BEFORE THE INDEPENDENT HEARING PANEL APPOINTED TO HEAR AND MAKE DECISIONS ON SUBMISSIONS AND FURTHER SUBMISSIONS ON THE INTENSIFICATION PLANNING INSTRUMENT

IN THE MATTER	of the Resource Management Act 1991 (the Act)
	AND
IN THE MATTER	of Hearing of Submissions and Further Submissions on the Upper Hutt City Council Proposed Intensification Planning Instrument under Schedule 1 of the Act

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STATEMENT OF EVIDENCE OF STUART FARRANT

ON BEHALF OF WELLINGTON REGIONAL COUNCIL

19 April 2023

Contents

Qualifications and experience

1 My full name is Stuart James Edgar Farrant. I am a Principal Ecological Engineer and Water Sensitive Design practice lead at Morphum Environmental Ltd; and hold a Bachelor of Engineering (Natural Resources) from University of Canterbury

2 I have over 16 years' experience working in multiple aspects of freshwater management and ecological engineering. I have worked for Morphum Environmental for 9 years establishing the southern sector office (Wellington) in 2014. Prior to that, I worked for 5 years as an Ecological Engineer in Melbourne, Australia.

3 I have experience working in a range of aspects relating to three waters management including design, technical review and auditing of constructed wetlands, vegetated stormwater treatment/conveyance systems, stream restoration and catchment planning. Specifically, I have extensive experience with the design and delivery of integrated stormwater management devices to mitigate adverse water quality effects from urban development at a range of scales.

4 I have contributed to and authored technical design guidelines for Councils/Utilities in New Zealand and Australia (including the Wellington Water 'Water Sensitive Design technical guidelines').

5 I was awarded a 2018 Winston Churchill Fellowship to travel internationally for the purposes of researching leading practice with urban water management in Europe, Scandinavia and USA.

6 I was appointed co-chair of the Te Awarua o Porirua Whaitua committee and the Te Whanganui a Tara Whaitua technical expert group and am familiar with the local context in terms of development typologies, biophysical conditions and ongoing national policy directions.

7 In 2020 I was appointed to the Wellington City Council Mayoral taskforce charged with investigating the current state of play with the provision of three waters services across the city and informing recommendations for changes to improve long term outcomes for the community and environment.

8 I am a member of Engineering New Zealand and Co-Chair of The Sustainability Society which is a technical interest group of Engineering New Zealand.

Code of conduct

9 While this is not an Environment Court hearing I have met the standards in that Court for giving expert evidence.

10 I have read the Code of Conduct for expert witnesses issued as part of the Environment Court Practice Note 2023 (Part 9). I agree to comply with the Code of Conduct. I am satisfied that the matters addressed in this statement of evidence are within my expertise. I am not aware of any material facts that have either been omitted or might alter or detract from the opinions expressed in this statement of evidence.

Scope of Evidence

11 The purpose of my evidence is to provide context and background on the importance and drivers for adopting policy which will ensure future development integrates policy and rules to protect freshwater values and in particular use Nature Based Solutions (NbS) to support and deliver a wide range of social and environmental benefits. This includes discussion on the definition of NbS and how this translates into practical measures that should be incorporated into planning tools to ensure improved outcomes in the future. Examples of existing NbS are provided for context.

Context and Drivers for Nature Based Solutions

12 Climate projections are generally agreed that future climate across the Wellington Region will include increased frequency and intensity of large rainfall events interspersed with prolonged dry periods. Temperatures are projected to increase across the Wellington Region (particularly in summer/autumn) with increased maximum temperatures and increased "Hot" days (Tmax >25). Rising sea levels will affect the coastline and the ability of freshwater (natural streams and stormwater networks) to 'drain' to the sea during peak rainfall and increasing the risk of coastal erosion during storm events.

13 These predicted changes will impact on natural systems and urban areas where the form of development can amplify impacts. Poorly planned and designed urban development will result in outcomes which impact on human health, mana whenua values, resilience of infrastructure and ecological health. Recent events across New Zealand have clearly highlighted many of the risks that urban and rural areas face with regards to extreme rainfall events and the impact on human health, economy and the environment.

14 Unless managed appropriately, modification for urban development (housing and commercial) causes an increased discharge of contaminants (in particular heavy metals, hydrocarbons, sediments and nutrients), increased runoff **volumes** during frequent small and moderate rainfall, increased runoff **flowrates** during less frequent large rainfall, increased air temperatures (urban heat island), increased water temperatures discharging to waterways, reduced indigenous biodiversity and a disconnect with historical ecosystems.

15 Changes in already modified land, such as conversion of rural land to urban (greenfield development) and intensification of existing urban areas (brownfield development or infill), cause a change, and generally a worsening, of existing impacts through increased impervious surfaces, further reduction in vegetation cover/biodiversity, increased vehicle usage and modification to waterways, including piping, bank lining and installation of outfall structures.

16 Any continuation of existing development practices, whereby development yields are maximised through widespread landform modification, combined with high intensity development, without requiring appropriate mitigation measures that address impacts wider than peak flows, will worsen current ecological, human health and cultural outcomes and result in considerable direct and indirect costs to rectify and or remedy in the future.

Risks of continuing Business as Usual

Stormwater drivers

17 Current development practices are typically driven by a desire to optimise housing yields within a given footprint. Housing typologies have in recent years evolved from almost entirely free-standing dwellings to increasing multi-unit developments to increase yield further. Due to the variable topography of the Wellington Region and desire to provide drive-on level access and slab on grade (a structural engineering practice using a concrete slab to provide the building foundation), developments often involve extensive earthworks to modify and retain land. Current development practice therefore results in extensive areas of impervious landcover (roofs, roads and hardstand), highly compacted and modified soils, minimal vegetation and disconnect from historical or remaining watercourses.

18 Whilst the intent of regional and district plan provisions is to manage development activity across the region to avoid flood risks, through defining habitable floor levels and requiring detention of peak flows (hydraulic neutrality), these are typically stipulated based on a climate change adjusted 1% Annual Exceedance Interval (AEP) and generally do not consider wider, but linked, cumulative and compounding impacts on urban resilience from the current and future climate. In particular, this does not consider the impacts of runoff

from smaller more frequent rainfall events which are increasing in intensity and frequency due to climate change.

19 Hydraulic neutrality (as defined by Wellington Water Ltd) is solely focussed on controlling peak flowrates to limit risks of downstream flooding from events **greater than** 10% Annual Exceedance Probability (10 year Average return Interval). This is achieved through holding back stormwater in detention tanks or basins and releasing it at a throttled flowrate to match the pre-development peak flowrate. Therefore, in the developed case, the risk of nuisance or damaging flooding should in theory be no greater than the current risk. Hydraulic neutrality does not provide substantive benefit to stream health.

20 In many instances measures to achieve hydraulic neutrality will worsen freshwater outcomes, by extending the duration of stormwater discharges in more frequent rainfall events, resulting in extended adverse conditions for freshwater species in addition to the instability caused by the increased frequency of stormwater runoff as compared to natural stream catchments. The adverse impacts on downstream waterbodies from stormwater detention is typically overlooked resulting in ongoing erosion and loss of biodiversity. These impacts occur where development discharges directly to a waterway or to a piped stormwater network which discharges to a waterway downstream,

21 Requirements for 'hydraulic neutrality' promote detention of peak rainfall events only and do not achieve the hydrological controls which are required to support aspirations to protect and enhance tributary streams, Te Awa Kairangi, Te Whanganui a Tara and align with the principles of Te Mana o Te Wai.

22 Hydrological controls are measures which aim to match the predevelopment flowrates across the full spectrum of rainfall events. This requires measures to match the pre development amount or volume of runoff from a site which represents the natural 'loss' of water from evaporation and transpiration. This is typically termed **retention** and is increasingly required for new developments by councils across Aotearoa.

23 The widespread application of hydraulic neutrality without hydrological controls will result in ongoing and significant ecological degradation within freshwater streams.

24 Discharge of urban stormwater (regardless of whether hydraulic neutrality is achieved) without appropriate management of contaminants will contribute to reduced water quality. Contaminants (including heavy metals, sediments, nutrients, hydrocarbons and temperature) are generated by all impermeable surfaces and vary between and during rainfall events depending on duration of dry periods between rainfall, intensity of rainfall

and landuse within catchment. Urban contaminants are both in dissolved and particulate form and are therefore readily transported to surface and ground water resources.

25 There has also been a historical reliance on infiltration across large parts of the Upper Hutt whereby stormwater is discharged to the ground (via designed infiltration basins/galleries) rather than conveyed in pipes to surface water bodies. This has enabled untreated stormwater to potentially mix with shallow aquifers, which in places either connect with surface waterbodies or provide recharge of aquifers used for consumptive purposes. Where stormwater contains dissolved contaminants (particularly from roads, carparks and unpainted roofs) this unmanaged infiltration increases the risk of ongoing decline in groundwater quality.

26 Ongoing adverse impacts on waterways due to an absence of appropriate hydrological controls (volume reduction) or water quality management results in substantial ongoing financial costs for design, consenting and construction of instream retaining structures to protect assets such as roading, utilities and private/public property. These costs are borne by councils without any ability to seek redress from private developers who have directly contributed to the downstream impacts through uncontrolled stormwater discharges. Costs of lost indigenous and taonga species and degradation of the mauri of waterways is not able to be monetised.

27 A continuation of existing development practice will accelerate the decline in environmental and social outcomes across Upper Hutt. In particular, a continuation of Business as Usual will result in the following:

27.1 Ongoing loss of indigenous biodiversity in waterbodies

27.2 Reduced quality of water in waterways adversely impacting on recreation and mahinga kai values

27.3 Ongoing loss of terrestrial biodiversity through reducing habitat and fragmented connections or ecological corridors

27.4 Reduced resilience to future climate change including both large shocks (floods/droughts) and changing seasonal patterns

27.5 Reduced resilience to natural disasters such as earthquakes and landslips which will impact water supply and drainage

27.6 Increasing urban temperatures with increased adverse health impacts

27.7 Continuing disconnect between communities and the natural environment

28 The schematic appended to this evidence provides a simplified graphic of the impact of urban intensification on stormwater and urban greenspace. This demonstrates that the unmitigated development of a single lot to three will result in a significantly increased volume of stormwater (which typically occurs in small rainfall events that would not naturally generate surface runoff) and reduced greenspace. Implementation of typical NbS will readily mitigate these impacts and can result in net benefits (enhancement) compared with existing conditions.

Terrestrial Drivers

29 Urban development often results in the clearance of indigenous vegetation (including regenerating scrub) and continued loss of urban vegetation through intensification. This results in large areas of urban development with low vegetation coverage and high proportions of impervious cover (roads, roofs and hardstand) and highly modified ground (such as grassed lawns and heavily compacted engineered fill). These impacts are worsened on sloping sites where the prevalence of 'slab on grade' building results in extensive earthworks (cut and fill) and limited protection for existing vegetation or provision of planted trees. Lack of greenspace and mature vegetation in urban areas results in:

29.1 Increased ambient temperatures through urban heat island effects whereby unshaded surfaces heat up and contribute to an increased air temperature in urban areas as compared to undeveloped areas. Heat stress on humans (particularly the elderly and young) is increasingly recognised as a contributing factor in poor health and fatalities.

29.2 Loss of biodiversity, and in particular urban ecology, which would otherwise connect communities with the natural environment and support indigenous species to move across and through urban areas to connect remnant areas of reserve land.

29.3 Loss of shading resulting in increased energy demands to cool buildings (commercial and residential) and vehicles.

29.4 Reduction in interception of rainfall during small rain events resulting in increased stormwater volumes and flowrates.

29.5 Loss of amenity and urban greenery contributing to decline in human mental health.

Description and Definition of Nature Based Solutions

30 Nature Based Solutions (NbS) are those which intentionally use natural ecological systems or mimic natural processes to support changes in landuse whilst ensuring the resilience of ecosystems, communities and cultural values. In 2022, the 5th session of the United Nations Environment Assembly (UNEA-5) formally adopted a definition of NbS as; "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits."

31 NbS are therefore defined by the ability to respond to more than one driver in a human influenced landscape and utilise natural systems in a manner which provides resilience across a range of spatial and temporal scales for both chronic and acute stressors.

32 Territorial and Unitary Councils across New Zealand have required management of site generated stormwater in line with the intent of NbS for many years. Hamilton City Council is currently in the process of implementing an amendment to their District Plan (PC12) which includes mandated requirements for all new development (including medium and high density) to achieve hydrological controls through a combination of both rainwater reuse and infiltration. These rules are supported by practice notes which provide detail on the size of required devices in relation to roof area and lot imperviousness. These deemed to comply solutions are intended to support small scale development (such as single dwelling to three) with larger developments being required to provide more comprehensive water impact assessments or comply with Integrated Catchment Management Plans.

33 Rules which are limited to only 'minimum pervious percentage' are intended to achieve comparable outcomes but do not mitigate for the stormwater generated by the remaining impervious cover (roofs and hardstand).

34 Examples of NbS include:

34.1 Retreat and/or restricted development on floodplains and wetlands with restoration/reinstatement of riverine ecosystems and riparian landscapes to buffer storms, accommodate lowland flooding, reduce risk to infrastructure, sequester carbon and support indigenous biodiversity.

34.2 Integration of water sensitive design elements including raingardens, green roofs, tree pits and vegetated swales with urban development to treat stormwater, retain initial rainfall depths, connect communities with nature, increase urban ecology and provide passive cooling/insulation.

34.3 Construction of urban wetlands to treat stormwater, provide flood detention, connect communities with nature and increase urban ecology.

34.4 Increased planting of urban trees (in particular, indigenous street trees) to mitigate urban heat impacts, reduce runoff in small rainfall events, support urban ecology and improve urban amenity/greening.

34.5 Capture of rainwater (at lot or community scale) for non-potable uses to retain small rainfall depths (replicate natural flow patterns), avoid contaminant discharge, reduce demand on mains supply, connect communities with water and provide resilience to shock events (such as earthquakes).

34.6 Protection and/or reinstatement of natural urban stream channels to safely pass extreme flood flows whilst supporting urban ecology and biodiversity.

34.7 Protection of shallow aquifers and groundwater through managing the volumes to match natural groundwater recharge rates and ensuring all infiltrated water is appropriately treated.

34.8 Identifying and protecting modified overland flows paths to replicate natural ephemeral hydrology and pass peak flows with managed risk to life and property.

34.9 Management of earthworks volumes and extent through developing with the landform and utilising building typologies which are better suited to the terrain such as timber piles as opposed to slab on grade.

34.10 Municipal collection and composting of organic and biodegradable waste to enable land application to retain organic nutrients, reduce greenhouse gas emissions and improve local soils.

35 Alternatives to NbS can in some instances provide a similar level of service for some of the drivers but will not typically provide co-benefits and in many instances can result in related negative outcomes such as:

35.1 High embodied carbon in heavily engineered concrete structures

35.2 Increased lifecycle costs from mechanised or bespoke water treatment systems

35.3 Financial impacts on private/public land through engineered solutions causing worsening of conditions such as erosion on adjacent land

35.4 Financial and social impacts from large climatic events such as floods and drought

36 NbS are therefore recognised as offering cost effective and resilient solutions to a wide range of often complex landuse related problems whilst simultaneously supporting other non-financial benefits to communities and indigenous ecosystems.

37 It is noted that UHCC adopted principles of NbS, including hydrological controls, through volume reduction and protection of water quality in the Wallaceville development plan change. This provides a local example of where recognition of the need to consider wider environmental and resilience issues has justified explicit requirements to improve stormwater management.

Examples of Nature Based Solutions

38 **<u>Te Kukuwai o Toa - Urban constructed wetland</u>**

38.1 Following expensive and damaging flooding of the Porirua CBD in 2015, investigations initially looked at how to improve flood resilience but were expanded to include water quality in response to the ongoing environmental degradation of Te Awarua o Porirua. Following a city-wide options assessment and prioritisation it was recognised that the Elsdon Park site could support multiple benefits through a nature based approach to manage water across all rainfall events. The now completed wetland has transformed a formally underutilised sports field into a thriving and diverse constructed wetland with approximately 45,000 locally indigenous plants (over 30 species) including a mix of aquatic and terrestrial plants which would have once been present in natural wetlands around the harbour. The 1 ha wetland treats urban stormwater from the 40 ha commercial and residential catchment during small to moderate rainfall events and during larger less frequent storms provides detention of stormwater to provide protection up to the 1% AEP event. This is achieved within an urban open space that invites the community in with boardwalks, viewing areas and signage (yet to be completed) to provide education on the cultural, ecological and historical context of the site. Te Kukuwai o Toa demonstrates an NbS which responds to existing landuse and is adaptive to future climate change in a fully accessible public reserve.

39 **Queen Elizabeth Park - Restored natural peat wetland**

39.1 Peat wetlands are recognised for their ability to sequester atmospheric carbon within deep saturated organic layers at and below the surface. They also support a diverse and unique biodiversity including indigenous plants and animals. They are typically located at the lower end of catchments and are often associated with areas subject to flooding with the ability to naturally detain flood waters which are slowly released to the ground and to smaller outlet streams. Draining of peat wetlands for uses including primary production and urban development lower the shallow groundwater table resulting in release of carbon in the form of methane. Drainage also results in a loss in biodiversity with replacement by exotic pasture and opportunistic weed species. Drained natural wetlands will typically remain subject to flooding and are increasingly susceptible as the intensity and frequency of large rainfall events increases. Queen Elizabeth Park (Kapiti) represents a large peat wetland which was previously partially drained initially for agriculture with roading and urban development on the margins, the majority of the remnant wetland areas is within Regional Park. GWRC are currently undertaking works to manipulate excavated drains to return a more natural wetland hydrology to support improved carbon sequestration, increased indigenous biodiversity and accommodate periodic flood flows. The restoration of the wetland demonstrates a NbS at a landscape scale which can support long term adaptation and mitigation at a regional scale.

40 **Floodable landscapes- Copenhagen Denmark**

40.1 Large urban flooding in 2011 across Copenhagen caused billions of dollars in damage and insurance claims. Described as a ‘Cloudbust’ the event was categorised as a 1 in 1000 year event (0.1% AEP) which exceeded previous design standards and overwhelmed any pre-existing flood management strategies which similarly to Aotearoa were designed to a 1% AEP LoS. These floods, and recognition that climate change was increasing the likelihood of events of similar magnitude, prompted a council led change in focus to shift towards accommodating flood flows within the urban environment as opposed to continued attempts to ‘drain’ peak flood flows. Through collaboration with water utilities, transport planners, parks planners, private developers/property owners and the insurance industry a city-wide strategy has been endorsed and financed to create future urban landscapes which can safely accommodate flood waters. Through initiatives such as the lowering of strategically selected roadways, creation of multi-use public spaces (such as sunken urban basketball courts) and integration of high amenity landscape design with flood detention capacity the City of Copenhagen is progressively implementing NbS at a range of scales which mimic the natural flood attenuation within low lying lands which protecting people and property.

41 **Porirua Park n Ride Raingardens - Water Sensitive Urban Design**

41.1 Carparks are a source of contaminants and contribute to increased stormwater volumes and flowrates due to expansive impermeable surfaces. In 2017 GWRC undertook an expansion and redevelopment of the Porirua Railway park n ride to increase parking capacity in line with increasing patronage of public transport. As part of these works options were developed to mitigate the impact of the carparks on freshwater and the harbour and to increase resilience to future climate change. This resulted in the inclusion of two large, agglomerated raingardens which capture and treat stormwater prior to discharge to the reticulated stormwater network. These are vegetated with locally sourced indigenous vegetation and provide treatment for approximately 85% of the annual rainfall which falls on the carparks. It is noted that whilst this provides a good example of a NbS in a large-scale council led project the outcomes could have readily been further improved through the planting of canopy shade trees to reduce thermal impacts on surface and vehicles and the use of permeable pavement where appropriate.

42 **Urban street trees– Melbourne Australia**

42.1 As a city subject to intense summer heat waves, the urban centre of Melbourne recognise the ability of street trees to mitigate existing and future heat days and the intercept initial rainfall to reduce stormwater in small events which would naturally be assimilated without surface runoff. Further co-benefits such as carbon sequestration, urban biodiversity, amenity and air quality are recognised and considered in provision of street trees as part of public and private re-development. In 2012 a city wide urban forest strategy was developed which considered the full range of benefits from increased canopy cover and supported investment in a long term planting strategy. This council led NbS considered benefits at a range of scales and recognised the need to take definitive action now to support long term adaptation to increasingly frequent heat events. Given climate projections across Wellington and the timeframe for locally indigenous canopy species to form effective canopies the opportunity to require well considered urban trees in new development and redevelopment is very well timed.

43 **Residential Rainwater Reuse – Kapiti**

43.1 Capture of rainwater/stormwater at a lot or subcatchment scale supports a wide range of benefits including water quality, retention and resilience. It is an especially cost effective means of mitigating the impacts of urban development and providing adaptation to future climate conditions. In 2009 KCDC adopted the requirement for all new dwellings to include lot scale rainwater capture (10,000L) to be plumbed into internal non potable demands such as toilet flushing and laundry. Whilst initially motivated by aspirations to reduce the demand on increasingly stressed municipal water supply the implementation has diverted substantial volumes of stormwater from the districts urban and natural waterways which support indigenous biodiversity, amenity and flood resilience. This use of developer funded rainwater capture and reuse in turn reduces the requirements for further stormwater treatment devices within the public realm (roads/reserves) therefore reducing the long term OPEX burden to Council. Rainwater reuse provides a readily scalable example of NbS which can be tailored to mimic the natural undeveloped hydrology through retention whilst supporting co-benefits to reduce impacts from municipal potable water takes, connecting communities with the water 'story' and providing resilience to potable water shortages and/or outages.

44 **Urban residential intensification – Hobsonville Point Auckland**

44.1 Development of the former RNZAF land at Hobsonville Point was planned as a high yield development with performance metrics to ensure that this did not compromise social and environmental outcomes. Initially commence prior to amalgamation, the development was subsequently supported by provisions in the Auckland Council Unitary Plan with clear requirements to manage stormwater, built form and public realm in line with national and international best practices. Largely completed the development has provided an exemplar for doing density well. Of note the development was largely unimpacted by recent intense rainfall (which exceeded 1% AEP) with flood water accommodated within landscape and limited property damage despite the intensity of rainfall in the immediate area. Extensive tree planting, restoration of coastal margins and integrated water sensitive design will continue to support ongoing improved environmental and social outcomes in coming years.

Effective Implementation of Nature Based Solutions

45 The specification or technical requirements to inform the selection and/or design of NbS need to respond to the specific functional requirement related to the proposed or existing landuse activity. These functional requirements may be triggered by change in landuse or development at a range of scales which in many instances will not trigger regional consents or oversight (for example development with permitted activity status).

46 Technical requirements/standards related to NbS could include metrics such as:

46.1 Percentage of effective pervious land on lots whereby effective pervious land includes the combination of undeveloped and vegetated land, areas of roof either in green roof or with rainwater reuse tanks and areas of paving/hardstand which connects to an appropriately designed stormwater treatment device.

46.2 Rainfall depth or water quality volume to be captured and treated for stormwater contaminants to protect urban streams, shallow groundwater and waterbodies.

46.3 Rainfall depth to be intercepted and retained (through reuse or infiltration) to match natural hydrology in freshwater and tidal streams.

46.4 Targets for mature tree canopy coverage for road corridors and car parks.

46.5 Proportion of public greenspace dedicated to functional indigenous ecosystems (this could include vegetated buffers and/or vegetated treatment devices).

46.6 Width of riparian margins to be planted in indigenous species (this could include proportion of vegetated treatment devices co-located in riparian corridors).

46.7 Net Carbon emissions to be offset taking into consideration sequestration achieved through vegetated systems and project related re-vegetation.

46.8 Annual Exceedance Probability (AEP) event to be managed to prevent downstream flooding impacts.

46.9 Proportion of impermeable landcover or public open space within urban areas

47 These metrics need to be understood by land owners (including public ownership), developers and investors at the outset to inform efficient and effective outcomes and ensure that development planning can proceed without undue time or cost.

48 NbS can result in activities or ‘green infrastructure’ which remains in either private or public ownership. Where NbS remain in private ownership there is a need to have some form of mechanism to ensure that the solutions remain in the intended condition and provide the functional outcomes over a realistic timeframe. These performance outcomes must therefore be clearly understood by current and future landowners and be able to be audited or monitored to ensure that the intended function is sustained. Hamilton City Council are currently developing a targeted program for periodic auditing, reporting and rectification notifications for private lot scale water sensitive design devices including Rainwater reuse tanks and lot scale infiltration.

49 Where NbS are vested into public ownership (or developed by territorial authorities) the councils must have an understanding and adequate resources to maintain NbS to ensure that the solutions remain in the intended condition and provide the functional outcomes over a realistic timeframe.

50 It is therefore considered critical that territorial authorities are equipped to support the implementation of NbS given the importance of these measures to support the growth and development of urban and rural land within their jurisdiction including where solutions are vested to councils and where they remain in private ownership but are maintained to provide a public good.

51 The inclusion of clear policy, rules and means of compliance relating to NbS in the regions District Plans is therefore an important consideration in supporting long term sustainable development and growth.

Conclusions

52 Legislative and non-legislative drivers for improved urban and rural outcomes is best supported by Territorial Authorities providing clear rules and policies through District Planning and associated codes of practice that can be assessed through consenting. This will be increasingly important with urban infill development which does not necessarily trigger Regional Council consents and in many instances is regarded as a permitted activity.

53 There remains apparent confusion around the difference between detention (hydraulic neutrality) and retention (hydrologic controls). It is important to recognise the fundamental difference between these terms with detention to support capacity and flood issues and retention to support environmental outcomes and Te Mana o Te Wai.

54 District Plans need to have clear requirements around outcomes and performance to be achieved in future landuse activities/developments within their jurisdiction and specific

metrics where NbS are the optimal means of supporting a suite of environmental, cultural and social outcomes which are resilient to climate and affordable over a realistic timeframe.

55 Existing Policy and Rules within the UHCC proposed District Plan need to be amended if future development is to avoid ongoing loss of freshwater values, biodiversity and cultural values/aspirations. In particular, standards to be met to meet permitted activity status need to include requirements for hydrological controls which will typically also support robust water quality improvements suited to medium/high density intensification.

56 Amendments proposed by GWRC (evidence of Ms Pamela Guest) are supported as a practical and robust means of achieving required outcomes from all future development, including medium and high density development.

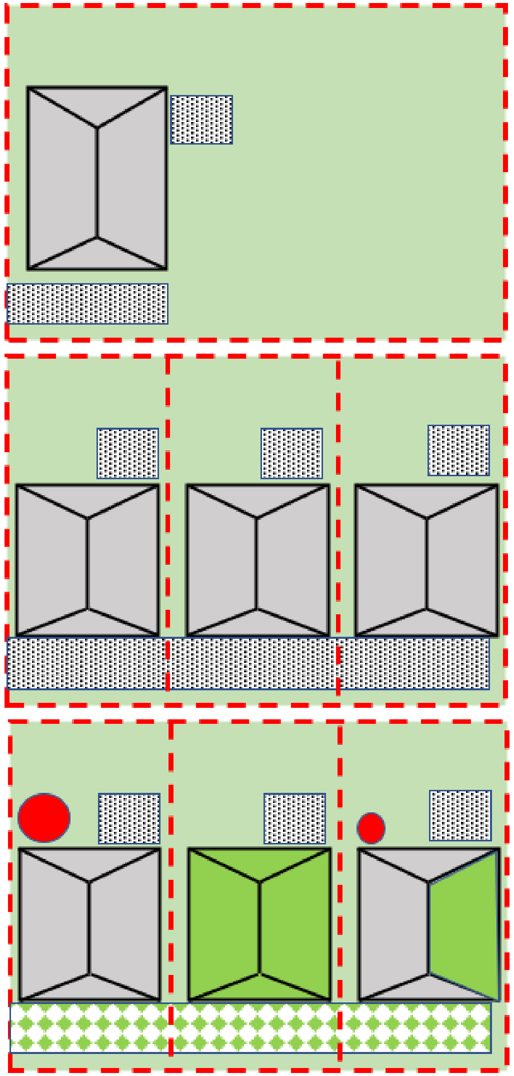
57 It is critical that improved urban stormwater outcomes and proposed NbS are independent of scale and apply to any change in landuse where impacts occur. This is especially important for future urban intensification and infill development which does not typically trigger resource consent but will result in cumulative impacts that will worsen the current poor outcomes and reduce the ability of communities and ecosystems to withstand current and future climatic conditions. Future intensification/infill needs to be recognised by UHCC as an opportunity to seek improvements on the current status quo.

58 Clarity around what the term resilient means is important to ensure that councils and landowners understand the intention to support environmental and social outcomes in the short and long term.

Stu Farrant

19 April 2023

Appendix 1; Intensification development schematic



1) Existing case - 600 m^2 Lot with single 120 m^2 dwelling

- Roof coverage 120 m^2 (20%)
- Driveway 60 m^2 (10%)
- Hardstand 30 m^2 (5%)
- Pervious area 390 m^2 (65%)

2) Future infill case - 3X 200 m^2 Lots with 100 m^2 dwellings

- Roof coverage 300 m^2 (50%)
- Driveway 60 m^2 (10%)
- Hardstand 60 m^2 (10%)
- Pervious area 240 m^2 (30%)

~70% increase in Stormwater Volume from frequent storms (<10mm depth)

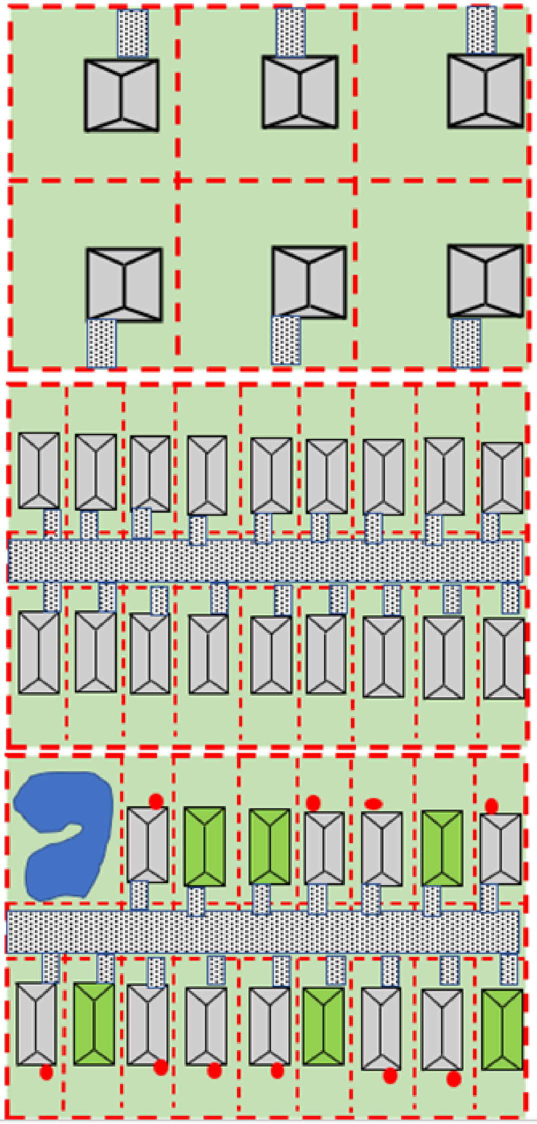
~40% loss in urban greenspace

3) Nature based solutions

- Rainwater collection and reuse (toilet flushing/irrigation)
- Green roofs
- Permeable paving
- Lot scale raingarden

~80% decrease in Stormwater Volume from frequent storms (<10mm depth)

~10% gain in urban greenspace



1) Existing case – 6 X 500 m² Lot with single 110 m² dwellings

- Roof coverage 660 m² (22%)
- Driveway 120 m² (4%)
- Hardstand 120 m² (4%)
- Pervious area 390 m² (70%)

2) Future infill case – 18 X 150 m² Lots with 70 m² dwellings

- Roof coverage 1215 m² (40%)
- Driveway 360 m² (12%)
- Public road 300 m² (10%)
- Pervious area 1125 m² (37%)

~110% increase in Stormwater Volume from frequent storms (<10mm depth)
~50% loss in urban greenspace

3) Nature based solutions

- Rainwater collection and reuse (toilet flushing/irrigation)
- Green roofs
- Permeable paving
- Lot scale raingarden

~80% decrease in Stormwater Volume from frequent storms (<10mm depth)
~10% gain in urban greenspace – Public realm