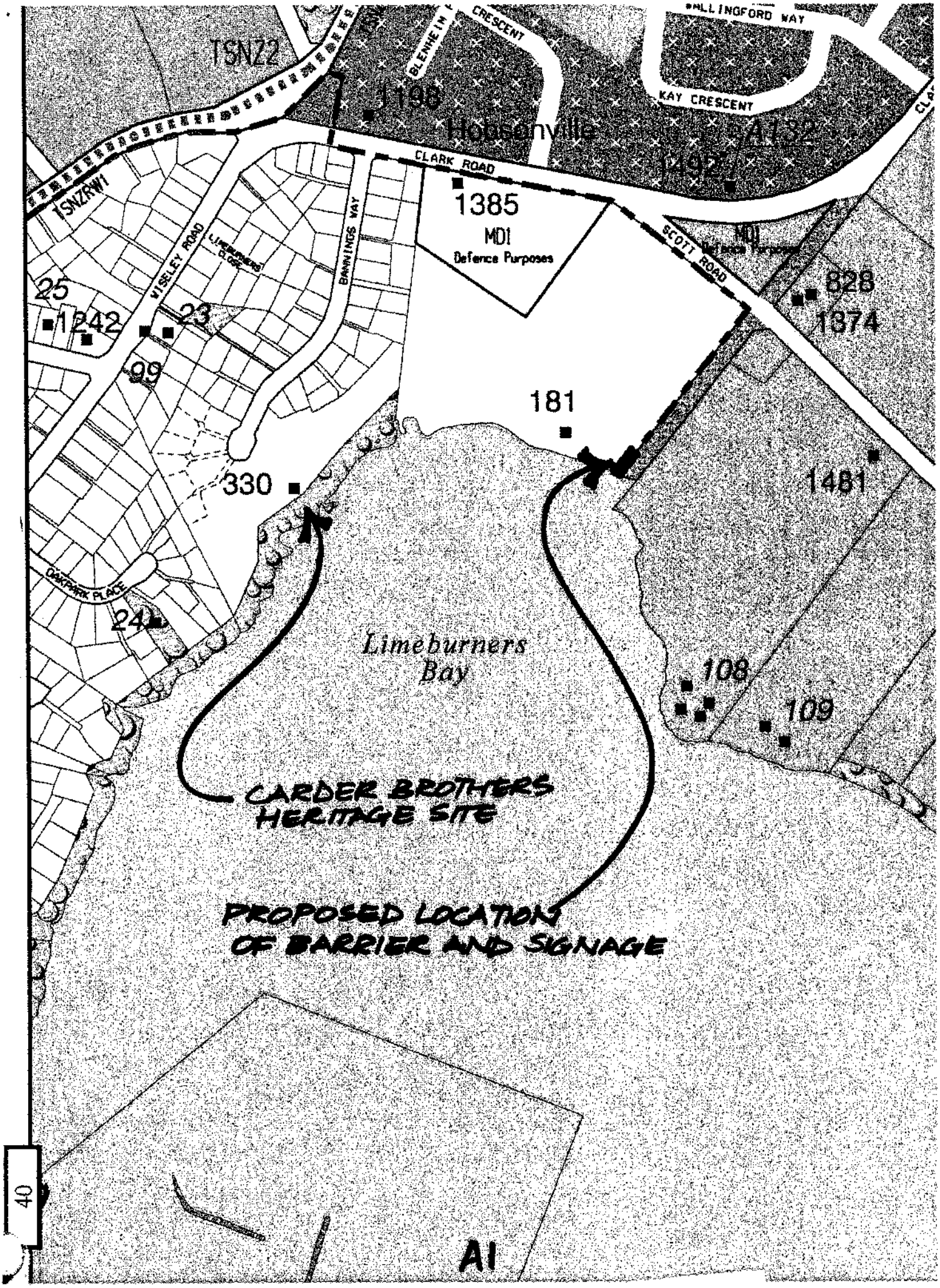
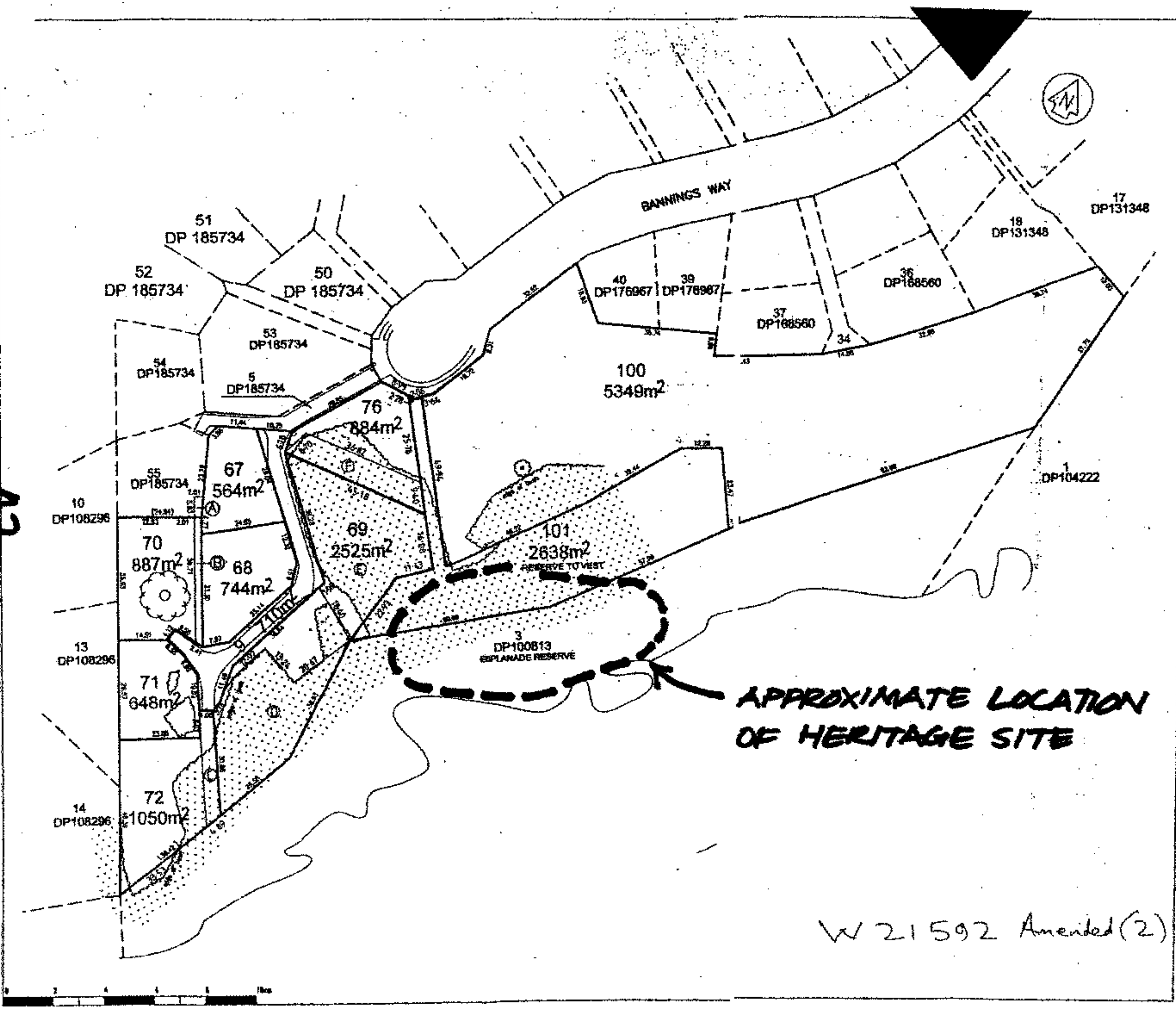

TSNZ2
TSNZRW1
1198
Hobsonville
A132
1492
CLARK ROAD
1385
MD1
Defence Purposes
SCOTT ROAD
828
1374
1481
181
330
25
1242
23
99
24
VISELEY ROAD
LIMEBURNERS CLOSE
BANNINGS WAY
OAKPARK PLACE
BLENHEIM CRESCENT
ALLINGFORD WAY
KAY CRESCENT
Limeburners Bay
108
109
CARDER BROTHERS HERITAGE SITE
PROPOSED LOCATION OF BARRIER AND SIGNAGE
A1



LOCAL AUTHORITY WAITAKERE CITY
COMPRISED IN CT 116A/821
SURVEY BLK & DISTRICT X WAITEMATA
TOTAL AREA 1.9871 ha
LEVELS ARE IN TERMS OF LANDS AND SURVEY DATUM
AREAS AND MEASUREMENTS ARE SUBJECT TO SURVEY

AMALGAMATION CONDITIONS

That Lot 8 hereon (legal access) be held as to 6 undivided one-sixth shares by the owners of Lots 67,68,69,70,71 and 72 hereon as tenants in common in the said shares and that individual Certificates of Title be issued in accordance therewith.

That Lot 5 DP185734 hereon (legal access) be held as to six undivided one-eighteenth shares by the owners of Lots 67,68,69,70,71 and 72 hereon as tenants in common in the said shares and that individual Certificates of Title be issued in accordance therewith.

That Lot 34 DP168560 hereon (legal access) be held as to 1 undivided one-third share by the owner of Lot 100 hereon as tenants in common in the said share and that on individual Certificate of Title be issued in accordance therewith.

Areas C, D, E & F are to be subject to restrictive covenants.

MEMORANDUM OF EASEMENTS

Purpose	Shown	Servient Tenement	Dominant Tenement
Sanitary Sewer	(A)	Lot 35 DP185734	Lots 67 – 7
	(B)	Lot 70	Lots 67 – 8 & 71 – 72

	NAME	DATE
SURVEYED	K.C.	2/02
DESIGNED	W.B	2/02
DRAWN	W.B	4/02
CHECKED		5/02
APPROVED		

CATO BOLAM CONSULTANTS
SURVEYORS PLANNERS
LAND DEVELOPMENT CONSULTANTS

CLIENT
BANNING
LIMEBURNERS BAY
WEST HARBOUR

DRAWING TITLE
SUBDIVISION STAGE 6B

ORIGINAL SCALE	ORIGINAL SIZE	REVISION NO
1:750	A2	
DATE	CAD REFERENCE	SHEET NO
	W142...	
DIRECTORY		JOB NO W142

APPENDIX A

CH2M BECA REPORT : ALTERNATIVE DISINFECTION SYSTEM FOR WAITAKERE WEST WAVE COMPLEX (5 May 2003)

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WAITAKERE CITY COUNCIL
- 6 MAY 2003
566574

CH2M Beca

Waitakere City Council
Civic Centre
Waipareira Ave
Private Bag 93109
HENDERSON

5th May 2003
Our Ref: 6511856/010 – Rev B
L1:98490-JFC34L01.DOC

RECEIVED ON
0 6 MAY 2003
BY PROJECT MANAGEMENT

Attention: Chris Thomas

Dear Sir

Alternative Disinfection System For Waitakere West Wave Complex

1 Introduction

Following a chlorine gas leak at Waitakere City Councils (WCC) West Wave Complex in November last year CH2M Beca were engaged by WCC to carry out the investigation into the cause of the incident along with a number of associated investigations.

One area where WCC have requested further information is the suitability and cost associated with switching to a sodium hypochlorite based chlorination system at the West Wave Complex.

This letter report will address the following:

- Detail the pros and cons associated both with chlorine gas systems and sodium hypochlorite systems.
- Comments on the apparent trend within the industry to adopt the use of sodium hypochlorite
- Provides budget capital and operating cost for a sodium hypochlorite system

2 Pros and Cons of Chlorination Systems

Chlorine gas and sodium hypochlorite are chemically identical when dissolved in water at the same pH. Hence there is no difference in the disinfection level provided. Differences can be broken down into Health and Safety issues and Operational issues.

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2.1 Safety Issues

- Both chemicals are hazardous, however the nature of the hazards differ.
- Chlorine gas is toxic and a strong oxidant, and will burn skin but the main hazard is through inhalation.
- Sodium hypochlorite is caustic and a strong oxidant and will burn skin and eyes.
- The use of chlorine gas requires a higher level of staff training.
- In general, sodium hypochlorite being a liquid will not disperse over a wide area, and hence the hazard is more confined, and less likely to be a public Health and Safety issue.
- The exception to this is that if hypochlorite is inadvertently mixed with an acid, chlorine gas will rapidly come out of solution, creating a hazard similar to a chlorine gas leak.

2.2 Operational Issues

- Sodium hypochlorite will require a larger storage facility compared with chlorine gas, being a 15% solution, where chlorine gas is 100% available chlorine.
- Sodium hypochlorite decays in storage and 2-4 weekly deliveries would be required, compared to 6 weekly replacement of the 920 kg chlorine drums.
- Sodium hypochlorite dosing equipment would be considered slightly less reliable than chlorine gas, but given a well designed installation, reliability for hypochlorite dosing should be adequate.
- Sodium hypochlorite will have a lower Health and Safety cost (less staff training and safety equipment).
- Sodium hypochlorite requires acid addition for pH correction, whereas chlorine gas requires base addition.
- Sodium hypochlorite is likely to give better control characteristics on smaller pools.

3 Trends Within The Industy

The best available data suggests that some 60-75% of New Zealand pools are using sodium hypochlorite, with the remainder (excluding smaller facilities) using chlorine gas.

AS

There appears to have been a trend away from the use of chlorine gas within the New Zealand swimming pool industry in recent years. Wellington City Council is an example of a facility operator that made the decision to switch to sodium hypochlortie after they had a gaseous chlorine incident.

Although there is no regulatory driver, it should be recognised that the regulations relating to the storage of chlorine gas are more onerous than those for sodium hypochlorite (The Dangergous Goods Regulations 1980 and AS/NZS 2927:2001 - *The Storage and Handling of Liquified Chlorine Gas*).

The shift away from chlorine gas appears to be based on the perception that alternatives are safe and gas systems are not.

Whilst there is no disputing that chlorine gas is a hazardous substance, it should be recognised that sodium hypochlorite is not a risk-free option. In figures compiled by the Chlorine Gas Disinfection Association (based in Pennsylvania, US), in response to the shift to sodium hypochlorite installations, sodium hypochlorite is reported to be responsible for serious gas release in approx. 30-35% of all chlorination incidents. Calcium hypochlorite contributes 25-30% and chlorine gas the remainder.

4 Cost Estimate for Conversion to Sodium Hypochlorite

A budget costing exercise was undertaken to provide an estimate of the capital cost required to switch the Aquatic Centre to sodium hypochlorite and of the likely operating costs. It should be noted that all costs are for comparative purposes only and should be considered to have an accuracy of +/-30% and exclude GST.

4.1 Capital Cost

Chlorine gas is acidic, where sodium hypochlorite is basic, and hence the cost of pH correction needs to be considered. We have assumed the use of carbon dioxide as an acid pH correction if sodium hypochlorite is dosed, due to its greater safety and ease of handling compared with alternative acids.

The capital cost of installation of sodium hypochlorite and carbon dioxide storage and dosing facilities is estimated at **$160,000**.

We have also provided cost estimates for consultancy fees associated with the design, installation, commissioning and training process. These are detailed in Table 1.

Table 1

Estimate of Consultancy Fees

Item	Est Cost ($)
Project Management	4,000
Design and procurment	15,500
HAZOP workshop	3,500
Commissioning	8,500
O&M Manuals	4,000
Training	3,000
Total Fees	**38,500**

4.2 Operating Cost

The current operating costs and chemical consumptions were provided by Doug Guthrie and are included for comparison purposes. Costs of chemicals not currently used were obtained from suppliers.

In the current figures it is not clear how much of the sodium bicarbonate on the existing facility is used for alkalinity addition, it has therefore been assumed that 7 x 25kg bags of sodium bicarbonate will be used for alkalinity addition if the facility was using sodium hypochlorite. The chemical consumptions and costs are shown in Table 2.

Table 2

Operational Cost Comparison

	Chlorine Gas	Sodium Hypochlorite
Chlorine	8,000 kg/annum @ $2.55/kg = $20,400/annum	8,000kg/annum as chlorine @ $3.66/kg as chlorine = $29,280
Soda Ash	2,600 kg/annum @$0.75/kg = $1,950/annum	$0
Sodium Bicarbonate	18,200 kg/annum @$0.72/kg = $13,100/annum	7,350 kg/ annum @$0.72/kg = $5,290/annum
Carbon Dioxide (acid)	$0	9,600kg/annum @ $1/kg = $9,600 / annum
Total	**$35,450/annum**	**$44,170/annum**

5 *Issues Associated With Conversion to Sodium Hypochlorite.*

The following is a list of issues that will need to be considered should the West Wave complex be converted to sodium hypochorite:

- Consideration of the contract implications with the original contractors and sub-contractors will be required.
- There will be pool shutdowns and service interruptions during the conversion. The pros and cons of a complete facility shutdown (short duration) compared to phased pool shutdowns (long duration and added complexity and cost) should be assessed.
- Chemical storage requirements are greater. Storage facilities will most likely be situated outside in the staff car park. This will mean a loss of car parking capacity.
- Centre staff will need to be aware that sodium hypochlorite decays, therefore the ordering and turnover of deliveries will have to take into account expected bather loads and pool useage.
- Access requirements for sodium hypochlorite bulk deliveries will have to be considered.
- There will be more M&E equipment in the plants and thus the maintenance requirements will increase.
- The current Deplox PID controllers will need to be retuned for use with CO_2 and sodium hypochlorite. This should be carried out during process commissioning, however further tuning will be required once bather load is re-introduced to the pools.
- There will be a requirement to retrain the plant operators.

6 *Conclusions*

The following conclusions can be drawn from this review and costing exercise:

- Wellington City Council converted to a sodium hypochlorite disinfection system following a chlorine gas incident.
- In NZ there is a trend away from chlorine gas with increased usage of sodium hypochlorite.
- Whilst there are still risks associated with a sodium hypochlorite systems, these are of a lesser nature and are more manageable than chlorine gas.

- The capital cost of converting to sodium hypochlorite is estimated to be $198,500 excluding GST(Accuracy of ±30%).
- The annual running costs of using sodium hypochlorite (and the associated pH correction chemicals) will be approx 1.25 times higher than using chlorine gas.

7 *Recommendations*

It is recommended that Waitakere City Council use the cost data and information provided to further evaluate their strategy for disinfection at the West Wave complex.

Yours faithfully
CH2M Beca Ltd

Clive Rundle
Technical Director Water

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Email: crundle@beca.co.nz

Chief Executive	
Corporate Services	
City Services Moselle	
Consultancy Services	✓
ECO WATER	
Strategic Group	
Consent Services	
Field Services	

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