

5. OCEAN OUTFALL PIPELINE: PIPE LENGTH AND UV DISINFECTION

Officer responsible
City Water and Waste Manager

Author
John Moore, Senior Projects Coordinator DDI 941-8961
Mike Stockwell, City Water and Waste Manager DDI 941-8332

The purpose of this report is to seek a decision regarding the length of the ocean outfall pipeline (2km or 3km) and whether to include artificial electrical UV disinfection in the treatment of the wastewater effluent.

OVERVIEW

The process of getting to a position of making a definitive recommendation regarding pipe length and UV disinfection has been long and complicated. It has included economic, environmental, and cultural considerations and much input from the community and professional experts. To obtain a comprehensive grasp of all of the details will require study of the attachments. For this reason this is a summary report which provides condensed information to give sufficient grasp of the significant issues to be able to confidently support the recommendations.

BACKGROUND

The Christchurch City Council (CCC) applied to Environment Canterbury (Ecan) in March 2001 to discharge wastewater from the CCC wastewater treatment plant to the Avon Heathcote Estuary. The application sought to allow discharge of wastewater from an upgraded treatment plant for 15 years. Ecan heard the application later in 2001 and early 2002 and released its decision in June 2002. It decided not to grant the CCC application, and discharge continued for some months under the "old" consent.

The CCC appealed the Ecan decision and resolved to prepare an assessment of environmental effects for an ocean outfall pipeline of no less than 2km long. This is in order to make an application for an ocean outfall. A short-term estuary consent which had key elements tied to progress for an ocean outfall was then negotiated with the registered interested parties to the estuary consent application. This enabled Ecan in October 2003 to grant a short-term estuary discharge consent subject to the following conditions.

1. The consent duration shall be until the ocean outfall is commissioned and becomes operational or until 30 September 2009, whichever is the sooner.
2. The consent holder shall use all practicable measures to achieve the following target dates ("the target dates"):
 - (a) Treatment pond upgrade completed by 30 April 2004;
 - (b) Final report on ocean current modelling made publicly available by 30 April 2004;
 - (c) Future water quality outcome from treatment plant report made publicly available by 31 August 2004;
 - (d) A complete resource consent application for the ocean outfall lodged with the Canterbury Regional Council by 20 December 2004;
 - (e) The tender for the construction of the ocean outfall awarded within eight calendar months of the commencement of the ocean outfall resource consent;
 - (f) The ocean outfall commissioned and operational within 19 calendar months of the date on which the tender for construction is awarded.

Item 1 above details the sunset date for the estuary discharge. Item 2 details key milestone dates which must be met to provide confidence that the ocean outfall pipeline will be operational no later than 30 September 2009 in accordance with the realistic time frame agreed for the estuary discharge consent. Note there is also an optimistic and pessimistic timeframe programmed respectively two years shorter and 18 months longer than the realistic timeframe, and dependant on the length of the resource consent period.

At this time, items 2 (a) and (b), have been achieved and item 2 (c) is on track to be achieved by the target date. A decision regarding pipe length and UV disinfection for the ocean outfall is now required to continue progress to achieve item 2 (d). (Items 2 (e) and 2 (f) follow later.)

It is also noted here that the Council has previously considered reports and made decisions regarding the pipe route, where Jellicoe Street was selected after extensive investigation and consultation. A report has also been previously considered regarding the options for contracting the ocean outfall pipeline, and a decision made for a design and build contract to be let for the whole of the works.

IMPERATIVE FOR COUNCIL TO MAKE DECISION

Achieving the milestones set out above is a legal statutory requirement of the Council's short-term estuary discharge consent. To achieve milestone 2 (d) (ie pipeline resource consent application) it is imperative that the Council makes a decision now on pipeline length and UV disinfection. This is essential to allow enough time to finalise the application documents (ie assessment of environmental effects etc) and lodge an application prior to 20 December 2004. Making this decision is not an option, it is a "must do".

INFORMATION REQUIRED TO MAKE A DECISION REGARDING PIPE LENGTH AND ARTIFICIAL UV DISINFECTION

To make the best possible decision regarding this important issue, very good information is required. Information has been gathered on all relevant technical issues including, costs, ocean current modelling, results from the oxidation pond upgrade, health risk assessment and environmental effects.

Consultation with the Christchurch community has also been undertaken. This has included Maori, key interest groups, and a representative sample of the Christchurch population. Submitters have also had the opportunity to put forward their views in writing and verbally, to the Sustainable Transport and Utilities Committee.

The Council decision regarding pipe length and whether or not to have artificial UV disinfection should be made through consideration of both the technical information and the views of the community. This report summarises the issues that will combine to influence that decision. Note that a more detailed presentation and discussion of these issues has already been undertaken at a seminar for the Sustainable Transport and Utilities Committee and all Councillors on 22 June 2004. A technical report on "Ocean Current Modelling", and the executive summary and conclusions for "Ocean Outfall Consultation with Christchurch Residents" was also included with the seminar material provided to all Councillors.

This section stresses that the decision on pipeline length and UV will be made on a balance of technical and community view considerations.

CONSULTATION AND COMMUNITY VIEWS

Maori

A working party has been established to consult with Maori on the ocean outfall. The working party was hosted and organised through Te Runanga O Ngai Tahu (TRONT) and consisted of representatives of the participating Papatipu Runanga, with Te Ngai Tuahuriri Runanga having mana whenua regarding the ocean outfall. A cultural impact assessment (CIA) was prepared on behalf of Te Ngai Tuahuriri which provided information about the settlement of Maori in the area and put forward the views of Maori regarding wastewater disposal to the ocean. The recommendations within the CIA and responses are detailed in Attachment 1.

Key Interest Groups

Several meetings have been held with key interest groups or are ongoing, to advise on progress with the preparation of the assessment of environmental effects document, and explain results from the ocean current modelling, the pond upgrade and the health risk assessment. Questions about construction and environmental effects have also been discussed. Key interest group issues are summarised in Attachment 2. It must be noted that not all the issues will be resolved to the total satisfaction of each group. This is not at all unusual in a consultation process which raises conflicting views. Ultimately the best fit decision has to be made which might not satisfy all views.

Wider Community Views

Qualitative Exploration (with “Water Quality and Beach Standards” consultation document)

A consultation document (Attachment 3) was prepared to provide information for the community about the ocean outfall and seek people's views about four outfall options; 2km, 3km, artificial UV and no artificial UV. The document was developed by running three, two-hour workshops with groups of up to six randomly selected participants to check that the information content was considered complete, unbiased, relevant and understandable. It was made clear that more information was available on the Council website if participants wanted to research issues in more detail. This document has had very favourable feedback in terms of its clarity and ability to be understood.

Representative Survey

Opinions Market Research Ltd, using the consultation document, then undertook a representative survey in terms of age, gender and community board area based on the 2001 Census of 600 Christchurch residents aged 15 and over. This survey had a statistical margin of error of +/- 4%.

Written Submissions

The consultation document, along with a tear-out submission form, was widely advertised and made available at Council outlets throughout the city and on the Council website. Submissions could be made from mid February 2004 until the end of March 2004, although several late submissions were also included in the analysis. A total of 239 submissions were received.

Verbal Submissions

Submitters who indicated a wish to make a verbal submission were invited to speak to the Sustainable Transport and Utilities Committee on 26 and 27 April 2004. Seventeen submitters made verbal submissions. The record is tabled.

Survey Analysis

A full analysis of the representative survey and the submitters' findings has been carried out by Opinions Market Research Ltd. An executive summary of this analysis was included with the information given at the 22 June 2004 Seminar and is available on request. The summary concludes in the last sentence *“On this basis, with more weight being applied to the findings from the representative survey, it is concluded that a three kilometre pipe without artificial ultraviolet treatment could be recommended.”* This conclusion is representative of the wider community views. Opinions Market Research has concluded that more weight can be placed on the representative survey because it canvassed 600 people representative of Christchurch residents aged 15 and over in terms of age, gender and community board. Whereas the submitters are a self selected group of 239 who were not necessarily representative of the population of Christchurch (for example, in terms of location, over a third were from the Burwood/Pegasus Community Board area). Of note, participants in the representative survey were required to read the consultation document in order to take part in the survey. This was not the case in relation to the Submitters. Attachment 4 is a graph showing the acceptability of each ocean outfall option for both the representative survey and the submitters group. This graph shows a 3km pipeline without artificial UV has the highest level of acceptability to the representative survey.

From the above section it is concluded that the weight of the community would prefer a 3km pipeline without artificial UV.

TECHNICAL MATTERS

Ocean Current Modelling

The University of New South Wales School of Civil and Environmental Engineering, Water Research Laboratory (WRL) has modelled the ocean currents at the potential discharge locations in Pegasus Bay for a period of 12 months. WRL has provided a report summarising the results of the modelling and this is available on request, and has been provided to all Councillors as part of the 22 June 2004 seminar material. The model has looked at how effluent is dispersed under the range of conditions experienced during the collection of this data using a concentration of contaminants of 10,000fc/100ml. (Note: This has been scaled down to 1,000fc/100ml - see below)

Effluent quality on completion of the major upgrade of the Christchurch Wastewater Treatment Plant and reconfiguration of the oxidation ponds was predicted to improve 10 fold, down to 1,000fc/100ml, and this figure was used within consultation documents. The actual reduction in contaminant concentration is discussed in the section below headed "Oxidation Pond Upgrade" and is confidently predicted to be down at this 1,000fc/100ml level on a continuing basis into the future, see below.

Attachment 5 is the technical interpretation of the ocean current modelling, applying the water quality effluent standard of 1,000fc/100ml used within the consultation document. It demonstrates that for a 2km long pipeline, for shellfish gathering, the worst case modelled was 1.5fc/100ml at the beach compared to the safe benchmark standard of 14fc/100ml (ie the worst case was almost 10 times safer than the upper safe limit faecal coliform count for shellfish gathering).

From this section it can be concluded that a 2 km long pipeline without artificial UV will (more than) meet safe shellfish gathering standards at the beach.

Oxidation Pond Upgrade

The negotiated consent to continue discharge to the estuary included milestone requirements to complete the oxidation pond upgrade by 30 April 2004. It also included making the water quality outcomes from the pond upgrade publicly available by 31 August 2004. The reason for the time between the upgrade, and the availability of results is to ensure sufficient data is available to provide a representative sample of reliable results. At this time, the 31 August date has not passed, however, in the limited time that the upgrade has been completed the results have been very encouraging.

Attachment 6 demonstrates those results. It shows that median faecal coliform discharge numbers, significantly less than 1,000fc/100ml, are being achieved as a result of the treatment plant and pond upgrade. This will give the community confidence that the use of an ocean outfall pipeline combined with a discharge concentration of 1,000fc/100ml which was used within the consultation documents for the effluent concentration, is already being achieved. There is every indication that results of this calibre will improve further, as summer approaches.

Contaminant concentrations could therefore be even safer than the very low (1.5fc/100ml at the beach) figure predicted above.

From this section it is concluded that the community can be confident that the results of the treatment plant and oxidation pond upgrade is as good, if not better, than predicted.

Health Risk Assessment

NIWA has provided an assessment of the probability of becoming ill from swimming at the beach attributable to the wastewater effluent for each outfall option.

The assessment was based on how many people would become ill if 1,000 people went to the beach at a given time. Because the number of people getting sick using this analysis were so small, this was converted to "if the population of Christchurch (approximately 300,000) went to the beach at a given time".

This information was shown in the consultation document Attachment 3 on page 8, and a comparison with normal living activities was made on page 6.

The assessment demonstrates the following, if 300,000 people went to the beach for a swim:

- With the existing estuary discharge, 300 to 6,300 people may become ill as a result of the discharge if they went swimming in the estuary (0 - 300 if they went swimming in the ocean)/
- With a 2km long pipeline discharge with no artificial UV, 0 to 9 people may become ill as a result of the discharge.
- At any time 17,400 of those people may become ill from normal day-to-day living risks (even if they had not gone for a swim).

Therefore the marginal extra risk posed by a 2km pipeline without artificial UV is almost 2,000 ($17,400/9 = 1,933$) times less than the risk of day to day living. It should also be noted that with a marginal risk of 9 per 300,000 people becoming ill with a 2km outfall, this will only be for 5% of the time (because the other 95% of the time the wastewater does not even reach the beach).

All other outfall options show lower risks of illness. Once the effluent is discharged to the ocean at 2km, the marginal reduction in risk for other outfall options becomes so low as not to be significant, from a health risk perspective. (Note, however, that the public consultation identified a desire for the highest practical standard and for a precautionary approach to be used.)

From this section it is concluded that the risk of becoming ill from swimming, or eating shellfish at the beach from the effects of the effluent discharging from a 2km pipeline without artificial UV, is extremely low.

Construction Effects

A number of ecological studies have been undertaken along the pipe route to identify the nature of flora and fauna in the vicinity of the pipeline. The results of these studies will be used to monitor the effects of the pipeline when it has been constructed. The advice received to date is that once the pipe is in place, there will be no different environmental effect between a 2km pipeline and a 3km pipeline. Of course, if a 3km pipeline is constructed there will obviously be an additional 1 km of disturbed seabed during the time of construction, however, it is expected that this would be recolonised relatively quickly after construction is completed.

From this section it is concluded that either a 2km or 3km pipeline without artificial UV will be acceptable in terms of construction effects on the environment.

Environmental Effects

Several studies have been undertaken to assess what the effects might be from the disposal of treated wastewater at least 2km into the ocean. These studies have included the characterisation of the wastewater for such things as nutrients, dissolved metals, temperature change, dissolved oxygen and organic compounds. Studies have also been carried out to assess existing flora and fauna in the vicinity of the outfall discharge, and including the intertidal area, the sea bed, and pelagic fish. The studies have concluded that it is extremely unlikely that any dissolved constituents within the wastewater would result in acute toxic effects even within the mixing zone (ie the area close to the end of the pipeline in which the effluent is diluted). There would also be no algal bloom problems. It is also considered to be highly unlikely that there will be any problems with colour or odour. An extensive monitoring programme will be undertaken to demonstrate that there will be no adverse effects of significance.

It can therefore be concluded from this section that for the purposes of assessing environmental effects, there is no measurable additional benefit in constructing a pipeline longer than 2km.

ARTIFICIAL UV DISINFECTION

During the consultation process Maori, and the submitters group, showed a clear preference for artificial UV disinfection.

Maori values require waste to touch land prior to disposal to water, and this can be achieved through a wetland. The TRONT working party has, however, taken a pragmatic approach regarding wastewater disposal in the Christchurch situation and acknowledge the ocean outfall is the only practicable option. Having made that major concession, the TRONT working party considered there is a need to mitigate the loss of their values, by providing artificial UV disinfection. The working party considers this to be a precautionary approach.

Submitters, (as defined in the "Wider Community Views" section) as a group, also considered artificial UV disinfection to be the preferable option for an ocean outfall, to provide a greater level of comfort.

Natural UV disinfection provided through sunlight, creates the greatest reduction in bug numbers within the oxidation ponds at the Christchurch Treatment Plant. During consultation it was stated that the oxidation pond upgrade was likely to reduce median faecal coliform numbers by a factor of 10 - down from 10,000fc/100ml to 1,000fc/100ml. As stated previously, early results are achieving this improvement, and it is confidently expected that continuing results better than 1,000fc/100ml will be achieved on a continuing basis into the future. This being the case, additional artificial UV disinfection which would lower bug numbers further will not change outcomes such as safe to swim, safe to eat shellfish or significantly change the health risk assessment.

From a technical point of view, artificial UV does not provide any additional benefit. Artificial UV disinfection would cost around \$7m to establish, and approximately \$1m per year to operate. Attachment 7 shows how the \$1m per year operating cost for UV is made up. Included in the operating cost for artificial UV is the need to use more than 2,500 kWh/d (ie about 50 household equivalents) which will have a negative environmental effect. The UV technology available at present would also require the replacement and disposal of approximately 300 UV tubes per year at a cost of approximately \$250,000 per year. It is acknowledged these are not large costs in terms of making sure the health of the community is maintained, however, there is no evidence that spending this money on artificial UV will result in significantly safer water quality. It should be noted here that although it is not common for sewage treatment plants to have both oxidation ponds and artificial UV treatment, an artificial UV disinfection plant could be constructed for the outfall at a later time without incurring undue additional costs. Indeed the pipeline influent design at the oxidation pond outlet will be carefully configured to ensure that this is entirely practicable.

It is therefore considered that the most appropriate strategy is to construct an ocean outfall without artificial UV disinfection, on the basis that it can be installed at little extra "add on" (ie above \$7m) cost in the future if required outcomes or the weight of community views change.

As discussed above only marginal improvements which are not significant would be achieved through provision of either an artificial UV disinfection plant or an additional 1km of pipeline. Community feedback, however, has expressed a clear desire for a 3km pipeline, while a portion of the community has expressed a desire for additional artificial UV disinfection. If the Council wishes to meet community expectation, it would be better to provide a 3km pipeline now rather than to install artificial UV disinfection. This is because of the very high cost of installing additional 1km pipe length at a later date (see below) combined with the low operating cost of the pipe compared to the high operating cost of artificial UV. Artificial UV can be installed at a later time at little extra cost.

From this section it is concluded that the pipeline should be constructed without artificial UV while ensuring that it can be installed later if required water quality outcomes change in the future.

PIPE LENGTH

As discussed above a 3km pipe line was the preferred option for submitters, Maori and the representative survey participants. Generally the reasons were to have the outfall as far away as possible, reduce health risks, and to take the precautionary approach. As with artificial UV disinfection, providing an additional 1km of outfall does not measurably change outcomes such as safe to swim and safe to eat shellfish. The marginal cost of an extra 1km of pipeline is estimated to be \$7m if constructed at the same time as the rest of the outfall pipeline. To construct a 2km pipeline, then return some time later to construct an additional 1km, is estimated to cost \$17m mostly due to mobilisation costs. The break down of costs to install an additional 1km of pipeline at a later date is shown in Attachment 8.

Although no measurably improved outcomes are achieved from an additional 1km of outfall, it can be seen that if community expectations change and higher standards are desired, it is more economic to construct an additional 1km at the same time as the rest of the outfall pipeline. Also as stated in the previous section, there are not the same ongoing operational costs involved with an additional 1km of pipeline that there are for an artificial UV disinfection plant.

From this section it is concluded that it would be financially prudent to construct a 3km pipeline now, rather than increase its length at a later date.

COSTS

The costs for the four options are shown in the table below and are broken down in greater detail in Attachment 9.

Table 1: Cost of each outfall option

Outfall option	\$m			
	2km no artificial UV	2km including artificial UV	3km no artificial UV	3km including artificial UV
Estimated cost including 20 years of ongoing operational costs where artificial UV is included	43	63	50	70
Elemental costs included in above totals:				
• Capital cost of pipe	43	43	50	50
• Capital cost of UV		7		7
• Operational cost of UV over 20 years		13		13
Residential rate increase for average property value of \$164,170 based on rates for Christchurch City Council of \$954	+ 4.0% per year (\$38.16) from 2008	+ 5.3% per year (\$50.56) from 2008	+ 4.7% per year (\$44.84) from 2008	+ 5.9% per year (\$56.29) from 2008

Notes

1. Capital cost of additional 1km extra pipeline if constructed in initial contract **\$7m**
2. Capital cost of 1km extra on pipeline added at later date **\$17m**
3. Capital cost of UV plant whether constructed initially or constructed later **\$7m**
4. Operational cost of artificial UV plant **\$1m/year**
5. Operational cost of artificial UV plant operated over 20 years, net present value **\$13m**
6. In the above table the capital costs are the construction costs and will not include the operational costs. The latter will be covered in the Council's operational budget

SOURCE OF FINANCE**Capital**

The source of capital finance is shown in the Council's 2004/05 budget as follows.

Table 2: Source of Finance

Year:	\$m					
	2004/5	2005/6	2006/7	2007/8	2008/9	Total
(a) Consultation, Technical investigations, Preparation of AEE, consenting etc	0.550	0.410				0.960
(b) Construction activities associated with Ocean Outfall			20.000	25.000	5.000	50.000
Total	0.550	0.410	20.000	25.000	5.000	50.960

Notes

- Additional amount spent in item (a) above in previous years 2002/03 and 2003/04 amounts to \$1.3m.
- The capital amount budgeted above will suffice for all options except a 3km ocean outfall with artificial UV disinfection. The latter will cost an additional \$7m.

Operational

The Council's operational budget has been increased to account for depreciation, pumping and maintenance of the ocean outfall as follows:

Table 3: Operational Budget

	\$m			
Year:	2007/08	2008/09	2009/10	Total
Depreciation	0.425	0.480		0.905
Ocean Outfall Pumping		0.100		0.100
Ocean Outfall Maintenance			0.050	0.050
Total	0.425	0.580	0.050	1.055

This section shows that the Council's 2004/05 capital budget has provided for all options consulted on, excluding a 3km pipeline combined with artificial UV disinfection, and that budget allocation has also been made for ongoing operational costs.

LEGAL COMMENTARY

No current specific legal issues have been identified regarding the decision as to pipe length and artificial UV disinfection. There remains the need to make a timely decision to comply with the conditions of the estuary discharge consent. If circumstances change with respect to any other matters of relevance (such as foreshore and seabed legislation) the Council will be briefed when these issues become apparent.

QUESTIONS FROM 22 JUNE 2004 SUSTAINABLE TRANSPORT AND UTILITIES SEMINAR

At the Sustainable Transport and Utilities seminar on 22 June 2004, a number of questions arose. For the purposes of clarity, these, together with answers, are listed in Attachment 10.

SUMMARY

- (a) A decision is required from the Council on pipeline length and whether or not to provide UV.
- (b) This decision requires balancing the technical evidence and the wishes of the community.
- (c) With a 2km pipeline without UV - safe bathing and shellfish gathering standards are met at the beach.
- (d) The weight of community opinion (measured by the representative survey) prefers a 3km pipeline without UV (note though that Maori would prefer 3km plus UV on a precautionary approach basis).
- (e) Adding 1km onto a 2km pipeline will cost \$7m capex now and \$17m capex if done at a later date.
- (f) Artificial UV will not increase health standards to any significant extent. It will cost \$7m capex now and \$1m per year to operate.
- (g) The resource consent application for the pipeline should not include artificial UV at this time, but the pipeline should be configured to ensure that a UV plant can be readily added later (ie if required water quality outcomes change in the future).
- (h) Weighing up all of the technical evidence together with the views of the community it is considered that a 3km pipeline should be built now with the provision to provide UV at a later date.

This section summarises the case for a 3km pipeline without artificial UV and stresses the importance for the Council to make a decision.

Staff**Recommendation:**

1. That the resource consent application be made to construct a 3km long pipeline, measured from mean low water to the centre of the diffuser section.
2. That the resource consent application for the pipeline should not include artificial UV at this time, but that the pipeline is configured to ensure that a UV plant can be readily added later.

Chairman's**Recommendation:**

That the above recommendation be adopted.