BEFORE THE CHRISTCHURCH REPLACEMENT DISTRICT PLAN INDEPENDENT HEARINGS PANEL

IN THE MATTER of the Resource Management Act 1991 and the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014

AND

IN THE MATTER of the Residential Proposal (part)

STATEMENT OF EVIDENCE OF ROBERT BRIAN NORTON ON BEHALF OF CHRISTCHURCH CITY COUNCIL

INTENSIFICATION - STORMWATER

11 MARCH 2015

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1. INTRODUCTION

1.1 My full name is Robert Brian Norton. My current role as Planning Engineer with Christchurch City Council (**City Council**) focuses on stormwater servicing and flood management. I have held this position for 5 years. I hold a Bachelor of Science (Civil Engineering) from the University of Washington in Seattle, USA. I have over 15 years of experience in the field of surface water management, flood mitigation and development with local government and private consulting.

1.2 As part of my role at the City Council, I have been asked to provide evidence in relation to the impact of the proposed (notified) and possible additional intensification areas on the City Council's surface water network.

1.3 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

1.4 The key documents I have used, or referred to, in forming my view while preparing this brief of evidence are:

(a) Christchurch City Council Waterways, Wetlands and Drainage Guide (2013/2011);
(b) Christchurch City Council Infrastructure Design Standard (2013);
(c) Christchurch City Council Surface Water Strategy (2009);
(d) Christchurch City Council Waterways and Wetlands Natural Asset Management Strategy (1999);
(e) South West Area Stormwater Management Plan (Golder Associates, 2011);
(f) Styx Stormwater Management Plan Blueprint for Surface Water Management (Capital Programme Group – CCC, August 2012; and
(g) Avon River Stormwater Management Plan (Capital Programme Group – CCC, DRAFT 2014)

2. SCOPE

2.1 The specific parts of the proposed Residential Chapter (**Proposal**) of the proposed Replacement District Plan (**pDPR**) that my evidence relates to are the proposed and potential additional areas of intensification.

3. EXECUTIVE SUMMARY

3.1 Intensification of residential sites will create more impervious surfaces which will generate more stormwater runoff (flow rate and volume) and more contaminants.

3.2 Increased runoff can adversely affect the City Council's ability to maintain its required level of service in the stormwater network by causing more frequent and severe flooding, erosion and contamination of natural water bodies. In order to mitigate these effects, intensification developments may be required to provide onsite stormwater facilities or engage in building techniques that reduce runoff and/or treat discharges from pollution-generating surfaces. Use of such facilities or techniques (sometimes referred to as "Low Impact Design", "Water Sensitive Design", "Source Control" or "Best Management Practices") are commonly used internationally, but tend to increase the cost and complexity of development. The availability of these techniques for onsite stormwater mitigation, however, means that stormwater servicing is not a substantial impediment to residential intensification.

4. BACKGROUND

4.1 When pervious land (such as grass or forest) is replaced by impervious surfaces (building roofs and sealed surfaces), the rate and volume of stormwater runoff increases during rainfall events. This is sometimes referred to as stormwater 'quantity' and can have adverse effects such as flooding and erosion of natural waterways.

4.2 Urban development also produces contaminants including sediment, metals and other chemicals which can be toxic to humans and the

environment. These contaminants collect on surfaces or bind to sediments and are mobilised during rainfall where they can then enter stormwater systems and reach rivers, wetlands, lakes or groundwater. This refers to stormwater 'quality'.

4.3 The primary function of the stormwater network is to protect public and environmental health by conveying surface water from rainfall, to the ocean or disposing of it into the ground. The stormwater network consists of both natural (streams and rivers) and artificially constructed (pipes and drains) components. The stormwater network also contains water storage systems (ponds and basins) and treatment systems designed specifically to remove urban contaminants from stormwater prior to reaching sensitive natural environments.

4.4 In terms of stormwater conveyance, the network is often considered to have at two components; a 'primary' and a 'secondary'. In many urban areas, primary networks are underground piped systems which are designed to manage the more frequent rainfall events with return periods up to 20% Annual Exceedance Probability (AEP; also sometimes referred to as a '5-year' event). Secondary networks are designed to manage less frequent but larger rainfall events (roads, waterways other overland flowpaths), typically up to 2% AEP ('50-year') return periods.

4.5 The level of service objectives for the City Council's stormwater network and managing flood risk are detailed in the Christchurch City Council Waterways, Wetlands and Drainage Guide (2003/2011) - Chapter 20 and the Infrastructure Design Standard (2013) - Part 5. Objectives relating to management of river flooding in the Heathcote, Avon and Styx Rivers are detailed in their corresponding Surface Water Management Plans.

4.6 Discharges into the network are managed through resource consents held by the City Council with the Canterbury Regional Council. There are several existing consents in place covering different parts of the city and different river catchments. Each consent has slightly different conditions however all of the consents are designed to deal with both water quantity and water quality effects. The City Council intends to lodge a single "comprehensive" stormwater consent application with the Regional Council

around the middle of 2015. This consent will cover the whole city and settlement areas of Banks Peninsula and will greatly simplify the consenting regime for the public stormwater network.

4.7 The City Council uses a combination of methods for analysing the needs of the stormwater network and for managing surface flooding. These include computer and other mathematical models. At the moment, the City Council does not have a single computer model which incorporates all parts of the public stormwater network, primarily due to cost, complexity and hardware constraints required to construct and operate such a model.

4.8 Where the stormwater network (primary and/or secondary) is at or over capacity, additional load has a higher probability of causing flooding of roads or property. Additional load comes primarily in the form of increased impervious surface coverage which causes increases to both the total flow rate and total volume of rainwater which is discharged from a site and into the network. In very general terms of performance of a local network, where critical storm durations are short, the stormwater *flow rate* is the primary concern. In terms of river flooding and large basin ponding (which have long critical storm durations), total stormwater *volume* has more of an effect.

4.9 The discharge of stormwater from new development may be constrained either directly by local infrastructure availability and capacity or by the cumulative impact of discharges into the downstream network. Exceeding the hydraulic capacity of the stormwater (piped) network leads to surcharging (when the pipeline is flowing full and stormwater spills out of sumps and manholes into roads or other property). Further exceeding the hydraulic capacity of the roading network, waterways or other secondary flow-paths can lead to flooding of land or buildings, potentially causing damage to land or property.

4.10 New stormwater networks (and upgrades to the existing network) are designed using some assumptions about the makeup of the catchment that they are meant to service. These assumptions include variables such as the anticipated land uses, expected impervious surface coverage,

infiltration characteristics of the natural ground and relative hydraulic gradient of the network.

4.11 For a given neighbourhood, if we ignore the parameters which are unchanged such as soil types and geography, the only variable affected by residential intensification is impervious surface coverage.

4.12 For reference, the City Council designs new stormwater networks (and upgrades to existing networks) with the following impervious surface coverage assumptions, which have been empirically determined through analysis of existing neighbourhoods (referring to operative City Plan zones):

(a) Living 1 Zone: 50% impervious, 50% pervious;
(b) Living 2 Zone: 65% impervious, 35% pervious;
(c) Living 3, 4 and 5 Zones: 70% impervious, 30% pervious;
(d) Business Zones: 90% impervious, 10% pervious; and
(e) Living Hills Zones: 45% impervious, 55% pervious.

4.13 Widespread intensification resulting in cumulative impervious surface coverage ratios in excess of the above assumptions will therefore lead to decreased network performance and increased frequency and extent of flooding, as well as increases in the contaminant loads discharged to waterways.

4.14 Stormwater quantity effects on the network can be mitigated either by upgrading the stormwater network or by reducing the rate of stormwater discharge into the system. Network upgrades for intensification are generally not feasible due to cost and complexity but individual site stormwater quantity mitigation is an option.

4.15 Individual site measures designed to reduce the flow and/or volume of stormwater discharging into the network, apart from limits to the proportion of impervious surfaces on a site, can include a variety of accepted practices if deemed suitable for the site:

(a) rain tanks or vaults or other storage areas (either above ground or below, depending on constraints);

(b) infiltration systems (soak pits, trenches or injection wells);

(c) pervious pavement;

(d) rain gardens or landscape-based storage or disposal systems; and

(e) vegetated 'green' roofs.

4.16 The Council manages stormwater discharges from residential developments through the building consent process under the Building Act 2004 as well as through the resource consent process (both subdivision and land use consents). Clause E1 – Surface water of the Building Code[1] contains the provisions of the Building Code in relation to storm water discharges. Additionally, as mentioned above the City Council holds various network discharge consents with the Canterbury Regional Council which require the City Council meet certain water quality and water quantity objectives. The City Council licences these network discharge consents to third party developers when they connect to the City Council's stormwater network. Conditions requiring onsite mitigation may be made as part of this process.

5. AREAS PROPOSED FOR INTENSIFICATION IN THE PROPOSED DISTRICT PLAN

5.1 The identification of the areas proposed for intensification in the pDPR was not influenced by areas where stormwater network capacity is limited because stormwater capacity was not identified as a significant constraint to development. This is primarily due to the ability of sites to self-mitigate their own stormwater effects either through the use of onsite rainwater storage, disposal to ground via soakage systems or other methods.

6. FUTURE DEVELOPMENT

6.1 It is expected that future intensification developments of all sizes will need to be individually assessed to determine if network capacity is available or

[1] Schedule 1 to the Building Regulations 1992.

if onsite mitigation (storage/disposal) will be required. This assessment is currently being performed for intensification developments through the resource and building consent process, and refinements are being made to which will simplify the analysis and requirements. This process is not expected to change significantly by implementation of the pDPR because storm water requirements for individual sites will continue to be assessed against the Building Code and against the conditions of City Council's network discharge consents, and managed through the building and resource consent processes.

6.2 Provision of onsite stormwater mitigation adds additional cost and complexity to a development project. Storing large volumes of stormwater on small sites can be difficult, particularly where gravity disposal relies on shallow kerb outlets. Individual developers will need to carefully consider stormwater at an early stage in their designs. The City Council is currently developing a guideline specifically targeting onsite stormwater mitigation for small sites to aid property owners, developers, architects and engineers. In addition, rebates on the Stormwater component of Development Contributions are offered to those developments providing onsite stormwater mitigation.

Robert Brian Norton
11 March 2015