IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER **Kapiti Coast District Council** Proposed Plan Change 2: Intensification (PPC2) to the Kapiti Coast District Plan.

STATEMENT OF EVIDENCE OF CRAIG MARTELL ON BEHALF OF THE MANSELL FAMILY SUBMITTER No. #S023

INTRODUCTION

Qualifications

1. My full name is Craig Murray Martell. My qualifications are Bachelor of Science (Hons) from Victoria University (1994) and Master of Science (Hydrology) from Victoria University (1996).

Experience

2. I am the Managing Director of Awa Environmental, an environmental consulting firm with a focus on hydraulic modelling of rivers and stormwater networks. I have 25 plus years' professional experience in hydraulic modelling, flood plain management and stormwater management. Prior to operating my own independent consultancy, I was amongst other roles, the practice leader for flood risk management at Jacobs NZ. I have worked extensively through New Zealand on river and urban stormwater projects and have been modelling stormwater systems since 1994.

3. For the majority of this time, I have had a strong working involvement in stormwater quality and quantity in Kapiti Coast District. This has included being the lead stormwater advisor to the Council, developing hydraulic models and associated flood hazard management plans from

1998 to present, designing and constructing numerous projects, providing asset management advice, climate change advice, low impact design standards, attending numerous public and private plan changes as an expert witness, and community consultation with much of the above. I have also worked extensively with developers in the district including substantial plan changes including leading the development of the Ngarara Zone and leading the 3 waters AEE for Waikanae North.

Code of Conduct

4. Although not necessary in respect of council hearings, I can confirm I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2014. I have complied with the Code of Conduct in preparing this evidence and I agree to comply with it while giving oral evidence before the hearing committee. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

BACKGROUND

5. I understand that as part of Proposed Plan Change 2 (PPC2) the Mansell Family have made a request to re-zone their land at Otaihanga as part of their submission. This includes a request to rezone the site from Rural Lifestyle to General Residential and amend plans and any relevant provisions.

6. I confirm that I have previously provided advice and undertaken assessment in support of the Mansell's subdivision of that site in 46 residential lots (RM210147) was a non-complying resource consent application. That application was publicly notified and went through a hearing process. It is described in more detail in the evidence of the submitters planning expert Mr Hansen (at para. 4.3). The Mansell family obtained subdivision consent with conditions from Kapiti Coast

District Council dated 2nd November 2022, which was appealed by a submitter to the Environment Court.

7. The Mansell family also obtained non-notified non-complying consents from Greater Wellington Regional Council in October 2021 and an Archaeological Authorisation for earthworks from Heritage New Zealand in January 2020 and has applied for lizard relocation permits from the Department of Conservation under the Wildlife Act.

8. I have been involved in the following aspects of the proposal, flood hazard assessment of effects modelling and reporting, options assessment for the sizing and design of stormwater mitigation devices Specifically, this has involved:

   (i) I have provided ongoing design advice to the project team on the options/requirements for stormwater mitigation of the development. I identified how low impact design solutions should be implemented, utilising the soakage potential of the dunes, across the site to achieve hydraulic neutrality as described in the Kapiti Coast District Council Subdivision and Development Principles and Requirements 2012 document.

   (ii) I have overseen the construction of the existing flood hazard model of the site using MIKEFLOOD software.

   (iii) I have attended meetings with Greater Wellington Regional Council (GWRC) and assisted the Applicant gain regional resource consents for the development.

   (iv) I was the primary reviewer of the Otaihanga Road Subdivision (including bulk earthworks and infrastructure) Flood Hazard Assessment of Effects report, as to the effects of the application, which supported the Application for resource consent to both GWRC and KCDC.

   (v) Participated in meetings.

- 13/05/2021 - Site visit & workshop – Phernne Tancock, Richard Mansell, Nick Taylor, Dave Compton Moen, Chris Hansen and Nick Goldwater.

- 20/07/2021 - GWRC meeting – Stu Farrant (GWRC Consultant), Genevieve Walker (GWRC Resource Advisor), Anna McLellan (GWRC Resource Advisor), Chris Hansen (Planner).

- 25/02/2021 - GWRC meeting – Ryan McAlister (Kaitohutohu/Resource Advisor, Environmental Regulation).

- 15/11/2021 – KCDC meeting - John Saxton (Senior Water & Wastewater Engineer), Rita O'Brien (Stormwater & Coastal Engineer), Sushil Timsina (Development Engineer), Sakirin Sapeas (Senior Business Advisor for Development Agreement, Amanda Cottrell (Executive Secretary), Richard Mansell (Applicant), Phernne Tancock (Barrister), Chris Hansen (Planner), Nick Taylor (Survey/Land Development).

(vi) Assisted the Applicant to respond to Further information Requests from both Regional and District Council's.

(vii) Attended the resource consent hearing and gave evidence on behalf of the Mansell Family.

9. As a result of my very recent prior involvement in the resource consent project, I have a good understanding of the site and surrounds and the potential effects of residential development in this location.

10. These are covered in detail in my assessment report which I co-authored for the resource consent application. A copy of this is attached at **(Appendix 1).**

11. in preparation for my evidence on PPC2 I have read:

- Cuttriss Consultant Limited report titled: Otaihanga Estates Proposed Subdivision at 131 – 155 Otaihanga Road and 48 – 58 Tieko Street, Otaihanga**.**

- HAL Hydraulics Analysis Limited report titled: Kapiti Coast District Council – Paraparaumu Wastewater Modelling Otaihanga Road Development Impact Assessmen**t.**

- Kapiti Coast District Council report titled: Plan Change 2 - Council Officers' Planning Evidence.

- Awa Environmental Limited report titled: Otaihanga Road Subdivision (including bulk earthworks and infrastructure) – Flood Hazard Assessment of Effects.

- NPS-UD May 2022 Update.

- KCDC proposed Plan Change 2 – Intensification and the accompanying s.32 Evaluation Report and appendices.

Description of the site

12. The site sits between Otaihanga Rd to the south, Tieko Street to the west and the new State Highway 1 to the east.

13. At the edge of Paraparaumu township the site is central within the district and better served by infrastructure than many of the greenfield areas to the north of Waikanae.

14. The site is dominated by large inland dunes with some lower lying interdune areas. These dune phases are characterised by high soakage soils that allow for a variety of low impact stormwater solutions to be implemented on site to manage stormwater within the development to meet KCDC's relevant requirements for hydraulic neutrality.

15. Given the sites location and elevation it is not prone to flooding from the Waikanae River or coastal inundation making it a good location for a residential development.

16. It should be noted that we have not undertaken a specific additional AEE report for the proposed change in urban form. We propose this is manged through consent conditions as covered in our evidence below.

17. We have however referred to our previous Awa Environmental Limited report titled: Otaihanga Road Subdivision (including bulk earthworks and infrastructure) – Flood Hazard Assessment of Effects, for spatial context.

RESPONSE TO FURTHER SUBMITTERS

18. The following concerns relevant to hydraulic modelling, flood-plain management and stormwater management have been raised in submissions on this proposal.

19. **Brent and Leanne Morris** (further submission number S235.FS.1) has expressed concern that there is not enough infrastructure in Otaihanga to handle intensification, especially if 3, three storeys are allowed. For example, our property has a sewer tank and pump that has to be pumped up over multiple hills and acres to connect to the existing mains in Tieko Street. There is no existing sewage connection along Otaihanga Road for the part of Otaihanga where we live.

20. The provision of infrastructure is a requirement for any new development. Confirming water supply or wastewater services can be provided to this development will be a condition of consent of any development that occurs under PPC2 - no houses will be developed without necessary services. On initial review additional density may benefit existing properties, i.e.: connecting the water supply from the northern end of Tieko Street back through the proposed development to Otaihanga Road will provide additional resilience.

21. Water supply pressures in this area appear to be strong and the watermain down Otaihanga Rd is relatively modern. There is no obvious reason to consider pressures cannot be maintained with the additional housing proposed but this will need to be confirmed by specific analysis.

22. Increased wastewater volumes are likely to require an upgrade to the Ratanui Pump Station which would have been running at capacity under the previous consented development. This is a relatively straight forward process of replacing the pump to upgrade the pump capacity and could be a condition of any future resource consent. It is not a barrier to developing or rezoning the site. The modelling undertaken by HAL as part of the Otiahanga Resource consent proposal would need to be revised to assess the requirements for the PS upgrade.

23. With regards to stormwater infrastructure the site is dominated by sandy soils. Previously it has been shown, in our report (Appendix 1), that stormwater effects can be managed on-site utilising these high soakage soils. We are confident the proposed increased density will not impact on this conclusion. However, some land that has currently being highlighted as development lots may need to be given up for the stormwater devices. In particular, the lots adjacent to the engineered wetland will need to be reduced in area and some redesign maybe required of the proposed roading network with the release of lots for stormwater treatment in and around the low point in the road around lots 17, 18, 24, 30 and 31, as shown in (Appendix 2). We have been advised by the client that they understand some lots may be lost in the detailed design phase of the project.

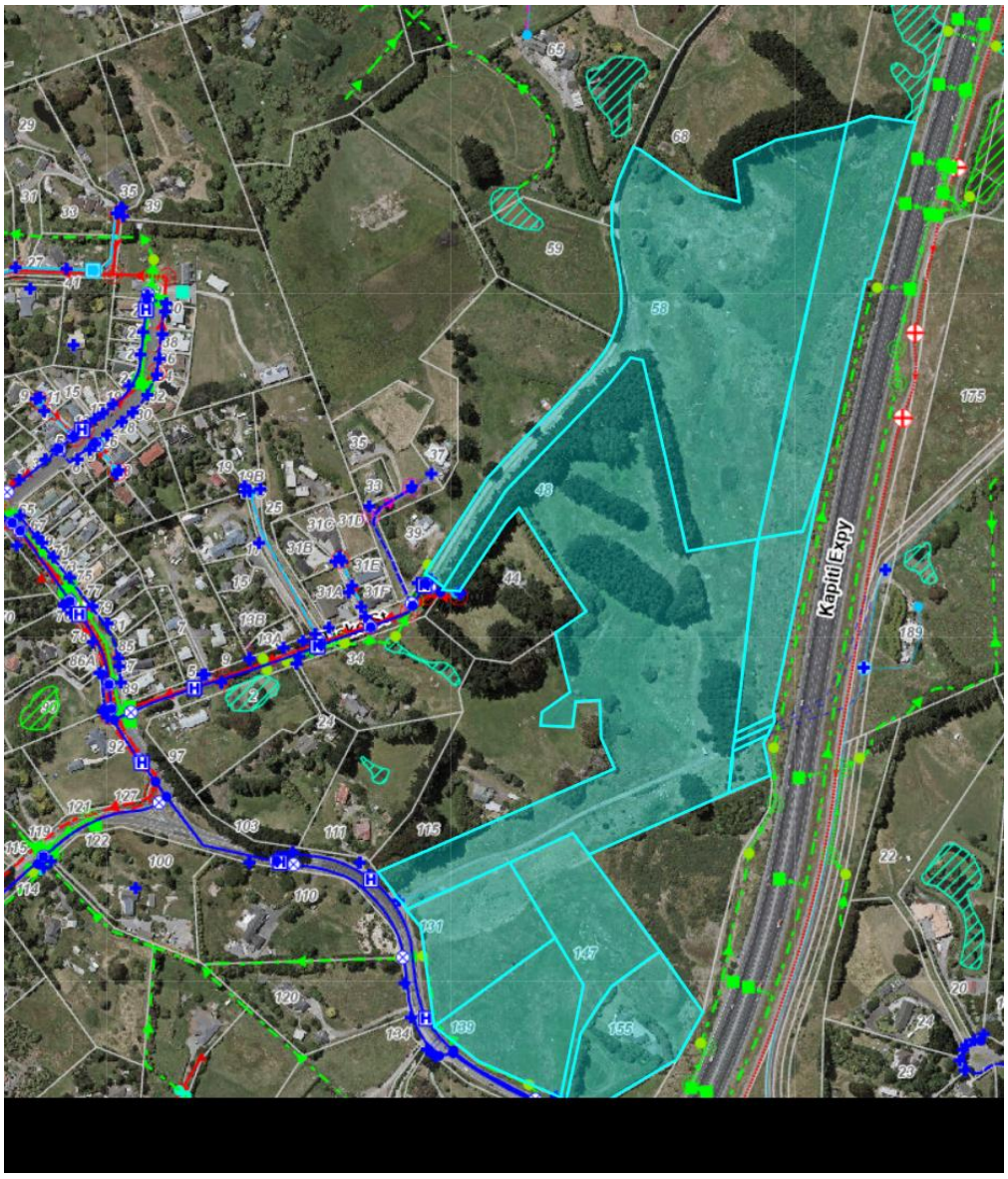
24. Malu Jonas [further submission number S054.FS.1] has expressed concern around the insufficient level of infrastructure to support intensification proposed by PC2. Our response to this is covered in 4.3, 4.4 and 4.5.

RESPONSE TO OFFICERS' PLANNING EVIDENCE REPORT

25. The Officers' Report/supporting review etc, has raised a number of matters/ issues/concerns that are within my area of expertise. I have carefully considered the points raised by the Officers and supporting experts relevant to my area of expertise, and they are discussed in detail below.

26. The Officers have raised a concern that "*the site is not next to an urban area that is connected to infrastructure services*".

27. It is unclear to us as to the nature of this comment as the site is adjacent to Tieko Street, a water-supply main, road infrastructure and the waste-water network as shown in the graphic from KCDC's Three Waters Services website.



28. There are no other matters raised by the council officers that we have any concern about.

CONCLUSION

29. The site is well located regionally for more intensive development in our view as;

    (i) It is closer to key infrastructure (Wastewater Treatment Plant, Water treatment plant, Road infrastructure) than other sites in the district.

    (ii) It takes advantage of large sand dunes that will allow for properties to be developed with on-site drainage.

    (iii) It is not flood prone.

30. Changes to development densities on the site will require re-assessment of infrastructure needs. This work would be completed as part of detailed design as part of a specific resource consent application for higher density development and any necessary works agreed with Council and provided as a condition on that resource consent.

31. We expect that the Ratanui Pump Station will need some form of upgrade should increased development densities be provided on this property, but there are options available to do so and this would not be onerous given the size of the development. There are solutions available for this.

32. cannot see any obvious infrastructure issues that cannot be resolved through design should higher densities be approved.

Craig Murray Martell
Dated 9 March 2023

Appendix 1

Otaihanga Road Subdivision (including bulk earthworks and infrastructure)

Flood Hazard Assessment of Effects

Doc Number: 10

Date 29/06/2021

Excellence Heart Innovation

OTAIHANGA ROAD SUBDIVISION (INCLUDING BULK EARTHWORKS AND INFRASTRUCTURE)

Project number	J000225
Document title	Otaihanga Road Subdivision (including bulk earthworks and infrastructure) – Flood Hazard Assessment of Effects
Document number	010
Version number	10
Date	29/06/2021
Project manager	Tony Trueman
Author	Tony Trueman

VERSION	DATE	DESCRIPTION	AUTHOR	REVIEWED
01	15/11/19	Draft	Tony Trueman	Craig Martell
02	14/01/19	Preliminary	Tony Trueman	Craig Martell
03	23/01/20	Revision	Tony Trueman	Chris Hansen
04	18/03/20	Draft Revision	Tony Trueman	Chris Hansen
05	28/04/20	Revision	Tony Trueman	Chris Hansen
06	30/06/20	Final	Tony Trueman	Craig Martell
07	19/02/21	Draft Revision	Tony Trueman	Chris Hansen
08	25/02/21	Draft Revision	Tony Trueman	Chris Hansen
09	27/02/21	Revision	Tony Trueman	Craig Martell
10	29/06/21	Final	Tony Trueman	Chris Hansen

EXECUTIVE SUMMARY

Awa Environmental Limited (Awa) was requested by Chris Hansen Consultants Limited, on behalf of their client, to undertake an assessment of effects for subdivision (including bulk earthworks and Infrastructure) of the site adjacent to Otaihanga Road in Paraparaumu. Where this report subsequently references the term "subdivision", it is to be read as including bulk earthworks and infrastructure. The subdivision will be built upon an existing greenfield site and will consist of 49 lots accessed off a right of way from Otaihanga Road.

The Kāpiti Coast District Council Flood Hazard Planning Maps shows a portion of the site affected by ponding associated with the local network and flooding from local waterways.

The effects of the subdivision have been assessed against the Proposed District Plan Appeals Version 2018 as it relates to ponding and the requirements under the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 as it relates to the discharge of water within 100m setback from a natural wetland.

Largely the flood effects will be managed across the area with on-site stormwater solutions. Any effects not managed by on-site soakage are proposed to be managed by on site compensatory storage.

A Mike Flood hydraulic model of the southern (residential) area has been built for both the existing (base) scenario and the proposed (subdivision) scenario.

The model has been used to:

- Determine the extent and depth of flooding within the base greenfield site.
- Determine the extent and depth of flooding within the proposed subdivision site.
- Options assessment of mitigating the effects of subdivision of the site.

Flood mitigation measures modelled include:

- Elevating building platforms above the modelled flood hazard.
- Excavation to provide compensatory storage.
- Modelling of additional stormwater network
- Alteration of existing drain layout

Modelling results indicate the subdivision can be implemented with less than minor effects on surrounding flood levels and, within the subdivision, the proposed mitigation measures are sufficient to ensure the subdivision will not be flooded in a 100-YR ARI event including the impacts of climate change.

The implementation of soakage solutions for the disposal of runoff to ground will focus on retaining the natural hydrological function of the wetland areas.

CONTENTS

1. INTRODUCTION

1.1. PROPOSED SUBDIVISION

1.1.1. SITE LOCATION

The site is located in Paraparaumu, on the Kāpiti Coast, adjacent to Otaihanga Road as shown in Figure 1.

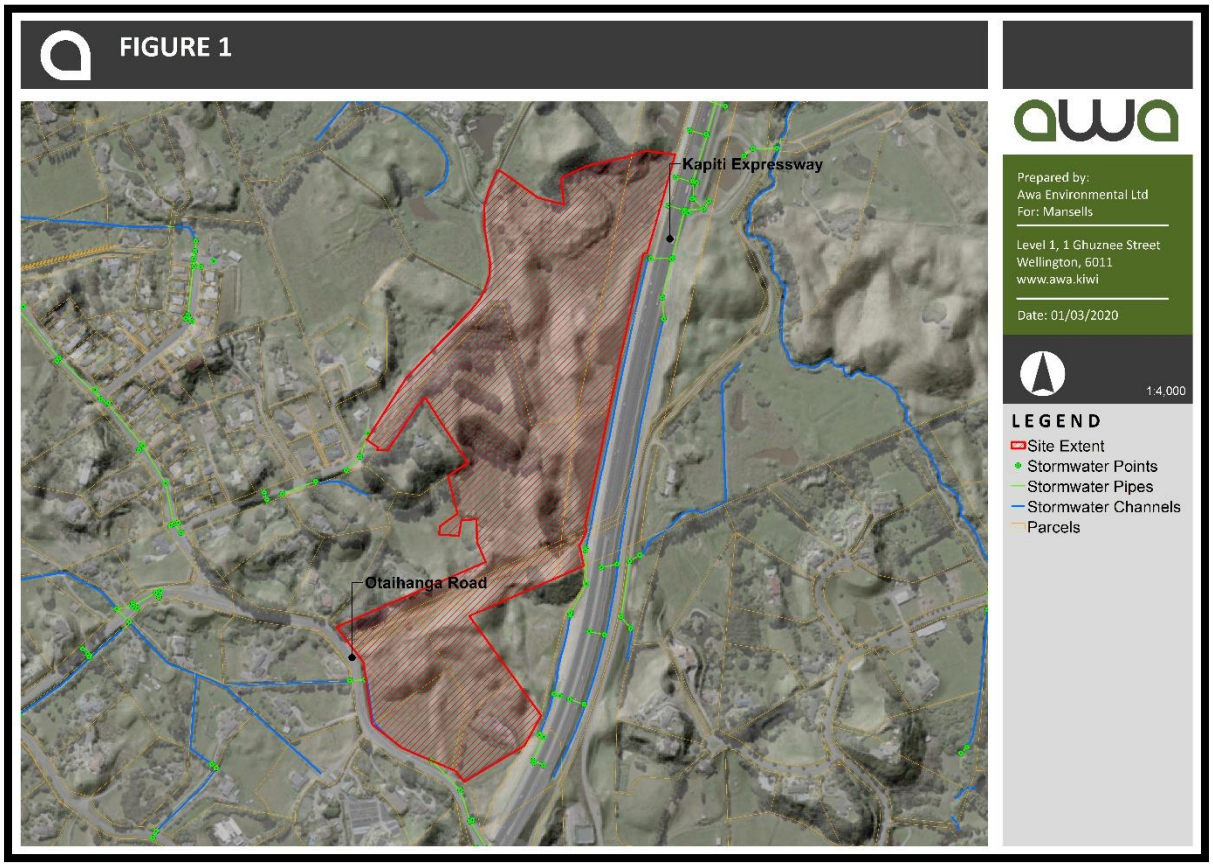


Figure 1: Site Location - Paraparaumu

1.1.2. ASSESSMENT OVERVIEW

The site has been split into two distinct areas reflecting the two different subdivision methodologies and proposed mitigation measures. The extents of the northern (rural life-style) and southern (residential) areas are shown in Figure 2.

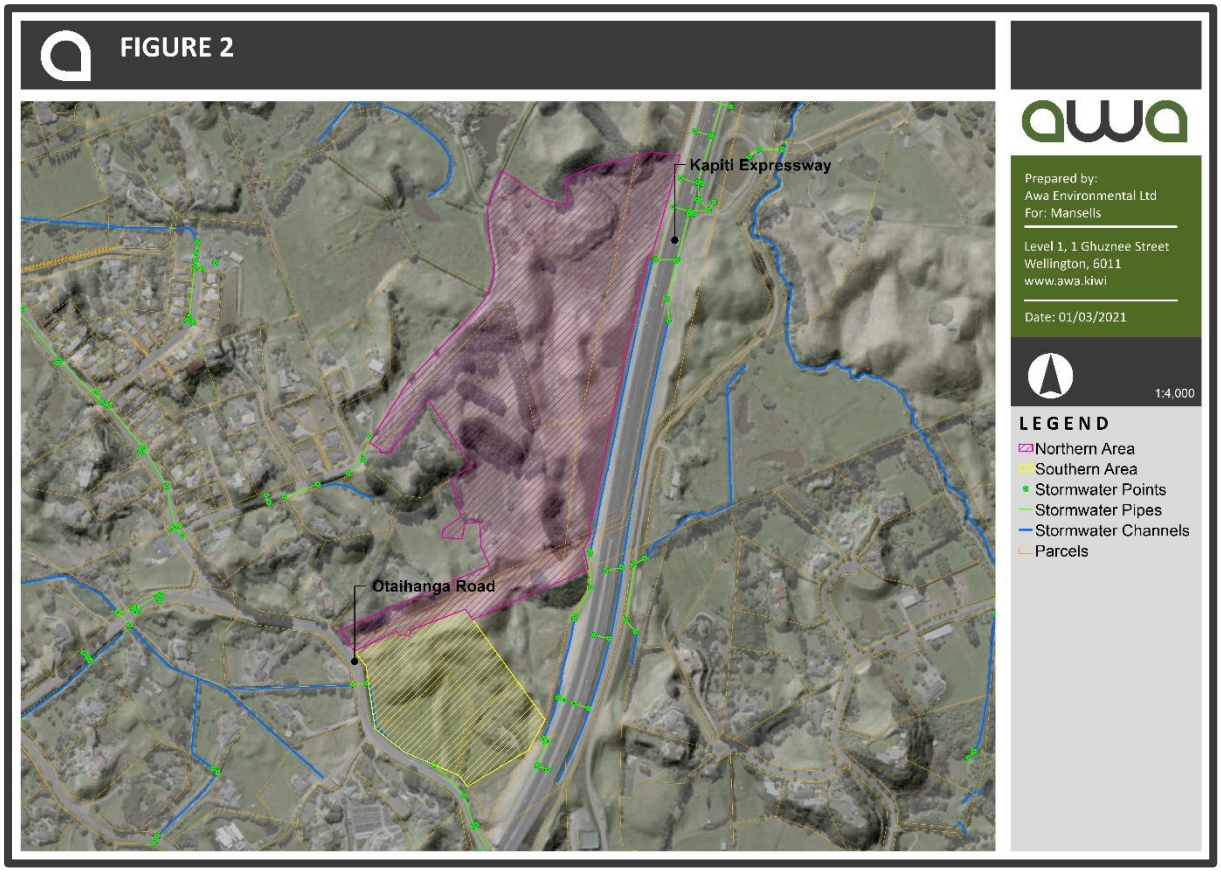


Figure 2: Subdivision Areas

1.1.3. NORTHERN (RURAL LIFE-STYLE) AREA

The northern (rural life-style) area will encompass larger lot sizes in the order of 2400 to 2800 m^2. The primary form of stormwater mitigation for these lots will be via individual lot soakage.

Soakage tests undertaken on site returned varying rates between 120 mm and 1200 mm/hour, as discussed in section 2.1.1. Given the larger lot sizes and natural soakage rates associated with the dune environment, mitigation via soakage field on the property is considered achievable. This methodology distributes the soakage over a dispersed area rather than concentrating discharge at a single location. Individual lot soakage devices will be sized at building consent stage for individual properties.

The hydrological impacts of the vehicle/pedestrian/cycle access to the northern (rural life-style) area, including formalisation of the Tieko Street entrance, has been assessed in HEC-HMS. Under-

drained bio-infiltration devices are proposed as the primary form of stormwater disposal and have been sized using a standard soakage calculation spreadsheet.

1.1.4. SOUTHERN (RESIDENTIAL) AREA

The southern (residential) area will encompass smaller lot sizes with a majority in the order of 500 to 1000 m^2. Two larger lots, in the order of 4000 to 7000 m^2 are included in this area. The primary form of mitigation for these lots will be stormwater retention in a single retention device adjacent to Otaihanga Road.

Assessment of the hydrological impacts of the southern (residential) area has been undertaken in HEC-HMS while the assessment of effects has been modelled using Mike Flood.

1.1.5. PROPOSED SITE LAYOUT

The site layout consists of 49 lots as shown in Figure 3. Access to the southern (residential) area, containing lots 23 to 49 will be off Otaihanga Road with access to the northern (rural life-style) area, containing lots 1 to 22 off Tieko Street.

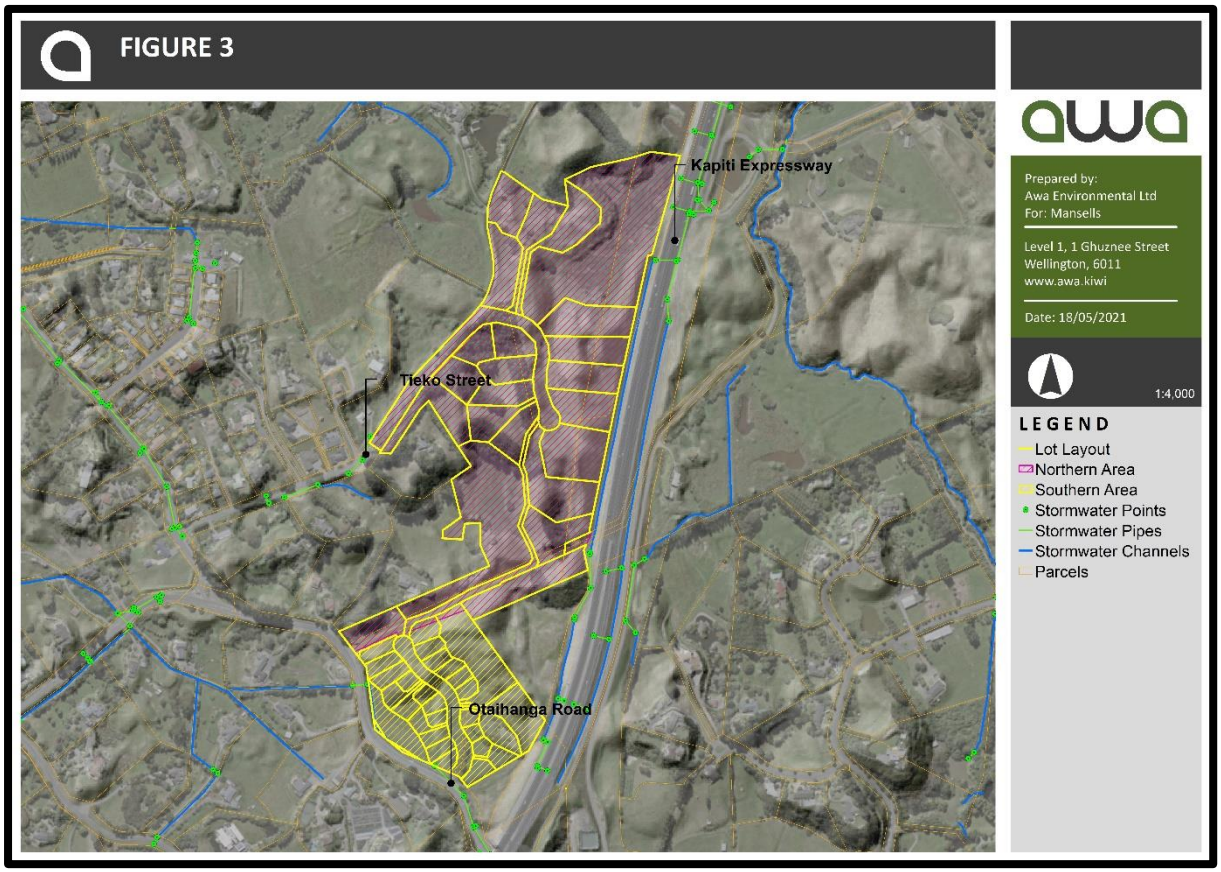


Figure 3: Proposed Site Layout

1.1.6. EARTHWORKS OVERVIEW

The final earthworks plan for the site is shown in Figure 4. Generally, cut/fill is proposed across much of the site to create building platforms and provide for vehicle/pedestrian/cycle access and infrastructure.

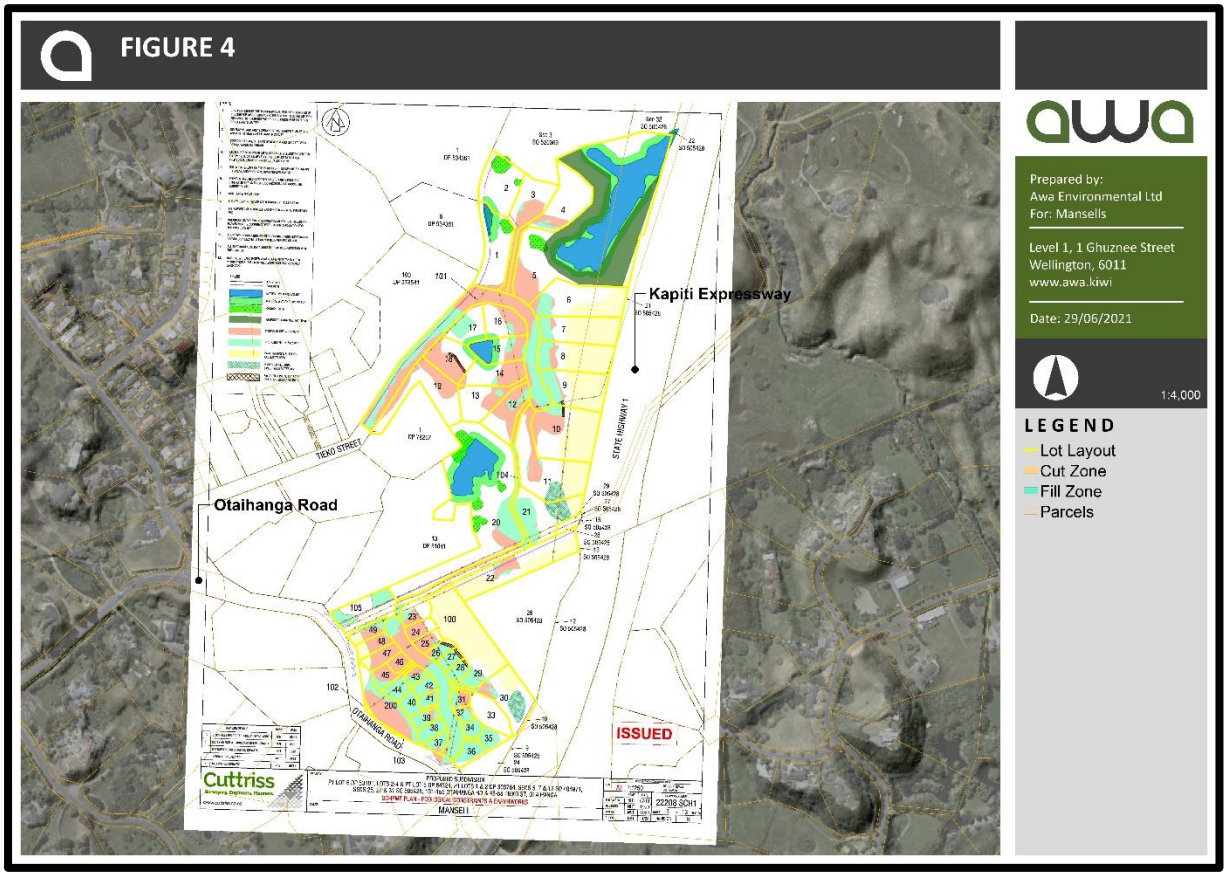


Figure 4: Final Earthworks Overview

1.1.7. KCDC & GW – FLOOD HAZARD

The northern extent of the site is currently shown as affected by ponding in the Kāpiti Coast District Council's flood hazard planning map as shown in Figure 5. This plan incorporates flooding from sources including ponding and overflow paths from the local stormwater network and flooding from local waterways. It also incorporates a freeboard component, 500mm in the vicinity of open channels and 300mm on the ground surface ponding and is used to inform recommended building levels.

The inclusion of the M2PP expressway into the Waikanae River flood hazard model has modified the flood extent and depth in this location. The impact of this is discussed in section 1.1.8.

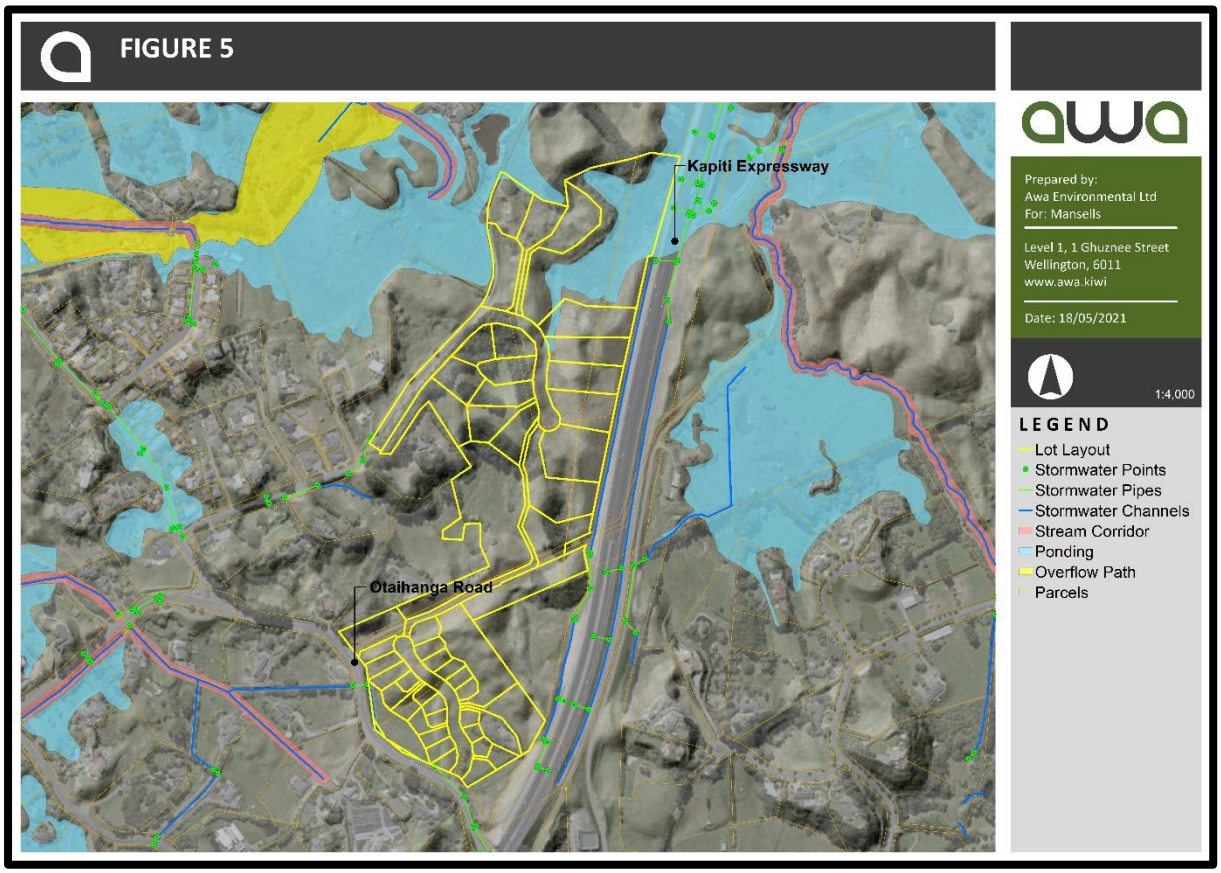


Figure 5: KCDC/GWRC Flood Hazard Management Plans

1.1.8. BASE FLOOD HAZARD - GWRC

The Greater Wellington Regional Council Waikanae model results of peak flood depth for the 100-Year ARI climate change base scenario event including the M2PP Expressway are shown in Figure 6. As this scenario does not include freeboard, we have assumed a freeboard of 500 mm which gives a peak water surface level of RL 6.1, as shown by the contour in Figure 6.

While lots 2, 3 and 5 have flooding within their boundaries in the base scenario no earthworks or dwellings will be located within the base flood hazard extent therefore, no compensatory storage needs to be considered.

While lots 6 and 7 are located within the freeboard water surface level of RL 6.1 fill earthworks will raise the building pad levels above this to RL 7.05 and RL 7.90, respectively.

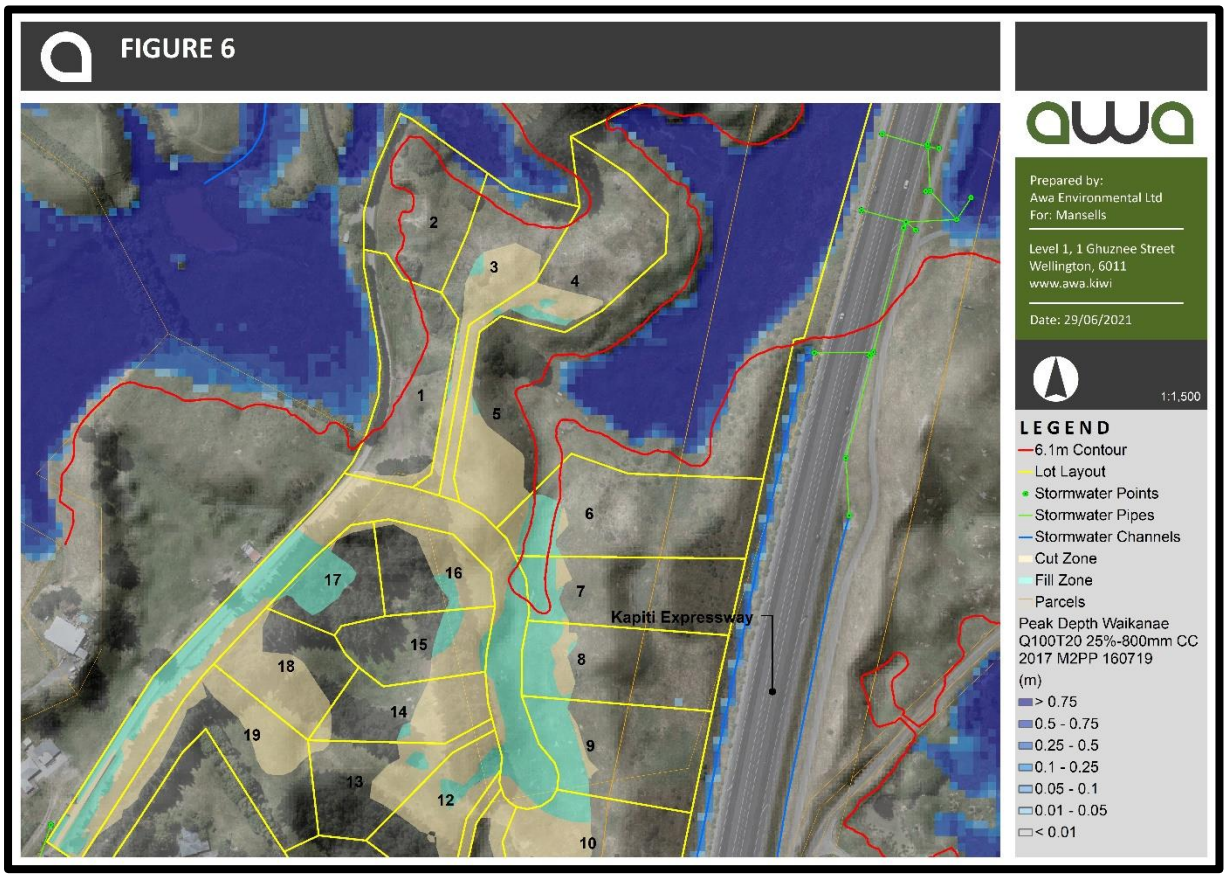


Figure 6: Northern Area Flood Hazard

1.1.9. PROPOSED DISTRICT PLAN

When property being considered for subdivision is affected by flood risk it is a requirement under the RMA that the effects of the development are considered before approval is given to manage the long-term costs of flooding to the wider community. This requirement is expressed under the Proposed District Plan as follows;

> *Policy 9.13 – Ponding, Residual Ponding, Shallow Surface Flow, Flood Storage and Fill Control Areas.*
>
> *When assessing applications for subdivision, use or development within a ponding, residual ponding, shallow surface flow, flood storage or fill control area, consider the following;*
>
> *a) the effects of the development on existing flood mitigation structures;*
> *b) the effects of the development on the flood hazard – in particular flood levels and flow;*
> *c) whether the development redirects floodwater onto adjoining properties or other parts of the floodplain;*
> *d) whether access to the site will adversely affect the flood hazard;*
> *e) the extent to which buildings can be located on areas of the property not subject to flooding; and*

f) whether any subdivision or development will or may result in damage to property or harm to people.

The relevant flood hazard rules and standards under the proposed District Plan which apply to subdivision and development are shown in Table 1;

*Table 9A.3. Restricted Discretionary Activities The following activities are **restricted discretionary** activities, provided that they comply with all corresponding permitted activity standards in this table, and all relevant rules and permitted activity standards in other Chapters (unless otherwise specified).*

Table 1: *(Table 9A.3) PDP Restricted Discretionary Activities*

RESTRICTED DISCRETIONARY ACTIVITIES	STANDARDS	MATTERS OVER WHICH COUNCIL WILL RESTRICT ITS DESCRETION
1. Any activity listed as a permitted activity in Table 9A.1 or a controlled activity in Table 9A.2 which does not comply with one or more of the associated standards, unless otherwise specified.		1. Consideration of the effects of the standard not met. 2. Measures to avoid, remedy or mitigate adverse effects 3. Cumulative effects
2. Subdivision where any part of the land contains flood storage, ponding, residual ponding or shallow surface flow areas.	1. Each lot shall have a building area located outside any river or stream corridor, overflow path or residual overflow path. 2. Each building area shall be located above the estimated 1% AEP flood event level. 3. Formed vehicle access does not adversely affect the 1% AEP flood hazard risk on other properties in the same flood catchment. 4. Compliance with all other relevant subdivision rules and standards in other chapters.	1. The design and layout of the subdivision. 2. Council's Subdivision and Development Principles and Requirements 2012. 3. The imposition of financial contributions in accordance with Chapter 12 of this Plan. 4. The location of any building platform or area relative to the natural hazards, historic heritage features, ecological sites, outstanding natural features and landscapes, and geological sites. 5. The location and design of any servicing of the subdivision. 6. The extent and effects of earthworks.
4. In a ponding or shallow surface flow area, earthworks which do not comply with one or more of the permitted activity standards under Rule 9A.1.4.		1. The effect of the earthworks on the effective functioning of the overflow path, residual overflow path or ponding or shallow surface flow area. 2. The avoidance or mitigation of adverse effects on the effective functioning of the overflow path, residual overflow path or ponding or shallow surface flow area.

As demonstrated in section 1.1.8 no earthworks will be undertaken within the base flood hazard. Local flooding has been mitigated as demonstrated in section 5.1.

2. SOAKAGE ASSESSMENT

2.1.1. SOAKAGE

Soakage testing has been undertaken at 7 locations across the site to determine soakage rates. An overview of the soakage locations is shown in Figure 7.

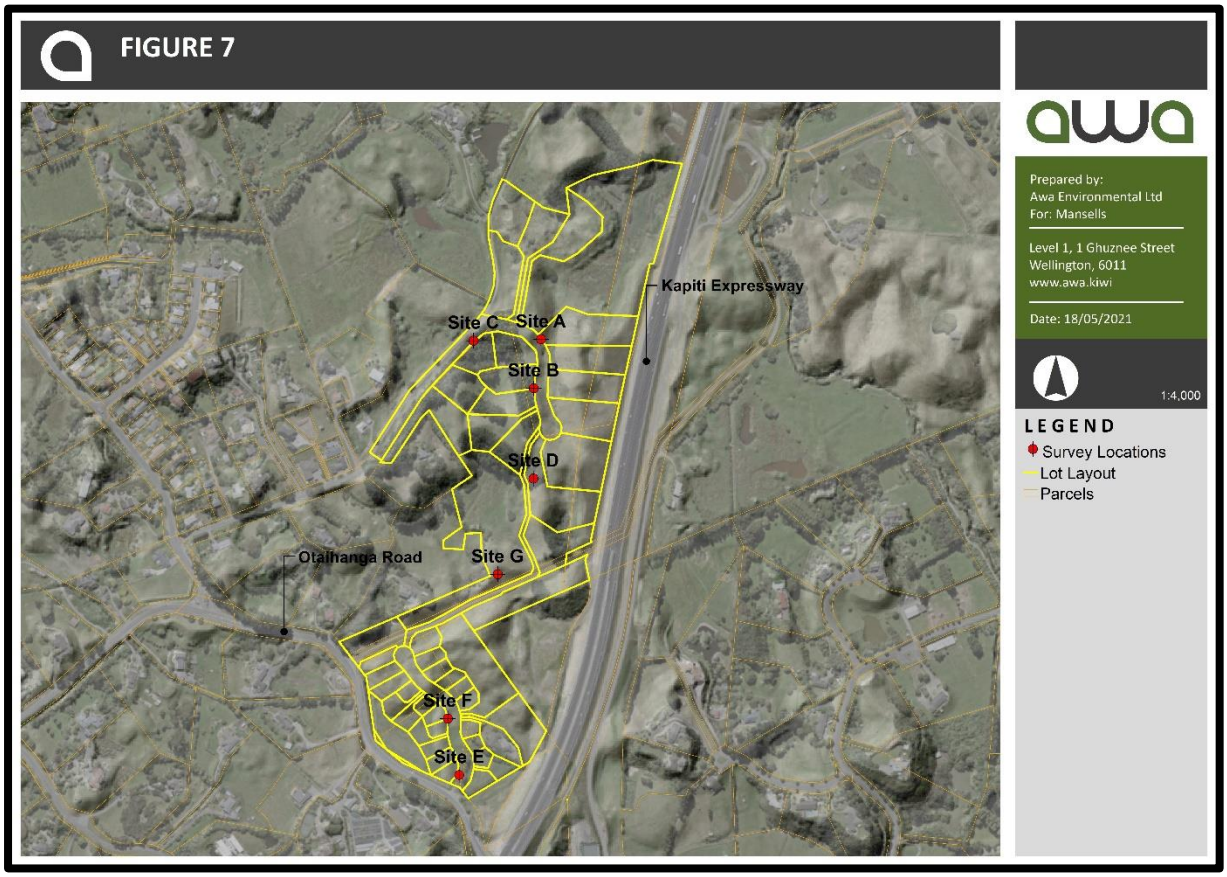


Figure 7 Soakage Test Locations

The wider Waikanae dune environment, in which this site is located, has been shown to have good natural drainage on elevated dunes. Soakage tests undertaken on site returned rates between 120 to 1200 mm/hour.

KCDC's Subdivision and Development Principles and Requirements document considers 0.25 (a Factor of Safety of 4) to be an appropriate reduction factor to be applied to the rate of soakage.

Applying the 0.25 reduction factor to the soakage rate returns values shown in Table 2.

Table 2 Soakage test results

Area Description	Average Soakage Rate mm/hr	Reduction Factor (0.25) (mm/hr)
Site A	120	30
Site B	160	40
Site C	320	80
Site D	146	36
Site E	200	50
Site F	1200	300
Site G	905	226

Soakage test sites A, B and C are located adjacent the vehicle/pedestrian/cycle access to the northern (rural life-style) area, including the Tieko Street entrance, and are therefore considered representative of soakage rates in this area.

For sizing of the under-drained bio-infiltration devices a conservative average soakage rate of 40 mm/hr has been used.

2.1.2. NORTHERN ACCESS - SOAKAGE DEVICE SIZING

Run-off from the vehicle/pedestrian/cycle access in the northern (rural life-style) area, including formalisation of the Tieko Street entrance, will require mitigation to ensure the increased discharge does not adversely affect the surrounding area.

To undertake this assessment the Cuttriss Consultants supplied roading scheme plan was used to determine the extents of the connected impervious areas which were split into two catchment areas. Catchment area 01 represents the impervious area associated with the formalisation of the Tieko Street entrance area and catchment area 02 represents the impervious area associated with the vehicle/pedestrian/cycle access in the northern (rural life-style) area.

The roading scheme plan was then referenced against the Cuttriss supplied earthworks plan to determine the location of the under-drained bio-infiltration devices and their associated swales. The swales will be used to convey run-off from the connected impervious areas to the devices, as shown in Figure 8. The under-drained bio-infiltration devices have been sized to accommodate the peak discharge from the 100 YR ARI Climate Change rainfall event.

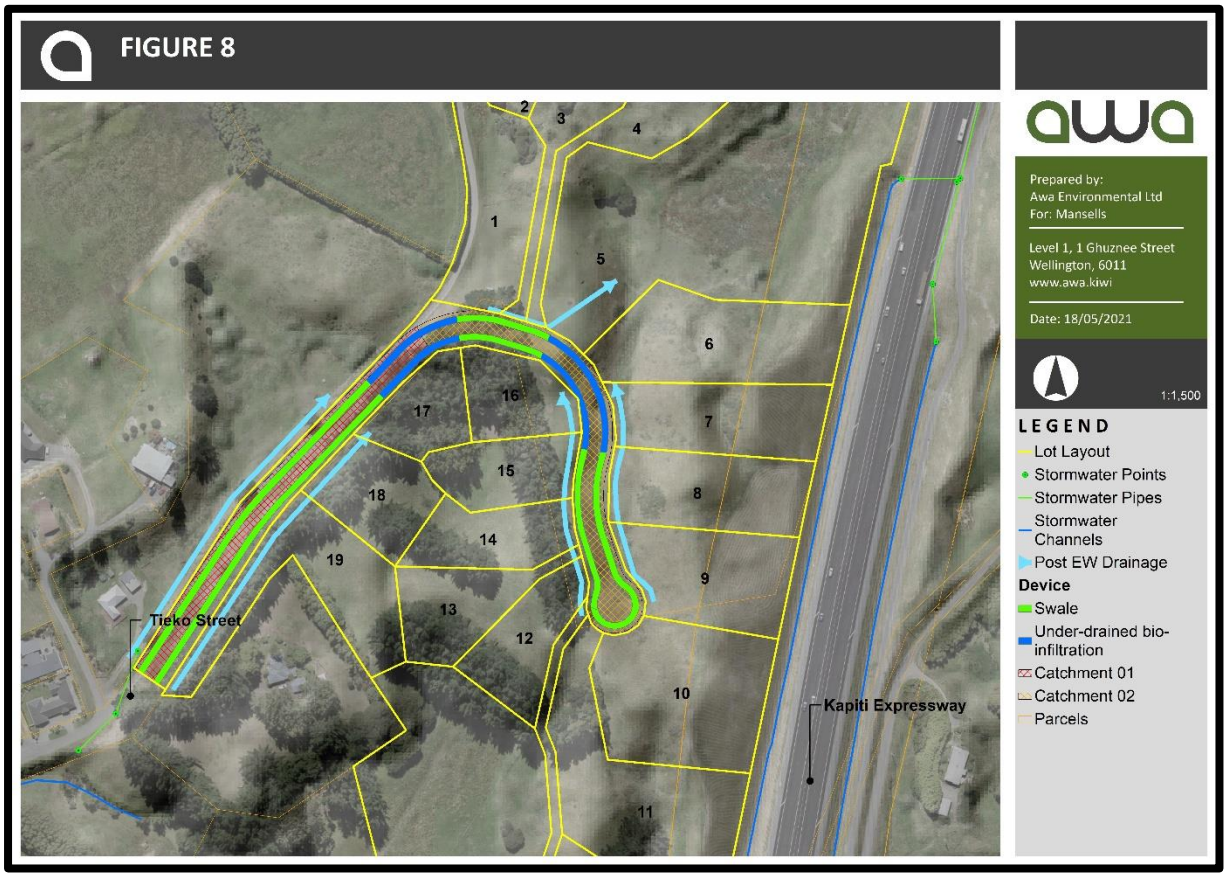


Figure 8: Vehicle/Pedestrian/Cycle Access North - Soakage Device Overview

The soakage design calculations, see section 2.1.3 & 2.1.4, show the length of the under-drained bio-infiltration device for catchment area 01 is 110 m and catchment area 02 is 150 m. Over the remainder of the catchments length a traditional swale will be used to convey run-off to the under-drained bio-infiltration devices.

A typical section through an under-drained bio-infiltration device is shown in Figure 9. Dimensions of the device will be sized during engineering detailed design as components of the device can be modified including replacement of coarse sand transition layer with geo-technical wrap.

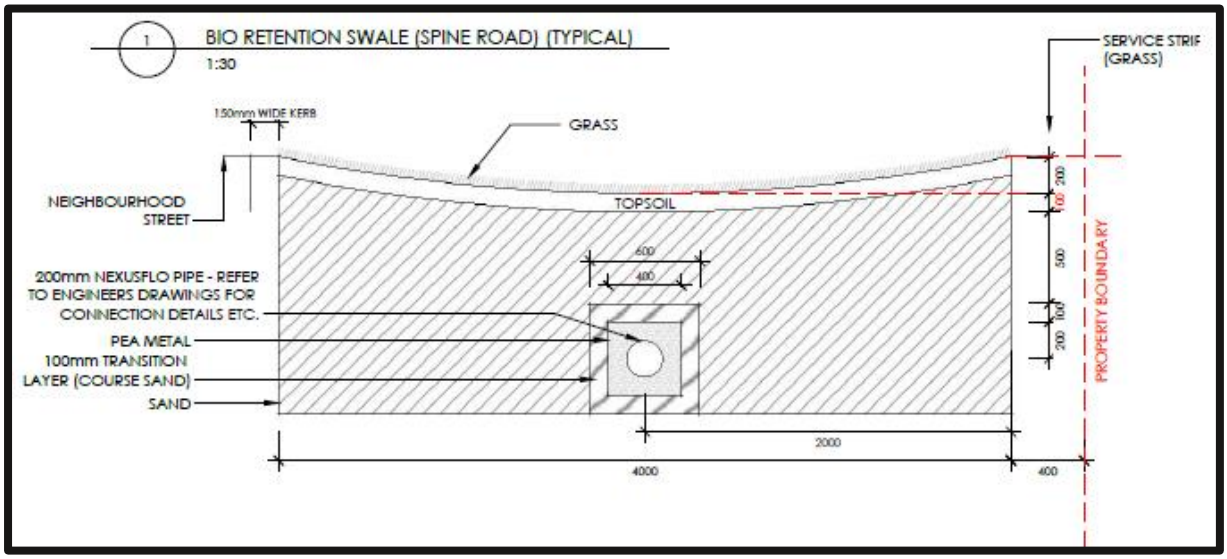


Figure 9 Under-drained Bio-Infiltration Device Section

2.1.3. CATCHMENT RUN-OFF

The two impervious catchment areas have been input into HEC-HMS to calculate their volume and peak discharges as shown in Table 3. The site falls within the 170 mm rainfall isohyet band associated with a 100 YR ARI Climate Change rainfall event.

Table 3: Discharge results from the HEC-HMS rainfall/run-off analysis

Catchment	Area Description	Peak Discharge (l/s)	Volume (m3)
Catchment area 01	Impervious Area 01	56	316
Catchment area 02	Impervious Area 02	65	368

2.1.4. SOAKAGE DESIGN CALCULATIONS

Discharge hydrographs from the HEC catchment analysis have been input into a standard soakage calculation spreadsheet.

The sizing of the under-drained bio-infiltration devices is shown in Table 4, see Appendix A for full calculations.

Table 4: Under-drained bio-infiltration device sizing

Catchment	Soakage Rate (mm/hr)	Device Name	Length (m)	Width (m)	Depth (m)	Porosity
Catchment area 01	40	under-drained device A1	110	3	1	0.3
Catchment area 02	40	under-drained device A2	150	2.5	1	0.3

2.1.5. GROUNDWATER

Resource Development Consultants Limited (RDCL) have undertaken geotechnical investigations across the site including the excavation of a number of test pits which noted soil profiles and the level at which groundwater, if any, was encountered.

NORTHERN (RURAL LIFE-STYLE) AREA

Several test pits undertaken on site within the northern (rural life-style) area, TP10 – 13, encountered groundwater levels at varying depths below ground, as shown in Figure 10.

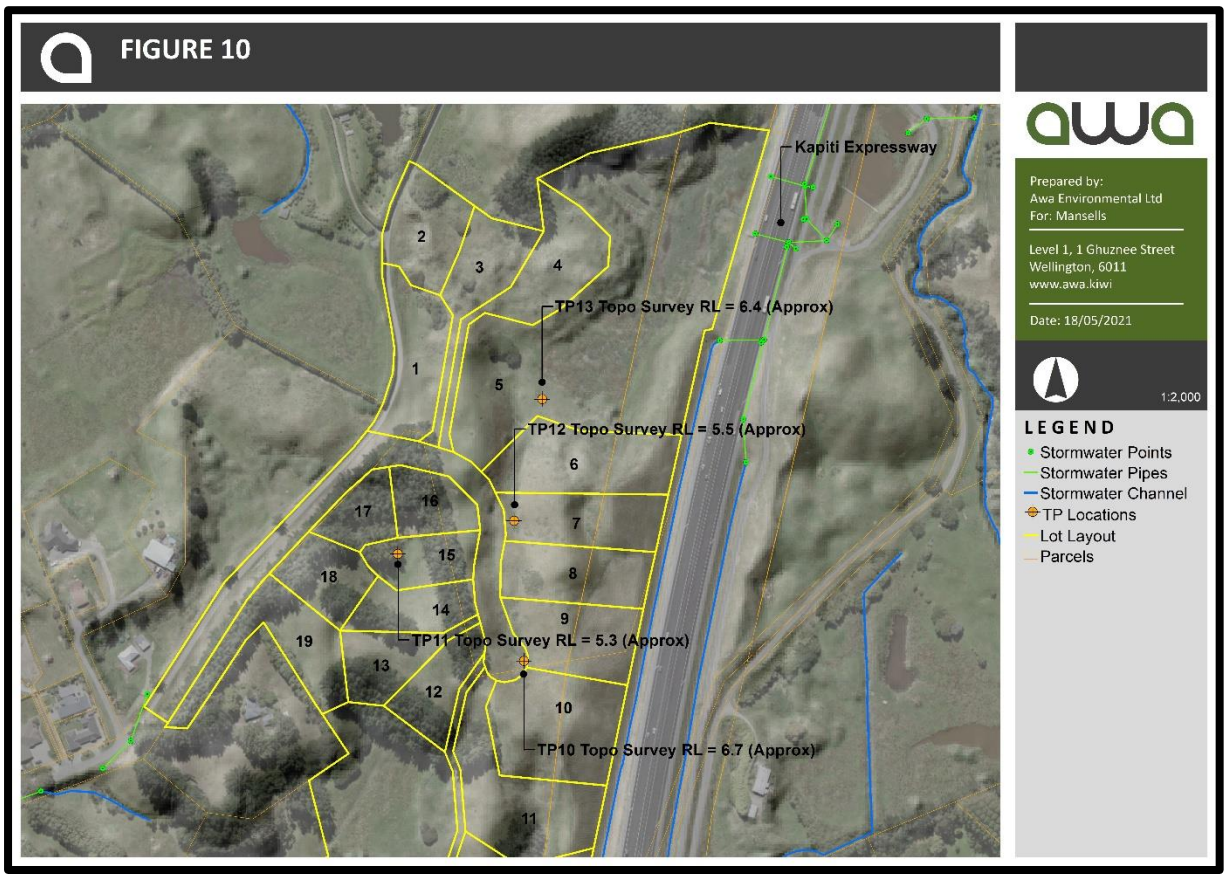


Figure 10 Test Pit Locations Encountering Groundwater

Groundwater depths vary between 1.4 to 2.9 metres below ground level as shown in Table 5.

Table 5: *Groundwater depths*

Test Pit	Ground Level	Groundwater (m bgl)	Groundwater Level
TP10	Approx. RL 6.7	1.8	Approx. RL 4.9
TP11	Approx. RL 5.3	1.4	Approx. RL 3.9
TP12	Approx. RL 5.5	2.1	Approx. RL 3.4
TP13	Approx. RL 6.4	2.9	Approx. RL 3.5

The low point in the post-earthworks design, located on the boundary of lot 5 and 6, will be at approx. RL 7.0. At this location groundwater levels in TP13 are approx. RL 3.5 leaving 3.5 metres between the design ground level and groundwater.

The under-drained bio-infiltration devices are also located adjacent this design low point. Given a depth of 1 metre to the base of the devices leaves a depth between the base of the device and groundwater of 2.5 metres.

SOUTHERN (RESIDENTIAL) AREA

A test pit undertaken on site within the southern (residential) area, TP03, encountered groundwater levels at 1.6m below ground or approximately RL 5.0. The location of Test Pit 03 is shown in Figure 11.

The site drains under Otaihanga Road through a dip and dune landscape out to the Mazengarb Stream. Existing groundwater levels within the area are being controlled by the surrounding drains and culvert network which would have originally been constructed to drain low lying land for farming.

The culvert under Otaihanga Road, is at an invert level of 5.75. Given the underlying, highly transmissive, poorly graded sands our experience is that groundwater will largely be controlled at a level similar to this invert.

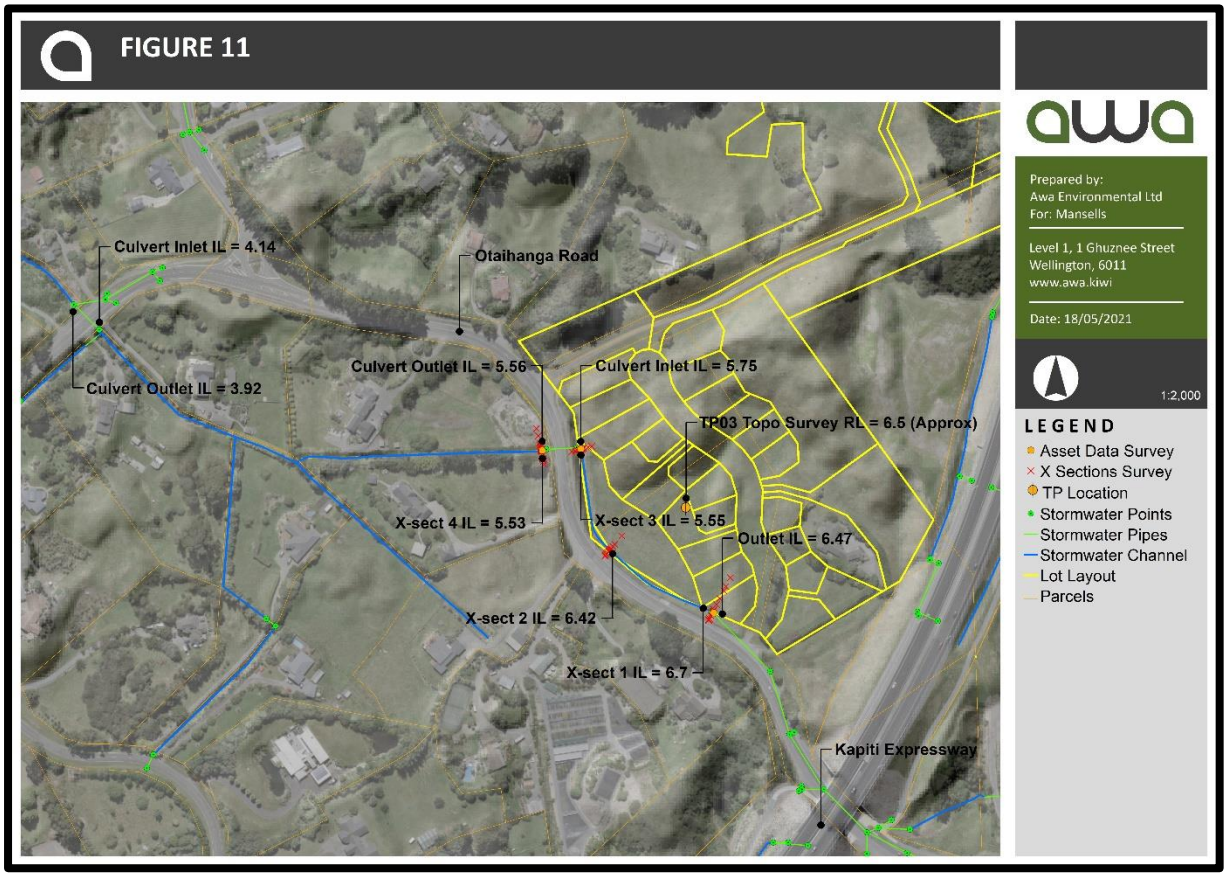


Figure 11 Groundwater Controls

2.1.6. ECOLOGICAL EFFECTS - STORMWATER

Under the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 it is a requirement to consider the implications on the natural wetlands where the discharge of water within 100m requires a non-complying activity consent.

The stormwater design for this development has therefore been to focus on retaining the natural hydrological function of the wetland areas.

To mitigate any negative impacts of development on the existing hydrological processes occurring within the wetland areas, the proposed design methodology will;

- Look to put all stormwater back into the ground by focusing on soakage solutions.
- Look to do this in a distributed way by having swales along the roads and soakage fields at household raintank overflows.
- For larger events runoff from roads will be directed via the swales to under-drained bio-infiltration devices at the low point in the road. These devices are designed to return all the runoff to ground.

In undertaking this approach, we intend that the rain that falls on impervious surfaces (roofs, driveways and roads) will be returned to ground as close to source as possible. As such the groundwater hydrology is unlikely to be altered and the only rainfall diverted away from groundwater will be the water that ends up in each homes raintank.

It is our expectation in rural dune soils that there will rarely be significant runoff overland due to high natural soakage rates. For this reason, focusing our design on soakage to accommodate up to a 100-year climate change event, will in our opinion map natural system responses to rainfall. Overland flows that do occur in events above the 100-year climate change event will be directed towards wetlands as is currently the case.

3. FLOOD HAZARD ASSESSMENT

3.1. BASE FLOOD HAZARD

Model results of peak flood depths for the 100-Year ARI climate change base scenario event for the southern (residential) area are shown in Figure 12. Results show on-site flooding, within the site extent, is localised to isolated low-lying areas.

Flooding in the wider catchment, to the east, is a result of the throttling effect of the culverts and network along Otaihanga Road. To the west of Otaihanga Road the effect of the downstream tailwater level can be seen with flooding in this location.

There is no flooding from the open channel adjacent the site due to the throttling of flow from upstream restricting the volume and peak discharge into the channel.

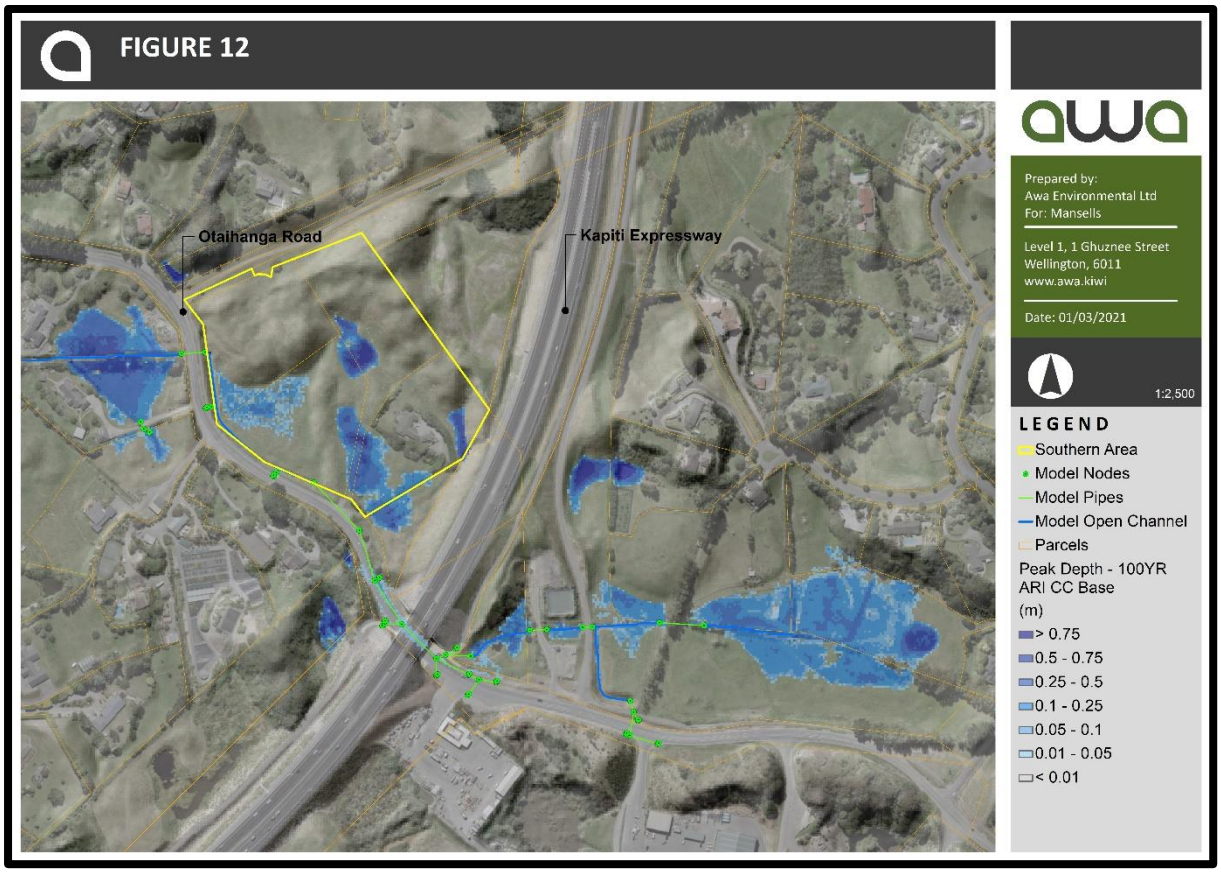


Figure 12: 100YR ARI CC Peak Inundation Depths - Base Scenario Flood Hazard

4. PROPOSED SUBDIVISION

4.1. SOUTHERN (RESIDENTIAL) SITE ALTERATIONS

The modification of land use from greenfield to residential will increase peak discharge and volume associated with an increase in impervious cover. An overview of the proposed lot layout and landcover is shown in Figure 13.

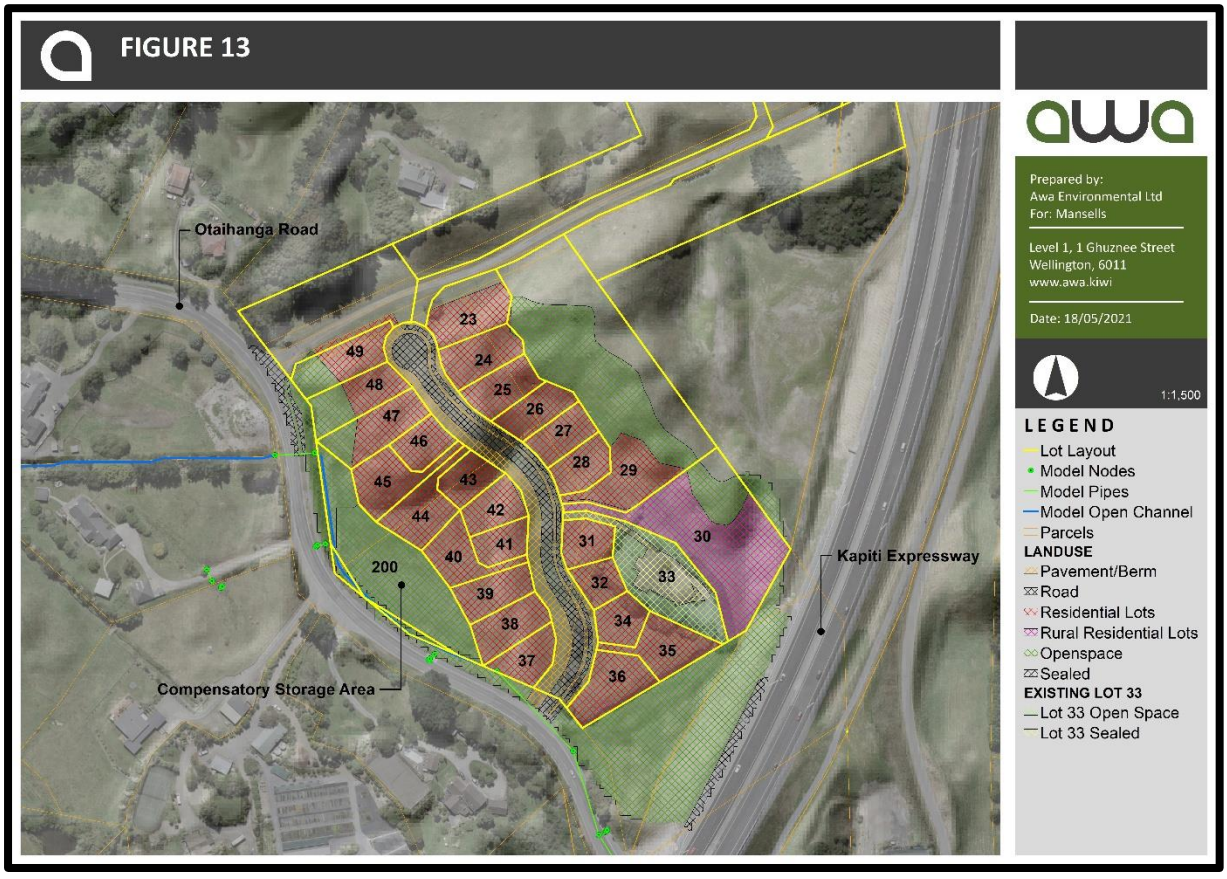


Figure 13: Southern (Residential) Area Overview

There is an existing lot 33 within the area identified in Figure 13. The existing impervious area for this lot has been accounted for in the subdivision scenario run-off calculations. The existing lot driveway access will be modified from its current connection to Otaihanga Road, to between future lots 30 and 31 to connect directly to the road access.

The assumed connected impervious area (CIA) for each land use type is shown in Table 6.

Table 6: Land use CIA

Land use Type	CIA
Residential Lots	55%
Rural Residential Lots	30%
Road	100%

Pavement/Berm	50%
Open Space	0%

The site will also require earth working to create building platforms. Alteration of the existing ground levels will impact on the existing flood hazard across the site where fill displaces storage volume. An overview of the proposed terrain is shown in Figure 14.

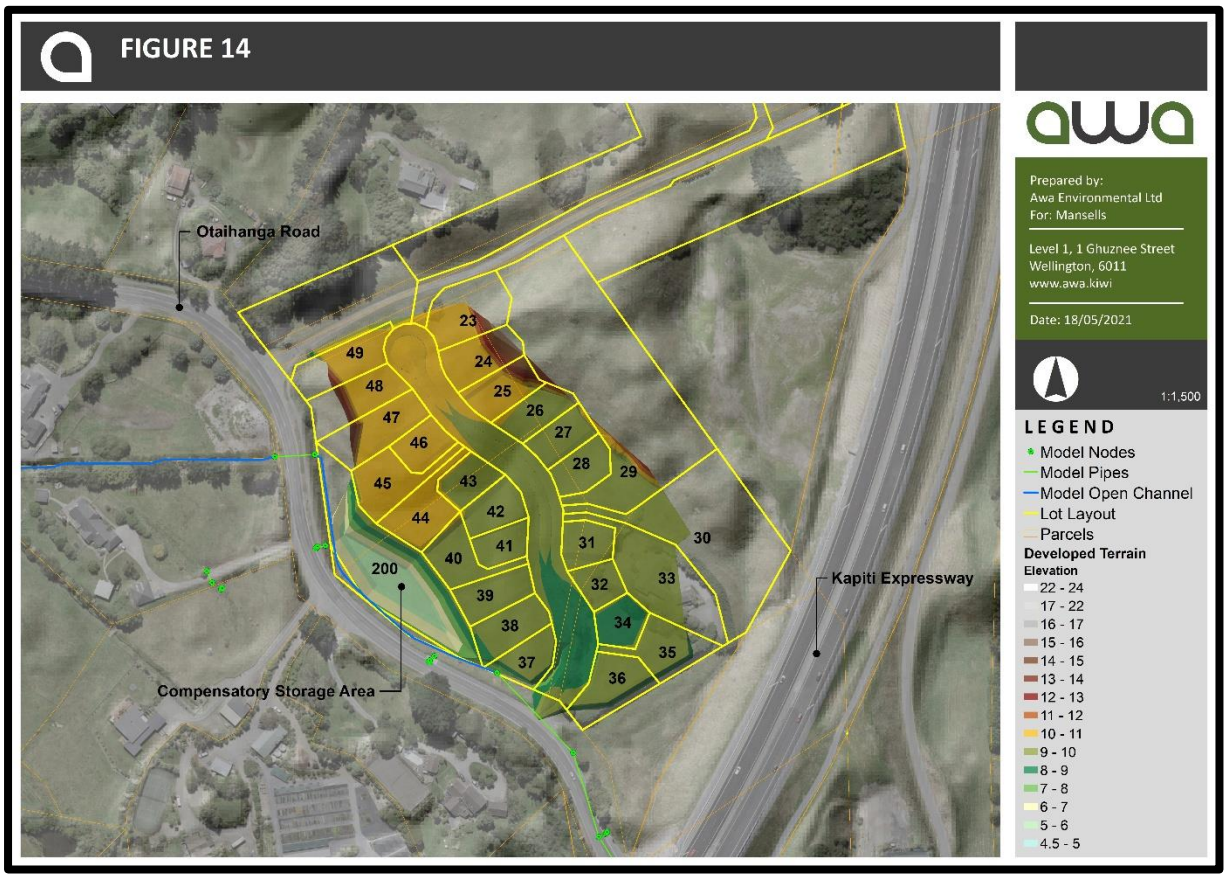


Figure 14: Proposed Terrain

To mitigate the adverse effects of subdivision and meet the relevant flood hazard rules and standards under the Proposed District Plan the following measures are proposed for the southern (residential) area as shown in Figure 15.

- Provide an outlet controlled compensatory storage area to manage the impacts associated with earthworks (loss of existing flood storage) and subdivision (increased run-off). The concept design of the storage area has an invert level at RL 5.8 with a 'throttling' culvert leaving the storage area at RL 5.8. The downstream controlling culvert is at RL 5.75.

- Modify the open channel adjacent to Otaihanga Road as part of the formalisation of the compensatory storage area.

- Traditional kerb and channel will convey run-off from the subdivision to the low point adjacent to lots 36 and 37 where it will be captured by sumps and conveyed via pipe to the compensatory storage area.

- In the existing scenario an isolated area of ponding occurs adjacent to the Kāpiti Expressway. This will be maintained to its existing extent and depth in the subdivision scenario using an overflow pipe connected into the existing stormwater network which outlets to the compensatory storage area.

- A non-return valve upstream of the storage pond to mitigate the potential for backflow.

- Ground levels will be located above the top level of the pond and above the crest level of Otaihanga Road.

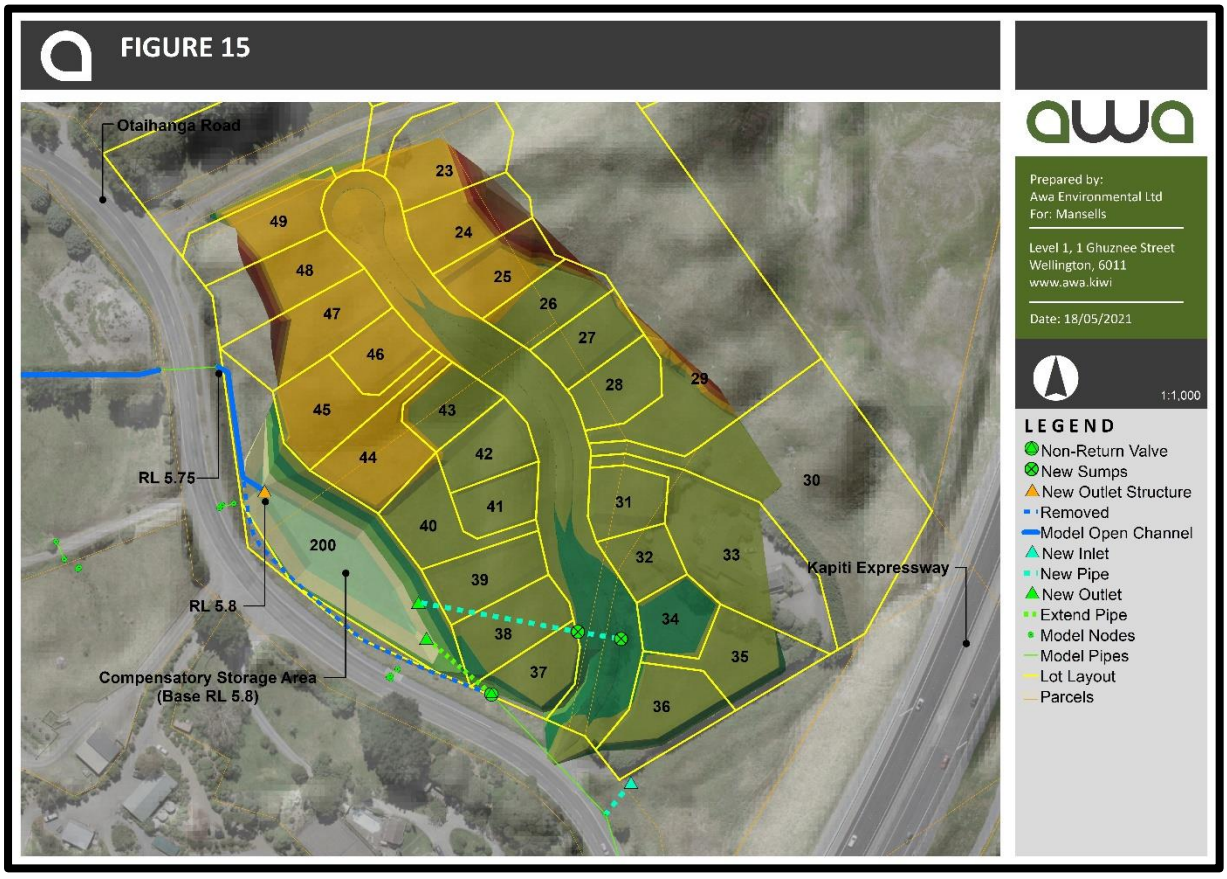


Figure 15: Mitigation Overview

5. SUBDIVISION FLOOD HAZARD

5.1. SUBDIVISION FLOOD HAZARD

Model results of peak flood depths for the 100-Year ARI climate change subdivision scenario are shown in Figure 16.

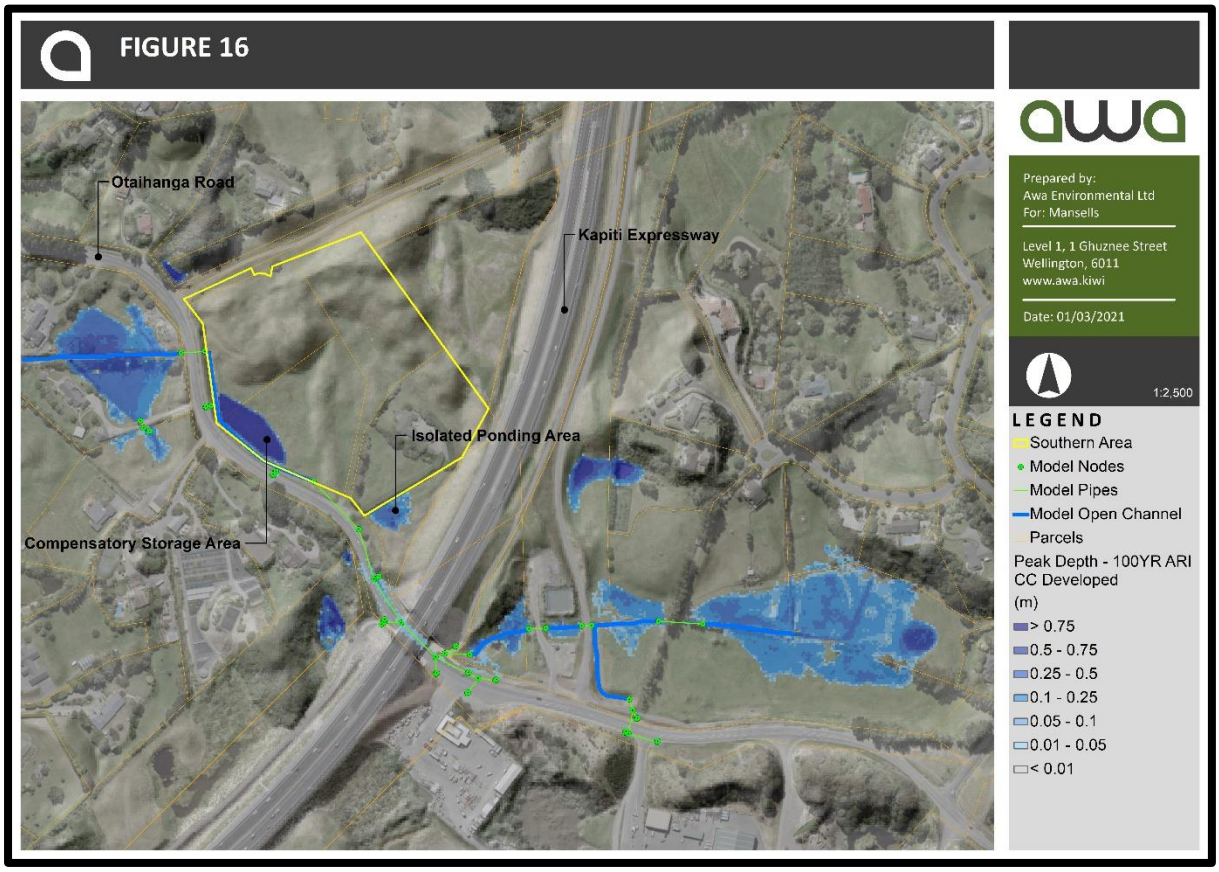


Figure 16: 100YR ARI CC Peak Inundation Depths - Subdivision Scenario Flood Hazard

Earth working of the site for subdivision, vehicle/pedestrian/cycle access and infrastructure has removed the isolated flooding within the southern (residential) area. This loss of storage has been off-set by the addition of the compensatory storage area.

The addition of the overflow pipe from the isolated ponding area adjacent to the Kāpiti Expressway, outside of the site, has mitigated any increase in off-site flood levels in this location.

The inclusion of the compensatory storage area and modifications to the upstream pipe and open channel connectivity has mitigated any increase in off-site flood depths and levels in the upstream ponding area to the east.

The inclusion of the compensatory storage area and modifications to the downstream open channel connectivity has mitigated any increase in off-site flood depths and levels in the downstream ponding area to the west.

5.2. INUNDATION DEPTH DIFFERENCE

A comparison of the depth difference within the site and surrounding area has been undertaken by taking the peak inundation depth results from the subdivision scenario and subtracting the peak inundation results from the base scenario, as shown in Figure 17.

Any increase/decrease in peak flood depth +/- 10 mm has been excluded as this is outside the tolerance of flood modelling.

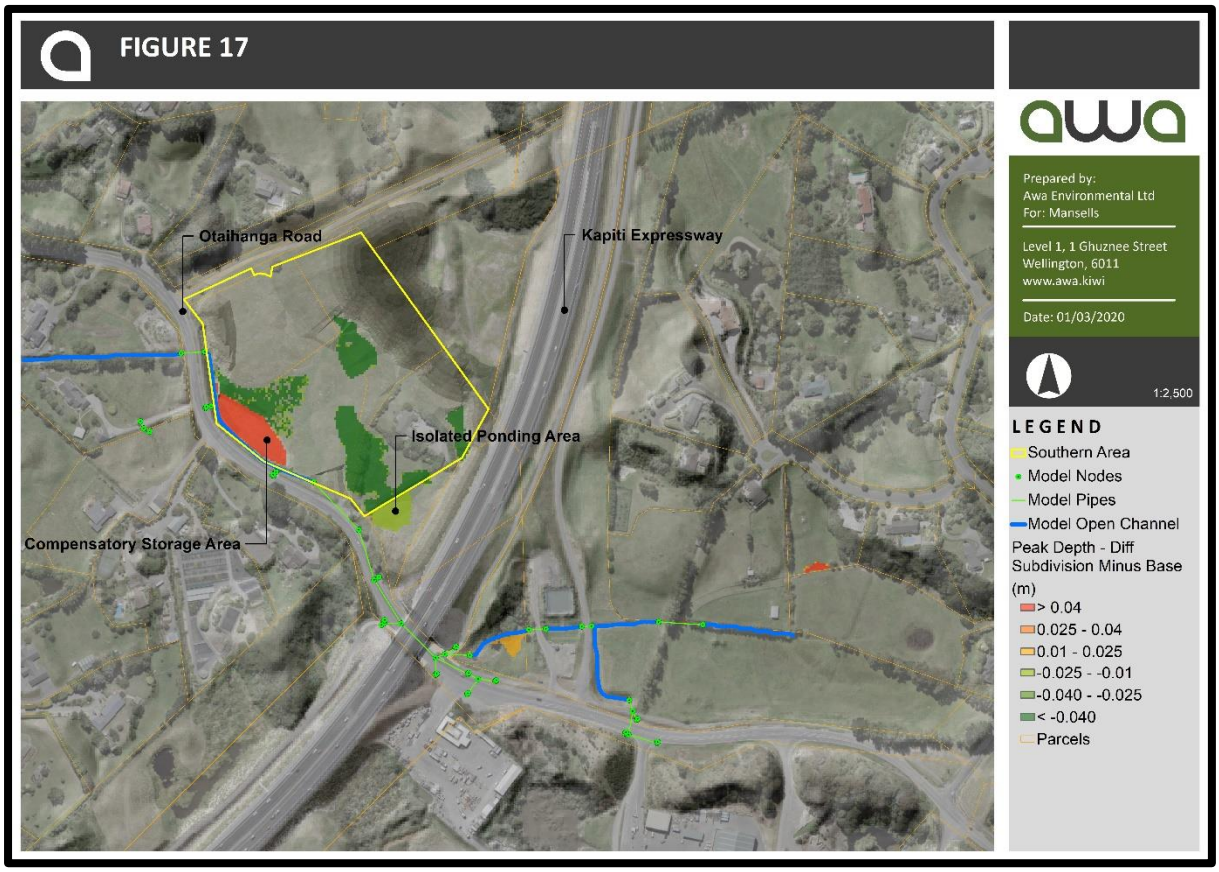


Figure 17: 100 YR ARI CC Inundation Depth Difference (Subdivision Scenario Minus Base Scenario)

Colours (orange to red) represent an increase in peak residual inundation depth with (yellow to green) representing a decrease in peak residual inundation depth.

Generally, within the site results show the proposed earth working of the site for building platforms, vehicle/pedestrian/cycle access and infrastructure will result in the greatest decrease in flood depths while the compensatory storage area results in the greatest increase in flood depths. Flood depths are reduced in the isolated ponding area adjacent the Kāpiti Expressway.

A minor instability in the model is resulting in some isolated increases in off-site peak flood depths to the east of the expressway which can be ignored.

5.3. SUMMARY

Southern (residential) area

Model results of peak flood depths for the 100-Year ARI climate change base scenario event for the southern (residential) area show on-site flooding, within the site, is localised to isolated low-lying areas.

Flooding in the wider catchment, to the east, is a result of the throttling effect of the culverts and network along Otaihanga Road. To the west of Otaihanga Road the effect of the downstream tailwater level can be seen with flooding in this location.

It is proposed to subdivide the southern (residential) area into 27 residential lots accessed of a ROW from Otaihanga Road. The site will require fill for building platforms, vehicle/pedestrian/cycle access and infrastructure. This fill will remove storage from the floodplain so compensatory storage adjacent Otaihanga Road is proposed to mitigate this loss of storage.

Modelling results show the subdivision can be implemented with less than minor effects on surrounding flood levels.

Northern (rural life-style) area

It is proposed to subdivide the northern (rural life-style) area into 22 rural residential lots accessed off Tieko Street. The primary form of stormwater mitigation to achieve hydrologic neutrality for these lots will be via individual lot soakage.

Given the larger lot sizes and good soakage rates associated with the dune environment, mitigation via soakage is considered achievable. This methodology distributes the soakage over a dispersed area rather than concentrating discharge at a single location. Individual lot soakage devices will be sized at building consent stage.

Swales will be used to convey run-off from the connected impervious areas to the under-drained bio-infiltration devices. The under-drained bio-infiltration devices have been sized to accommodate the peak discharge from the 100-YR ARI Climate Change rainfall event.

The effects of the proposed subdivision have been assessed against the relevant provisions of the Proposed District Plan Appeals Version 2018 and requirements under the Resource Management (National Environmental Standards for Freshwater) Regulations 2020. If subdivision occurs as outlined in this report our professional opinion is that it will meet these relevant provisions and requirements.

5.4. REFERENCES

Kāpiti Coast District Council, Appendix 1 - Updated Isohyet Based Calculation of Design Peak flows, 11 October 2011

Guidelines for Stormwater Modelling using Mike Flood, DHI, November 2013

Begg, J.G.; Johnston, M.R. (compilers) 2000: Geology of the Wellington area: scale 1:250,000. Wellington: Institute of Geological & Nuclear Sciences. Institute of Geological & Nuclear Sciences 1:250,000 geological map 10. 64 p. + 1 folded map

Quick Reference Guide for Design Storm Hydrology, Cardno, February 2016

M2PP-131-M-REPG-1022; MacKays to Peka Peka Expressway Annual Groundwater (Level) Monitoring Report May 2017 to April 2018; Prepared for NZTA Transport Agency by Mackays to Peka Peka Expressway Alliance, June 2018.

Report On: Geotechnical Investigation, RDCL, April 2020

APPENDIX A1 IMPERVIOUS AREA 1 - 100YR

Client: **Mansells**

Location: **Otaihanga - Soakage - CatchmentArea 1_100yr**

Job No: **J000225**

Input Data by: TT
Input Checked by: CMM

Rainfall Data (100 CC% AEP):

Duration [min]	10	20	30	60	120	360	720	1440
Intensity [mm/hr]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Catchment:

	Roof	Road	Lawn	Other
Area [m^2]	0	0	0	0
C	0.90	0.85	0.40	0.35

Total Area	0	m^2
Weighted C	#DIV/0!	

Soak Pit:

Soakage Rate, SR =	40	mm/hr
Length, L =	110.00	m
Width, W=	3.00	m
Depth, D =	1.00	m
Initial Water Depth =	0.00	m
Porosity, n =	0.30	[Volume of Voids/Total Volume]
Central Riser, Dia =	0.00	m
Central Riser, Area =	0.0	m^2

Storage Available = 99.0 m^3
(Based on porosity)
Storage Required = 94.8 m^3

Max Water Depth = 0.965 m
OK

NOTE: The design assumes that the base of the soak pit is above ground water level to ensure that drainage occurs through the base of the pit as well as through the side walls.

Constants:

Time Step, T =	5	min
PEAK	0.056	
VOLUME	316	

Time [min]	Rainfall Intensity [mm/hr]	Runoff [m^3/s]	ΔV_{in} [m^3]	$\Delta V_{out, base}$ [m^3]	Excess Runoff [m^3]	Depth in Soak Pit [m]	$\Delta V_{out, wall}$ [m^3]	ΣV_{in} [m^3]	ΣV_{out} [m^3]	Required Storage [m^3]
0		0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
5	0.0	0.00024	0.000	1.100	-1.100	0.000	0.000	0.000	0.000	0.000
10	0.0	0.00074	0.071	1.100	-1.029	0.000	0.000	0.071	0.071	0.000
15	0.0	0.00106	0.223	1.100	-0.877	0.000	0.000	0.294	0.294	0.000
20	0.0	0.00111	0.318	1.100	-0.782	0.000	0.000	0.612	0.612	0.000
25	0.0	0.00112	0.333	1.100	-0.767	0.000	0.000	0.945	0.945	0.000
30	0.0	0.00113	0.337	1.100	-0.763	0.000	0.000	1.282	1.282	0.000
35	0.0	0.00113	0.339	1.100	-0.761	0.000	0.000	1.621	1.621	0.000
40	0.0	0.00114	0.340	1.100	-0.760	0.000	0.000	1.961	1.961	0.000
45	0.0	0.00115	0.342	1.100	-0.758	0.000	0.000	2.303	2.303	0.000
50	0.0	0.00115	0.344	1.100	-0.756	0.000	0.000	2.647	2.647	0.000
55	0.0	0.00116	0.346	1.100	-0.754	0.000	0.000	2.992	2.992	0.000
60	0.0	0.00116	0.347	1.100	-0.753	0.000	0.000	3.340	3.340	0.000
65	0.0	0.00117	0.349	1.100	-0.751	0.000	0.000	3.689	3.689	0.000
70	0.0	0.00118	0.351	1.100	-0.749	0.000	0.000	4.040	4.040	0.000
75	0.0	0.00118	0.353	1.100	-0.747	0.000	0.000	4.393	4.393	0.000
80	0.0	0.00119	0.355	1.100	-0.745	0.000	0.000	4.747	4.747	0.000
85	0.0	0.0012	0.357	1.100	-0.743	0.000	0.000	5.104	5.104	0.000
90	0.0	0.0012	0.359	1.100	-0.741	0.000	0.000	5.463	5.463	0.000
95	0.0	0.00121	0.361	1.100	-0.739	0.000	0.000	5.823	5.823	0.000
100	0.0	0.00122	0.363	1.100	-0.737	0.000	0.000	6.186	6.186	0.000
105	0.0	0.00122	0.365	1.100	-0.735	0.000	0.000	6.550	6.550	0.000
110	0.0	0.00123	0.367	1.100	-0.733	0.000	0.000	6.917	6.917	0.000
115	0.0	0.00124	0.369	1.100	-0.731	0.000	0.000	7.285	7.285	0.000
120	0.0	0.00124	0.371	1.100	-0.729	0.000	0.000	7.656	7.656	0.000
125	0.0	0.00125	0.373	1.100	-0.727	0.000	0.000	8.029	8.029	0.000
130	0.0	0.00126	0.375	1.100	-0.725	0.000	0.000	8.404	8.404	0.000
135	0.0	0.00126	0.377	1.100	-0.723	0.000	0.000	8.781	8.781	0.000
140	0.0	0.00127	0.379	1.100	-0.721	0.000	0.000	9.161	9.161	0.000
145	0.0	0.00128	0.382	1.100	-0.718	0.000	0.000	9.542	9.542	0.000
150	0.0	0.00129	0.384	1.100	-0.716	0.000	0.000	9.926	9.926	0.000
155	0.0	0.0013	0.386	1.100	-0.714	0.000	0.000	10.313	10.313	0.000
160	0.0	0.0013	0.389	1.100	-0.711	0.000	0.000	10.701	10.701	0.000
165	0.0	0.00131	0.391	1.100	-0.709	0.000	0.000	11.092	11.092	0.000
170	0.0	0.00132	0.393	1.100	-0.707	0.000	0.000	11.486	11.486	0.000

175	0.0	0.00133	0.396	1.100	-0.704	0.000	0.000	11.881	11.881	0.000
180	0.0	0.00134	0.398	1.100	-0.702	0.000	0.000	12.280	12.280	0.000
185	0.0	0.00134	0.401	1.100	-0.699	0.000	0.000	12.681	12.681	0.000
190	0.0	0.00135	0.403	1.100	-0.697	0.000	0.000	13.084	13.084	0.000
195	0.0	0.00136	0.406	1.100	-0.694	0.000	0.000	13.490	13.490	0.000
200	0.0	0.00137	0.409	1.100	-0.691	0.000	0.000	13.899	13.899	0.000
205	0.0	0.00138	0.411	1.100	-0.689	0.000	0.000	14.310	14.310	0.000
210	0.0	0.00139	0.414	1.100	-0.686	0.000	0.000	14.724	14.724	0.000
215	0.0	0.0014	0.417	1.100	-0.683	0.000	0.000	15.141	15.141	0.000
220	0.0	0.00141	0.420	1.100	-0.680	0.000	0.000	15.561	15.561	0.000
225	0.0	0.00142	0.423	1.100	-0.677	0.000	0.000	15.984	15.984	0.000
230	0.0	0.00143	0.426	1.100	-0.674	0.000	0.000	16.409	16.409	0.000
235	0.0	0.00144	0.429	1.100	-0.671	0.000	0.000	16.838	16.838	0.000
240	0.0	0.00145	0.432	1.100	-0.668	0.000	0.000	17.269	17.269	0.000
245	0.0	0.00146	0.435	1.100	-0.665	0.000	0.000	17.704	17.704	0.000
250	0.0	0.00147	0.438	1.100	-0.662	0.000	0.000	18.142	18.142	0.000
255	0.0	0.00148	0.441	1.100	-0.659	0.000	0.000	18.583	18.583	0.000
260	0.0	0.00149	0.444	1.100	-0.656	0.000	0.000	19.027	19.027	0.000
265	0.0	0.0015	0.448	1.100	-0.652	0.000	0.000	19.474	19.474	0.000
270	0.0	0.00151	0.451	1.100	-0.649	0.000	0.000	19.925	19.925	0.000
275	0.0	0.00153	0.454	1.100	-0.646	0.000	0.000	20.380	20.380	0.000
280	0.0	0.00154	0.458	1.100	-0.642	0.000	0.000	20.837	20.837	0.000
285	0.0	0.00155	0.461	1.100	-0.639	0.000	0.000	21.299	21.299	0.000
290	0.0	0.00156	0.465	1.100	-0.635	0.000	0.000	21.764	21.764	0.000
295	0.0	0.00157	0.469	1.100	-0.631	0.000	0.000	22.232	22.232	0.000
300	0.0	0.00159	0.472	1.100	-0.628	0.000	0.000	22.705	22.705	0.000
305	0.0	0.0016	0.476	1.100	-0.624	0.000	0.000	23.181	23.181	0.000
310	0.0	0.00161	0.480	1.100	-0.620	0.000	0.000	23.661	23.661	0.000
315	0.0	0.00163	0.484	1.100	-0.616	0.000	0.000	24.145	24.145	0.000
320	0.0	0.00164	0.488	1.100	-0.612	0.000	0.000	24.634	24.634	0.000
325	0.0	0.00166	0.492	1.100	-0.608	0.000	0.000	25.126	25.126	0.000
330	0.0	0.00167	0.497	1.100	-0.603	0.000	0.000	25.623	25.623	0.000
335	0.0	0.00168	0.501	1.100	-0.599	0.000	0.000	26.124	26.124	0.000
340	0.0	0.0017	0.505	1.100	-0.595	0.000	0.000	26.629	26.629	0.000
345	0.0	0.00172	0.510	1.100	-0.590	0.000	0.000	27.139	27.139	0.000
350	0.0	0.00173	0.515	1.100	-0.585	0.000	0.000	27.653	27.653	0.000
355	0.0	0.00175	0.519	1.100	-0.581	0.000	0.000	28.173	28.173	0.000
360	0.0	0.00176	0.524	1.100	-0.576	0.000	0.000	28.697	28.697	0.000
365	0.0	0.00194	0.529	1.100	-0.571	0.000	0.000	29.226	29.226	0.000
370	0.0	0.00231	0.583	1.100	-0.517	0.000	0.000	29.809	29.809	0.000
375	0.0	0.00254	0.693	1.100	-0.407	0.000	0.000	30.502	30.502	0.000
380	0.0	0.0026	0.763	1.100	-0.337	0.000	0.000	31.265	31.265	0.000
385	0.0	0.00262	0.779	1.100	-0.321	0.000	0.000	32.044	32.044	0.000
390	0.0	0.00264	0.787	1.100	-0.313	0.000	0.000	32.831	32.831	0.000
395	0.0	0.00267	0.793	1.100	-0.307	0.000	0.000	33.624	33.624	0.000
400	0.0	0.00269	0.800	1.100	-0.300	0.000	0.000	34.424	34.424	0.000
405	0.0	0.00271	0.807	1.100	-0.293	0.000	0.000	35.231	35.231	0.000
410	0.0	0.00274	0.814	1.100	-0.286	0.000	0.000	36.046	36.046	0.000
415	0.0	0.00276	0.821	1.100	-0.279	0.000	0.000	36.867	36.867	0.000
420	0.0	0.00279	0.829	1.100	-0.271	0.000	0.000	37.696	37.696	0.000
425	0.0	0.00281	0.836	1.100	-0.264	0.000	0.000	38.532	38.532	0.000
430	0.0	0.00284	0.844	1.100	-0.256	0.000	0.000	39.376	39.376	0.000
435	0.0	0.00287	0.852	1.100	-0.248	0.000	0.000	40.229	40.229	0.000
440	0.0	0.0029	0.860	1.100	-0.240	0.000	0.000	41.089	41.089	0.000
445	0.0	0.00293	0.869	1.100	-0.231	0.000	0.000	41.958	41.958	0.000
450	0.0	0.00296	0.878	1.100	-0.222	0.000	0.000	42.836	42.836	0.000
455	0.0	0.00299	0.887	1.100	-0.213	0.000	0.000	43.722	43.722	0.000
460	0.0	0.00302	0.896	1.100	-0.204	0.000	0.000	44.618	44.618	0.000
465	0.0	0.00305	0.905	1.100	-0.195	0.000	0.000	45.523	45.523	0.000
470	0.0	0.00308	0.915	1.100	-0.185	0.000	0.000	46.438	46.438	0.000
475	0.0	0.00312	0.925	1.100	-0.175	0.000	0.000	47.363	47.363	0.000
480	0.0	0.00315	0.935	1.100	-0.165	0.000	0.000	48.298	48.298	0.000
485	0.0	0.00319	0.946	1.100	-0.154	0.000	0.000	49.244	49.244	0.000
490	0.0	0.00323	0.957	1.100	-0.143	0.000	0.000	50.200	50.200	0.000
495	0.0	0.00327	0.968	1.100	-0.132	0.000	0.000	51.168	51.168	0.000
500	0.0	0.00331	0.980	1.100	-0.120	0.000	0.000	52.148	52.148	0.000
505	0.0	0.00335	0.992	1.100	-0.108	0.000	0.000	53.140	53.140	0.000
510	0.0	0.00339	1.004	1.100	-0.096	0.000	0.000	54.145	54.145	0.000
515	0.0	0.00344	1.017	1.100	-0.083	0.000	0.000	55.162	55.162	0.000

520	0.0	0.00348	1.031	1.100	-0.069	0.000	0.000	56.193	56.193	0.000
525	0.0	0.00353	1.045	1.100	-0.055	0.000	0.000	57.238	57.238	0.000
530	0.0	0.00358	1.059	1.100	-0.041	0.000	0.000	58.297	58.297	0.000
535	0.0	0.00363	1.074	1.100	-0.026	0.000	0.000	59.371	59.371	0.000
540	0.0	0.00369	1.090	1.100	-0.010	0.000	0.000	60.461	60.461	0.000
545	0.0	0.00365	1.106	1.100	0.006	0.000	0.000	61.568	61.561	0.006
550	0.0	0.00351	1.095	1.100	-0.005	0.000	0.000	62.663	62.661	0.002
555	0.0	0.00345	1.053	1.100	-0.047	0.000	0.000	63.716	63.716	0.000
560	0.0	0.00349	1.034	1.100	-0.066	0.000	0.000	64.750	64.750	0.000
565	0.0	0.00355	1.048	1.100	-0.052	0.000	0.000	65.798	65.798	0.000
570	0.0	0.00362	1.066	1.100	-0.034	0.000	0.000	66.864	66.864	0.000
575	0.0	0.0037	1.087	1.100	-0.013	0.000	0.000	67.951	67.951	0.000
580	0.0	0.00377	1.109	1.100	0.009	0.000	0.000	69.060	69.051	0.009
585	0.0	0.00385	1.131	1.100	0.031	0.000	0.000	70.191	70.151	0.040
590	0.0	0.00394	1.155	1.100	0.055	0.001	0.000	71.347	71.252	0.095
595	0.0	0.00403	1.181	1.100	0.081	0.002	0.001	72.528	72.352	0.175
600	0.0	0.00412	1.208	1.100	0.107	0.003	0.001	73.736	73.454	0.282
605	0.0	0.00422	1.237	1.100	0.135	0.004	0.002	74.972	74.556	0.416
610	0.0	0.00433	1.267	1.100	0.165	0.006	0.003	76.239	75.659	0.580
615	0.0	0.00445	1.300	1.100	0.196	0.008	0.004	77.539	76.764	0.775
620	0.0	0.00457	1.335	1.100	0.230	0.010	0.006	78.874	77.870	1.004
625	0.0	0.00471	1.372	1.100	0.266	0.013	0.008	80.245	78.977	1.268
630	0.0	0.00485	1.412	1.100	0.305	0.016	0.010	81.658	80.087	1.571
635	0.0	0.00526	1.456	1.100	0.346	0.019	0.012	83.113	81.199	1.914
640	0.0	0.00598	1.579	1.100	0.467	0.024	0.015	84.692	82.314	2.378
645	0.0	0.00651	1.794	1.100	0.679	0.031	0.018	86.486	83.432	3.054
650	0.0	0.00677	1.952	1.100	0.834	0.039	0.023	88.438	84.555	3.883
655	0.0	0.00702	2.032	1.100	0.908	0.049	0.030	90.470	85.685	4.785
660	0.0	0.00728	2.105	1.100	0.976	0.058	0.037	92.575	86.822	5.754
665	0.0	0.00785	2.185	1.100	1.048	0.069	0.044	94.760	87.966	6.794
670	0.0	0.00876	2.355	1.100	1.211	0.081	0.052	97.114	89.118	7.997
675	0.0	0.0095	2.629	1.100	1.477	0.096	0.061	99.744	90.279	9.465
680	0.0	0.00998	2.850	1.100	1.688	0.113	0.072	102.593	91.451	11.142
685	0.0	0.01049	2.994	1.100	1.822	0.132	0.085	105.588	92.637	12.951
690	0.0	0.01108	3.147	1.100	1.961	0.151	0.099	108.734	93.836	14.898
695	0.0	0.01101	3.324	1.100	2.124	0.173	0.114	112.058	95.050	17.008
700	0.0	0.01021	3.303	1.100	2.089	0.194	0.130	115.361	96.280	19.080
705	0.0	0.01032	3.062	1.100	1.832	0.213	0.146	118.423	97.527	20.896
710	0.0	0.01268	3.095	1.100	1.849	0.231	0.160	121.518	98.787	22.732
715	0.0	0.01721	3.804	1.100	2.544	0.257	0.174	125.322	100.061	25.261
720	0.0	0.02433	5.163	1.100	3.889	0.296	0.194	130.485	101.354	29.131
725	0.0	0.0425	7.300	1.100	6.006	0.357	0.223	137.785	102.678	35.108
730	0.0	0.05589	12.750	1.100	11.427	0.472	0.269	150.535	104.046	46.489
735	0.0	0.04177	16.768	1.100	15.399	0.628	0.356	167.303	105.502	61.800
740	0.0	0.02318	12.532	1.100	11.076	0.740	0.473	179.834	107.075	72.759
745	0.0	0.01562	6.955	1.100	5.382	0.794	0.557	186.790	108.732	78.057
750	0.0	0.01173	4.685	1.100	3.028	0.825	0.598	191.475	110.431	81.044
755	0.0	0.01079	3.518	1.100	1.820	0.843	0.621	194.993	112.152	82.841
760	0.0	0.01135	3.237	1.100	1.516	0.858	0.635	198.230	113.887	84.343
765	0.0	0.01153	3.405	1.100	1.670	0.875	0.647	201.635	115.634	86.001
770	0.0	0.01099	3.460	1.100	1.713	0.893	0.659	205.094	117.393	87.701
775	0.0	0.01044	3.298	1.100	1.539	0.908	0.672	208.393	119.165	89.227
780	0.0	0.00996	3.133	1.100	1.360	0.922	0.684	211.526	120.949	90.576
785	0.0	0.00926	2.987	1.100	1.203	0.934	0.694	214.512	122.744	91.769
790	0.0	0.00831	2.779	1.100	0.984	0.944	0.704	217.291	124.547	92.744
795	0.0	0.00762	2.493	1.100	0.689	0.951	0.711	219.784	126.358	93.425
800	0.0	0.00728	2.287	1.100	0.476	0.956	0.716	222.071	128.175	93.896
805	0.0	0.00701	2.184	1.100	0.368	0.959	0.720	224.255	129.995	94.260
810	0.0	0.00678	2.104	1.100	0.284	0.962	0.723	226.358	131.818	94.541
815	0.0	0.00631	2.033	1.100	0.210	0.964	0.725	228.392	133.642	94.749
820	0.0	0.00557	1.893	1.100	0.069	0.965	0.727	230.285	135.469	94.816
825	0.0	0.00507	1.672	1.100	-0.154	0.964	0.727	231.957	137.296	94.661
830	0.0	0.00486	1.520	1.100	-0.307	0.960	0.726	233.478	139.122	94.356
835	0.0	0.00471	1.459	1.100	-0.367	0.957	0.724	234.937	140.945	93.991
840	0.0	0.00458	1.414	1.100	-0.410	0.953	0.721	236.350	142.766	93.584
845	0.0	0.00446	1.374	1.100	-0.447	0.948	0.718	237.724	144.584	93.140
850	0.0	0.00434	1.337	1.100	-0.481	0.943	0.714	239.060	146.398	92.662
855	0.0	0.00423	1.302	1.100	-0.512	0.938	0.711	240.362	148.208	92.154
860	0.0	0.00413	1.270	1.100	-0.541	0.933	0.707	241.632	150.015	91.617

865	0.0	0.00404	1.239	1.100	-0.567	0.927	0.703	242.872	151.818	91.054
870	0.0	0.00395	1.211	1.100	-0.591	0.921	0.698	244.083	153.616	90.467
875	0.0	0.00386	1.184	1.100	-0.614	0.915	0.694	245.267	155.409	89.857
880	0.0	0.00378	1.159	1.100	-0.635	0.908	0.689	246.426	157.199	89.227
885	0.0	0.00371	1.135	1.100	-0.654	0.902	0.684	247.561	158.983	88.578
890	0.0	0.00364	1.112	1.100	-0.672	0.895	0.679	248.673	160.762	87.911
895	0.0	0.00357	1.091	1.100	-0.688	0.888	0.674	249.764	162.536	87.228
900	0.0	0.0035	1.070	1.100	-0.704	0.881	0.669	250.835	164.305	86.530
905	0.0	0.00353	1.051	1.100	-0.718	0.874	0.664	251.886	166.069	85.817
910	0.0	0.00368	1.060	1.100	-0.703	0.866	0.658	252.946	167.827	85.119
915	0.0	0.00374	1.103	1.100	-0.655	0.860	0.653	254.049	169.579	84.469
920	0.0	0.0037	1.122	1.100	-0.630	0.853	0.648	255.171	171.327	83.844
925	0.0	0.00365	1.111	1.100	-0.637	0.847	0.643	256.282	173.070	83.212
930	0.0	0.0036	1.095	1.100	-0.647	0.840	0.638	257.377	174.808	82.569
935	0.0	0.00355	1.080	1.100	-0.658	0.834	0.633	258.457	176.541	81.916
940	0.0	0.0035	1.065	1.100	-0.668	0.827	0.628	259.522	178.269	81.253
945	0.0	0.00346	1.050	1.100	-0.678	0.820	0.623	260.573	179.992	80.580
950	0.0	0.00341	1.037	1.100	-0.686	0.813	0.618	261.609	181.710	79.899
955	0.0	0.00337	1.023	1.100	-0.695	0.806	0.613	262.632	183.423	79.209
960	0.0	0.00333	1.010	1.100	-0.702	0.799	0.607	263.643	185.130	78.512
965	0.0	0.00329	0.998	1.100	-0.710	0.792	0.602	264.641	186.832	77.808
970	0.0	0.00325	0.986	1.100	-0.716	0.785	0.597	265.626	188.529	77.097
975	0.0	0.00321	0.974	1.100	-0.723	0.777	0.591	266.600	190.220	76.380
980	0.0	0.00317	0.963	1.100	-0.728	0.770	0.586	267.563	191.906	75.657
985	0.0	0.00314	0.952	1.100	-0.734	0.763	0.580	268.515	193.586	74.929
990	0.0	0.0031	0.941	1.100	-0.739	0.755	0.575	269.456	195.261	74.196
995	0.0	0.00307	0.931	1.100	-0.744	0.748	0.569	270.388	196.930	73.458
1000	0.0	0.00304	0.921	1.100	-0.748	0.740	0.563	271.309	198.593	72.715
1005	0.0	0.00301	0.911	1.100	-0.752	0.733	0.558	272.220	200.251	71.969
1010	0.0	0.00298	0.902	1.100	-0.756	0.725	0.552	273.122	201.903	71.219
1015	0.0	0.00295	0.893	1.100	-0.759	0.717	0.546	274.015	203.549	70.466
1020	0.0	0.00292	0.884	1.100	-0.762	0.710	0.540	274.899	205.189	69.710
1025	0.0	0.00289	0.875	1.100	-0.765	0.702	0.535	275.774	206.824	68.950
1030	0.0	0.00286	0.867	1.100	-0.768	0.694	0.529	276.641	208.452	68.188
1035	0.0	0.00284	0.859	1.100	-0.770	0.686	0.523	277.499	210.075	67.424
1040	0.0	0.00281	0.851	1.100	-0.772	0.679	0.517	278.350	211.692	66.658
1045	0.0	0.00278	0.843	1.100	-0.774	0.671	0.511	279.193	213.303	65.890
1050	0.0	0.00276	0.835	1.100	-0.776	0.663	0.505	280.028	214.909	65.120
1055	0.0	0.00274	0.828	1.100	-0.777	0.655	0.499	280.856	216.508	64.348
1060	0.0	0.00271	0.821	1.100	-0.779	0.647	0.493	281.677	218.102	63.575
1065	0.0	0.00269	0.814	1.100	-0.780	0.639	0.488	282.491	219.689	62.801
1070	0.0	0.00267	0.807	1.100	-0.781	0.631	0.482	283.297	221.271	62.027
1075	0.0	0.00264	0.800	1.100	-0.782	0.624	0.476	284.097	222.846	61.251
1080	0.0	0.00262	0.793	1.100	-0.782	0.616	0.470	284.891	224.416	60.475
1085	0.0	0.00244	0.787	1.100	-0.783	0.608	0.464	285.678	225.980	59.698
1090	0.0	0.00207	0.732	1.100	-0.832	0.599	0.458	286.409	227.538	58.872
1095	0.0	0.00183	0.620	1.100	-0.938	0.590	0.451	287.029	229.089	57.940
1100	0.0	0.00178	0.550	1.100	-1.002	0.580	0.444	287.579	230.633	56.946
1105	0.0	0.00176	0.535	1.100	-1.009	0.569	0.437	288.114	232.170	55.944
1110	0.0	0.00175	0.529	1.100	-1.008	0.559	0.429	288.642	233.699	54.943
1115	0.0	0.00173	0.524	1.100	-1.005	0.549	0.421	289.166	235.220	53.946
1120	0.0	0.00171	0.519	1.100	-1.002	0.539	0.414	289.685	236.734	52.951
1125	0.0	0.0017	0.514	1.100	-0.999	0.529	0.406	290.200	238.240	51.959
1130	0.0	0.00168	0.510	1.100	-0.996	0.519	0.398	290.709	239.739	50.971
1135	0.0	0.00167	0.505	1.100	-0.993	0.509	0.391	291.215	241.230	49.985
1140	0.0	0.00166	0.501	1.100	-0.990	0.499	0.383	291.716	242.713	49.003
1145	0.0	0.00164	0.497	1.100	-0.987	0.489	0.376	292.213	244.189	48.024
1150	0.0	0.00163	0.493	1.100	-0.983	0.479	0.368	292.705	245.657	47.048
1155	0.0	0.00162	0.489	1.100	-0.980	0.469	0.361	293.194	247.118	46.076
1160	0.0	0.0016	0.485	1.100	-0.976	0.459	0.353	293.679	248.571	45.107
1165	0.0	0.00159	0.481	1.100	-0.973	0.449	0.346	294.159	250.017	44.142
1170	0.0	0.00158	0.477	1.100	-0.969	0.440	0.339	294.636	251.456	43.180
1175	0.0	0.00156	0.473	1.100	-0.965	0.430	0.331	295.109	252.887	42.222
1180	0.0	0.00155	0.469	1.100	-0.962	0.420	0.324	295.579	254.311	41.268
1185	0.0	0.00154	0.466	1.100	-0.958	0.410	0.316	296.044	255.727	40.317
1190	0.0	0.00153	0.462	1.100	-0.954	0.401	0.309	296.506	257.136	39.370
1195	0.0	0.00152	0.459	1.100	-0.951	0.391	0.302	296.965	258.538	38.427
1200	0.0	0.00151	0.455	1.100	-0.947	0.382	0.295	297.420	259.933	37.487
1205	0.0	0.0015	0.452	1.100	-0.943	0.372	0.287	297.872	261.320	36.552

1210	0.0	0.00148	0.449	1.100	-0.939	0.363	0.280	298.321	262.701	35.620
1215	0.0	0.00147	0.445	1.100	-0.935	0.353	0.273	298.766	264.074	34.692
1220	0.0	0.00146	0.442	1.100	-0.931	0.344	0.266	299.208	265.440	33.768
1225	0.0	0.00145	0.439	1.100	-0.927	0.334	0.259	299.647	266.799	32.848
1230	0.0	0.00144	0.436	1.100	-0.923	0.325	0.252	300.083	268.151	31.932
1235	0.0	0.00143	0.433	1.100	-0.919	0.316	0.245	300.516	269.496	31.020
1240	0.0	0.00142	0.430	1.100	-0.915	0.307	0.238	300.946	270.834	30.112
1245	0.0	0.00141	0.427	1.100	-0.911	0.297	0.231	301.373	272.165	29.208
1250	0.0	0.0014	0.424	1.100	-0.907	0.288	0.224	301.797	273.489	28.308
1255	0.0	0.00139	0.421	1.100	-0.903	0.279	0.217	302.218	274.806	27.412
1260	0.0	0.00139	0.418	1.100	-0.899	0.270	0.210	302.636	276.116	26.520
1265	0.0	0.00138	0.416	1.100	-0.895	0.261	0.203	303.052	277.419	25.633
1270	0.0	0.00137	0.413	1.100	-0.890	0.252	0.197	303.465	278.716	24.749
1275	0.0	0.00136	0.410	1.100	-0.886	0.243	0.190	303.875	280.006	23.869
1280	0.0	0.00135	0.408	1.100	-0.882	0.234	0.183	304.283	281.289	22.994
1285	0.0	0.00134	0.405	1.100	-0.878	0.225	0.176	304.688	282.565	22.123
1290	0.0	0.00133	0.403	1.100	-0.874	0.216	0.170	305.091	283.835	21.256
1295	0.0	0.00133	0.400	1.100	-0.870	0.208	0.163	305.491	285.098	20.393
1300	0.0	0.00132	0.398	1.100	-0.865	0.199	0.156	305.888	286.354	19.534
1305	0.0	0.00131	0.395	1.100	-0.861	0.190	0.150	306.284	287.604	18.679
1310	0.0	0.0013	0.393	1.100	-0.857	0.182	0.143	306.676	288.848	17.829
1315	0.0	0.00129	0.390	1.100	-0.853	0.173	0.137	307.067	290.084	16.983
1320	0.0	0.00129	0.388	1.100	-0.849	0.164	0.130	307.455	291.315	16.140
1325	0.0	0.00128	0.386	1.100	-0.844	0.156	0.124	307.841	292.538	15.302
1330	0.0	0.00127	0.384	1.100	-0.840	0.147	0.117	308.224	293.756	14.469
1335	0.0	0.00126	0.381	1.100	-0.836	0.139	0.111	308.606	294.967	13.639
1340	0.0	0.00126	0.379	1.100	-0.832	0.130	0.105	308.985	296.171	12.814
1345	0.0	0.00125	0.377	1.100	-0.828	0.122	0.098	309.362	297.370	11.992
1350	0.0	0.00124	0.375	1.100	-0.823	0.114	0.092	309.737	298.562	11.175
1355	0.0	0.00124	0.373	1.100	-0.819	0.106	0.086	310.110	299.747	10.362
1360	0.0	0.00123	0.371	1.100	-0.815	0.097	0.080	310.480	300.927	9.553
1365	0.0	0.00122	0.369	1.100	-0.811	0.089	0.073	310.849	302.100	8.749
1370	0.0	0.00122	0.367	1.100	-0.807	0.081	0.067	311.216	303.267	7.948
1375	0.0	0.00121	0.365	1.100	-0.802	0.073	0.061	311.580	304.428	7.152
1380	0.0	0.0012	0.363	1.100	-0.798	0.065	0.055	311.943	305.583	6.360
1385	0.0	0.0012	0.361	1.100	-0.794	0.057	0.049	312.304	306.732	5.572
1390	0.0	0.00119	0.359	1.100	-0.790	0.049	0.043	312.662	307.875	4.788
1395	0.0	0.00118	0.357	1.100	-0.786	0.041	0.037	313.019	309.012	4.008
1400	0.0	0.00118	0.355	1.100	-0.782	0.033	0.031	313.374	310.142	3.232
1405	0.0	0.00117	0.353	1.100	-0.778	0.025	0.025	313.728	311.267	2.460
1410	0.0	0.00117	0.351	1.100	-0.773	0.017	0.019	314.079	312.386	1.693
1415	0.0	0.00116	0.350	1.100	-0.769	0.010	0.013	314.429	313.499	0.929
1420	0.0	0.00115	0.348	1.100	-0.765	0.002	0.007	314.776	314.606	0.170
1425	0.0	0.00115	0.346	1.100	-0.761	0.000	0.001	315.122	315.122	0.000
1430	0.0	0.00114	0.344	1.100	-0.757	0.000	0.000	315.467	315.467	0.000
1435	0.0	0.00114	0.343	1.100	-0.757	0.000	0.000	315.809	315.809	0.000
1440	0.0	0.00113	0.341	1.100	-0.759	0.000	0.000	316.150	316.150	0.000

APPENDIX A2 IMPERVIOUS AREA 2 - 100YR

Client: **Mansells**

Location: **Otaihanga - Soakage - CatchmentArea 2_100yr**

Job No: **J000225**

Input Data by: TT
Input Checked by: CMM

Rainfall Data (100 CC% AEP):

Duration [min]	10	20	30	60	120	360	720	1440
Intensity [mm/hr]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Catchment:

	Roof	Road	Lawn	Other
Area [m^2]	0	0	0	0
C	0.90	0.85	0.40	0.35

Total Area	0	m^2
Weighted C	#DIV/0!	

Soak Pit:

Soakage Rate, SR =	40	mm/hr
Length, L =	150.00	m
Width, W=	2.50	m
Depth, D =	1.00	m
Initial Water Depth =	0.00	m
Porosity, n =	0.30	[Volume of Voids/Total Volume]
Central Riser, Dia =	0.00	m
Central Riser, Area =	0.0	m^2

Storage Available = 112.5 m^3
(Based on porosity)
Storage Required = 108.6 m^3

Max Water Depth = 0.974 m
OK

NOTE: The design assumes that the base of the soak pit is above ground water level to ensure that drainage occurs through the base of the pit as well as through the side walls.

Constants:

Time Step, T =	5	min
PEAK	0.065	
VOLUME	368	

Time [min]	Rainfall Intensity [mm/hr]	Runoff [m^3/s]	ΔV_{in} [m^3]	$\Delta V_{out, base}$ [m^3]	Excess Runoff [m^3]	Depth in Soak Pit [m]	$\Delta V_{out, wall}$ [m^3]	ΣV_{in} [m^3]	ΣV_{out} [m^3]	Required Storage [m^3]
0		0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
5	0.0	0.00027	0.000	1.250	-1.250	0.000	0.000	0.000	0.000	0.000
10	0.0	0.00087	0.082	1.250	-1.168	0.000	0.000	0.082	0.082	0.000
15	0.0	0.00123	0.260	1.250	-0.990	0.000	0.000	0.342	0.342	0.000
20	0.0	0.00129	0.369	1.250	-0.881	0.000	0.000	0.711	0.711	0.000
25	0.0	0.00131	0.387	1.250	-0.863	0.000	0.000	1.099	1.099	0.000
30	0.0	0.00131	0.392	1.250	-0.858	0.000	0.000	1.490	1.490	0.000
35	0.0	0.00132	0.394	1.250	-0.856	0.000	0.000	1.884	1.884	0.000
40	0.0	0.00132	0.395	1.250	-0.855	0.000	0.000	2.279	2.279	0.000
45	0.0	0.00133	0.397	1.250	-0.853	0.000	0.000	2.677	2.677	0.000
50	0.0	0.00134	0.400	1.250	-0.850	0.000	0.000	3.076	3.076	0.000
55	0.0	0.00135	0.402	1.250	-0.848	0.000	0.000	3.478	3.478	0.000
60	0.0	0.00135	0.404	1.250	-0.846	0.000	0.000	3.881	3.881	0.000
65	0.0	0.00136	0.406	1.250	-0.844	0.000	0.000	4.287	4.287	0.000
70	0.0	0.00137	0.408	1.250	-0.842	0.000	0.000	4.695	4.695	0.000
75	0.0	0.00137	0.410	1.250	-0.840	0.000	0.000	5.105	5.105	0.000
80	0.0	0.00138	0.412	1.250	-0.838	0.000	0.000	5.517	5.517	0.000
85	0.0	0.00139	0.414	1.250	-0.836	0.000	0.000	5.932	5.932	0.000
90	0.0	0.0014	0.417	1.250	-0.833	0.000	0.000	6.349	6.349	0.000
95	0.0	0.0014	0.419	1.250	-0.831	0.000	0.000	6.768	6.768	0.000
100	0.0	0.00141	0.421	1.250	-0.829	0.000	0.000	7.189	7.189	0.000
105	0.0	0.00142	0.424	1.250	-0.826	0.000	0.000	7.612	7.612	0.000
110	0.0	0.00143	0.426	1.250	-0.824	0.000	0.000	8.038	8.038	0.000
115	0.0	0.00144	0.428	1.250	-0.822	0.000	0.000	8.467	8.467	0.000
120	0.0	0.00144	0.431	1.250	-0.819	0.000	0.000	8.898	8.898	0.000
125	0.0	0.00145	0.433	1.250	-0.817	0.000	0.000	9.331	9.331	0.000
130	0.0	0.00146	0.436	1.250	-0.814	0.000	0.000	9.767	9.767	0.000
135	0.0	0.00147	0.438	1.250	-0.812	0.000	0.000	10.205	10.205	0.000
140	0.0	0.00148	0.441	1.250	-0.809	0.000	0.000	10.646	10.646	0.000
145	0.0	0.00149	0.444	1.250	-0.806	0.000	0.000	11.090	11.090	0.000
150	0.0	0.0015	0.446	1.250	-0.804	0.000	0.000	11.536	11.536	0.000
155	0.0	0.00151	0.449	1.250	-0.801	0.000	0.000	11.985	11.985	0.000
160	0.0	0.00151	0.452	1.250	-0.798	0.000	0.000	12.436	12.436	0.000
165	0.0	0.00152	0.454	1.250	-0.796	0.000	0.000	12.891	12.891	0.000
170	0.0	0.00153	0.457	1.250	-0.793	0.000	0.000	13.348	13.348	0.000

175	0.0	0.00154	0.460	1.250	-0.790	0.000	0.000	13.808	13.808	0.000
180	0.0	0.00155	0.463	1.250	-0.787	0.000	0.000	14.271	14.271	0.000
185	0.0	0.00156	0.466	1.250	-0.784	0.000	0.000	14.737	14.737	0.000
190	0.0	0.00157	0.469	1.250	-0.781	0.000	0.000	15.206	15.206	0.000
195	0.0	0.00158	0.472	1.250	-0.778	0.000	0.000	15.678	15.678	0.000
200	0.0	0.00159	0.475	1.250	-0.775	0.000	0.000	16.153	16.153	0.000
205	0.0	0.0016	0.478	1.250	-0.772	0.000	0.000	16.631	16.631	0.000
210	0.0	0.00162	0.481	1.250	-0.769	0.000	0.000	17.112	17.112	0.000
215	0.0	0.00163	0.485	1.250	-0.765	0.000	0.000	17.597	17.597	0.000
220	0.0	0.00164	0.488	1.250	-0.762	0.000	0.000	18.085	18.085	0.000
225	0.0	0.00165	0.491	1.250	-0.759	0.000	0.000	18.576	18.576	0.000
230	0.0	0.00166	0.495	1.250	-0.755	0.000	0.000	19.070	19.070	0.000
235	0.0	0.00167	0.498	1.250	-0.752	0.000	0.000	19.568	19.568	0.000
240	0.0	0.00168	0.502	1.250	-0.748	0.000	0.000	20.070	20.070	0.000
245	0.0	0.0017	0.505	1.250	-0.745	0.000	0.000	20.575	20.575	0.000
250	0.0	0.00171	0.509	1.250	-0.741	0.000	0.000	21.084	21.084	0.000
255	0.0	0.00172	0.512	1.250	-0.738	0.000	0.000	21.596	21.596	0.000
260	0.0	0.00173	0.516	1.250	-0.734	0.000	0.000	22.112	22.112	0.000
265	0.0	0.00175	0.520	1.250	-0.730	0.000	0.000	22.633	22.633	0.000
270	0.0	0.00176	0.524	1.250	-0.726	0.000	0.000	23.157	23.157	0.000
275	0.0	0.00177	0.528	1.250	-0.722	0.000	0.000	23.684	23.684	0.000
280	0.0	0.00179	0.532	1.250	-0.718	0.000	0.000	24.216	24.216	0.000
285	0.0	0.0018	0.536	1.250	-0.714	0.000	0.000	24.753	24.753	0.000
290	0.0	0.00182	0.540	1.250	-0.710	0.000	0.000	25.293	25.293	0.000
295	0.0	0.00183	0.545	1.250	-0.705	0.000	0.000	25.838	25.838	0.000
300	0.0	0.00184	0.549	1.250	-0.701	0.000	0.000	26.387	26.387	0.000
305	0.0	0.00186	0.553	1.250	-0.697	0.000	0.000	26.940	26.940	0.000
310	0.0	0.00188	0.558	1.250	-0.692	0.000	0.000	27.498	27.498	0.000
315	0.0	0.00189	0.563	1.250	-0.687	0.000	0.000	28.061	28.061	0.000
320	0.0	0.00191	0.567	1.250	-0.683	0.000	0.000	28.628	28.628	0.000
325	0.0	0.00192	0.572	1.250	-0.678	0.000	0.000	29.200	29.200	0.000
330	0.0	0.00194	0.577	1.250	-0.673	0.000	0.000	29.778	29.778	0.000
335	0.0	0.00196	0.582	1.250	-0.668	0.000	0.000	30.360	30.360	0.000
340	0.0	0.00198	0.587	1.250	-0.663	0.000	0.000	30.947	30.947	0.000
345	0.0	0.00199	0.593	1.250	-0.657	0.000	0.000	31.540	31.540	0.000
350	0.0	0.00201	0.598	1.250	-0.652	0.000	0.000	32.138	32.138	0.000
355	0.0	0.00203	0.603	1.250	-0.647	0.000	0.000	32.741	32.741	0.000
360	0.0	0.00205	0.609	1.250	-0.641	0.000	0.000	33.350	33.350	0.000
365	0.0	0.00226	0.615	1.250	-0.635	0.000	0.000	33.965	33.965	0.000
370	0.0	0.00268	0.677	1.250	-0.573	0.000	0.000	34.642	34.642	0.000
375	0.0	0.00296	0.805	1.250	-0.445	0.000	0.000	35.448	35.448	0.000
380	0.0	0.00302	0.887	1.250	-0.363	0.000	0.000	36.335	36.335	0.000
385	0.0	0.00305	0.905	1.250	-0.345	0.000	0.000	37.240	37.240	0.000
390	0.0	0.00307	0.914	1.250	-0.336	0.000	0.000	38.155	38.155	0.000
395	0.0	0.0031	0.922	1.250	-0.328	0.000	0.000	39.077	39.077	0.000
400	0.0	0.00313	0.930	1.250	-0.320	0.000	0.000	40.007	40.007	0.000
405	0.0	0.00315	0.938	1.250	-0.312	0.000	0.000	40.945	40.945	0.000
410	0.0	0.00318	0.946	1.250	-0.304	0.000	0.000	41.891	41.891	0.000
415	0.0	0.00321	0.955	1.250	-0.295	0.000	0.000	42.845	42.845	0.000
420	0.0	0.00324	0.963	1.250	-0.287	0.000	0.000	43.809	43.809	0.000
425	0.0	0.00327	0.972	1.250	-0.278	0.000	0.000	44.781	44.781	0.000
430	0.0	0.0033	0.981	1.250	-0.269	0.000	0.000	45.762	45.762	0.000
435	0.0	0.00333	0.990	1.250	-0.260	0.000	0.000	46.752	46.752	0.000
440	0.0	0.00337	1.000	1.250	-0.250	0.000	0.000	47.752	47.752	0.000
445	0.0	0.0034	1.010	1.250	-0.240	0.000	0.000	48.762	48.762	0.000
450	0.0	0.00343	1.020	1.250	-0.230	0.000	0.000	49.782	49.782	0.000
455	0.0	0.00347	1.030	1.250	-0.220	0.000	0.000	50.812	50.812	0.000
460	0.0	0.00351	1.041	1.250	-0.209	0.000	0.000	51.853	51.853	0.000
465	0.0	0.00354	1.052	1.250	-0.198	0.000	0.000	52.905	52.905	0.000
470	0.0	0.00358	1.063	1.250	-0.187	0.000	0.000	53.968	53.968	0.000
475	0.0	0.00362	1.075	1.250	-0.175	0.000	0.000	55.043	55.043	0.000
480	0.0	0.00366	1.087	1.250	-0.163	0.000	0.000	56.130	56.130	0.000
485	0.0	0.00371	1.099	1.250	-0.151	0.000	0.000	57.229	57.229	0.000
490	0.0	0.00375	1.112	1.250	-0.138	0.000	0.000	58.341	58.341	0.000
495	0.0	0.0038	1.125	1.250	-0.125	0.000	0.000	59.466	59.466	0.000
500	0.0	0.00384	1.139	1.250	-0.111	0.000	0.000	60.605	60.605	0.000
505	0.0	0.00389	1.153	1.250	-0.097	0.000	0.000	61.757	61.757	0.000
510	0.0	0.00394	1.167	1.250	-0.083	0.000	0.000	62.925	62.925	0.000
515	0.0	0.00399	1.182	1.250	-0.068	0.000	0.000	64.107	64.107	0.000

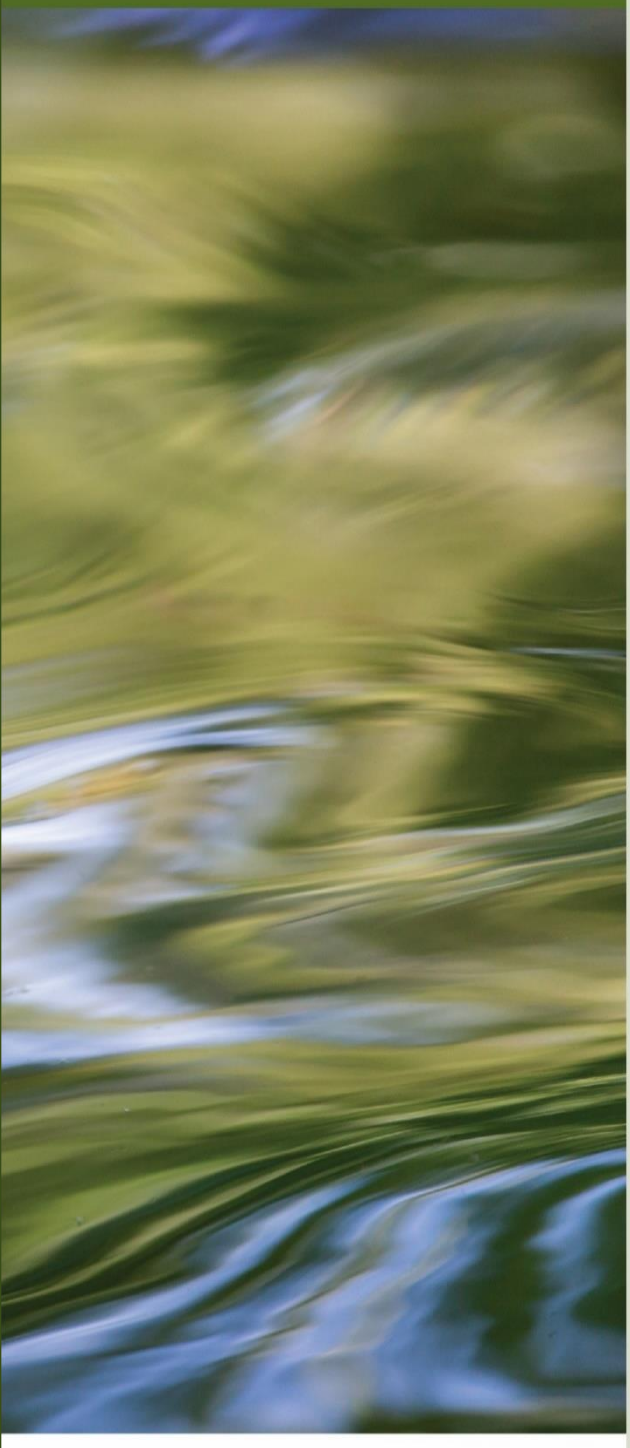
520	0.0	0.00405	1.198	1.250	-0.052	0.000	0.000	65.305	65.305	0.000
525	0.0	0.0041	1.214	1.250	-0.036	0.000	0.000	66.520	66.520	0.000
530	0.0	0.00416	1.231	1.250	-0.019	0.000	0.000	67.751	67.751	0.000
535	0.0	0.00422	1.249	1.250	-0.001	0.000	0.000	68.999	68.999	0.000
540	0.0	0.00429	1.267	1.250	0.017	0.000	0.000	70.266	70.249	0.017
545	0.0	0.00424	1.286	1.250	0.036	0.000	0.000	71.552	71.499	0.052
550	0.0	0.00408	1.273	1.250	0.023	0.001	0.000	72.825	72.750	0.075
555	0.0	0.00401	1.224	1.250	-0.027	0.000	0.001	74.048	74.000	0.048
560	0.0	0.00406	1.202	1.250	-0.049	0.000	0.000	75.250	75.250	0.000
565	0.0	0.00413	1.217	1.250	-0.033	0.000	0.000	76.468	76.468	0.000
570	0.0	0.00421	1.239	1.250	-0.011	0.000	0.000	77.707	77.707	0.000
575	0.0	0.00429	1.263	1.250	0.013	0.000	0.000	78.971	78.957	0.013
580	0.0	0.00438	1.288	1.250	0.038	0.000	0.000	80.259	80.207	0.051
585	0.0	0.00448	1.315	1.250	0.065	0.001	0.000	81.574	81.458	0.116
590	0.0	0.00457	1.343	1.250	0.092	0.002	0.001	82.917	82.709	0.208
595	0.0	0.00468	1.372	1.250	0.121	0.003	0.002	84.289	83.961	0.328
600	0.0	0.00479	1.404	1.250	0.152	0.004	0.003	85.693	85.214	0.479
605	0.0	0.00491	1.437	1.250	0.184	0.006	0.004	87.130	86.468	0.662
610	0.0	0.00503	1.473	1.250	0.218	0.008	0.006	88.603	87.724	0.878
615	0.0	0.00517	1.510	1.250	0.254	0.010	0.008	90.113	88.982	1.131
620	0.0	0.00531	1.551	1.250	0.293	0.013	0.010	91.664	90.242	1.421
625	0.0	0.00547	1.594	1.250	0.334	0.016	0.013	93.258	91.505	1.753
630	0.0	0.00564	1.641	1.250	0.378	0.019	0.016	94.899	92.771	2.128
635	0.0	0.00612	1.692	1.250	0.426	0.023	0.019	96.591	94.041	2.550
640	0.0	0.00695	1.835	1.250	0.565	0.028	0.023	98.426	95.314	3.112
645	0.0	0.00756	2.085	1.250	0.811	0.035	0.028	100.511	96.592	3.918
650	0.0	0.00787	2.269	1.250	0.990	0.044	0.036	102.779	97.878	4.901
655	0.0	0.00816	2.361	1.250	1.076	0.053	0.045	105.141	99.173	5.968
660	0.0	0.00846	2.447	1.250	1.152	0.064	0.054	107.587	100.477	7.110
665	0.0	0.00912	2.539	1.250	1.235	0.075	0.065	110.126	101.792	8.335
670	0.0	0.01019	2.736	1.250	1.422	0.087	0.076	112.863	103.118	9.745
675	0.0	0.01104	3.056	1.250	1.730	0.103	0.089	115.918	104.456	11.462
680	0.0	0.0116	3.312	1.250	1.973	0.120	0.104	119.230	105.811	13.419
685	0.0	0.01219	3.480	1.250	2.126	0.139	0.122	122.710	107.183	15.527
690	0.0	0.01288	3.657	1.250	2.285	0.159	0.141	126.367	108.574	17.793
695	0.0	0.01279	3.863	1.250	2.471	0.181	0.162	130.229	109.986	20.243
700	0.0	0.01186	3.838	1.250	2.426	0.203	0.184	134.068	111.421	22.647
705	0.0	0.01199	3.559	1.250	2.124	0.222	0.206	137.627	112.877	24.750
710	0.0	0.01474	3.597	1.250	2.141	0.241	0.226	141.224	114.353	26.871
715	0.0	0.02	4.421	1.250	2.945	0.267	0.245	145.645	115.848	29.797
720	0.0	0.02828	6.001	1.250	4.506	0.307	0.271	151.645	117.369	34.276
725	0.0	0.04939	8.483	1.250	6.962	0.369	0.312	160.129	118.931	41.197
730	0.0	0.06496	14.817	1.250	13.255	0.487	0.375	174.946	120.556	54.390
735	0.0	0.04855	19.487	1.250	17.862	0.646	0.495	194.433	122.301	72.131
740	0.0	0.02694	14.564	1.250	12.819	0.760	0.656	208.997	124.208	84.789
745	0.0	0.01815	8.083	1.250	6.177	0.814	0.772	217.080	126.230	90.850
750	0.0	0.01363	5.445	1.250	3.423	0.845	0.828	222.525	128.308	94.217
755	0.0	0.01254	4.089	1.250	2.011	0.863	0.859	226.613	130.417	96.196
760	0.0	0.01319	3.762	1.250	1.653	0.877	0.877	230.375	132.544	97.831
765	0.0	0.0134	3.957	1.250	1.830	0.894	0.892	234.332	134.686	99.646
770	0.0	0.01278	4.021	1.250	1.879	0.910	0.909	238.353	136.844	101.508
775	0.0	0.01214	3.833	1.250	1.675	0.925	0.926	242.186	139.020	103.166
780	0.0	0.01157	3.641	1.250	1.465	0.938	0.941	245.827	141.211	104.616
785	0.0	0.01077	3.471	1.250	1.280	0.950	0.954	249.298	143.415	105.884
790	0.0	0.00966	3.230	1.250	1.026	0.959	0.965	252.528	145.630	106.898
795	0.0	0.00886	2.897	1.250	0.681	0.965	0.975	255.424	147.855	107.570
800	0.0	0.00846	2.658	1.250	0.433	0.969	0.981	258.082	150.086	107.997
805	0.0	0.00815	2.538	1.250	0.307	0.971	0.985	260.620	152.321	108.300
810	0.0	0.00788	2.445	1.250	0.210	0.973	0.988	263.065	154.558	108.507
815	0.0	0.00733	2.363	1.250	0.125	0.974	0.990	265.428	156.798	108.630
820	0.0	0.00648	2.200	1.250	-0.039	0.974	0.991	267.629	159.038	108.590
825	0.0	0.00589	1.944	1.250	-0.297	0.971	0.990	269.572	161.279	108.294
830	0.0	0.00565	1.767	1.250	-0.473	0.967	0.988	271.339	163.516	107.823
835	0.0	0.00548	1.695	1.250	-0.542	0.962	0.983	273.034	165.750	107.285
840	0.0	0.00532	1.643	1.250	-0.591	0.957	0.978	274.677	167.978	106.699
845	0.0	0.00518	1.596	1.250	-0.632	0.952	0.973	276.273	170.201	106.072
850	0.0	0.00504	1.553	1.250	-0.670	0.946	0.967	277.827	172.418	105.408
855	0.0	0.00492	1.513	1.250	-0.704	0.939	0.961	279.340	174.630	104.710
860	0.0	0.0048	1.476	1.250	-0.736	0.933	0.955	280.816	176.835	103.981

865	0.0	0.00469	1.440	1.250	-0.764	0.926	0.948	282.256	179.033	103.223
870	0.0	0.00459	1.407	1.250	-0.791	0.919	0.941	283.663	181.224	102.439
875	0.0	0.00449	1.376	1.250	-0.815	0.912	0.934	285.040	183.409	101.631
880	0.0	0.0044	1.347	1.250	-0.837	0.904	0.927	286.387	185.586	100.801
885	0.0	0.00431	1.319	1.250	-0.858	0.897	0.919	287.706	187.755	99.951
890	0.0	0.00423	1.293	1.250	-0.877	0.889	0.912	288.999	189.916	99.082
895	0.0	0.00415	1.268	1.250	-0.894	0.881	0.904	290.266	192.070	98.196
900	0.0	0.00407	1.244	1.250	-0.910	0.873	0.896	291.511	194.216	97.295
905	0.0	0.00411	1.221	1.250	-0.924	0.865	0.887	292.732	196.353	96.379
910	0.0	0.00427	1.232	1.250	-0.905	0.857	0.879	293.964	198.482	95.482
915	0.0	0.00435	1.282	1.250	-0.847	0.849	0.871	295.246	200.603	94.643
920	0.0	0.0043	1.304	1.250	-0.817	0.842	0.863	296.550	202.716	93.834
925	0.0	0.00424	1.291	1.250	-0.822	0.834	0.856	297.841	204.822	93.019
930	0.0	0.00418	1.273	1.250	-0.833	0.827	0.848	299.114	206.920	92.194
935	0.0	0.00413	1.255	1.250	-0.843	0.820	0.841	300.369	209.011	91.358
940	0.0	0.00407	1.238	1.250	-0.853	0.812	0.833	301.607	211.094	90.513
945	0.0	0.00402	1.221	1.250	-0.862	0.804	0.825	302.828	213.170	89.658
950	0.0	0.00396	1.205	1.250	-0.871	0.797	0.818	304.032	215.237	88.795
955	0.0	0.00391	1.189	1.250	-0.879	0.789	0.810	305.221	217.297	87.924
960	0.0	0.00387	1.174	1.250	-0.886	0.781	0.802	306.396	219.349	87.046
965	0.0	0.00382	1.160	1.250	-0.892	0.773	0.794	307.555	221.393	86.162
970	0.0	0.00377	1.146	1.250	-0.898	0.765	0.786	308.701	223.429	85.272
975	0.0	0.00373	1.132	1.250	-0.904	0.757	0.778	309.833	225.456	84.376
980	0.0	0.00369	1.119	1.250	-0.909	0.749	0.770	310.952	227.476	83.476
985	0.0	0.00365	1.106	1.250	-0.913	0.741	0.761	312.058	229.487	82.571
990	0.0	0.00361	1.094	1.250	-0.917	0.733	0.753	313.152	231.490	81.662
995	0.0	0.00357	1.082	1.250	-0.921	0.724	0.745	314.234	233.485	80.749
1000	0.0	0.00353	1.070	1.250	-0.924	0.716	0.736	315.304	235.472	79.833
1005	0.0	0.00349	1.059	1.250	-0.927	0.708	0.728	316.364	237.450	78.914
1010	0.0	0.00346	1.048	1.250	-0.930	0.700	0.720	317.412	239.419	77.992
1015	0.0	0.00342	1.038	1.250	-0.932	0.691	0.711	318.449	241.381	77.069
1020	0.0	0.00339	1.027	1.250	-0.934	0.683	0.703	319.477	243.334	76.143
1025	0.0	0.00336	1.017	1.250	-0.936	0.675	0.694	320.494	245.278	75.216
1030	0.0	0.00333	1.007	1.250	-0.937	0.666	0.686	321.501	247.214	74.287
1035	0.0	0.0033	0.998	1.250	-0.938	0.658	0.678	322.499	249.142	73.358
1040	0.0	0.00327	0.989	1.250	-0.939	0.650	0.669	323.488	251.061	72.427
1045	0.0	0.00324	0.980	1.250	-0.939	0.641	0.661	324.468	252.971	71.496
1050	0.0	0.00321	0.971	1.250	-0.940	0.633	0.652	325.438	254.873	70.565
1055	0.0	0.00318	0.962	1.250	-0.940	0.625	0.644	326.400	256.767	69.633
1060	0.0	0.00315	0.954	1.250	-0.940	0.616	0.635	327.354	258.652	68.702
1065	0.0	0.00313	0.946	1.250	-0.940	0.608	0.627	328.300	260.529	67.771
1070	0.0	0.0031	0.938	1.250	-0.939	0.600	0.618	329.237	262.397	66.840
1075	0.0	0.00307	0.930	1.250	-0.938	0.591	0.610	330.167	264.256	65.911
1080	0.0	0.00305	0.922	1.250	-0.938	0.583	0.601	331.089	266.108	64.982
1085	0.0	0.00283	0.915	1.250	-0.937	0.575	0.593	332.004	267.950	64.053
1090	0.0	0.0024	0.850	1.250	-0.992	0.566	0.584	332.854	269.784	63.070
1095	0.0	0.00213	0.720	1.250	-1.114	0.556	0.575	333.575	271.610	61.965
1100	0.0	0.00207	0.639	1.250	-1.187	0.545	0.565	334.213	273.425	60.788
1105	0.0	0.00205	0.622	1.250	-1.193	0.535	0.554	334.835	275.229	59.606
1110	0.0	0.00203	0.614	1.250	-1.190	0.524	0.544	335.449	277.023	58.426
1115	0.0	0.00201	0.609	1.250	-1.185	0.514	0.533	336.058	278.806	57.252
1120	0.0	0.00199	0.603	1.250	-1.180	0.503	0.522	336.661	280.578	56.083
1125	0.0	0.00198	0.598	1.250	-1.174	0.493	0.512	337.259	282.340	54.919
1130	0.0	0.00196	0.593	1.250	-1.169	0.482	0.501	337.852	284.091	53.761
1135	0.0	0.00194	0.587	1.250	-1.164	0.472	0.490	338.439	285.831	52.608
1140	0.0	0.00192	0.582	1.250	-1.158	0.462	0.480	339.021	287.561	51.460
1145	0.0	0.00191	0.577	1.250	-1.152	0.451	0.469	339.599	289.280	50.318
1150	0.0	0.00189	0.573	1.250	-1.147	0.441	0.459	340.171	290.989	49.182
1155	0.0	0.00188	0.568	1.250	-1.141	0.431	0.449	340.739	292.688	48.051
1160	0.0	0.00186	0.563	1.250	-1.135	0.421	0.438	341.302	294.376	46.926
1165	0.0	0.00185	0.559	1.250	-1.130	0.411	0.428	341.861	296.054	45.807
1170	0.0	0.00183	0.554	1.250	-1.124	0.401	0.418	342.415	297.722	44.693
1175	0.0	0.00182	0.550	1.250	-1.118	0.391	0.408	342.965	299.380	43.585
1180	0.0	0.0018	0.545	1.250	-1.112	0.381	0.398	343.510	301.027	42.483
1185	0.0	0.00179	0.541	1.250	-1.106	0.371	0.388	344.051	302.665	41.387
1190	0.0	0.00178	0.537	1.250	-1.100	0.362	0.378	344.588	304.292	40.296
1195	0.0	0.00176	0.533	1.250	-1.094	0.352	0.368	345.122	305.910	39.212
1200	0.0	0.00175	0.529	1.250	-1.089	0.342	0.358	345.651	307.517	38.133
1205	0.0	0.00174	0.525	1.250	-1.083	0.333	0.348	346.176	309.115	37.060

1210	0.0	0.00173	0.521	1.250	-1.077	0.323	0.338	346.697	310.703	35.994
1215	0.0	0.00171	0.518	1.250	-1.071	0.313	0.328	347.215	312.282	34.933
1220	0.0	0.0017	0.514	1.250	-1.065	0.304	0.319	347.728	313.850	33.878
1225	0.0	0.00169	0.510	1.250	-1.059	0.295	0.309	348.238	315.409	32.829
1230	0.0	0.00168	0.507	1.250	-1.052	0.285	0.299	348.745	316.959	31.786
1235	0.0	0.00167	0.503	1.250	-1.046	0.276	0.290	349.248	318.499	30.749
1240	0.0	0.00165	0.500	1.250	-1.040	0.267	0.281	349.748	320.029	29.718
1245	0.0	0.00164	0.496	1.250	-1.034	0.257	0.271	350.244	321.550	28.693
1250	0.0	0.00163	0.493	1.250	-1.028	0.248	0.262	350.737	323.062	27.674
1255	0.0	0.00162	0.490	1.250	-1.022	0.239	0.252	351.226	324.565	26.662
1260	0.0	0.00161	0.486	1.250	-1.016	0.230	0.243	351.712	326.058	25.655
1265	0.0	0.0016	0.483	1.250	-1.010	0.221	0.234	352.196	327.542	24.654
1270	0.0	0.00159	0.480	1.250	-1.004	0.212	0.225	352.675	329.017	23.659
1275	0.0	0.00158	0.477	1.250	-0.998	0.203	0.216	353.152	330.483	22.670
1280	0.0	0.00157	0.474	1.250	-0.992	0.195	0.207	353.626	331.939	21.687
1285	0.0	0.00156	0.471	1.250	-0.986	0.186	0.198	354.097	333.387	20.710
1290	0.0	0.00155	0.468	1.250	-0.980	0.177	0.189	354.565	334.826	19.739
1295	0.0	0.00154	0.465	1.250	-0.974	0.168	0.180	355.030	336.256	18.773
1300	0.0	0.00153	0.462	1.250	-0.968	0.160	0.171	355.492	337.678	17.814
1305	0.0	0.00152	0.459	1.250	-0.962	0.151	0.163	355.951	339.090	16.861
1310	0.0	0.00151	0.456	1.250	-0.956	0.143	0.154	356.408	340.494	15.914
1315	0.0	0.0015	0.454	1.250	-0.950	0.134	0.145	356.861	341.889	14.972
1320	0.0	0.00149	0.451	1.250	-0.944	0.126	0.137	357.312	343.276	14.037
1325	0.0	0.00149	0.448	1.250	-0.938	0.118	0.128	357.761	344.654	13.107
1330	0.0	0.00148	0.446	1.250	-0.932	0.109	0.120	358.207	346.024	12.183
1335	0.0	0.00147	0.443	1.250	-0.926	0.101	0.111	358.650	347.385	11.265
1340	0.0	0.00146	0.441	1.250	-0.921	0.093	0.103	359.091	348.738	10.353
1345	0.0	0.00145	0.438	1.250	-0.915	0.085	0.094	359.529	350.082	9.447
1350	0.0	0.00144	0.436	1.250	-0.909	0.077	0.086	359.964	351.418	8.546
1355	0.0	0.00144	0.433	1.250	-0.903	0.069	0.078	360.398	352.746	7.651
1360	0.0	0.00143	0.431	1.250	-0.897	0.061	0.070	360.828	354.066	6.762
1365	0.0	0.00142	0.428	1.250	-0.891	0.053	0.062	361.257	355.378	5.879
1370	0.0	0.00141	0.426	1.250	-0.886	0.045	0.054	361.683	356.682	5.001
1375	0.0	0.0014	0.424	1.250	-0.880	0.037	0.046	362.107	357.977	4.129
1380	0.0	0.0014	0.421	1.250	-0.874	0.029	0.038	362.528	359.265	3.263
1385	0.0	0.00139	0.419	1.250	-0.869	0.022	0.030	362.947	360.545	2.403
1390	0.0	0.00138	0.417	1.250	-0.863	0.014	0.022	363.364	361.817	1.548
1395	0.0	0.00138	0.415	1.250	-0.857	0.006	0.014	363.779	363.081	0.698
1400	0.0	0.00137	0.413	1.250	-0.852	0.000	0.006	364.192	364.192	0.000
1405	0.0	0.00136	0.410	1.250	-0.846	0.000	0.000	364.602	364.602	0.000
1410	0.0	0.00135	0.408	1.250	-0.842	0.000	0.000	365.011	365.011	0.000
1415	0.0	0.00135	0.406	1.250	-0.844	0.000	0.000	365.417	365.417	0.000
1420	0.0	0.00134	0.404	1.250	-0.846	0.000	0.000	365.821	365.821	0.000
1425	0.0	0.00133	0.402	1.250	-0.848	0.000	0.000	366.223	366.223	0.000
1430	0.0	0.00133	0.400	1.250	-0.850	0.000	0.000	366.624	366.624	0.000
1435	0.0	0.00132	0.398	1.250	-0.852	0.000	0.000	367.022	367.022	0.000
1440	0.0	0.00131	0.396	1.250	-0.854	0.000	0.000	367.418	367.418	0.000

APPENDIX B – NZTA TECHNICAL REPORT

Refer attachment



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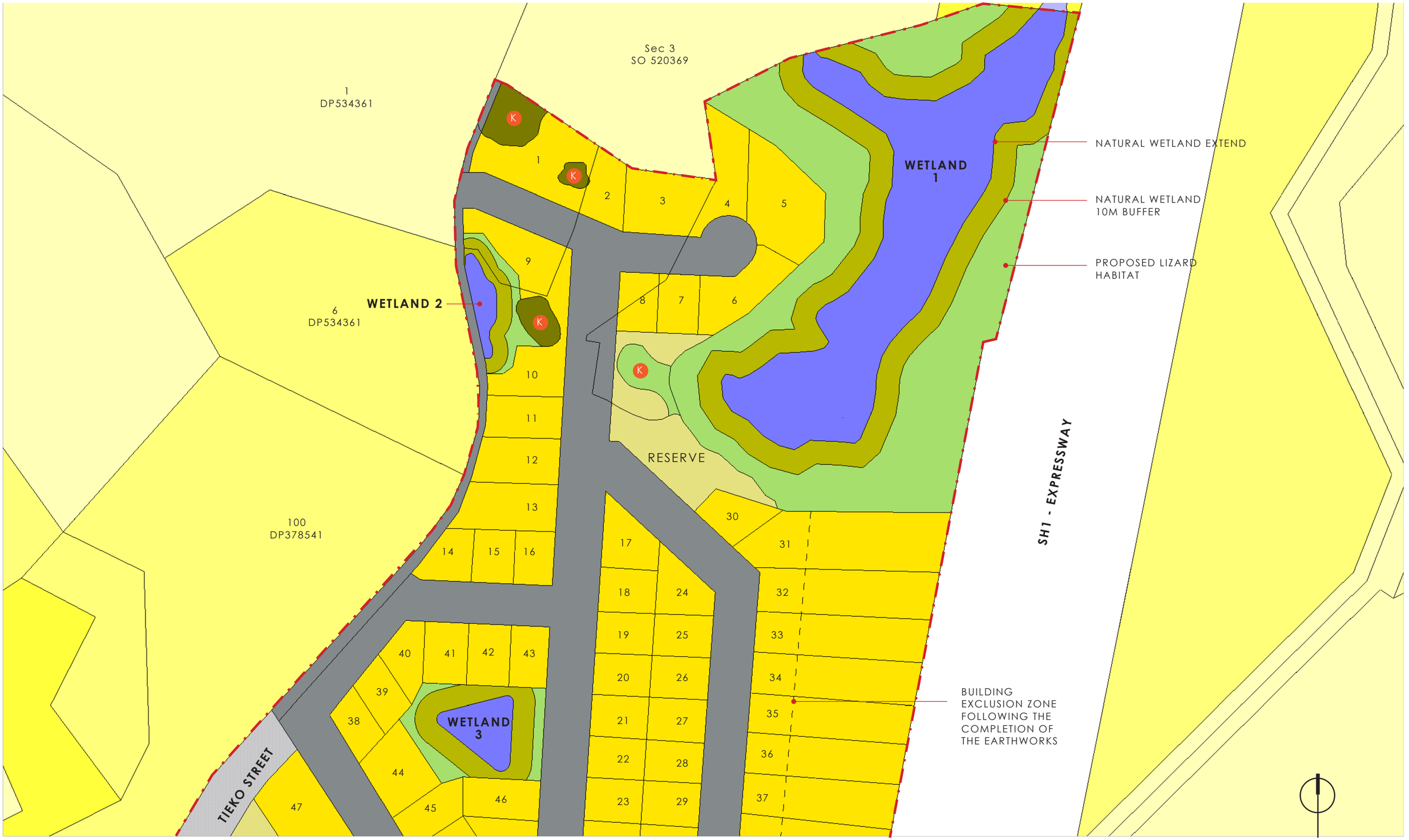
For Mansells

Appendix 2



A. SCHEME PLAN (1:1,500@A3) - SHEET 1

FOR SUBMISSION PURPOSES ONLY

Project name: KCDC PC2 SUBMISSION - INTENSIFICATION EXERCISE
Drawing name: **SCHEME PLAN**
Designed by: DAVE COMPTON-MOEN
Original issue date: 18 JANUARY 2023
Scales: 1:1,500

Revision no:	Amendment:	Approved	Date
A	Initial Issue	DCM	18/01/2023

DCM URBAN DESIGN LIMITED
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CHRISTCHURCH 8011
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Project no / drawing no: **2023_005 /SCH001**

Revision: **A**

A. SCHEME PLAN (1:1,500@A3) - SHEET 2

FOR SUBMISSION PURPOSES ONLY

Project name: KCDC PC2 SUBMISSION - INTENSIFICATION EXERCISE
Drawing name: **SCHEME PLAN**
Designed by: DAVE COMPTON-MOEN
Original issue date: 18 JANUARY 2023
Scales: 1:1,500

Revision no:	Amendment:	Approved	Date
A	Initial Issue	DCM	18/01/2023

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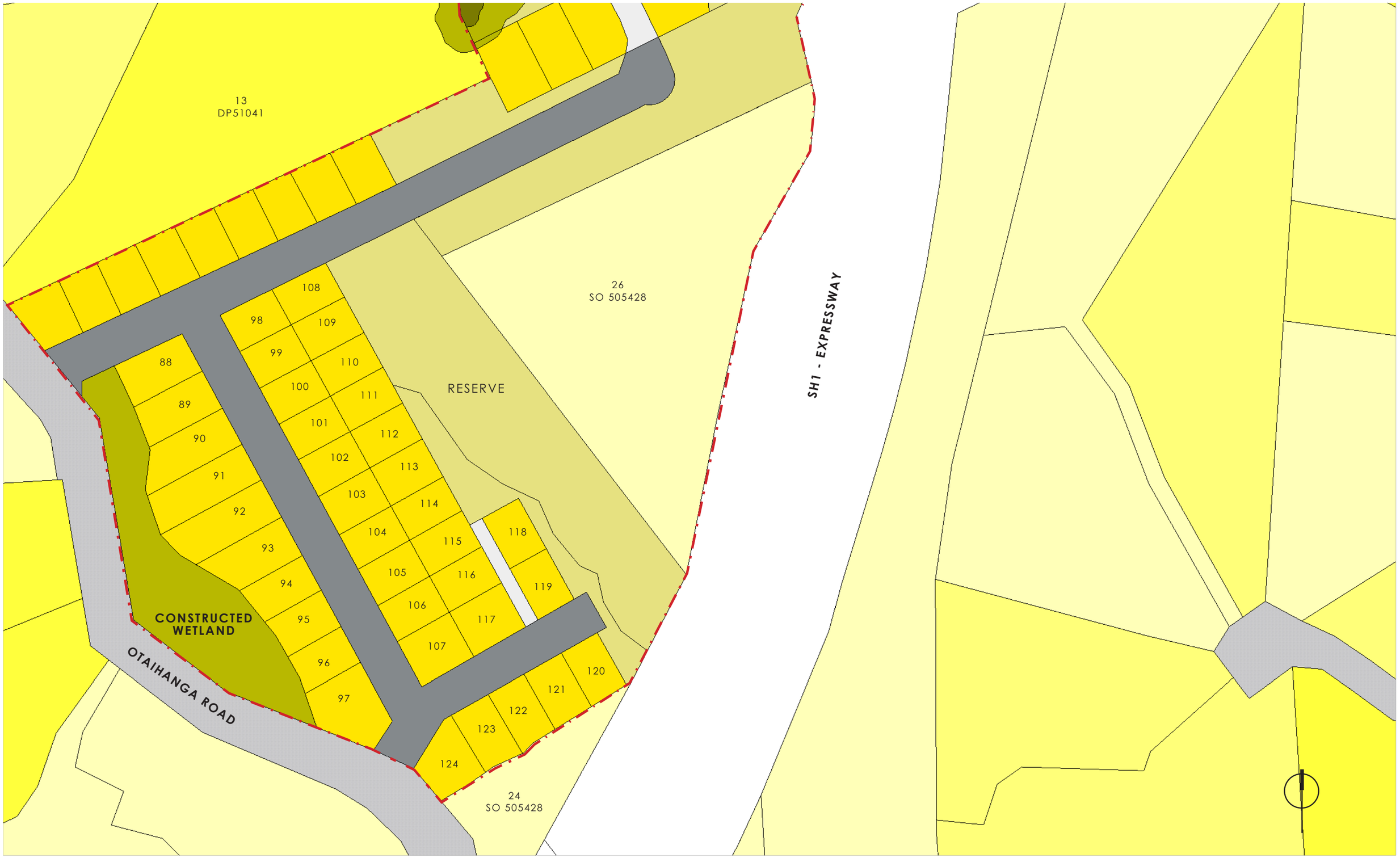
Project no / drawing no: **2023_005 /SCH002**

Revision: **A**



A. SCHEME PLAN (1:1,500@A3) - SHEET 3

FOR SUBMISSION PURPOSES ONLY

Project name:	KCDC PC2 SUBMISSION - INTENSIFICATION EXERCISE
Drawing name:	**SCHEME PLAN**
Designed by:	DAVE COMPTON-MOEN
Original issue date:	18 JANUARY 2023
Scales:	1:1,500

Revision no:	Amendment:	Approved	Date
A	Initial Issue	DCM	18/01/2023

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Project no / drawing no: **2023_005 /SCH003** Revision: **A**