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Committee Utility Services
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Relocation of the Point Howard Pumps

1. Purpose

To background the seismic risks associated with the Randwick Valve Chamber which houses the Point Howard pumps and outline a proposal to build a new pumping station in Eastern Bays Marine Drive.

2. Background

This report provides background information for one of the major capital projects that is scheduled to start in the 2003/04 financial year.

The Wellington Region generally and the wholesale water supply network is exposed to seismic hazards from a number of different fault sources. The 1991 *“Lifelines in Earthquake Wellington Case Study”* identified the wholesale water supply as vulnerable to seismic effects. *The Wellington Regional Council Bulk Water Supply – Seismic Assessment July 1993* showed the Randwick Valve Chamber which houses the Point Howard pumps as vulnerable to strong ground shaking and liquefaction.

In July 1999 Sinclair Knight Merz carried out a seismic review of the Randwick Valve Chamber. The review showed there is a high probability of sustained damage during a moderate or major earthquake event. The major concern was flooding of the valve chamber due to dislocation of the access tunnel and roof slabs. Subsequently a new pumping station in Eastern Bays Marine Drive has been investigated.

Now is an opportune time to relocate the pumping station as Hutt City Council is redeveloping the Hutt Park site and the area around the Greater Wellington Water facility.

3. Seismic Hazard

Seismic hazards to the wholesale water supply include movement of the Wellington Fault, movement of the West Wairarapa Fault, movement of other faults in the Region producing strong ground shaking, and earthquakes at more remote locations. The Lifelines Group adopted the Wellington Fault event as the more severe seismic scenario for consideration of seismic impact on lifelines such as the wholesale water supply.

Typically a Wellington Fault event would have a Richter magnitude of 7.5 with approximately five-metre horizontal and one-metre vertical fault movement. The event has an average recurrence interval of 600 years, and an elapsed time since the last rupture of approximately 340 to 490 years. The probability of a Wellington Fault event occurring in the next 50 years is approximately 10%.

The valve chamber is located in an area with a high potential for liquefaction approximately three kilometres from the Wellington Fault.

4. Existing Randwick Valve Chamber

4.1 Description

The Randwick Valve Chamber (in which the Point Howard pumps are located) at Hutt Park is adjacent to the roundabout at the intersection of Seaview Road, Waione Street and Randwick Road as shown on Figure 1. Built below ground in around 1980 it has two adjacent chambers (5.3 by 7.1 metres and 8.3 by 6.4 metres in plan, approximately 2.7 metres deep). The roof upper surface, approximately one metre above mean sea level, is flush with the Hutt Park parking area as shown on Figure 2.

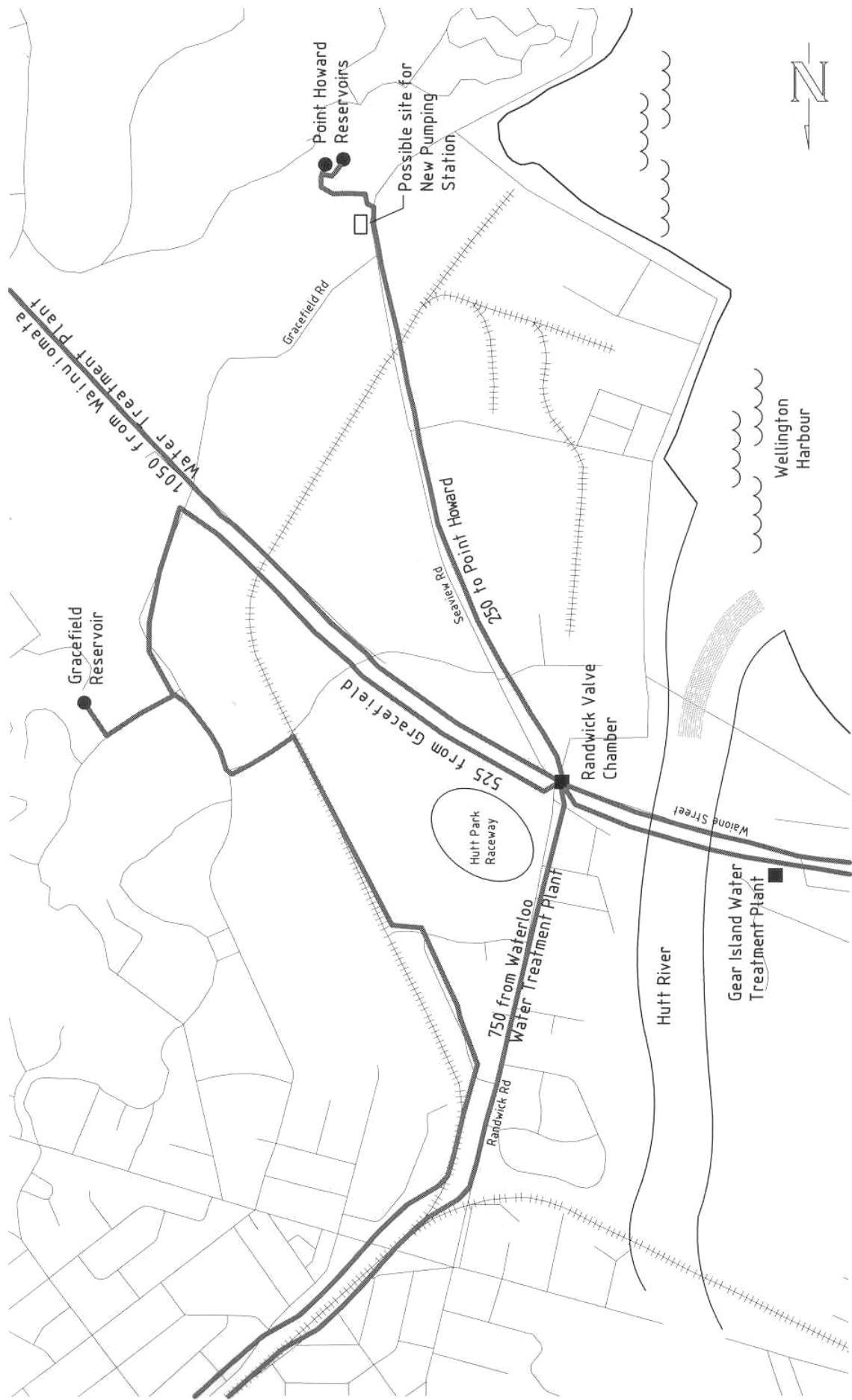


Figure 1 Randwick Valve Chamber and Proposed Point Howard Pumping Station



Figure 2 Existing Valve Chamber located under carpark at Randwick (above ground control room on the left)



Figure 3 Proposed Point Howard Pumping Station site

An above ground control room (nine by four metres) is linked to the valve chamber by a seven metre long access tunnel formed from concrete box sections.

The chamber houses pipework and valves associated with the connection of pipelines from the Waterloo Water Treatment Plant, and the Wainuiomata Water Treatment Plant to Wellington. Also housed in the chamber are the Point Howard pumps which provide the only supply of water for Eastbourne via the Point Howard reservoir.

The Point Howard pumping station supplies approximately 4,700 people (2001 Statistics NZ urban resident population). Hutt City Council is currently redeveloping the Hutt Park entrance at Randwick Valve Chamber. The new entrance will be off the roundabout and immediately adjacent to the above ground control room.

4.2 Seismic Risk to Existing Valve Chamber

Ground distortion at the site is highly likely due to liquefaction. Differential ground movement will mean the control building will require replacement during the restoration period and damage to pipelines at the chamber.

Liquefaction and resultant lateral spreading will restrict the adjacent Awamutu and Waiwhetu stream flow to the extent that the low-lying area of the chamber site will be flooded. General subsidence of one metre from a Wellington Fault event would probably further aggravate flooding in the area.

It is expected that the valve chamber will be filled with water and sand within an hour of a Wellington Fault event through joints opened up by differential movement between tunnel segments and roof panels. Even for smaller earthquakes (with return periods of 30 to 100 years) the chamber is likely to be flooded in a number of hours due to opening of the joints.

Flooding of the chamber may damage pump motors beyond repair or at least require their full cleaning and rewiring. If the chamber can be drained and the motors are repairable then it could be up to approximately three weeks before the facility is operable. Should the motors require replacement delivery of new motors could take approximately six to eight weeks.

The time to restore water after a seismic event is critical. The total time to recover is influenced by the extent of damage, resources available and priority assigned to the work. Estimates of recovery times are difficult, as there will be very high and competing demands on available resources following an earthquake. Any pre-earthquake capital improvements and planning that significantly reduces the time to recover will be very advantageous. The length of time to recover will be dependent on any necessary upstream repairs.

4.3 Seismic Mitigation

Significant modification is required to reduce the risk to the valve chamber. Even with modification the chamber would still be vulnerable to damage including flooding. Given the subsidence, liquefaction and lateral spreading potential of the low-lying area it could be very difficult to protect the pump motors from flooding.

Mitigation would include construction of a new control building, decommissioning of the access tunnel, provision of new roof access to the valve chamber and modification of roof panel seals. The estimated cost of mitigation is \$200,000.

4.4 Point Howard Pumps

The Asset Management System shows the Point Howard pumps were installed in 1981 with an expected life of 30 years. Switchgear was installed in 1978 with an expected life of 25 years and is now at the end of its life. A review of pump motors in 2000 showed that, the motors had low class insulation with a shorter life than expected and, the motors should be upgraded. Recent pump efficiency testing showed that one of the pumps in particular had a low efficiency. Refurbishment of the pumps and switchgear is expected within the next five years at an estimated cost of \$330,000.

4.5 Conclusion

Pumps and switchgear are at or near the end of their expected lives. Under moderate and Wellington Fault seismic events the valve chamber would be flooded due to dislocation of the access tunnel and roof panels. Limited seismic mitigation is possible. However, due to the low-lying area and high potential for liquefaction, mitigation from flooding of the Point Howard pumps may not be totally effective. The cost of seismic mitigation and refurbishment of the Point Howard pumps is estimated at \$530,000.

5 Possible New Point Howard Pumping Station

5.1 Description

A new pumping station approximately seven by four metres is proposed on Eastern Bays Marine Drive near the intersection with Gracefield Road. The site is located at the foot of the hillside as shown on Figures 1 and 3. The building would be of concrete block construction set back from the carriageway. The site is adjacent to the existing rising main to the Point Howard reservoir minimising pipe laying. The property owner has granted approval in principle for use of the site.

Alternative sites along Seaview Road were considered but discounted as they would be on reclaimed land and subject to potential liquefaction. Possible sites in Gracefield Road were considered but were over \$60,000 more expensive due to additional pipe laying.

5.2 Seismic Risk

A specially designed pumping station is proposed that will withstand rock falls from the hillside above the site. Small irregular falls are likely throughout the life of the structure. A major seismic event could trigger large rock falls of up to approximately 200m³ of material falling onto the pumping station. Subsequently rock falls would need clearing to reach the pumping station.

5.3 Proposed Work

A new pumping station with a specially designed sloping roof and a strong back wall will be constructed to house new pumping equipment and switch boards at the Eastern Bays Marine Drive site. Existing pumps, motors and switchgear at Randwick Valve Chamber would be decommissioned and removed. The existing Randwick Valve Chamber control building, transformer and tunnel would be demolished. A new roof accessway into the valve chamber would be provided.

Hutt City Council are currently constructing a new access road into Hutt Park from the Randwick Road roundabout. The new access road has been designed to clear Greater Wellington Water structures but the control building and transformer would be very prominent adjacent to the new entrance. Hutt City Council acknowledges that removal of the control building and transformer would have significant aesthetic benefit to the Hutt Park entrance and associated landscaping possibilities. In recognition of this, Hutt City Council has offered a contribution of \$30,000 towards relocating the pumping station.

The total cost of the new pumping station and demolition at Randwick Valve Chamber is estimated at \$600,000 after taking into account Hutt City Council's contribution.

6 Comparison

A comparison of the existing site and proposed new pumping station is:

	<i>Existing Site</i>	<i>New pumping station Eastern Bays Marine Drive</i>
<i>Estimated Cost</i>	\$530,000	\$600,000
<i>Problems associated with Wellington Fault event</i>	Flooding and damage to pump motors	Soil and rock slides
<i>Mitigation</i>	Some mitigation possible but site still prone to flooding	Building designed to withstand rock falls
<i>Access to site following Wellington Fault event</i>	Possibly impeded by flooding	Rock falls to be cleared
<i>Landowner</i>	Hutt City Council would prefer the site cleared	Agreement in principle

7 Summary

The existing Point Howard pumps at Randwick Valve Chamber are vulnerable to flooding as a result of moderate and Wellington Fault movement seismic events. After a seismic event and depending on the damage to the pump motors, it could be approximately eight weeks before the site is operable.

Seismic mitigation at the existing valve chamber will reduce but not eliminate the potential for flooding. The Point Howard pumps and switchgear are due for refurbishment within the next five years. The cost of seismic mitigation at Randwick Valve Chamber and refurbishment of the Point Howard pumps is \$530,000.

To reduce seismic risk a new specially designed pumping station should be constructed on the Eastern Bays Marine Drive at a cost of \$600,000. While the new pumping station is slightly more expensive, shifting to a new site moves the Point Howard pumps away from a site vulnerable to flooding after a seismic event.

Now is an opportune time to relocate the Point Howard pumps given the refurbishment of the Point Howard pumps and switchgear in the near future, the Hutt City Council development at Hutt Park and the reduced seismic risk of the proposed site.

8 Recommendations

That the Committee:

1. *receive the report.*
2. *approve the relocation of the Point Howard pumps.*
3. *note that \$600,000 has been included in the Capital works programme over the next two financial years for a replacement pumping station.*

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