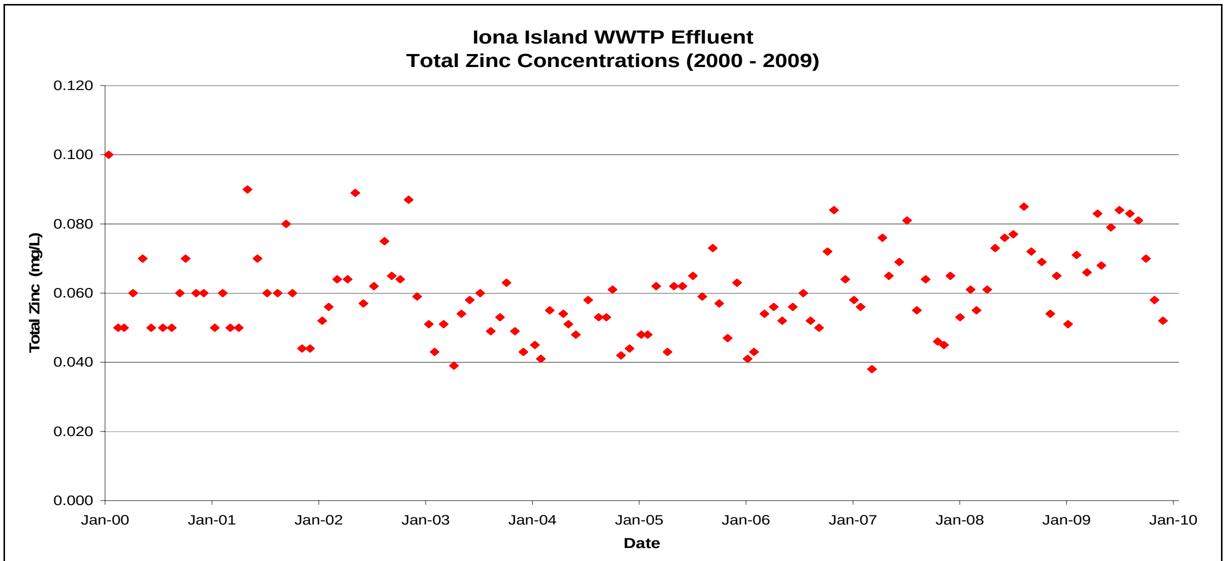

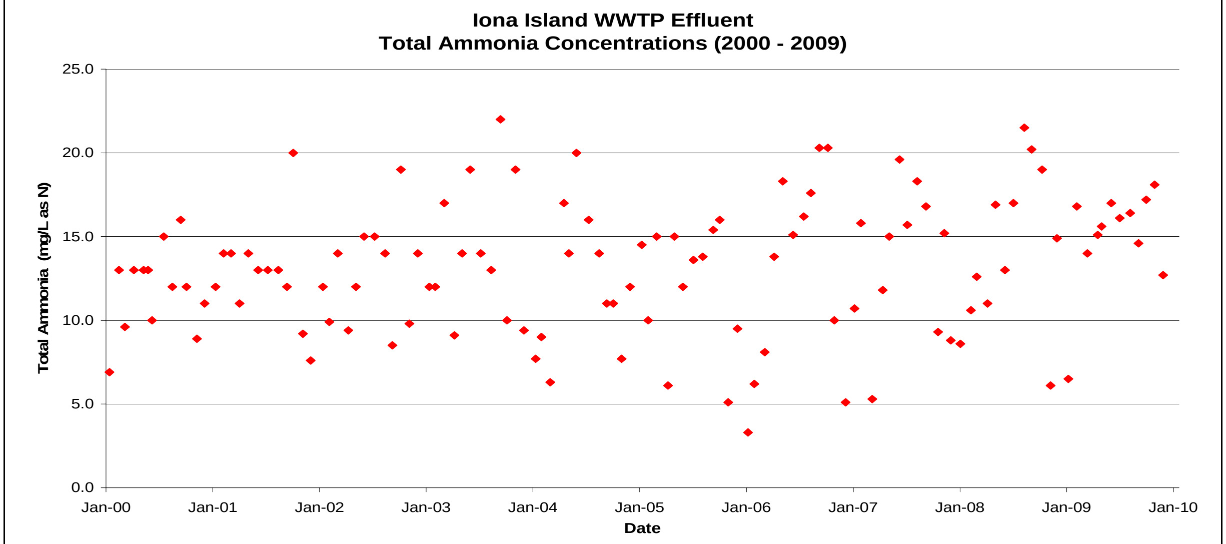

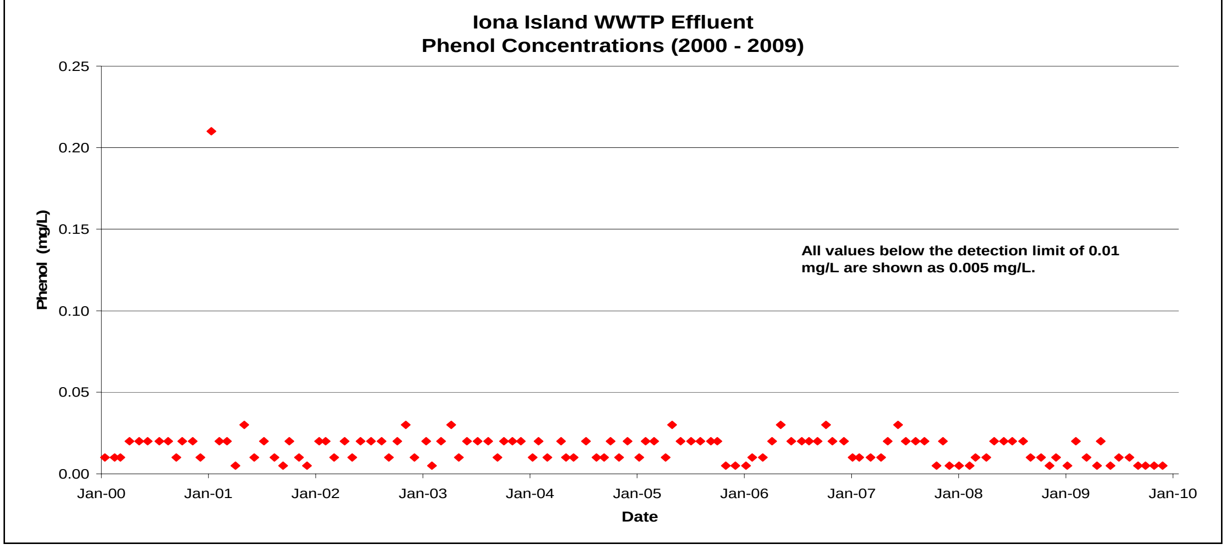

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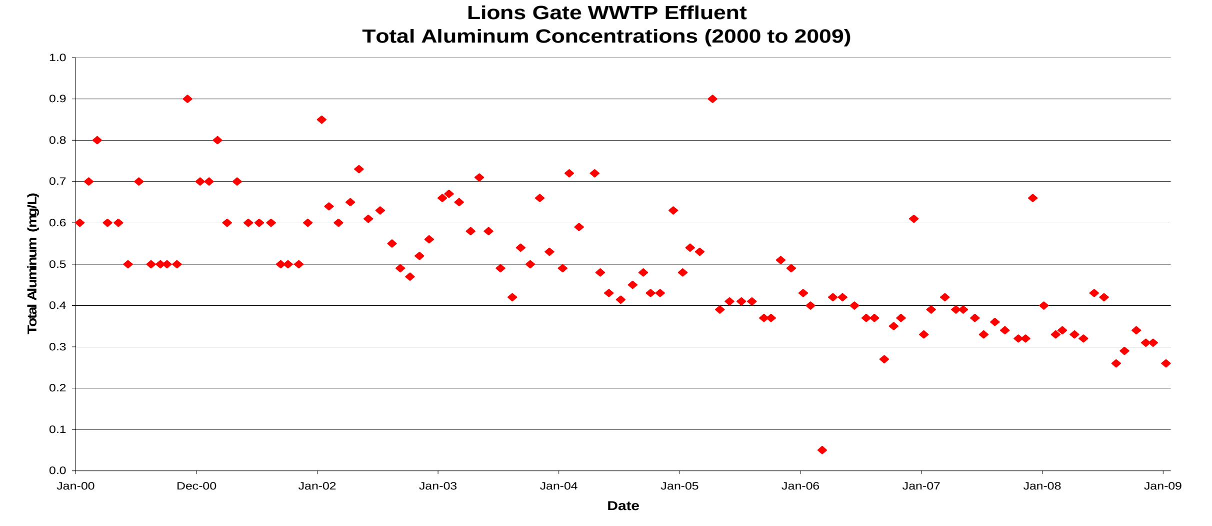

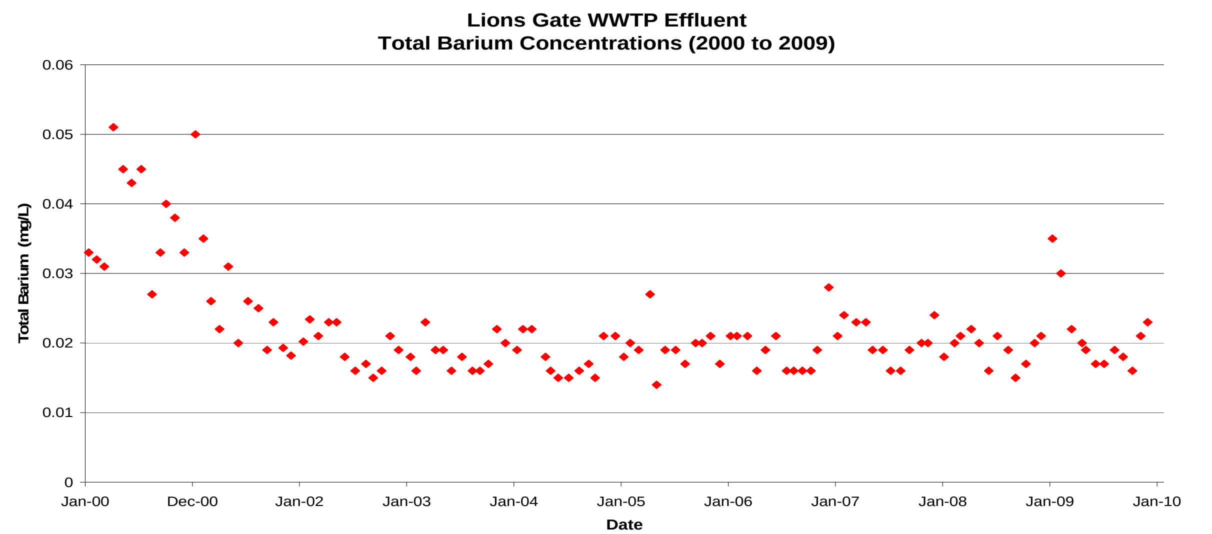

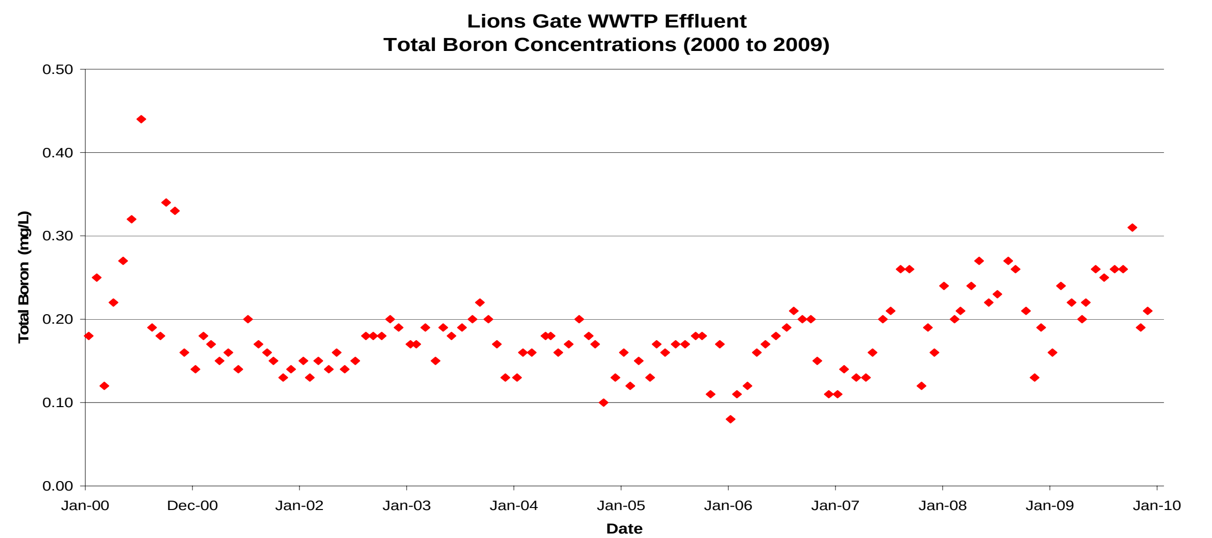

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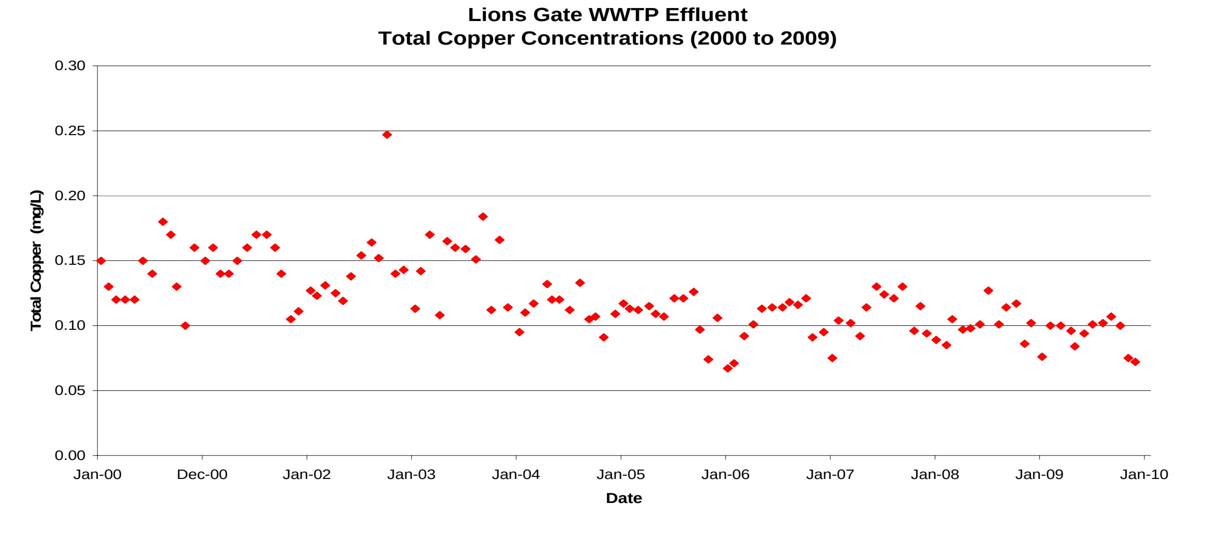

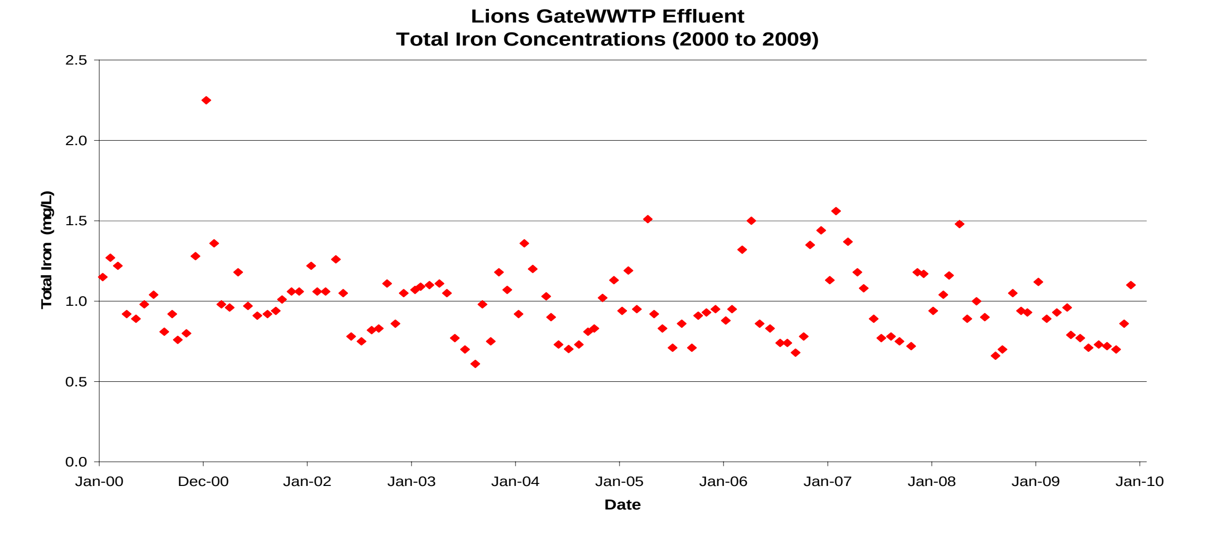

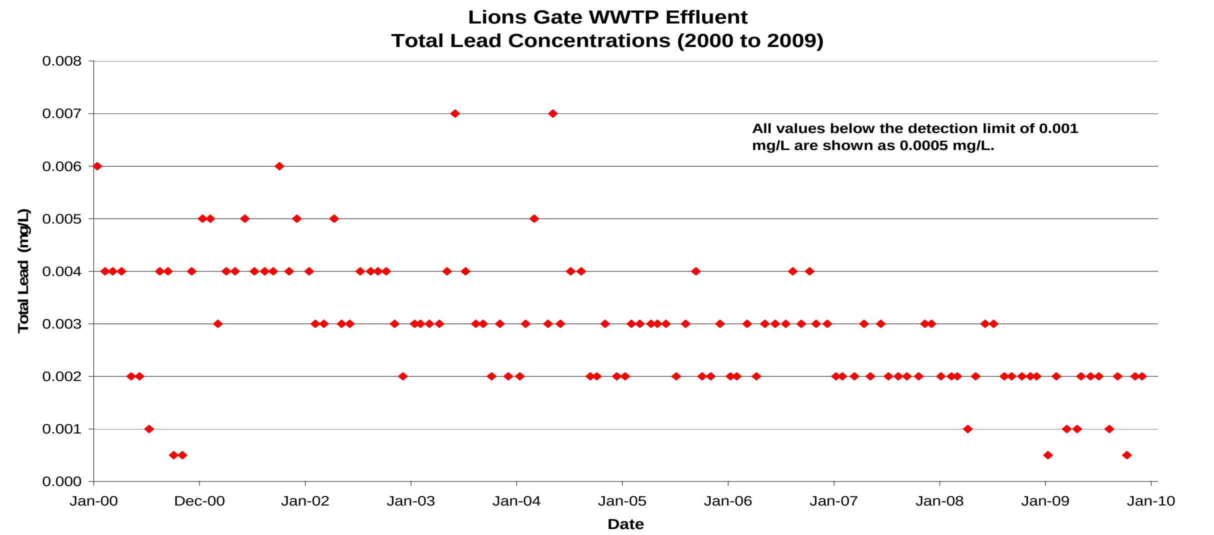

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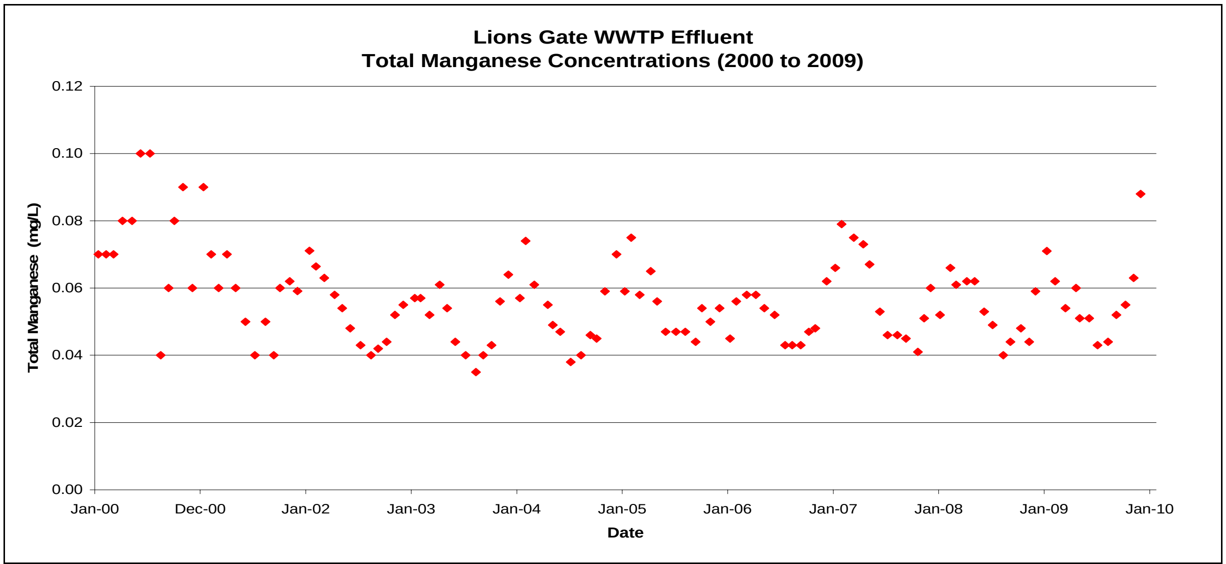

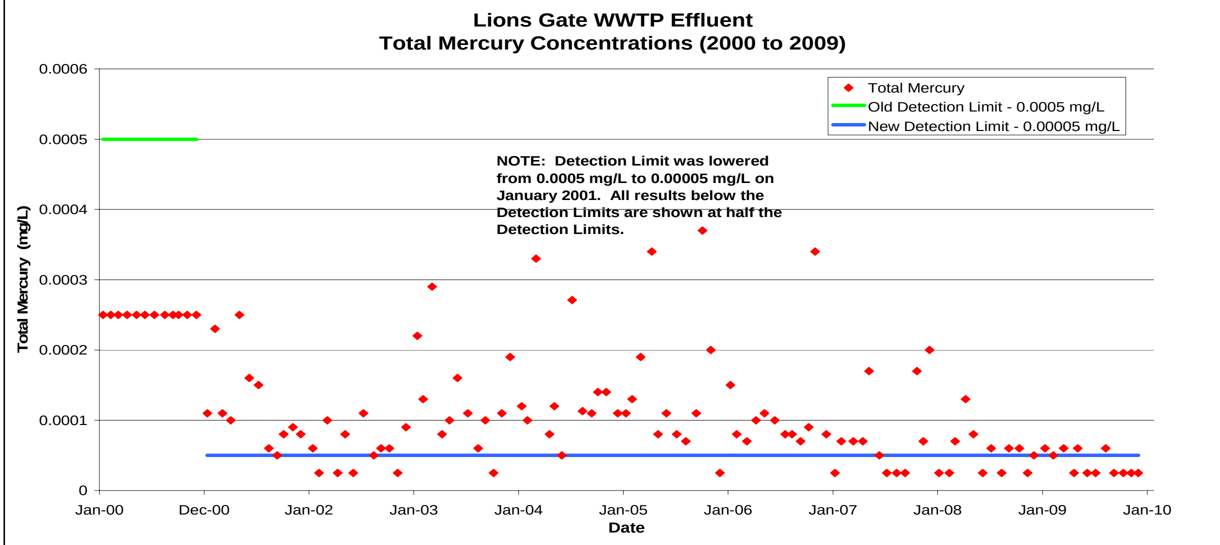

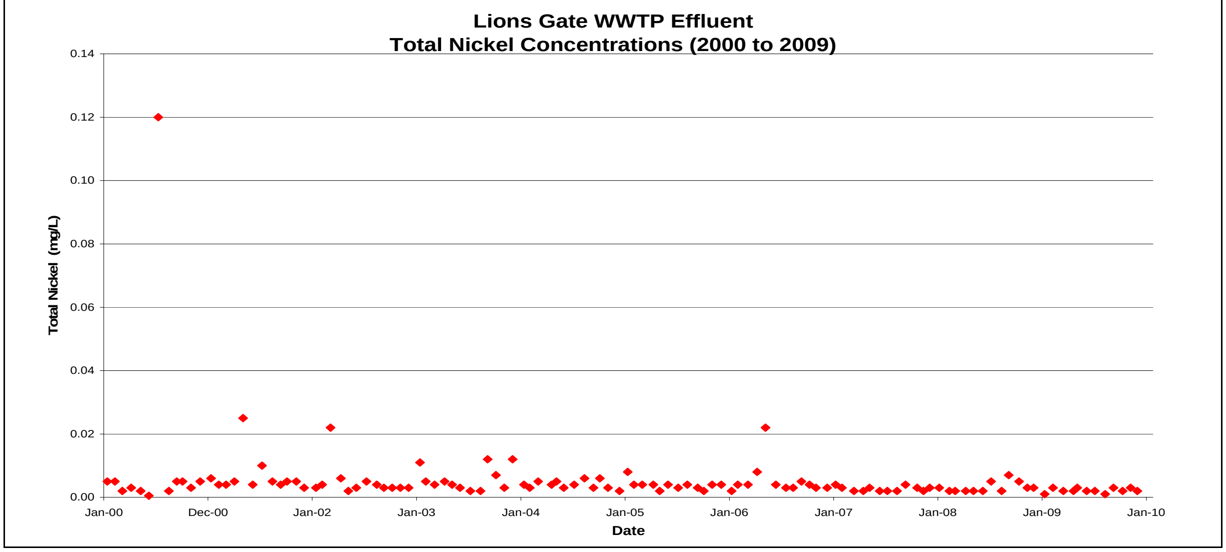

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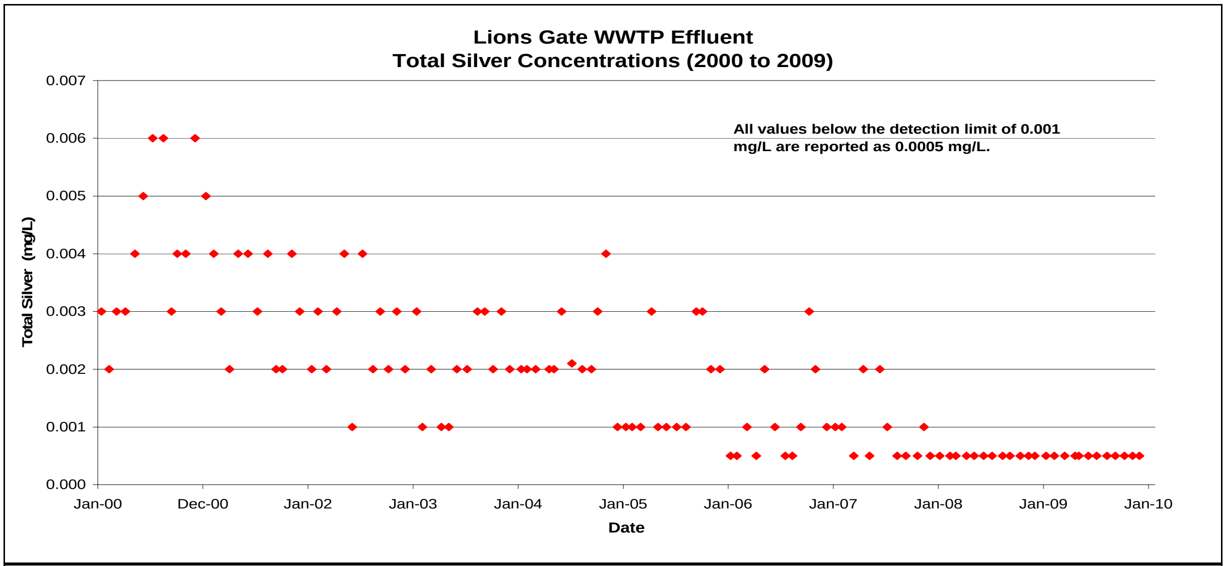

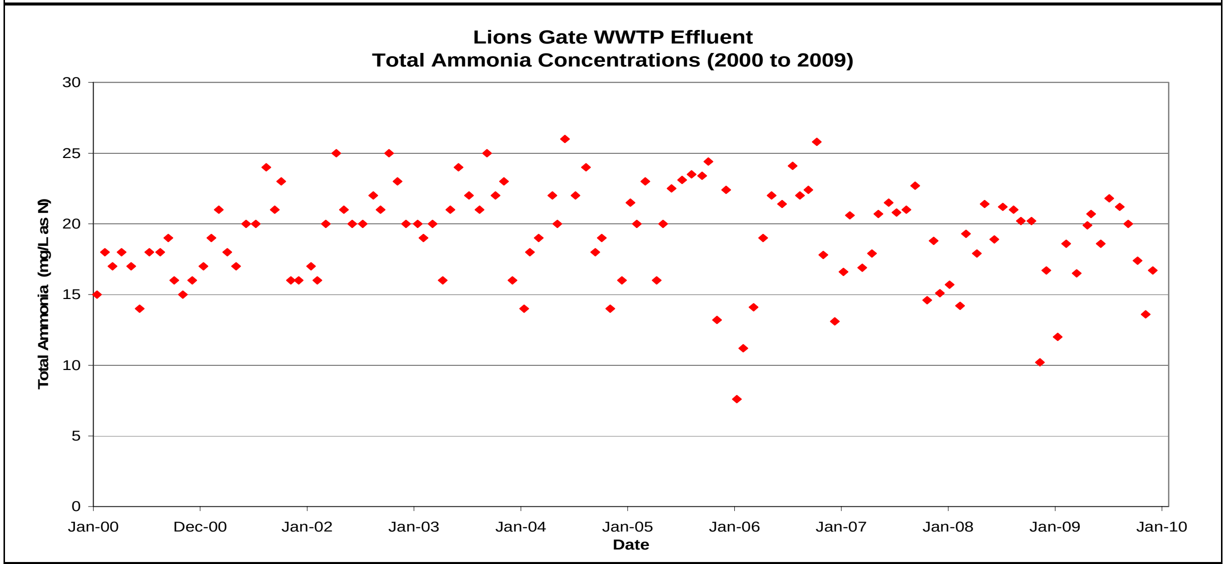

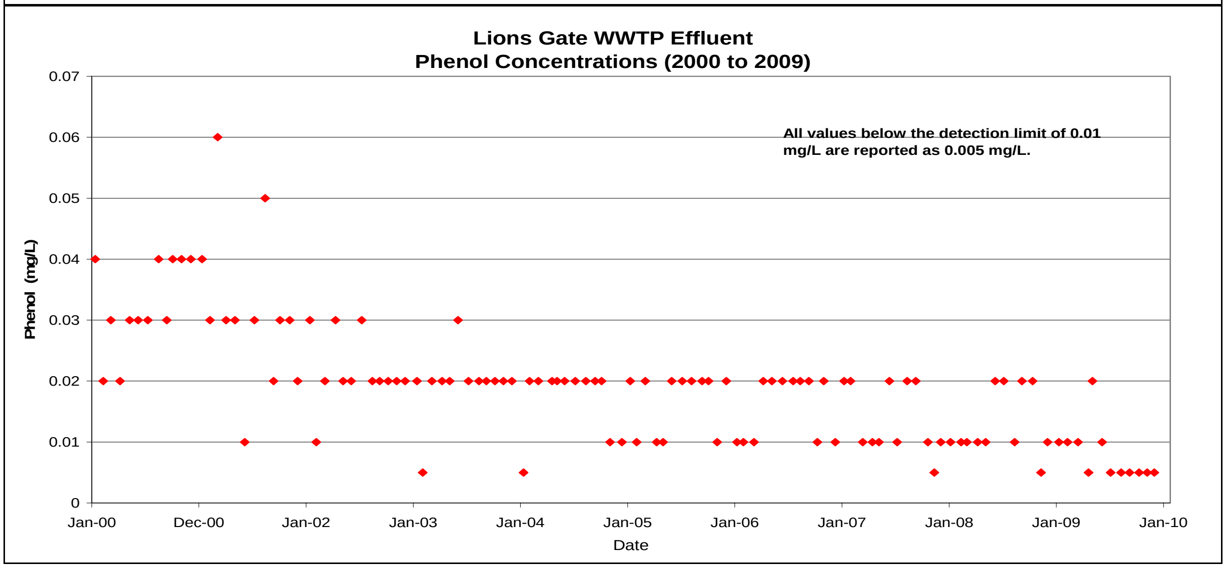

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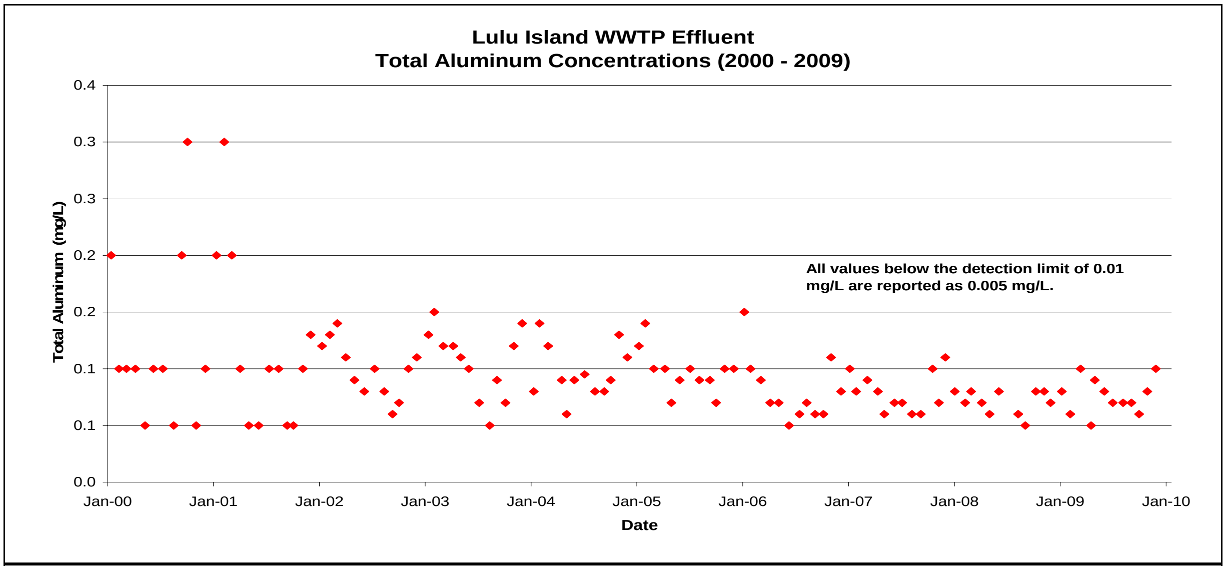

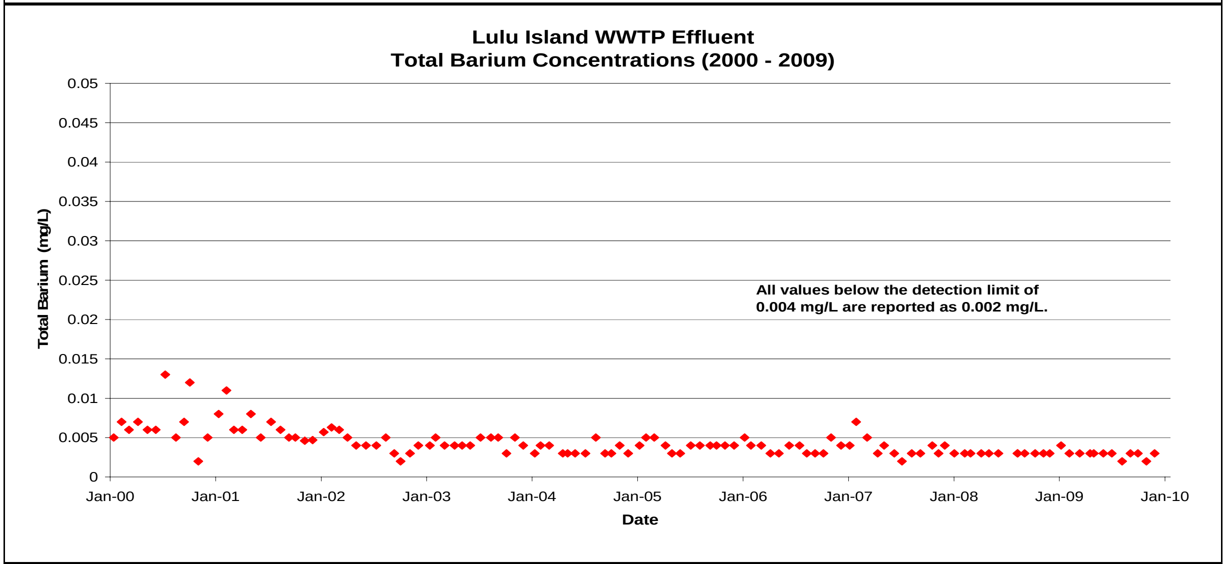

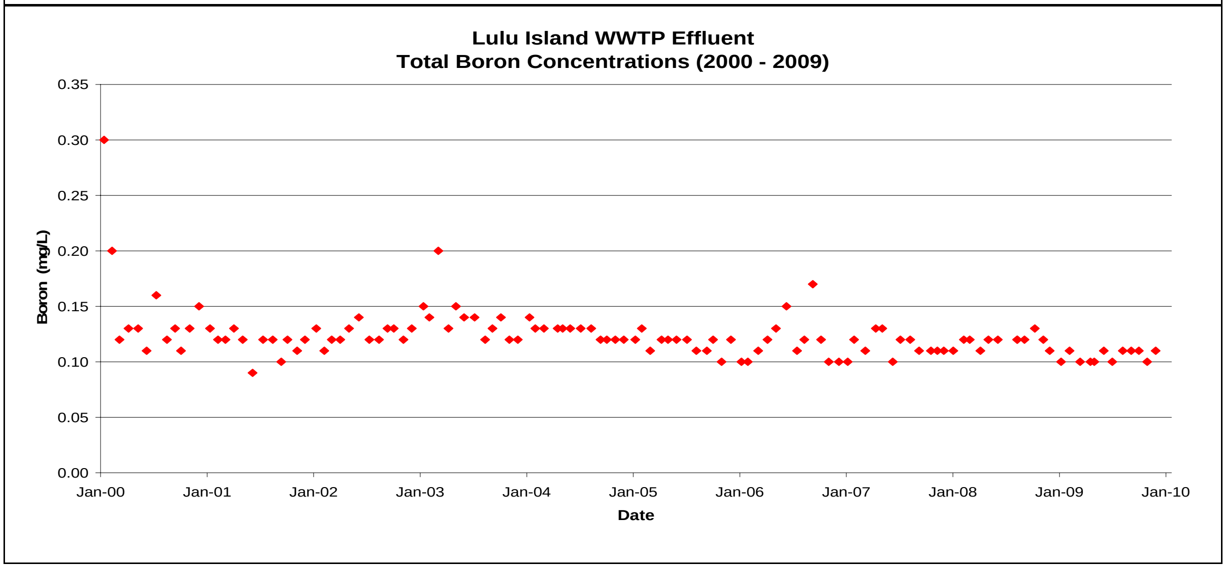

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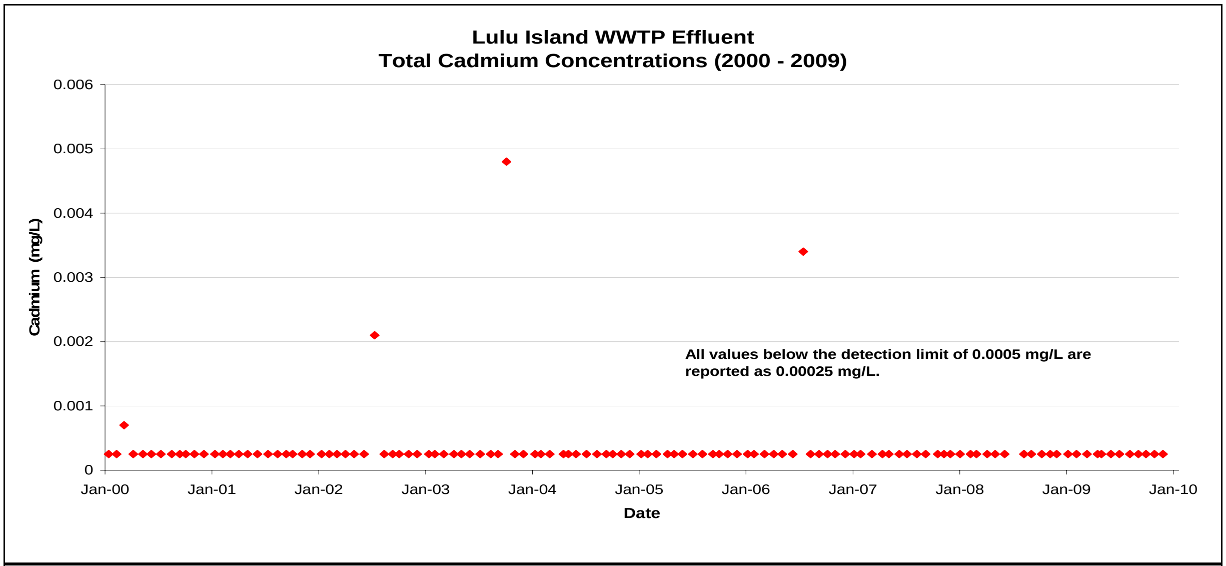

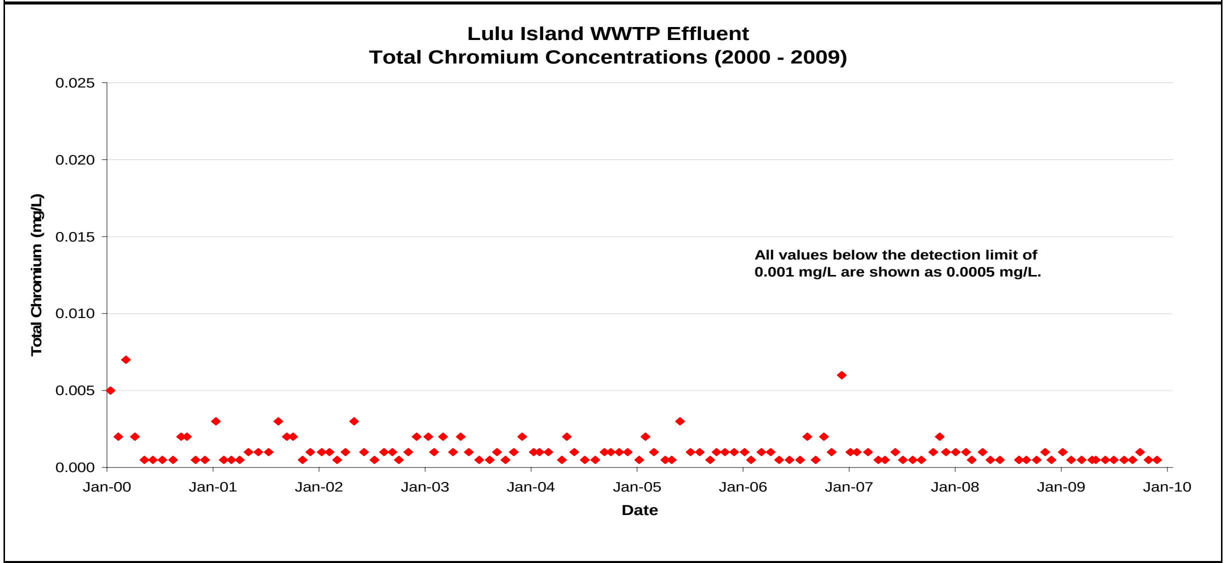

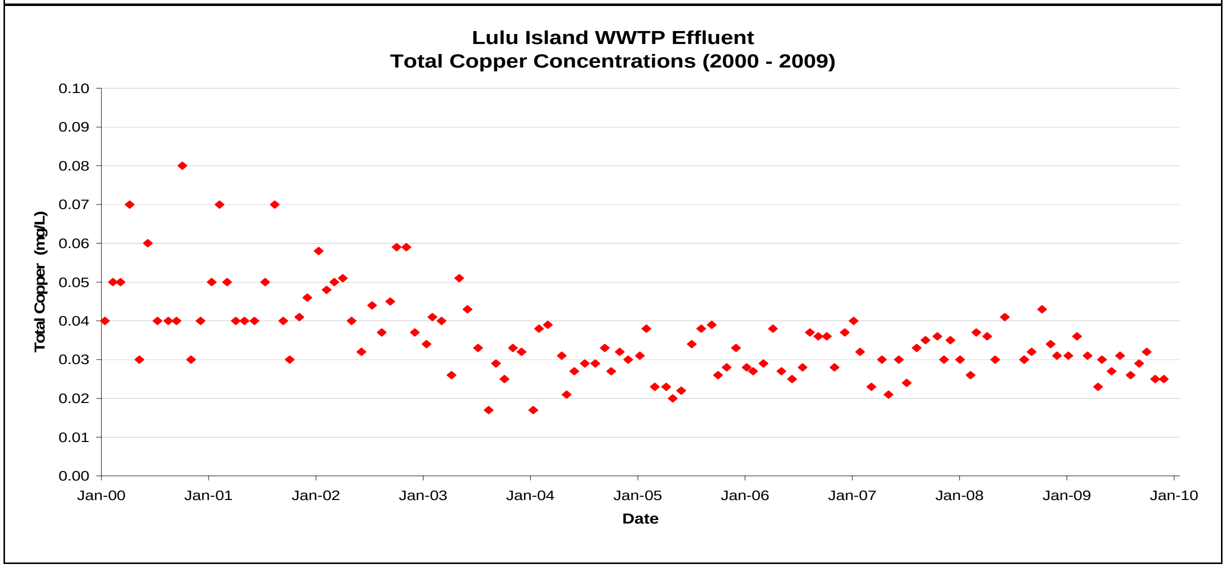

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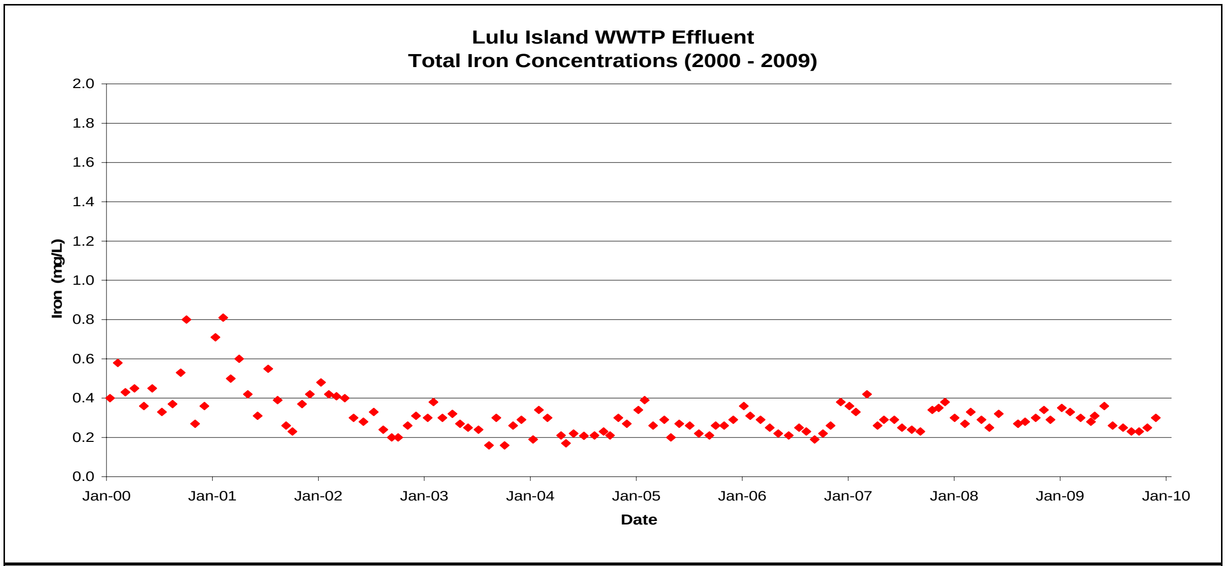

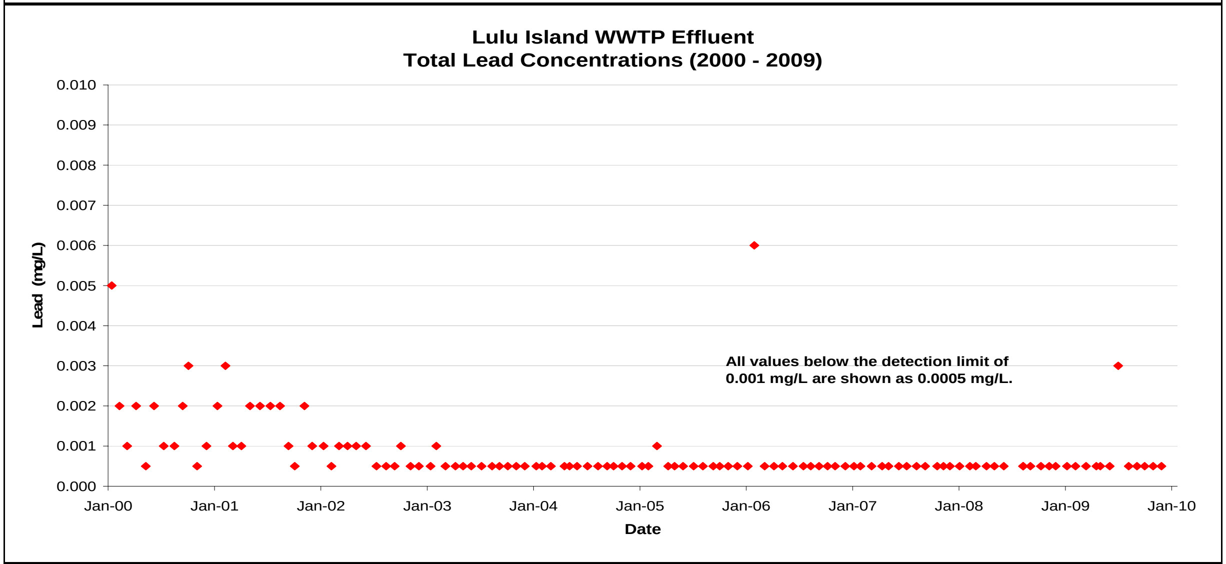

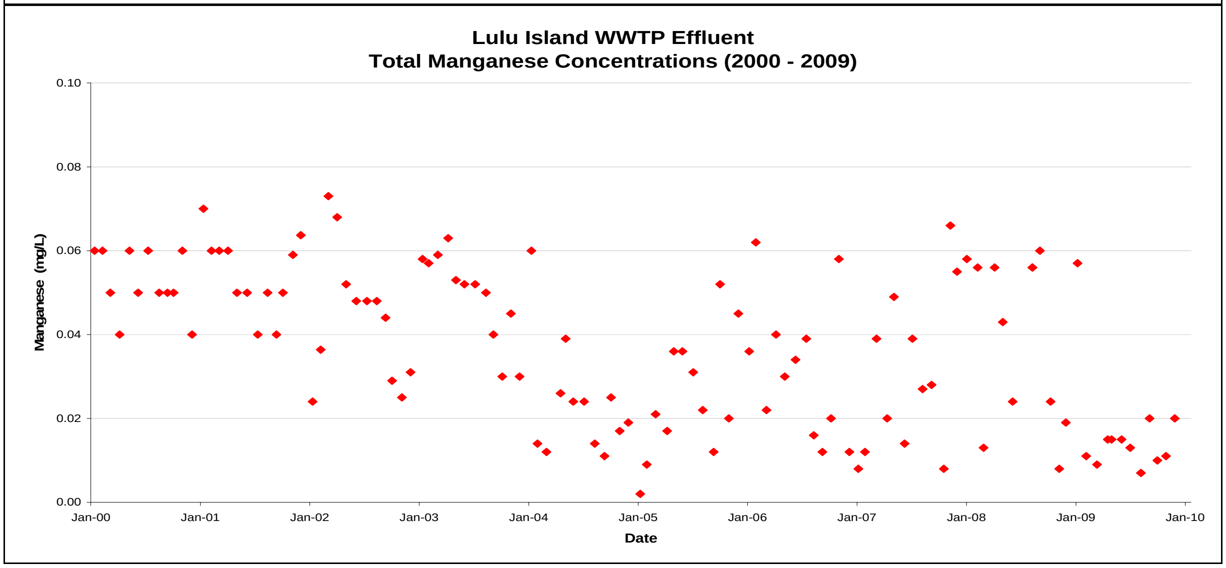

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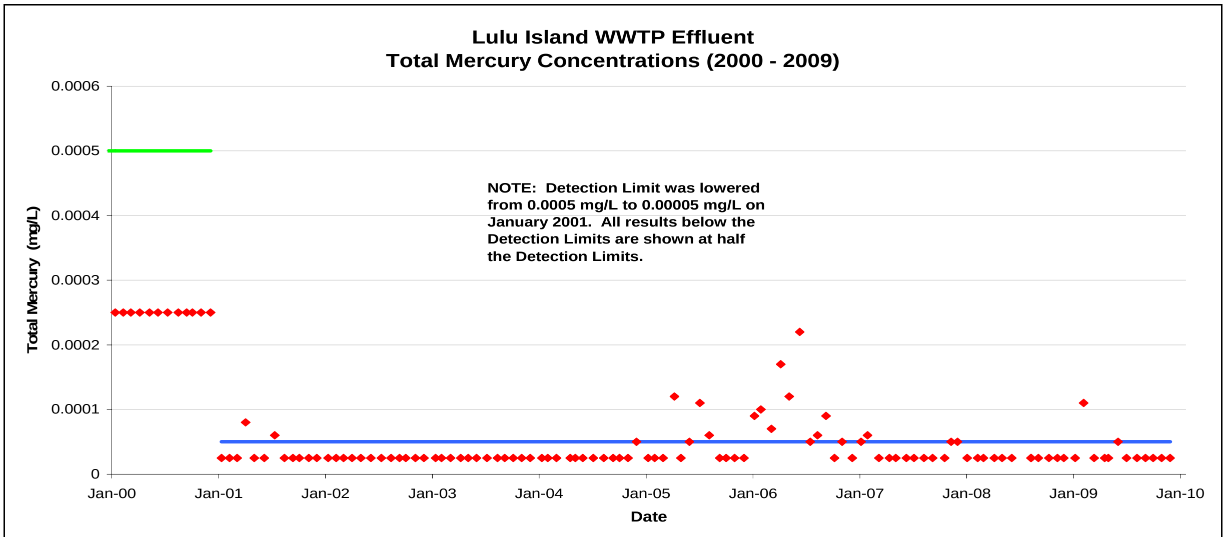

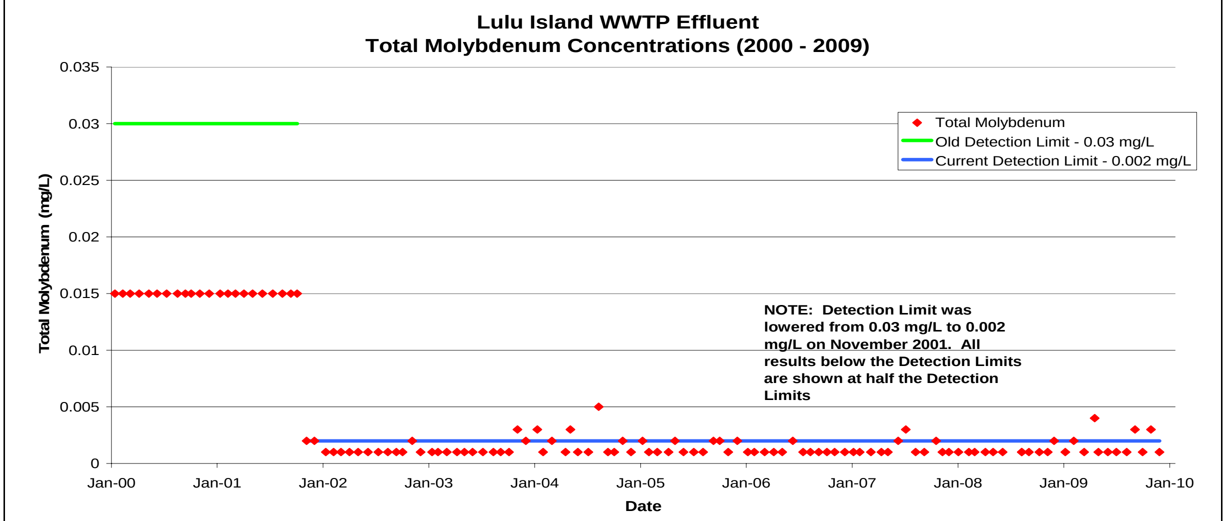

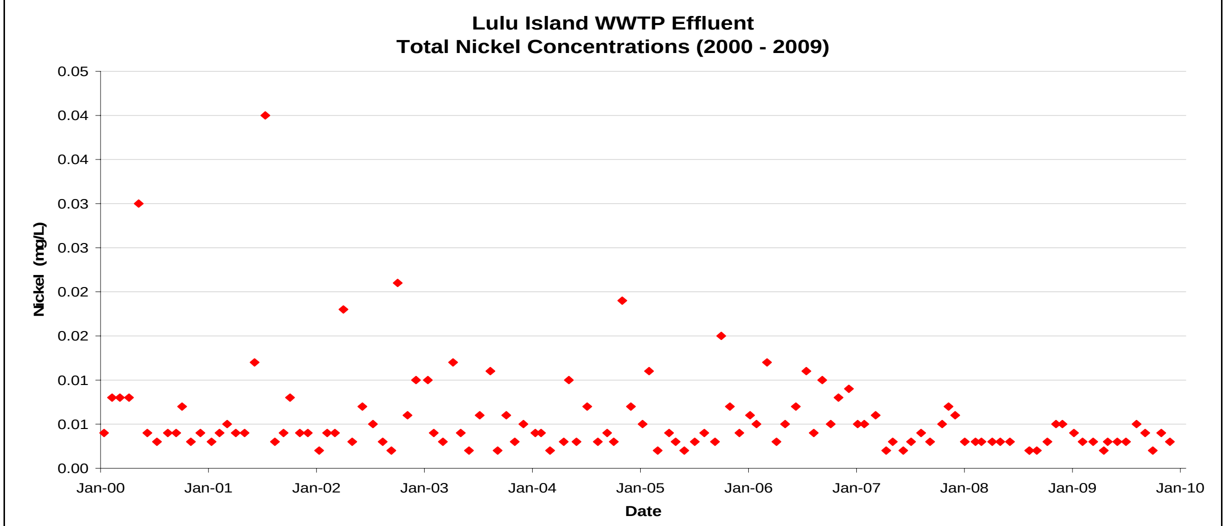

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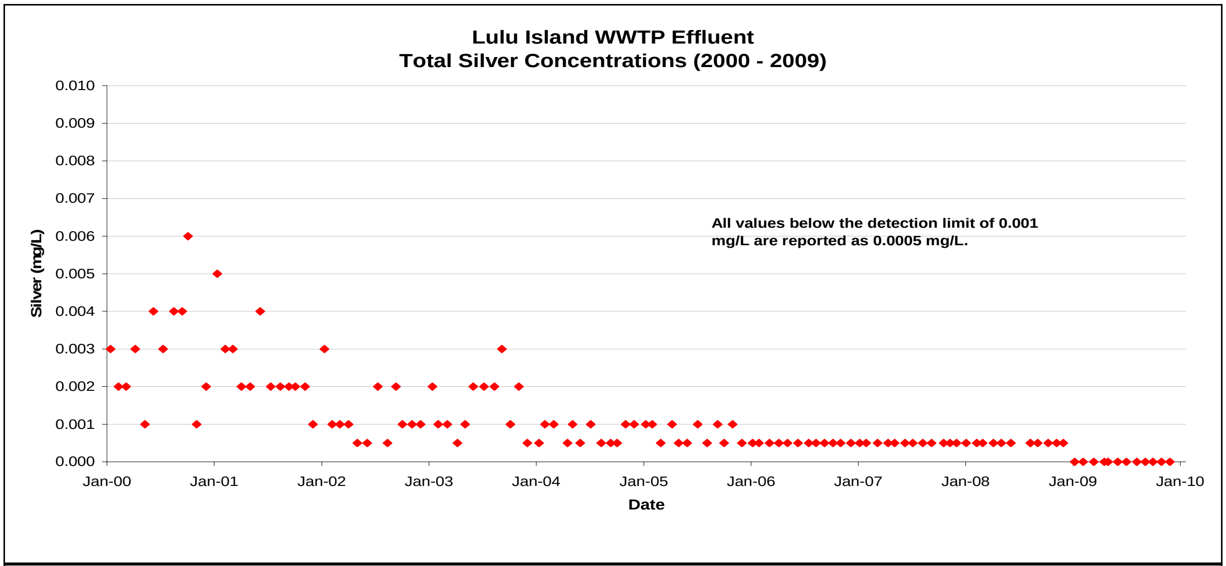

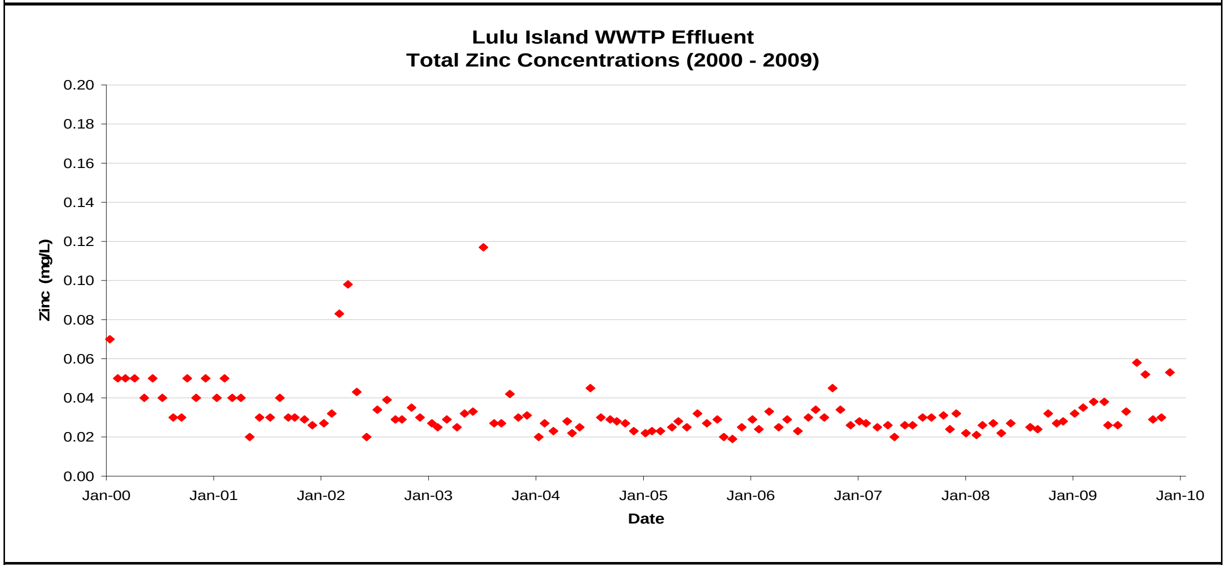

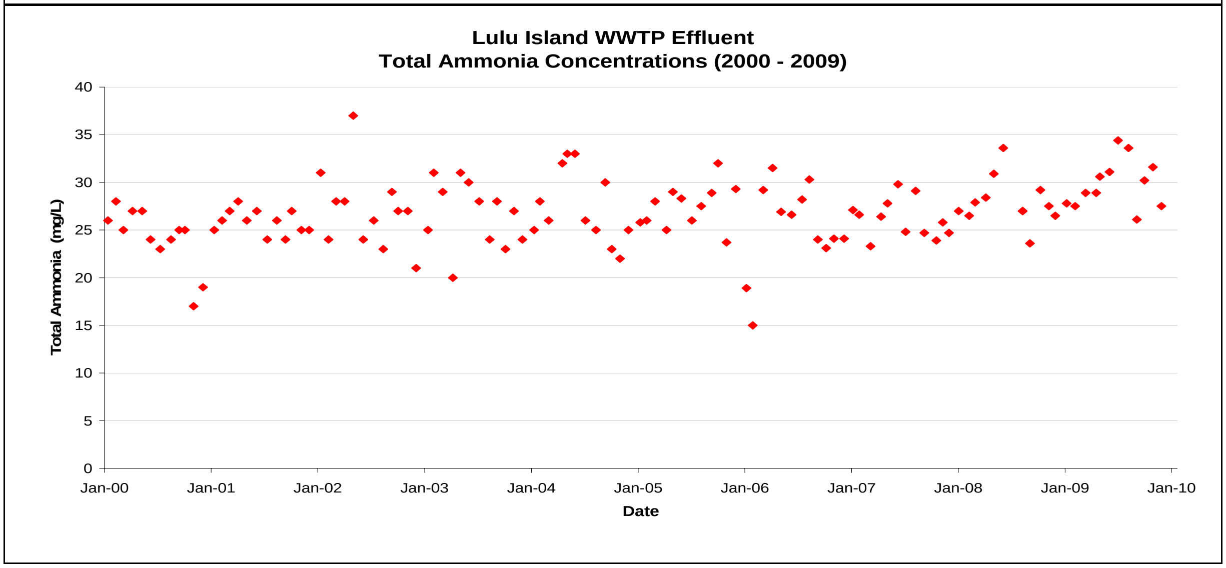

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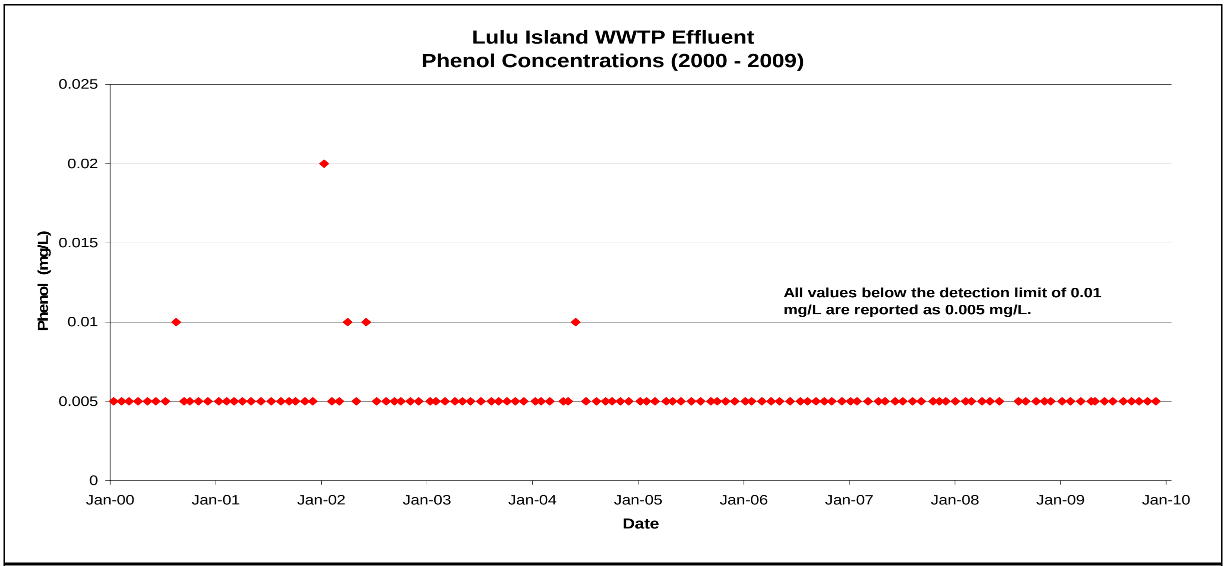
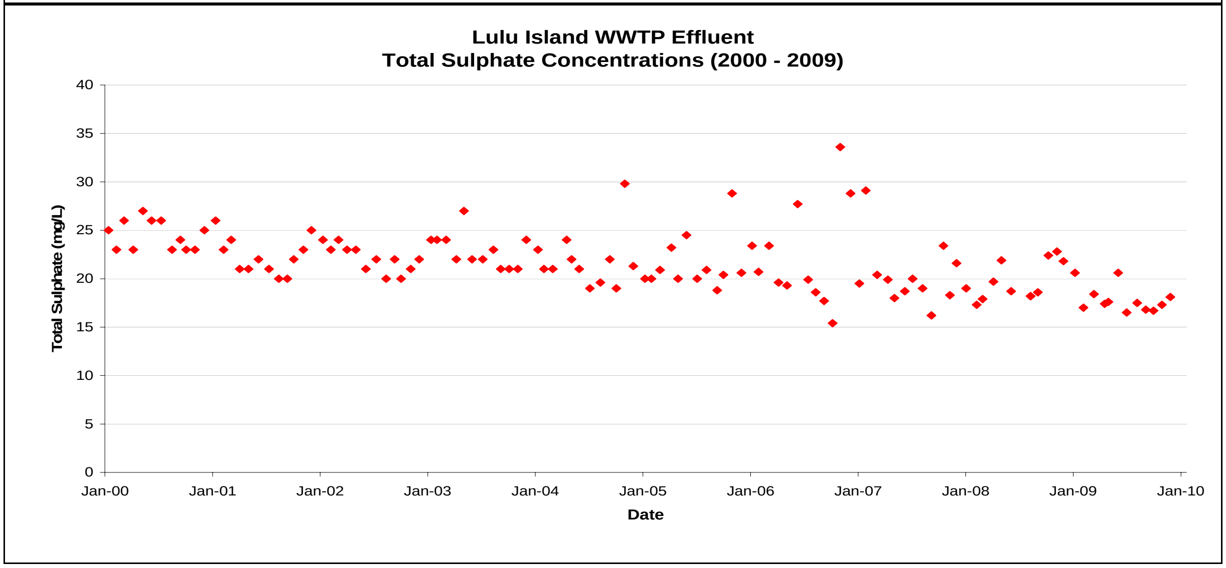
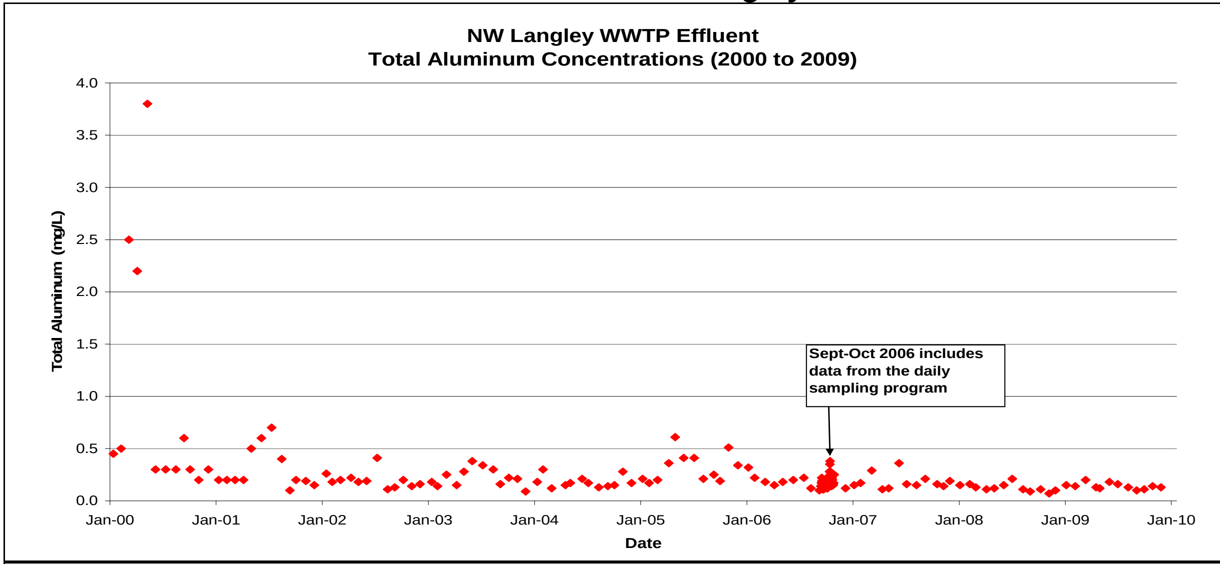
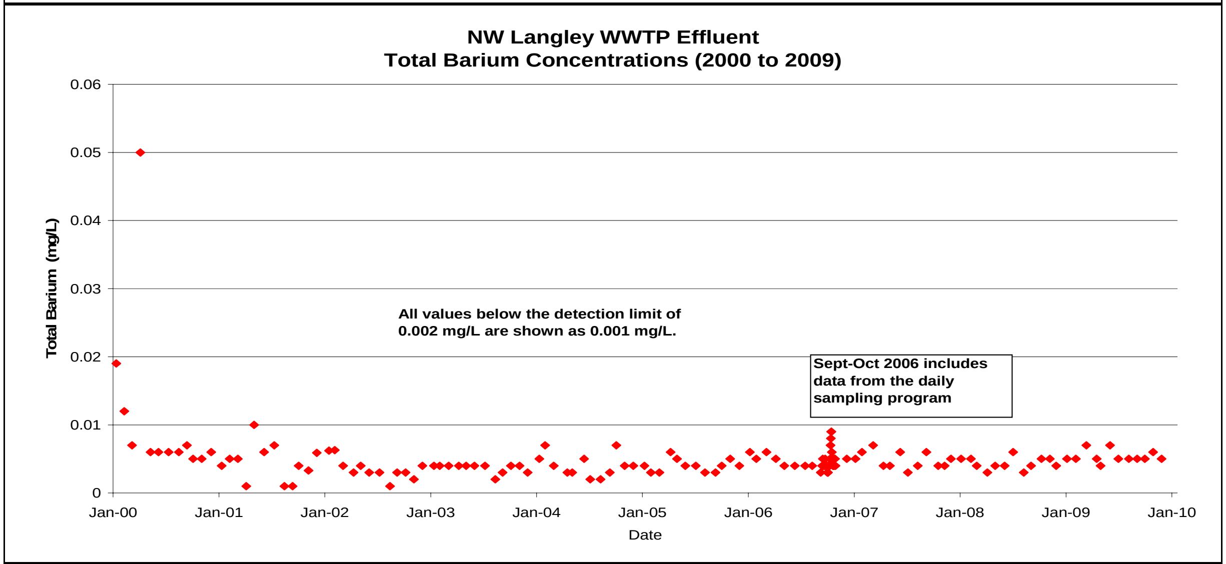
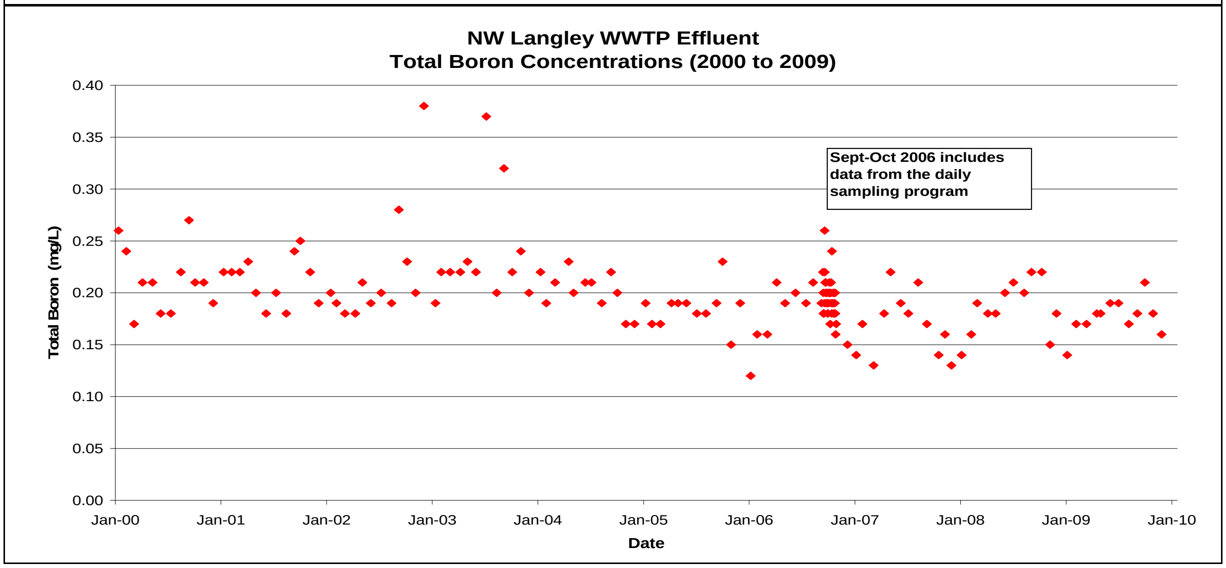




Effluent Data Northwest Langley WWTP







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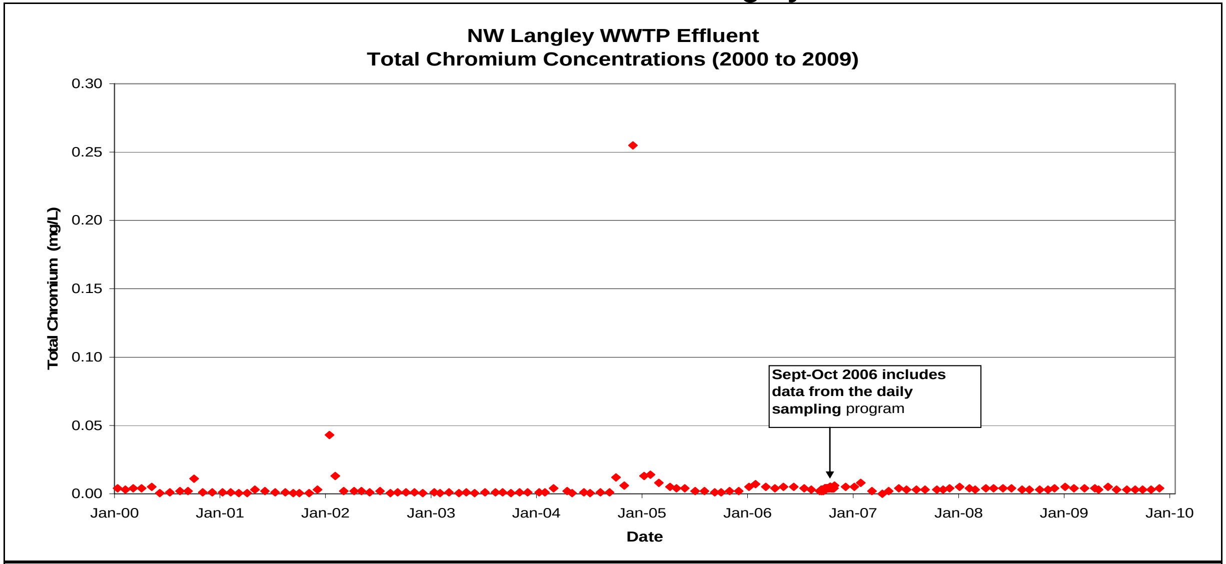

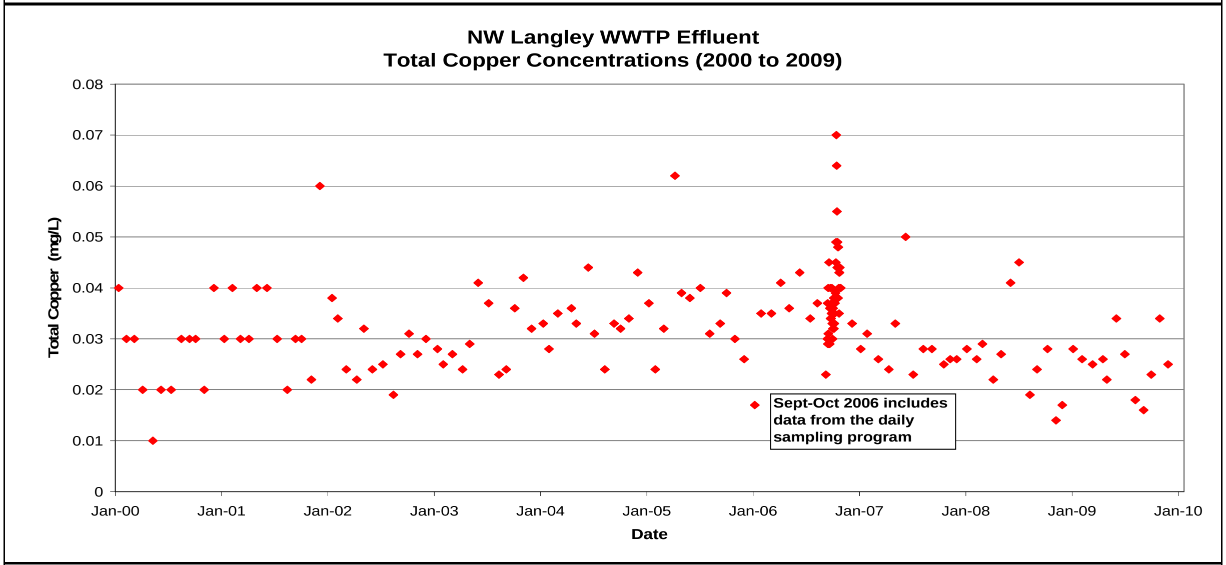

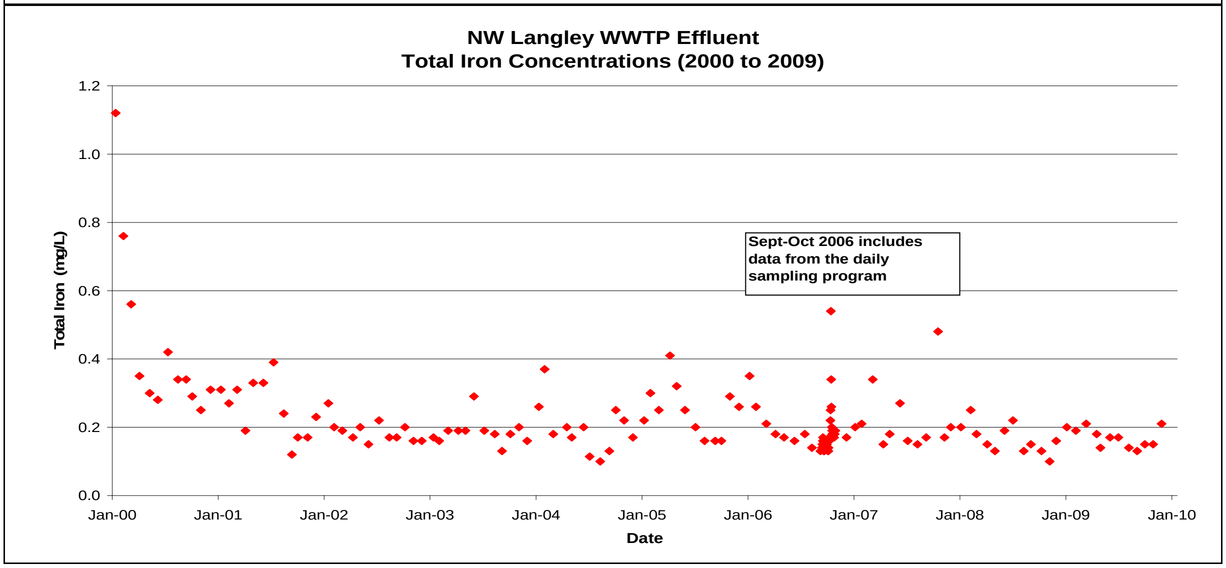

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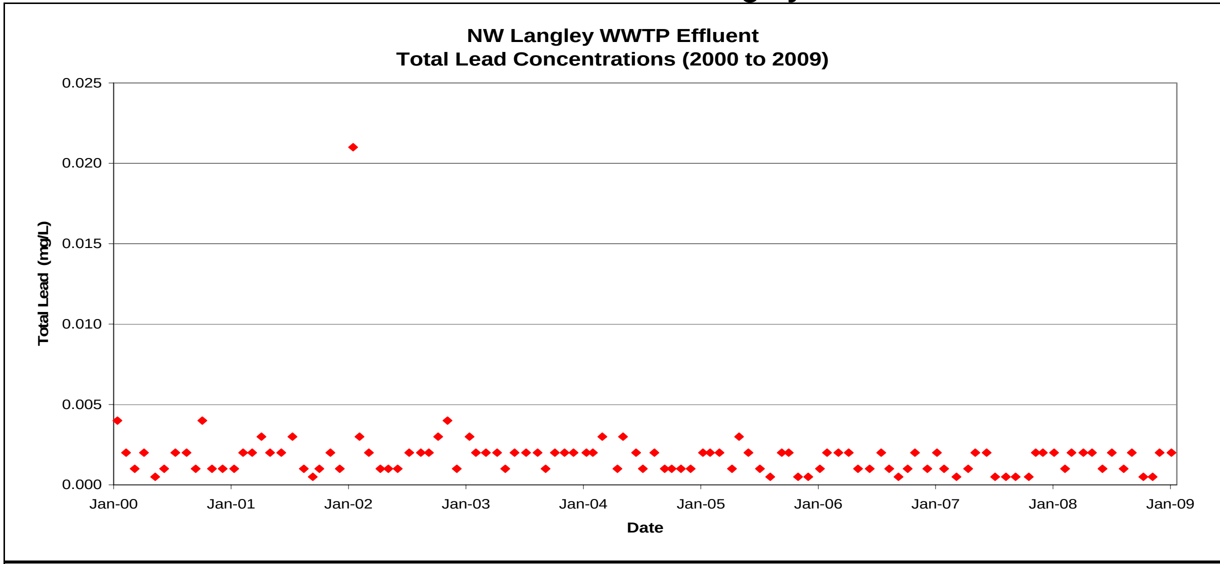

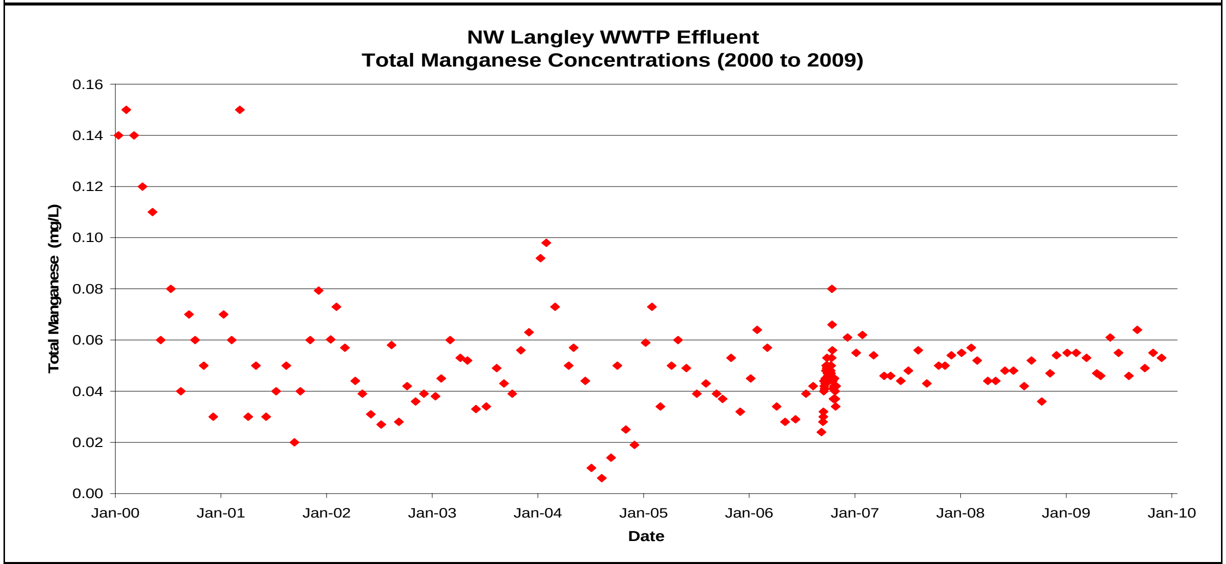

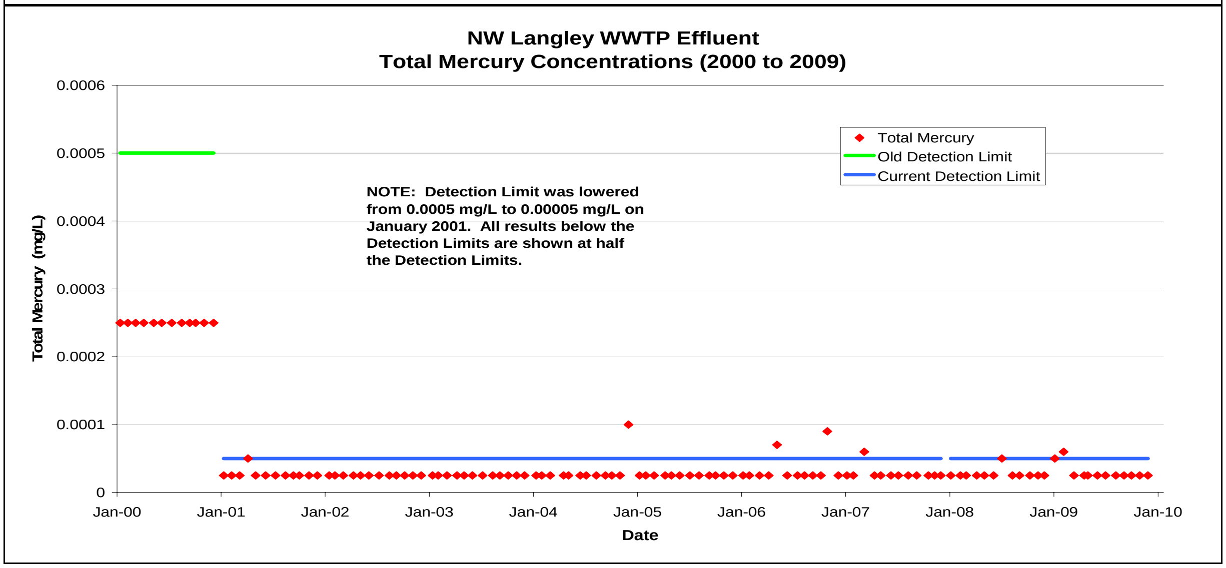

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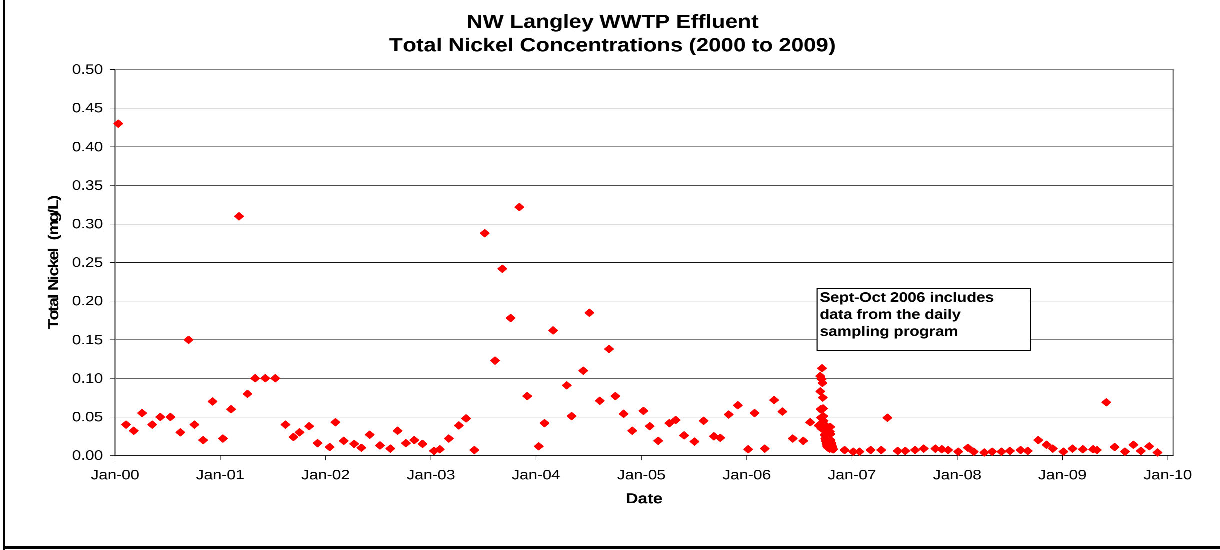

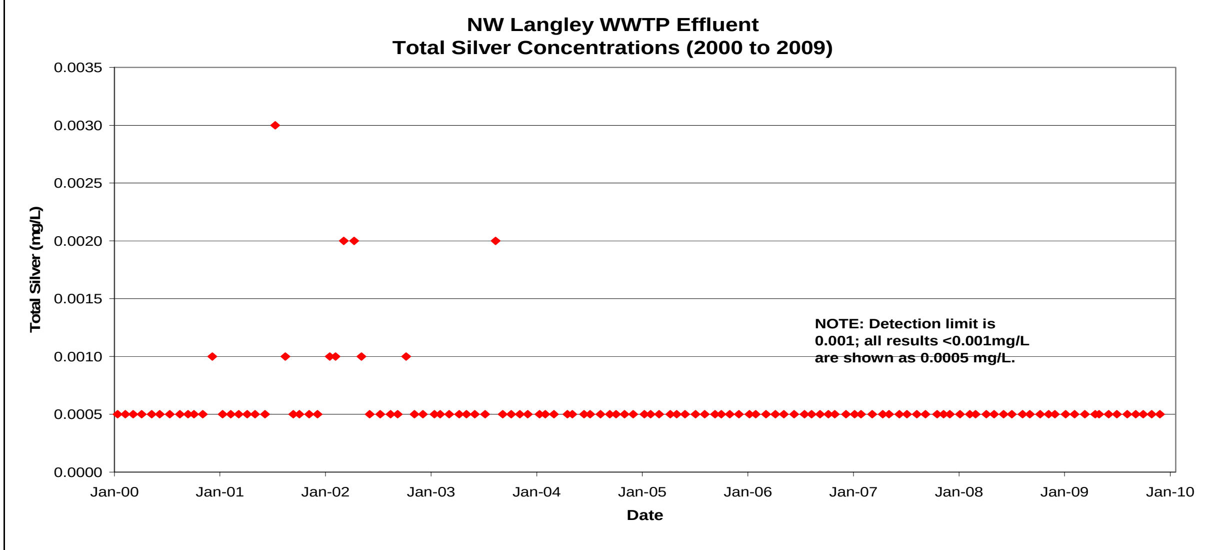

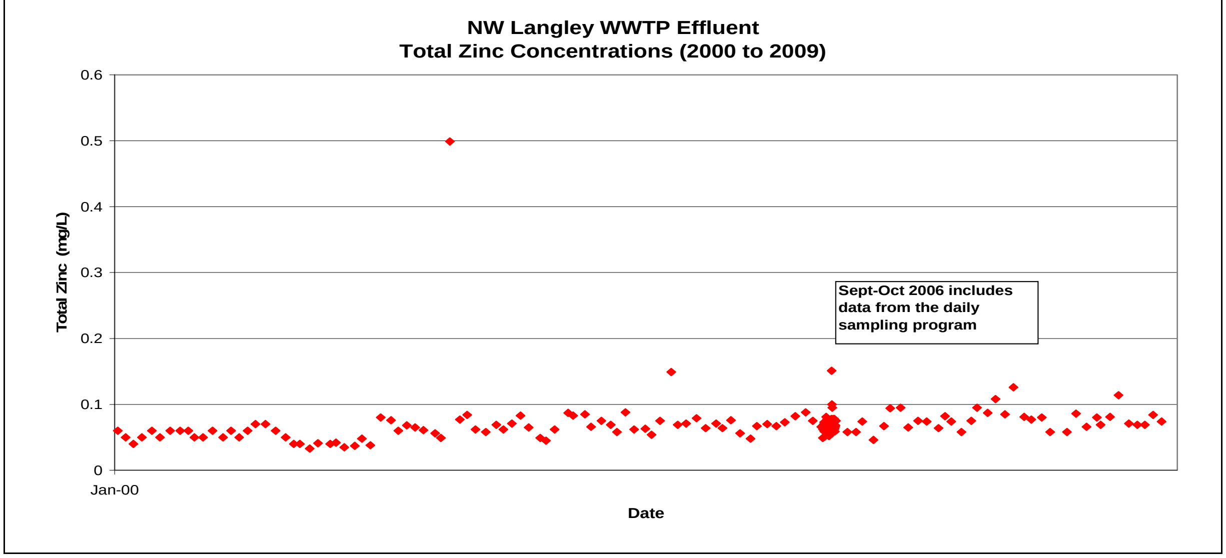

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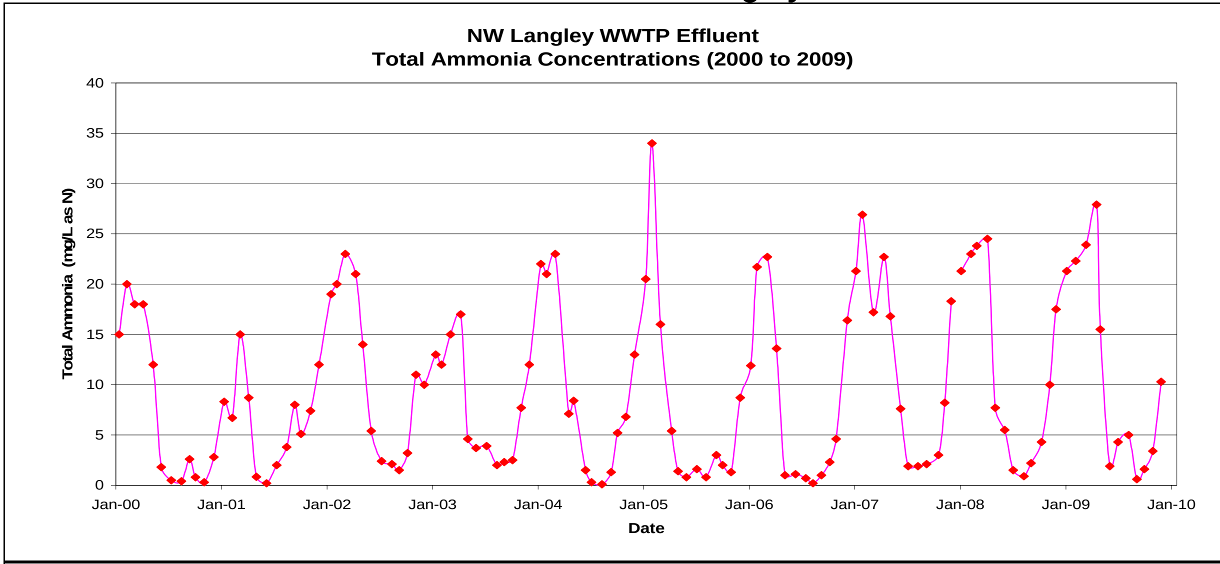
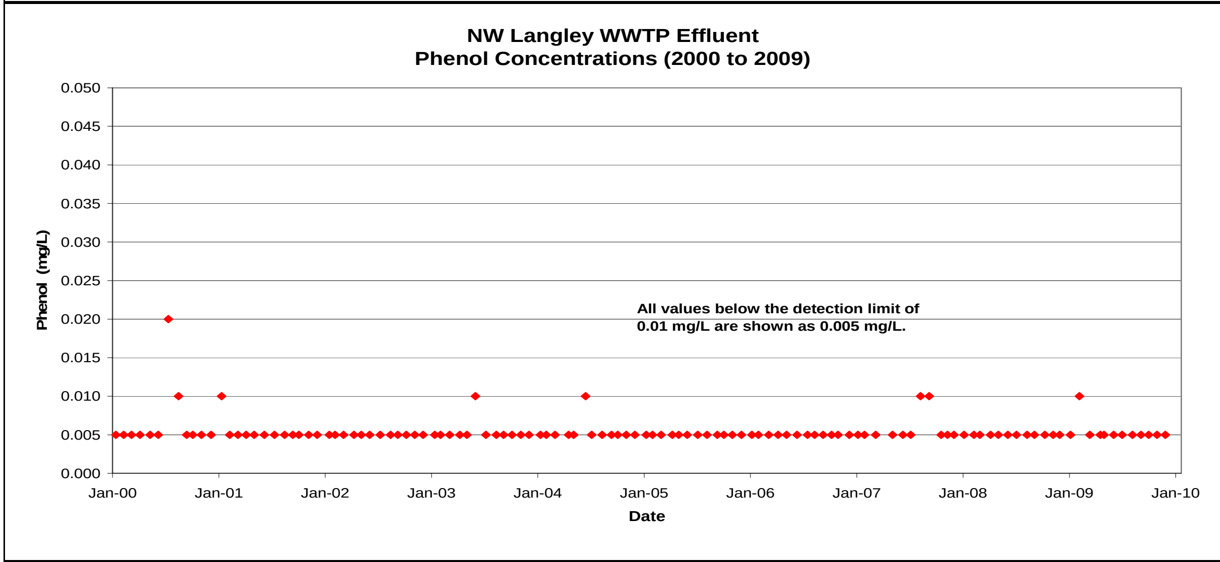
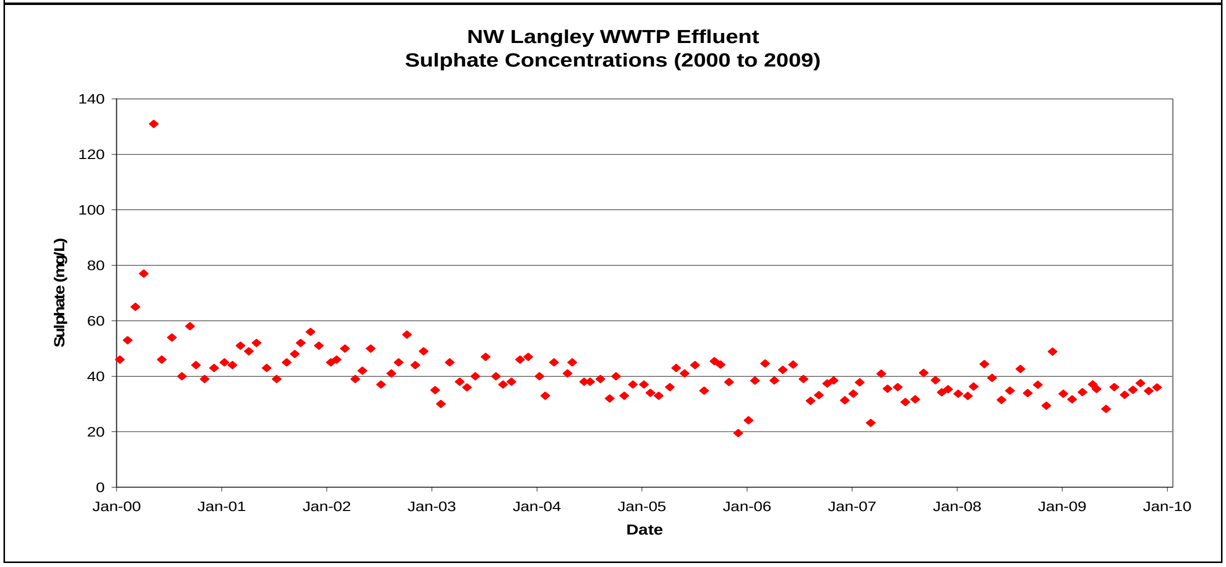


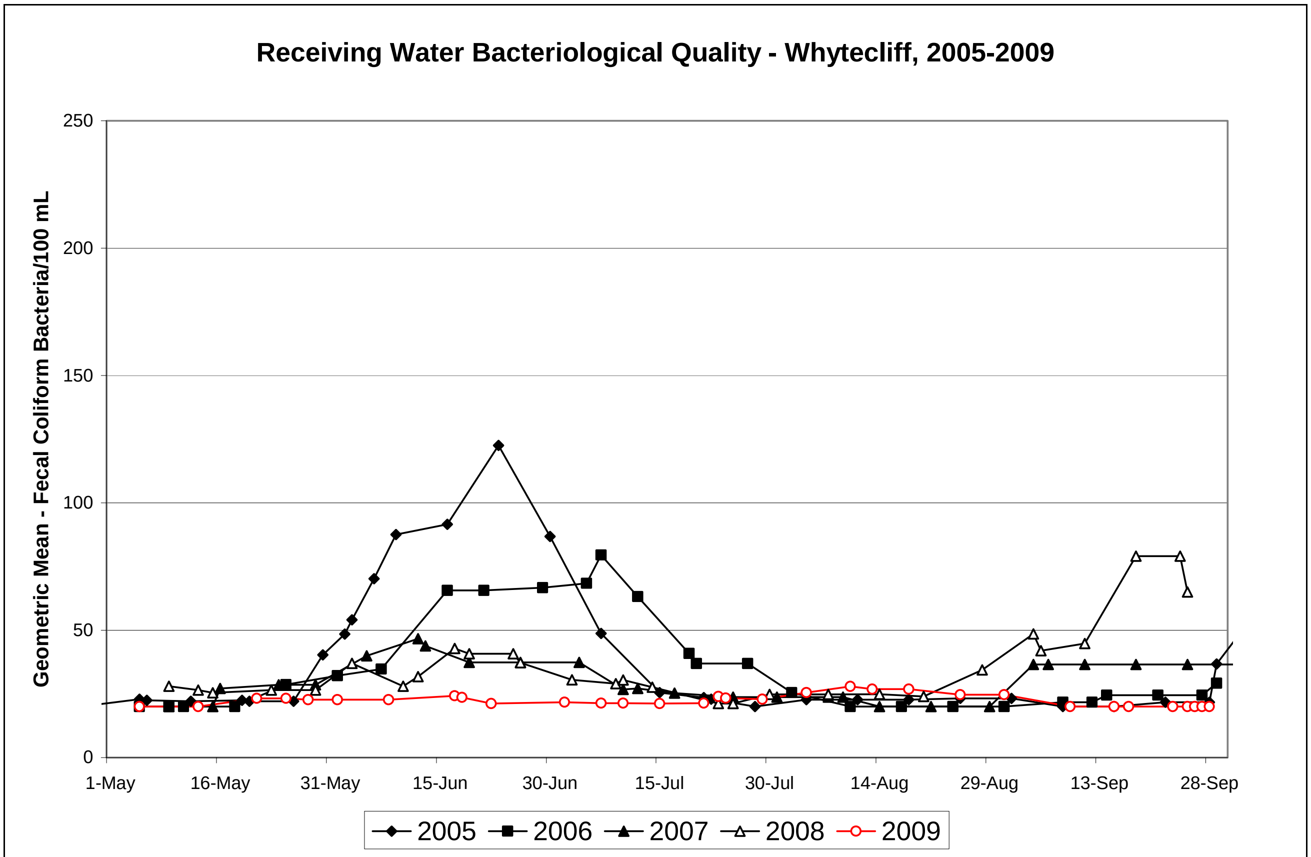


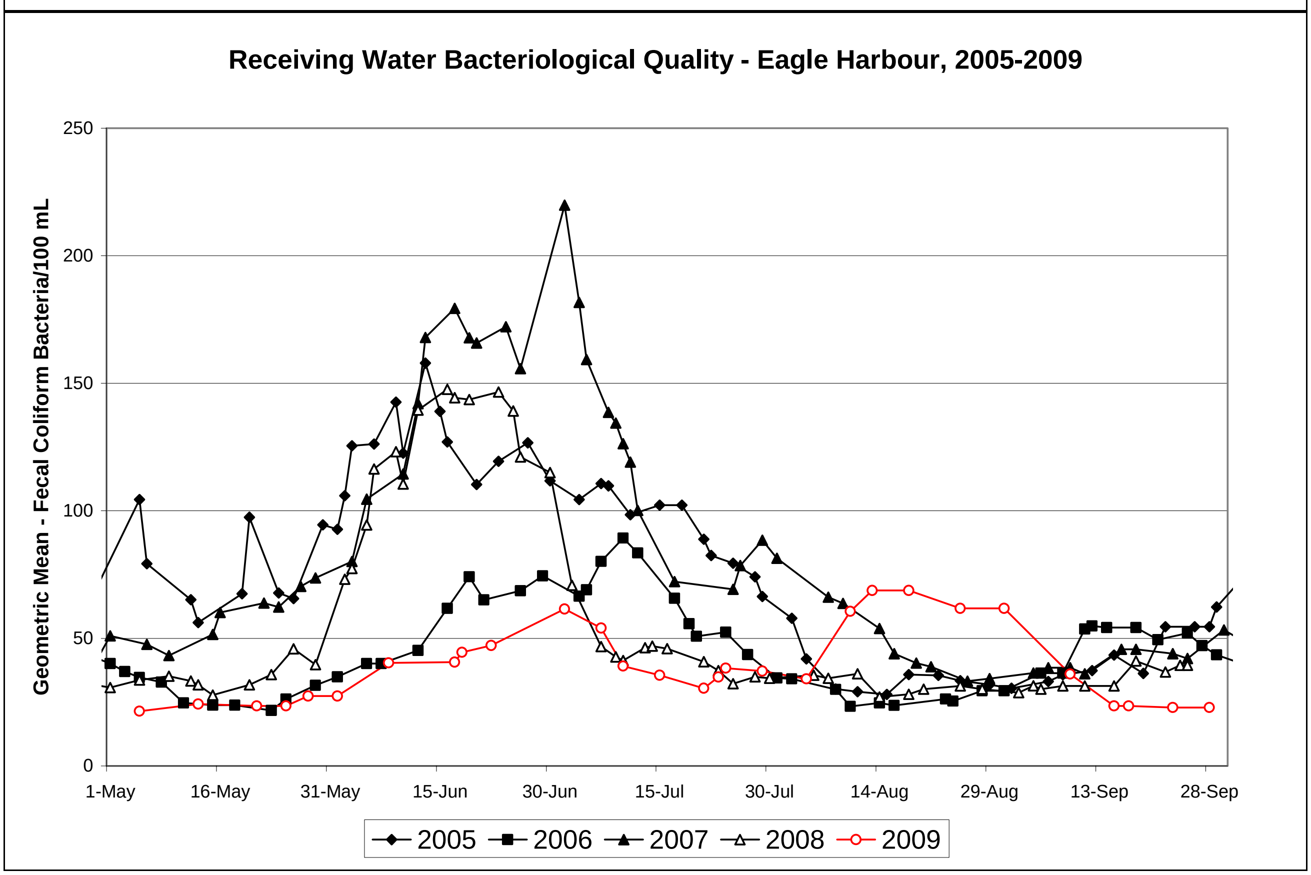


APPENDIX C

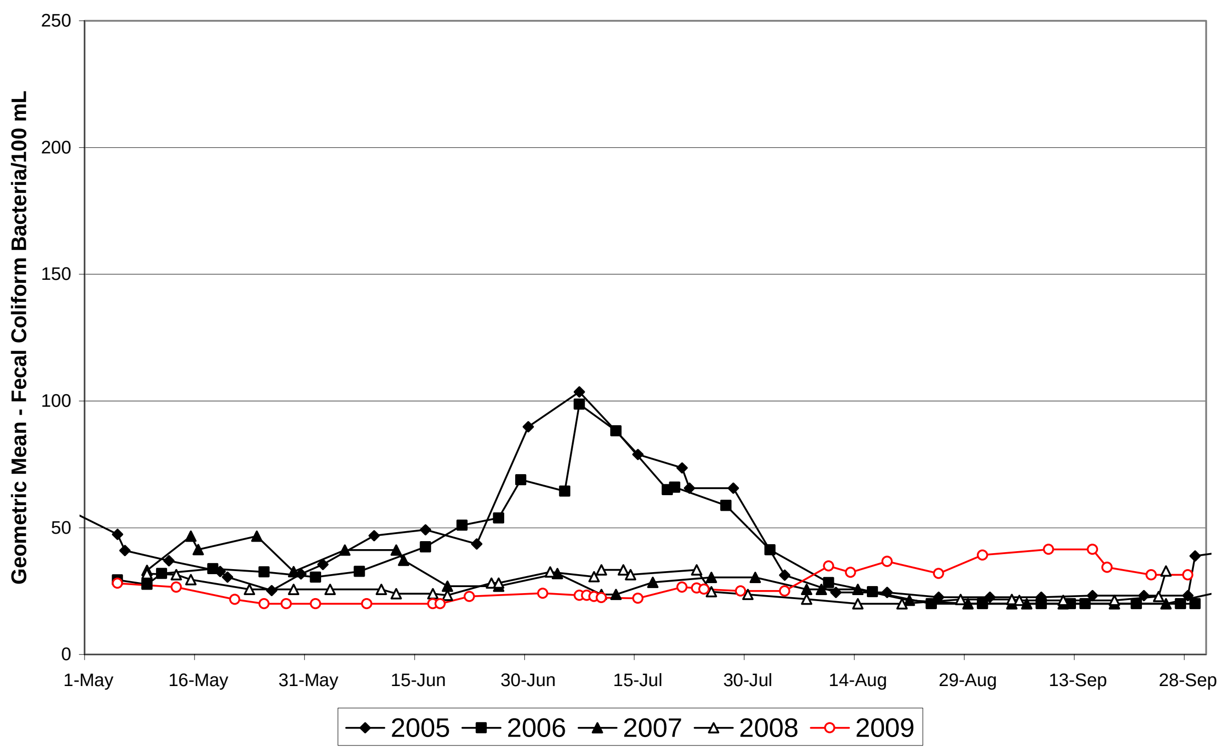
Receiving Water Bacteriological Quality
30-Day Geometric Means of Fecal Coliform Levels

Guidelines for Beach Water Quality
For a body of water to be considered safe for primary-contact recreation, the guidelines stipulate that the geometric mean of results of at least 5 samples collected in a 30 day period should not exceed 200 fecal coliform bacteria per 100 mL. False Creek is not classified as a primary-contact recreational water body (i.e., a beach).

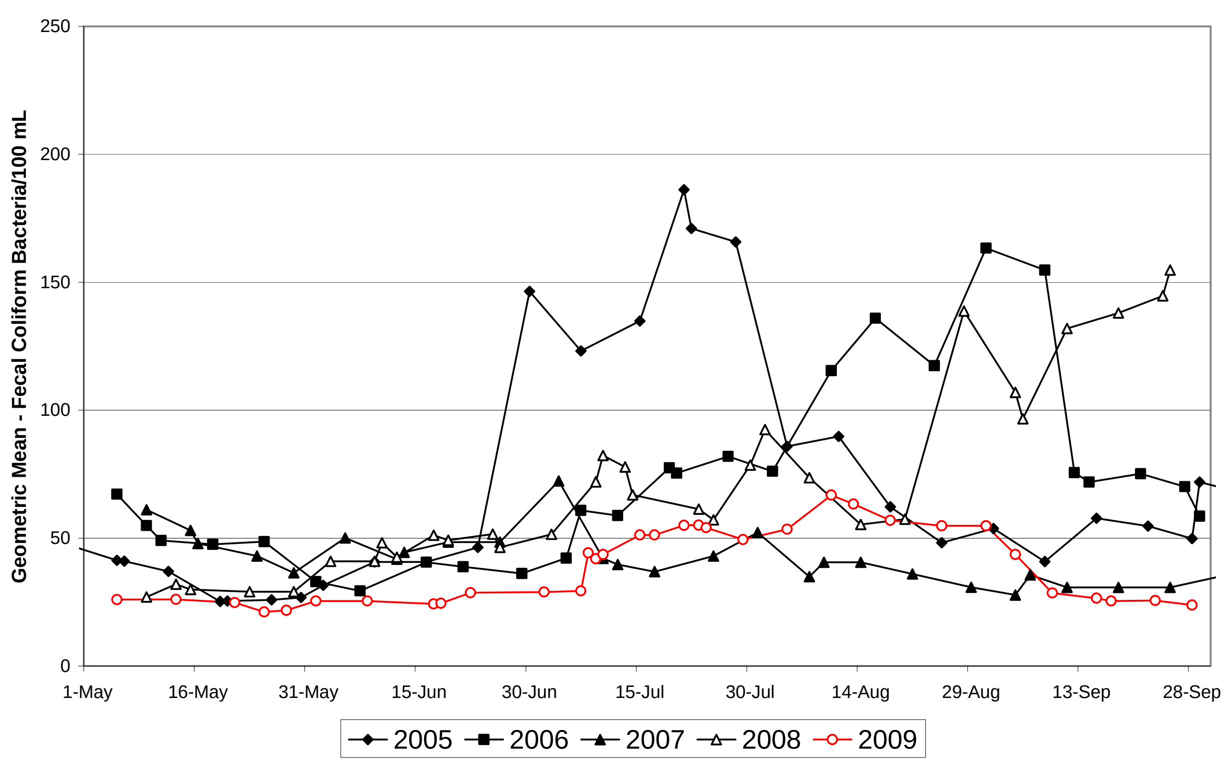

Receiving Water Bacteriological Quality - Whytecliff, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

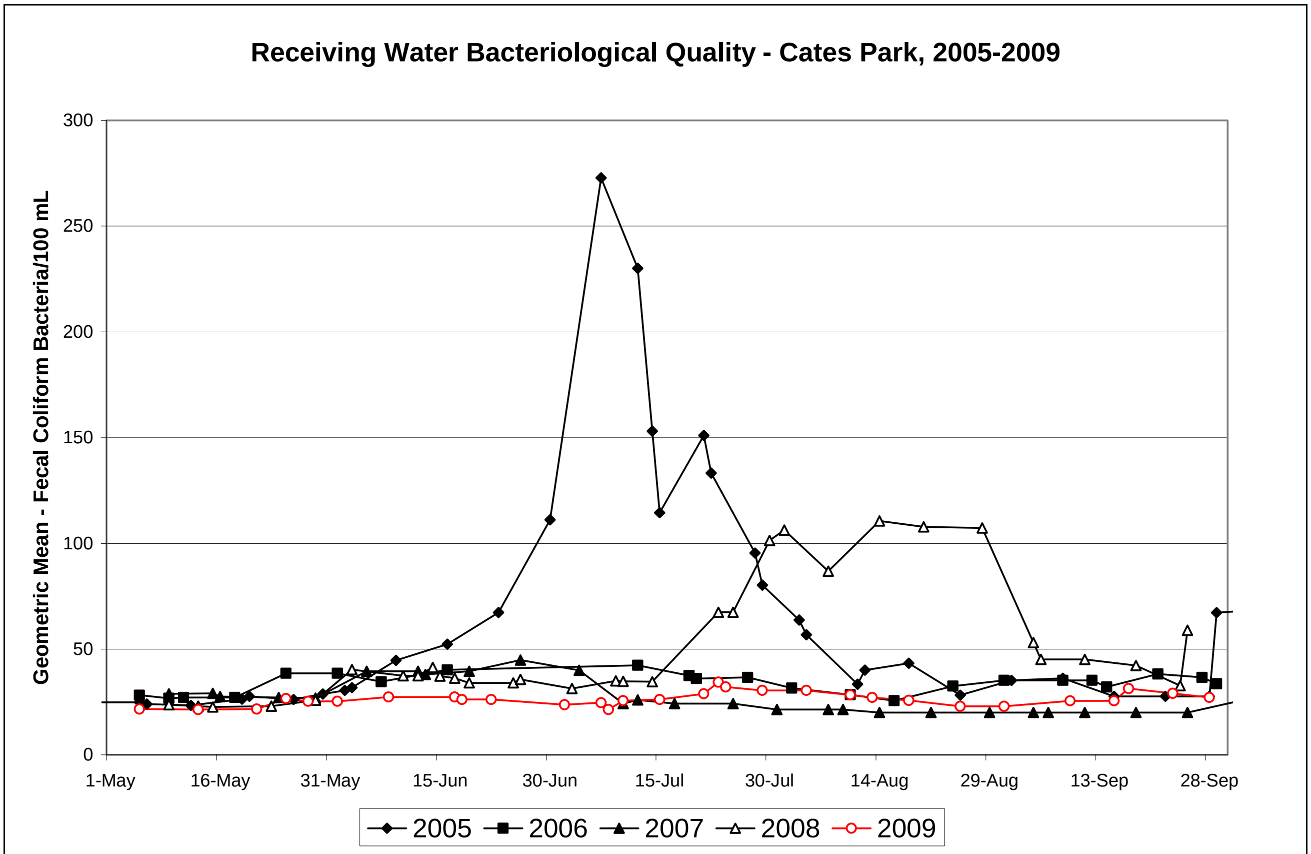

Receiving Water Bacteriological Quality - Eagle Harbour, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

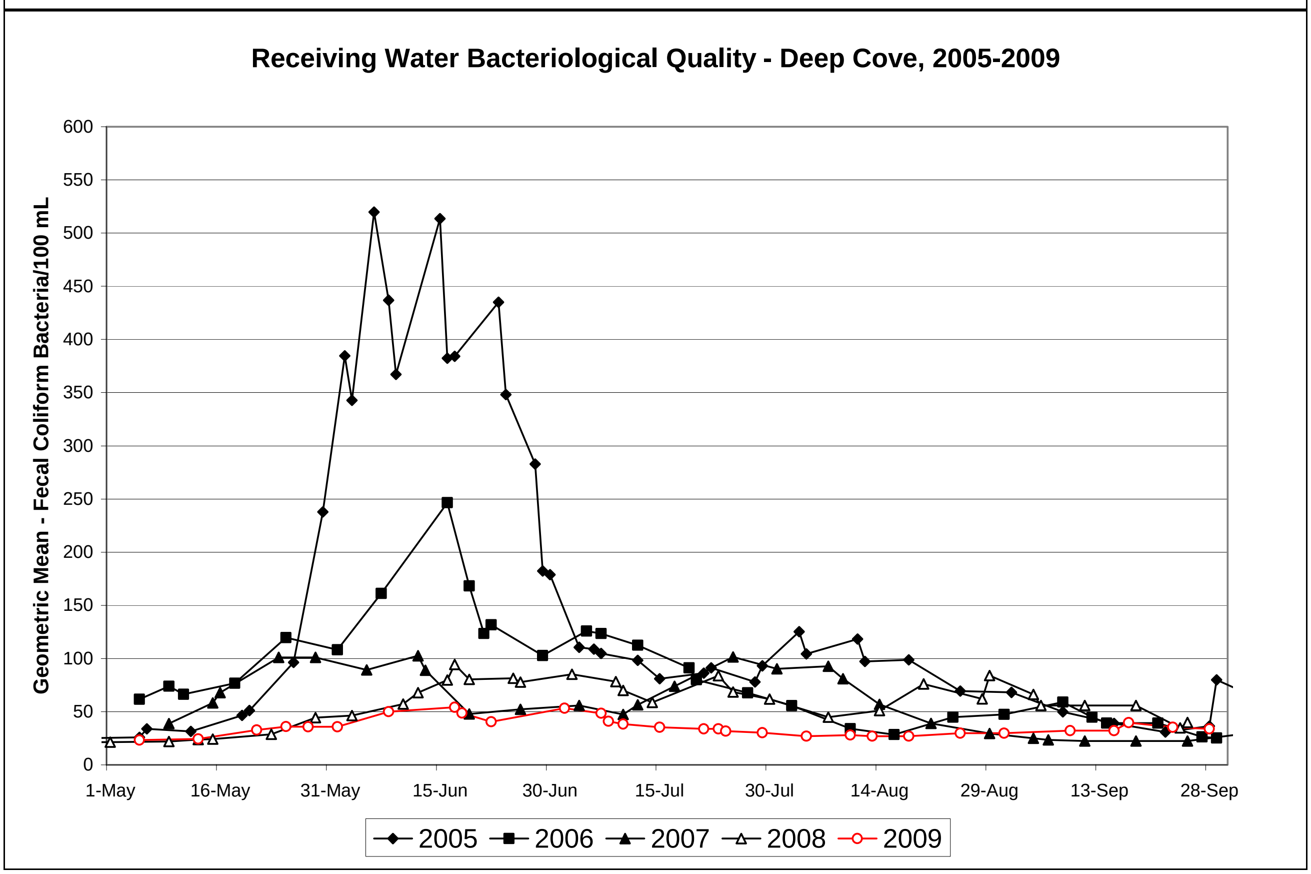
Receiving Water Bacteriological Quality - Dundarave, 2005-2009

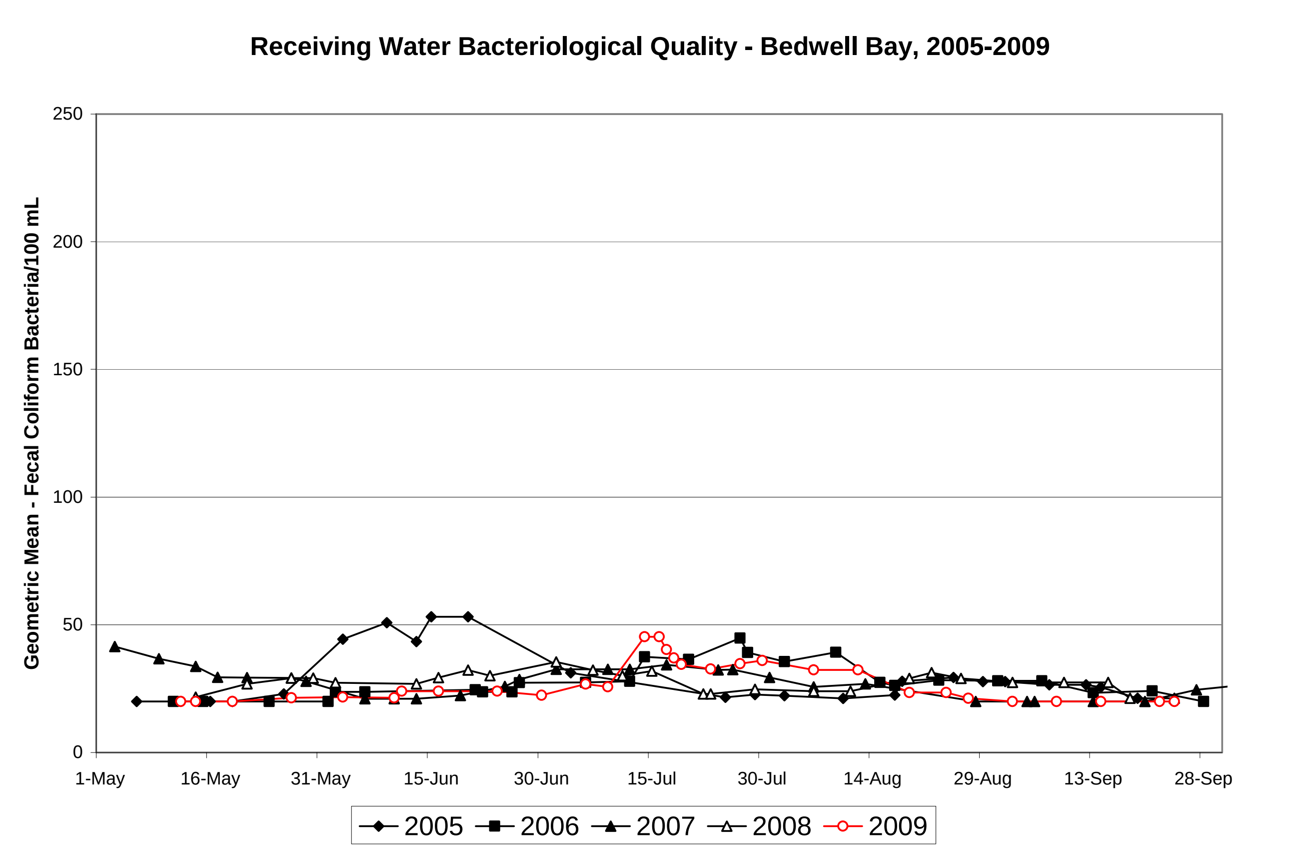


Receiving Water Bacteriological Quality - Ambleside Beach, 2005-2009

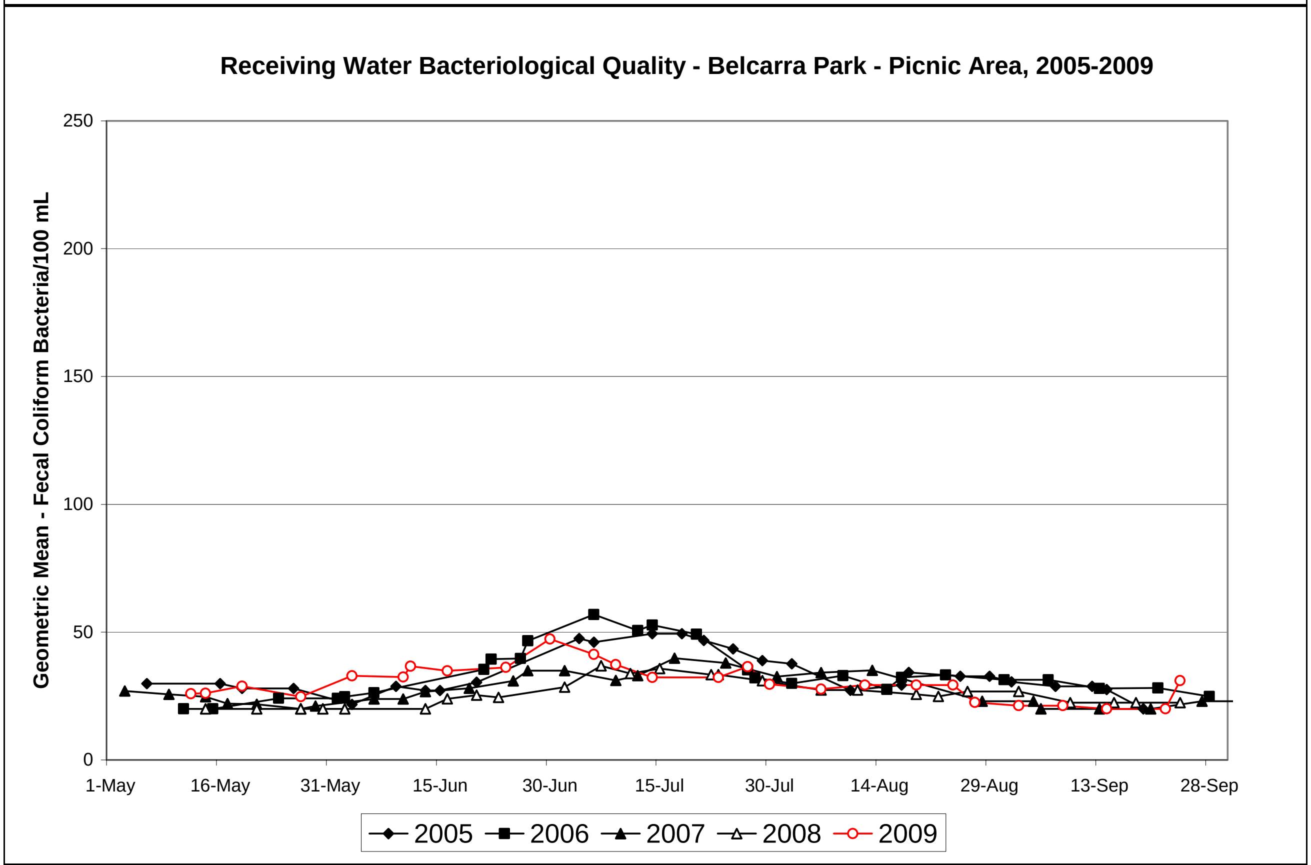



Receiving Water Bacteriological Quality - Cates Park, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

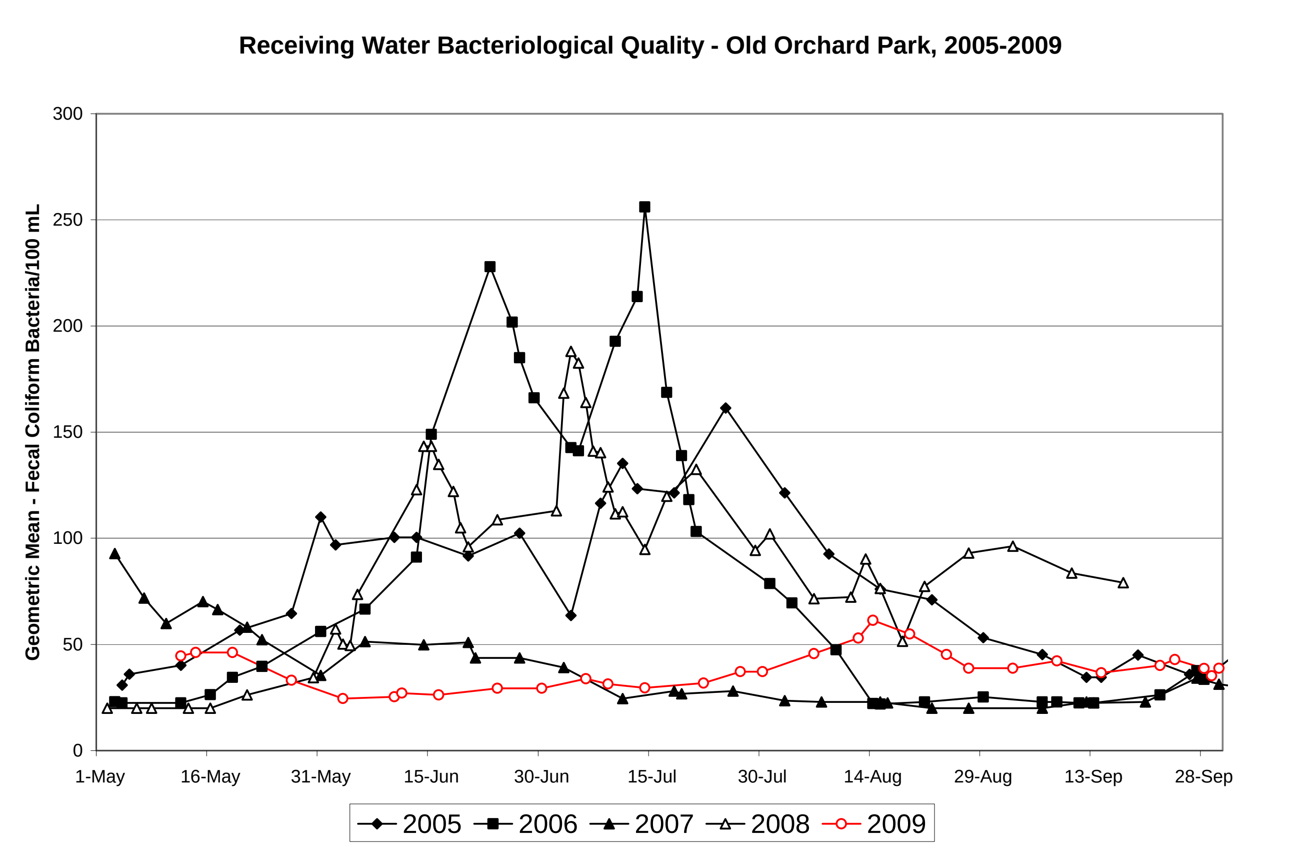

Receiving Water Bacteriological Quality - Deep Cove, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
600
550
500
450
400
350
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

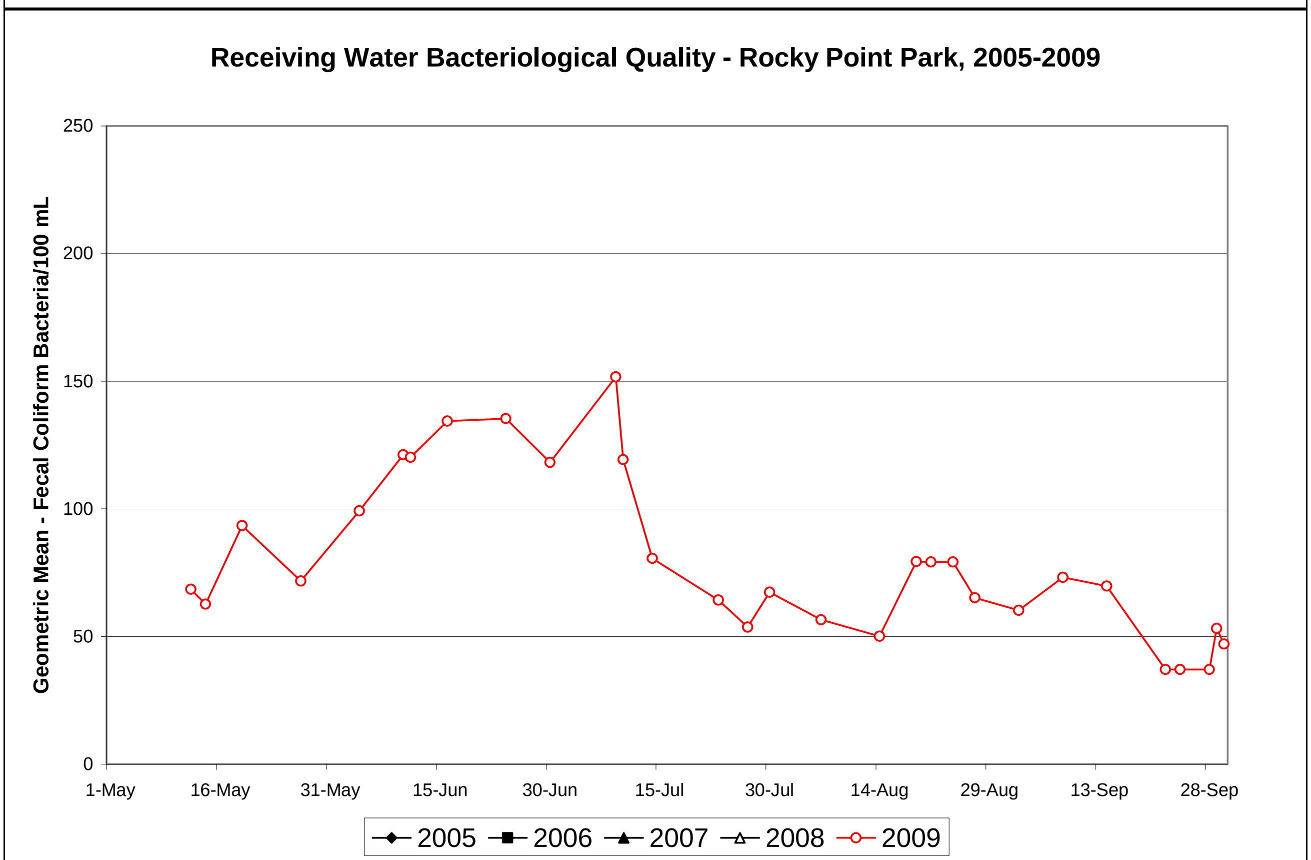


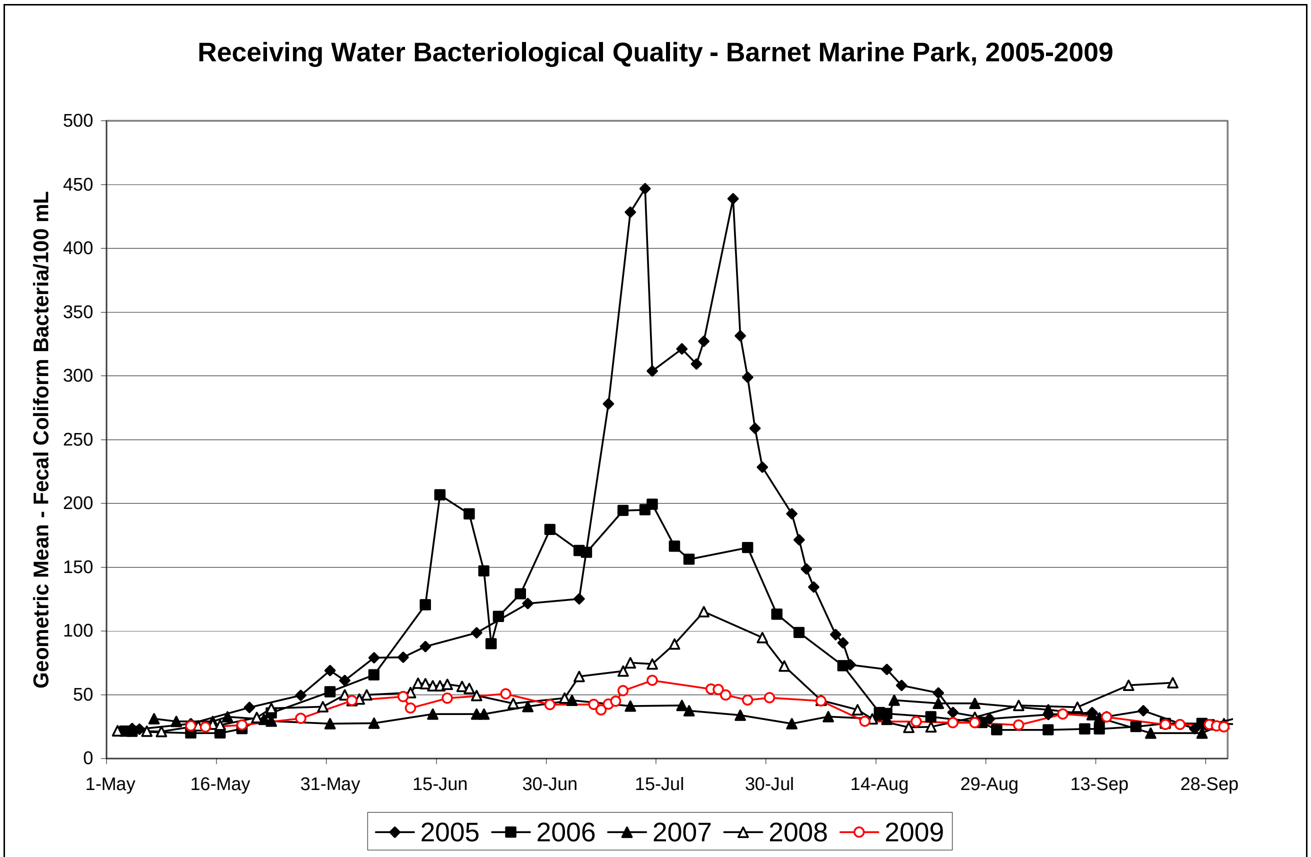
Receiving Water Bacteriological Quality - Bedwell Bay, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

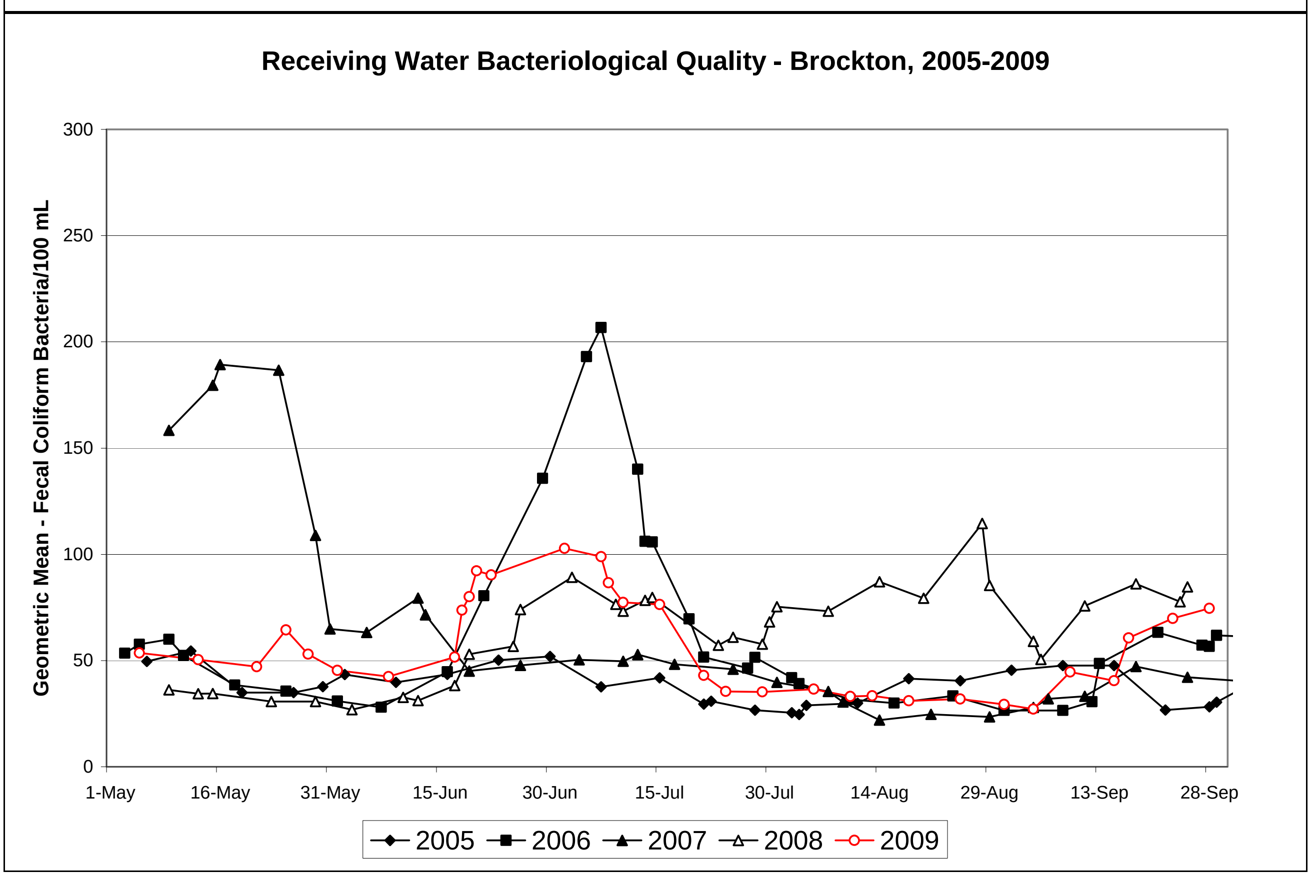


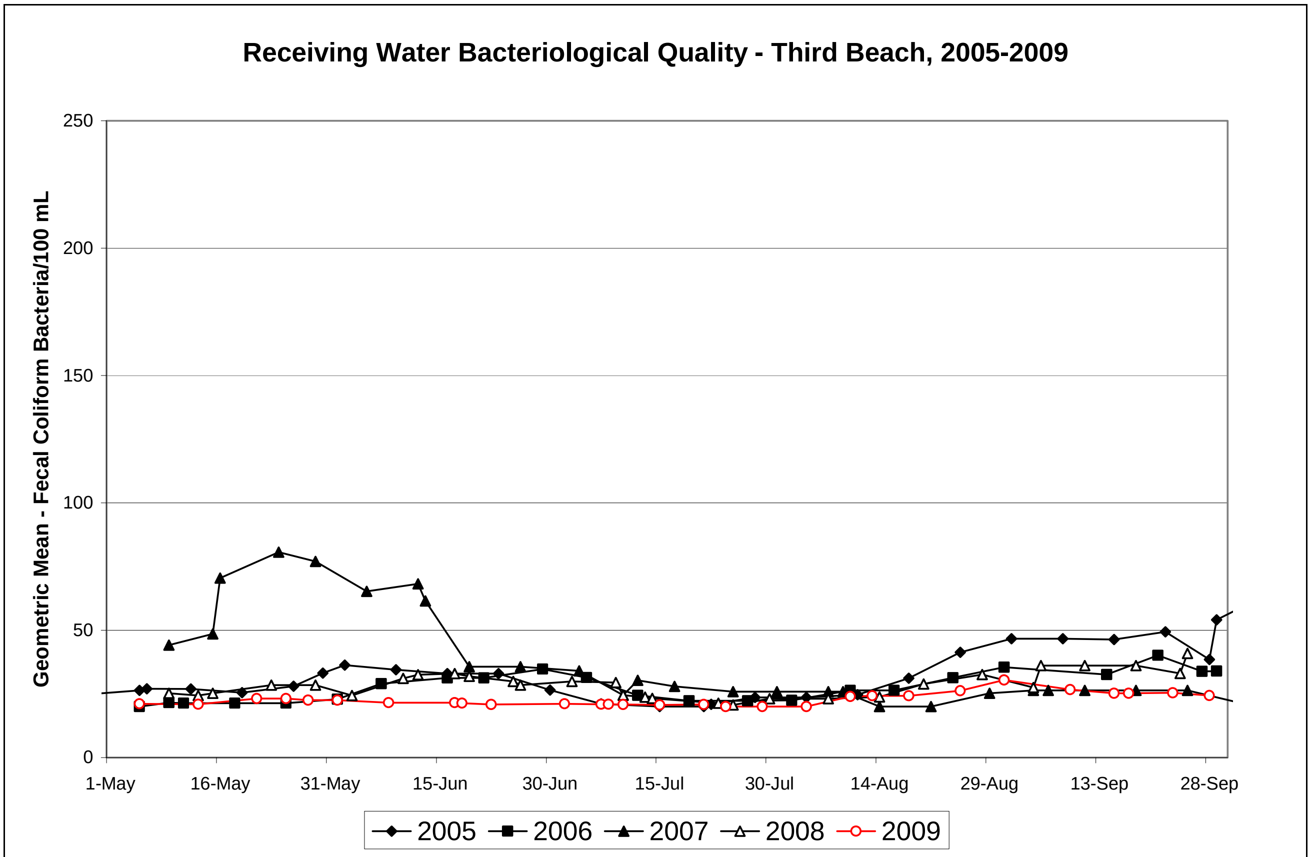
Receiving Water Bacteriological Quality - Belcarra Park - Picnic Area, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

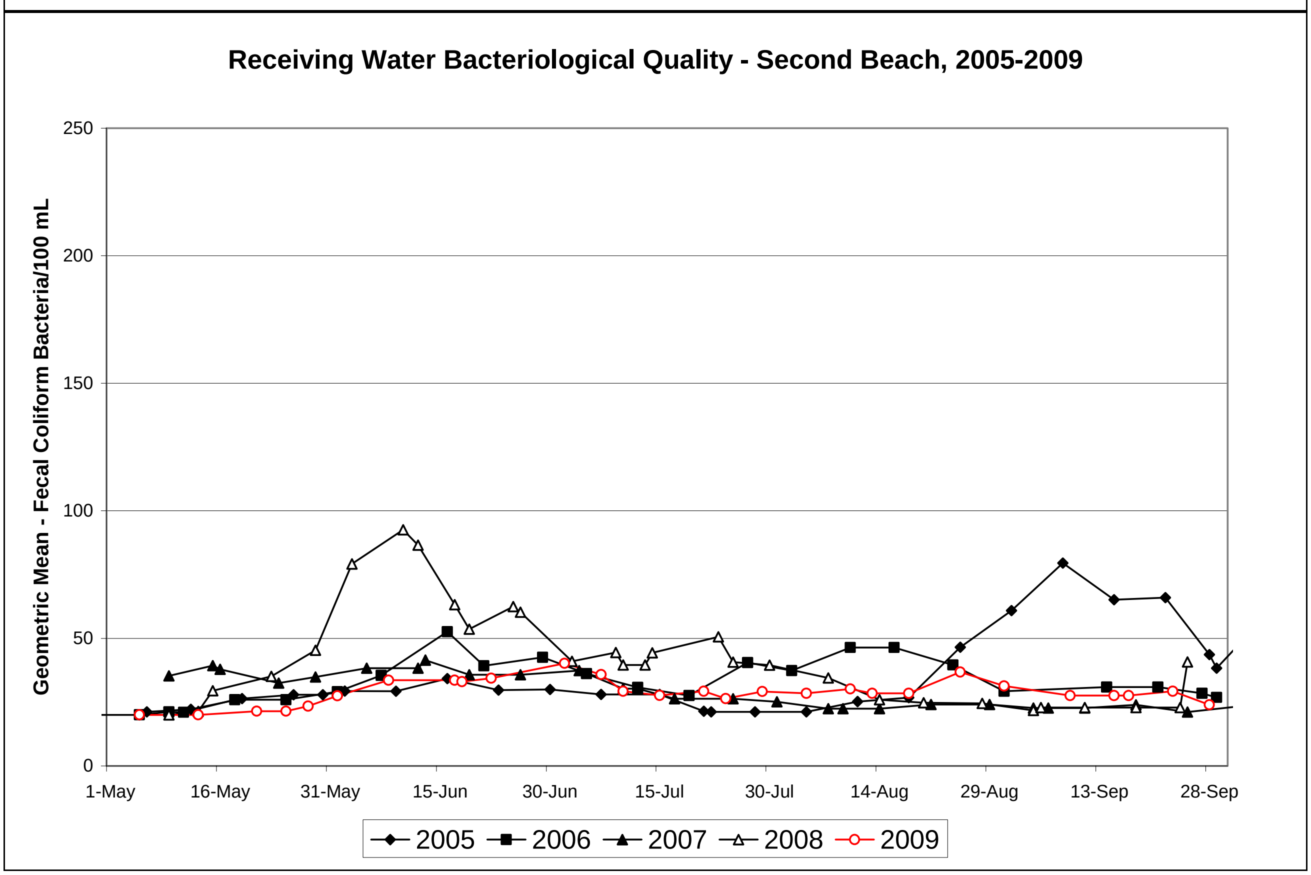

Receiving Water Bacteriological Quality - Old Orchard Park, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
300
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Rocky Point Park, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

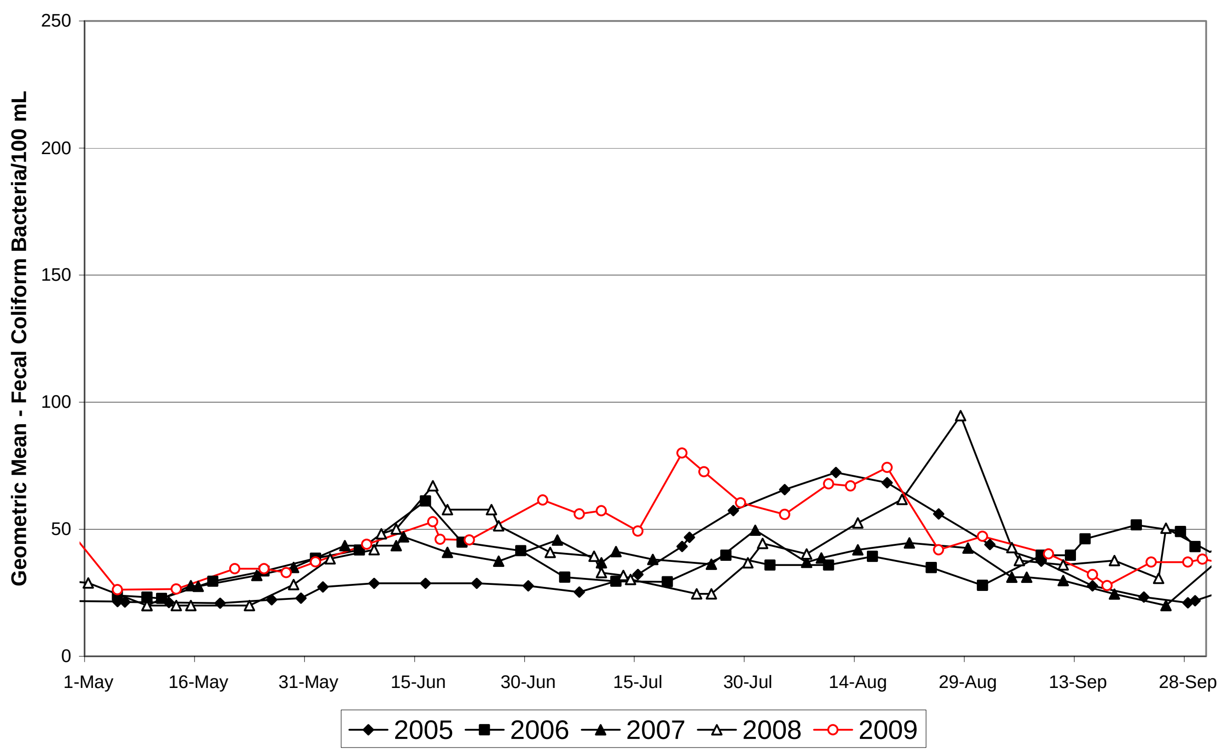

Receiving Water Bacteriological Quality - Barnet Marine Park, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
300
350
400
450
500
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Brockton, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
300
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

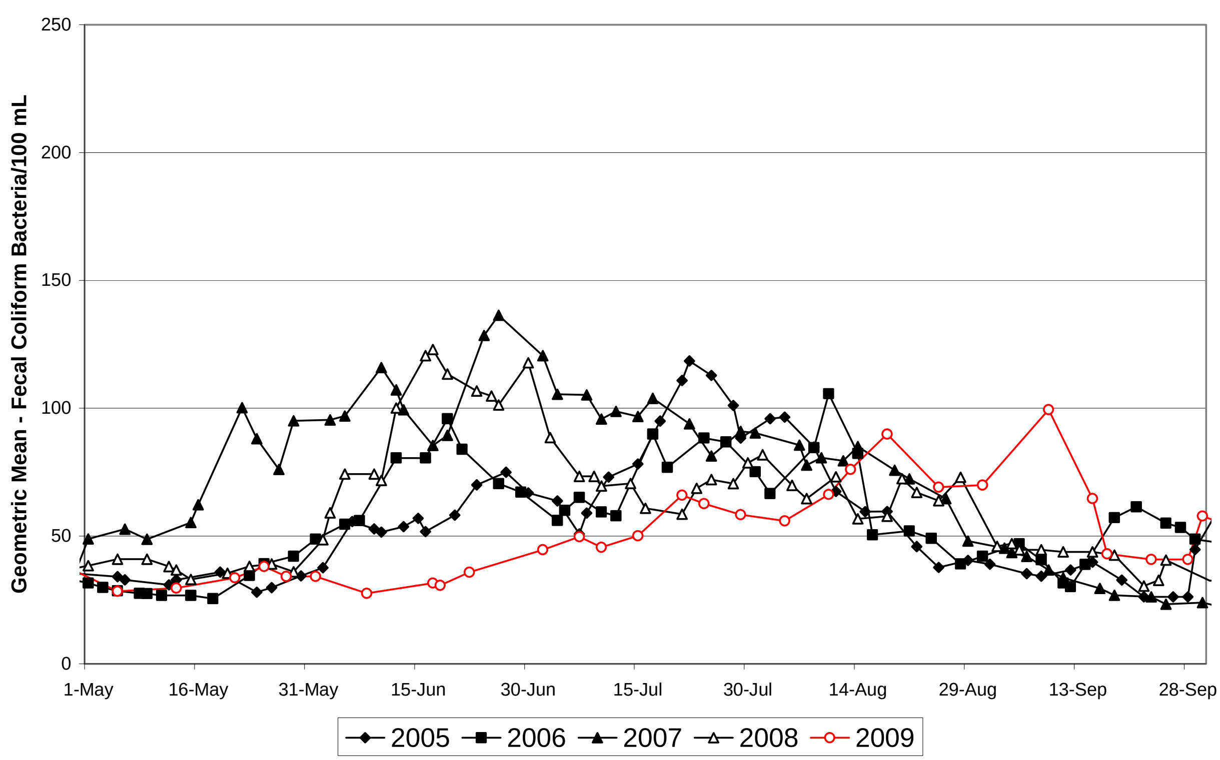

Receiving Water Bacteriological Quality - Third Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

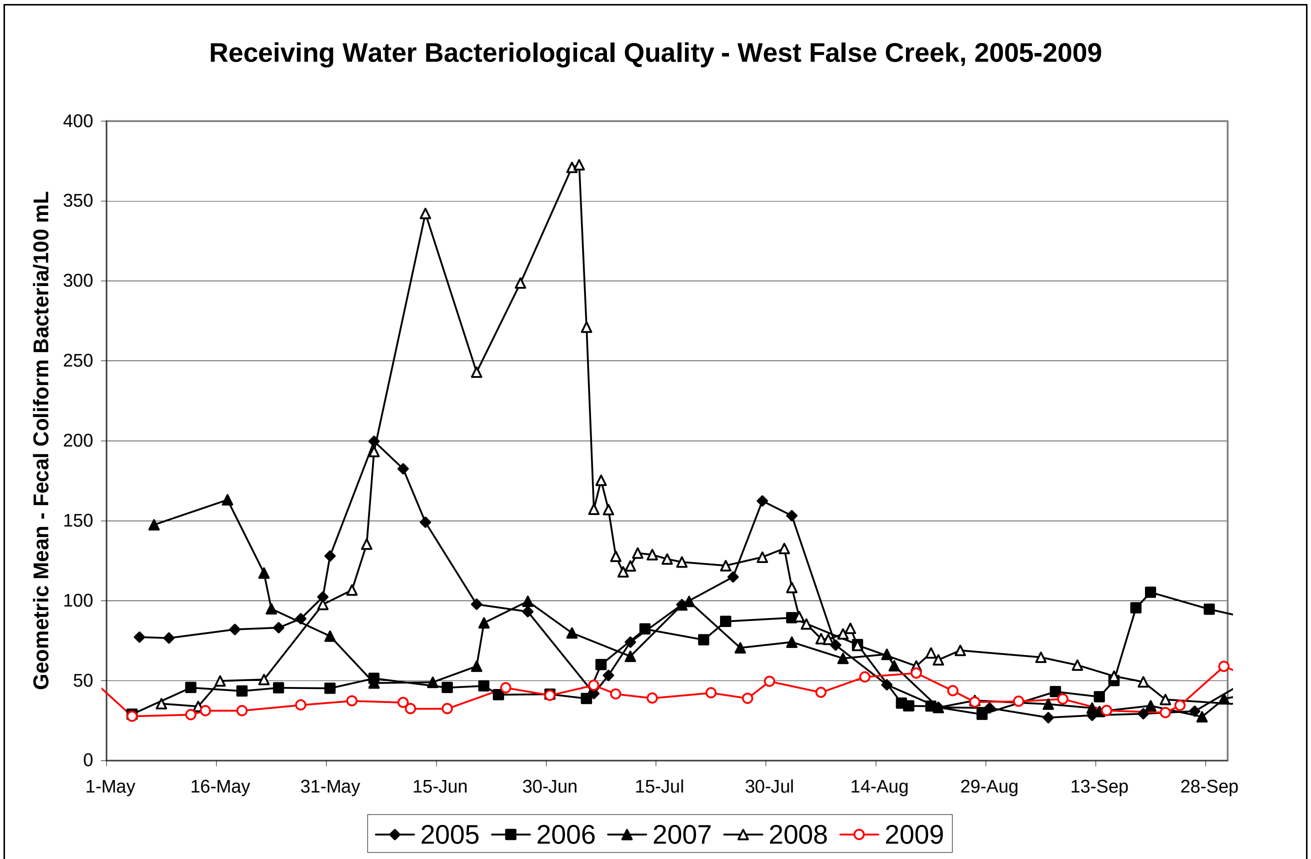

Receiving Water Bacteriological Quality - Second Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

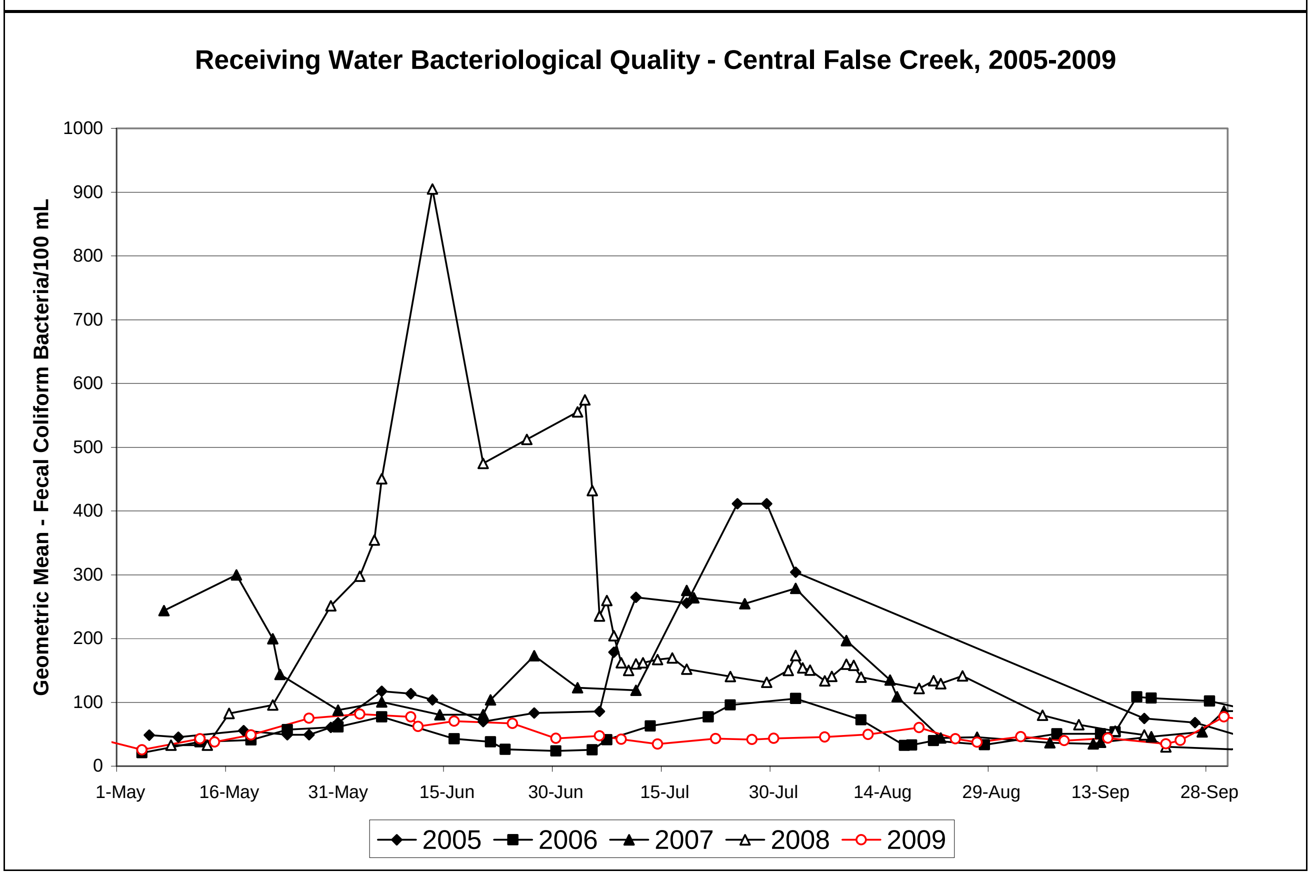
Receiving Water Bacteriological Quality - English Bay, 2005-2009



Receiving Water Bacteriological Quality - Sunset Beach, 2005-2009




Receiving Water Bacteriological Quality - West False Creek, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
400
350
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Central False Creek, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
1000
900
800
700
600
500
400
300
200
100
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
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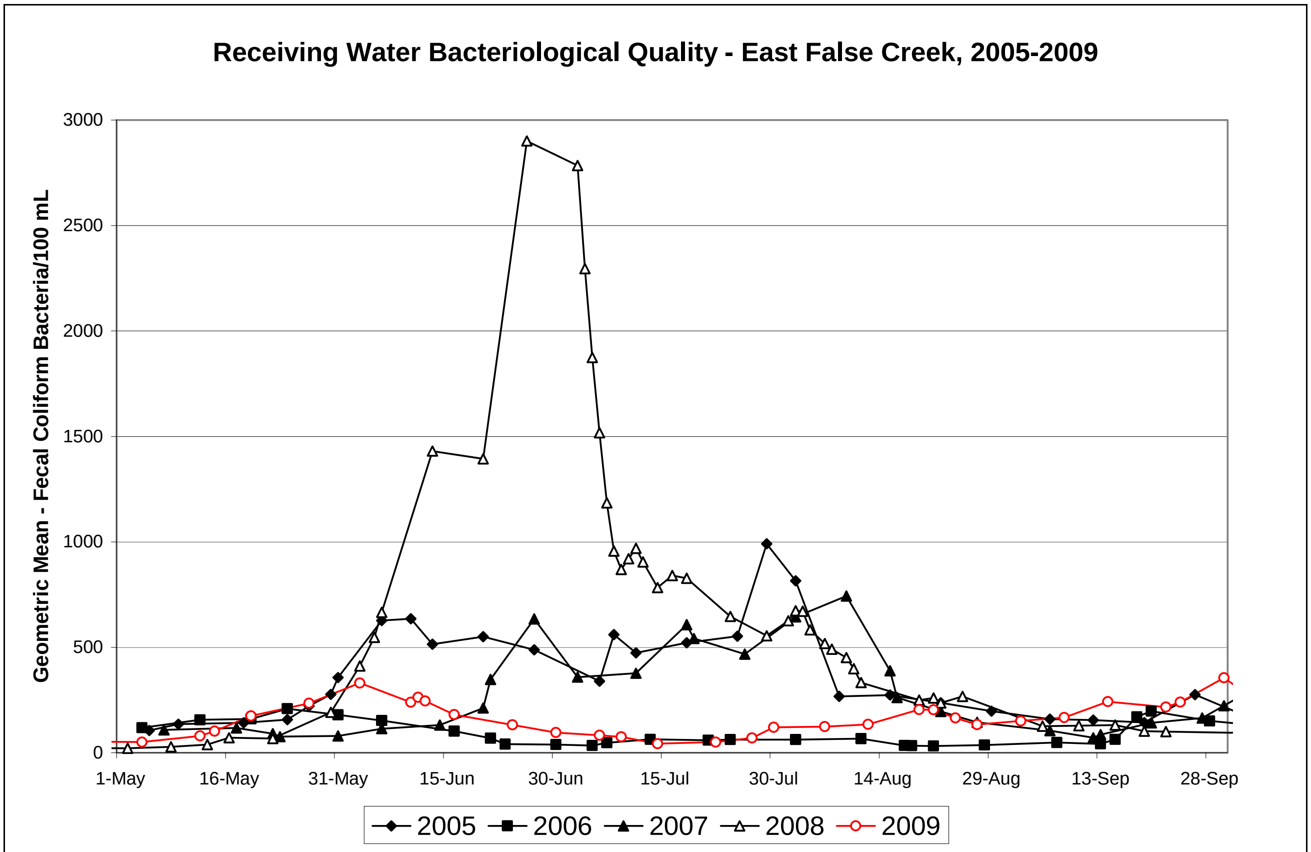
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - East False Creek, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
500
1000
1500
2000
2500
3000
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
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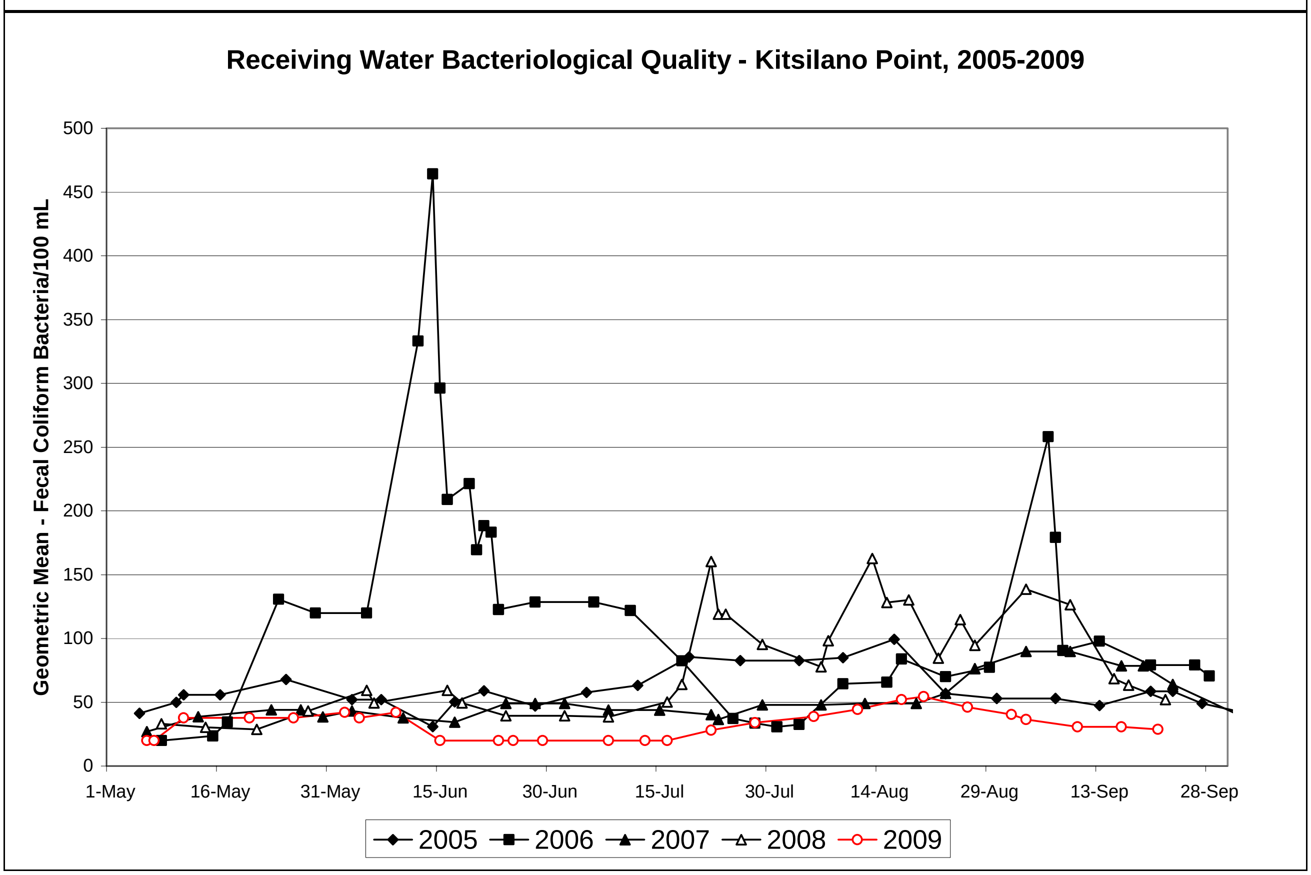
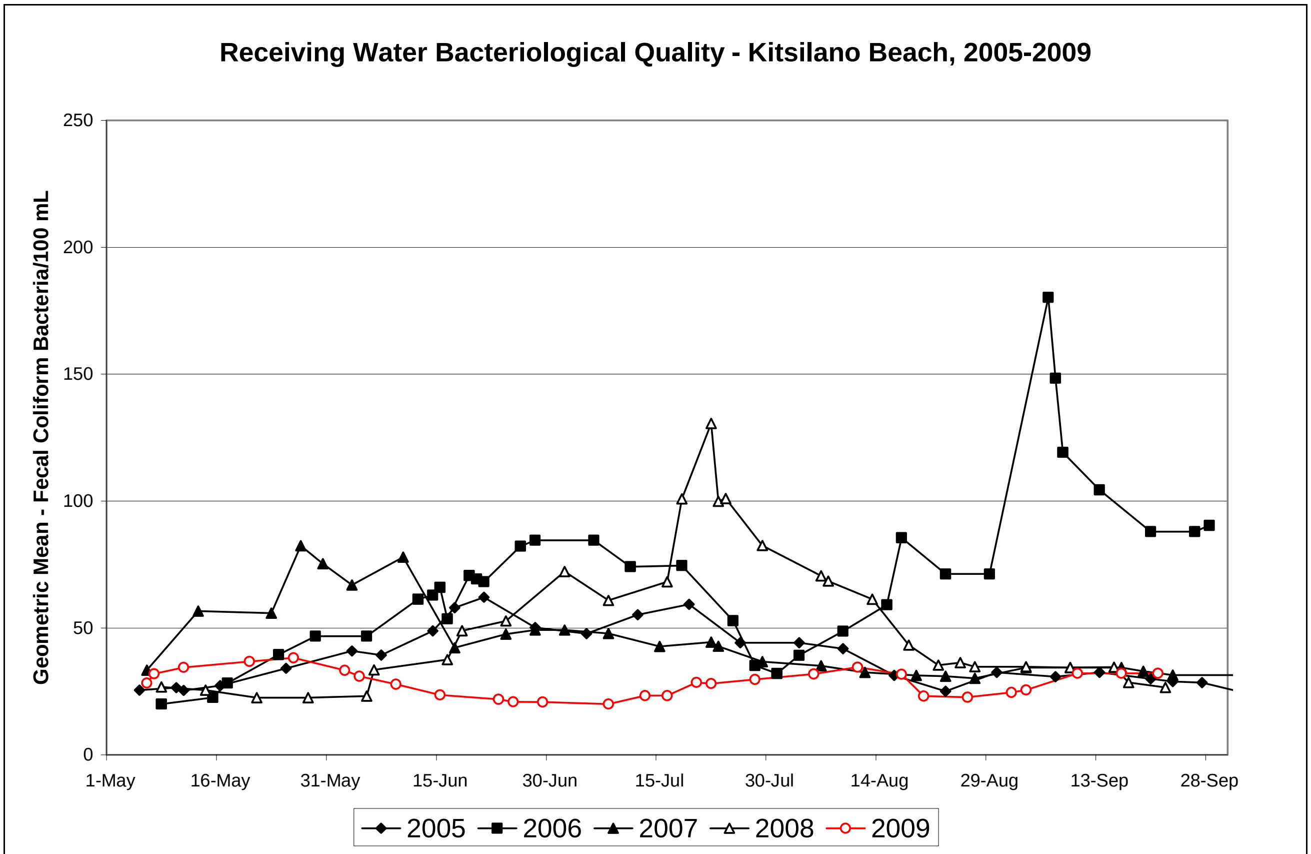
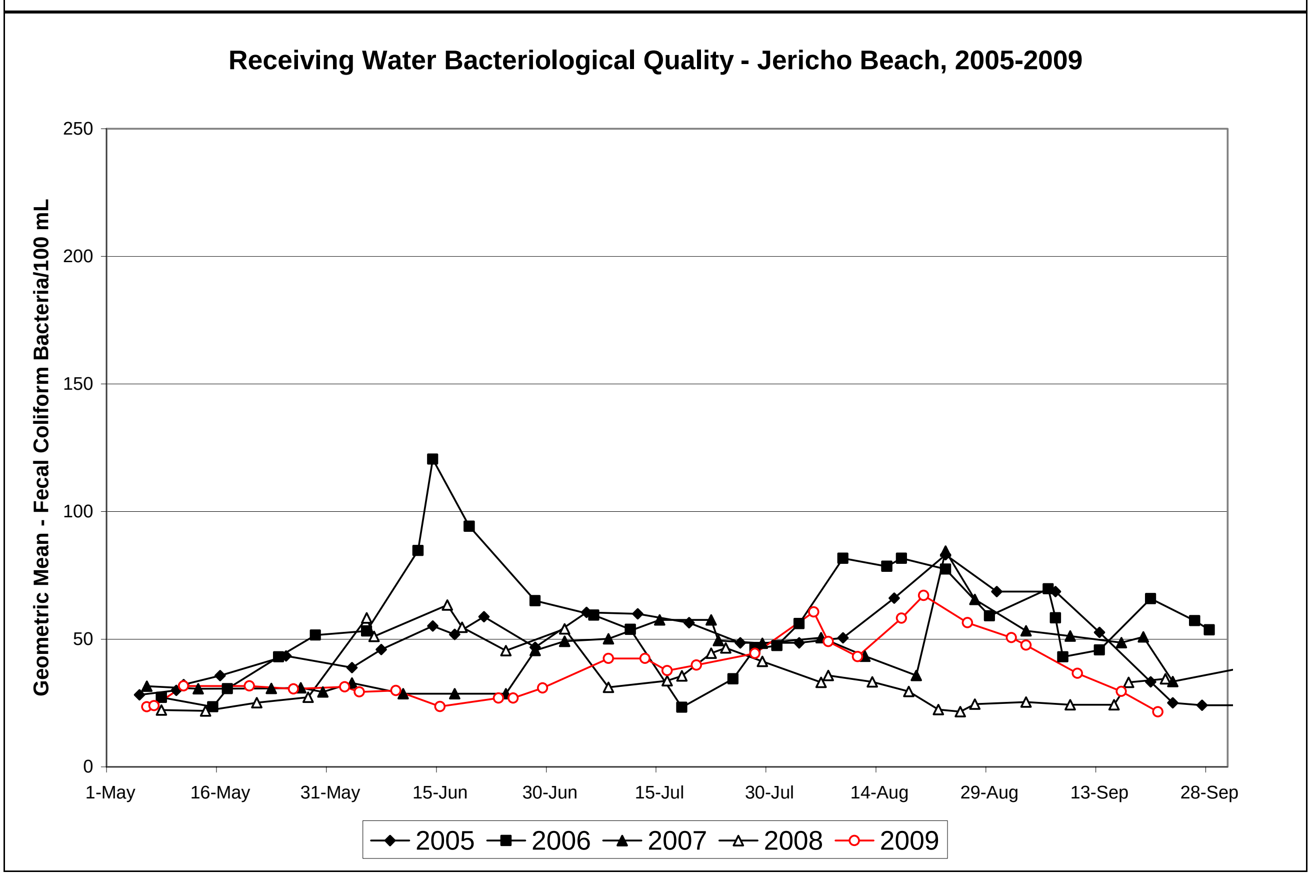
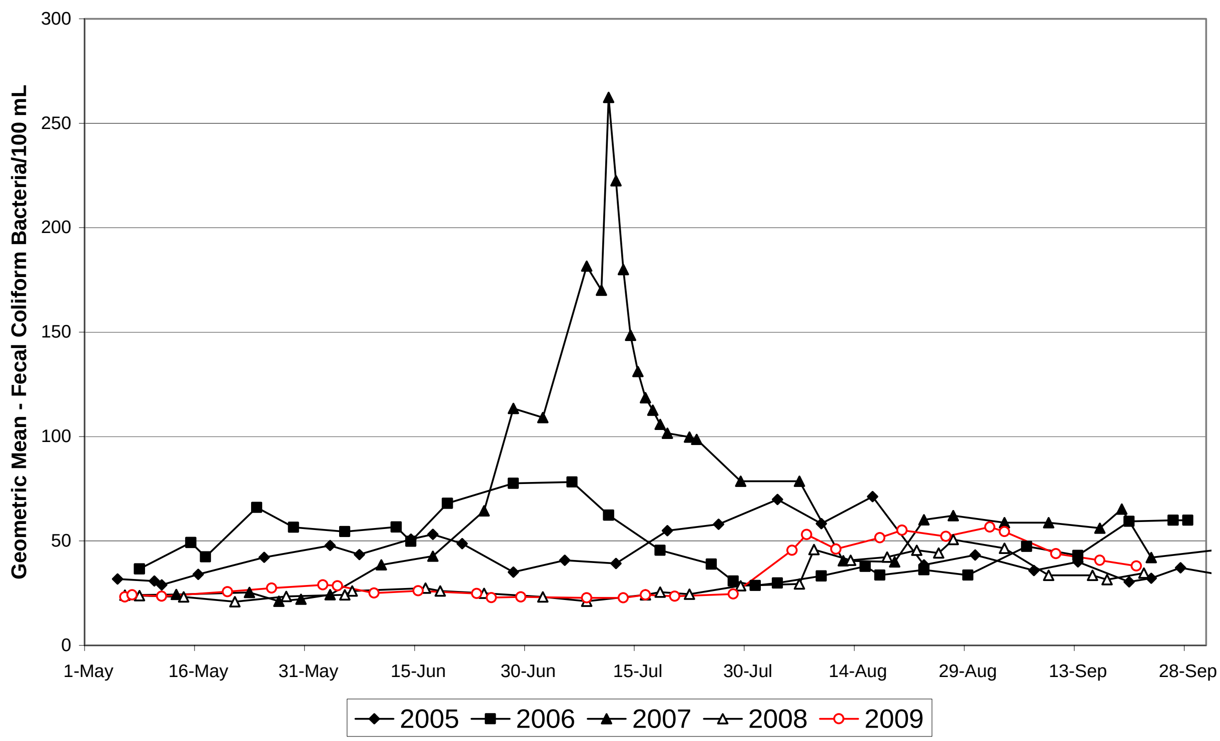
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Kitsilano Point, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
300
350
400
450
500
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

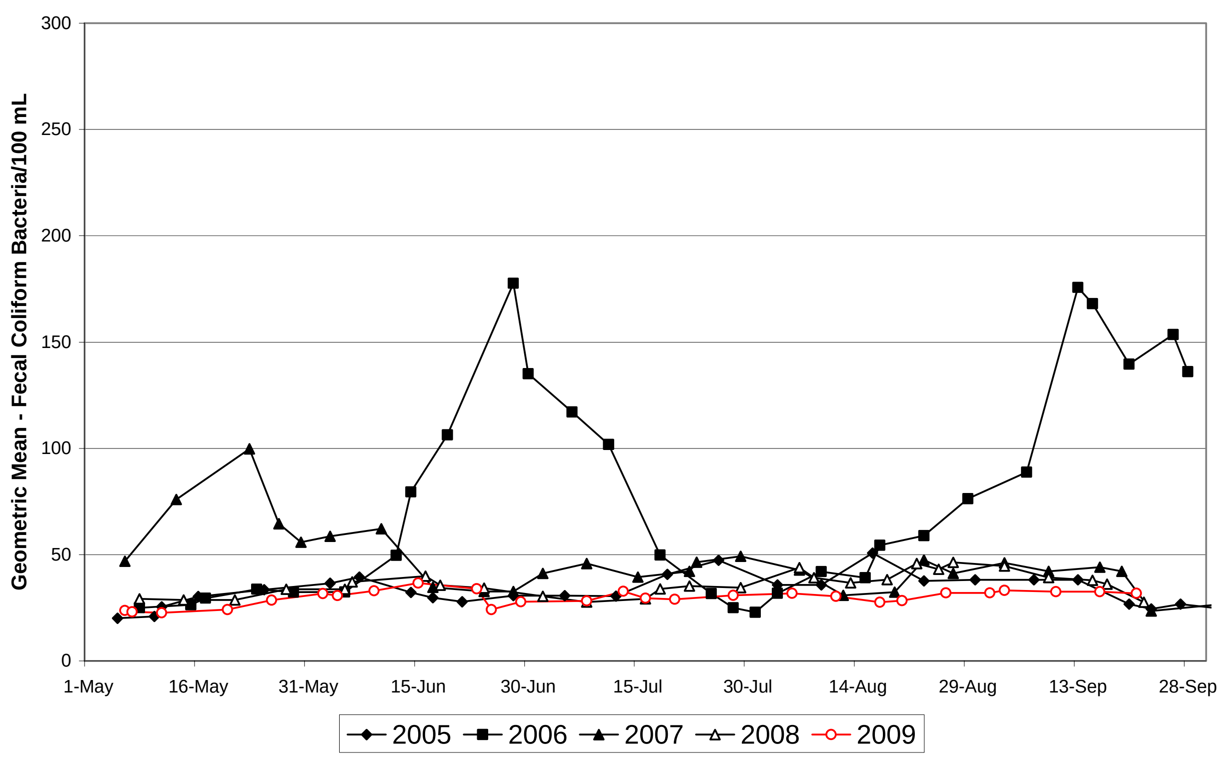

Receiving Water Bacteriological Quality - Kitsilano Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

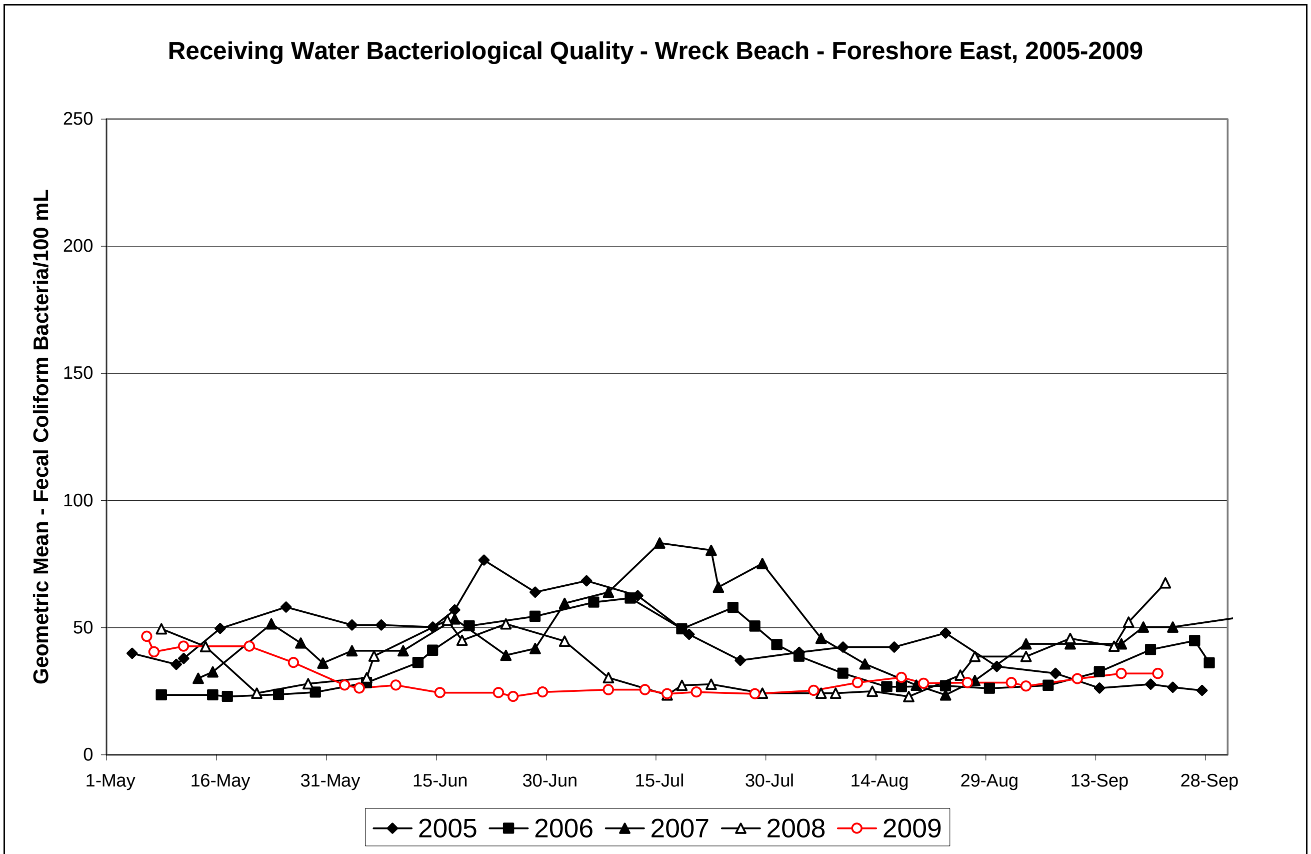

Receiving Water Bacteriological Quality - Jericho Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

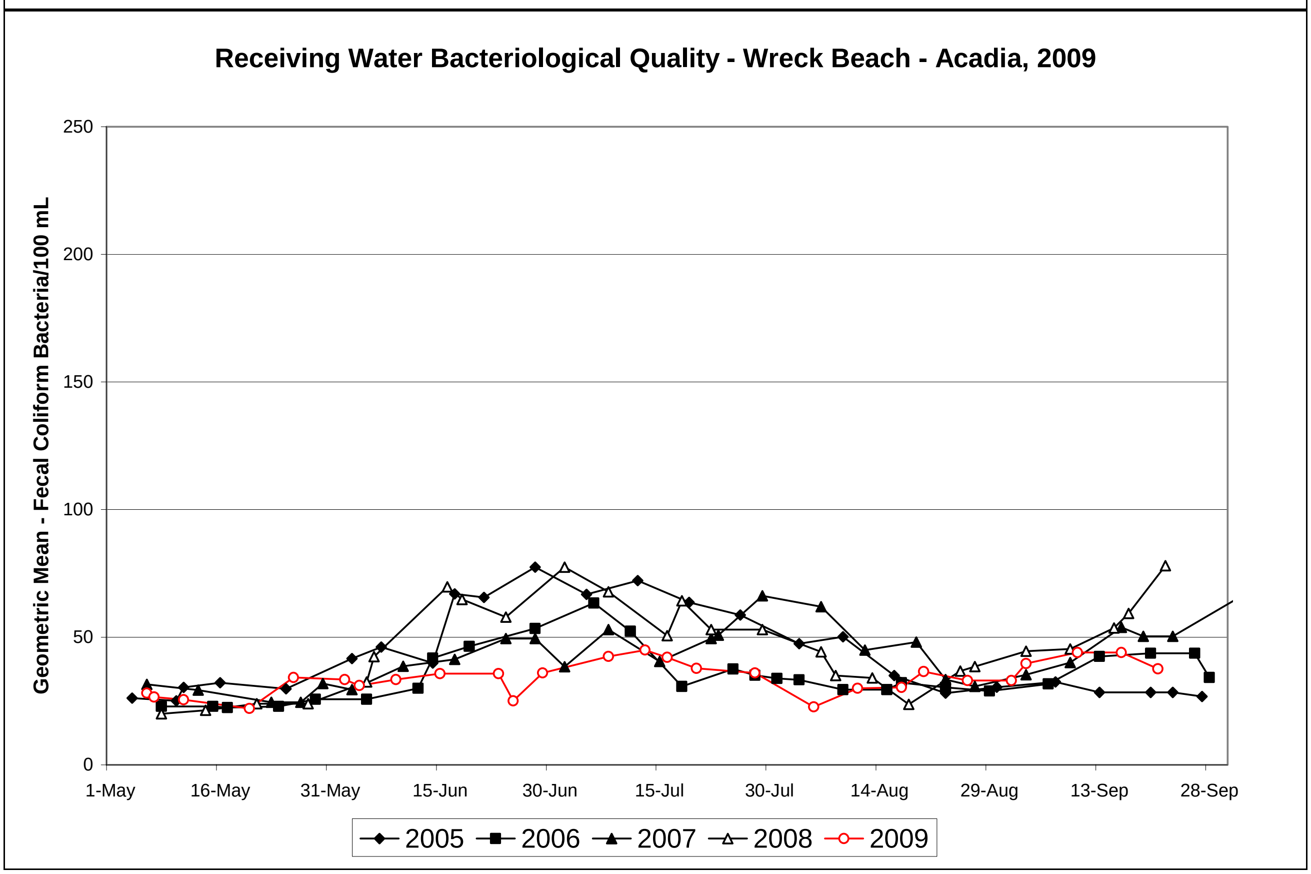
Receiving Water Bacteriological Quality - Locarno Beach, 2005-2009

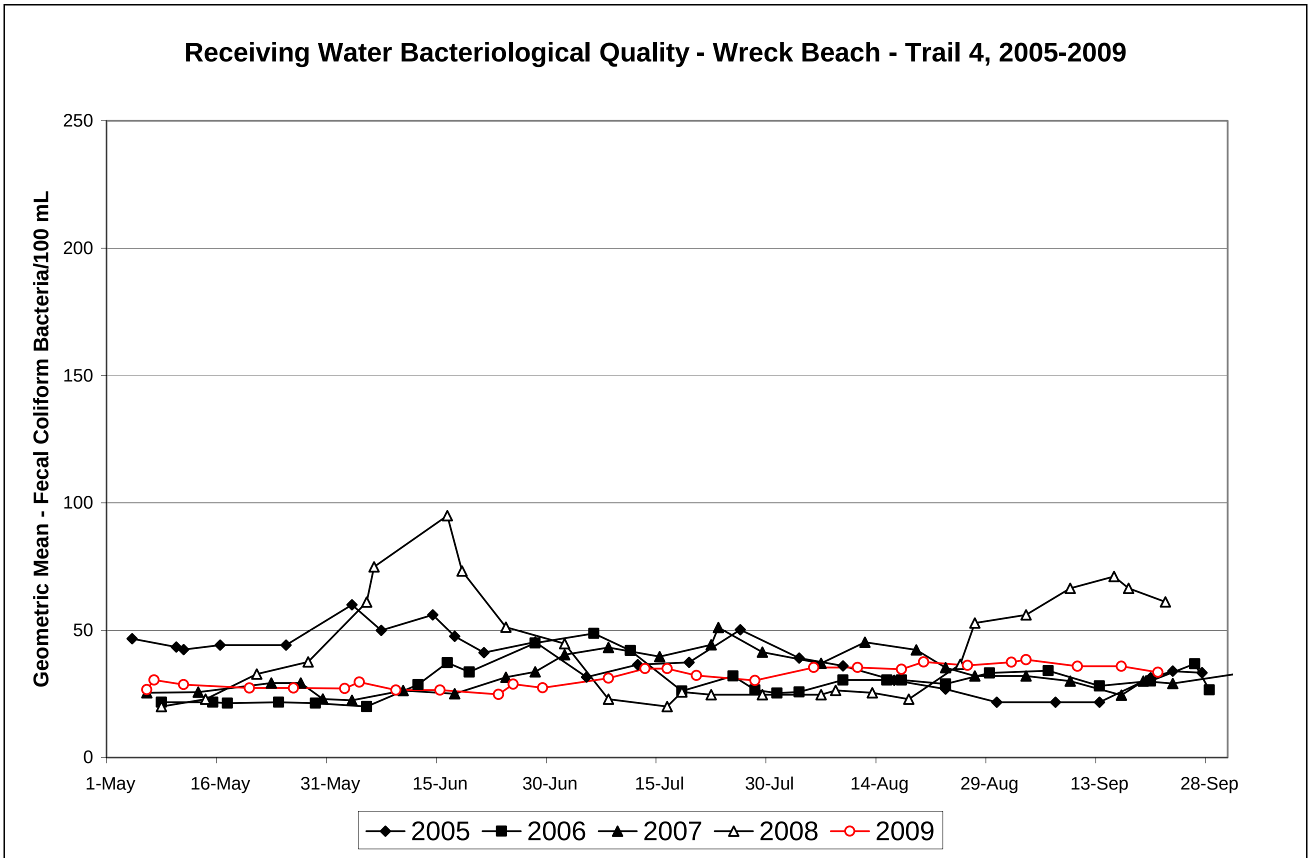


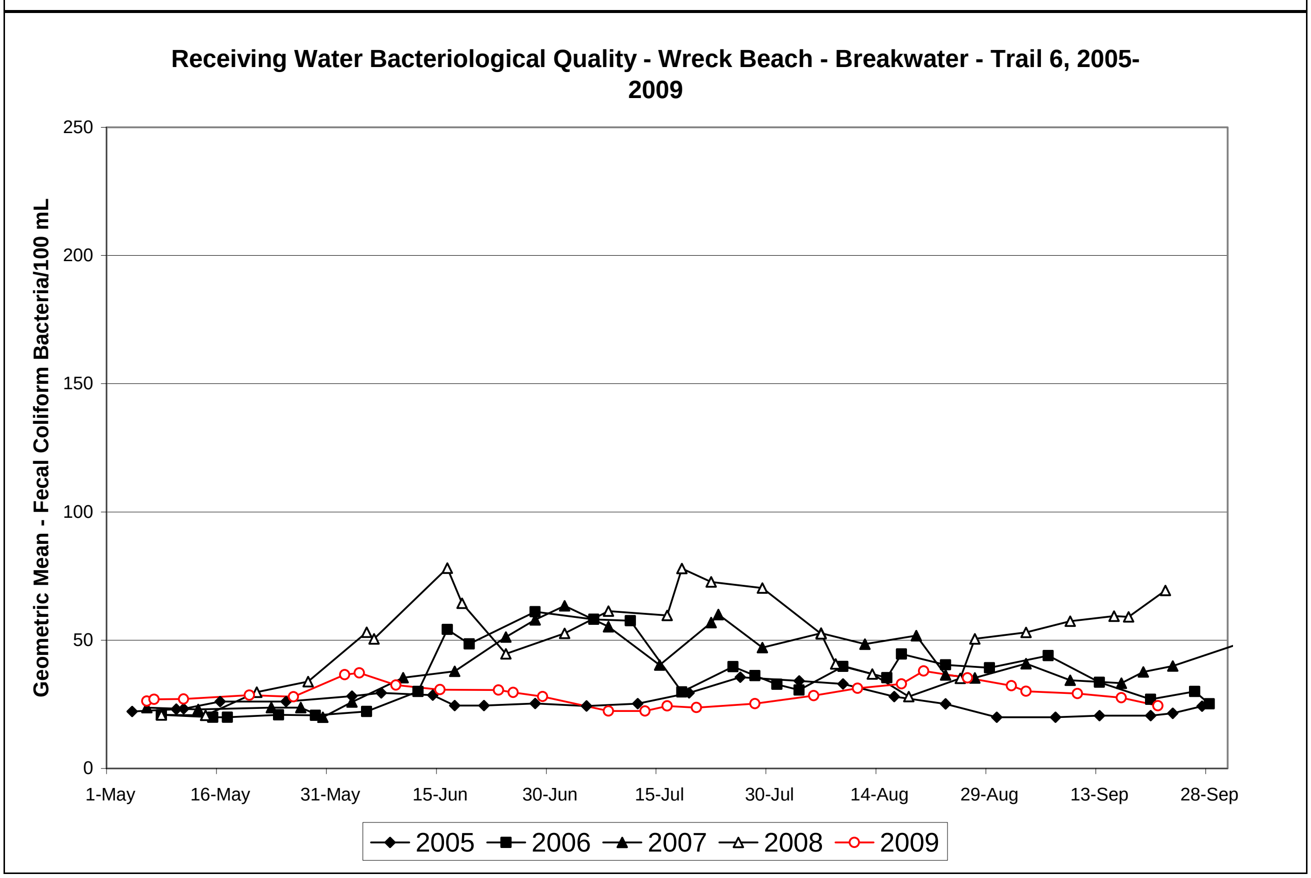
Receiving Water Bacteriological Quality - Spanish Banks, 2005-2009



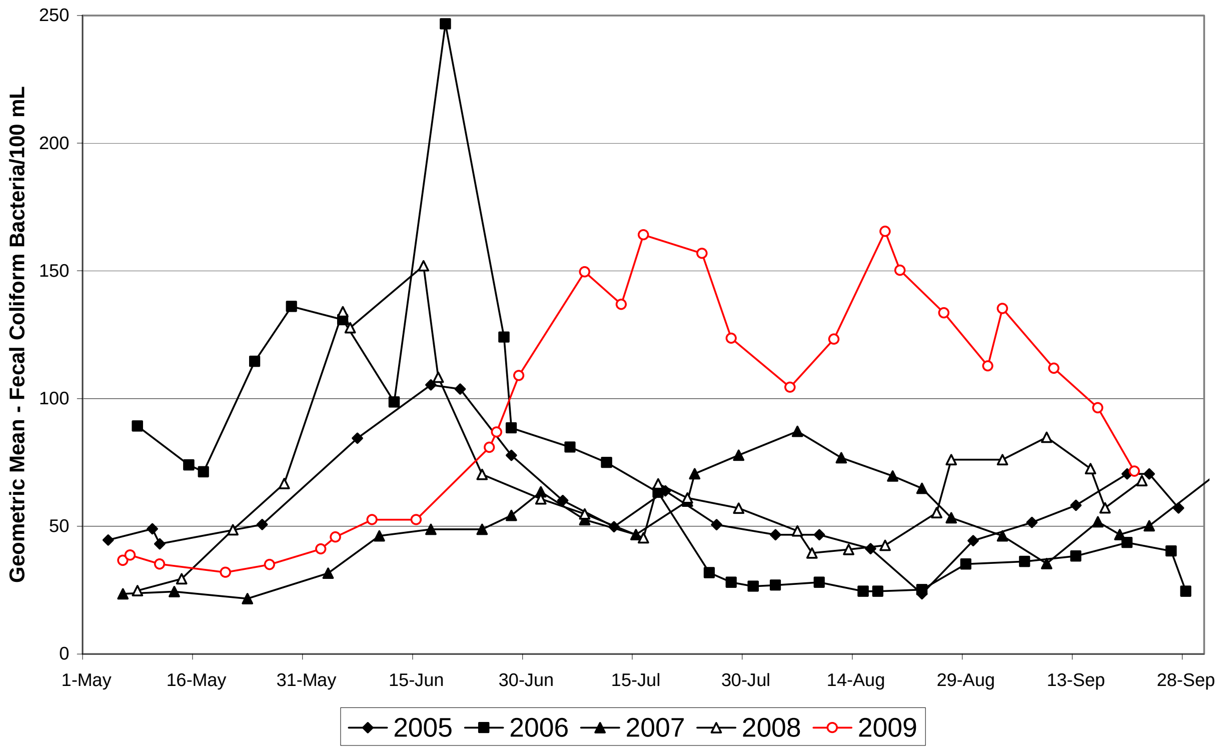

Receiving Water Bacteriological Quality - Wreck Beach - Foreshore East, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Wreck Beach - Acadia, 2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

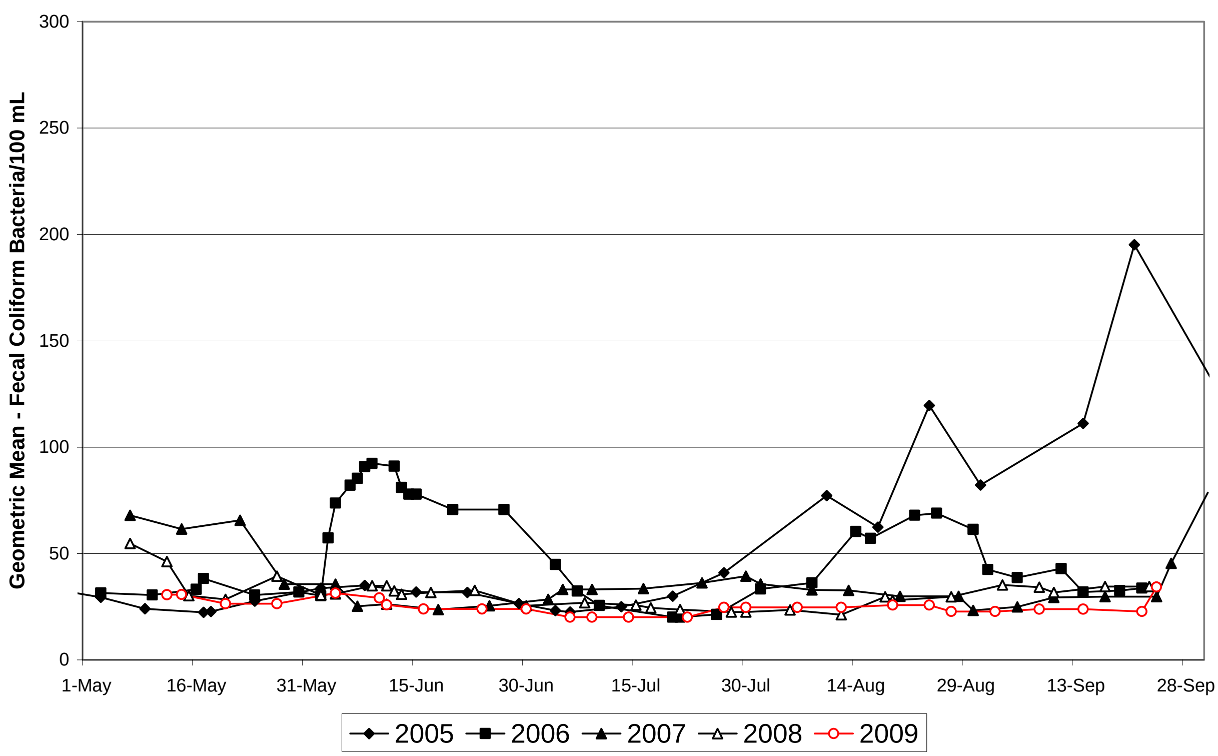

Receiving Water Bacteriological Quality - Wreck Beach - Trail 4, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

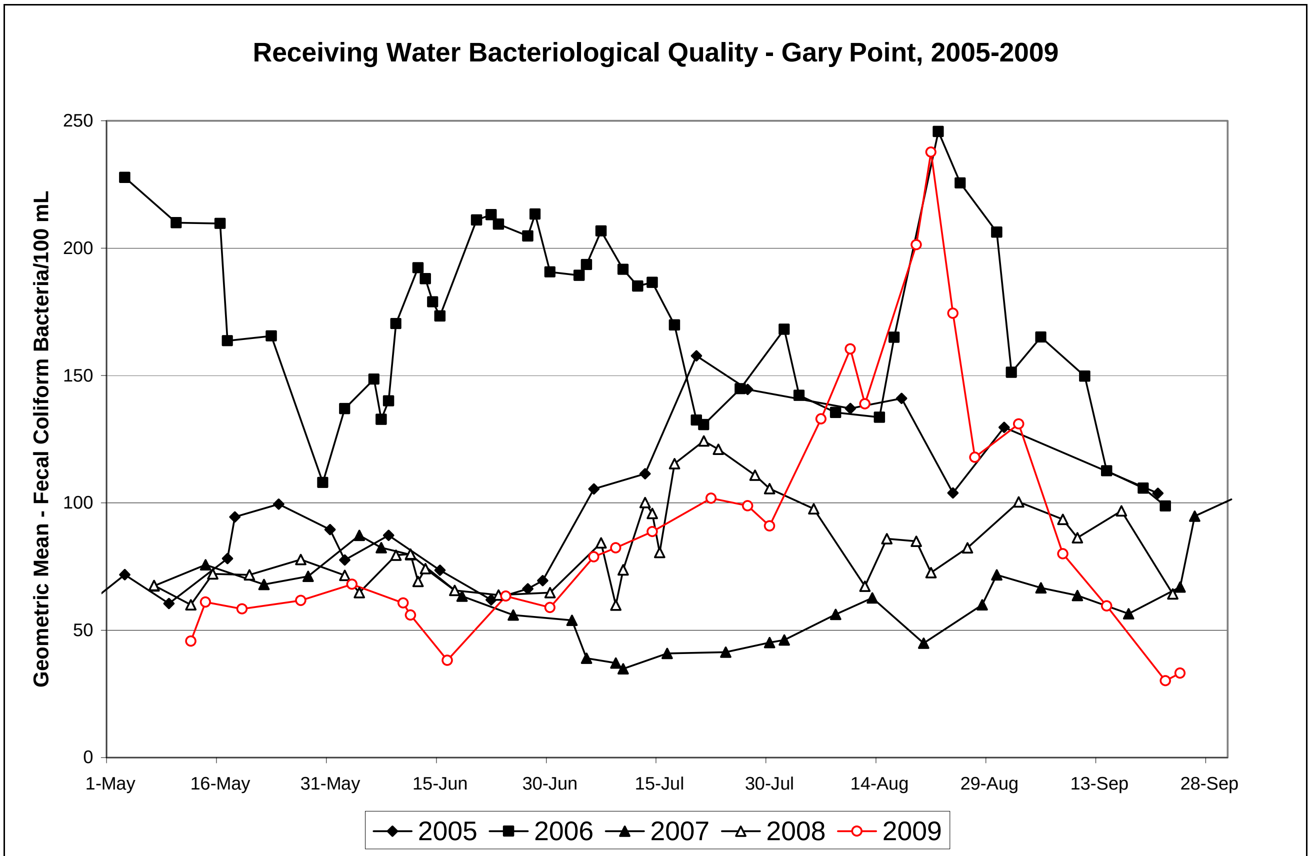

Receiving Water Bacteriological Quality - Wreck Beach - Breakwater - Trail 6, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

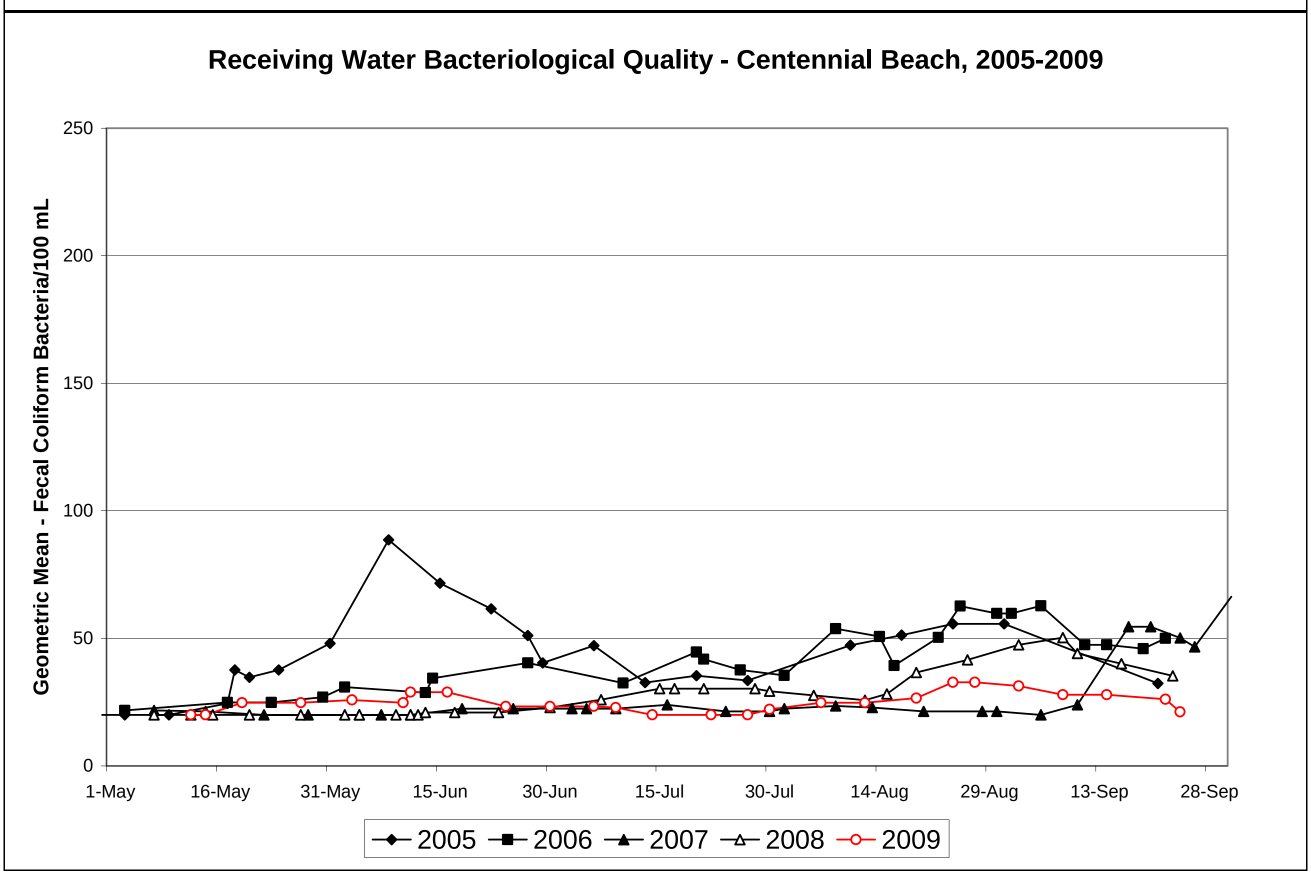
Receiving Water Bacteriological Quality - Wreck Beach - Trail 7 - Oasis, 2005-2009

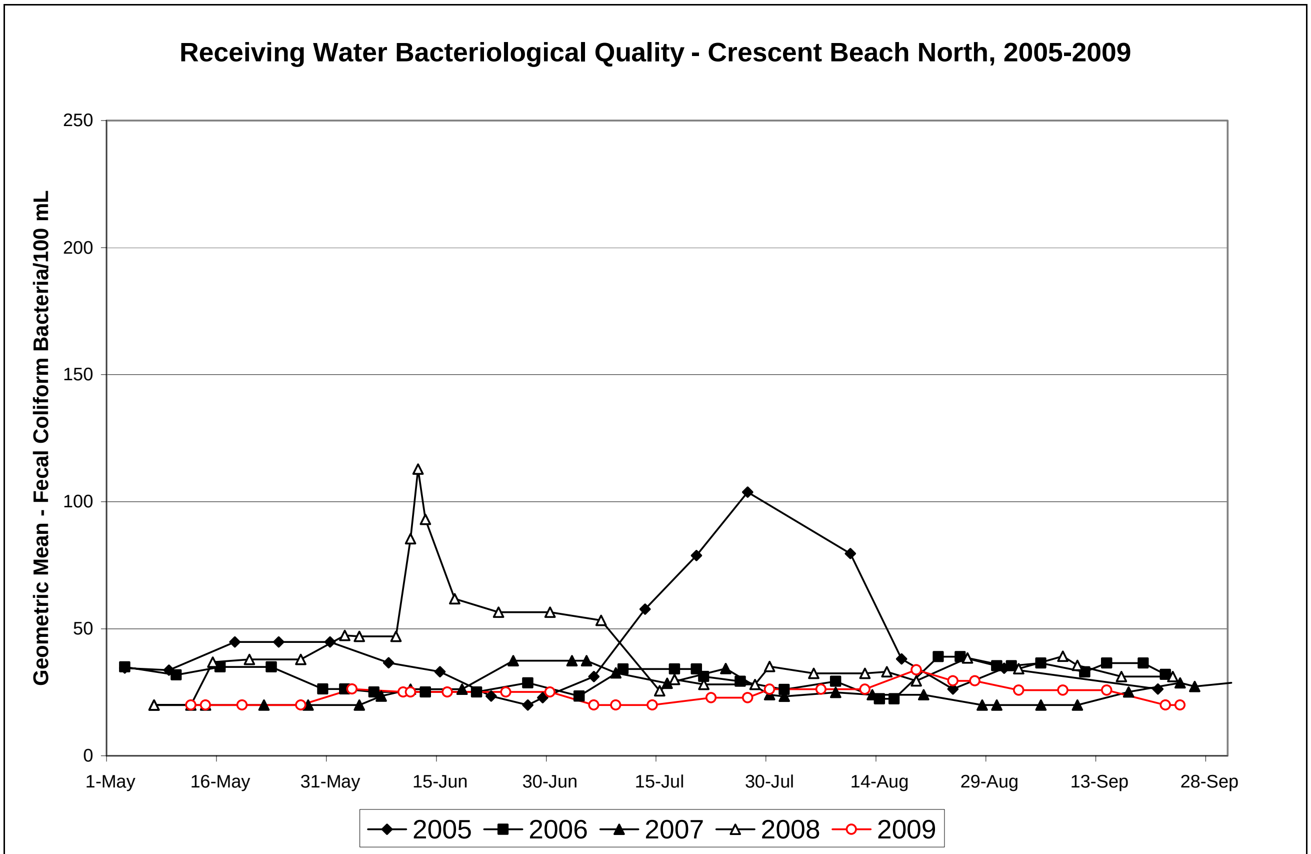


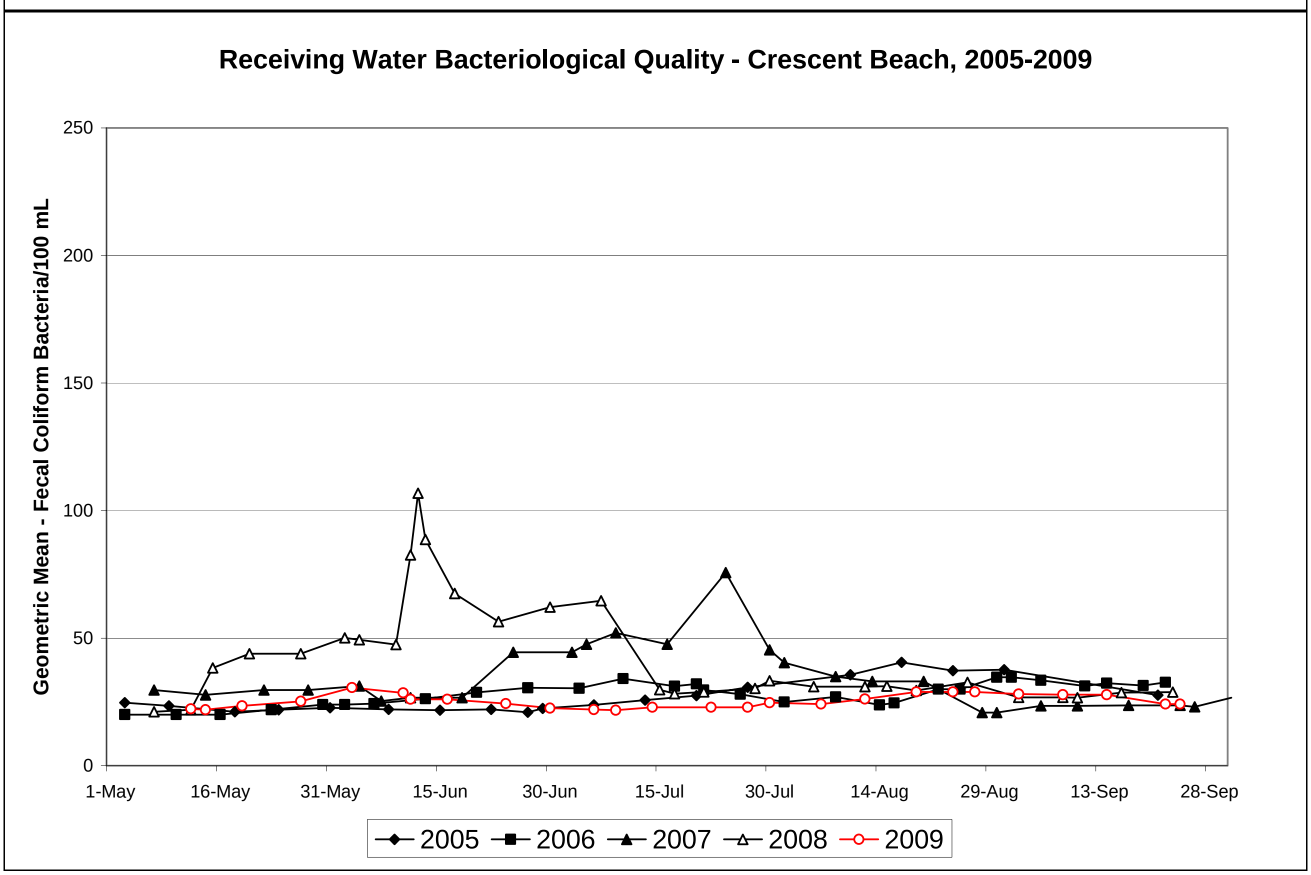
Receiving Water Bacteriological Quality - Iona Beach, 20052-2009

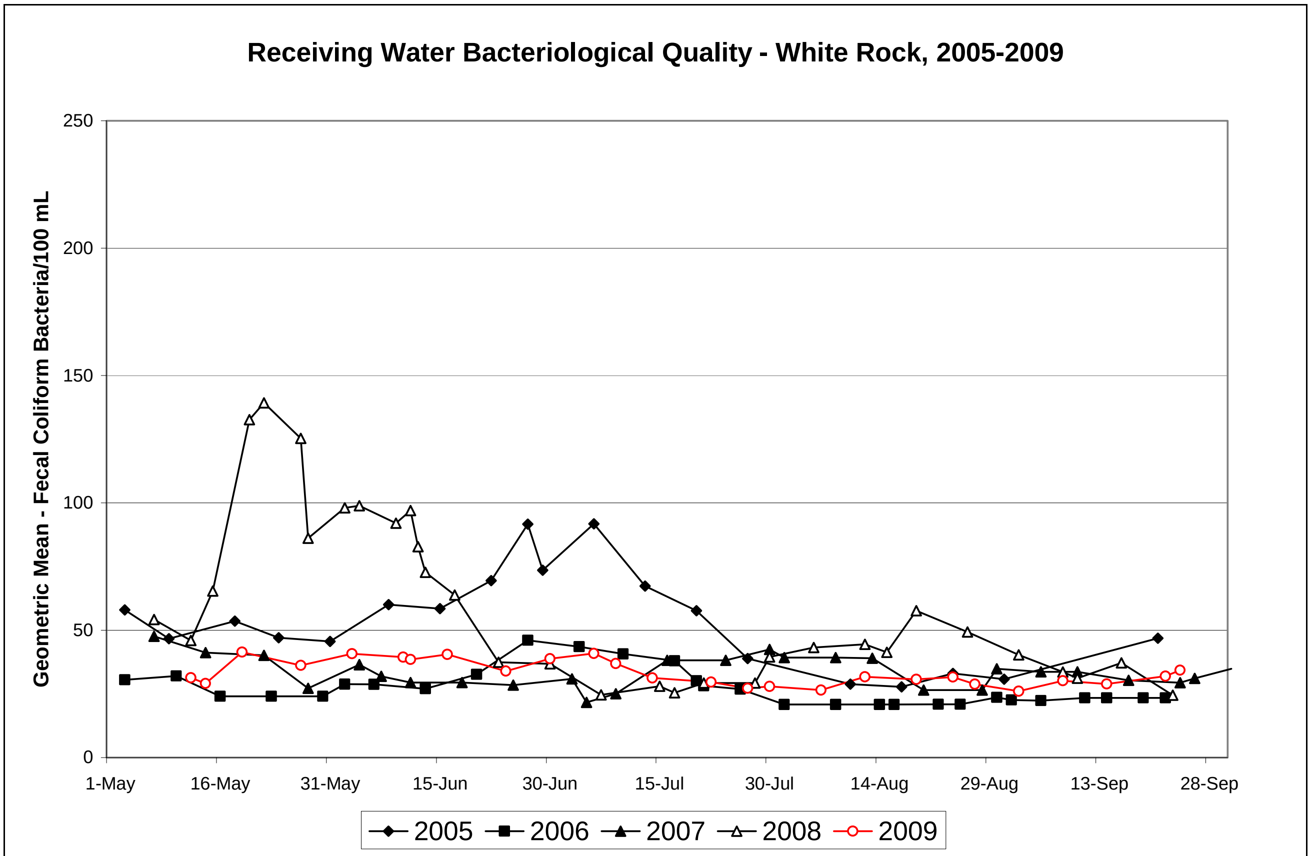



Receiving Water Bacteriological Quality - Gary Point, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

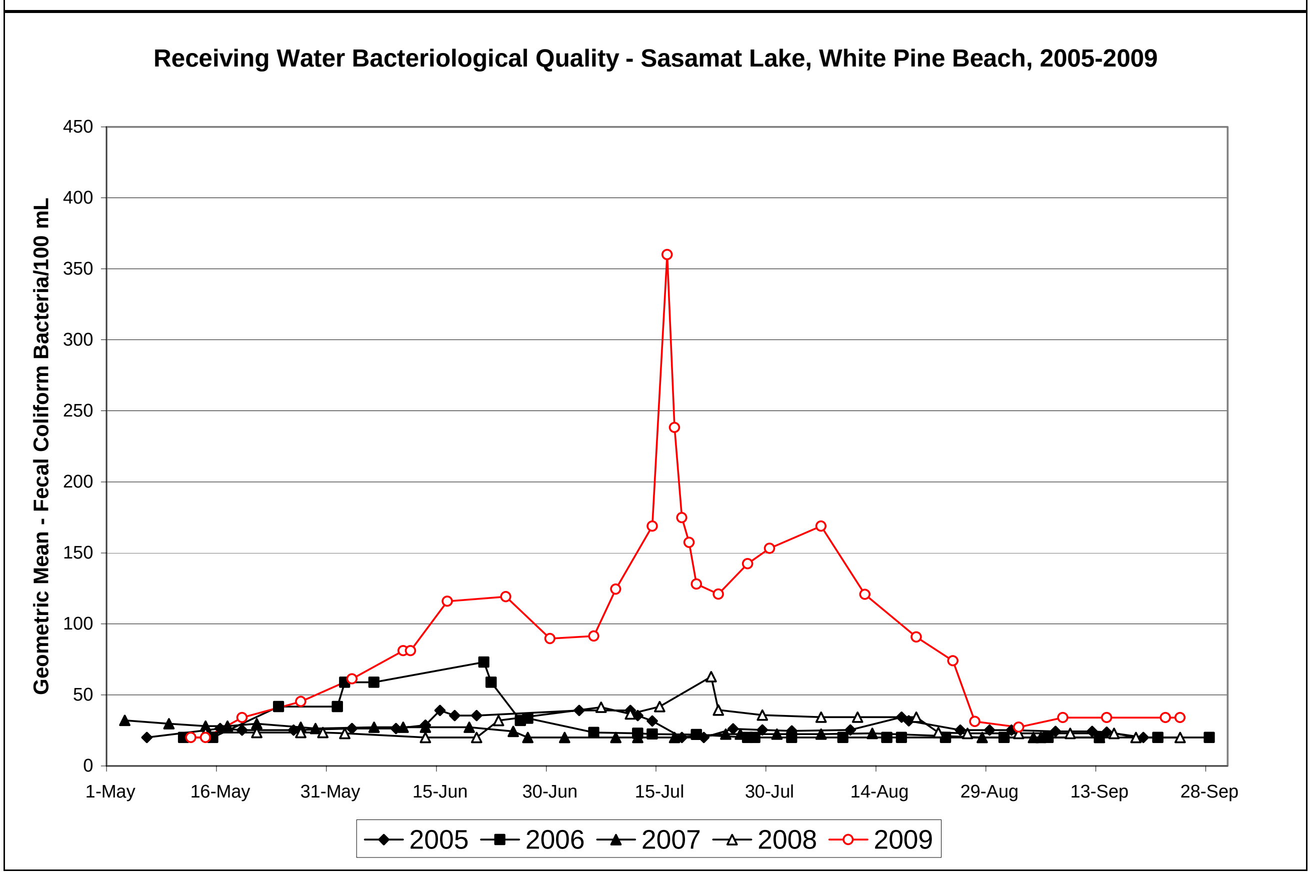

Receiving Water Bacteriological Quality - Centennial Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
0
50
100
150
200
250
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009


Receiving Water Bacteriological Quality - Crescent Beach North, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

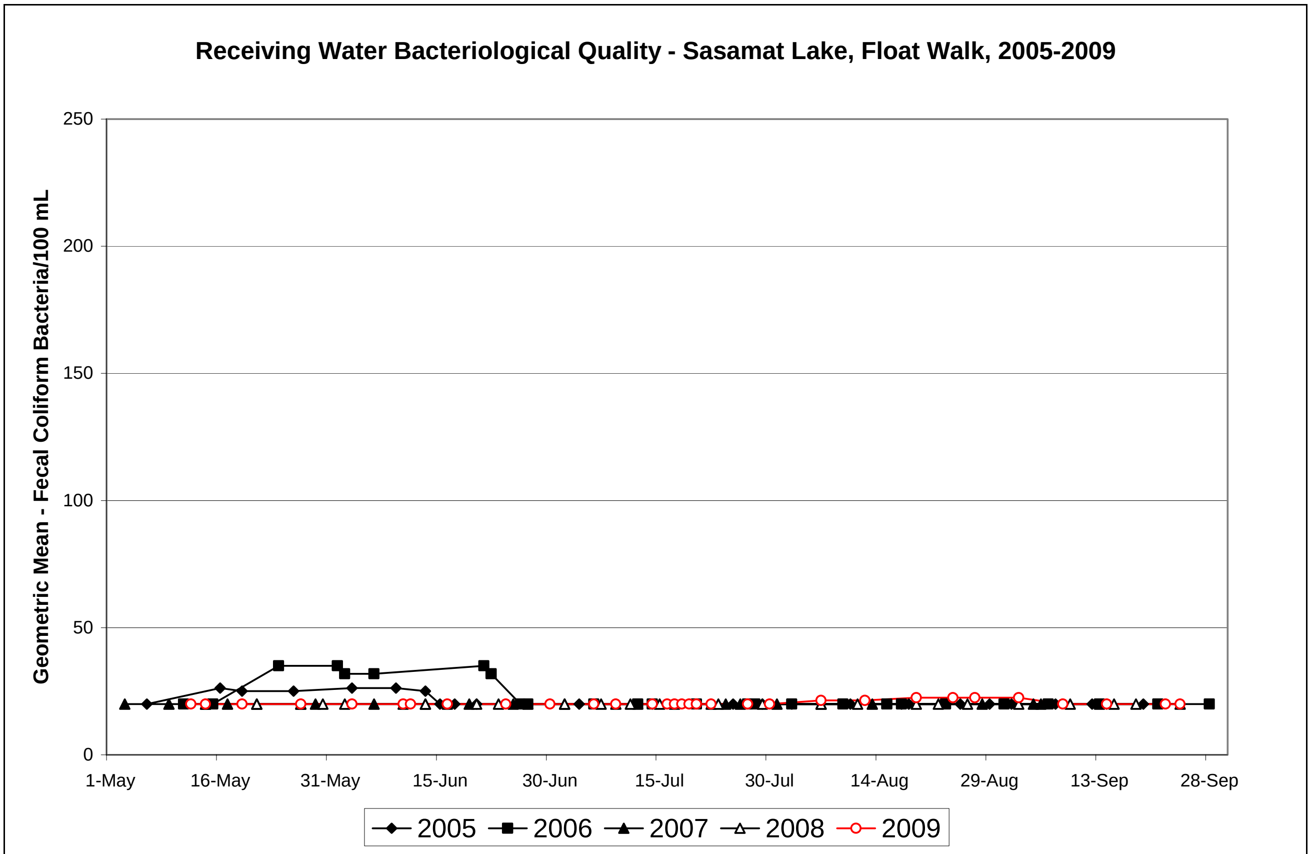

Receiving Water Bacteriological Quality - Crescent Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

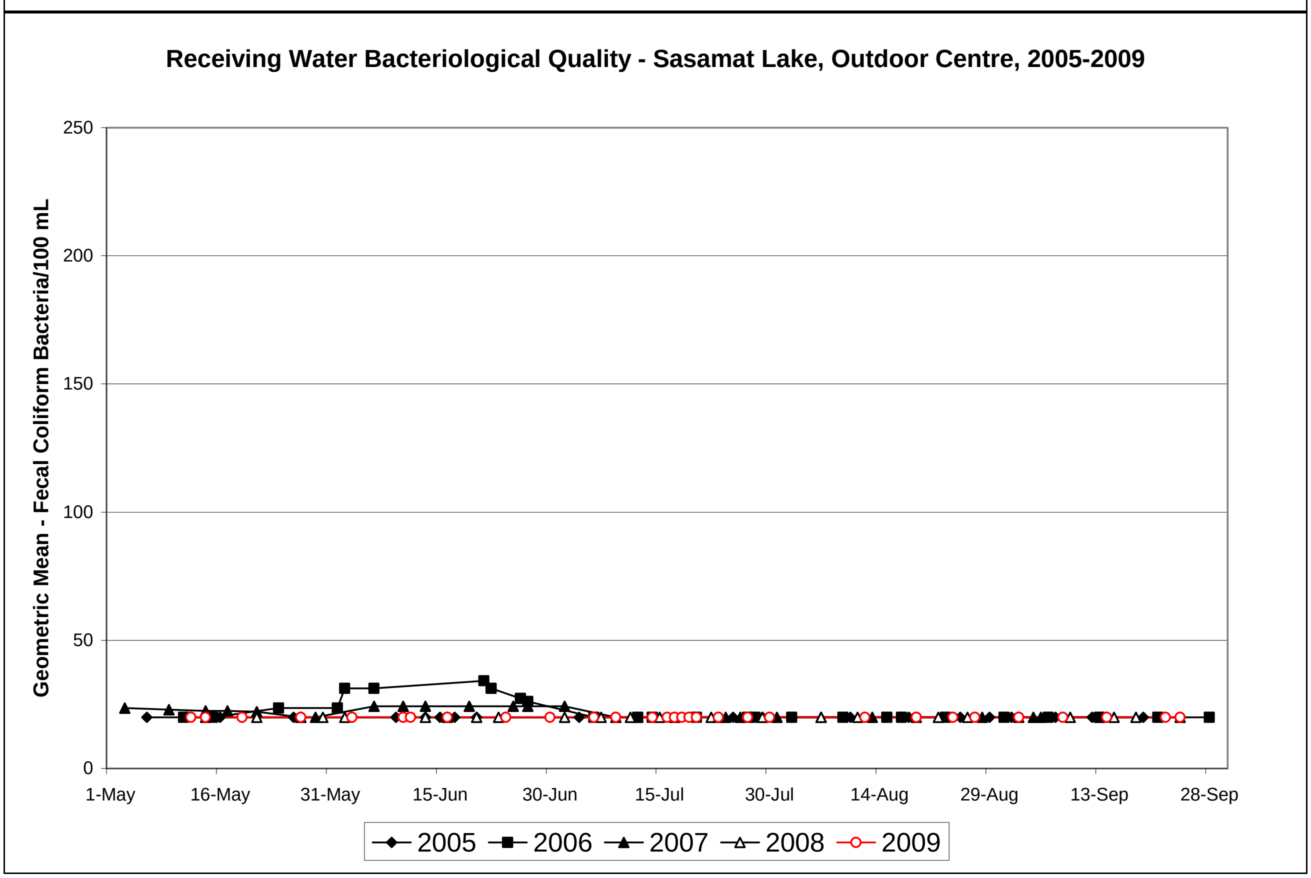


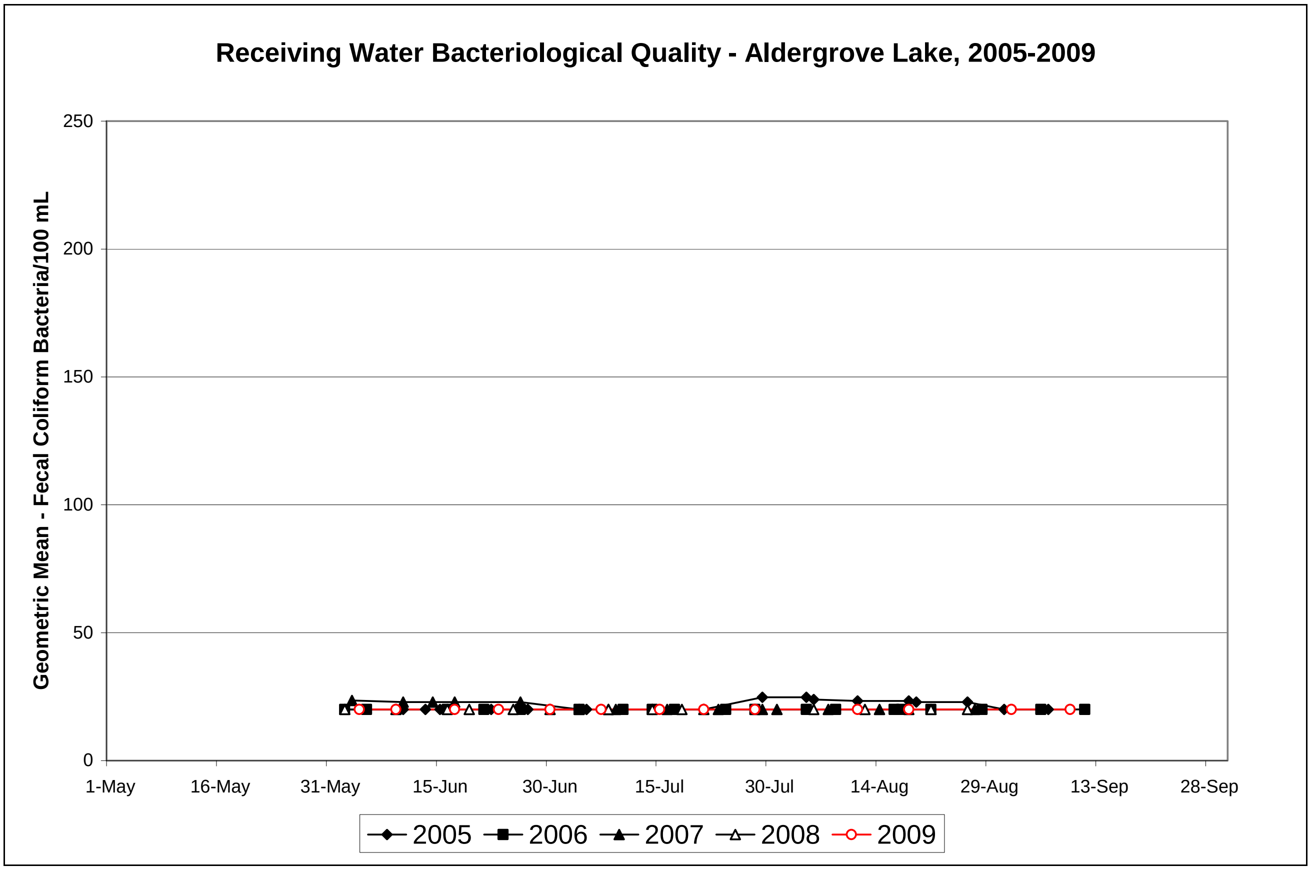
Receiving Water Bacteriological Quality - White Rock, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009



Receiving Water Bacteriological Quality - Sasamat Lake, White Pine Beach, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
450
400
350
300
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

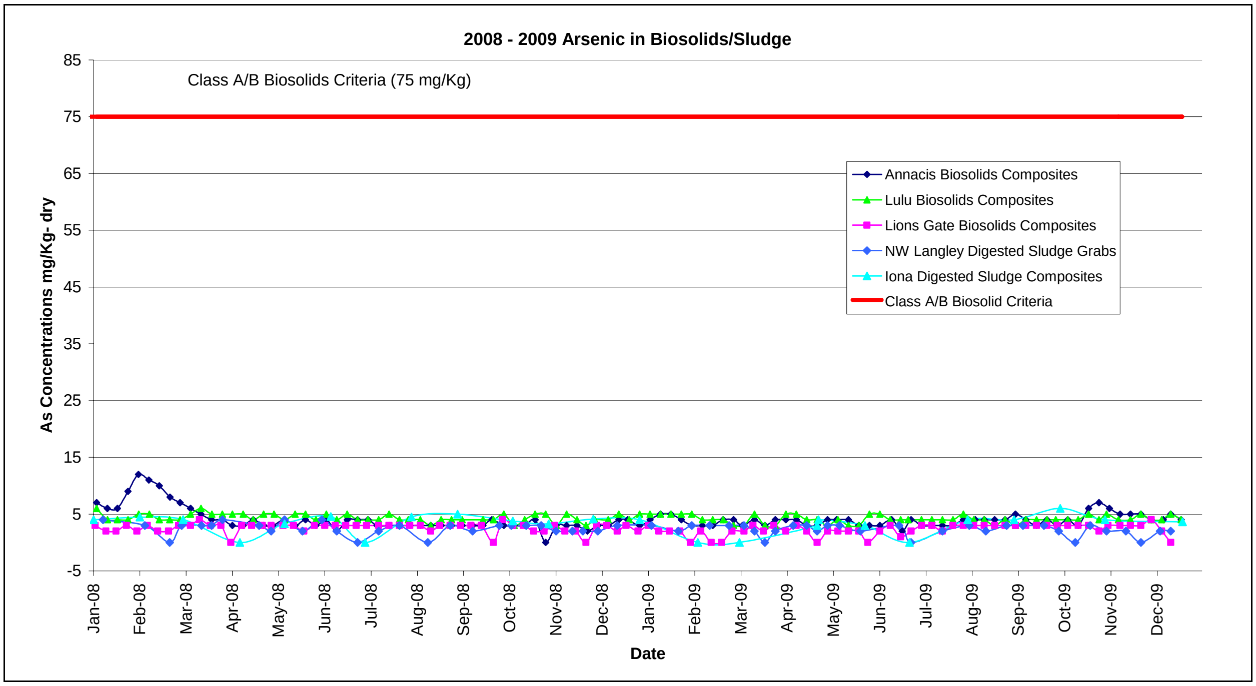

Receiving Water Bacteriological Quality - Sasamat Lake, Float Walk, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

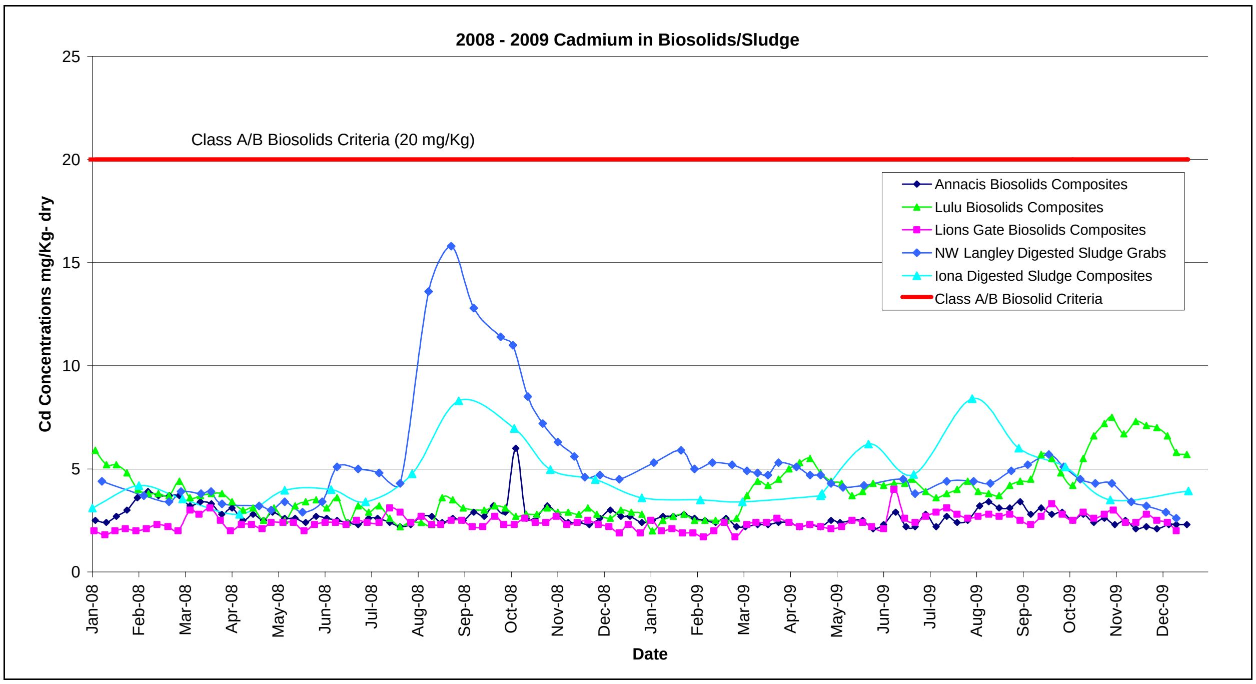

Receiving Water Bacteriological Quality - Sasamat Lake, Outdoor Centre, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

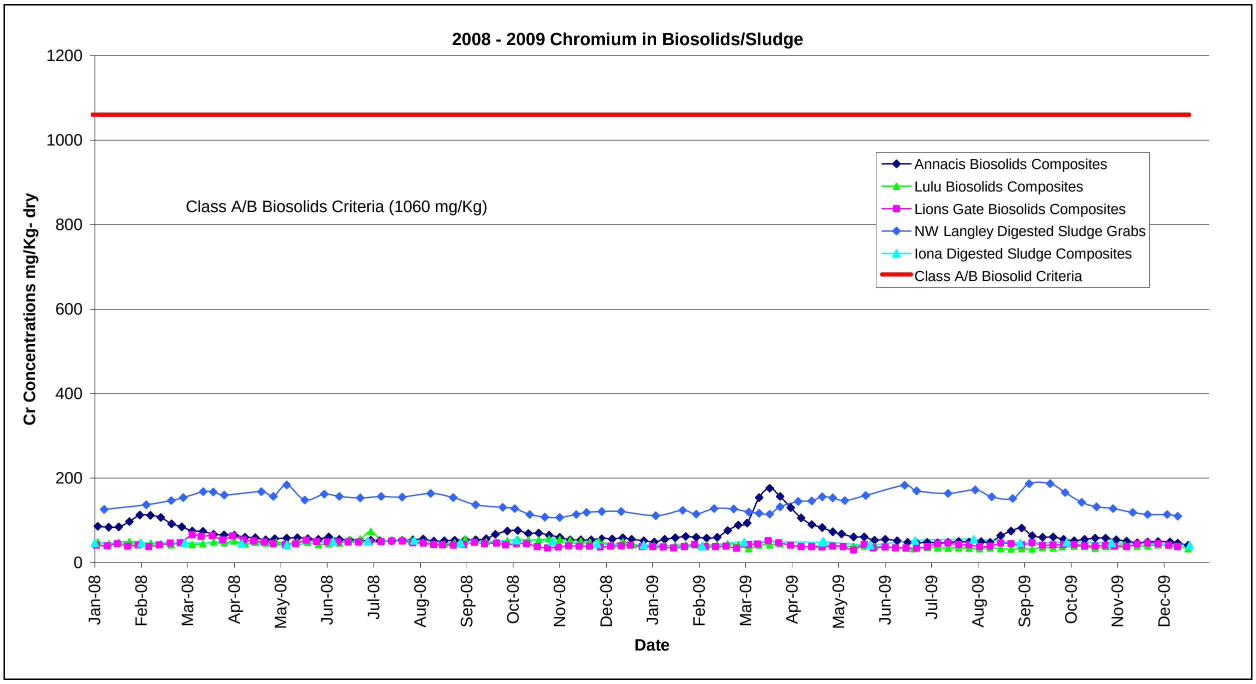

Receiving Water Bacteriological Quality - Aldergrove Lake, 2005-2009
Geometric Mean - Fecal Coliform Bacteria/100 mL
250
200
150
100
50
0
1-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
2005
2006
2007
2008
2009

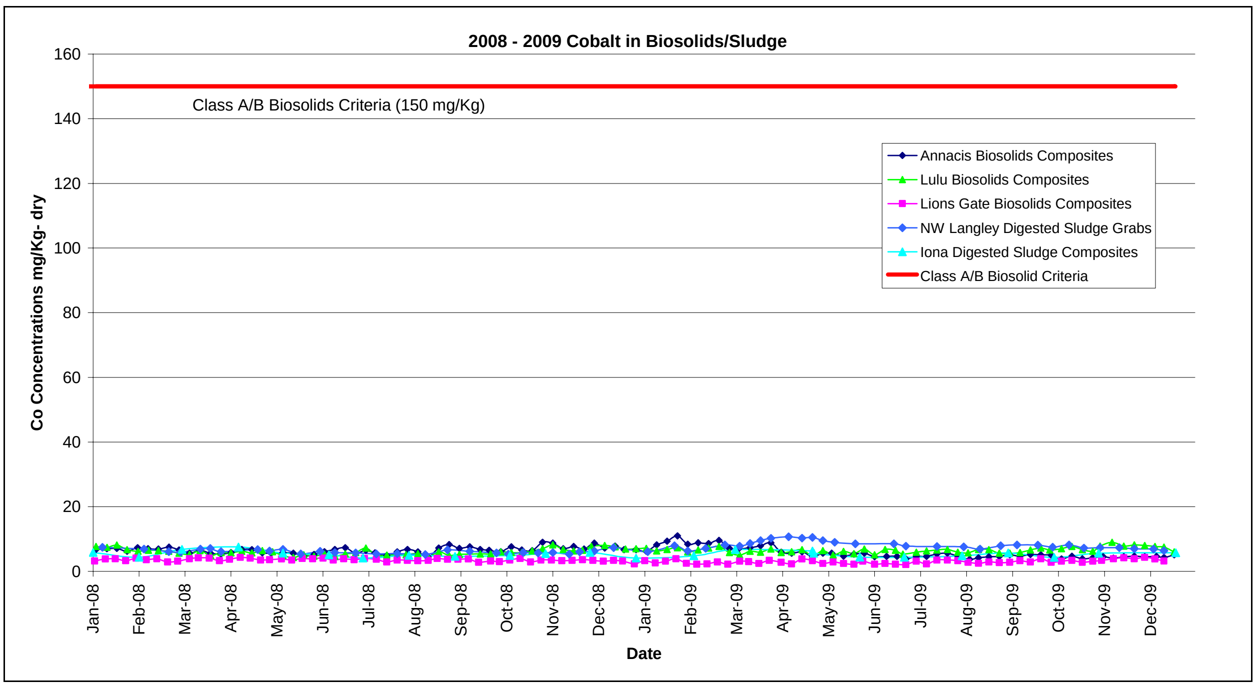
APPENDIX D

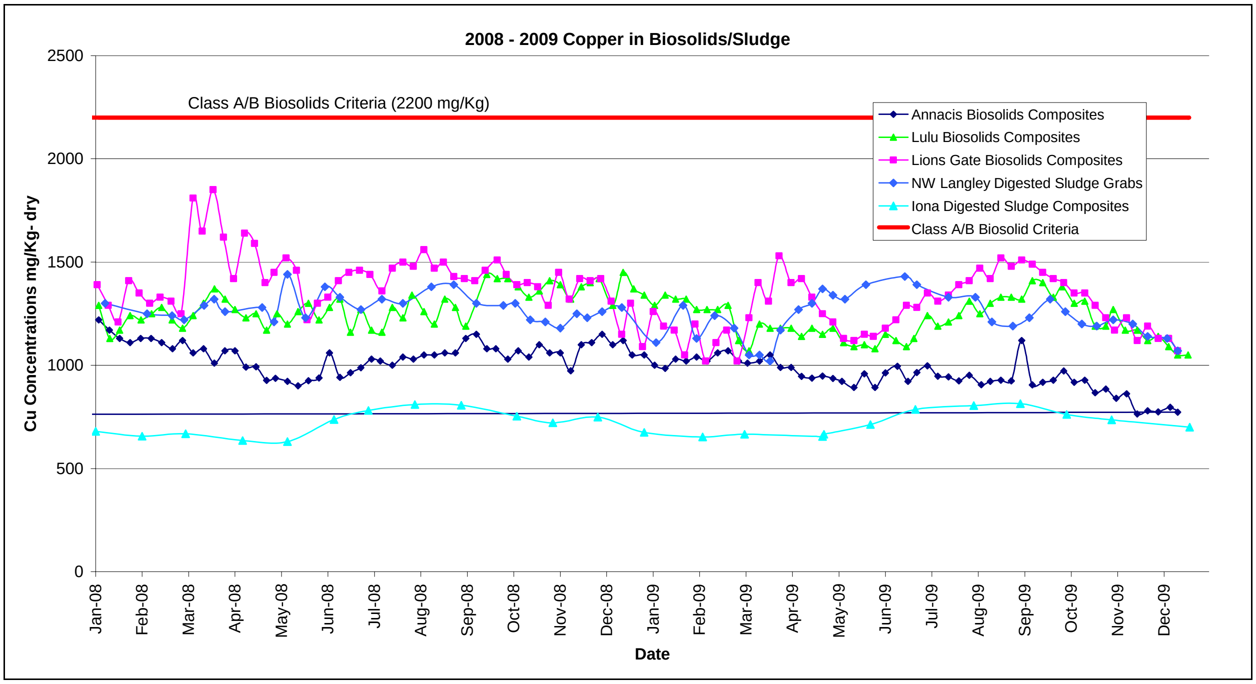
2008 TO 2009 BIOSOLIDS/SLUDGE MONITORING PROGRAMS
COMPARISON OF METALS AND FECAL COLIFORM DATA
WITH
ORGANIC MATTER RECYCLING REGULATION, February, 2002


2008 - 2009 Arsenic in Biosolids/Sludge
Class A/B Biosolids Criteria (75 mg/Kg)
As Concentrations mg/Kg- dry
85
75
65
55
45
35
25
15
5
-5
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date


2008 - 2009 Cadmium in Biosolids/Sludge
Class A/B Biosolids Criteria (20 mg/Kg)
Cd Concentrations mg/Kg- dry
25
20
15
10
5
0
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date


2008 - 2009 Chromium in Biosolids/Sludge
Cr Concentrations mg/Kg- dry
Class A/B Biosolids Criteria (1060 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
1200
1000
800
600
400
200
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date


2008 - 2009 Cobalt in Biosolids/Sludge
Co Concentrations mg/Kg- dry
Class A/B Biosolids Criteria (150 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
160
140
120
100
80
60
40
20
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date


2008 - 2009 Copper in Biosolids/Sludge
Class A/B Biosolids Criteria (2200 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Cu Concentrations mg/Kg- dry
2500
2000
1500
1000
500
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
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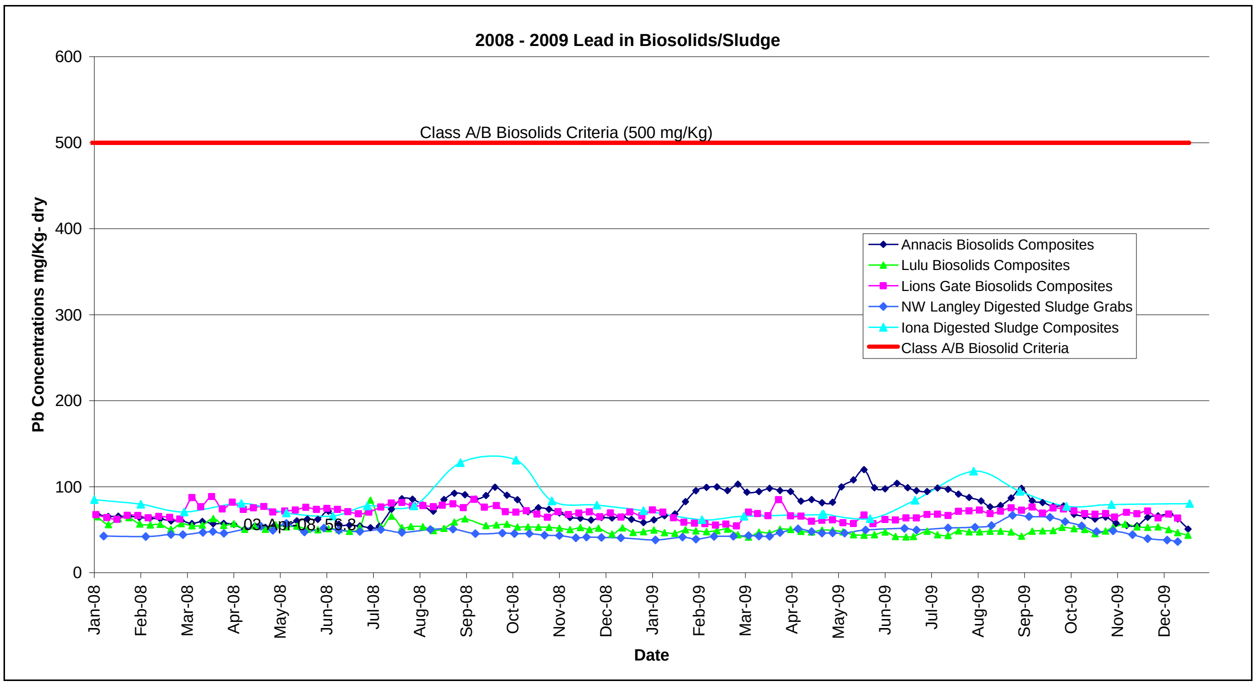
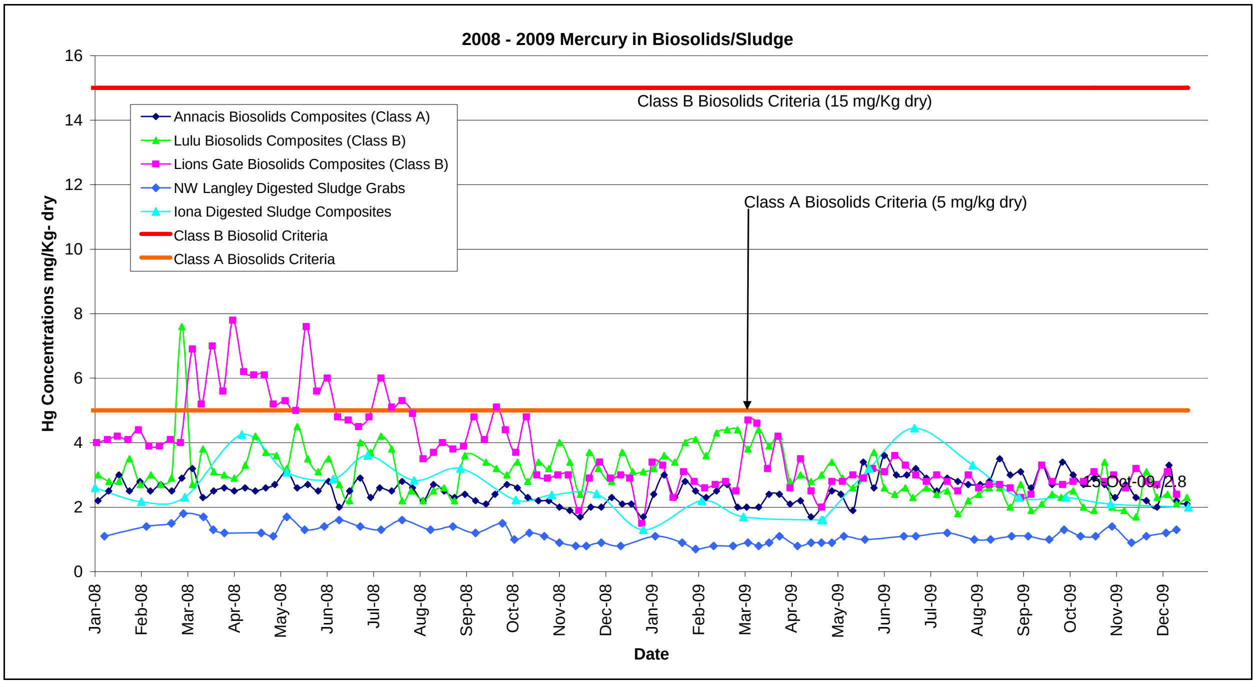
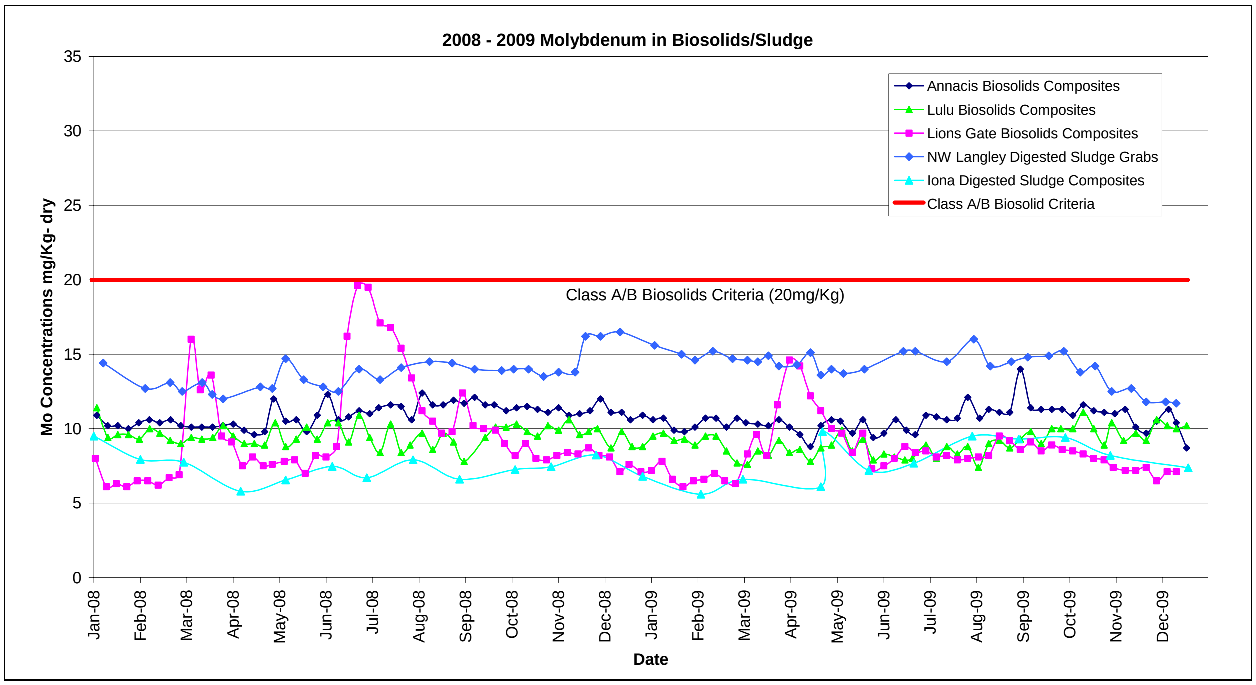
Sep-09
Oct-09
Nov-09
Dec-09
Date


2008 - 2009 Lead in Biosolids/Sludge
Class A/B Biosolids Criteria (500 mg/Kg)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Pb Concentrations mg/Kg- dry
600
500
400
300
200
100
0
03-Apr-08, 56.8
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date


2008 - 2009 Mercury in Biosolids/Sludge
Class B Biosolids Criteria (15 mg/Kg dry)
Annacis Biosolids Composites (Class A)
Lulu Biosolids Composites (Class B)
Lions Gate Biosolids Composites (Class B)
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class B Biosolid Criteria
Class A Biosolids Criteria
Class A Biosolids Criteria (5 mg/kg dry)
15-Oct-09, 2.8
Hg Concentrations mg/Kg- dry
Date
16
14
12
10
8
6
4
2
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09


2008 - 2009 Molybdenum in Biosolids/Sludge
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Class A/B Biosolids Criteria (20mg/Kg)
Mo Concentrations mg/Kg- dry
Date
35
30
25
20
15
10
5
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
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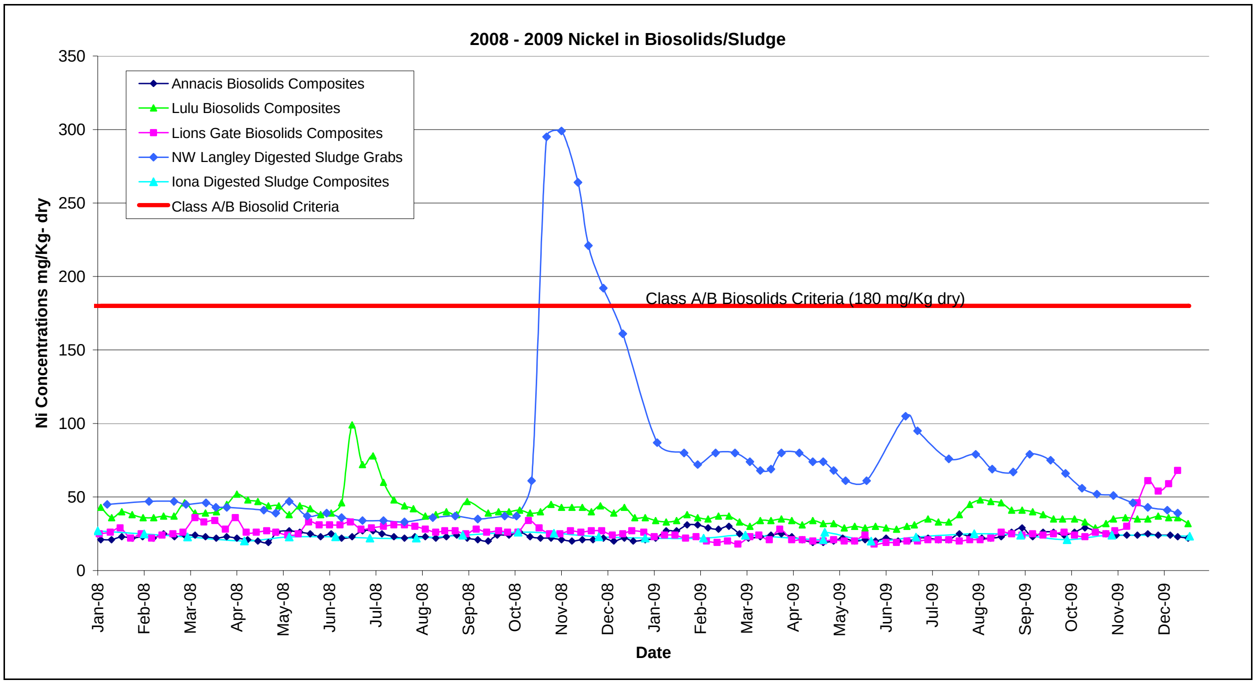
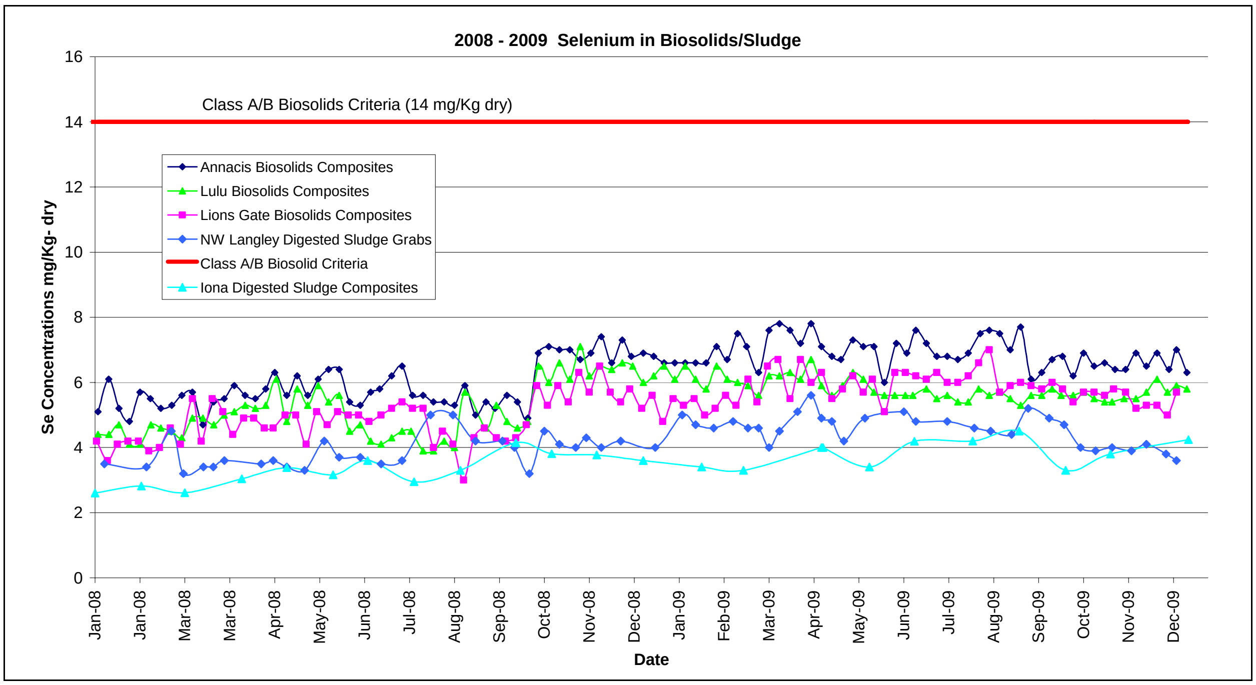
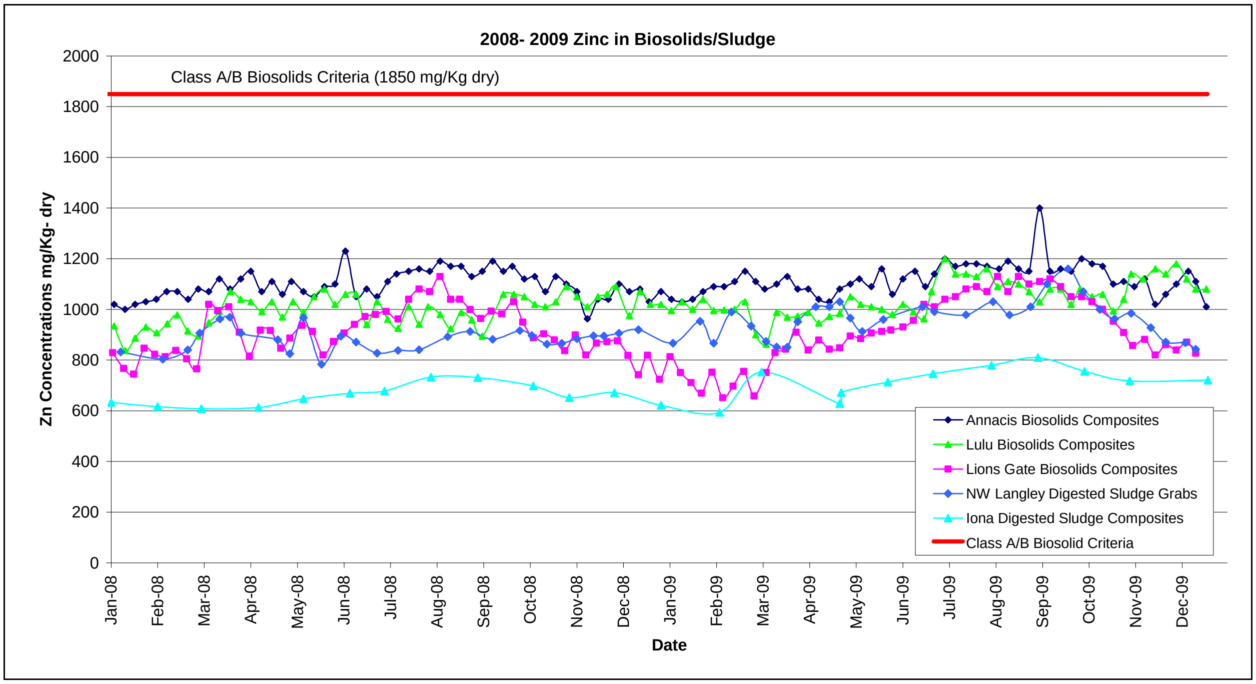
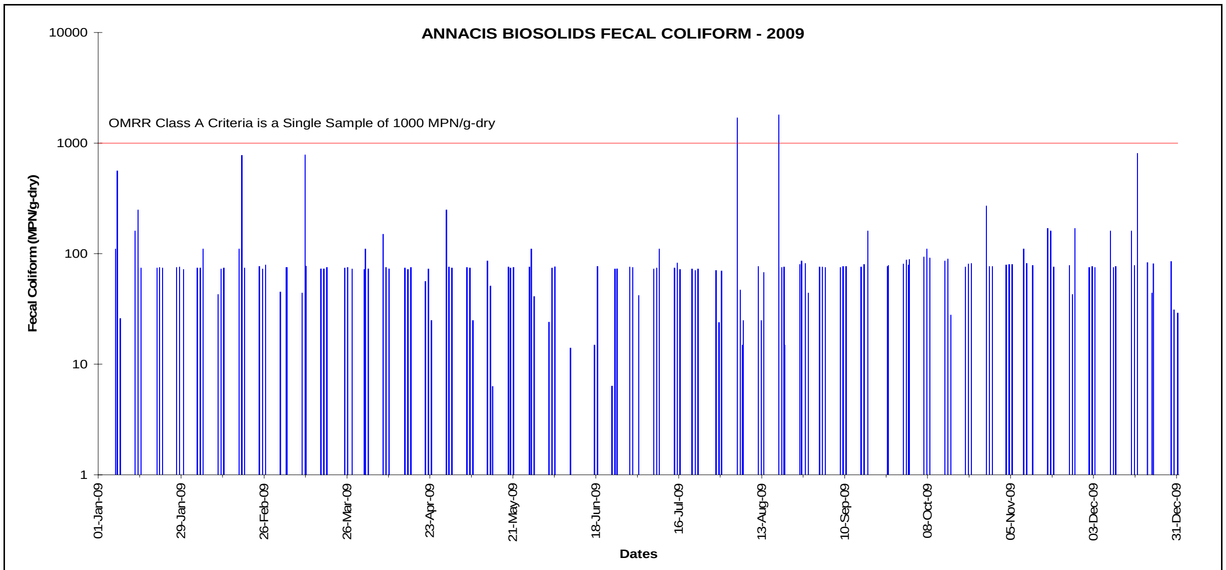
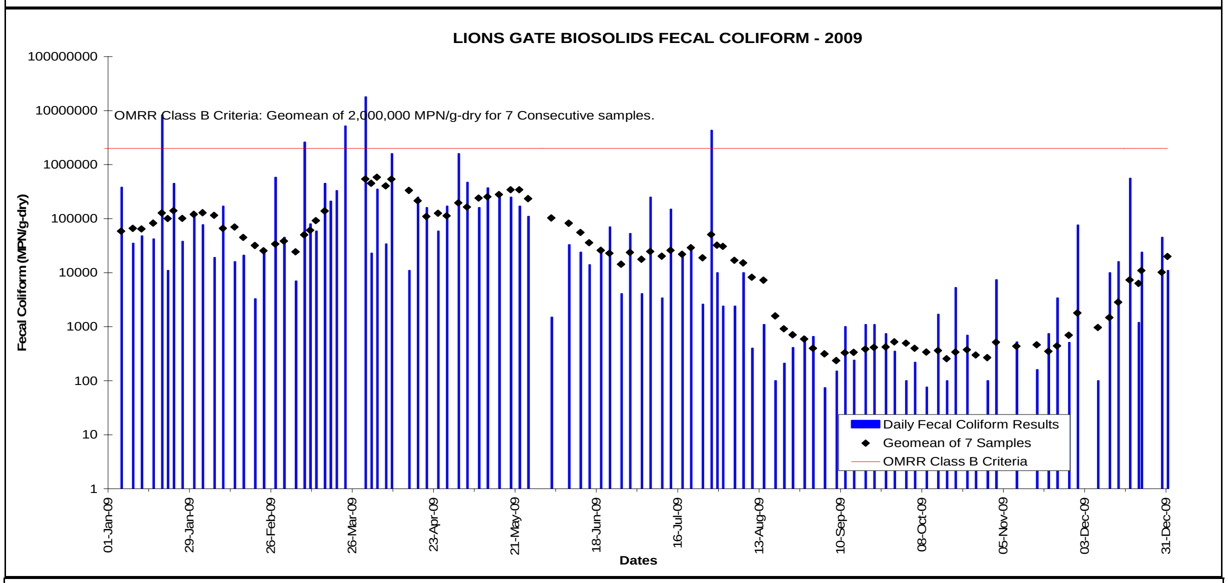
Oct-09
Nov-09
Dec-09

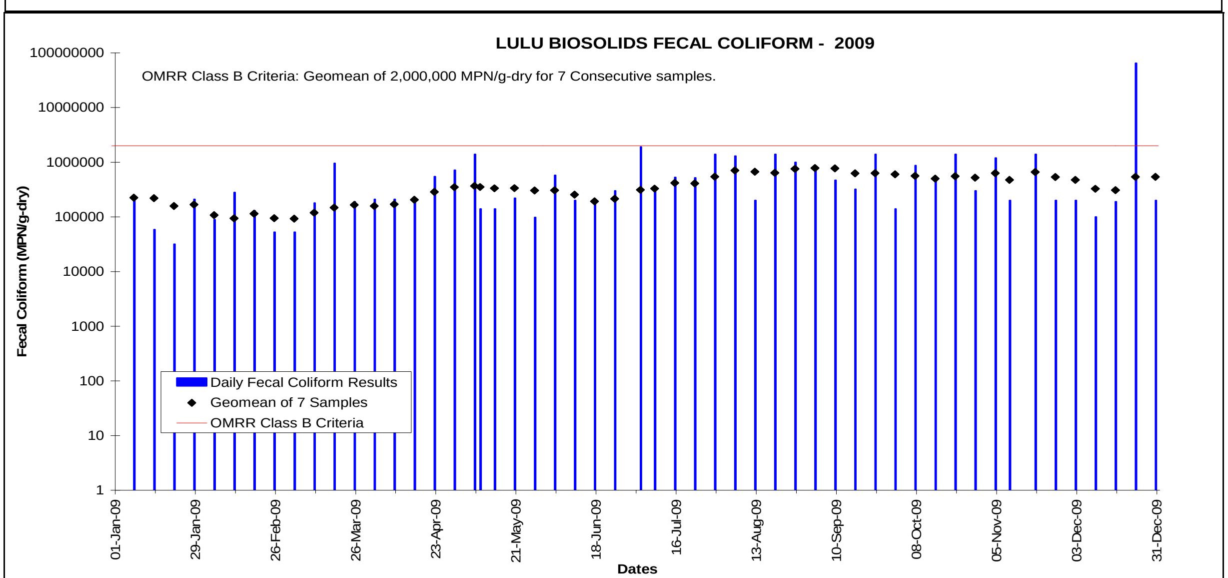

2008 - 2009 Nickel in Biosolids/Sludge
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria
Class A/B Biosolids Criteria (180 mg/Kg dry)
Ni Concentrations mg/Kg- dry
350
300
250
200
150
100
50
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date

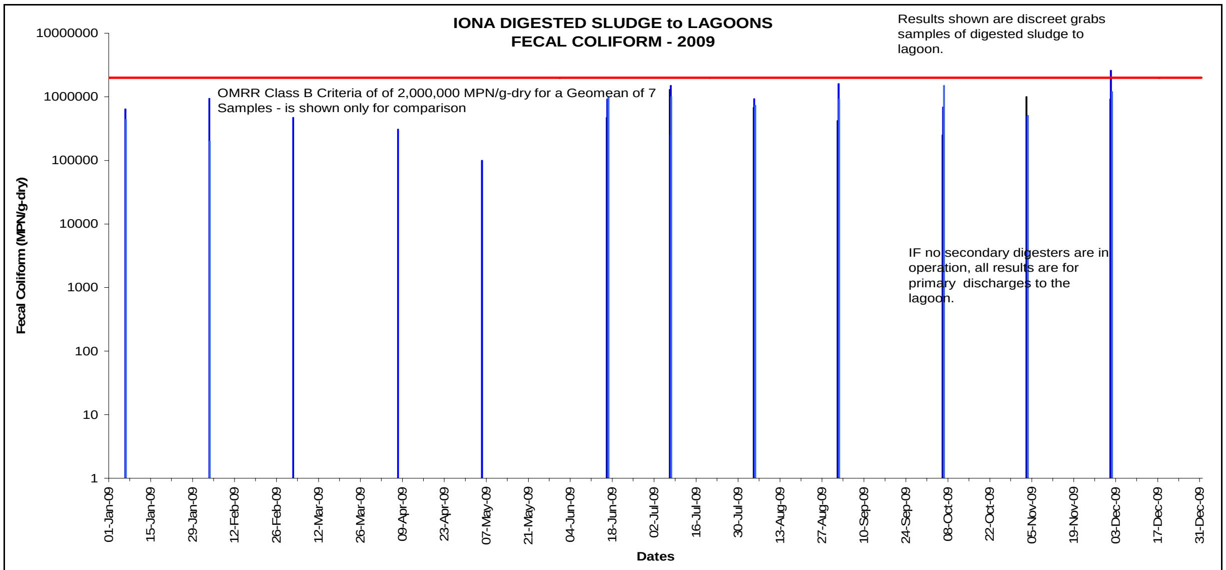

2008 - 2009 Selenium in Biosolids/Sludge
Class A/B Biosolids Criteria (14 mg/Kg dry)
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Class A/B Biosolid Criteria
Iona Digested Sludge Composites
Se Concentrations mg/Kg- dry
16
14
12
10
8
6
4
2
0
Jan-08
Jan-08
Mar-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date

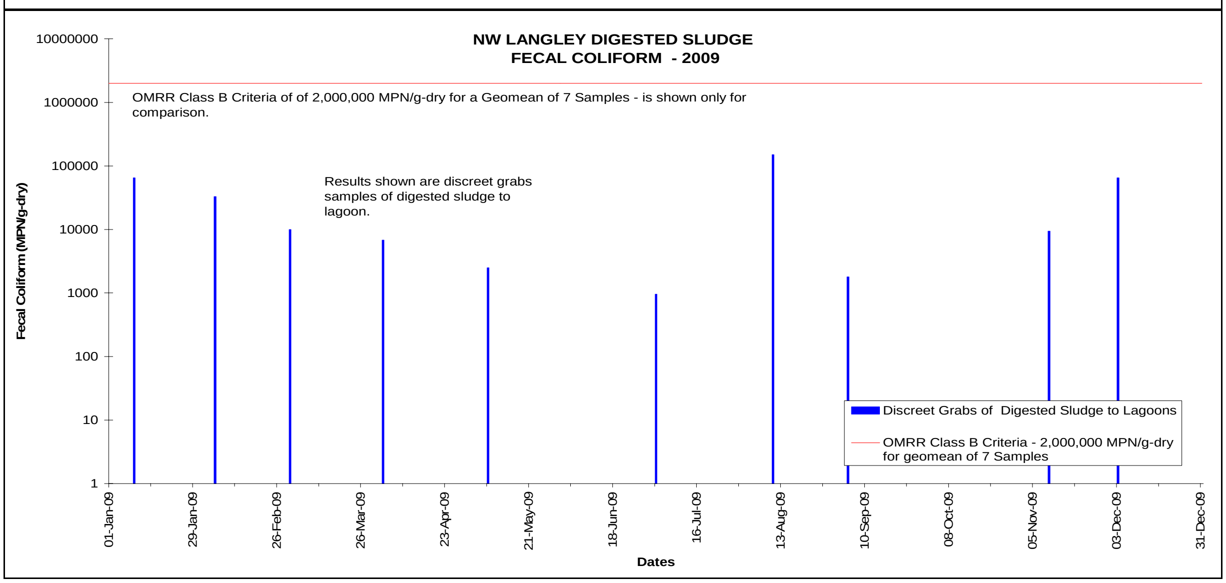

2008- 2009 Zinc in Biosolids/Sludge
Class A/B Biosolids Criteria (1850 mg/Kg dry)
Zn Concentrations mg/Kg- dry
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Jan-08
Feb-08
Mar-08
Apr-08
May-08
Jun-08
Jul-08
Aug-08
Sep-08
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Jun-09
Jul-09
Aug-09
Sep-09
Oct-09
Nov-09
Dec-09
Date
Annacis Biosolids Composites
Lulu Biosolids Composites
Lions Gate Biosolids Composites
NW Langley Digested Sludge Grabs
Iona Digested Sludge Composites
Class A/B Biosolid Criteria


ANNACIS BIOSOLIDS FECAL COLIFORM - 2009
OMRR Class A Criteria is a Single Sample of 1000 MPN/g-dry
Fecal Coliform (MPN/g-dry)
10000
1000
100
10
1
01-Jan-09
29-Jan-09
26-Feb-09
26-Mar-09
23-Apr-09
21-May-09
18-Jun-09
16-Jul-09
13-Aug-09
10-Sep-09
08-Oct-09
05-Nov-09
03-Dec-09
31-Dec-09
Dates


LIONS GATE BIOSOLIDS FECAL COLIFORM - 2009
OMRR Class B Criteria: Geomean of 2,000,000 MPN/g-dry for 7 Consecutive samples.
Fecal Coliform (MPN/g-dry)
100000000
10000000
1000000
100000
10000
1000
100
10
1
Daily Fecal Coliform Results
Geomean of 7 Samples
OMRR Class B Criteria
01-Jan-09
29-Jan-09
26-Feb-09
26-Mar-09
23-Apr-09
21-May-09
18-Jun-09
16-Jul-09
13-Aug-09
10-Sep-09
08-Oct-09
05-Nov-09
03-Dec-09
31-Dec-09
Dates


LULU BIOSOLIDS FECAL COLIFORM - 2009
OMRR Class B Criteria: Geomean of 2,000,000 MPN/g-dry for 7 Consecutive samples.
Fecal Coliform (MPN/g-dry)
100000000
10000000
1000000
100000
10000
1000
100
10
1
Daily Fecal Coliform Results
Geomean of 7 Samples
OMRR Class B Criteria
01-Jan-09
29-Jan-09
26-Feb-09
26-Mar-09
23-Apr-09
21-May-09
18-Jun-09
16-Jul-09
13-Aug-09
10-Sep-09
08-Oct-09
05-Nov-09
03-Dec-09
31-Dec-09
Dates


IONA DIGESTED SLUDGE to LAGOONS
FECAL COLIFORM - 2009
Results shown are discreet grabs samples of digested sludge to lagoon.
OMRR Class B Criteria of of 2,000,000 MPN/g-dry for a Geomean of 7 Samples - is shown only for comparison
IF no secondary digesters are in operation, all results are for primary discharges to the lagoon.
Fecal Coliform (MPN/g-dry)
10000000
1000000
100000
10000
1000
100
10
1
01-Jan-09
15-Jan-09
29-Jan-09
12-Feb-09
26-Feb-09
12-Mar-09
26-Mar-09
09-Apr-09
23-Apr-09
07-May-09
21-May-09
04-Jun-09
18-Jun-09
02-Jul-09
16-Jul-09
30-Jul-09
13-Aug-09
27-Aug-09
10-Sep-09
24-Sep-09
08-Oct-09
22-Oct-09
05-Nov-09
19-Nov-09
03-Dec-09
17-Dec-09
31-Dec-09
Dates


NW LANGLEY DIGESTED SLUDGE
FECAL COLIFORM - 2009
OMRR Class B Criteria of of 2,000,000 MPN/g-dry for a Geomean of 7 Samples - is shown only for comparison.
Results shown are discreet grabs samples of digested sludge to lagoon.
Fecal Coliform (MPN/g-dry)
10000000
1000000
100000
10000
1000
100
10
1
Discreet Grabs of Digested Sludge to Lagoons
OMRR Class B Criteria - 2,000,000 MPN/g-dry for geomean of 7 Samples
01-Jan-09
29-Jan-09
26-Feb-09
26-Mar-09
23-Apr-09
21-May-09
18-Jun-09
16-Jul-09
13-Aug-09
10-Sep-09
08-Oct-09
05-Nov-09
03-Dec-09
31-Dec-09
Dates