Regulations of Effluent Discharges in the Otago Region

Selva Selvarajah

Otago Regional Council, Private Bag 1954, Dunedin.

ABSTRACT

There is a widely held view among the technocrats and policy makers that in New Zealand the point source discharges are no longer an issue and that they have been managed properly. The reality is the contrary. Many local authority sewage discharges arc still of third world discharge quality and many consented discharges to water will still require lengthy mixing zones. The paper uses several consent applications as examples to demonstrate how consent process could he used successfully in dealing with complex land and water discharges of effluent.

INTRODUCTION

Based on the origin, effluent is widely classified as farm, septic tank, municipal and industrial. Since the enactment of the Resource Management Act (RMA) 1991 there has been an increased focus on effluent discharges by regional councils in New Zealand. Regional rules regulating effluent discharges have been introduced. Many councils promoted land based discharges as their preferred discharge option. Many councils accorded permitted activity status for most land based farm effluent and septic tank discharges. Municipal and industrial discharges have been considered as high scale and high risk discharges, hence required resource consents from regional councils. Through resource consents process many councils showed preference to land based discharges of municipal and industrial discharges over discharges to water.

For more than a decade there has been considerable improvement in effluent discharges by regional council regulation of effluent discharges. Currently in many regions, more than 70% of the surface water contamination is attributed to non-point sources of discharges. There is a widely held belief by the policy makers and the technocrats that the point sources of pollution such as effluent discharges have been dealt with largely, hence the focus should be to deal with the non-point discharges from intensive farming Whilst I agree it is timely to deal with the non-point sources of pollution, a sustained effort is required from the regional councils to ensure all point source discharges are dealt with properly.

It has been more than 16 years since the RMA had been enacted. Despite the high progress made to date, there are still many municipal and several industrial effluent discharges that are of poor quality. The effluent treatment of these discharges is substandard and often does not match the scale and environmental risks of the discharges. In many cases regional councils are reluctant to impose stringent consent requirements due to financial constraints

Resource consent process provides an ideal opportunity to address poor effluent or point source discharges. Resource consent process has to comply with the RMA requirements, otherwise expensive judicial reviews may occur or the community faith in the resource consent process

may diminish. Consequently, more focus is accorded to consent process. It is equally important to also focus on the environmental outcome of the resource consent decision.

Without sound policies, technical knowledge and pragmatism resource consent process may not always yield the desired environmental outcomes. The exception to this is where a consent applicant voluntarily adopts best practice and promotes high environmental outcomes. Unfortunately, in the majority of cases, environmental outcomes of the consented activity take a secondary role to consent process. This paper promotes an environmental outcome based consent process by using several effluent discharge consents in the Otago region as examples.

DISCUSSION

What is an acceptable consented effluent discharge?

This section of the paper provides some guidance on acceptable discharges. The guidance is based on technical information, legal requirement and cultural sensitivity. For example, culturally it is offensive for Maori to discharge municipal or human effluent into waterways because the *mauri* of the water will be affected by this discharge.

Under legal requirements for consent process, compliance with any national environmental standards (NES), regional policies and rules and s15 (in cases where there is no regional rule) and s107 of the RMA provided all relevant provisions are followed as per Part 6 (resource consents) of the Act.

(a) Discharges to water

To meet the cultural requirements of the iwi, ideally a zero discharge to water is preferred particularly with regard to municipal effluent, otherwise the discharge can be either direct (through pipes or diffusers) or indirect (to trenches). Usually an AEE is provided by the applicant or its consultant. I he AEE will describe the discharge quality and any potential adverse effects on the receiving environment. The consent officer will ensure compliance with s107 of the RMA:

S107 (1) Except as provided in subsection (2), a consent authority shall not grant a discharge permit [or a coastal permit to do something that would otherwise contravene section 15] [or section 15A] allowing-

(a) The discharge of a contaminant or water into water; or

[(b) A discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or]

[(ba) The dumping in the coastal marine area from any ship, aircraft, or offshore installation of any waste or other matter that is a contaminant,-]

*if **after reasonable mixing** the contaminant or water discharged (either by itself or in combination with the same, similar or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:*

(c) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

(d) Any conspicuous change in the colour or visual clarity;

(e) Any emission of objectionable odour;

(f) The rendering of fresh water unsuitable for consumption by farm animals;

(g) Any significant advent effects on aquatic life...

SI07 must be complied with hence the requirement is **bottom line**. Many consent officers and consultants misinterpret the above RMA provision, particularly the issue of 'reasonable mixing'. It has been perceived by most consent officers and consultants that a mixing zone shall always be provided as a 'non-compliance zone'. In the past, in New Zealand, there have been attempts made by technocrats and bureaucrats to define an acceptable mixing zone. Many consultants still require or recommend the regional councils to grant long mixing zones (several hundred metres).

The Otago Regional Council (ORC) Water Plan has a good policy on mixing zone. The Water Plan Policy 7.7.6 states, *"...where mixing zone is required for the discharge of contaminants to water, to ensure that it is limited to the extent necessary to take account of:*

(a) The sensitivity of the receiving environment;

(b) The natural and human use values identified in Schedule 1;

(c) The natural character of the water body;

(d) The amenity values supported by the water body;

(e) The physical process acting on the area of discharge; and

(f) The particular discharge, including contaminant type, concentration, and volume...

Notwithstanding the Water Plan policy on mixing zone the legal advice obtained on reasonable mixing by ORC emphasises that a consent authority could set higher discharge requirements than provided in sl07 of the RMA. In other words, if a council chooses to provide no zone of non-compliance in a consent, such a practice will not breach s107. Furthermore, if a Water Plan policy requires a waterway to be managed for a particular use (e.g. contact recreation) I assume that the whole of the waterway is accessible to the community for contact recreation. I cannot see how a consent authority or the applicant could contemplate a non-complying zone (e.g. faecal bacteria levels exceeding contact recreation guideline level) that will conflict with the intended outcome of a Plan (e.g. Water Plan Policy 7.6.1- *To enhance water quality in the following water bodies so that they become suitable to support primary contact recreation (a) Mill Creek and Lake Hayes… (f) Koau Branch of the Clutha River/Mata-Au…).*

The debate on the length of mixing zone often causes a ‘friction’ between the applicants and the consent authority. To remove this 'friction’ between the applicants consultants and consents officers on mixing zone, I suggest that as a good practice, at the outset the applicant and the consent officers should focus on the extent of the treatment of an effluent including the best practicable options and alternatives. The next step is to assess any adverse effects of the discharge including the effects on contaminant assimilation. Poor proposals are easily noticeable and will be based on a philosophy of ‘dilution as a solution' and use the available dilution to design a treatment system. If such poor practices are not tackled, it could be argued that a primary treatment system may simply satisfy the requirements of a sewage discharge to a large water body. Such a practice is similar to some third world countries who cannot afford proper treatment systems

Latest examples of Otago Regional Council consents to discharge to water

PPCS Limited Finegand (Meatworks discharge)

PPCS Limited Finegand (Balclutha) had been discharging up to 20,000 m^3/d of raw meatworks effluent to the Koau Branch of the Clutha River for many years (e.g. BOD 1500 mg/L, TSS 1200 mg/L, and $9x10^6$ E.coli cfu/100 mL). During the consent renewal in 2004, the applicant and its consultant proposed a biological treatment system which required a large mixing zone to comply with the Water Plan. The key contaminant of contention was faecal bacteria. ORC staff argued for an in-pipe E.coli levels to meet the contact recreation guideline level. This was because the Water Plan policy required the river to be returned to contact recreation status. Since the applicant was worried that the proposed biological treatment would not comply with the ORC staff recommendation, the applicant opposed to the staff recommendation. The hearing panel which comprised of technical commissioners decided on a middle-of-the-road' discharge quality of 2000 E.coli cfu/100 mL (median) with a supportive condition of " *the wastewater discharge shall not give rise to any of the following effects in the receiving waters outside of a mixing zone restricted to an area of no more than one third of the river width, situated to avoid bank contact and extending no more than 150 metres downstream of the point of discharge:- (a) the rendering of fresh water unsuitable for consumption by farm animals or…”.*

The applicant appealed the decision. During the appeal mediation process it was identified by the applicant that to achieve the discharge quality prescribed in the decision, a DAF (dissolved air floatation) system would be required to treat the meatworks ellluent. Since the ORC consultant had a previous experience in trialling similar systems, the applicant requested an interim pilot trial at its Belfast plant. The applicant trialled a DAF system at Belfast under the guidance of the ORC consultant with the consensus of the Court and ORC. Since the trial was successful the appeal was resolved with minor word changes to the consents. The treatment plant had been completed at a cost of 12 million dollars at the end of 2007.

Fonterra Stirling (Dairy factory)

Fonterra Stirling cheese factory has a current consent that authorises a wastewater discharge of 3000 m^3 and 7000 kg COD/d into the Matau Branch of the Clutha River. This consent expires in 2021. In 2003 the ORC field auditing indicated that there were high levels of faecal bacteria detected in the discharge. There was no authorisation in the consent to discharge faecal bacteria. This incident triggered a series of discussions with the company which resulted in both ORC and Fonterra signing a Memorandum of Understanding (MoU) to improve the river

water quality. The vision stated in the MoU was "*.. The signatories to this MOU agree to work together to achieve the shared vision of clean healthy water for the Matau Branch of the Clutha River. Clean healthy water means water that meets or exceeds the requirements of recreational water use (including contact recreation) and healthy aquatic habitat and ecosystems, and does not affect downstream water users…".*

Following several feasibility studies (including one on land based system) and liaison with ORC and in accordance with the MoU, Fonterra had applied for a consent at the end of 2007. Fonterra proposes to install a membrane bioreactor system (MBR) which would provide a discharge with an estimated median of 10 E.coli cfu/100 mL, 10 BOD mg/L and <10 total-N mg/L. The process both parties had gone through illustrates the successful and collaborative way a major industry and a regional council have worked towards an agreed outcome. From a consent process viewpoint, given the existing consent expires in 2021, under normal circumstances a costly review process (s128 of the RMA) would have required to deal with the discharge. Such a process has not been required because of the MoU. The consent is being processed non-notified and it would he recommended to grant for a term of 35 years.

Dunedin International Airport Limited (Sewage)

Dunedin International Airport Limited (DIAL) previously had a discharge consent to discharge 150 m^3 of treated sewage effluent (e.g. ammoniacal-N 50 mg/L, 6 x $l0^5$ faecal coliforms cfu/100 ml) to the Main Drain. The Taieri Main Drain is part of the ORC West Taieri Drainage Scheme, draining an area of 7500 ha predominantly under dairying. The Main Drain water is pumped into Lake Waipori at the Waipori Pumping Station. The Main Drain water quality is poor with elevated levels of mineral-N and faecal bacteria. Whilst a majority of the poor water quality had been attributed to farm runoff and drainage, being the only point discharge and of human origin, ORC wanted improved discharge quality from the DIAL.

In 2004 the DIAL applied to renew its consent. The DIAL proposed to nitrify the effluent from the Imhoff tank and then to denitrify using a constructed wetland. The proposal was not satisfactory to ORC because the proposed nutrients and the faecal bacteria levels were too high. Given the Dunedin City Council (DCC) owned 50% of the DIAL shares and being a local authority, the DIAL approached DCC for a possibility of reticulating the DIAL effluent. The reticulation of the DIAL was dependent on DCC reticulating the Outram village septic-tank discharges. Outram is a growing lifestyle residential area which is situated within the ground water protection zone identified in the Water Plan hence ORC was supportive of a full reticulation. Unfortunately, DCC did not see the need for a reticulation leaving DIAL to provide a better effluent discharge proposal to satisfy ORC. Under the circumstances, in order to progress with a water discharge, ORC encouraged the DIAL to consider a membrane filtration as a tertiary treatment system. The rationale behind such an approach was to reduce or eliminate human faecal bacteria. Following an assessment of feasibility, the DIAL had agreed to include a membrane filtration system in lieu of the proposed constructed wetland systems.

The consent was granted for a 20 year term with faecal coliforms not exceeding 260 cfu/l00 mL on a 90^{th} percentile, with rolling geometric mean not exceeding 10 mg ammoniacal-N/L and 10 BOD mg/L. There was no restriction on nitrate-N levels because of the high potential for denitrification in the Main Drain. Early results obtained following the commissioning of the new treatment system suggest that the faecal coliforms were well below 10 cfu/100 mL.

(b) Land discharges

Effluent discharge to land is the preferred option for ORC (Water Plan Policy 7.7.1 - *To promote discharges of contaminants to land in preference to water, where appropriate).* Discharges to land face more challenges in the Otago Region for the following key reasons:

• Applicants' and consultants lack of knowledge;

• Freezing weather conditions, and

• Poor infiltration rates.

Land discharges could be classified as land **disposal** and land **treatment**. Often land treatment is confused with land disposal. A typical land treatment system is defined in this paper as *that utilises an engineered effluent application system to irrigate pre-treated or raw effluent to soil to aid bio-chemical processes in soil along with crop/plant uptake of nutrients to minimise or to avoid onsite or offsite contamination.* Therefore, land treatment of effluent requires consideration to the extent of pre-treatment of effluent, application method (e.g. sprinklers verses drips), effects of aerosols (where applicable), contaminant bio-chemical reactions in soil, plant uptake, nutrient budgets, contaminant leaching to ground water and effects, and any surface water contamination.

In contrast to land treatment systems, in most cases land disposal does not require any complex technical expertise. Key information required is infiltration rate which will dictate the rate of effluent discharge. Effluent treatment prior to discharge may require primary or secondary treatment. Often trenches are used to dispose effluent with sufficient rotation available to avoid clogging. ORC does not promote this 'trench technology' because the technology is crude with several uncertainties. However, it may be argued correctly that such a discharge option is still superior to a well-treated discharge to water. Land disposal should be assessed on a case by case basis giving particular regard to depth to or distance to ground water and surface water respectively and contaminant plumes and their effects on aquifers and surface water. Clearly, land treatment is the preferred option for ORC.

Depending on the effluent type (e.g. farm effluents) and the land treatment system (e.g. pasture or forest), a well-designed and managed land treatment system will treat raw effluent. However, where land area is sufficient hydraulically but not sufficient to deal with nutrient loading, a reduction in nutrient level is required through pre-treatment. Generally, land treatment systems are capable of dealing with high BOD (Biochemical Oxygen Demand) and faecal bacteria loadings. However, as a rule of thumb, effluent with heavy metals should not be treated by land because long-term land application will result in heavy metal accumulation in soil (Water Plan Policy 7.7.2 *When considering the discharge of any contaminant to land, to have regard to: (a) the ability of the land to assimilate the contaminant; (b) any potential for soil contamination; and (c) potential for land stability).*

One of the key advantages of a land treatment system that utilises any crops or trees for productive purposes, is that a substantial income could be generated from a properly designed and managed system. Sewage effluent application to non-food crops or trees is a straightforward process. Effluent without any human or animal pathogens could be utilised by pasture, viticulture, food crops or orchards. Some industries may restrict the use of human effluent on food or beverage base crops.

Effluent application method is selected on the basis of weather conditions (freezing conditions may require drips), surrounding environment (aerosol effects) and plant and soil types. To minimise nitrate leaching nitrogen (N) loading should be compatible with the land use or plant type (Table 1).

Table 1. Examples of crop/plant type and N loading rates

Crop/plant type	N loading rate (kg/N/ha/year)
Pine	100
Eucalvptus (coppice)	200
Maize silage	500
Pasture (cut & carry)	600
Dairy pasture (grazed with little monitoring)	150
Dairy pasture (grazed with high monitoring)	300

Latest examples of Otago Regional Council consents to discharge to land

(i) Land disposal

Wanaka-Albert Town Sewage Discharge

Historically, the Wanaka-Albert Town sewage was discharged into the Clutha River (headwaters at the outlet of Lake Wanaka). Due mainly to the basic treatment accorded, the sewage discharge quality was poor causing sewage fungus growth downstream to the discharge. Lake Wanaka water is of excellent quality with E.coli levels for the majority of the period remaining below 10 cfu/100 ml (median of 1 E.coli cfu/100 mL, ORC, 2007).

During the renewal of consent the Queenstown Lakes District Council (QLDC) proposed a land based discharge in the Wanaka Airport area (70 ha). The ground water table was assessed to be at 70 m depth and the ground water flow was to the Clutha River. It was proposed that 26400 m^3 treated effluent would be discharged to rapid infiltration trenches up to 2000 mm/d. The distance between the disposal site and the Clutha River was 1.6 km.

Whilst ORC was pleased with the removal of direct sewage discharge to Clutha River, the contention was on the potential of ground water contamination. There are existing and likely future users of the ground water in the area. Therefore ORC commissioned a report on the effects of the land based disposal on ground water quality. The report was based on ground water contamination modelling which considered a worst case scenario of no additional breakdown of effluent-N in the vadose zone. The report concluded that in order to not exceed a ground water nitrate-N drinking water guideline level of 11.3 mg/L, the discharge should not exceed 12 mg total-N/L.

The consent was granted for a term of 35 years with several ground water and discharge monitoring conditions. The 80th percentile non-exceedance of 12 mg total-N/L, 1000 E.coli

cfu/100 mL, 35 mg BOD/L was required. The ground water quality non-exceedance of 11.3 mg nitrate-N/L and <1 E.coli cfu/100 mL was also required.

(ii) Land treatment

Jacks Point Limited

Jacks Point Limited development has been one of the largest residential developments in the Queenstown area in the recent years. Four hundred and twenty hectares of land has been converted into mainly residential blocks and golf courses. Instead of reticulating and discharging the entire development's treated sewage effluent into the lake Wakatipu or on one land location, the proposal was to use several packed bed reactors to treat and discharge sewage effluent to several land locations. Since the discharge was land based the proposal was welcomed by ORC.

Given there is insufficient historical information on Lake Wakatipu, water quality and lake dynamics and the fact that several well known lakes in New Zealand such as Lake Taupo and Lake Rotorua had sustained ecological damage by elevated nutrients, ORC approached the proposal very cautiously. Therefore the proposal required a nutrient budget approach. Several assumptions/facts were used in the process; (a) the historical extensive land use (sheep fanning) had not impacted the lake water quality; (b) the lake water quality is excellent (median total-N and total-P being 0.05 mg/L and 0.003 mg/L respectively and median E.coli being 2 cfu/100 mL, ORC. 2007); (c) if the catchment nutrient input is maintained at or below the historical land use nutrient outputs the lake water quality will be either improved or maintained at the existing status.

It was decided to focus on N loading given P is likely to be adsorbed to soil. After consultation with the AgResearch scientists it was agreed between the ORC and Jacks Point Limited that the historical nitrate leaching loss has been 9 kg N ha year. Whilst the leaching loss reflects more recent and intensive sheep farming, the long term average leaching loss would have been well below 9 kg N/ha/year. From a total area of 420 ha the total nitrate leaching loss was estimated as 3780 kg N/ha. The consent requirement of the mass leaching for the entire site was 2800 kg N/year. The median effluent total-N requirement from the packed bed reactors was 20 mg L. In addition to this restriction several piezometer sites are also required to be monitored for nitrate-N and E.coli on a monthly basis and a restriction of not exceeding 3 mg nitrate-N/L change in ground water quality has also been placed in the consent.

Full detail of this project is provided in the field notes of the NZLTC meeting.

CONCLUSIONS

In the past several years the Otago Regional Council has been very successful in dealing with historical and new water and land point discharges through consent process. The success is attributed to (a) the Water Plan policy directions; (b) applicants' co-operation and foresight; (c) high technical and pragmatic knowledge on treatment systems and their limitations held by parties involved in the process; and (d) an outcome based approach by Otago Regional Council staff. The absence of any of the above factors would have resulted in either poor or unwarranted costly treatment systems.

REFERENCES

Otago Regional Council 2007. State of the Environment Report- Surface Water Quality in Otago Pp. 145.