

# CASE STUDY

## LIVING IN AN EARTHQUAKE ZONE

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### PRESTONS PARK, CHRISTCHURCH, NEW ZEALAND

New Zealand's second-most populous city, Christchurch sits on an active seismic fault and in 2011 the city made headlines around the world when it was hit by a major earthquake, which caused widespread damage and killed almost 200 people.

One of the major issues that can arise in the event of an earthquake is that pipes break, spewing sewerage onto family lawns and into environmentally sensitive areas. Given the ongoing threat of seismic activity, Ngai Tahu Property wanted a system for its new Prestons Park residential development that was safe and resilient.

It was clear that traditional gravity sewers would not meet the needs of a city that was prone to earthquakes. After extensive research in Japan on the effects of their sewer networks after earthquakes, it was found that vacuum sewerage systems, which are well used throughout Japan, would be the best technology for Christchurch.

Since the February 2011 quake, the Christchurch City Council has rezoned a large number of sections for housing and with the urgent need to house more than 10 000 displaced and homeless residents, new land subdivisions such as Prestons had to be urgently developed.



Prestons Park, Christchurch

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### key outcomes

- 1.** **SINGLE VACUUM PUMP STATION**  
One station can handle the whole development. This lessened capital costs and saved on space that would otherwise have taken up valuable housing space. As the pump station is the only location where power is required then the system becomes more resilient during earthquakes and power outages. A backup generator can still ensure that the whole system continues to operate.
- 2.** **SHALLOW TRENCHES FOR EXCAVATION**  
All vacuum mains are installed at less than 2 meters in depth. As this area had a high water table, this ensured no holdups due to dewatering, this reduced costs. It also meant that construction of the sewer system was a lot faster than even the developer thought was possible.
- 3.** **LOW MAINTENANCE COSTS**  
The vacuum system at Prestons has proven to be reliable and trouble free. There has been no evidence of infiltration from either the high water table or storms. This has allowed for an increase in density as the system has spare capacity and the wet weather allowance has not been required.

### THE CHALLENGE

Design a sewerage system for a new residential development located within an earthquake zone. Ensure it is safe, reliable and flexible enough to withstand a natural disaster, while also serving the needs of a fast-growing suburb.

Residential areas have other characteristics that require flexible solutions. For instance, flows from schools are interrupted during holidays and weekends, which can lead to problems if there is not enough air entering the sewerage system. In addition, Prestons Park incorporates a number of commercial developments, including a petrol station, supermarket and car wash, each of which have their own peaks and troughs in terms of flow volumes.

It was also important to design a system in an area that had a very highwater table that created concerns about future infiltration from not only ground water but also from storm runoff.

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### THE FLOVAC SOLUTION

One key feature of Flovac's system is its use of negative pressure. In the event of a vacuum-mains break or rupture, especially during an earthquake, the negative pressure prevents sewage from leaking out.

In contrast, low-pressure pump systems rely on positive pressure, which causes sewage to spill into surrounding residential and sensitive areas if a pipeline breaks.

Flovac's vacuum sewer system is particularly suited for residential areas with community facilities like schools and commercial establishments such as supermarkets and petrol stations.

For example, its air inlet system is designed to ensure a constant supply of air, which adjusts automatically during periods of varying usage, like school holidays. The system also accommodates high flow volumes, making it ideal for commercial operations such as car washes.

All collection pits for the sewer are in the berm at the side of the road and not on people's properties. So there are no requirements for easements and operators do not need to enter anyone's yard.



Vacuum Pump Station Training Session



Marshlands School with Collection Pits and Flovac Pillars

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## GREEN INFRASTRUCTURE

*'Flovacs' system has set a new standard for residential developments in the Christchurch region. It has delivered on its promise of reliability and resilience and helped ensure Prestons Park is a world class project.'*

**Bob Smith, Ngai Tahu Property.**

## THE RESULTS

Prestons has become a sustainable residential precinct which can accommodate over 2,300 houses, 8 000 residents, commercial and retail developments, a school and supermarket. While any development project of this scale in Christchurch would usually take up to 15 years to complete, the scale of the crisis meant that it was essential that this project be completed in less than half of that time.

The whole site can also be serviced by one vacuum sewage pump station with pipes only needing to be placed in shallow trenches above the water table.

Because the vacuum mains are made of polyethylene, they can both stretch and bend making them extremely resilient during earthquakes, and able to provide uninterrupted service during a power outage. The vacuum system is not only earthquake resilient but reduces impact from construction, hazardous situations and pollution and waste, as well as conserves energy. This is just one of the innovations that are ensuring Prestons is a thriving new community in Christchurch.

The Flovac Vacuum Pump Station was installed in 2015 and it has grown in line with the residential development's expansion.

The system has exceeded the developer's expectations in terms of ongoing operational benefits. In particular, the system's operators have had virtually no need to enter residents' properties to deal with sewerage management issues.

for more information

Join us in shaping a sustainable future. To learn more about how Flovac is leading the change in environmental engineering and how we can assist in your wastewater management needs, contact us at [info@flovac.com](mailto:info@flovac.com)