ATTACHMENT 4: ENVIRONMENTAL EFFECTS SUMMARY

Note - the technical reports on which this summary is based are all available on request.

URBAN DESIGN EFFECTS

The urban design effects of the NDH have been assessed by **McIndoe Urban**, in the context of the existing environment, Dunedin City Council strategies and plans for the Central City, and the 2GP provisions that seek that streetscape amenity is maintained and enhanced, including through use of landscaping, and ensuring an architecturally interesting **façade** through building modulation and the use of glazing. Assessment of the development against Crime Presentation through Environmental Design (CPTED) principles has also been undertaken by **Boffa Miskell**. The findings of those assessments are summarised below.

The height of the NDH buildings will be conspicuous in many views. While the overall effect is appreciable, it is not however considered necessarily to be negative. Dunedin's city centre is already characterised by large and tall buildings and is therefore inherently capable of absorbing change with additional such buildings. These existing large and tall buildings are spread widely around in a series of clusters to create a polycentric urban form. The additional cluster formed by the proposal is located close to the city centre. Being well within the bounds of existing large buildings, the proposal therefore contributes positively to the centre's polycentric form and the wider character of the city.

The bulk of the buildings is exceptional in the Dunedin urban context. However, the overall form and design approach are sound from an urban design perspective. Additive composition and vigorous articulation of forms lessen the visual impact of the hospital's height and bulk, and produce a broken silhouette on the city's skyline. This allows the complex to present as a cluster of smaller blocks, which are individually comparable to existing multi-storey structures. The articulation of building forms and generous separation will also achieve a comfortable and respectful scale relationship between the new hospital and nearby heritage buildings and precincts.

Shading effects will arise from the location and height of the building mass relative to pedestrian areas that may be sensitive to shade, including Anzac Square and surrounding streets. Additional shading of Anzac Square will however be limited to relatively short durations in the afternoon between midday and 3pm either side of mid-winter. At any time when additional shade is cast, a significant portion of the square will remain in sun. For surrounding streets, there will be a slight inconsequential increase in shade in mid-winter relative to a permitted 20m high building height on the site.

Activation of the building edges of the Inpatient and Outpatient Buildings has been achieved on all frontages except for Castle Street, where the location of the 'back of house' operational and service areas, and a solid frontage limits the number of human scale-features in the façade and at the street edge. An appropriate urban design outcome has however been achieved by incorporation of terraced steps and landscaping that give a high level of streetscape amenity, cross block links that provide permeability through the site and assist activation of the street edge, and concealment of the service yards from the street.

The Ancillary Building is appropriately scaled and the 3 dimensional form and articulation of the building is well resolved, and in keeping with its environment. Ongoing design development will provide opportunities to further mitigate the utilitarian/service nature

of the building including by introducing minor tertiary elements to break the monotony of the long facades to Castle Street and Bow Lane. Further development of the landscape design in this location will also assist.

The development proposes two glass clad air bridges over St Andrew Street between the Inpatient and Outpatient Building for staff/patient circulation. The two bridges will have a significant effect by interrupting views along the street. However, the experience of the public realm will, on balance, be positive due to the enhanced edge quality along the street, eventful architecture, and visual lightness of the glass and steel air bridge structures which contrast favourably with the more solid building forms either side. A third air bridge is also proposed over Castle Street between the Inpatient and Ancillary Building to support logistic/service functions. This single storey, semi transparent glazed bridge is well proportioned relative to the Ancillary Building, and has only a 'moderate' adverse visual effect.

External ground level pedestrian connections around the site have been provided for, including a broad pedestrian crossing linking the Inpatient and Outpatient Buildings across St Andrew Street. A more direct pedestrian desire line however also exists between the north-facing main public entrance of the Inpatients Building with the west-facing main entrance of the Outpatient's Building, which can be readily accommodated by adding a further crossing point to provide for pedestrian convenience and safety. This is to be further explored.

Overall, the NDH has been designed to avoid or successfully mitigate most adverse urban design effects, in particular:

- The new hospital will be seen in a context of existing tall building clusters: the CBD, the existing hospital and the university. The proposed building complex including taller building forms will reinforce Dunedin's characteristic polycentric urban form. The additional building cluster gives added 'visual weight' to the city centre and establishes a stronger focal point within the vista.
- Building height, bulk and scale are successfully mitigated by strategies of strongly expressed formal modulation and the use of transitional volumes at edges.
- The St Andrew Street overbridges provide internal connections critical to the functioning of the hospital, and their effects are partially mitigated by transparency, and offset by enhancements to the street edges, particularly the spaces and environments towards and at the Cumberland Street end of this block. The single storey glazed Castle Street air bridge is well proportioned relative to the Ancillary Building.
- The extent and quality of open space provided along Cumberland Street is a significant and tangible public benefit that may also be considered an 'offset' for any effects of over-height buildings.
- By rebuilding the hospital in a central location, the proposal secures a prominent long-standing component of Dunedin's inner-city economy and identity.

The design of the NDH gives a sense of well-being and safety. The design provides definition between public/private uses and facilitates intuitive wayfinding through access management techniques. Most notably this includes the creation of a hospital street that provides the primary point of public arrival to the Inpatient Building, and separate staff access through the Pavilion Building, that will also support staff safety. Access management and safety will also be supported by swipe card access to secure parts of

the hospital, and a visually prominent security kiosk at the receptions of the Inpatient and Outpatient Buildings.

A number of recommendations have been made to ensure CPTED issues are suitably resolved at the detailed design level. This includes the use of well-defined entrances and physical control measures to define public/private access, providing clear sightlines that support informal surveillance, avoiding creation of entrapment spaces, development way-finding and lighting strategies, and including high quality durable materials in the surrounding public realm areas. Adherence to these recommendations will ensure that the CPTED effects of the proposal are acceptable.

VISUAL EFFECTS

The visual effects of the NDH have been assessed by **Boffa Miskell**, in the context of the existing urban fabric, and the 2GP provisions that seek buildings and structures are of a height that minimises as far as practicable adverse effects on the skyline vista of the city, particularly as viewed from Dunedin's inner hill suburbs across the upper harbour towards the Otago Peninsula.

The assessment has considered the viewing audiences, the potential visibility at a variety of representative viewpoints, and the visual effects that may be experienced from these viewpoints. The potential viewing audience (mid and long distance views) for the hospital buildings include residences near the edge of the escarpment of the upper residential hill suburbs, residences in the lower hill suburbs, and users of roads that connect across the town belt. In addition, views could be obtained from the eastern side of the Otago Harbour around and near the head of the harbour.

In views from the upper hill suburbs, visual effects will be mostly low or low-moderate, depending on the backdrop that the buildings are viewed against. Specifically, from the north and the south effects will be low, as the buildings would be visually absorbed into the urban context in the long distance views. In views from the west the visual effects will be low-moderate as the entirety of the built form is more apparent in the mid-distance, side-on views. However, in these views the buildings will not break the roofline of existing buildings against the backdrop of the waters of Otago Harbour due to the elevated viewing angle. Furthermore, the effects of the development are mitigated through the design and composition of the buildings that reduces the visual impact of its height and bulk.

In some of the mid-distance views from the lower hill suburbs to the west the buildings will protrude into views of the harbour and peninsula beyond, breaking the roofline of existing buildings. These visual effects will be moderate, without being significant. While the bulk of the buildings will lead to a moderate change in the views towards the harbour from these viewpoints, the architectural design with façade articulation and broken up built form would minimise adverse visual effects.

The views from the eastern side of Otago Harbour will only be affected to a low level, leading to less than minor visual effects, as the buildings are integrated in the poly-centric urban form without breaking the line of built development in the backdrop of the view.

Overall, the potential adverse effects of building height, bulk and scale are successfully mitigated by strategies of strongly expressed formal modulation and the use of transitional volumes at edges. The variation in materials, cladding systems and colour

will provide visual interest and a differentiation between the various parts of the building. In combination with the intricate massing and varied elevations, the buildings will read as a collection of buildings rather than a single massive structure. The proposed composite forms will produce a broken silhouette on the city's skyline where the proposal protrudes from the existing roofline against the backdrop of the harbour or town belt.

WIND EFFECTS

Wind impact assessment has been undertaken by **Meteorology Solutions** to inform the concept design process. The assessment has been undertaken in the context of the 2GP provisions that seek to minimise, as far as practicable, adverse effects of wind on pedestrian amenity and safety.

Informed by Computation Fluid Dynamics modelling, the assessment has compared the anticipated wind impacts of the hospital buildings against both the current pre-demolition extent of built development on the site, and the 'cleared' site scenario ahead of construction. A critical determinant of the anticipated wind impacts is the height of the hospital buildings. Taller buildings cause deflection of wind off the façade(s) as well as enhancing channelling of wind flow around and between the structures.

There is a relatively low mean wind speed climate for the Dunedin urban area in the vicinity of the NDH site. Once cleared of buildings in readiness for construction, significant wind impacts are not expected over the site or its surroundings. Following construction of the hospital, there will be an increase in the wind impacts in the surrounding streets, especially for Cumberland Street south of St Andrews Street. However, the higher wind impacts are mostly confined to the street area and in most locations are within the Lawson wind comfort criteria suitable for that location. Furthermore, no dangerous areas will be created for pedestrians in the surrounding area because of wind, based on the NEN 8100 wind danger criteria.

During west and southwest wind conditions, the new hospital will channel winds into the main entrance of the Inpatient Building, and also result in relatively high wind impacts being experienced in the vicinity of the entrance to the Outpatient Building on Cumberland Street. Such wind conditions however would only occur about 3% of the time (or about 250 hours per year).

Proposed landscaping, including trees and other vegetation, will noticeably reduce wind speeds and the extent of the higher wind impact locations. As such, it is anticipated that overall there will be no significant adverse wind effects on pedestrian amenity or safety.

NOISE EFFECTS

The noise and vibration effects from the construction and operation of the NDH have been assessed by **Acoustic Engineering Services (AES)**, in the context of whether such noise will comply with the relevant 2GP noise standards. The assessment has excluded noise from site demolition, ground preparation, and piling for the new buildings, which are covered in separate project consenting phases. The assessment has accounted for the location of the new hospital site within the existing elevated ambient noise levels of the Dunedin CBD, and also the presence of noise sensitive activities (including those containing sleeping areas) within the vicinity.

The most dominant noise and vibration sources during construction will be site works and excavation equipment, generators, concrete pumping/pouring, heavy vehicle

movements, and the use of cranes. Operationally, significant noise sources will be mechanical plant (e.g. standby generators, heat pump chillers, diesel boilers, extraction fans etc) and heavy vehicles associated with regular servicing and supply for the hospital. Operation of the hospital will also involve ambulance and emergency helicopter movements.

It is expected that construction noise and vibration for the Inpatient and Outpatient Buildings will comply with the relevant 2GP noise standards. Furthermore, it is expected that the majority of construction works for the Ancillary Building on the Bow Lane Block will comply with the noise standards, however due to the proximity of neighbouring activities, noise from excavators and heavy vehicles may not comply where construction occurs adjacent to the boundary. Installation of acoustically effective site hoardings, adopting standard best construction practice (e.g. restricting hours/duration of work, machinery and equipment specification, complaints procedures and appointment of a Noise Liaison Officer for the community), and implementation of a Construction and Vibration Management Plan will be used to further minimise construction noise and vibration effects. With these measures implemented, construction noise is not anticipated to produce a significant effect.

Once operational, it is expected the new hospital and associated mechanical plant and facilities will comply with the 2GP noise limits and accordingly not give rise to significant adverse noise effects. A shelter will be required to be constructed along the boundary of the Ancillary Building loading dock and the closest residential receptor (27 Anzac Avenue) in order to achieve compliance. With particular regard to ambulance and emergency helicopter movements, it is noted that these 'emergency service' noise sources are specifically exempt from having to comply with the 2GP noise limits. The facades of the new hospital buildings will also be designed to control noise break in to noise sensitive spaces from onsite and offsite noise sources. The level of acoustic insulation of the buildings will exceed that required by the 2GP noise insulation rules.

TRANSPORTATION EFFECTS

The transportation effects of the NDH have been assessed by **Novo Group**, in the context of the existing transportation environment, and the 2GP provisions that seek that adverse effects on the safety and efficiency of the transport network will be avoided or, if avoidance is not practicable, adequately mitigated.

Although potential future changes to the transport network (as signalled by the Waka Kotahi led Shaping Future Dunedin Transport project) have been taken into account to ensure the NDH can integrate with any future network changes, the transportation assessment has been undertaken within the context of the existing transport environment.

The hospital is well located to be accessible by a variety of travel modes, including by car, bicycle, walking, and public transport. In particular, the site is within a 200m walk of the Bus Hub on Great King Street, and is adjacent to on-road segregated cycle ways which provide for safe cycle access to the site. Sufficient cycle parking and end of trip facilities will be provided at the hospital to cater for expected cycle demands. A staff Travel Plan is proposed to encourage use of these travel modes over the use of car travel.

There is no minimum car parking requirement for new hospitals under the 2GP. Furthermore, the recently released NPS-UD specifies district plans are not to set

minimum car parking rate requirements (other than for accessible car parks). Notwithstanding, the new hospital will provide an equivalent level of car parking provision to the existing hospital of 181 spaces, of which 69 will be located on the site (including pick up and drop off spaces). Mobility car parking will be provided at a level that exceeds the 2GP and Building Code requirements. In addition, there is a large number of publicly available car parking spaces within walking distance of the proposed hospital which have capacity to accommodate additional demand. Opportunities for other off-site parking are also being explored, but do not form part of the current proposal.

The predicted traffic generation of the activity will be spread over several access locations. The number of vehicle movements are not expected to be high, particularly given the pick up/drop off movements will be split across accesses to Cumberland and Castle Street. The existing road network has sufficient spare capacity to accommodate the number of movements from the hospital in this location.

The number and width of proposed vehicle accesses reflects the need to separate operational vehicles (e.g. ambulances, goods vehicles, VIE tanker etc) from general traffic (e.g. public pick up/drop off), and to accommodate tracking paths of the types of vehicles expected to use them. The number of accesses is appropriate given the length of the site frontages, the current one-way configuration of Cumberland and Castle Streets, and the low pedestrian volumes on the Castle Street frontage. Furthermore, the location and width of the accesses and available sightlines, will enable safe crossing by pedestrians, and safe and efficient movement of traffic and cyclists on the adjacent roads, based on the anticipated types and numbers of vehicles using each access point.

The internal driveways are of a suitable width to ensure the safe and efficient movement of vehicles within the site. The layout of the proposed car parking areas will comply with the minimum requirements of the applicable NZ standards, ensuring they are practical and functional. Use of give-way signage at the exit from the Inpatient emergency department car park will ensure vehicle access to the site from Cumberland Street is not obstructed by exiting vehicles that would result in vehicles queuing and affecting the safe and efficient operation of Cumberland Street.

The Ancillary Building on the Bow Lane block will accommodate a loading dock for goods vehicles serving the hospital, accessed from Anzac Avenue. The traffic volumes on Anzac Avenue and predicted truck volumes accessing the site will be low, such that trucks will be able to access the site without any detrimental effects on pedestrian safety along the site frontage, and the safety and efficiency of vehicle and cycle movements on Anzac Avenue.

Overall the transportation effects of the NDH are anticipated to be acceptable, and not significant.

FLOODING EFFECTS

The hospital site is located on low-lying land approximately 1.8m to 2.5m above present-day sea level, 1km from the Otago Harbour shoreline. An assessment has been undertaken by **Jacobs** of the potential for flooding to impact the hospital site from three principal sources – nearby stream overflow, rainfall/runoff from catchments in the city centre and overflow from the stormwater network, and storm tides in the Otago Harbour. The assessment has been completed in the context of the 2GP provisions that seek to ensure the risk to development from natural hazards, including climate change, is no more than low in the short to long term.

Flood modelling shows that with the existing stormwater infrastructure and flood defences in the city and allowing for anticipated effects of climate change to a design horizon of 2090, the likelihood of flooding at the site is at least 10% AEP (1/10 year). The depth of ponded water at the lowest point in the streets around the site during a coincident rainfall and storm tide event is estimated to range from approximately 600mm above ground level in a 10% AEP event to 1500mm at ground level in a 0.2% AEP (1/500 year) event.

Given the location of the site and the nature of the surrounding infrastructure and development in relation to the sources of flooding, flood risk will be mitigated primarily through setting the floors of the buildings at a sufficient height above ground level to reduce risk. The ground floors of the proposed buildings (which contain critical emergency service functions) have been set at a level that provides protection from flooding in a 0.2% AEP ("1 in 500 year") event, including an allowance for the effects of climate change to 2090, the effects of the development itself, and an appropriate freeboard. Based on this floor level, the mitigated potential risk is assessed to be no more than low.

The concept design also includes earthworks to raise the level of the land around part of the perimeter of the new buildings to enable access from street level, and for landscaping and amenity purposes. The earthworks will reduce the volume of water that can occupy the site during a flood and will prevent overland flow across the site.

Modelling of the effects of the proposed earthworks on flood risk outside the NDH site shows that the required earthworks will tend to increase the flood water level and extent of flooding around the site when compared to site conditions prior to construction of the earthworks. This increase in flood extent is greater for flood events of higher likelihood of occurrence (10% AEP flood) than for those of lower likelihood (0.2% AEP). However, for both high and low likelihoods, the increase in modelled flood extent is limited and does not include properties additional to those that would already be flooded.

To the east of Cumberland Street, the increase in maximum flood level is generally less than 50mm for the range of likelihoods considered (10% to 0.2% AEP). Along Cumberland Street and to the west of the street the effect on flood levels is greater but more localised, extending as far as Great King Street. The maximum increase in modelled flood level in this area is approximately 200mm for the 10% AEP and approximately 70mm for the 0.2% AEP. While these increases in flood level are likely to have a more than minor effect on the absolute impacts of flooding to individual properties, under the 2GP definitions of flood risk relevant to the earthworks activities, the existing levels of flood risk are likely to remain unchanged.

Factoring in the Bow Lane block, the total volume of floodwater displaced by the development in a 1-in-10 year event could increase by about 30-40% with a broadly similar increase in the effect on flood depths (i.e. an overall effect of potentially up to 250mm to 300mm), which, while significant, is no worse than that which would be generated by a permitted development on the Bow Lane site that did not involve any earthworks.

GREENHOUSE GAS EMISSION EFFECTS

The NDH is being designed to significantly reduce greenhouse gas emissions. The existing Dunedin Hospital is heated by coal fired steam boilers at the Dunedin Energy Centre. The use of coal combined with the inefficiency of the steam heating system

makes this a main contributor to the high greenhouse gas emissions from the existing hospital.

The design concept for the new Inpatient Building and Outpatient Building proposes the use of heat pump central plant supplied by the low carbon electrical grid as the primary energy source. Backup diesel fired boilers will supplement the heat pumps to provide occasional peak load top up and emergency resilience to the heating system. The high efficiency of the heat pump heating plant using low carbon electricity will significantly reduce carbon emissions during the operation of the new hospital. Plans to move New Zealand's electricity generation to 100% renewable generation by 2030 will further reduce hospital carbon and greenhouse gas emissions.

Other operational measures to achieve low carbon outcomes include:

- Energy efficient system design and operation.
- Metering and automatic monitoring provisions to facilitate ongoing management and monitoring of operational efficiency and savings
- Best practice building systems commissioning including an Independent Commissioning Agent and post occupancy building tuning of the systems
- An emphasis on sustainable transport, including: adopting a travel plan that promotes use of public and active transport; providing low emission vehicle parks and EV charging; providing facilities to encourage active transport by staff and visitors such as cycle parks and end of trip facilities.

The project in effects terms therefore meets the sustainable management test of the RMA.