18. DISINFECTION TRIALS ON OXIDATION POND EFFLUENT

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Corporate Plan Output: Liquid Waste Capital Asset Improvements	

The purpose of this report is to outline the current situation with disinfection technology and to recommend the trial of some Ultra Violet disinfection systems on the discharge of wastewater from an oxidation pond. New technology is claimed to use only 20% of the power required for normal UV systems. This aspect could have significant cost implications if UV disinfection was to be required on the discharge from the Christchurch Wastewater Treatment Plant.

BACKGROUND

Councillors are aware that we are in the process of preparing to seek a new resource consent for effluent discharge from our Christchurch Wastewater Treatment Plant. The current consent expires on 1 October 2001, and a new discharge consent application has to be lodged by 1 April 2001. This process has been regularly reported to the Council latterly in November 1999 when the next steps were outlined. The timing of these steps is now expected as follows:

Complete scientific studies	February 2000
Seminar for Councillors	16 March 2000 and 19 May 2000
Council resolves which option(s) to consult public about	May/June 2000 City Services
Formal public consultation period	June/August 2000
Councillors hear public submissions	September 2000
Council selects single option	October 2000
Consent application lodged	November 2000

WASTEWATER STERILISATION

General

There is a strong probability that some form of disinfection will be required on the effluent from the Christchurch Wastewater Treatment Plant discharge in the future, particularly if the discharge is to continue into the Estuary and a contact recreation standard is to be achieved. It is almost certain that a modified pond system could not achieve such a standard of disinfection reliably, particularly as there is a contribution of faecal bacteria from wildlife that use the ponds. In the past chlorine dosing was the usual method of achieving bacterial reductions, however with the large quantities of chlorine required on wastewaters and with growing concerns about the resulting chlorine compound residuals in the environment there has been a strong move towards the use of Ultra Violet light as a means of disinfection of wastewaters. Standard UV systems usually require a clear effluent relatively free of suspended solids to be effective at killing the bacteria. An effluent high in suspended solids is much less effective or requires a very much higher input of power to achieve the desired result.

Normally wastewaters would be disinfected directly after the treatment plant and **before** entry to the ponds where the effluent is clearest with very little suspended solids. However the advantage of disinfecting **after** ponds is that there is then an attempt to kill all the bacteria including the bird bacteria. An additional advantage of UV after the ponds is that the ponds act as a reservoir buffer to the peak flows, smoothing the flow rate and allowing a smaller UV plant. This results in lower capital costs and more importantly lower operating costs. The disadvantage of disinfecting after the ponds is that the ponds will have higher suspended solids than a discharge direct from the treatment plant. This will increase costs, firstly as a result of the higher UV dose requirement (hence higher power requirement) and secondly as a result of the need to clean the UV tubes more frequently either mechanically or manually. As an indication the approximate electrical operating costs alone for a full-scale plant in Christchurch operating on a clear effluent at average flow is $315,000 per year. (Based on a scale up of the Tauranga Plant) This would be much higher when operating on turbid effluent after the ponds.

NEW DISINFECTION TECHNOLOGY

(a) **UV Tube Wiping**

It is not usual for UV disinfection to be used on oxidation pond effluent in (ie on effluent **after** ponds). There are however two small modified UV disinfection plants operating on oxidation pond effluent in Australia and two very small standard UV plants operating on Oxidation Pond effluent in New Zealand. The flow at these plants is very small. The modification to overcome algae and scale build-up on the UV tubes is basically a wiping system on the UV lamps to maintain cleanliness of the lamps and increase the time between manual cleaning events. Both of the major manufacturers of UV systems now offer the wiping system modification as standard. Other suppliers are expected to follow suit.

In summary UV operation on pond effluent and new UV wiped systems are new to the market and currently have only operated on small scale systems generally with variable results.

(b) **SIG Technology**

The Christchurch Wastewater Treatment Plant provided assistance to a laboratory scale trial of a new UV technology in 1999. This system using the proprietary name of SIG Technology, is the most promising of a number of possible new disinfection technologies. This new technology provides an additional process before the standard UV process to enhance the effectiveness of the system and to greatly reduce the power requirements for achieving disinfection. This SIG Technology UV system has now been progressed to the stage of full pilot trial capability, and potentially will reduce power consumption by 80% and provide an effective kill of protozoa in addition to bacteria and virus. These claims have yet to be substantiated for wastewaters typical of Christchurch.

(c) **High Voltage Disinfection**

The University of Canterbury Electrical Engineering Department has developed and now market this technology for potable water purification and has recently done some testing of the technology on oxidation pond effluent. The success of this initial testing leads to the possibility of trialing the High Voltage disinfection system beside other disinfection systems.

PROPOSED TRIAL

The proposed trial will test the effectiveness of the new High Voltage disinfection, conventional UV disinfection and the new SIG UV Technology system in a side by side trial on wastewater from the Christchurch oxidation ponds. The trial will establish firstly background levels (initial testing) of a range of pathogenic organisms and indicator organisms and then secondly effectiveness of each of the technologies for killing the organisms.

This trial will first and foremost test the effectiveness of these technologies in disinfecting oxidation pond effluent. A second important aspect of the trial will be the relative power use required to achieve the appropriate level of disinfection in each case. This would be the first time some of these organisms have been tested for in Christchurch's wastewater, and the first time such a wide range of organisms would be investigated. In addition to the main trials on pond wastewater, a longer term (one month) trial is proposed for the SIG Technology UV system and High Voltage system to assess performance over time on a limited number of organisms.

This trial will clearly assess the effectiveness of UV as a disinfection option on pond wastewater and allow the comparison of conventional UV technology with a new SIG UV technology and the High Voltage disinfection technology of potentially much lower operating cost.

COST OF TRIAL

A proposal has been sought from Woodward Clyde Limited (Engineering and Environmental Consultants to Christchurch City Council) to set up, manage and report the trial results.

• Project Management and Reporting	9,900	
• Set Up Costs	25,354	
• Initial Testing	8,386	
• Main trials	91,890	
• High Voltage set up and testing	45,000	
• Contingency (10%)	18,053	
	198,583	
Total Say	**200,000**	(excludes GST)

It is proposed that the Council will provide analysis for all the routine parameters. These costs are not included above (value approximately $5,000). It is proposed that equipment suppliers would supply all necessary equipment and on site electrical generation free of charge (value $13,000). The Councils share of the costs including contingency would be $200,000. While this appears a large sum, analysis for viruses and protozoa has historically always been very expensive. Of the initial testing and main trials above (total $110,276), $91,086 is taken up by this analysis for these non-routine organisms.

FUNDING FOR TRIAL

The annual operating budget for the Christchurch Wastewater Treatment Plant for the current year is $4.492m and as detailed in the 5 month report this will be underspent by an estimated $500,000 at the end of June 2000. The underspend will result mainly from reduced maintenance costs, higher than budgeted Trade Waste revenue and reduced biosolids polymer purchase costs. It is proposed in the five month report that $150,000 of this underspend be used to fund the proposed UV trials as outlined above and that the remaining funding, $50,000 come from the 2000/2001 Christchurch Wastewater Treatment Plant Upgrade Investigations Allowance. (Note that 14 February Strategy and Resources Committee approved the suggested method of funding the $150,000 element).

SUMMARY

This report recommends funding trials on the effectiveness of current and new sterilisation technology on Christchurch Wastewater Treatment Plant pond effluent including testing for a wide range of pathogenic organisms. These trials will show whether we can successfully operate UV treatment after the oxidation ponds, and if both trials are successful operating costs could be reduced by more than $200,000 per year.

Subcommittee Recommendation:

1. That the Waste Management Unit proceed with the UV trial as proposed in the report. (Note that 14 February Strategy & Resources Committee have already approved funding up to $150,000 from under expenditure in the 1999/2000 Wastewater Treatment Plant operating budget.)

2. That discussions be held with the University of Canterbury on the provision of testing of the high voltage system alongside the SIG Technology and conventional UV system, and that the cost of $50,000 be met from the 2000/01 budget for the Capacity Upgrade work.

3. That staff be asked to seek (i) an undertaking that any manufacturing of the new technology plant be based in Christchurch, or, alternatively, (ii) other ways of securing the Council's investment in the new technology.

   Note: SIG have now undertaken to base their manufacturing plant in Christchurch – refer letter of 22 February 2000 attached.

Chairman's Recommendation: That the above recommendation be adopted.