

HYDROLOGICAL & ENVIRONMENTAL IMPLICATIONS OF HOUSING INTENSIFICATION TO THE SINGLE HOUSE ZONE SUBURB OF COCKLE BAY

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Executive Summary

This Discussion Paper has been prepared to highlight concerns regarding consequences of possible intensification within the Cockle Bay area following the adoption of the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021. These concerns can be presented as part of the Plan Change process to Auckland Council and Independent Hearings Panel (IHP) by residents who are concerned about possible intensification. The Act enables Auckland Council to incorporate some safeguards (“qualifying matters”) into the Auckland Unitary Plan (AUP) to preclude intensification considered to be unsuitable for an area.

The Discussion Paper suggests a number of reasons why intensification within the Cockle Bay catchment has the potential to cause adverse effects. It suggests these “qualifying matters” can be included in an updated AUP and be used to prevent undesirable developments. These reasons include:

- **Inadequate Drainage Infrastructure Capacity:** Stormwater, wastewater and water supply infrastructure in the Cockle Bay catchment was predominantly installed several decades ago. Many properties do not have piped stormwater network to cater for Auckland Council’s current stormwater design standard for a 10 year Average Recurrence Interval (ARI) flow, still less the water flow than projected to occur as a result of climate change. Extensive flooding occurred in Cockle Bay in 2018 due to inadequate capacity of the drainage infrastructure.

There have already been incidences of flooding and stream erosion requiring costly remediation. Intensification will increase this risk. The risk will be further compounded by the possible occurrence of “Atmospheric Rivers” - very intense, localized rainfall, affecting Cockle Bay. One only has to look at more recent flooding instances in New Zealand and Australia to draw a picture of the potential devastation that could occur in the area.

- **Wastewater Infrastructure Failures:** Watercare’s records indicate an ongoing history of sewer overflows in the area. The age of the wastewater infrastructure with broken pipes or displaced joints contributes to freshwater infiltration into the wastewater pipes and sewage leakage from pipes into the local environment, further contributing to environmental and community health problems.

Under these circumstances of the stormwater and wastewater networks being inadequate for existing development, it is obvious that these systems will not cope with the intensification, significant upgrading and renewal may be required.

- **The Provisions of the AUP will not be met:** The AUP standards (Section E8.6) requires any development does not result in, or increase, flooding of other properties in rainfall events upto the 10 year ARI, or inundation of buildings up to the 100 year ARI. The storms of 2018 which were 10 year ARI and less caused properties and habitable floors flooding in Cockle Bay. Neither the existing main drainage culverts, nor the streams or other overland flow channels were able to convey that flood safely. In the event of intensification occurring over the catchment as a whole, any mitigation measures provided in the upper half of the catchment such as rainwater tanking to limit the post development larger flows of 10 year ARI and 100

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year ARI to their existing rates, will not improve existing flooding. The increased volumes from these storms will rather worsen the situations. Larger flow attenuation provided in the lower half of the catchment will not be effective due to possibility of the peaks coinciding, which will make existing flooding worse. This flooding will be further compounded by the projected sea level rise as a result of climate change effects.

- **Increased Sedimentation on Cockle Bay:** Recent surveys of Cockle Bay have identified and quantified increased sedimentation, thus threatening the marine environment. Intensification will inevitably increase this degradation.
- **Compliance with New Zealand Coastal Policy Statement, 2010:** This Discussion Paper has identified ten requirements of the New Zealand Coastal Policy Statement that apply to Cockle Bay area, including avoiding adverse effects from intensification; and risks to habitats from sedimentation. We are concerned that these requirements may not be met by the intensification.

1 Purpose of Discussion Paper

The purpose of this Discussion Paper is to explore the physical, legislative and regulatory constraints that require consideration in any Plan Change now required to meet the requirements of the Resource Management (Enabling Housing and Other Matters) Act 2021. The Act will allow many property sites to be developed to higher densities than those currently permitted. The Act also provides for “qualifying matters” to be incorporated into Council’s planning documents in order to avoid adverse effects from intensification. This Paper provides the hydrological and environmental implications of intensification in the Cockle Bay suburb and raises qualifying matters to be considered when finalizing the Plan Change.

The Discussion Paper suggests intensification is not suitable for the Single House Zone (SHZ) of Cockle Bay catchment area due to its special physical features, sensitive receiving environments and inadequate supporting drainage infrastructure. The catchment extends from the Sandspit and Litten Roads ridge line down to the sea. It is bounded by Sandspit Road, Litten Road, Pohutekawa Avenue and Cockle Bay Road. Some locations are designated Significant Ecological Areas (SEAs) with existing constraints which will need to be reviewed.

We suggest that local residents interested in making a submission on the Plan Change required by the Act consider the factors outlined below. Any points they support can be included in their submissions on the Plan Change with a request that they be considered by the Independent Hearings Panel (IHP) to be appointed to provide recommendations to Council.

2 Inadequacy of Stormwater Infrastructure

Much of the area was developed under the legacy Manukau City Council from the mid-1970s onwards. A large number of existing properties in the Cockle Bay catchment potentially eligible for intensification do not have stormwater reticulation. Many still rely on soak holes most of which are dysfunctional. This has a significant effect on the capacity of stormwater infrastructure to cater for future stormwater flows associated with intensification. This capacity problem is explained by the fact that the legacy Manukau City Council rules set a design standard of a 5 - year ARI for the primary drainage system design. The Auckland City Council’s design standard at the time was, and still is, for a 10 - year ARI. Thus, not only does the area have insufficient drainage capacity to cope with the flows expected if all existing houses were connected to the stormwater infrastructure, but the designed capacity is insufficient to cope with Council’s standard of 10- year ARI² to accommodate climate change factor³ for the future, resulting in increased flooding risks.

3 Increased Flooding Risks

The more significant flooding in the Cockle Bay area have occurred in recent years. The flooding that occurred in 2018⁴ from storms (3rd June, 15th July and 29th August) reported by Council to be of 10 - year ARI and less flooded a larger number of properties and at least two habitable floors (See Figure 1 below).

The capacity of the 1500 mm diameter culvert under Pah Road that conveys the majority of the catchment runoff was known to have been exceeded in two of the three flooding events⁵, with flow spilling over Pah Road causing major flooding issue.

Climate change is predicted to increase both the likelihood and magnitude of rainfall. The peak flow rate at a 100 - year ARI will be approximately double the size of the 10- year ARI flow of 2018, the extent of the 100 - year ARI flood in the future when affected by climate change will be significantly larger than that of 2018 flood. Intensification will potentially alter catchment properties and microclimate, which in turn will influence on-site and downstream hydrological processes, rainfall-runoff relationships, groundwater recharge, and the overall catchment water balance. Council is

² Reference 1

³ Reference 1

⁴ Reference 2

⁵ Reference 2

required under the AUP⁶ to protect properties against flooding in rainfall events up to the 10 - year ARI or inundation of buildings in rainfall events up to the 100 - year ARI.



Figure 1 Flooded properties in the three storm events in 2018 at Cockle Bay (Reference 2)

Figure 2(a) below provides the National Policy Statement on Urban Development Zone map of NZ Government's new housing rules that apply to the Cockle Bay suburb and Figure 2(b) represents the AUP Zone map for this area⁷.



Figure 2(a) NPS-UD Zone Map

Figure 2(b) AUP Zone map

⁶ Reference 3

⁷ Reference 4

The maximum imperviousness for the Medium Density Residential Standards (MDRS) is not specified⁸. If it is greater than 60% specified for the SHZ, then stormwater flows and volumes from the intensified sites will be greater than that for the SHZ developments. The building coverage for the MDRS is 50%⁹ of the net site areas compared to 35% for the SHZ areas. As such, compared to the intensified sites, the SHZ areas will provide more spaces and opportunities to adopt water sensitive urban design techniques within the pavement areas and use more environmental responsive materials such as permeable pavements as part of the hydrology mitigation to meet detention and retention requirements for the SMAF-2 designation¹⁰ of the Cockle Bay catchment. Permeable pavements can reduce runoff and flooding which will also help replenish groundwater flows¹¹. Also, intensified sites are likely to be more environmentally damaging due to their larger building coverages than that of the SHZ sites, potentially causing higher temperature effects to the neighbourhoods and the water bodies.

It is expected that a range of the flows such as 2- year ARI, 10- year ARI and 100- year ARI from new intensification in the upper half of the Cockle Bay catchment would be controlled to their current levels through rainwater detention tanks or similar other detention devices. The 100- year ARI flow attenuation in the lower half of the catchment will not be effective due to possibility of the peak flows coinciding¹². Because of the reason of the peak flows coinciding, Council's Stormwater Management Devices in the Auckland Region (GD01)¹³ suggests that detention of 10% AEP (10-year ARI) and 1% AEP (100 -year ARI) rainfall events is not required for developments that are located within the lower half of the catchment. This situation will make flooding in the lower part of the Cockle Bay catchment worse than it is now.

For both the upper and lower parts of the catchment, the total volumes from intensification at the 10 - year ARI and 100 -year ARI storms will increase causing severe flooding if existing under-capacity drainage systems are not upgraded to convey larger flows safely. The inconvenience from this flooding can include the loss of enjoyment of the natural environment, health and safety hazards to the residents; erosion and shifting of streams between properties adding financial burden to property owners, the potential loss of land and the loss of amenity of that place for the community.

Not only does the existing infrastructure lack the capacity to meet Council's current design standards for stormwater (e.g. the 1500 mm dia culvert under Pah Road), but in the event of intensification the streams that provide much of the drainage for this catchment will be unable to cope with surplus volumes of water requiring significant additional investments in stormwater infrastructure for intensification to mitigate this risk.

4 Risks from “Atmospheric Rivers”

As referenced in Section 3 above, severe flooding in Cockle Bay has become relatively a recent phenomenon. It is noted that no precise rainfall data is available for the Cockle Bay catchment, as the nearest recording station is some distance away. However, an email from Mr Nick Vigar (Safeswim Program Manager, Healthy Waters of Auckland Council) dated 21 February 2022 suggested that there are good reasons to believe that the Cockle Bay catchment does receive frequent & intense cloudbursts, resulting in unusually heavy rainfalls¹⁴. This reinforces the importance for limiting development where there is inadequate existing drainage infrastructure.

Improvements in science have enabled better understanding and tracking of weather patterns, leading to the identification of so-called “Atmospheric Rivers” (AR). Researchers have reported that New Zealand is located in a region of high AR frequency where nine of the ten most damaging floods between 2007 and 2017 occurred during AR events¹⁵. Indications are that Cockle Bay is a location more liable to experience intense rainfall attributable to these events¹⁶, making stormwater infrastructure capacity adequate to cope with Council's design standards is particularly important.

⁸ Reference 5

⁹ Reference 5

¹⁰ Reference 3

¹¹ Reference 3

¹² Reference 7

¹³ Reference 6

¹⁴ Reference 8

¹⁵ Reference 9

¹⁶ Reference 8

Designing drainage systems for the ARs is not practical, however, upgrading of existing infrastructure to cope with Council's design standards will ease flooding from the ARs.

Cockle Bay catchment is relatively steep at 3% slope. A number of properties have stability issues. The possibility of destabilisation of already unstable properties from the effects of intensification and extreme rainfall events cannot be ignored.

5 Cockle Bay Stream Erosion and the Sedimentation of Turanga Estuary

Associated with the need to comply with the provisions of the Coastal Policy Statement is the obligation in the AUP to safeguard streams and biodiversity. The Cockle Bay stream originating from Sandspit Road and discharging to Cockle Bay is a permanent stream (AC's Geomap) which was listed by the legacy Manukau City Council as protected (Manukau Operative District Plan 2002). This stream drains into the Turanga Estuary (designated as SEA-M2 under Schedule 4 -Significant Ecological Areas- Marine Schedule, AUP). The New Zealand Fisheries Assessment Report 2021/49¹⁷ states "... changes in sediment composition across years were evident for a number of sites (e.g., Cockle Bay, Bowentown Beach, Raglan and Whitianga harbours), which showed a shift towards higher fractions of fine sand and fines in recent surveys".

Intensification will create numerous building construction sites in the Cockle Bay catchment. It is essential that the erosion and sediment control (ESC) measures and practices used on the sites during construction periods recognise the sensitivity of the receiving environments and manage discharges of sediments accordingly. The current ESC practice is to retain 75% of sediments generated from the sites, the remaining 25% finer sediments will discharge to the receiving environments. This will lead to more sedimentation occurring in the Cockle Bay Stream and in the Turanga Estuary.

The Research priorities report published by the Department of Conservation¹⁸ suggests that once sediment has accumulated in the CMA, there are very few realistic options for remediation. It is typically not practical to remove problematic sediment by dredging, and every attempt to reseed shellfish populations on seabeds that have become muddy has failed to date. Therefore, mitigation is usually the most effective action.

The AUP designates the Cockle Bay Stream and its catchment as Stormwater Management Area – Flow 2 (SMAF-2) and the Turanga estuary as SMAF-1 (Figure 3 below). Both areas have high aquatic biodiversity needing protection from further adverse effects of stormwater runoff associated with urban development. Intensification, and all the associated earthworks and the subsequent runoff and pollution, is likely to increase sedimentation and further damage marine habitats.

Cockle Bay Stream is currently unstable and is unable to contain the current 10-year ARI flow within its banks. Overflows occur at several places onto private properties. As far as possible individual property owners maintain this stream within their property boundaries, flooding becomes an added financial burden to them.

Widely accepted hydraulic modelling will demonstrate the erosion attributable to increased water flows and increased flow durations¹⁹. Although detention devices can be designed to limit peak flow rates from 2 -year ARI through to the 100 -year ARI to their predevelopment levels, this does not address the increase in runoff volumes²⁰. The flood volumes from intensification in Cockle Bay catchment will be larger than from the SHZ development as discussed in section 3 above. Two-year flow control may exacerbate channel degradation, as increased volume in post-development runoff results in channel banks exposed to erosive flows for longer durations and more frequently than in the pre-development state²¹. From this, the stream bed and sides are likely to erode further and can bring changes to the hydraulics, morphology and ecology of the stream resulting in further degradation of its water quality and subsequent loss of habitats. Stream channels are dynamic systems that can accumulate, convey or lose sediment over time and space.

¹⁷ Reference 10

¹⁸ Reference 11

¹⁹ Reference 12

²⁰ Reference 12

²¹ Reference 12

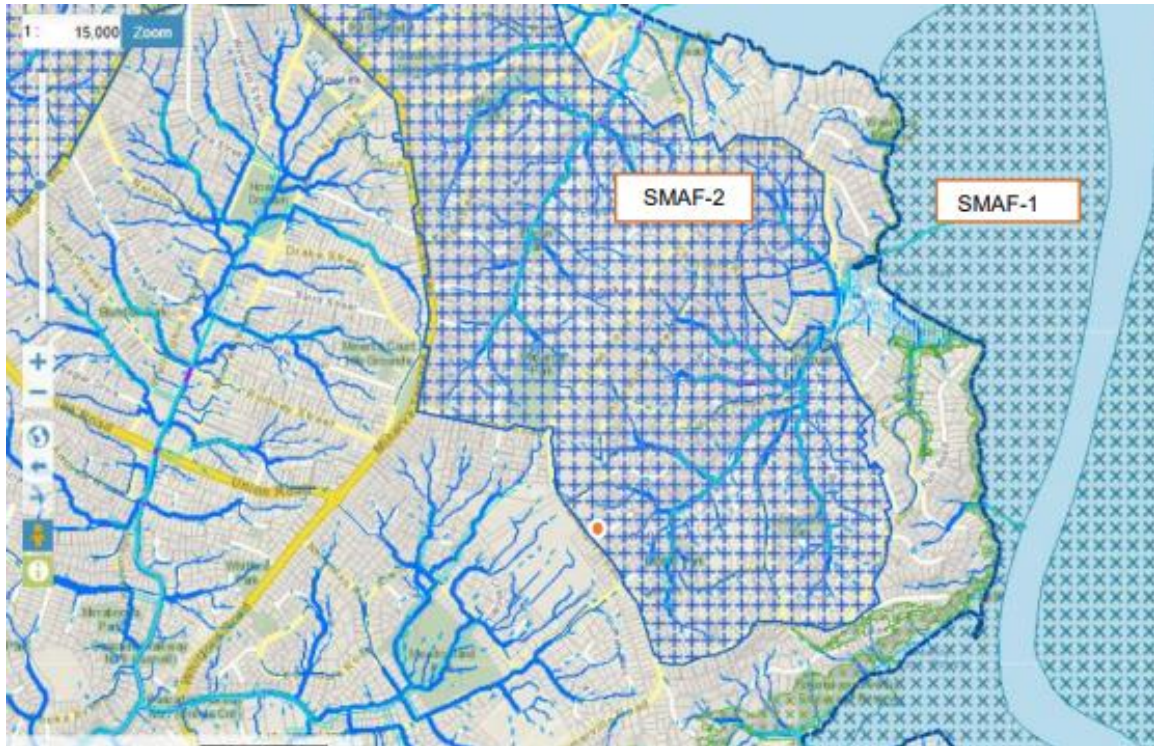


Figure 3 SMAF-1 and SMAF-2 Areas (AUP- Reference 3)

Furthermore, the combination of contamination released from intensification, reduced base flows from reduced infiltration; potential contamination of groundwater flows and increased water temperature from climate change effects are set to further deteriorate the water quality and environments.

6 Wastewater Infrastructure Issues

Watercare records suggest that the Cockle Bay catchment has a history of sewer overflows. The wastewater system is quite old. Several of the lines are AC pipes laid in 1963 or thereabouts. These lines will have cracked pipes, joint defects, which can allow infiltration and exfiltration, or both. Watercare's report on Cockle Bay Flow Monitoring²² found some wastewater catchments to respond rapidly to rainfall with notable peaks of up to 8 times the typical average dry weather flow rates indicating direct stormwater connections into sewer lines.

So, stormwater and wastewater issues are interrelated; there is potential for water quality issues, and smell and health hazards to the affected property owners. Some overflow manholes lie within the 100-year ARI floodplain indicating stormwater and sewer issues are interrelated and mixed.

Intensification will add more load to the wastewater system due to increased population resulting in more overflows, health risks and environmental degradation.

7 Compliance with New Zealand Coastal Policy Statement, 2010²³

Section 77G of the Resource Management (Enabling Housing and Other Matters) Act 2021 sets out eligible qualifying matters that can be applied to ensure intensification does not occur where it will have adverse effects. This includes application of the provisions of the New Zealand Coastal Policy Statement (NZCPS), 2010.

²² Reference 13

²³ Reference 14

The following provisions of NZCPS, 2010 are applicable to the SHZ areas of Cockle Bay:

- i) Cockle Bay suburb is close to the coastal location, there can be direct adverse effects of intensification to the coastal environments (Relevance: Preamble).
- ii) The natural and recreational attributes of the coast and its attraction as a place to live and visit will be subjected to growing pressure from the intensified suburb on coastal space and other resources (Relevance: Preamble)
- iii) Intensification will increase activities inland which will have a major impact on coastal water quality (Relevance: Preamble).
- iv) As outlined earlier, intensification will put species, habitats and ecosystems in the stream and coastal environment under pressure (Relevance: Preamble).
- v) Intensification will result in poor and declining coastal water quality in many areas as a consequence of point and diffuse sources of contamination, including stormwater and wastewater discharges (Relevance: Preamble)
- vi) The continuing coastal erosion and other natural hazards that will be exacerbated by climate change will be made worse by the intensification which will increasingly threaten existing infrastructure, public access and other coastal values as well as private properties (Relevance: Preamble) .
- vii) Intensification may fail to achieve the rate at which built development and the associated public infrastructure are enabled to provide for the reasonably foreseeable needs of population growth without compromising the other values of the coastal environment (Relevance: Policy 6 (1) (b).
- viii) Reducing sediment loadings in runoff and in stormwater systems through controls on land use activities is unlikely from intensification compared to the SHZ situation (Relevance: Policy 22(4).
- ix) For the current state of the reticulation network in Cockle Bay suburb with wastewater leakages and overflows occurring, the intensification is unlikely to be able to completely prevent these discharges to water in the coastal environment. A wastewater upgrade and renewal plan will be required to prevent this to happen (Relevance: Policy 23(2) (a)
- x) The intensification does not have a plan to consider the likely impact of coastal processes and climate change so as not to compromise the ability of future generations to have access to public open space (Relevance: Policy 18(d).

8 Conclusion

Any decision to permit intensification in the Cockle Bay catchment will carry big hydrological and environmental risks. The stormwater and wastewater networks are inadequate for existing developments, therefore do not have the capacity to service intensification. Significant upgrades will be required to stormwater and wastewater networks and sewer pumping stations before there is adequate capacity to accept increased levels of discharges. A comprehensive infrastructure upgrade plan will be required as part of the intensification plan. Adequate infrastructure should be in place prior to any intensification occurring.

Note: This report is prepared for the SHZ Cockle Bay Suburb. The issues raised in this report may be applicable to other SHZ suburbs of Auckland who have similar physical characteristics and social settings.

References

Reference 1: Auckland Council Code of Practice for Land Development and Subdivision Chapter 4-Stormwater, January 2022.

Reference 2: Quantifying the contribution of rainfall and tide levels on flooding in low-lying coastal areas by Cheryl Bai (Auckland Council) and Josh Irvine (WSP/ Opus): 2019 Stormwater Conference & Expo).

Reference 3: The Auckland Unitary Plan Operative in Part, 29 September 2016.

Reference 4: Auckland Council's Preliminary Viewer for NPS-UD and MDRS, April 2022.

Resource 5: Management (Enabling Housing Supply and other Matters) Amendment Bill, Schedule 3A Part 2, Clause 13 (enacted).

Reference 6: Stormwater Management Devices in the Auckland Region (GD01).

Reference 7: NZTA Stormwater Treatment Standards for State Highways, May 2010.

Reference 8: Mr Nick Vigar's (Safeswim Program Manager, Healthy Waters of Auckland Council) email dated 21 February 2022 to Mr Matthew Brajkovich, Chairman of the Howick Ratepayers and Residents Association Inc.

Reference 9: Extreme rainfall in New Zealand and its association with Atmospheric Rivers, 2021 by Kimberley J Reid, Suzanne M Rosier, Luke J Harrington, Andrew D King and Todd P Lane.

Reference 10: New Zealand Fisheries Assessment Report 2021/49, September 2021.

Reference 11: Steering our waka through turbid waters, research priorities over the next 5 years for sediments in the coastal marine area of Aotearoa New Zealand, published by the Department of Conservation, September 2021.

Reference 12: Defining hydrologic Mitigation Targets for stormwater design in Auckland, TP 2013/024, Auckland Council.

Reference 13: A report on "Cockle Bay Wastewater Flow Monitoring", by Mott MacDonald New Zealand Limited, 23 March 2020 for Watercare Services Ltd.

Reference 14: New Zealand Coastal Policy Statement, 2010.