Research and evaluate the use of wastewater contaminant fees

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Abstract:

Economic (fiscal) instruments, being dynamic and flexible forms of regulations, have transformed the pattern of pollution control (D. Austin, 1999). These instruments primarily consist of 'market incentives', which allow a set pollution targets to be met for a lesser net cost giving them a significant monetary advantage over conventional command and control regulations. Another advantage of using these instruments is that industries try to optimize their activities and improve technologies so that meeting targets becomes cheaper for them, benefiting the overall environment in the long run.

Metro Vancouver uses a fee system for wastewater contaminant control and currently charges the permit holders based on flow, BOD and TSS. But some of the industries pay less due to lesser BOD and TSS load despite contributing a significant portion of other contaminants to the treatment plant. Developing a fee system and charging for other contaminants can act as an incentive to reduce the discharge of these contaminants while decreasing the financial burden on Metro Vancouver for contaminant monitoring and other purposes.

Contents

OBJECTIVE OF THE STUDY

To review pricing strategies in other jurisdictions around the world that charge for a wide range of contaminants other than biochemical oxygen demand (BOD), total suspended solids (TSS), and volume, and to evaluate these strategies in the Metro Vancouver context.

This will be achieved by:

1. Reviewing similar pricing strategies from other jurisdictions around the world,

2. Evaluating how these pricing strategies were developed including how the unit costs were developed,

3. Evaluating the pros and cons of each approach in the Metro Vancouver wastewater context.

CHAPTER 1

INTRODUCTION

Pollution levy systems, in general, are based on the 'polluter pays' principle which states that those who produce or cause pollution should bear the costs associated with managing the pollution to prevent the damage caused by the pollution to human health or the environment. As a part of a set of extensive concepts introduced in the Rio declaration of 1992 to lead global sustainable development, this principle has been applied to polluters of land, water, air and even noise. While it is very advantageous as a market-based economic incentive to internalize the cost of pollution and as a drive to reduce pollution, the primary disadvantage of this principle is that it is very hard to put a price on 'pollution'. Essentially, implementing a tax or a fee system would require us to determine what contaminants to charge for, how much to charge, whether or not to provide incentives to improve the discharge quality amongst many other factors. While there are difficulties associated with the implementation, the principle is still very effective as there are multiple jurisdictions from around the world that have experienced continued successes in pollution management, through the innovative use of the polluter pays principle supplemented by various incentives.

Metro Vancouver is a partnership of 21 municipalities, one Electoral Area and one Treaty First Nation. One of the core services they provide is wastewater treatment and management through a system of five wastewater treatment plants, an extensive system of pumping stations and sewer mains, and also regularly monitor the environment to ensure the proper functioning of the system. Metro Vancouver currently regulates industrial discharges through its Sewer Use Bylaw and the Bylaw requires that significant dischargers be regulated directly through the issuance of a Waste Discharge Permit. Metro Vancouver presently uses a fee system that charges the discharge permit

holders based on BOD, TSS, and flow. Metro Vancouver treats the wastewater to meet provincial and federal wastewater discharge regulations as well as provincial regulations regarding the beneficial use biosolids. Hence, some industries that contribute more to the loading of certain other contaminants, like heavy metals, pharmaceuticals etc., on the treatment plant while having a low flow, BOD and TSS, do not contribute to the full cost of their discharge and essentially become free riders.

In this study, pollution levy systems of various jurisdictions from around the world are evaluated and the effectiveness of those systems in Metro Vancouver's context is analysed. The results from the analysis are used to develop a strategy for Metro Vancouver to establish an effective contaminant fee system and outline the information required for the same. The selected jurisdictions are:

1. European jurisdictions -

1.1 Germany

1.2 The Netherlands

2. Australian jurisdictions -

2.1 Sydney water

3 North American jurisdictions -

3.1. NPDES - US EPA

3.2. British Columbia

3.3 Capital Regional District

4 Other jurisdictions -

4.1 China

4.2 Malaysia

4.3 Philippines

CHAPTER 2

METRO VANCOUVER WASTEWATER SYSTEM

Fig 2.1. Metro Vancouver's jurisdiction

2.1. Introduction:

Metro Vancouver presently issues Waste Discharge Permits to regulate the amount and quality of industrial wastewater that manufacturers and industries discharge into the sewers. Industrial users that release waste through the sewers into a treatment facility and meet certain criteria specified in the Sewer Use Bylaw No. 299, 2007 must hold a valid waste discharge permit. The fees that are collected for the wastes discharge are called 'liquid waste fees'.

2.2. Purpose of the fee system:

As specified in the Sewer Use Bylaw 299, 2007, the aim of the bylaw and the regional source control program are:

- To protect the Sewers and Sewage Facilities from damage and promoting the efficient and cost-effective operation of Sewers and Sewage Facilities
- To promote the quality of the biosolids
- To protect human health and safety
- To assist the District's efforts to remain in compliance with laws and regulatory instruments to which it is subject
- To protect the environment
- To impose fees payable by persons who discharge liquid waste into a Sewage Facility or whose liquid waste is treated by a Sewage Facility

2.3. Design of the fee system:

The Liquid Waste fees charged consists of the permit application fee, administration fee, and the industrial treatment fee, which consists of capacity charges and usage charges (Metro

Vancouver). The permit application fee is paid when the industry applies for a new waste discharge permit or applies for an amendment to an existing permit, the administration fee is paid annually, whereas the industrial treatment fee is paid on a quarterly basis. The above-mentioned fees are described below as per the Sewer Use Bylaw 299, 2007 in Table 2.1.

Liquid Waste Fee = Application fee (if applying for a permit) **+ Administration fee + Total Usage Charge + Total Capacity Charge**

Table 2.1. Liquid Waste Fees – Metro Vancouver

Fee Type	**Amount**	**Description**
Application Fee	$1000	For industrial sites
Administration Fee	$1400 + ($300 x $A^{0.3}$) + B where, A = maximum daily flow, in cubic metres per day, for the facility, as specified in the Waste Discharge Permit, B = the dollar amount for the industry type, determined by the type of industry as specified in the Sewer Use Bylaw	Annual Fee
Industrial treatment fee	The Industrial treatment fee is the sum of the total Usage Charge and the total capacity charge.	

<table>
<tr><td></td><td colspan="2">Total Usage Charge:
$UC_{tot} = UC_{vol} + UC_{BOD} + UC_{TSS}$
The total usage charge (UC_{tot}) is the sum of the following, calculated on a quarterly basis in each calendar year: (a) the usage charge for volume of Non-Domestic Waste (UC_{vol}); and (b) the usage charge for the mass of Biochemical Oxygen Demand (“BOD”) (UC_{BOD}) and Total Suspended Solids (“TSS”) (UC_{TSS}).</td><td rowspan="3">Calculated and paid quarterly</td></tr>
<tr><td>Usage charge for volume (UC_{vol}):

$UC_{vol} = V_q \times UCR_{vol}$</td><td>$V_q$ = volume of non-domestic wastewater discharged in the quarter, in cubic metres (m^3).
UCR_{vol} = usage charge rate for volume in dollars per cubic metre ($/m3), as determined by the District.</td></tr>
<tr><td>Usage charge for BOD (UC_{BOD}):

$UC_{BOD} = (C_{BOD} \times V_q \times UC_{BOD})/1000$</td><td>$V_q$ = volume of non-domestic wastewater discharged in the quarter, in cubic metres (m^3).
UCR_{BOD} = usage charge rate for BOD, in dollars per kilogram ($/kg), as determined by the District.</td></tr>
</table>

Usage charge for the mass of TSS (UC_{TSS}): $UC_{TSS} = (C_{TSS} \times V_q \times UCR_{TSS})/ 1000$	C_{TSS} = average concentration of TSS, in milligrams per litre (mg/L). V_q = volume of non-domestic wastewater discharged in the quarter, in cubic metres (m^3). UCR_{TSS} = usage charge rate for TSS, in dollars per kilogram ($/kg), as determined by the District.	
<u>Total Capacity Charge (CC_{tot}):</u> $CC_{tot} = CC_{vol} + CC_{BOD} + CC_{TSS}$ where, $CC_{vol,}$ CC_{BOD} and CC_{TSS} are the capacity charges for volume, for BOD and TSS of Non-Domestic Waste discharged in the previous calendar year;		
Capacity charge for volume (CC_{vol}): $CC_{vol} = V_M \times CCR_{vol}$	V_M = the twelve month average of the maximum daily volumes reported for each month in the previous calendar year, in cubic metres per day (m3 /d). CCR_{vol} = capacity charge rate for in dollars per cubic metres per day	

		($/m3 /d), as determined by the District.	
	Capacity charge for BOD (CC_{BOD}): $CC_{BOD} = M_{90\text{-}BOD} \times CCR_{BOD}$	$M_{90\text{-}BOD}$ = the 90th percentile of the daily sample masses of BOD measured in the previous calendar year, in kilograms per day (kg/d). CCR_{BOD} = capacity charge rate for BOD, in dollars per kilogram per day ($/kg/d), as determined by the District.	
	Capacity charge for the mass of TSS (CC_{TSS}): $CC_{TSS} = M_{90\text{-}TSS} \times CCR_{TSS}$	$M_{90\text{-}TSS}$ = the 90th percentile of the daily sample masses of TSS measured in the previous calendar year, in kilograms per day (kg/d). CCR_{TSS} = capacity charge rate for TSS for the sewerage area in dollars per kilogram per day ($/kg/d), as determined by the District.	

The industrial usage charge rates and capacity charge rates are determined by Metro Vancouver and are reviewed annually. They can be found in Table 2.2.

Table 2.2. Industrial Pricing Strategy Table (2019)

Usage Charges					
	FSA	**VSA**	**LIWSA**	**NSSA**	**NWL**
BOD ($/kg)	$0.528	$0.085	$0.658	$0.277	$0.528
TSS ($/kg)	$0.653	$1.187	$0.732	$1.629	$0.653
Flow ($/$m^3$)	$0.229	$0.142	$0.260	$0.321	$0.229
Capacity Charges					
	FSA	**VSA**	**LIWSA**	**NSSA**	**NWL**
BOD ($/kg)	$7.672	$18.814	$7.719	$20.779	$9.313
TSS ($/kg)	$41.473	$61.369	$17.957	$36.847	$30.205
Flow ($/$m^3$)	$17.538	$45.677	$5.048	$28.279	$10.188

Where,

FSA = Fraser Sewerage Area;

VSA = Vancouver Sewerage Area

LIWSA = Lulu Island West Sewerage Area;

NSSA = North Shore Sewerage Area

NWL = Northwest Langley Sewerage Area

2.4. Exemptions from the system:

There are no exemptions presently.

2.5. Revenue collected and use of revenue:

The actual collected revenue through the Waste Discharge system in 2017 was 9.8 million dollars in 2017, and increased by 18% over the period of 2 years due to increase in the unit costs (Metro Vancouver, 2019). This revenue is used as a part of the operating budget of Metro Vancouver for the Greater Vancouver Sewerage & Drainage District (GVS&DD) (Metro Vancouver, 2017).

2.6. Environmental effect after implementation:

For most of the contaminants studied by Metro Vancouver, there has been a significant decrease in the flow and the loading of the contaminants in all of the WWTP's of Metro Vancouver from 2001 to 2012.

Certain contaminants like

- Oil and grease in Annacis Island WWTP (Metro Vancouver, 2014),
- Phenols and lead in Lulu Island WWTP (Metro Vancouver, 2014),
- Heavy metals in Lions Gate WWTP (Metro Vancouver, 2013),
- Ammonia and phenols in Iona Island WWTP (Metro Vancouver, 2014), and
- Copper, aluminium and boron in North West Langley WWTP (Metro Vancouver, 2014)

have increased in loading due to the activities in various industries. While the amount of metals incoming into most WWTPs have reduced, for the production of better biosolids, they need to be reduced further.

2.7. Effects on pollution producers:

The impact of the load from industrial dischargers on the total influent load of all the WWTPs were studied by Metro Vancouver in 2013 and 2014 and the industrial impact has been decreasing consistently for most of the contaminants. The exceptions include the contaminants, highlighted in Section 2.6., that have increased in loading in the wastewater treatment plants. In addition, a closer look at the polluting industries also indicates that the firms have been mostly compliant with the set permit effluent standards.

2.8. Summary:

Metro Vancouver has a complex wastewater discharge fee system charging the polluters based on volume, TSS and BOD. The wastewater discharge permit holders are authorized to discharge wastes into a sewerage facility when the discharges comply with a set of effluent standards set by Metro Vancouver. They pay an annual administration fee and a quarterly industrial treatment fee calculated based on the discharge quality and quantity. This industrial treatment fee consists of a total usage charge and a total capacity charge invoiced directly by Metro Vancouver. The revenue collected through this system is used as a part of the operating budget of Metro Vancouver. While most of the monitored parameters have decreased in loading, some parameters especially heavy metals have increased in concentration in certain sewerage areas and are impacting the quality of the biosolids. Developing a more comprehensive contaminant fee system could help reduce and control the loading of pollutants.

CHAPTER 3

GERMANY'S WASTEWATER TAX SYSTEM

Fig 3.1. Map of Germany

3.1. Introduction:

The German Wastewater Tax, also known as AbwAG, was established in 1981. According to this law, all direct discharges of wastewater, including discharges into natural or ground water, industrial and sewage treatment plant discharges, storm water discharges, agricultural discharges, and domestic sewage waste require permits (Schäfer L, 2013). These discharge permits are only provided under two conditions: if the discharges are kept as low as possible (based on set emission limit values) and the required processes are carried out with the best available technology. The discharges should comply with the standards set by the AbwAG, and the standards vary depending on the type of industry the discharges come from, and can be stricter depending on the local governments and the sensitivity of the ecology (Federal Environmental Agency, 2001). Other indirect discharges into sewer system are governed by an ordinary user fee (ECOTEC, 2001).

3.2. Purpose of the tax:

The AbwAG is designed to be a penalty tax, with the primary purpose that all discharges, be it industrial or municipal, should adhere to the set standards. Even though there are certain exemptions and increased incentives as discussed in Section 3.4, the tax aims to improve the effluent quality for safe disposal into the environment by taxing the polluters.

3.3 Design of the tax system:

The tax charged for the dischargers depends on the toxicity of the effluent. The toxicity is measured by the total number of 'damage units' that the effluent comprises of. A damage unit represents a certain fixed quantity of contaminants as shown in the Table 3.1. below. Germany presently charges polluters based on Chemical Oxygen Demand, Nitrogen, Phosphorus, organic halogens and heavy metals (ECOTEC, 2001).

Table 3.1. Damage unit contaminant equivalents

Sl.no	Contaminant	Weight of one equivalent unit
1	Chemical Oxygen Demand	50 kg
2	Nitrogen	25 kg
3	Phosphorus	3 kg
4	Organic Halogens	2 kg
5	Mercury	20 g
6	Cadmium	100 g
7	Chromium	500 g
8	Nickel	500 g
9	Lead	500 g
10	Zinc	1000 g

11	Toxicity to fish	3000 cubic meters of wastewater divided by a dilution factor, by which wastewater is no longer toxic to fish.

These values are set based on a certain amount of inhabitant equivalents, also known as the population equivalents. But the exact value is difficult to confirm. According to literature, there are multiple conflicting numbers. The German Federal Environmental Agency, Umweltbundesamt, quotes that one damage unit is equivalent to the damage caused by the untreated wastewater produced by one inhabitant in a year (inhabitant equivalence); ECOTEC quotes that one damage unit is equivalent to 2.5 population equivalents whereas the European Parliament quotes that 1.5 damage units is approximately equivalent to the toxicity of untreated wastewater of one inhabitant per year. But No further relevant literature was found to support these values.

The charge levied per damage unit had been increasing steeply from DM 12 since its inception, where DM is the German Mark. But since 1997, the charge levied on one damage unit is equal to DM 70 and there have been no more increases in the charge. The charges levied are based on the values specified on the discharge permit rather than actual parameter based measurements and are to be paid annually.

3.4. Exemptions from the system

There are certain conditions under which the tax the polluters have to pay are reduced. They are:

- If the effluents meet the emission limit values set, the tax levied is reduced to 50 percent of the value stated on the permit. The emission limits are set in the permit based on the best available technology (BAT) standards and the industry of origin.

- If the damage units obtained post monitoring the effluents are lesser than those of the values stated in the discharge permit, the tax levied is further reduced.
- Specific threshold values are set for contaminants (See Appendix A). If the measured contaminant concentration is less than the threshold values, these contaminants are not included in the calculation of the tax.
- Investments by polluters in a treatment facility, assuming that this facility will lead to a decrease in at least 20 % of the pollution, will lead to a reduction in the lax levied for three years before completion of the facility.

There are also certain conditions where the polluters don't have to pay a tax. They include:

- Effluent discharge into a water body that was already contaminated prior to its use and no change in water characteristics would be observed after discharge,
- Discharge of effluent into a water body created during the extraction of minerals, given that this effluent was the product of washing the mineral products and will ensure that no other contaminants will enter other water bodies.
- Effluent discharge generated from marine vessels or watercraft into the waterbody on which it was operated,
- Discharge of stormwater running off from paved commercial areas under three hectares in area and from railroads where no public sewer systems were used for the discharge.

3.5. Revenue collected and use of revenue:

According to AbwAG, the collected revenue is to be used specifically for measures that maintain or improve the quality of water. These measures have been listed out in the framework as follows:

1. Construction of wastewater and sewage treatment plants,

2. Construction of stormwater treatment facilities,

3. Construction of sewers to permit joint treatment facilities,

4. Construction of sewage sludge disposal facilities,

5. Measures for observing and improving water quality and measures for maintaining water bodies,

6. Research on and development of facilities for improving water quality,

7. Basic and further training of operating staff for facilities designed to maintain and improve water quality.

As mentioned above, the tax is charged for both municipal sewage and industrial wastewater. While the exact revenue from each sector couldn't be found in literature, the German Federal Environment Agency (Umweltbundesamt) has estimated that 60 per cent of the revenue is obtained from the municipalities' wastewater treatment plants while the remaining 40 per cent is from the industries and commercial institutions (ECOTEC, 2001).

3.6. Environmental Effect after implementation:

Even though the wastewater tax in Germany acts as a complement to the household water tax, many of the contaminants decreased in concentration over the years. The primary polluting industry in Germany had been the chemical industry and in that industry alone, there was a 74 per cent decrease in halogenated organics, a 55 percent decrease in chemical oxygen demand, 57 per cent in nitrogen and 50 percent decrease in phosphorus levels between 1995 and 2006 (VCI 2006). Overall, in 2007, close to 93% of effluents received tertiary treatment, which is a significantly high percentage even when compared to other European countries (McGlade et. al.,2011). As all the

revenue from the tax is recycled back to support measures to improve the quality of water, there was a considerable increase in the quality of water bodies. The percentage of Class II water bodies increased from 47 per cent to 65 percent in 2000 within a period of 5 years (McGlade et. al.,2011). Class II water bodies are water bodies with low organic or inorganic nutrient supply and without substantial oxygen depletion. They are also densely populated with wide variety of aquatic species (Umwelt Bundesamt).

In addition, the revenue recycling led to Germany being one of the highest investors in wastewater to almost EUR 1.18/m^3 of wastewater (BDEW, 2010). To sum it up, the wastewater tax in Germany was proven to be highly effective, both economically and environmentally placing Germany on the forefront of advanced wastewater treatment.

3.7. Effect on producers:

After the effluent tax was introduced, there were three options available for the tax payers - improve the manufacturing processes, perform on-site wastewater treatment and/or pay the effluent tax (Kraemer 1995). These options to counteract the effluent tax with certain abatement measures led to the development of better effluent treatment facilities. After the tax was put in place, a survey revealed that 75 percent of private industries and 66 per cent of the municipal corporations had taken steps to improve advanced wastewater treatment (Barde and Smith, 1997).

3.8. Summary

The wastewater tax in Germany is a moderately complex system, with contaminants being charged based on their toxicity. A certain amount of each contaminant corresponds to a ‘damage unit’, and the contaminants charged for include Chemical Oxygen Demand, Nitrogen, Phosphorus, organic halogens and heavy metals. All polluters that discharge directly into water bodies, including wastewater and sewage treatment plants and industries are charged based on the damage unit

values of their effluent. Other discharges into a wastewater treatment system are governed by an ordinary user fee. There are exemptions and benefits to the polluters based on certain conditions as outlined above. As a result of the stringent standards and expensive taxes, a vast majority of the municipalities and industries have upgraded their effluent treatment system to ensure that the tax paid is low. Most of the targets set while implementing this wastewater tax system were met and this system proved to be a success leading Germany to the forefront of advanced wastewater treatment (Federal Environmental Agency, 2001).

CHAPTER 4

SYDNEY WATER – WASTEWATER FEE SYSTEM

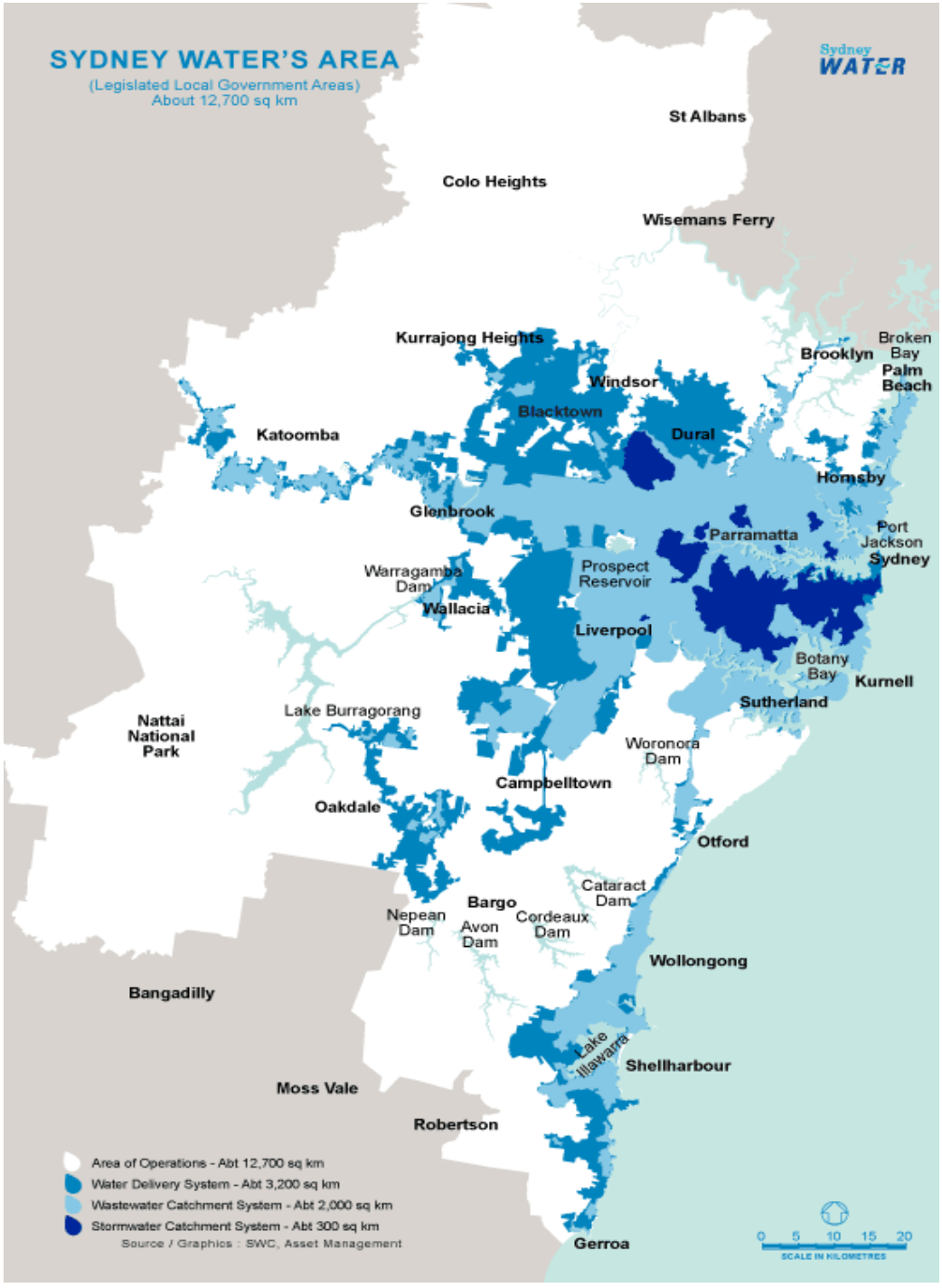

Fig 4.1. Sydney Water's jurisdiction

4.1. Introduction

Sydney Water Corporation, commonly known as Sydney Water, is a New South Wales (NSW) government corporation which provides services including drinking water, wastewater management and stormwater management for the NSW state of Australia, specifically the Greater Metropolitan Sydney, the Illawarra and the Blue Mountains regions. Presently, Sydney Water owns and operates 16 wastewater treatment plants, and collects and treats over 1.8 billion litres of wastewater from both industries and municipalities. Apart from treatment, Sydney Water also recovers nutrients from waste for reuse as fertilizers. The treated wastewater is released back into natural water bodies, only when it meets the standards set by the Environmental Policy Association of NSW. Sydney Water also continuously invests in their treatment plants to improve effluent quality (Sydney Water Corporation, 2017).

Sydney Water accepts wastewater from both municipal and non-municipal sources for further treatment. The non-municipal wastewater is termed as 'trade wastewater' by Sydney Water. There are two types of trade wastewater, commercial trade wastewater and industrial trade wastewater. Commercial trade wastewater comprises of wastewater from:

- commercial cooking,
- mechanical workshops,
- car washing (Automotive),
- laundry (commercial, hospital, hotel, etc.),
- shopping centers with centralized pre-treatment,
- aquatic centers,
- cooling tower and boiler blowdown.

Industrial trade wastewater comprises of wastewater from:

- Industrial or commercial sources other than the ones listed above
- Trucked wastewater, including septic effluents
- Marine vessels like ships and boats
- Run-off from contaminated sources

Like other countries, an approval from Sydney Water is required of non-commercial sources before they release trade wastewater and are charged appropriate fees for the same. For certain contaminants that aren't charged, acceptance standards have been set to ensure that overloading doesn't occur.

4.2 Purpose of the fee system

The fee system is designed such that the fees collected will cover the cost of managing and treating commercial and industrial trade wastewater. Sydney Water also has certain conditions and requirements as a part of the trade wastewater treatment for the following reasons as mentioned,

- To encourage minimising waste and support water efficiency.
- To protect the workers in and around the treatment plant
- To protect the treated water receiving environments
- To prevent damage to the wastewater treatment system
- To produce good recycled water and recover high quality biosolids

4.3. Design of the fee system

4.3.1. Commercial Trade Wastewater:

Grease traps must be set in the commercial establishments to trap all the grease waste. Sydney Water uses an electronic tracking system called Wastesafe to track the generation, collection and transportation of the grease waste. Sydney Water also schedules frequent cleanings to clean out the grease traps by an authorised transporter from Wastesafe, and this service is directly charged

to the owner of the commercial establishments. For establishments with a grease trap, there is a fixed quarterly charge of AUD 29.19 and the charges for missing a scheduled cleaning is AUD 320 for grease traps less than 2000 litres and AUD 640.02 if more.

Aside from the grease trap fees, the fee charged for treatment of commercial waste consists of two components: management charges and waste quality charges.

4.3.1.1. Management charges -

The management charges comprise of the permit fees for monitoring, inspections and administering permits, additional inspection fees if additional inspections are required to ensure compliance, and grease trap charges. The management charges are further described below in Table 4.1.

Table 4.1 - Management Charges for Commercial Trade Wastewater

Fee Type	**Amount (AUD)** 1 AUD = 0.8 CAD	**Description**
Permit fee - first process	41.04	Quarterly fee
Permit fee - additional process	14.09	Quarterly fee
Application and variation fee	0	-
Additional inspection fee	217.60	Per inspection
Liquid waste - grease trap charge	29.19	Quarterly

4.3.1.2. Water Quality Charges:

Commercial establishments are charged based on the type of processes that lead to the production of the effluent. Each process group has a volumetric charging rate. The wastewater quality of commercial trade wastewater is based on historical records collected by Sydney Water for the particular process and wastewater charges are set accordingly. Similar processes are charged similarly as a group, at a certain AUD/kL of effluent. If the discharge is metered then the total volume of discharge is directly calculated. If not, then the discharge volume is based on a sample from a similar business. Also, if certain establishments have poorly maintained pre-treatment systems, then they could be charged more by Sydney Water. In addition, if flow is required to be monitored by Sydney Water, the establishment is required to install a meter for the same. In addition, based on the type of industry, certain pre-treatments are mandatory and they can be found attached in Appendix B.

The charging rates are given below in Table 4.2.

Table 4.2 - Water Quality Charges for Commercial Trade Wastewater

Commercial institution process group	Charging rate ($/kL) (AUD)
High strength BOD - food Fried chicken BOD > 2000 mg/L Asian style BBQ Ice cream parlour Bakery retail - hot breads, cakes	4.029 If the pre-treatment is not maintained, a higher charge of $12.581/kL is applied.

Low strength BOD - food Hamburger restaurant Cafeteria, canteen and school Hot meals Take-away, including fish and chips, hot chicken Snack bar, coffee lounge, hot foods Restaurant Kitchen - hospitals, nursing homes Pizza restaurant Fried chicken BOD < 2,000 mg/L Delicatessen with hot food, wholesale food, caterer, butcher, retail non cooking < 12kL/day maximum Bakery retail - pies, sausage rolls	2.452 If the pre-treatment is not maintained, a higher charge of $12.581/kL is applied.
Automotive Service station under canopy Panel beating and spray painting Car detailer Car wash - hand wash and pressure spray Car wash - mechanical <12 kL/day Mechanical workshop, auto recyclers	0.8
Commercial laundry Laundromat Commercial laundry < 2 ML/yr Laundry – hospital, nursing home, hotel < 2 ML/yr	0.500

Small dyers < 600 L/day	
Equipment hire washing	3.653
Lithographic processing	0.385

It can be noted that these process groups are only charged by volume and not based on contaminants.

4.3.2. Industrial trade wastewater:

Certain commercial establishments that are not covered under commercial trade wastewater and industries are required to have a permit before discharging their effluent. There are certain conditions that are outlined in the permit, which include daily discharge limits on contaminants and volume, how the discharge fee is calculated, acceptable effluent standards and a requirement to frequently monitor and analyse the trade wastewater.

To manage and treat the industrial trade wastewater, the fee charged is made up of two components, management charges and waste quality charges.

4.3.2.1. Management charges:

Just like the commercial trade wastewater, the management fee is charged for industrial trade wastewater to administer, monitor and offer permits, and handling grease traps. In addition to the fees charged for commercial establishments, an additional fee called the consent fee is charged for industrial trade wastewater. Consent fees are described based on the risk index of the industrial establishment; where the risk index is determined based on the 'risk' of accepting and treating the

wastewater as determined by Sydney Water on a scale of 1 to 7, with the risk varying according to the industry. The risk index varies from establishment to establishment and no further information was directly available for the same. The fees are described below in Table 4.3.

Table 4.3 - Management Charges for Industrial Trade Wastewater

Fee type	**Amount (AUD)** **1 AUD = 0.8 CAD**	**Description**
Application fee (standard)	$525.28	When applying for a permit to cover the cost of establishing and processing new applications.
Variation fee	$631.55	If changes are to be made in an existing permit, this fee is charged. Change can be made once every 6 months and not more frequently.
Renewal fee	No fee	-
Additional inspections	$217.60	Per inspection
Liquid waste trap (grease trap) charge	$29.19 / trap	-
Missed service charge	$320.00	Grease trap 2,000 L or less

Missed service charge	$640.02	Grease trap greater than 2,000 L
Consent fees (Risk Index)	$2,272.30 (1, 2 or 3) $1,048.85 (4) $699.64 (5) $349.82 (6) $174.91 (7)	To cover the cost to manage approval to discharge and includes planned inspections, monitoring and administrative costs. They are paid quarterly.

4.3.2.2. Waste Quality Charges:

The waste quality fees charged depend on the amount of contaminants in the wastewater and what kind of treatment plant they are discharged to - primary, secondary or tertiary. The contaminants are also charged based on their mass as in $/kg. In addition, certain contaminants that have a domestic equivalent, like BOD, suspended solids etc. are charged after the 'equivalent domestic mass' is subtracted from them.

The calculation is as follows:

Actual chargeable trade waste mass = Trade waste mass - Equivalent domestic mass

where,

Equivalent domestic mass = Volume of waste * Equivalent domestic concentration

The concentration of chargeable contaminants, and a fixed group of other contaminants must fall below the acceptable standards set as mentioned in Appendix B.

The charge per contaminant is mentioned below depending on the treatment plant in Table 4.4.

The charge of contaminants based on their mass, their acceptable standards and domestic equivalents is given below.

Table 4.4 - Water Quality Charges for Industrial Trade Wastewater

Substance	**Acceptance Standards (mg/L)**	**Domestic Equivalent (mg/L)**	**Charging rate ($/kg)**
BOD - primary	-	230	0.308 + (0.122 x [BOD mg/L]/600)
BOD - secondary/ tertiary	-	230	2.001 + (0.133 x [BOD mg/L]/600)
Suspended solids - primary	600	200	0.559
Suspended solids - secondary/ tertiary	600	200	1.619
Grease - primary	110	50	0.504
Grease - secondary/ tertiary	200	50	1.546

Nitrogen - primary	-	-	0.000
Nitrogen - secondary/ tertiary	250	50	1.834
Phosphorus - primary	-	-	0.000
Phosphorus - secondary/ tertiary	50	10	6.577

These charges are reviewed every 4 years by Independent Pricing and Regulatory Tribunal, Sydney (IPART). The charges set are based on historical records, inflation and future predictions to ensure that the revenue recovered covers the efficient costs of handling these wastes, treating them to acceptable standards and including an allocation of corporate overheads. IPART also noted that maximum charges are set on trade wastewater, as extensive reviews including discussions with stakeholders involved, independent consultants were conducted during the previous review before setting the charges, in 2012.

4.4. Exemptions from the system:

Industrial establishments are presently not allowed any exceptions if they discharge effluents to treatment plants. But there are certain groups of commercial processes that are not being charged for effluent discharged and are listed below in Table 4.5.

Table 4.5 - Exemptions from the system

Photographic Waterless minilab, with silver recovery unit (SRU) Waterless minilab, used chemistry taken off-site Waterwash minilab, with SRU Waterwash minilab, silver rich wastewater transported off-site Xray, with SRU Xray, silver rich wastewater transported off-site Graphic arts film, with SRU Graphic arts film, silver rich wastewater transported off-site Photo outlab, with SRU Professional lab, with SRU Wholesale lab, with SRU < 2 kL/day Microfilm processing, with SRU Educational institution – black & white photo only Dental hospital, silver rich wastewater transported off-site	No charge
Ship to shore pump out	No charge
Miscellaneous School laboratory Municipal pool/aquatic centre Screen printing Battery room – commercial Ceramic and pottery (hobby club) Stoneworking Glass finishing (commercial) Small laboratory,	No charge

hospital/university laboratory, pathology laboratory, morgue Mobile bin wash – commercial Portable toilet waste Cooling tower, boiler blowdown – commercial	

4.5. Revenue collected and use of revenue:

According to IPART, the revenue collected through trade wastewater charges help recover percent of the total corporate costs, by July 2020 and hence were set to increase 1.9 percent every year from 2016 to 2020. IPART also noted that if Sydney water aimed at recovering 100 percent of their costs then there must be an increase of 3.7 percent each year and to ease the burden on establishments, the decision was made to slowly recover the costs.

4.7. Effects on pollution producers:

More information is needed to draw substantial conclusions.

4.8. Summary:

Sydney Water charges their polluters differently depending on what kind of establishments they own and broadly classified the wastewater from these establishments into two - commercial and industrial trade wastewater. The charges that are set for each contaminant depends on the cost of handling, management and treatment of wastewater, and the type of treatment plant they are

discharged to amongst other factors. For certain contaminants that aren't being charged, acceptance standards have been established to ensure that no overloading happens. The charges are reviewed every 4 years and are revised to account for inflation, and improving cost recovery.

CHAPTER 5

THE PHILIPPINES

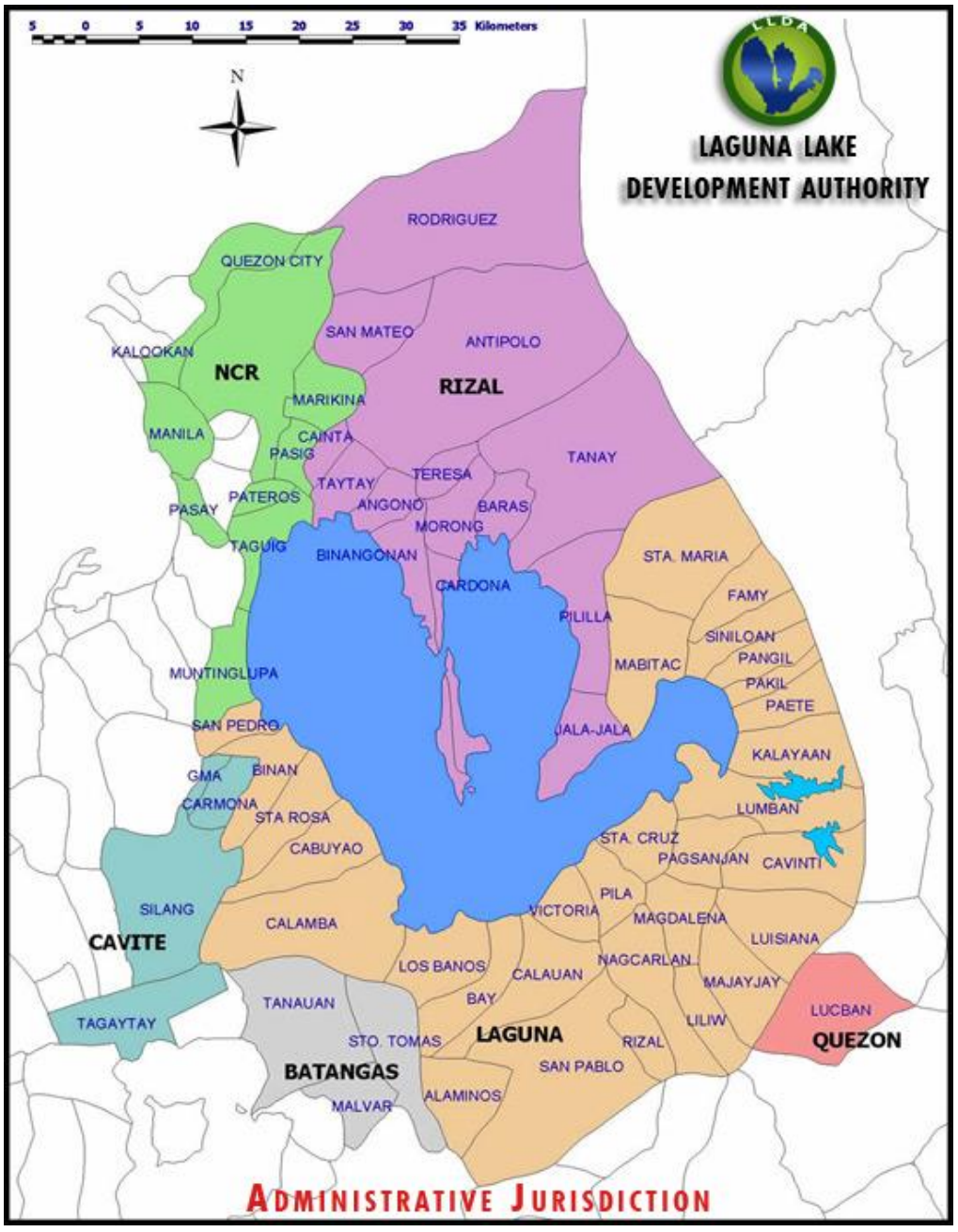

Fig 5.1. Administrative Jurisdiction of the Laguna Lake Development Authority

5.1. Introduction

There are two institutions responsible for monitoring the activity of industries and ensuring water regulatory compliance in the Philippines - The Laguna Lake Development Authority (LLDA) and the Department of Environment and Natural Resources (DENR). All activities that lead to the discharge of liquid waste into and/or could cause damage to any water body are regulated under the Philippine Clean Water Act of 2004. The quality of the effluent discharged into any water body should conform to the set effluent standards for all pollutants and the effluent standards set vary according to the type of water body they are discharged into.

The wastewater discharge fee system in the Philippines is known as the Environmental User Fee System or EUFS, and has been put into regulation by the LLDA in 1997, making the Philippines one of the first Asian countries to put into place a rigid discharge fee system. This EUF complemented the existing system in the Philippines focused on ensuring that the liquid waste pollution is reduced in the Laguna de Bay region.

All industries that have the potential to discharge wastewater effluents into any water bodies in the Laguna de Bay region are required to obtain a 'Discharge Permit' and pay the corresponding fee, known as Environmental User Fee (EUF) annually. Presently, the Environmental User Fee System covers all industrial establishments be it commercial or agro-based and efforts are underway to cover households.

5.2. Purpose of the fee system:

With a catchment basin area of 45000 square kms, the Laguna de Bay is the largest lake in the Philippines (E. Mercado, 2008). The Department of Environmental and Natural Resources estimated that around sixty percent of the residents in the region, around 8.4 million, discharge

their wastes into the lake directly. These wastes include agricultural, industrial and domestic wastes. To control the polluting contaminants in the lake, the EUFS was drafted with a primary goal of reducing the load of pollutants on the lake by increasing the accountability of the polluters (A. Santos-Borja et al., 2006). As a direct application of the "Polluter Pays Principle", this system enforces direct liability for environmental damage caused in the Laguna de Bay Region ensuring that firms adapt processes such as to reduce the environmental effects of their daily activities (WEPA). The most significant pollutant of the lake was found to be BOD and hence, BOD was the primary factor that was chosen to be offset by implementing the EUFS. (Mercado, 2008).

5.3. Design of the fee system:

The Environmental User Fee (EUF) is paid annually by establishments that hold a valid discharge permit. This discharge permit, which should be renewed annually, authorizes industries to discharge wastewater into the tributaries within the Laguna de Bay region as long as the wastewater complies with the effluent standards set by the LLDA. The effluent standards are attached in Appendix C.

The fees were set up based on a numerical model to ensure at least 50 percent reduction in BOD within the first year of implementation and hence were set quite high (USEPA, 2004).

The EUF paid is a sum of a fixed fee, a variable fee and a processing fee and is paid annually.

EUF = **Fixed Fee** + (**Variable Fee*** Total BOD5) + **Processing Fee** (5,000 PHP)

where PHP = Philippine peso

The Processing fee is paid to apply for a discharge permit, for renewal of an existing permit or for revalidation of an existing permit and thus is paid annually. Before a permit is issued, the firms are required to pay the estimated fee for a year before the issuance of the permit.

5.3.1. Fixed fee:

The fixed fee is determined by the volumetric rate of wastewater discharge by the industries/ establishments. The fixed fee is determined by the volumetric daily discharge of the wastewater and the type of pollutants in the wastewater - conventional or with heavy metals. The established fixed fees are given in Table 5.1.

Conventional Pollutants - Discharge (m3)/ day	**Fee (PHP)** **1 PHP = 0.025 CAD**
Less than 30 m3/day	8,000
30 m3/day to 150 m3/day	16,000
More than 150 m3/day	24,000
With Heavy Metals - Discharge (m3/day) **Heavy metals – Cd, Cr, Ar, Hg, Pb etc.**	**Fee (PHP)** **1 PHP = 0.025 CAD**
Less than 150 m3/day	16,000
More than 150 m3/day	24,000

Table 5.1. Fixed Fees established by the Laguna Lake Development Authority

5.3.2. Variable Fee:

The variable fee is calculated as the product of the total effluent BOD_5 concentration and the unit variable fee. The total effluent BOD_5 is calculated in kg as the product of average effluent concentration, daily wastewater discharge and number of discharge days per year.

The established variable fees are given in Table 5.2.

Table 5.2. Variable Fees established by the Laguna Lake Development Authority

Variable Fee	Fee (PHP/kg BOD)
Discharged contaminants comply with the effluent standards	5.00
Discharged contaminants exceed effluent standards	30.00

The EUFS also gave firms additional monetary incentives to construct and use wastewater treatment plants at the firms at a cost lower than the fees charged for discharging wastewater into Laguna de Bay (E. Mercado, 2008). This is also advantageous for the firm as they have control over the treatment with regard to how and when the wastewater can be treated (UNESCAP, 2008)

5.4. Exemptions from the system:

The only exemption provided is for establishments that have a volumetric discharge of less than 12 cubic meters per day. In such cases, the establishments, generally restaurants, food chains and

similar firms, only pay the fixed minimum fee. However, if the volumetric discharge exceeds 12 cubic meters per day, the firms would pay additional fines and penalties. This effluent standard will be used for two years and then the standards will be progressively made stricter (PEMSEA,2005)

5.5. Revenue collected and use of revenue

According to LLDA, the fixed fee is collected to cover the cost of the administrative procedures required to track the environmental performance of the industries. A higher fee is charged for industries that discharge a higher volume of water due to increased monitoring requirements. The variable fee was put into place to drive establishments to reduce the BOD loading into the lake. Eighty percent of the generated revenue is used for monitoring and implementing the EUFS whereas the remaining twenty percent was designated for implementing or developing other environmental projects (Convention on Biological Diversity, n.d.).

5.6. Environmental effect after implementation

The EUFS had a phase based implementation with the first phase covering only 5 major industrial sectors that contributed around 90 percent of the pollution. Within one year of implementation, in 1997, the BOD loading was reduced by 2,800 metric tons. As the system expanded in 1998 to cover all the industries in the region, the overall BOD loading reduced to around 3014 metric tons, close to 88 percent. Within 10 years of implementation i.e. by 2006, the percentage of industrial pollution into the Laguna de Bay was reduced to 11 percent from the initial 40 percent in 1996 (

E. Mercado, 2008). Now, domestic wastewater, primarily from households form almost 77 percent of the BOD loading and the next phase of the EUFS is to expand to cover households (S. Pagiola, 2002).

5.7. Effects on pollution producers

When the system was put in place in 1997, the average BOD loading per establishment was 24.34 metric tons and within 10 years it was drastically reduced to 1.29 metric tons per establishment. In addition, by 2007, 70 percent of the industries that applied for a discharge permit was issued one compared to the 50 percent approval rate in 1997, which directly indicates that the quality of the effluent has improved and the number of effluent standard-compliant firms has increased. The EUFS was also complemented by various measures by the LLDA including linkages between various key industrial sectors to create a space for collaboration and to assist these firms to comply with the effluent standards.

5.8. Summary

The Environmental User Fee system was established with the primary aim of reducing the BOD loading on the Laguna de Bay basin. And within 10 years of implementation the system has seen great success with a 96 percent reduction in BOD by 2003 for the 5 primary industry sectors covered in 1997 and with the lake's quality improved to be suitable for fishing and industrial use (USEPA, 2004). According to the system, the industries that hold a valid discharge permit are charged a fee known as the environmental user fee which consists of a fixed fee, variable fee and

a processing fee. While the fixed fee has been increasing, the variable fee has remained constant over the years. Various other incentives are provided for establishments to set up treatment facilities within the establishment to meet effluent standards. Other marketing initiatives by the LLDA complemented the EUFS, which included enlisting help from volunteers, NGOs, organizations and the general public also led to the success of the system and further improvement of the environmental condition of the Laguna de Bay watershed (USEPA, 2004).

CHAPTER 6

CHINA'S WASTEWATER TAX SYSTEM

Fig 6.1. Administrative Jurisdiction of the People's Republic of China

6.1. Introduction

Before 2015, China charged industrial contaminants based on treatment costs under the wastewater pollutant fee system. But the fees charged were relatively low, leading to an increase in wastewater discharge by 32 billion tons of wastewater within a span of 15 years. In addition, the low fees led to a lack of incentive for industries to reuse and recycle wastewater. Out of all the wastewater sources, industrial wastewater discharge was estimated to be at least 20-25 billion tons in 2000 (X. Guo et al., 2018). There was also a lack of awareness to pay the fees and lack of mandatory enforcement and collection measures for fees, which were major drawbacks of the fee system. Hence, in 2016, the People's Republic of China passed the Environmental Protection Tax Law to replace the previously existing pollutant discharge fee system to regulate environmental pollution and this law was later enforced in January 2018. This law carried provisions to regulate air, water, solid waste and noise pollution.

According to the State Administration of Taxation, China, with this shift from a fee system to a tax system three major changes were observed. While previously, the pollution fee was collected by sector administrations, now the tax collection is done by the tax and fiscal authorities, customs and other bodies. In addition, while the fees were established by the treatment costs the taxes are fixed. Also, the previously collected fees had to be earmarked for environmental projects the taxes collected can be used by the State Administration for any purpose.

To complement the Environmental Protection tax law, the State Administration also issued a 10 point water action plan in 2015. One of the primary goals identified was to improve the surface water quality of 70% of the individual rivers to meet the quality for domestic use, also known as Grade III.

The environmental protection taxes are imposed on a yearly, monthly or quarterly basis depending on the local tax administrators based on the actual situation. Under special circumstances where taxes cannot be levied periodically, a one-time payment can be authorized (B. Jones, 2015).

6.2. Purpose of the tax system:

While China already had a pollutant discharge system in place, the low fees charged for industrial polluters failed to motivate the firms to reduce pollution. Also the primary goal of regulating the pollution was difficult to achieve as water pollution kept increasing. In addition, some local authorities also exploited certain loopholes within the pollutant discharge fee system and provided exemptions for firms that were heavily polluting (Lifang, 2018). To offset these drawbacks, the Environmental Protection tax law was put in place in 2016 to replace the fee system. Local authorities are also allowed to fix the tax rate applicable for each pollutant within their jurisdiction and the rate charged lies within the range presented by the State Administration. This authority provided to local administrations will help reflect the local context better and the polluting industries' situation. (A. Cecenia, 2018).

6.3. Design of the tax system:

According to the law, the tax levied on the industries depend on three factors,

1. The type of contaminants discharged
2. The province where the waste is discharged
3. The medium of pollution - air, water or land

There are pollutant equivalency values allotted for contaminants based on their potency to pollute. Water pollutants are classified into two classes, with Class I consisting of stronger contaminants like heavy metals, whereas Class 2 consists of other water pollutants like SS, BOD, petroleum derivatives, oils etc. highlighted in Table 6.1.

The tax is calculated using the following formula:

Environmental Tax = Pollutant Equivalent Weight x Applicable tax rate for the pollutant

where,

Pollution Equivalent Weight = (Total volume of pollutant discharged/ pollutant equivalent value).

Class I pollutants are charged higher than the Class 2 pollutants as they have a higher polluting potential, even in smaller concentrations (B. Jones, 2015). The applicable tax rate range for water pollutants as set by the State Administration is 1.4 to 14 RMB per pollution equivalent and the local authorities fix the rate based on their localities (R. Hoffman, 2015). RMB, also known as the Chinese Yuan is the currency of China, and is equivalent to 0.19 CAD. Aside from Class 1 and 2 pollutants, water pollutants are also charged based on the pH, color, number of coliform groups and residual chlorine pollutants. In addition, small polluters like animal husbandry and small businesses for which actual monitoring cannot be performed a separate set of equivalent values are also provided and can be found in Table 6.1. as given below (China Law Translate, 2017).

Table 6.1. Pollutant equivalent values for taxable water pollutants

Class-I Pollutants	**Pollution equivalent values (kg)**
1. Total mercury	0.0005

2. Total cadmium	0.005
3. Total chromium	0.04
4. Hexavalent chromium	0.02
5. Total arsenic	0.02
6. Total lead	0.025
7. Total nickel	0.025
8. Benzo-(a)-pyrene	0.0000003
9. Total beryllium	0.01
10. Total silver	0.02

Class-II Pollutants	**Pollution equivalent values (kg)**
11. Suspended solids (SS)	4
12. Biochemical oxygen demand (BOD_5) (or)	0.5
13. Chemical oxygen demand (CODcr) (or)	1
14. Total organic carbon (TOC) Only one of factors are charged from one discharge outlet.	0.49
15. Petroleum and derivatives	0.1

16. Animal and vegetable oils	0.16
17. Volatile phenols	0.08
18. Total cyanides	0.05
19. Sulfides	0.125
20. Ammonia nitrogen	0.8
21. Fluorides	0.5
22. Formaldehyde	0.125
23. Aniline	0.2
24. Nitrobenzene	0.2
25. Anionic surfactant (LAS)	0.2
26. Total copper	0.1
27. Total zinc	0.2
28. Total manganese	0.2
29. Color developer (CD-2)	0.2
30. Total phosphorus	0.25
31. Elemental phosphorous (in P)	0.05
32. Organophosphorus pesticide (in P)	0.05

33. Dimethoate	0.05
34. Parathion-methyl	0.05
35. Malathion	0.05
36. Parathion	0.05
37. Pentachlorophenol and sodium pentachlorophenate (in pentachlorophenol)	0.25
38. chloroform	0.04
39. Adsorbable organic halides (AOX) (in Cl)	0.25
40. Carbon tetrachloride	0.04
41. Trichloroethylene	0.04
42. Tetrachloroethylene	0.04
43. benzene	0.02
44. Methylbenzene	0.02
45. Ethylbenzene	0.02
46. ortho-Xylene	0.02
47. para-Xylene	0.02
48. meta-Xylene	0.02

49. chlorobenzene	0.02
50. ortho dichlorobenzene	0.02
51. p-dichlorobenzene	0.02
52. p-nitrochlorobenzene	0.02
53. 2,4-dinitrochlorobenzene	0.02
54. Phenol	0.02
55. m-cresol	0.02
56. 2,4-dichlorophenol	0.02
57. 2,4,6-trichlorophenol	0.02
58. Dibutyl phthalate	0.02
59. Dioctyl phthalate	0.02
60. Acrylonitrile	0.125
61. Total selenium	0.02

Pollutants - pH, color, coliform groups, residual chlorine		**Pollution equivalent values**
1. pH value	1. 0-1, 13-14	0.06 tons of sewage

	2. 1-2, 12-13	0.125 tons of sewage
	3. 2-3, 11-12	0.25 tons of sewage
	4. 3-4, 10-11	0.5 tons of sewage
	5. 4-5, 9-10	1 ton of sewage
	6. 5-6	5 tons of sewage
2. Color		5 tons of water · unit
3. Number of Coliform groups (or) 4. Amount of residual chlorine (hospital wastewater disinfected with chlorine) Taxes are levied on either the number of coliform groups or the amount of residual chlorine		3.3 tons of sewage

Pollution Equivalents for Water Pollutants of Livestock Husbandry and Small Businesses when actual monitoring cannot be performed		**Pollution equivalent values**
	1. Cattle	0.1 head
	2. Pigs	1 head

Taxes are only levied on livestock breeding farms with stock of more than 50 heads of cattle, 500 pigs, or 5000 chicken, ducks, or other poultry.	3. Chicken, ducks and other poultry	30 birds
4. Small businesses		1.8 tons of sewage
5. Food and beverage, entertainment, and service industries		0.5 tons of sewage
6. Hospital Where there are more than 20 beds in a hospital	Disinfected	0.14 beds
		2.8 tons of sewage
	Not disinfected	0.07 beds
		1.4 tons of sewage

The water pollutants that are discharged from every outlet will be divided based on their classes as Class 1 and Class 2 in accordance with Table 6.1 and ranked in a decreasing order of their pollutant equivalents. After sorting the pollutants, the environmental tax is to be charged for the first five pollutants on Class 1 and the first three pollutants on Class 2 (China Law Translate, 2017).

These pollution equivalent values have been determined through a comprehensive analysis conducted by the State Administration of Taxation based on the level of damage caused to the

environment by the pollutants or by the discharge activities, and the technological cost of treating the pollutants. Hence, if different pollutants have the same pollution equivalents in the same polluting medium, then they can approximately cause similar damage to the environment (China Law Translate, 2017).

In addition, the discharged amounts of water pollutants are calculated based on the automatic monitoring data from the polluter or a monitoring institution if available and compliant with the national standards. Otherwise, they are calculated based on estimates provided by the environmental authorities based on the activities of the polluters.

Based on the provinces the applicable tax rate per province as fixed by the local tax administrations is given in Table 6.2. (M. Geraci, 2018)

Table 6.2. Applicable Tax Rate per province

Province	**RMB/Unit** **1 RMB = 0.19 CAD**
Beijing	14.0
Tianjin	12.0
Hebei	11.2
Henan	5.6
Jiangsu	8.4
Shanghai	1.4
Chongqing	3.0
Hunan	3.0
Shandong	3.0

Hubei	2.8
Guangdong	2.8
Sichuan	2.8
Guizhou	2.8
Hainan	2.8
Guangxi	2.8
Shanxi	2.1
Zhejiang	1.4
Fujian	1.5
InnerMongolia	1.4
Yunnan	1.4
Liaoning	1.4
Shaanxi	1.4
Ningxia	1.4
Xinjiang	1.4
Jilin	1.4
Gansu	1.4
Qinghai	1.4
Jiangxi	1.4
Anhui	1.4

6.4. Exemptions from the system:

There are some temporary exceptions provided for under the environmental tax law (China Law Translate, 2017 and Peking University Law, 2018). The tax is waived for certain activities that include:

1. Pollutants that are discharged directly into urban sewage treatment plants or urban domestic waste treatment plants established according to law when the emission standards are met;
2. Pollutants from agriculture and small-scale animal husbandry, and
3. Mobile pollution sources including motor vehicles, locomotives, non-road mobile machinery, ships and aircraft, as long as the pollutants are within the emission standards
4. Special cases where the State Administration approves the tax exemptions.

In addition to the exemptions, there is a tax reduction option offered for industries compliant with the standards. If the amount of discharged taxable pollutants by a firm is 30 percent less than that of the local or national effluent standards, then the environmental tax levied is reduced to 75 percent. Furthermore, if the discharged pollutants are 50 percent less than the national standard, then the tax levied is reduced by 50 percent (China Law Translate, 2017).

6.5. Revenue collected and use of revenue:

Within half a year of implementation, the State Administration reported that RMB 9.68 billion, was collected, which was reportedly 22.1 percent higher than that collected by the pollutant discharge fee system within the previous year over the same period (State Administration of Taxation China, 2018). In addition, previously the State Administration took ten percent of the collected fee whereas through the tax system, local tax administrations collect a hundred percent

of the tax revenue and use the tax revenue as deemed appropriate in the local context (A. Cecenia, 2018).

6.6. Environmental effect after implementation:

The State Administration of Taxation of China has noted that after implementing the Environmental Protection Tax, centralized treatment of wastewater has increased which has also improved the efficiency of pollution control. More information on exact effects on the environment after implementation is needed to draw more conclusions.

6.7. Effects on pollution producers

Unlike the fee system, the Environmental Tax charges polluters differently based on their level of pollution, with the heavy polluters paying more than the light ones (A. Cecenia, 2018). In addition, the State Administration has also noted that the tax system has encouraged firms to upgrade into cleaner technologies leading to a reduction in wastewater discharge and the pollutants in it (China Law Translate, 2017). Furthermore, due to the provision of the tax reduction options on complying with the higher standards, more industries are taking notable initiatives to meet the standards and thus reducing their discharge.

6.8. Summary

China passed the Environmental Protection Law in 2016 and replaced an existing pollutant fee discharge system to control and regulate environmental pollution. Under this system air, water, solid waste and noise pollution are being regulated. The taxable water pollutants are classified into

two Class 1 and Class 2, based on the damage they caused to the environment. Accordingly, the pollutants are assigned an equivalent value. This value is used to calculate the equivalent weight of the pollutant in the discharge and the equivalent weight X the applicable tax rate as mentioned by the Chinese province is the environmental tax levied on the industry. The pollutants are ranked in decreasing order based on the equivalent values and the first five pollutants in Class 1 and the first three pollutants in Class 2 are charged. Provision for tax reductions and exemptions are provided under the special conditions. With public welfare and Environmental Protection being the primary goals of the Environmental Protection Law, strict enforcement of the law is expected to lead to industries and firms reducing their polluting activities (The National Law Review, 2015)

CHAPTER 7

THE NETHERLANDS

Fig 7.1. Administrative Jurisdiction of the Netherlands

7.1. Introduction:

In 1970, the Netherlands set up a wastewater levy system under the Surface Waters Pollution Act of 1970, which was enforced later in 1971 (ECOTEC). Following the polluter-pays principle, this wastewater levy system was initially enforced for a full cost recovery to finance the treatment of wastewater but the extremely high charges resulted in a decrease in wastewater discharge (Afromaison).

There are two primary governing agencies that collect the wastewater levy and this depends on which type of surface water, state waters (Rijkswaterstaat or RWS) or regional waters (Waterschappen) the wastewater is discharged into (European Parliament, 2001). The basis of the wastewater levy system remains the same for both the agencies. The levy system charges for both direct and indirect discharges of wastewater into surface waters and/or treatment plants and the firms are required to apply for a 'Watervergunning' or a water permit (Omgevingsloket). This water permit legally authorizes the firms to discharge wastewater as long as the wastewater meets the effluent standards. The emission limits are set based on the general emission limit values based on the best available technologies, and in some cases depending on the environmental quality of the receiving water (European Parliament, 2001).

The pollutants charged for under the levy system include organics, nitrogen, mercury, cadmium, copper, zinc, lead, nickel, chromium and arsenic. Based on the amount of pollutants discharged annually, their equivalent pollution units are calculated and charged accordingly. The wastewater levy for pollutants is called the wastewater levy if the polluters discharge wastes into a treatment plant and a pollution charge if the wastewater is discharged into open waters. The basis and charge for both the levies is the same per pollution unit. The charge per pollution unit stands at the rate of

54 Euros per pollution unit in 2019 (Waternet Netherlands, 2019) and the levy is imposed annually.

7.2. Purpose of the system:

The wastewater levy system was put into place such as to ensure that the revenue generated can recover the cost of wastewater treatment. The charges for organic compounds ensured that the industrial sector, agricultural sector and households were targeted and charges on heavy metals ensured that other pollutants are also charged for. Even though it was primarily established for 100 percent cost recovery, the high levies drove the establishments to decrease their pollution loads (USEPA, 2004).

7.3. Design of the system:

The firms are charged annually based on the amount of pollution units (p.u.) that the firms discharge as mentioned in their permit. One pollution unit for organic wastes is defined as the average of organic material produced by one individual in a day whereas one pollution unit for a heavy metals is 100 g if it is the sum of mercury, arsenic and cadmium and a 1000 g if it is the sum of zinc, nickel, lead, copper and chromium. They can be calculated as follows (H. Warmer and R. Dokkam, 2002):

<u>Organic pollutants:</u>

Total p.u. = [Amount of organics discharged/yr]/ [Avg. organic material produced/yr]

= [COD + (4.57*N) kg/yr]/ [49.6 kg/yr]

where,

COD - Chemical Oxygen Demand

N - Kjeldahl Nitrogen

Heavy Metals:

Mercury, arsenic and cadmium:

Total p.u. = [Amount of Hg, Ar and Cd discharged/yr]/[100 g/yr]

Zinc, nickel, lead, copper and chromium:

Total p.u. = [Amount of Zn, Ni, Pb and Cr discharged/yr]/[1 kg/yr]

If some of the heavy metals are taken into account while calculating organic materials, then there is deduction made while calculating the pollution units of the heavy metals.

After estimating the pollution units of the discharged wastewater discharged (USEPA, 2004), the polluters are divided into three groups based on the amounts of pollution units discharged as shown in Table 7.1.

Table 7.1. Pollution charge based on p.u. discharged

Pollution units discharged	**Source of pollution**	**Pollution units charged for**
Less than 5 p.u.	Households and small firms	3 p.u.

5 p.u. - 1000 p.u. of organic pollutants (maximum is 100 p.u. in some cases depending on the industry)	Medium firms/ establishments	Estimated p.u. based on the processes, raw materials and water use.
More than 1000 p.u. per day of organic pollutants or more than 10 p.u. of heavy metals	Industries and treatment plants	Actual discharge - for industries. Treatment plants don't pay for discharges into regional waters and pay a reduced charge for discharges into state waters.

To complement the wastewater charge, there is also a water system charge for households and landowners to cover the cost of water management which is also paid annually (Waternet Netherlands). If the establishments that pay the wastewater levy based on the estimated pollution units feel that they are overcharged, they can self-monitor and report to the water boards.

7.4. Exemptions:

There are presently no exemptions from the system, except for wastewater treatment plants. They are exempted from all charges if they discharge effluent into regional waters and pay 10 percent of the charge imposed on industries if they discharge into state waters (European Parliament, 2001).

7.5. Revenue collected and use of revenue:

Along with the wastewater system levy, there is a water system levy collected by the Regional Water Boards which are all earmarked to finance the water and wastewater treatment and management in the Netherlands. The annual estimated revenue from wastewater and pollution levies were a total of 1279 million Euros in 2016, accounting for about 47.5 percent of the total revenue collected by the water boards.

7.6. Environmental effect after implementation:

A study by the PBL Netherlands Environmental agency and the Institute for European Environmental Policy indicated that the removal rates of major pollutants like Nitrogen, Phosphorus and suspended organic matter after wastewater treatment has increased significantly, with all the removal rates over 80 percent. Another study by ECOTEC had found that the net pollution load on surface waters had reduced over 90 percent by 1996 and the organic waste discharges had reduced to 12 percent of the initial levels in 1970.

7.7. Effects on pollution producers:

The study by the PBL Netherlands Environmental agency and the Institute for European Environmental Policy also showed that the polluting firms and treatment plants had invested in upgrading their own treatment technologies so as to reduce the levies paid. ECOTEC also noted that total emissions in wastewater discharge has decreased from around 33 million population equivalents in 1975 to around 22 million population equivalents in 2008 as many firms had invested in decentralized treatment within the firms.

7.8. Summary:

The Netherlands has a fairly complex system of water levies. Aside from the wastewater and pollution levy, there is also a water system charge and the revenue from all the charges is recovered for use in water treatment and management by the Regional Water Authorities. The pollutants charged for under the levy system include organics, nitrogen, mercury, cadmium, copper, zinc, lead, nickel, chromium and arsenic. Based on the quantity of the pollutants discharged, their equivalent pollution units are calculated and the polluters are classified into three based on how many pollution units they produce. Based on the category of pollution they produce, they are charged accordingly. The extremely high levy rates have led to firms installing wastewater treatment facilities within the firms to reduce the tax paid.

CHAPTER 8

MALAYSIA

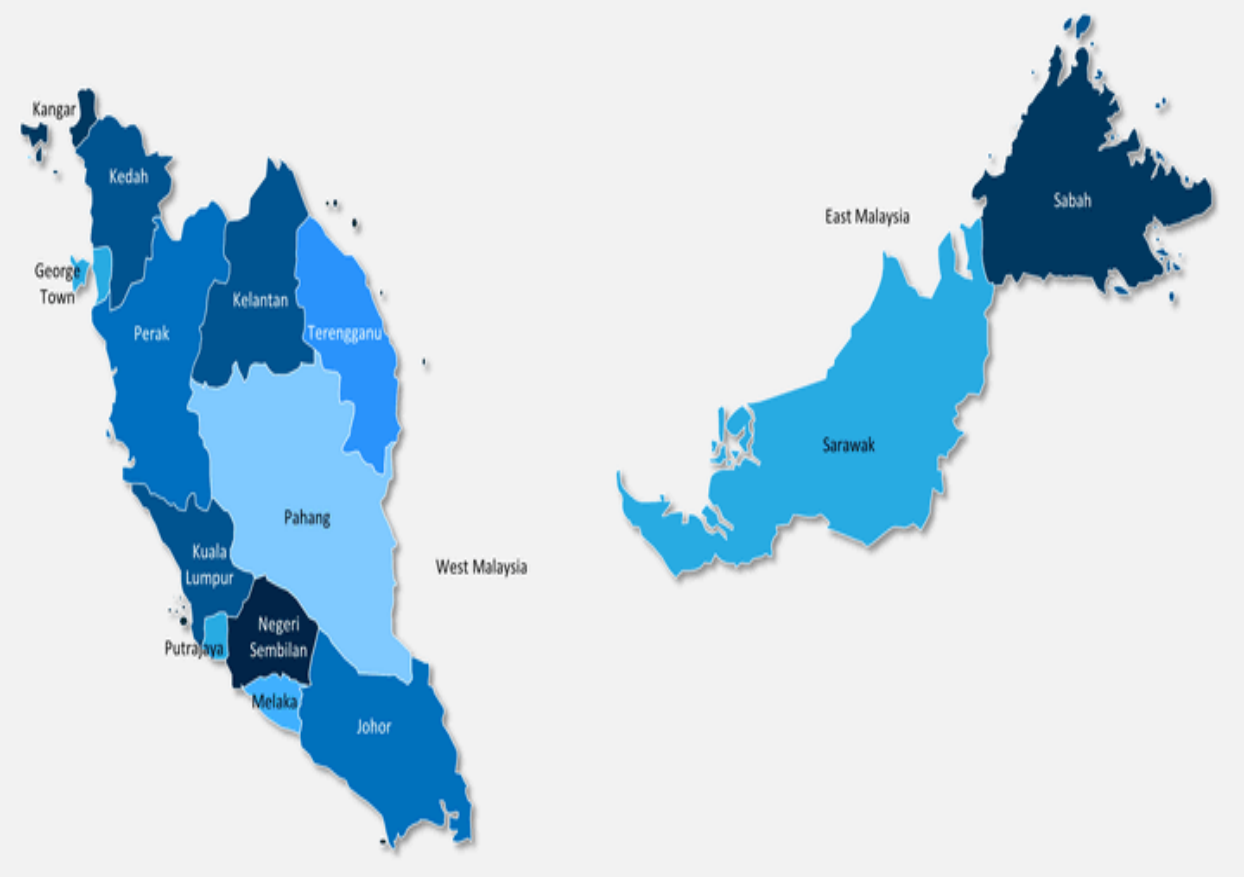

Fig 8.1. Administrative Jurisdiction of Malaysia

8.1. Introduction:

Malaysia is the largest producer and exporter of palm oil and this results in the production of high-BOD strength effluent (H. Kemyab, 2018). Hence, when the first fee-regulation was put in place, the primary aim was to reduce BOD produced by highly polluting industries of palm oil and rubber. According to the Environmental Quality (Sewage and Industrial effluents) Regulations 1979, palm oil and rubber industries were subject to a variable fee for effluent discharge. The fee was charged based on the quantity and concentration of BOD. The fee was composed of two levels. A base fee of RM 150 and a fee of RM 10/ton of BOD if the effluent meets standards and a fee of RM 100/ton of BOD if the effluent quality is over the standard for the first year (1 RM = 0.32 CAD). Following the first year, if the effluent standards weren't met, then the violating industries had their licenses temporarily suspended or permanently shut down. While this system helped bring down the concentration of BOD, almost a 99 percent reduction in 7 years (USEPA, 2004), the concentration of other contaminants had gone up. Hence, through the Environmental Quality (Industrial Effluents) Regulations 2009, more strict regulations were set up. This regulation applies for any establishment that discharge effluents, industrial or mixed (combination of industrial effluent and sewage) on or into the soil, or any water bodies. A written permit or a license, must be obtained from the Director General of Environmental Quality (DG) before effluents are discharged into a receiving water body or the soil. In addition, the industry should also monitor the concentration of COD and other parameters as mentioned using pre-installed monitoring and recording equipment, maintain a record of these pollutants and submit these records to the DG, every 30 days. The industries are charged accordingly based on the contaminants in their effluents and the receiving water body or soil. The contaminants charged for include BOD, mercury, cadmium, chromium, arsenic, cyanide, lead, copper, manganese, nickel, tin, silver, selenium, barium, fluoride,

formaldehyde, zinc, boron, iron, phenol, sulphide, oil and grease, and ammoniacal nitrogen. Based on the monthly monitoring data submitted, the industries are charged according to the contaminant concentrations.

8.2. Purpose of the fee system:

The Environmental Quality Act in 1974 or the EQA was set up as a legislative economic instrument to improve and maintain the surface water and soil quality in Malaysia. It is considered to be a detailed legislative Act to protect the environment and control pollution by holding polluters accountable for their actions in accordance with the "Polluters pay principle"(M. Ariffiin, 2015).

8.3. Design of the system:

Any firm that releases its effluents into a water body or the soil is required to obtain a license for the same, from the Director General of Environmental Quality. The license fee is RM 500 and the effluent-related license fee based on the concentration of the effluents is calculated and must be paid. The license is generally valid for a year and after that it must be renewed.

The effluent-related license fee is calculated based on the contaminant concentration in the effluent and the catchment area into which it is discharged into. The discharge points for which the Standard A regulations apply to are given in Schedule 11A in the Environmental Quality (Industrial Effluents) Regulations 2009 and Standard B regulations apply to discharge into any other waters and soil. The effluent fees are given below in Table 8.1.

Table 8.1. Contaminant fees for the effluents

Contaminant	**Fee (RM) per kg of contaminant - Standard A** **1 RM = 0.32 CAD**	**Fee (RM) per kg of contaminant - Standard B** **1 RM = 0.32 CAD**
BOD at 20°C	0.5	0.05
Mercury	2500	250
Cadmium	2500	250
Chromium, Hexavalent	2500	250
Chromium, Trivalent	2500	250
Arsenic	2500	250
Cyanide	2500	250
Lead	2500	250
Copper	2500	250
Manganese	2500	250
Nickel	2500	250
Tin	2500	250

Silver	2500	250
Selenium	2500	250
Fluoride	2500	250
Barium	2500	250
Zinc	2500	250
Boron	500	50
Phenol	500	50
Sulphide	500	50
Oil and Grease	500	50
Ammoniacal Nitrogen	500	50

The effluent standards, set according to the best available technology as attached in Appendix D must be adhered to while discharging effluents into the waters. If the firms are constructing an industrial effluent treatment system to treat the effluent, they must comply with the specifics in the Guidance Document on the Design and Operation of Industrial Effluent Treatment Systems issued by the Department of Environment. The effluents will also be monitored regularly and the reports must be sent to the DG every month for verification to ensure that the effluent quality hasn't changed.

While no data is available to rationalize the exact fee charged for contaminants presently, previously, the fees were dependent on the level which would lead to the decrease in effluents without burdening the industry instead of the marginal costs and benefits of decreasing pollution (USEPA, 2004).

8.4. Exemptions from the system:

There are presently no exemptions provided from the system. But certain incentives are provided for the eligible companies. In accordance with Schedule 3 of the Income Tax Act of 1997, capital allowance at an initial rate of 40 percent and an annual rate of 20 is provided for eligible industries to install pollution control equipment in their effluent treatment plants (Department of Environment, 2010).

8.5. Revenue collected and use of revenue:

The revenue collected through the water service industry in total has been used as a part of the budget of the Department of Environment (USEPA, 2004). While there is no available information on the exact revenue generated from the effluent fees, the gross output value from water supply, sewerage, waste management and remediation activities had an annual growth of 8.1 percent from 2015 to 2017, with the final value being 14.4 billion RM for the activities in 2017 (Department of Statistics Malaysia, 2019).

8.6. Environmental effect after implementation:

More information is needed to draw substantial conclusions.

8.7. Effects on pollution producers

The compliance rates of industries to the effluent standards have slowly been rising. Out of the 6590 industries inspected in 2012, 98 percent met the standards while out of 11410 inspections in 2014, 99 percent complied with the standards. This has been attributed to the regulations being effective as the industries resort to complying to avoid paying the high fees. Most of the non-compliant firms were found to be small and medium sized firms without resources to invest in treatment technologies (S. Sharifuddin, 2017)

8.8. Summary:

The effluent fee system of Malaysia when it began in 1979 was quite unique. While initially the fee was established to curb BOD pollution from the two highest polluting industries, in 2009 the fee was expanded to cover all firms, including treatment plants that release effluents into open waters or the soil. Any establishment that wants to discharge effluents must obtain a license from the DG of Environmental Quality (or renew once an existing license expires) and pay the license fee and the effluent-related license fee. The effluent related license fee is calculated based on the concentration of contaminants and the point of effluent discharge. All effluents must meet the effluent standards set based on the best management practices before discharge. The discharge must also be monitored regularly and monthly reports must be sent to the DG for verification of compliance. Over the years, the compliance rates of industries have been increasing and most of the non-compliant firms were found to be small establishments who didn't have the resources to set up advanced treatment technologies.

CHAPTER 9

STATE OF WASHINGTON, UNITED STATES

Fig 9.1. State of Washington, United States

9.1. Introduction:

Water pollution from point sources into water bodies is regulated in the United States by the National Pollutant Discharge Elimination System (NPDES) which was created in 1972 by the Clean Water Act. The United States Environmental Protection Agency (USEPA) authorizes the NPDES permit to State governments to enforce the program.

In the State of Washington, the Washington State Department of Ecology issues NPDES permits for federally-owned facilities on tribal lands and all discharges to surface waters. All other discharges to groundwater or publicly owned discharge works (POTW) are issued State Waste Discharge (SWD) permits by the USEPA. The permits are issued as general water quality permits or individual water quality permits. Both types of permits contain the permitted effluent limits, the requirements for monitoring and reporting requirements, and operation and maintenance requirements based on the permit holder to ensure no damage to the environment or people's health.

The categories of the general water quality permits include:

- Aquatic pesticide permits
- Boatyard General Permit
- Bridge & Ferry Terminal Washing Permit
- Concentrated Animal Feeding Operation Permit
- Construction Stormwater General Permit
- EPA Vessel General Permit (greywater)
- Fresh Fruit Packing General Permit
- Sand & Gravel General Permit
- Stormwater general permits

- Upland Fin Fish Permit
- Vessel Deconstruction Permit
- Water Treatment Plant General Permit
- Winery General Permit

All other discharges including industrial effluents into groundwater or POTW, that are not covered by the general water quality permits will be covered by the individual water quality permits.

9.2. Purpose of the fee system:

To protect environmental health, wastewater and stormwater discharges are regulated with the system of water discharge permits - both NPDES and SWD permits. Permit holders are required to pay the permit fees that are based on the factors related to the complexity of the permit issued, the compliance and cost recovery, pollutant loading, toxicity of pollutants and to encourage recycling and a reduction in the quantity of pollutants (Washington State Legislature, 2003).

9.3. Design of the system:

Fees under the NPDES and the SWD permits are established based on the category of the industry or facility. The permit fees based are charged annually and first time applicants pay an application fee which is 25 percent of the annual permit fee if the annual permit fee is USD 1000 or higher and USD 250, if the annual permit fee is less than USD 1000. The permit fees can be found in on Table H.1 of Appendix H.

For industries/ facilities that fall under more than one category (excluding sand and gravel, shipyards or RCRA) that fall under multiple categories will be charged under the category with the highest fee.

9.4. Revenue and use of revenue:

The state of Washington charges the permit fee such as to fully recover the costs of permit processing, compliance monitoring, conducting inspections and laboratory analyses, overseeing the performance of the programs, overhead expenses etc. In addition, based on the category of the industry, the fee is also based on the loading of the pollutants, their toxicity and to encourage the firms to practise recycling and reduce the loading of pollutants. The revenue that is collected is fully recycled back by the Department of Ecology to support the program (Washington State Legislature, 2003).

9.5. Exemptions from the system:

While there are no exceptions, fee reductions are provided to eligible industries under certain circumstances. They include:

(1) Industrial facility is a market research facility primarily researching the viability for products and processes that reduce or eliminate wastewater pollutants or wastewater pollutant generating activities, covered under an individual permit issued within the past three fiscal years and assessed the permit fee under a classified fee category. If eligible, then the industry pays a permit which is 25 percent of the initial assessed value.

(2) Small business fee reduction: When a facility/ business is formed to make a profit, is independently owned, has a sale of one million dollars or less on the relevant products and services, and has an annual permit fee of $ 500 or more, they can provide the necessary evidence and apply for a fee reduction. If found eligible, the permit fee is reduced by 50 percent of the initial assessed fees (Washington State Legislature, 2003).

9.6. Environmental effect after implementation:

Within a period of 30 years in between 1972 and 2002, water quality of surface water bodies including rivers, coastal waters and lakes have gone up substantially. While in 1972, only one third

of the water bodies were considered suitable for fishing and swimming, by 2002 the water quality had improved to about two thirds of surface water bodies are considered safe for fishing and swimming (USEPA, 2001).

9.7. Effects on pollution producers:

The number of NPDES permits issued by 2001 is 4 times the number when the program was started in 1972 with more than 400,000 industrial facilities requiring the NPDES permits (USEPA, 2001). More information is needed to draw substantial results as to the effects of the NPDES program on the activities of the industries.

9.8. Summary:

The NPDES program was implemented under the Clean Water Act in 1972 to regulate the wastewater discharge from point sources into the surface waters of the United States. The NPDES permit is issued by the EPA or an authorized state. In the state of Washington, there are two types of permits issued - NPDES and SWD permits. The permit fee for both the permits is charged annually and is based on the category of industry or facility. The fees is aimed to recover all the costs for permit processing activities, administrative or monitoring activities, and all overhead expenses. In addition, it is also based on the toxicity of the pollutants and could be charged such as to encourage companies to recycle or reduce the pollutants. The NPDES system has been fairly successful and is believed to have removed millions of pounds of both conventional and toxic contaminants from entering the water bodies (USEPA, 2001).

CHAPTER 10

BRITISH COLUMBIA

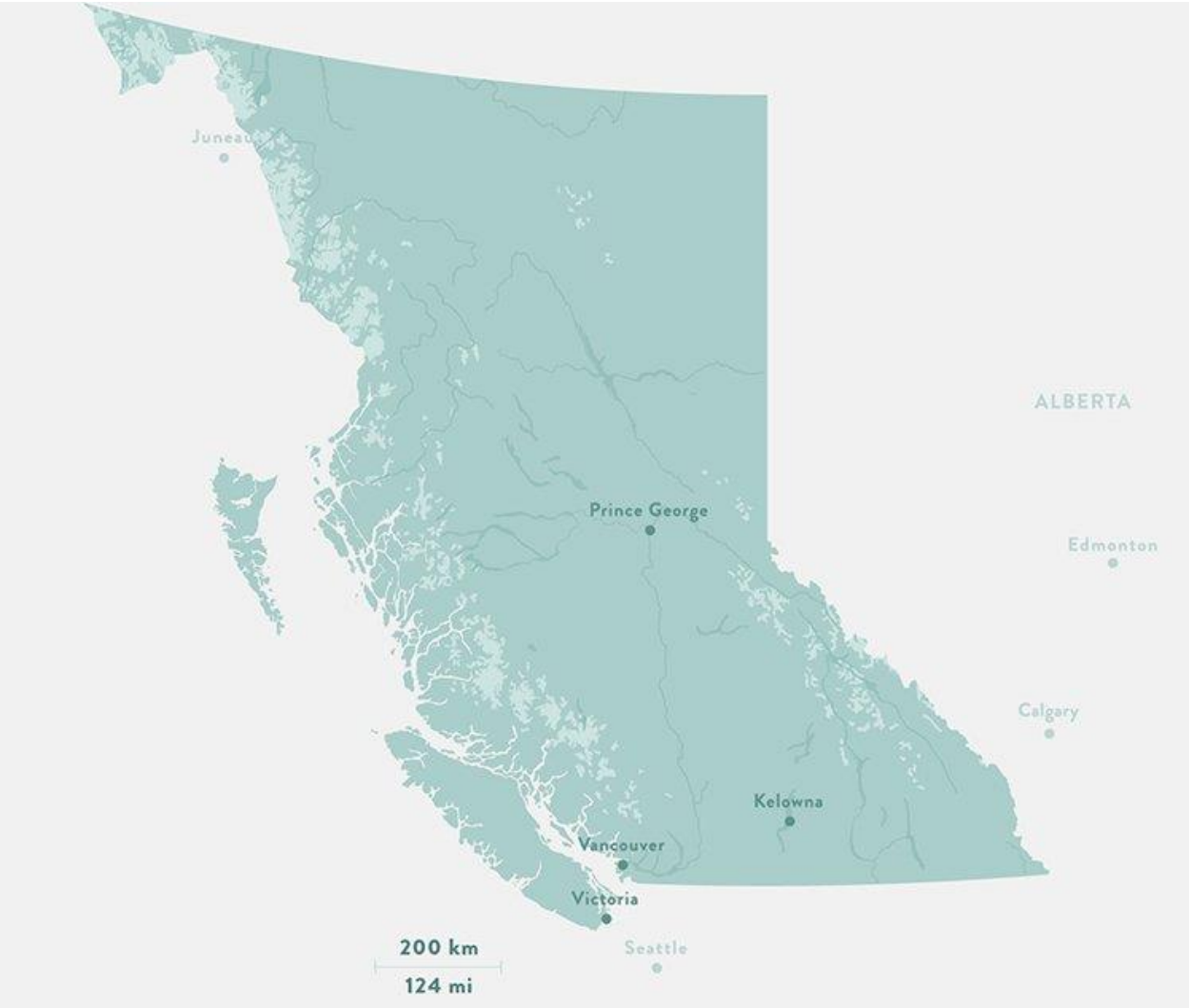

Figure 10.1.: Jurisdiction of British Columbia

10.1. Introduction:

The province of British Columbia regulates the activities of certain industries that discharge waste into land, water or air using the Waste Discharge Regulation (WDR) under the Environmental Management Act (EMA) by requiring that these industries obtain permits from the ministry of environment. The EMA, through the WDR prescribes that certain industries as classified under Schedule 1 and Schedule 2 will have to obtain authorizations from the ministry to discharge waste and can be found in Table F.1 and Table F.2. of Appendix F. Industries that are not covered in Schedules 1 and 2, while not needing a permit or an authorization to discharge waste will have to comply with the established standards and not cause pollution.

The industries covered under Schedule 1 of the WDR are required to get site specific authorizations from the ministry due to their potential for substantial environmental impact. The industries covered under Schedule 2 of the WDR are regulated by the minister of environment's code of practice, which eliminates these industries from needing a site specific authorization. In case of a lack of a code of practice for industries in Schedule 2, authorizations are required for waste discharges (Ministry of Environment, 2007).

An annual charge must be paid by the permit holder which includes a base fee depending on the type of the permit and the sum of the fees based on each contaminant that has been authorized under the permit.

11.2. Purpose of the fee system:

The WDR was established under the EMA to regulate discharges of industrial and municipal wastes, hazardous wastes, and pollution into the environment while protecting both the environment and public health (Ministry of Environment). Aside from the authority to regulate

activities, the WDR also has options for better enforcement and to increase compliance such as administrative penalties and fines. The fee system in the WDR was established as a relatively small economic incentive to treat the effluents from various industries and businesses better and for a cost recovery ranging from 75 to 125 percent.

11.3. Design of the fee system:

Before applying for a new permit or for an amendment to an existing permit, the applicant or the permit holder must pay a fee of CAD 400. Aside from the application/amendment fee, the permit holders must pay an annual charge for each permit they hold. Each permit fee is the sum of the base fee based on the type of the permit and a contaminant fee, based on the quantity of each contaminant and their corresponding unit fee.

Base fee:

The Base fee depends on the type of permit and can be either air, effluent, refuse or storage permits. Presently, all these types are charged the same base fee, which is 200 CAD.

Contaminant fee:

The unit contaminant fees based on the type of contaminant is given below in Table 10.1.

Table 10.1. - Discharge fee for contaminants

Contaminant	**Fee per Tonne Discharged (CAD)**
ammonia	124.52
AOX	330.62
arsenic	330.62
BOD	24.97
chlorine	330.62
cyanide	330.62
fluoride	124.52
metals	330.62
nitrogen and nitrates	49.77
oil and grease	83.02
other petroleum products	83.02
other solids	16.53
phenols	330.62
phosphorus and phosphates	124.52

sulphates	4.85
sulphides	330.62
surfactants	83.02
suspended solids	16.53
other contaminants not otherwise specified in this table	16.53

The total contaminant fee is calculated by multiplying the unit contaminant fee with the quantity of the contaminant. The quantity of each of the contaminants discharged is calculated by the maximum authorized rate of discharge and contaminant concentration as specified in the permit or by the regulation. In case the permit doesn't specify the contaminant concentration or the discharge rate, the discharge factors as determined by the director based on the approved industrial activities can be used to determine the contaminant fee.

The contaminant fees are designed based on the toxicity of the contaminant to the environment. Hence, the contaminants that pose a larger potential environmental loading impact have a higher charge per tonne. In addition, the contaminant fees help recover a part of the cost of treatment of the effluents. The unit fees are also revised every year to account for inflation.

11.4. Revenue and use of revenue:

The revenue collected under the Environmental Management Act for the WDR is through the Permit and Approval Fees and Charges Regulation. All fees collected under this regulation are directed to the Sustainable Environment Fund (SEF). For the fiscal year ending in March 2020,

the revenue into the SEF is estimated to be 24 million CAD. This includes the revenue of 5 million CAD collected from the 1% tax on disposal diapers. The government estimate show that about 2/3 of the Environmental Protection Division's (EPD) annual budget is received from SEF, so in general terms all of revenue covers all of EPD's activities (BC Ministry of Finance).

11.5. Exemptions from the system:

The permit application fee and the annual charges are waived for effluent type permits under the following conditions:

- if the permit is held by the government of BC or Canada
- if the permit is held by a person that discharges domestic sewage on an Indian reserve.

No other exceptions apply to the other industries (Permit And Approval Fees and Charges Regulation, EMA, 1992).

11.6. Effect on pollution producers:

While there is no well documented information on this front, direct sources from the Ministry of Environment and Climate Change Strategy suggested, based on observation, that there may be a very minor economic incentive related to the fees. For example, a hypothetical large industrial discharge may be paying $1M/yr. Depending on the current quantity and quality of their discharges, the capital cost to reduce their loading by 50% could be in the $50M range. That would equate to a payback period of 100 years. For smaller discharges with less expensive treatment technologies the payback period may be significantly shorter.

11.7. Effect on the environment:

The main policy intent of the fees is polluter pays principle - which leads to cost recovery for the activities of the Environmental Protection Division. Direct sources from the Ministry of Environment and Climate Change Strategy suggested that there is a minor though not documented improvement (reduction) in authorized loadings. The main mechanism for protecting human health and the environment is the standards set in ministry authorizations. The ministry strives to use best achievable technology and continuous improvement approaches in setting those standards.

11.8. Conclusion:

Under the Environmental Management Act's WDR, industrial activities that discharge wastes into land, water or air are regulated. The industries that are classified under Schedule 1 and 2 are required to obtain permits or authorizations to discharge wastes and the industries that don't fall under these categories are required to comply with the standards set. The fees are collected under the permit and approval fees and charges regulation of the EMA. The fees collected for a waste discharge permit include the base fee and the contaminant fee which is the product of the unit contaminant fee and the quantity of the contaminant. The contaminant fees are based on the toxicity of the contaminant to the environment and are revised every year to account for inflation. This fees collected is used to recover costs for the activities of the Environmental Protection Division.

CHAPTER 11

CAPITAL REGIONAL DISTRICT

Fig 11.1 – Capital Regional District

11.1. Introduction:

The Capital Regional District (CRD) is a regional government on the southern region of Vancouver Island and the Gulf Islands, for 13 municipalities and three electoral areas comprising of more than 413,000 people. The Regional Source Control Program (RSCP) of the CRD regulate the discharge of non-domestic waste into the sewers using the CRD Bylaw 2922, under which non-domestic waste can be discharged into the sewers if the necessary source control and pre-treatment measures are practised (CRD).

Under the CRD Sewer Use Bylaw, industries and businesses that discharge waste (more than 10 cubic meters per day) into the sewers are required to get waste discharge permits under which they're regulated. The permits lay out a list of requirements for effluent treatment, quality, monitoring and reporting. Waste discharge permit holders are charged an annual base fee, and a quarterly discharge fee based on the volume of discharge and the loading of the parameters as mentioned in the waste discharge permit.

Some industries or businesses need to adhere to certain codes of practice as defined by the CRD sewer use bylaw. In addition, some industries that have a relatively lower impact on the effluent collection and treatment system, and the receiving environments are issued letters of authorization that include site-specific, case by case basis requirements and best management practices to ensure that the impact of the effluent discharge is limited. In all cases, the industries and businesses operating under the Bylaw are required to sample their effluent, monitor the flow and report the data to the program frequently as required. Regular inspections are also carried out by the source control staff to ensure compliance.

11.2. Purpose of the fee system:

Like the waste discharge regulation of BC established under the Environmental Management Act to ensure that effluent discharge from industries, hazardous wastes and environmental pollution is regulated while public and environmental health is protected (RSCP, 2018). The goals identified by the regional source control program as of 2014 are:

- To protect the receiving environments adjacent to the sewage outfalls of the CRD
- To protect the sewage facilities and treatment plants of the CRD and its associated municipalities.
- To protect the public health and safety
- To protect the quality of the biosolids and sludge.
- To apply the source control program to all users of the CRD sewage facilities.

11.3. Design of the system:

While applying for the waste discharge permit, the applicant is required to pay the application fee of 500 CAD. Once the permit is issued the permit holder is required to pay the permit administration fees, which comprises of the base fee and the discharge fee.

Base Fee:

The base fee is not applicable for first time permit holders as part of the application fee is applied as the base fee. From the next year, an annual fee of 250 CAD is applied for all permit holders as the base fee.

Discharge Fee:

The discharge fee is a quarterly fee, applied based on the volume of the effluent and the loading of the contaminants as mentioned in the wastewater discharge permit.

The wastewater flow must be measured by the permit holders by using a flow measuring device and report an estimate of the daily and monthly discharge volumes by following the monitoring and reporting requirements as outlined.

The parameter loading calculation depends on the type of parameter discharged. The formula for the different parameters are given below in Table 11.1:

Table 11.1. - Loading calculations for different parameters

Parameter	**Loading Calculation**
COD Flow Oil and Grease Suspended solids Cyanide (CN) Oil and Grease (Hydrocarbons) Phenols PAHs Benzene Ethyl Benzene Toluene Xylenes Chloride (Cl)	The total loading for the quarter is the sum of the three monthly loadings for each parameter as calculated for each parameter and month as given below, $L_a = (C_a x\ F)/1000$ Where, L_a = loading of the parameter 'a' for a one month period, in kg C_a = concentration of parameter 'a', in mg/L F = monthly non-domestic effluent flow (m3)

Sulphate (SO4) Sulphide (S)	
Oil and Grease	The total loading for the quarter is the sum of the three monthly loadings for oil and grease as calculated per month as given below, L = [(C-H)x F]/1000 Where, L = loading for oil and grease for a one month period (kg) C = concentration of oil and grease, mg/L. H = concentration of oil and grease as hydrocarbons, in mg/L. (H = 0, where there is no result reported). F = total non-domestic effluent flow (m3).
Metals - Arsenic (As) Cadmium (Cd) Chromium (Cr) Copper (Cu) Lead (Pb) Mercury (Hg)	The total loading for the quarter is the sum of the three monthly loadings for oil and grease as calculated per month as given below, $L_a = [(C_a - P_a) \times F]/ 1000$ Where, L_a = loading for parameter 'a' for a one month period, in kg. C_a = concentration of parameter 'a', in mg/L.

Silver (Ag) Nickel (Ni) Zinc (Zn) Cobalt (Co) Iron (Fe) Manganese (Mn) Molybdenum (Mo) Selenium (Se)	P_a = practical quantitation limit of parameter 'a' as given in Table G.1 of Appendix G, in mg/L. F = total non-domestic effluent flow (m3).

The total quarterly discharge fee applicable is a sum of the quarterly discharge fees for the individual parameters described in Table 11.2. and the quarterly discharge fee for flow as shown below:

The discharge fee for each parameter aside from flow is:

$$\mathbf{D_a = L_a \times R_a}$$

Where,

D_a = discharge fee for parameter 'a' for a quarterly period, in dollars (CAD).

L_a = total loading for parameter 'a' for a quarterly period, in kg.

R_a = unit rate for parameter 'a' as listed in Table 11, in CAD/kg.

The discharge fee for flow is:

$$\mathbf{D = F_q \times R}$$

Where:

D = discharge fee for total quarterly flow, in dollars (CAD).

F_q = total non-domestic waste flow for the quarter, in cubic meters (m3).

R = unit rate for flow as listed in Table 11.2., in dollars (CAD).

Table 11.2. : Discharge fee per parameter

Parameter	**Discharge fee (CAD)**
COD	0.02/ kg
Flow	0.01/m3
Oil and Grease	0.25/kg
Suspended solids	0.07/kg
Arsenic (As)	61.25/kg
Cadmium (Cd)	81.67/kg
Chromium (Cr)	6.13/kg
Copper (Cu)	24.50/kg
Cyanide (CN)	24.50/kg
Lead (Pb)	24.50/kg
Mercury (Hg)	1,225/kg
Silver (Ag)	49/kg

Nickel (Ni)	8.17/kg
Zinc (Zn)	8.17/kg
Oil and Grease (Hydrocarbons)	1.63/kg
Phenols	24.50/kg
Cobalt (Co)	4.90/kg
Iron (Fe)	0.49/kg
Manganese (Mn)	4.90/kg
Molybdenum (Mo)	4.90/kg
Selenium (Se)	81.67/kg
PAHs	490/kg
Benzene	245/kg
Ethyl Benzene	122.5/kg
Toluene	122.5/kg
Xylenes	122.5/kg
Chloride (Cl)	0.02/kg
Sulphate (SO4)	0.02/kg

Sulphide (S)	24.50/kg

The permitted limits of all these polluting parameters can be found in Table .1 of Appendix G.

The pollution parameter fees were developed in the early 2000s and haven't been revised since. A new revision of the Sewer Use Bylaw is expected to launch in late 2019 (RSCP, 2018). More information on how the fees were developed is not available yet.

11.4. Exemptions from the system:

There are presently no exemptions for industries that release more than 10 cubic metres of waste per day.

11.5. Revenue collected and use of revenue:

By 2017, there were 41 active waste discharge permits from which revenue was collected, the majority of which were on-going permits without an expiration date. While the exact revenue from the RSCP couldn't be inferred, the total revenue collected through sewer services was CAD 54 million dollars in 2017 (CRD, 2018). The collected revenue is used to fund the regional source control program.

11.6. Environmental effect after implementation:

As of 2017, for the 9th consecutive year, the mixed liquor results from the Ganges treatment plant met the Class A biosolids criteria for all metals and so did the Saanich Peninsula wastewater treatment plant's dewatered sludge results. The RSCP also led to the decrease of the inputs into the sewer system through various non-regulatory tools. In addition, concentrations of metals have

been observed to be continuously decreasing in both concentrations and loading over time (RSCP, 2018).

11.7. Effects on pollution producers:

As of 2017, close to 2000 industries and businesses were regulated through discharge permits (41 active), 11 sector based codes of practice and authorizations (92 active). The percentage of industries and businesses regulated under the Bylaw that obtained a rating of 'overall compliance' was found to be 96 percent.

11.8. Summary:

The Capital Regional District regulates the discharge of wastes from industries and businesses through the RSCP under the CRD Sewer Use Bylaw 2922. Under the Bylaw, the businesses that discharge more than 10 cubic metres of waste daily into the sewers are required to obtain waste discharge permits, or authorizations or follow certain codes of practice as deemed appropriate. All businesses operating under the Bylaw are required to sample their effluent, monitor the flow and report the data to the RSCP as frequently as required. In addition, regular inspections are also carried out to ensure compliance. For the waste discharge permit, aside from the application fee, an annual base fee, and a quarterly discharge fee based on the volume of the effluent and the loading of the contaminants are charged. The contaminants charged for include conventional pollutants, metals amongst others. The revenue generated through the collection of the fees is used to fund the RSCP. As of 2017, the overall compliance of around 2000 businesses and industries regulated under the regional source control program was found to be 96 percent.

CHAPTER 12

SUMMARY

Name of the country	Brief Description	Parameters Charged for	Use of Revenue	Metro Vancouver's context	
				Advantages	Drawbacks
Germany	• Tax system • Direct and indirect discharges including agricultural discharges are charged. • Tax charged is based on a certain amount of 'damage units'. • The value of a damage unit of a polluting parameter is based on inhabitant equivalents.	• Chemical Oxygen Demand • Nitrogen • Phosphorus • Organic Halogens • Mercury • Cadmium • Chromium • Nickel • Lead • Zinc • Toxicity of fish	Used for measures to maintain or improve the quality of water.	• Damage units can be developed for concerned contaminants based on inhabitant equivalents. • If the tax is high and pollution abatement incentives are provided, the industries could potentially opt to develop wastewater effluent systems and reduce the liquid waste handling charges of Metro Vancouver.	• An adaptation of this system might not be well received by the industrial stakeholders that are supposed to pay the tax. • Shifting a fee system to a tax system has various administrative complications.
Sydney Water	• Fee system • Polluting sources are divided into two – commercial and industrial sources and are charged differently.	• Commercial sources are charged based on the type of business. • Industrial sources are charged for	Used to recover costs of water treatment and management.	• Charges are defined based on economic factors and will ensure a constant flow of revenue for operation costs. • This system could be modified for charging for	• If the aim is to get polluters to reduce discharge, this might not be very effective as the primary goal the charges is based on is recovering a part of the costs.

	• For industries, the charges also depend on the type of treatment plant the waste is disposed of into. • Charges are reviewed every 4 years based on historical records, inflation and future predictions.	BOD, Suspended solids, Grease, Nitrogen, and Phosphorous.		other contaminants like heavy metals. • Regular revision of charges would help reflect to current scenarios better.	
The Philippines	• Fee system • Established to reduce the load of BOD into the Laguna de Bay. • Covers industries, commercial or agro based establishments.	• Fees are based on the volumetric discharge and the total effluent BOD.	Used for administrative purposes to cover the cost of performance monitoring of industries.	• This system was very successful in achieving great reduction in their primary parameter of concern – BOD. If Metro Vancouver is looking at reducing a single parameter, the variable fee concept could be utilised.	• Establishing a variable fee similar to this system for multiple parameters would be very difficult, and might not be efficient.
China	• Tax system • An equivalent value is set for each pollutant based on the toxicity of the pollutant to the environment and the cost of treating the pollutant and is used to calculate the weight of pollutant discharged. • The taxes applicable on a unit of each pollutant is	• Heavy metals, suspended solids, BOD, Petroleum and its derivatives, oils, organic compounds etc.	Can be used by the local tax administrators as deemed necessary.	• This system can be used to charge for multiple parameters, while keeping it simple for users. • The decentralization of the authority to local administrators is an advantage to help reflect the local scenarios better.	• Shifting a fee system to a tax system has various administrative complications. • An adaptation of this system might not be well received by the industrial stakeholders that are supposed to pay the tax

	different for every province. • Covers all industries and establishments including animal husbandry farms.				
The Netherlands	• Fee system. • Equivalent pollution units discharged by industries is calculated. • Based on the amount of pollution units discharged the firms are classified into 3 groups and charged accordingly. • The charges set are for a hundred percent cost recovery for wastewater treatment.	• Organic pollutants. • Heavy metals.	Used to recover costs for wastewater treatment and management.	• A hundred percent cost recovery system would reduce the wastewater treatment expense of Metro Vancouver. • Classification of industries and charging them based on the amount of pollution units discharged would be beneficial for small establishments without the resources to set up treatment plants.	• Having a different formula for calculating pollution units for different parameters makes the system hard to navigate for the general public.
Malaysia	• Fee system. • Charges based on weight of pollutant and the type of waters the waste is discharged into. • The unit fee was previously set such that the fee would decrease the amount of effluents discharged without burdening the industry.	• BOD • Heavy metals • Other metals, elements and compounds	Used to recover part of the budget for the Department of Environment.	• This system can be used to establish a unit fee for contaminants based on economic factors and without stressing the industry. • Multiple contaminants can be charged for and the system is relatively simpler to navigate.	• The charges might not be high enough to impact a change in the effluent quality.

State of Washington, USA	• Fee system • Fee is based on the category of industry/ facility. • Fee is fixed based on toxicity of pollutant, loading, administrative and other expenses, and could be a driver to encourage industries to reduce pollutant loading.	• Type of industry	Hundred percent cost recovery for administrative, monitoring, compliance, overhead expenses etc.	• This system can be used to separate firms into categories and charge according to the pollution they cause and the costs involved.	• Fee charged not transparent and clear for users.
British Columbia	• Fee system • Based on the classification of industries into Schedule 1 and 2. • Fees is based on toxicology of the contaminant and is revised annually to account for inflation.	• BOD • Heavy metals • Other metals, elements and compounds	Used to recover 75 to 125 percent costs for treatment.	• This system can be used to charge for multiple parameters, while keeping it simple for users.	• This system has not been established keeping in mind, decrease of pollutant loading but rather the cost recovery. Hence, if one of the goals of Metro Vancouver is to reduce contaminant loadings then a different approach might be more suitable.
Capital Regional District	• Fee System • All industries/businesses that discharge waste into the sewers is regulated. • Discharge fee is based on type and amount of contaminants discharged. • More information on the fee development process is needed.	• BOD • Heavy metals • Other metals, elements and compounds	Used to fund the Regional Source control program.	• This system can be used to charge for multiple parameters, while keeping it simple for users.	• More information is needed to draw substantial conclusions.

CHAPTER 13

RECOMMENDATIONS

Metro Vancouver currently regulates industrial discharges through its Sewer Use Bylaw. The aim of this Bylaw and the Source Control program is to:

- To protect the Sewers and Sewage Facilities from damage and promoting the efficient and cost-effective operation of Sewers and Sewage Facilities.
- To promote the quality of the biosolids.
- To protect human health and safety.
- To assist the District's efforts to remain in compliance with laws and regulatory instruments to which it is subject.
- To protect the environment.
- To impose fees payable by persons who discharge liquid waste into a Sewage Facility or whose liquid waste is treated by a Sewage Facility.

The Bylaw requires that significant dischargers be regulated directly through the issuance of a Waste Discharge Permit.

Studies were conducted in the five WWTP's of Metro Vancouver to assess the effectiveness of the discharge system to control the industrial flows and loadings. The loading of most monitored parameters had significantly decreased from 2001 to 2012 for all the treatment plants, with the exception of certain parameters. While the increase in loading in certain parameters was attributed to over-estimation like cadmium, copper, nickel and zinc in Lionsgate Treatment plant (Metro Vancouver, 2013), parameters like boron, phenols, lead, ammonia, oils and grease have increased in loading due to various industries. As it is important to maintain the quality of biosolids and the

effluent released into the environment, charging for parameters that affect the quality of biosolids could lead to a decrease in the loading of these contaminants.

The following strategies can be used by Metro Vancouver to develop a wastewater discharge fee system that aligns with their identified goals.

13.1. DESIGNING A FEE SYSTEM:

Out of the 9 jurisdictions studied, 6 jurisdictions - namely, Germany, China, the Netherlands Malaysia, British Columbia and Capital Regional District have a similar system in place. A certain amount of the pollutant is set as a 'unit' of pollution and each pollutant is assigned a certain fee based on their toxicity, cost of treatment and/ or other economic factors and the industry is charged accordingly. Due to strict effluent standards in all these jurisdictions, effluents are treated before release into surface water. A detailed comparison can be found in Table 10.1.

Table 13.1 - Basis of the fee/ unit

Country	**Purpose of fee**	**Basis of 'unit' of pollution**	**Basis of fee/ unit**
Germany	To improve effluent quality	A multiple of Inhabitant equivalents.	Economic factors and the same fee for all pollutants.
China	Regulating pollution	Toxicity of the pollutant to the environment and the cost of treating the pollutant	Depends on the province.

The Netherlands	Cost Recovery	Inhabitant equivalents for organics and is 100 g if it is the sum of mercury, arsenic and cadmium and a 1000 g if it is the sum of zinc, nickel, lead, copper and chromium.	Economic factors (100 percent cost recovery) and the same fee for all pollutants.
Malaysia	To improve effluent quality	1 kilogram of contaminant	Economic factors with an aim to decrease in effluents without burdening the industry.
British Columbia	Cost Recovery	Toxicity of the pollutant to the environment and the cost of treating the pollutant	Depends on the contaminant.
Capital Regional District	Cost Recovery	More information is needed	Depends on the contaminant.

To adapt this system to Metro Vancouver's context, information is needed on whether to base the unit of pollutants and their fees on inhabitant equivalents, toxicity of the contaminant, and economic factors like the cost of treatment and what percentage of costs must be recovered. In addition, identifying whether reduction of contaminants or higher cost recovery is more important could be valuable in developing the new system. While all the systems have been relatively

successful, taking inputs from industrial stakeholders would also be helpful in developing the new fee system.

An advantage of establishing such a system is that once a new fee system is developed, the same basis can be used to expand the list of contaminants charged for, in case of a rising problem of emerging contaminants. In addition, having a different fee/unit based on the location of the discharge point can be implemented. Regular revision of the pricing system can also be carried out on the basis of the 'pollution unit' and the fee/unit. Lastly, this system would be simple to navigate for all users.

13.2. CONTROLLING A SINGLE PARAMETER:

In addition to a fairly comprehensive list of contaminants, if Metro Vancouver wants to focus on the decrease of the loading of a single parameter, say BOD, a system similar to the variable fee system of the Philippines can be established. According to the Philippines' user fee system, the variable fee is dependent on the concentration of the pollutant which was BOD, and the established unit fee for the contaminant. The unit fee is six times higher when the concentration of the contaminants does not meet the effluent standards. This rigorous measure drove a significant decrease in the loading of the primary parameter and could perform in a similar way when implemented in Metro Vancouver's context.

13.3. USE OF REVENUE:

Out of the 9 jurisdictions studied, 8 jurisdictions, except for China, use the revenue generated through a wastewater fee or tax system for water and wastewater, quality and management measures. The revenue generated in China however is available for use as deemed necessary by

the local tax authorities. Similar to the current use, the revenue generated through the Metro Vancouver discharge fee system can be used to recover administrative and operating costs in the Greater Vancouver Sewerage & Drainage District.

13.4. EXEMPTIONS AND INCENTIVES

Out of the jurisdictions that have been reviewed, Germany and China have a very similar tax exemption system. If the industrial discharger meets a standard, which is a certain percentage lower than the established standards, they only have to pay a part of the actual tax due as determined. Whereas Malaysia and the Philippines provide incentives for the industries to set up WWTPs within the establishment. In addition, the State of Washington has a fee reduction program for small, independent businesses. Provision of similar incentives or exemptions to industries in Metro Vancouver could hence be a driver for a reduction in pollution load as the industries will upgrade their management practices and/or upgrade their wastewater treatment facilities and small industries will not be severely affected by the permit fees. Input from the industrial stakeholders can be useful while introducing incentives and exemptions.

CONCLUSIONS

The contaminant fee regulations of 9 jurisdictions that charge for a variety of contaminants other than BOD and TSS were reviewed. The pricing strategies and the development of the unit costs were studied. The pros and cons of each approach was assessed in the Metro Vancouver context and pricing strategies were developed for Metro Vancouver for further use. The information and data required for Metro Vancouver to develop a new contaminant fee system were also identified.

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APPENDIX A - GERMANY

Threshold concentrations and annual permitted discharge of contaminants in effluents

Adapted from Annex 1 - Damage units for effluent charge (2005) - WP3 EX-POST Case studies Effluent Tax in Germany, Ecologic Institute

Pollutants	Threshold concentration	Annual permitted discharge
Chemical oxygen demand (COD)	20 mg/ l	250kg/ year
Phosphorous	0.1 mg/ l	15 kg/ year
Nitrogen (sum of separate values of Nitrate nitrogen, nitrite nitrogen and ammonium nitrogen	5mg/l	125 kg/ year
Organic halogens	100 microgram/ l	10kg/ year
Mercury	1 microgram/ l	100g/ year
Cadmium	5 microgram/ l	500g/ year
Chromate	50 microgram/l	2.5 kg/ year
Nickel	50 microgram/l	2.5 kg/ year

Lead	50 microgram/l	2.5 kg/ year
Copper	100 microgram/l	5 kg/ year
Toxicity for fish eggs	the toxicity for fish needs to be assessed by dividing 6,000m^3 of effluent by a dilution factor (G(deep)EI) which makes this effluent harmless to fish and fish eggs	G(deep)EI =2

APPENDIX B – SYDNEY WATER

B.1. PRE-TREATMENTS REQUIRED FOR COMMERCIAL TRADE WASTEWATER

Food establishments

Generally food establishments only need to install:

- in-sink and in-floor bucket traps
- an appropriately sized grease trap

There are certain processes that may need additional pre-treatment equipment, such as upstream grease removal devices or under sink pump units and all equipment installed and used should be sized appropriately based on the estimated maximum hourly flow rate. In addition, all the pre-treatment equipment used should be listed by Sydney Water Corporation.

Automotive establishments

Generally automotive establishments need to install:

- in-sink and in-floor bucket traps
- an oil water separation system with a collection pit and pump.

All equipment installed and used should be sized appropriately based on the estimated maximum hourly flow rate. In addition, all the pre-treatment equipment used should be listed by Sydney Water Corporation.

Other commercial establishments

All equipment installed and used should be sized appropriately based on the estimated maximum hourly flow rate. In addition, all the pre-treatment equipment used should be listed by Sydney Water Corporation.

B.2. Acceptance Standards for Industrial Trade Wastewater

Adapted from the Sydney water acceptance standards and charging rates fact sheet 2019 – 2020.

Contaminant	**Acceptance standard (mg/L)**
Acetaldehyde*	5
Acetone*	400
Aluminium	100
Arsenic	1
Barium	5
Boron	100
Bromine*	5
Cadmium	1
Chlorinated phenolics	0.05
Chlorine*	10
Chromium	3
Cobalt	5

Copper	5
Cyanide*	1
Fluoride	20
Formaldehyde*	30
General pesticides (excludes OC and OP)	0.1
Herbicides and defoliants	0.1
Iron	50
Lead	2
Lithium (specified systems only)	10
Manganese	10
Mercaptans	1
Mercury	0.03
Methyl Ethyl Ketone*	100
Molybdenum	100

Nickel	3
Organoarsenic compounds	0.1
pH*	7-10 units
Petroleum hydrocarbons (flammable)*	10
Benzene*	0.1
Toluene*	0.5
Ethylbenzene*	1

*For substances that pose a particular health and safety risk, apply acceptance standards to the concentration of substances in a discrete sample of trade wastewater discharge as well as in composite samples.

APPENDIX C – PHILIPPINES

C.1. General Effluent Standards of 2016

Parameter	Effluent Standards (for Class C)
BOD	50 mg/L
COD	100 mg/L
TSS	100 mg/L
Oil and grease	5 mg/L
Color	150 NTU
Total Coliform	10000 MPN/ 100 mL
Fecal Coliform	400 MPN/ 100 mL
Ammonia as NH_3 - N	0.5 mg/L
Nitrate as NO_3 - N	14 mg/L
Phosphate	1 mg/L
Surfactants (MBAS)	15 mg/L

C.2. Classification of water bodies:

Water Body Classification and Usage of Freshwater	
	INTENDED BENEFICIAL USE
CLASS AA	Public Water Supply Class I – Intended primarily for waters having watersheds, which are uninhabited and/or otherwise declared as protected areas, and which require only approved disinfection to meet the latest PNSDW
CLASS A	Public Water Supply Class II – Intended as sources of water supply requiring conventional treatment (coagulation, sedimentation, filtration and disinfection) to meet the latest PNSDW

CLASS B	Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, etc.)
CLASS C	1.Fishery Water for the propagation and growth of fish and other aquatic resources 2.Recreational Water Class II – For boating, fishing or similar activities 3.For agriculture, irrigation and livestock watering
CLASS D	Navigable waters

Water Body Classification and Usage of Marine Waters

CLASSIFICATION	INTENDED BENEFICIAL USE
CLASS SA	1.Protected Waters – Waters designated as national or local marine parks, reserves, sanctuaries and other areas established by law (Presidential Proclamation 1801 and other existing laws), and/or declared as such by appropriate government agecncy, LGUs, etc. 2.Fishery Water Class I – Suitable for shellfish harvesting for direct human consumption
CLASS SB	1.Fishery Water Class II – Waters suitable for commercial propagation of shellfish and intended as spawning areas for milkfish (*Chanoschanos*) and similar species 2.Tourist Zones – For ecotourism and recreational activities 3.Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, skin diving, etc.)

CLASS SC	1.Fishery Water Class III – For the propagation and growth of fish and other aquatic resources and intended for commercial and sustenance fishing 2.Recreational Water Class II – For boating, fishing or similar activities 3.Marshy and/or mangrove areas declared as fish and wildlife sanctuaries
CLASS SD	Navigable waters

APPENDIX D – CHINA

D.1. Maximum Allowable Discharge Concentrations for Pollutants in China
Retrieved from: China Water Risk Organization

National Standard of the People's Republic of China Integrated Wastewater Discharge Standard GB 8978 - 1996					
No.	**Pollutant**	**Application Scope**	**Class 1**	**Class 2**	**Class 3**
1	pH (1)	All discharging work units	6 ~ 9	6 ~ 9	6 ~ 9
2	Color (Dilution Ratio)	All discharging work units	50	80	-
3	Suspended Solids (SS) (2)	Mining, ore dressing, coal dressing industries	70	300	-
		Arterial gold dressing	70	400	-
		Alluvial gold dressing in outlying districts	70	800	-
		Urban secondary wastewater treatment plants	20	30	-
		Other discharging industries	70	150	400

National Standard of the People's Republic of China Integrated Wastewater Discharge Standard GB 8978 - 1996					
No.	**Pollutant**	**Application Scope**	**Class 1**	**Class 2**	**Class 3**
4	BOD_5 (3)	Beet sugar processing, ramie de-gluing, wet method fibre board, dyes, fur treating industries	20	60	600
		Cane sugar processing, alcohol, MSG, leather, chemical fibre starch industries	20	100	600
		Urban secondary wastewater treatment plants	20	30	-
		Other discharging work units	100	150	300
5	COD (4)	Beet sugar processing, synthetic fatty acid, wet method fibre board, dyes, fur treating, organophosphorus pesticide industries	100	200	1000
		MSG, alcohol, pharmaceuticals and pharmaceutical raw materials, biological pharmaceuticals, ramie degluing, leather, chemical fibre starch industries	100	300	1000
		Petrochemical industry (including refining)	60	120	500
		Urban secondary wastewater treatment plants	60	120	-
		Other discharging work units	100	150	500
6	Petroleum Hydrocarbons	All discharging work units	5	10	20
7	Vegetable and Animal Oils	All discharging work units	10	15	100
8	Volatile Phenols	All discharging work units	0.5	0.5	2

9	Total Cyanides (CN^-)	All discharging work units	0.5	0.5	1
10	Sulphides ($S^=$)	All discharging work units	1	1	1

National Standard of the People's Republic of China Integrated Wastewater Discharge Standard GB 8978 - 1996					
No.	**Pollutant**	**Application Scope**	**Class 1**	**Class 2**	**Class 3**
11	Ammonium Nitrogen	Pharmaceuticals and pharmaceutical raw materials, dyes, petrochemical industries	15	50	-
		Other discharging work units	15	25	-
12	Fluorides (F^-)	Yellow phosphorous industry	10	15	20
		Low phosphate areas (water bodies containing <0.5mg/L phosphate)	10	20	30
		Other discharging work units	10	10	20
13	Phosphates (as P)	All discharging work units	0.5	1	-
14	Formaldehyde	All discharging work units	1	2	5
15	Aniline	All discharging work units	1	2	5
16	Nitrobenzene	All discharging work units	2	3	5
17	Anionic Surfactant (LAS)	All discharging work units	5	10	20
18	Total Copper (Cu)	All discharging work units	0.5	1	2

19	Total Zinc (Zn)	All discharging work units	2	5	5
20	Total Manganese (Mn)	Synthetic fatty acid industry	2	5	5
		Other discharging industries	2	2	5

National Standard of the People's Republic of China Integrated Wastewater Discharge Standard GB 8978 - 1996					
No.	**Pollutant**	**Application Scope**	**Class 1**	**Class 2**	**Class 3**
23	Phosphorus (as an element)	All discharging work units	0.1	0.1	0.3
24	Organophosphorus Pesticide	All discharging work units	below detection limit	0.5	0.5
25	Dimethoate (Rogor)	All discharging work units	below detection limit	1	2
26	Parathion	All discharging work units	below detection limit	1	2
27	Methyl Parathion	All discharging work units	below detection limit	1	2
28	Malathion	All discharging work units	below detection limit	5	10
29	Pentachlorophenol and Santobrite (as Pentachlorophenol)	All discharging work units	5	8	10
30	Absorptive Organic Halide (as Cl)	All discharging work units	1	5	8
31	Chloroform	All discharging work units	0.3	0.6	1
32	Carbon Tetrachloride	All discharging work units	0.03	0.06	0.5
33	Chlorylene	All discharging work units	0.3	0.6	1
34	Tetrachloroethylen e	All discharging work units	0.1	0.2	0.5

35	Benzene	All discharging work units	0.1	0.2	0.5
36	Methylbenzene	All discharging work units	0.1	0.2	0.5
37	Ethylbenzene	All discharging work units	0.4	0.6	1
38	o-Xylene	All discharging work units	0.4	0.6	1

National Standard of the People's Republic of China Integrated Wastewater Discharge Standard GB 8978 - 1996					
No.	**Pollutant**	**Application Scope**	**Class 1**	**Class 2**	**Class 3**
39	Paraxylene (p-Xylene)	All discharging work units	0.4	0.6	1
40	m-Xylene	All discharging work units	0.4	0.6	1
41	Chlorobenzene	All discharging work units	0.2	0.4	1
42	o-Dichlorobenzene	All discharging work units	0.4	0.6	1
43	p-Dichlorobenzene	All discharging work units	0.4	0.6	1
44	p-Nitrochlorobenzene	All discharging work units	0.5	1	5
45	2,4-Dinitrochlorobenzene	All discharging work units	0.5	1	5
46	Oxybenzene	All discharging work units	0.3	0.4	1
47	m-Oxytoluol	All discharging work units	0.1	0.2	0.5
48	2,4-Chlorophenol	All discharging work units	0.6	0.8	1
49	2,4,6-Trichlorophenol	All discharging work units	0.6	0.8	1
50	Dibutyl (o-) phthalate	All discharging work units	0.2	0.4	2
51	Dioctyl (o-) phthalate	All discharging work units	0.3	0.6	2
52	Acrylonitrile	All discharging work units	2	5	5
53	Total Selenium (Se)	All discharging work units	0.1	0.2	0.5

National Standard of the People's Republic of China Integrated Wastewater Discharge Standard GB 8978 - 1996					
No.	**Pollutant**	**Application Scope**	**Class 1**	**Class 2**	**Class 3**
54	Excrement, Intestines, Fungus Count	Hospitals*, veterinary hospitals and medical institutions with wastewater containing pathogens	500 pieces/L	Not defined in the EPA list	5000 piece s/L
		Wastewater from contagious disease and tuberculosis hospitals	100 pieces/L	500 pieces/ L	1000 piece s/L
55	Total Excess Chlorine (used for Chlorine)	Hospitals*, veterinary hospitals and medical institutions with wastewater containing pathogens	<0.5**	>3 (contac t time ³ 1hr)	>2 (conta ct time ³ 1hr)
		Wastewater from contagious disease and tuberculosis hospitals	<0.5**	>6.5 (contac t time ³ 1.5hr)	>5 (conta ct time ³1.5hr)
56	Total Organic Carbon (TOC)	Synthetic fatty acid industry	20	40	-
		Ramie degluin g industry	20	60	-
		Other discharging work units	20	30	-

APPENDIX E – MALAYSIA

E.1. Effluent standards of industrial effluents containing COD based on industry type and Standards A and B

Trade/Industry	Unit	Standard A	Standard B
Pulp and paper industry			
(i) pulp mill	mg/L	80	350
(ii) paper mill (recycled)	mg/L	80	250
(iii) pulp and paper mill	mg/L	80	300
Textile industry	**mg/L**	**80**	**250**
Fermentation and distillery industry	mg/L	400	400
Other industries	mg/L	80	200

E.2. Effluent standards of industrial effluent or mixed effluent of Standards A and B

Parameter	Unit	Standard	
		A	B

(1)	(2)	(3)	(4)
Temperature	°C	40	40
pH Value	–	6.0-9.0	5.5-9.0
BOD_5 at 20oC	mg/L	20	50
Suspended Solids	mg/L	50	100
Mercury	mg/L	0.005	0.05
Cadmium	mg/L	0.01	0.02
Chromium, Hexavalent	mg/L	0.05	0.05
Chromium, Trivalent	mg/L	0.20	1.0
Arsenic	mg/L	0.05	0.10
Cyanide	mg/L	0.05	0.10
Lead	mg/L	0.10	0.5
Copper	mg/L	0.20	1.0
Manganese	mg/L	0.20	1.0
Nickel	mg/L	0.20	1.0
Tin	mg/L	0.20	1.0
Zinc	mg/L	2.0	2.0
Boron	mg/L	1.0	4.0

Iron (Fe)	mg/L	1.0	5.0
Silver	mg/L	0.1	1.0
Aluminium	mg/L	10	15
Selenium	mg/L	0.02	0.5
Barium	mg/L	1.0	2.0
Fluoride	mg/L	2.0	5.0
Formaldehyde	mg/L	1.0	2.0
Phenol	mg/L	0.001	1.0
Free Chlorine	mg/L	1.0	2.0
Sulphide	mg/L	0.50	0.50
Oil and Grease	mg/L	1.0	10
Ammoniacal Nitrogen	mg/L	10	20
Colour ADMI*		100	200

APPENDIX F – BRITISH COLUMBIA

As adapted from the Waste Discharge Regulation, Environmental Management Act.

Table F.1. - Activities under Schedule 1:

Industries, Trades, and Businesses, Operations and Activities	
1	Abrasives Industry
2	Aluminum and Aluminum Alloy Products Industry
3	Asbestos Mining Industry
4	Asphalt Roof Manufacturing Industry
5	Biotechnology Industry
6	Burning of Vegetative Debris
6.1	Burning or Incineration of Prohibited Material
7	Burning or Incineration of Waste
8	Burning or Incineration of Wood Residue
9	Cement and Lime Manufacturing Industry

10	Chemical and Chemical Products Industry
11	Clay Industry
12	Commercial Waste Management or Waste Disposal Industry
13	Contaminated Site Contaminant Management
14	Dairy Products Industry
15	Electrical or Electronic Products Industry
16	Electrical Power Industry
17	Flour, Prepared Cereal Food and Feed Industry
18	Glass and Glass Products Industry
19	Hazardous Waste Management
20	Industrial Fastener Industry
21	Metal Processing and Metal Products Manufacturing Industry
22	Metal Smelting, Iron and Steel Foundry and Metal Refining Industry

23	Mining and Coal Mining Industry
24	Municipal Sewage Management
25	Municipal Solid Waste Management
26	Municipal Waste Incineration or Burning Industry
27	Non-Metallic Mineral Products Industry
28	Oil and Natural Gas Industry — Large
29	Ozone Depleting Substances and other Halocarbons Management
30	Paperboard Industry
31	Paper Industry
32	Particle and Wafer Board Industry
33	Pipeline Transport Industry with Approved Operating Plan
34	Plastic and Synthetic Resin Manufacturing Industry
35	Pulp Industry

36	Refined Petroleum and Coal Products Industry
37	Meat By-product Processing Industry
38	Sugar Processing and Refining Industry
39	Veneer and Plywood Industry
40	Wire and Wire Rope Fabricating Industry

Table F.2. - Activities under Schedule 2

Industries, Trades, Businesses, Operations and Activities		**Code of Practice**
1	Agricultural Operations	Code of Practice for Agricultural Environmental Management
2	Antisapstain Chemicals Management	
3	Aquaculture — Land-based Industry	
4	Aquaculture — Marine-based Industry	
5	Asphalt Plant Industry	

6	Beverage Industry	
7	Coalbed Gas Exploration and Production Industry	
8	Composting Operations	
9	Concrete and Concrete Products Industry	Code of Practice for the Concrete and Concrete Products Industry
10	Deep Well Disposal	
11	Fish Products Industry	
12	Fruit and Vegetable Processing Industry	
13	Industrial Non-hazardous Waste Landfills	Code of Practice for Industrial Non-Hazardous Waste Landfills Incidental to the Wood Processing Industry
14	Naturally Occurring Radioactive Materials Management	
15	Oil and Natural Gas Industry — Small	
16	Petroleum Storage	

17	Pipeline Transport Industry	
18	Placer Mining Industry	
19	Plastics and Composite Products Industry	
20	Poultry Processing Industry	Code of Practice for the Slaughter and Poultry Processing Industries
21	Product Storage — Bulk Solids	
22	Slaughter Industry	Code of Practice for the Slaughter and Poultry Processing Industries
23	Soil Enhancement Using Wastes	Code of Practice for Soil Amendments
24	Vehicle Dismantling and Recycling Industry	
25	Vehicle, Industrial Machinery and Parts and Accessories Manufacturing Industry	
26	Wood Processing Industry — Primary	
27	Wood Processing Industry — Secondary	

28	Wood Treatment Industry	

APPENDIX G – CAPITAL REGIONAL DISTRICT

Table G.1 - Practical quantitation limits and permissible limits of polluting parameters

Parameter	Permissible Limit (mg/L)	Practical Quantitation Limit (mg/L)
COD	1,000	-
Flow	-	-
Oil and Grease	100	-
Suspended solids	350	-
Arsenic (As)	0.4	0.0005
Cadmium (Cd)	0.3	0.0005
Chromium (Cr)	4	0.05
Copper (Cu)	1	0.05
Cyanide (CN)	1	-
Lead (Pb)	1	0.005
Mercury (Hg)	0.02	0.00025
Silver (Ag)	0.5	0.0005
Nickel (Ni)	3	0.1
Zinc (Zn)	3	0.025
Oil and Grease (Hydrocarbons)	15	-
Phenols	1	-
Cobalt (Co)	5	0.05
Iron (Fe)	50	0.15
Manganese (Mn)	5	0.025
Molybdenum (Mo)	5	0.15
Selenium (Se)	0.3	0.0025

PAHs	0.05	-
Benzene	0.1	-
Ethyl Benzene	0.2	-
Toluene	0.2	-
Xylenes	0.2	-
Chloride (Cl)	1500	-
Sulphate (SO4)	1500	-
Sulphide (S)	1	-

APPENDIX H – STATE OF WASHINGTON

Table - H.1. Annual Permit Fee for 2020 and 2021 based on the categories of industry/ facility (Washington State Legislature, 2003).

CATEGORY OF INDUSTRY/ FACILITY	FY 2020 ANNUAL PERMIT FEE (USD) 1 USD= 1.32 CAD	FY 2021 ANNUAL PERMIT FEE & BEYOND(USD) 1 USD = 1.32 CAD
Aluminium Alloys	$21,768.00	$22,950.00
Aluminium and Magnesium Reduction Mills		
a. NPDES Permit	115,785.00	115,785.00
b. State Permit	57,895.00	57,895.00
Aluminium Forming	65,304.00	68,850.00
Aquaculture		

a. Finfish hatching and rearing - Individual Permit	5,889.00	5,889.00
b. Finfish hatching and rearing - General Permit Coverage	4,125.00	4,125.00
c. Shellfish hatching	223.00	223.00
Aquatic Pest Control		
a. Irrigation Districts	647.00	682.00
b. Mosquito Control Districts	647.00	682.00
c. Invasive Moth Control	647.00	682.00
d. Aquatic Species Control & Eradication	647.00	682.00
e. Oyster Growers	647.00	682.00
f. Rotenone Control	647.00	682.00
Boat Yards - Individual Permit Coverage		
a. With stormwater only discharge	558.00	588.00
b. All others	1,113.00	1,173.00
Boat Yards - General Permit Coverage		
a. With stormwater only discharge	509.00	537.00

b. All others	1,031.00	1,087.00
Bridge Washing		
a. Single-site Permit	3,839.00	4,047.00
b. WSDOT Annual Fee	12,757.00	13,450.00
Coal Mining and Preparation		
a. < 200,000 tons per year	8,702.00	9,175.00
b. 200,000 - < 500,000 tons per year	19,593.00	20,657.00
c. 500,000 - < 1,000,000 tons per year	34,827.00	36,718.00
d. 1,000,000 tons per year and greater	65,304.00	68,850.00
Combined Industrial Waste Treatment		
a. < 10,000 gpd	3,972.00	3,972.00
b. 10,000 - < 50,000 gpd	9,816.00	9,816.00
c. 50,000 - < 100,000 gpd	19,636.00	19,636.00
d. 100,000 - < 500,000 gpd	39,266.00	39,266.00
e. 500,000 gpd and greater	58,901.00	58,901.00

Combined Food Processing Waste Treatment Facilities	18,797.00	18,797.00
Combined Sewer Overflow System		
a. < 50 acres	3,927.00	3,927.00
b. 50 - < 100 acres	9,816.00	9,816.00
c. 100 - < 500 acres	11,783.00	11,783.00
d. 500 acres and greater	15,704.00	15,704.00
Commercial Laundry	526.00	555.00
Concentrated Animal Feeding Operation		
a. < 200 Animal Units	292.00	308.00
b. 200 - < 400 Animal Units	732.00	772.00
c. 400 - < 600 Animal Units	1,466.00	1,546.00
d. 600 - < 800 Animal Units	2,198.00	2,317.00
e. 800 Animal Units and greater	2,935.00	3,094.00
Dairies $.50 per Animal Unit not to exceed $1,969.00 for FY 2020 and $2,076.00 for FY 2021 & beyond		

Facilities Not Otherwise Classified - Individual Permit Coverage		
a. < 1,000 gpd	1,963.00	1,963.00
b. 1,000 - < 10,000 gpd	3,927.00	3,927.00
c. 10,000 - < 50,000 gpd	9,817.00	9,817.00
d. 50,000 - < 100,000 gpd	15,704.00	15,704.00
e. 100,000 - < 500,000 gpd	31,258.00	31,258.00
f. 500,000 - < 1,000,000 gpd	39,266.00	39,266.00
g. 1,000,000 gpd and greater	58,900.00	58,900.00
Facilities Not Otherwise Classified - General Permit Coverage		
a. < 1,000 gpd	1,377.00	1,377.00
b. 1,000 - < 10,000 gpd	2,849.00	2,849.00
c. 10,000 - < 50,000 gpd	6,874.00	6,874.00
d. 50,000 - < 100,000 gpd	10,997.00	10,997.00
e. 100,000 - < 500,000 gpd	21,987.00	21,987.00

f. 500,000 - < 1,000,000 gpd	27,484.00	27,484.00
g. 1,000,000 gpd and greater	41,232.00	41,232.00
Flavor Extraction		
a. Steam Distillation	202.00	202.00
Food Processing		
a. < 1,000 gpd	1,961.00	1,961.00
b. 1,000 - < 10,000 gpd	5,003.00	5,003.00
c. 10,000 - < 50,000 gpd	8,934.00	8,934.00
d. 50,000 - < 100,000 gpd	14,036.00	14,036.00
e. 100,000 - < 250,000 gpd	19,633.00	19,633.00
f. 250,000 - < 500,000 gpd	25,819.00	25,819.00
g. 500,000 - < 750,000 gpd	32,393.00	32,393.00
h. 750,000 - < 1,000,000 gpd	39,266.00	39,266.00
i. 1,000,000 - < 2,500,000 gpd	48,374.00	48,374.00
j. 2,500,000 - < 5,000,000 gpd	53,993.00	53,993.00

k. 5,000,000 gpd and greater	58,901.00	58,901.00
Fruit Packing - Individual Permit Coverage		
a. 0 - < 1,000 bins/yr.	392.00	392.00
b. 1,000 - < 5,000 bins/yr.	786.00	786.00
c. 5,000 - < 10,000 bins/yr.	1,570.00	1,570.00
d. 10,000 - < 15,000 bins/yr.	3,144.00	3,144.00
e. 15,000 - < 20,000 bins/yr.	5,199.00	5,199.00
f. 20,000 - < 25,000 bins/yr.	7,264.00	7,264.00
g. 25,000 - < 50,000 bins/yr.	9,717.00	9,717.00
h. 50,000 - < 75,000 bins/yr.	10,800.00	10,800.00
i. 75,000 - < 100,000 bins/yr.	12,564.00	12,564.00
j. 100,000 - < 125,000 bins/yr.	15,704.00	15,704.00
k. 125,000 - < 150,000 bins/yr.	19,633.00	19,633.00
l. 150,000 bins/yr. and greater	23,524.00	23,524.00

Fruit Packing - General Permit Coverage		
a. 0 - < 1,000 bins/yr.	274.00	274.00
b. 1,000 - < 5,000 bins/yr.	550.00	550.00
c. 5,000 - < 10,000 bins/yr.	1,100.00	1,100.00
d. 10,000 - < 15,000 bins/yr.	2,201.00	2,201.00
e. 15,000 - < 20,000 bins/yr.	3,643.00	3,643.00
f. 20,000 - < 25,000 bins/yr.	5,085.00	5,085.00
g. 25,000 - < 50,000 bins/yr.	6,800.00	6,800.00
h. 50,000 - < 75,000 bins/yr.	7,557.00	7,557.00
i. 75,000 - < 100,000 bins/yr.	8,788.00	8,788.00
j. 100,000 - < 125,000 bins/yr.	10,997.00	10,997.00
k. 125,000 - < 150,000 bins/yr.	13,744.00	13,744.00
l. 150,000 bins/yr. and greater	16,491.00	16,491.00
Fuel and Chemical Storage		
a. < 50,000 bbls	1,963.00	1,963.00

b. 50,000 - < 100,000 bbls	3,927.00	3,927.00
c. 100,000 - < 500,000 bbls	9,816.00	9,816.00
d. 500,000 bbls and greater	19,636.00	19,636.00
Hazardous Waste Clean Up Sites		
a. Leaking Underground Storage Tanks (LUST)		
1. State Permit	5,149.00	5,149.00
2. NPDES Permit Issued pre 7/1/94	5,148.00	5,148.00
3. NPDES Permit Issued post 7/1/94	10,298.00	10,298.00
b. Non-LUST Sites		
1. 1 or 2 Contaminants of concern	10,069.00	10,069.00
2. > 2 Contaminants of concern	20,137.00	20,137.00
Ink Formulation and Printing		
a. Commercial Print Shops	3,021.00	3,021.00
b. Newspapers	5,035.00	5,035.00
c. Box Plants	8,055.00	8,055.00

d. Ink Formulation	10,070.00	10,070.00
Inorganic Chemicals Manufacturing		
a. Lime Products	9,816.00	9,816.00
b. Fertilizer	11,816.00	11,816.00
c. Peroxide	15,704.00	15,704.00
d. Alkaline Earth Salts	19,636.00	19,636.00
e. Metal Salts	27,482.00	27,482.00
f. Acid Manufacturing	38,942.00	38,942.00
g. Chlor-alkali	78,533.00	78,533.00
Iron and Steel		
a. Foundries	21,768.00	22,950.00
b. Mills	43,573.00	45,939.00
Metal Finishing		
a. < 1,000 gpd	2,609.00	2,751.00
b. 1,000 - < 10,000 gpd	4,351.00	4,587.00

c. 10,000 - < 50,000 gpd	10,879.00	11,470.00
d. 50,000 - < 100,000 gpd	21,767.00	22,949.00
e. 100,000 - < 500,000 gpd	43,530.00	45,894.00
f. 500,000 gpd and greater	65,299.00	68,845.00
Noncontact Cooling Water With Additives - Individual Permit Coverage		
a. < 1,000 gpd	1,229.00	1,229.00
b. 1,000 - < 10,000 gpd	1,713.00	1,713.00
c. 10,000 - < 50,000 gpd	3,685.00	3,685.00
d. 50,000 - < 100,000 gpd	8,593.00	8,593.00
e. 100,000 - < 500,000 gpd	14,721.00	14,721.00
f. 500,000 - < 1,000,000 gpd	20,863.00	20,863.00
g. 1,000,000 - < 2,500,000 gpd	27,001.00	27,001.00
h. 2,500,000 - < 5,000,000 gpd	32,993.00	32,993.00
i. 5,000,000 gpd and greater	39,266.00	39,266.00

Noncontact Cooling Water With Additives - General Permit Coverage		
a. < 1,000 gpd	861.00	861.00
b. 1,000 - < 10,000 gpd	1,716.00	1,716.00
c. 10,000 - < 50,000 gpd	2,579.00	2,579.00
d. 50,000 - < 100,000 gpd	6,015.00	6,015.00
e. 100,000 - < 500,000 gpd	10,307.00	10,307.00
f. 500,000 - < 1,000,000 gpd	14,606.00	14,606.00
g. 1,000,000 - < 2,500,000 gpd	18,899.00	18,899.00
h. 2,500,000 - < 5,000,000 gpd	23,191.00	23,191.00
i. 5,000,000 gpd and greater	27,484.00	27,484.00
Noncontact Cooling Water Without Additives - Individual Permit Coverage		
a. < 1,000 gpd	984.00	984.00
b. 1,000 - < 10,000 gpd	1,963.00	1,963.00
c. 10,000 - < 50,000 gpd	2,948.00	2,948.00

d. 50,000 - < 100,000 gpd	6,874.00	6,874.00
e. 100,000 - < 500,000 gpd	11,783.00	11,783.00
f. 500,000 - < 1,000,000 gpd	16,687.00	16,687.00
g. 1,000,000 - < 2,500,000 gpd	21,511.00	21,511.00
h. 2,500,000 - < 5,000,000 gpd	26,503.00	26,503.00
i. 5,000,000 gpd and greater	31,414.00	31,414.00
Noncontact Cooling Water Without Additives - General Permit Coverage		
a. < 1,000 gpd	688.00	688.00
b. 1,000 - < 10,000 gpd	1,377.00	1,377.00
c. 10,000 - < 50,000 gpd	2,064.00	2,064.00
d. 50,000 - < 100,000 gpd	4,811.00	4,811.00
e. 100,000 - < 500,000 gpd	8,246.00	8,246.00
f. 500,000 - < 1,000,000 gpd	11,683.00	11,683.00
g. 1,000,000 - < 2,500,000 gpd	15,117.00	15,117.00

h. 2,500,000 - < 5,000,000 gpd	18,554.00	18,554.00
i. 5,000,000 gpd and greater	21,987.00	21,987.00
Nonferrous Metals Forming	21,768.00	22,950.00
Ore Mining		
a. Ore Mining	4,352.00	4,588.00
b. Ore mining with physical concentration processes	8,704.00	9,177.00
c. Ore mining with physical and chemical concentration processes	34,827.00	36,718.00
Organic Chemicals Manufacturing		
a. Fertilizer	19,636.00	19,636.00
b. Aliphatic	39,266.00	39,266.00
c. Aromatic	58,901.00	58,901.00
Petroleum Refining		
a. < 10,000 bbls/d	39,266.00	39,266.00
b. 10,000 - < 50,000 bbls/d	77,853.00	77,853.00

c. 50,000 bbls/d and greater	157,075.00	157,075.00
Photofinishers		
a. < 1,000 gpd	1,570.00	1,570.00
b. 1,000 gpd and greater	3,927.00	3,927.00
Power and/or Steam Plants		
a. Steam Generation - Nonelectric	7,924.00	7,924.00
b. Hydroelectric	7,924.00	7,924.00
c. Nonfossil Fuel	11,781.00	11,781.00
d. Fossil Fuel	31,414.00	31,414.00
Pulp, Paper and Paper Board		
a. Fiber Recyclers/Nonwood Pulp Mills	19,632.00	19,632.00
b. Paper Mills	39,266.00	39,266.00
c. Groundwood Pulp Mills		
1. < 300 tons per day	58,901.00	58,901.00
2. > 300 tons per day	117,813.00	117,813.00

d. Chemical Pulp Mills		
w/o Chlorine Bleaching	157,068.00	157,068.00
e. Chemical Pulp Mills		
w/Chlorine Bleaching	176,697.00	176,697.00
Radioactive Effluents and Discharges (RED)		
a. < 3 waste streams	37,986.00	37,986.00
b. 3 - < 8 waste streams	65,965.00	65,965.00
c. 8 waste streams and greater	108,648.00	108,648.00
RCRA Corrective Action Sites	27,597.00	27,597.00
Sand and Gravel - Individual Permit Coverage		
a. Mining Activities		
1. Mining, screening, washing and/or crushing	3,581.00	3,581.00
2. Nonoperating site (fee per site)	147.00	147.00
b. Asphalt Production		
1. 1 - < 50,000 tons/yr.	1,492.00	1,492.00

2. 50,000 - < 300,000 tons/yr.	3,582.00	3,582.00
3. 300,000 tons/yr. and greater	4,480.00	4,480.00
4. Nonoperating Asphalt	147.00	147.00
c. Concrete Production		
1. 1 - < 25,000 cu. yds/yr.	1,492.00	1,492.00
2. 25,000 - < 200,000 cu. yds/yr.	3,582.00	3,582.00
3. 200,000 cu. yds/yr. and greater	4,480.00	4,480.00
4. Nonoperating Concrete	147.00	147.00
The fee for a facility in the sand and gravel production category is the sum of the applicable fees in the mining activities and concrete and asphalt production categories.		
d. Portable Operations		
1. Rock Crushing	3,581.00	3,581.00
2. Asphalt	3,581.00	3,581.00
3. Concrete	3,581.00	3,581.00
4. Nonoperating Site	147.00	147.00

Sand and Gravel - General Permit Coverage		
a. Mining Activities		
1. Mining, screening, washing and/or crushing	2,505.00	2,505.00
2. Nonoperating site (fee per site)	103.00	103.00
b. Asphalt Production		
1. 0 - < 50,000 tons/yr.	1,046.00	1,046.00
2. 50,000 - < 300,000 tons/yr.	2,507.00	2,507.00
3. 300,000 tons/yr. and greater	3,135.00	3,135.00
4. Nonoperating Asphalt	103.00	103.00
c. Concrete Production		
1. 0 - < 25,000 cu. yds/yr.	1,046.00	1,046.00
2. 25,000 - < 200,000 cu. yds/yr.	2,507.00	2,507.00
3. 200,000 cu. yds/yr. and greater	3,135.00	3,135.00
4. Nonoperating Concrete	103.00	103.00

The fee for a facility in the sand and gravel production category is the sum of the applicable fees in the mining activities and concrete and asphalt production categories.		
d. Portable Operations		
1. Rock Crushing	2,507.00	2,507.00
2. Asphalt	2,507.00	2,507.00
3. Concrete	2,507.00	2,507.00
4. Nonoperating	103.00	103.00
Seafood Processing		
a. < 1,000 gpd	1,963.00	1,963.00
b. 1,000 - < 10,000 gpd	5,003.00	5,003.00
c. 10,000 - < 50,000 gpd	8,934.00	8,934.00
d. 50,000 - < 100,000 gpd	14,036.00	14,036.00
e. 100,000 gpd and greater	19,636.00	19,636.00
Shipyards		
a. Per crane, travel lift, small boat lift	4,352.00	4,588.00

b. Per drydock under 250 ft in length	4,352.00	4,588.00
c. Per graving dock	4,352.00	4,588.00
d. Per marine way/ramp	6,528.00	6,882.00
e. Per syncrolift	6,528.00	6,882.00
f. Per drydock 250 ft and over in length	8,704.00	9,177.00
g. In-water vessel maintenance	8,704.00	9,177.00
The fee for a facility in the shipyard category is the sum of the fees for the applicable units in the facility.		
Solid Waste Sites (nonstormwater)		
a. Nonputrescible	7,850.00	7,850.00
b. < 50 acres	15,703.00	15,703.00
c. 50 - < 100 acres	31,414.00	31,414.00
d. 100 - < 250 acres	39,266.00	39,266.00
e. 250 acres and greater	58,901.00	58,901.00
Textile Mills	78,533.00	78,533.00

Timber Products		
a. Log Storage	3,927.00	3,927.00
b. Veneer	7,850.00	7,850.00
c. Sawmills	15,704.00	15,704.00
d. Hardwood, Plywood	27,482.00	27,482.00
e. Wood Preserving	37,706.00	37,706.00
Vegetable/Bulb Washing Facilities		
a. < 1,000 gpd	130.00	130.00
b. 1,000 - < 5,000 gpd	262.00	262.00
c. 5,000 - < 10,000 gpd	517.00	517.00
d. 10,000 - < 20,000 gpd	1,042.00	1,042.00
e. 20,000 and greater	1,721.00	1,721.00
Vehicle Maintenance and Freight Transfer		
a. < 0.5 acre	3,927.00	3,927.00
b. 0.5 - < 1.0 acre	7,850.00	7,850.00

c. 1.0 acre and greater	11,781.00	11,781.00
Vessel Deconstruction	19,157.00	20,197.00
Water Plants - Individual Permit Coverage	5,359.00	5,359.00
Water Plants - General Permit Coverage	3,752.00	3,752.00
Wineries - Individual Permit Coverage		
a. < 24,999 gallons per year (gpy)	423.00	423.00
b. 25,000 - < 39,999 gpy	621.00	621.00
c. 40,000 - < 54,999 gpy	960.00	960.00
d. 55,000 - < 69,999 gpy	1,297.00	1,297.00
e. 70,000 - < 99,999 gpy	1,636.00	1,636.00
f. 100,000 - < 299,999 gpy	2,370.00	2,370.00
g. 300,000 - < 699,999 gpy	7,111.00	7,111.00
h. 700,000 - < 999,999 gpy	16,594.00	16,594.00
i. 1,000,000 - < 1,999,999 gpy	23,762.00	23,762.00
j. 2,000,000 gpy and greater	47,470.00	47,470.00

Wineries - General Permit Coverage		
a. < 24,999 gpy	296.00	296.00
b. 25,000 - < 39,999 gpy	434.00	434.00
c. 40,000 - < 54,999 gpy	671.00	671.00
d. 55,000 - < 69,999 gpy	907.00	907.00
e. 70,000 - < 99,999 gpy	1,144.00	1,144.00
f. 100,000 - < 299,999 gpy	1,657.00	1,657.00
g. 300,000 - < 699,999 gpy	4,973.00	4,973.00
h. 700,000 - < 999,999 gpy	11,604.00	11,604.00
i. 1,000,000 - < 1,999,999 gpy	16,617.00	16,617.00
j. 2,000,000 gpy and greater	33,196.00	33,196.00