



Site 10 – Structural Effects

Site 10 presents a reasonably significant challenge from a natural hazard perspective with its high shaking hazard, liquefaction/lateral spreading potential and susceptibility to Tsunami/Seiching waves. The site is also relatively low and could be subject to potential, occasional, future inundation, particularly as a consequence of prolonged sea-level rise. The structural and architectural design mitigates these issues with a high-performance structure expected to perform well in excess of code minimum requirements. In addition the development will result in the remediation of existing in-ground contamination.

The liquefaction and lateral spreading arises through the relatively un-compacted reclamation fill dating from 1900. As part of the development significant sub-ground mitigation will be provided to address the liquefaction/lateral spreading potential through the use of Deep-Soil-Mixing [DSM] a technology that uses a deep drilling auger to mix cement with the underlying soils to form a grid of weak-concrete walls, spaced at around 4m centres, over the whole site. This grid of walls provides five functions; confinement of the liquefiable soils, lateral bracing down to the non-liquefiable sub-strata, a platform on which to found the new structure, encapsulation of contaminated material and effective cut-off of contaminated ground-water flow towards the harbour.

Localised de-watering will occur during construction to enable formation of the basement slab. The de-watering will be restricted to zones within the grid of DSM wall and typically will only lower the water table by 1m to 1.5m. This will be a localised effect, due to the presence of the DSM walls and the ready re-supply of water from the groundwater and the sea. Accordingly, water-tables beneath neighbouring buildings will not undergo significant change. In any event, the buildings in the immediate vicinity are deep-founded and so would not experience loss of support as a result of ground water changes.

Above the foundation the building superstructure will be base-isolated to provide an extremely high level of seismic life-safety protection coupled with damage avoidance, business continuity and protection of contents. Base isolation will provide seismic, life-safety performance in excess of Importance Level 3 [IL3]. Above the base isolators the structure will be predominantly steel-framed to provide the strength and resilience at the least weight. The upper floor slabs will be reinforced concrete.

Below the isolation plane will be a single-level, tanked basement to provide space for services and off-waterfront parking. Excavated material from the basement will be tested for contamination and treated/disposed as appropriate.

The new building ground floor will be set as high as practicable while still providing access from existing waterfront levels. This means that the ground floor and basement levels may become susceptible to occasional inundation as a result of sea-level rise after approximately 100 years. Future mitigation to prevent flooding of the ground floor will be possible by simply raising the building at the isolator level. Lifting technologies capable of raising the building structure are already in existence. Mitigation options to prevent flood waters from entering the basement will include raising of the crest to the vehicle ramp, together with the surrounding ground surface levels and/or the installation of flood-gates that could be used for the duration of an exceptionally high tide event.

As with other low-lying properties around the Wellington region, ground floor spaces may be inundated during Tsunami or Seiching waves. The first floor level has been set sufficiently high to avoid damage, based on maximum wave height predictions. While significant damage could be expected to the ground floor non-structural elements, the primary structure will have sufficient resilience to resist the wave actions.

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