CLIVE RESIDENTIAL SUBDIVISION DEVELOPMENT

[STAGE 1 FAST TRACK APPLICATION]

PREPARED FOR TOMORROW DEVELOPMENTS LIMITED

PREPARED BY DEVELOPMENT NOUS LIMITED

30 AUGUST 2022

DEVELOPMENT NOUS

www.developmentnous.nz

SCHOOL ROAD, CLIVE

ENCLOSURE A

RECORD OF TITLES - LEGAL DESCRIPTIONS

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Historical Search Copy

R.W. Muir
Registrar-General
of Land

Constituted as a Record of Title pursuant to Sections 7 and 12 of the Land Transfer Act 2017 - 12 November 2018

Part-Cancelled

Identifier	**HB84/296**
Land Registration District	**Hawkes Bay**
Date Issued	02 July 1935

Estate	Fee Simple
Area	8698 square metres more or less
Legal Description	Lot 1-16 Deposited Plan 345 and Part Shown Road Deposited Plan 345

Original Registered Owners
Anthony James Burns as to a 1/2 share
Francis Joseph Burns as to a 1/2 share

Interests

214165 Gazette Notice declaring part Lots 6, 7, 8 and 9 DP 345 shown hatched red on diagram hereon containing 14.6 perches taken for a sewerage pump station and shall vest in The Hawke's Bay County Council - 27.7.1967 at 10.40 am

10909127.1 Transmission of a 1/2 share/interest Francis Joseph Burns to Donald John Kennedy as Executor and Leo Paschal Francis Lafferty as Executor - 6.12.2017 at 3:54 pm

10909127.2 Transfer to Anthony James Burns - 6.12.2017 at 3:54 pm

11123524.1 Transmission to Donald John Kennedy as Executor - 30.7.2018 at 3:34 pm

11123524.2 Transfer to Nicholas Matthew Biss - 30.7.2018 at 3:34 pm

11237859.1 Transfer to Nicholas Matthew Biss and Joanne Maree Biss - 28.9.2018 at 9:40 am

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

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Registered Owners
Nicholas Matthew Biss and Joanne Maree Biss

Interests

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UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier **HB84/297**

Part-Cancelled

Land Registration District **Hawkes Bay**

Date Issued 02 July 1935

Estate Fee Simple

Area 12.0141 hectares more or less

Legal Description Part Suburban Section 23 West Clive and
Part Suburban Section 24 West Clive

Registered Owners

Nicholas Matthew Biss and Joanne Maree Biss

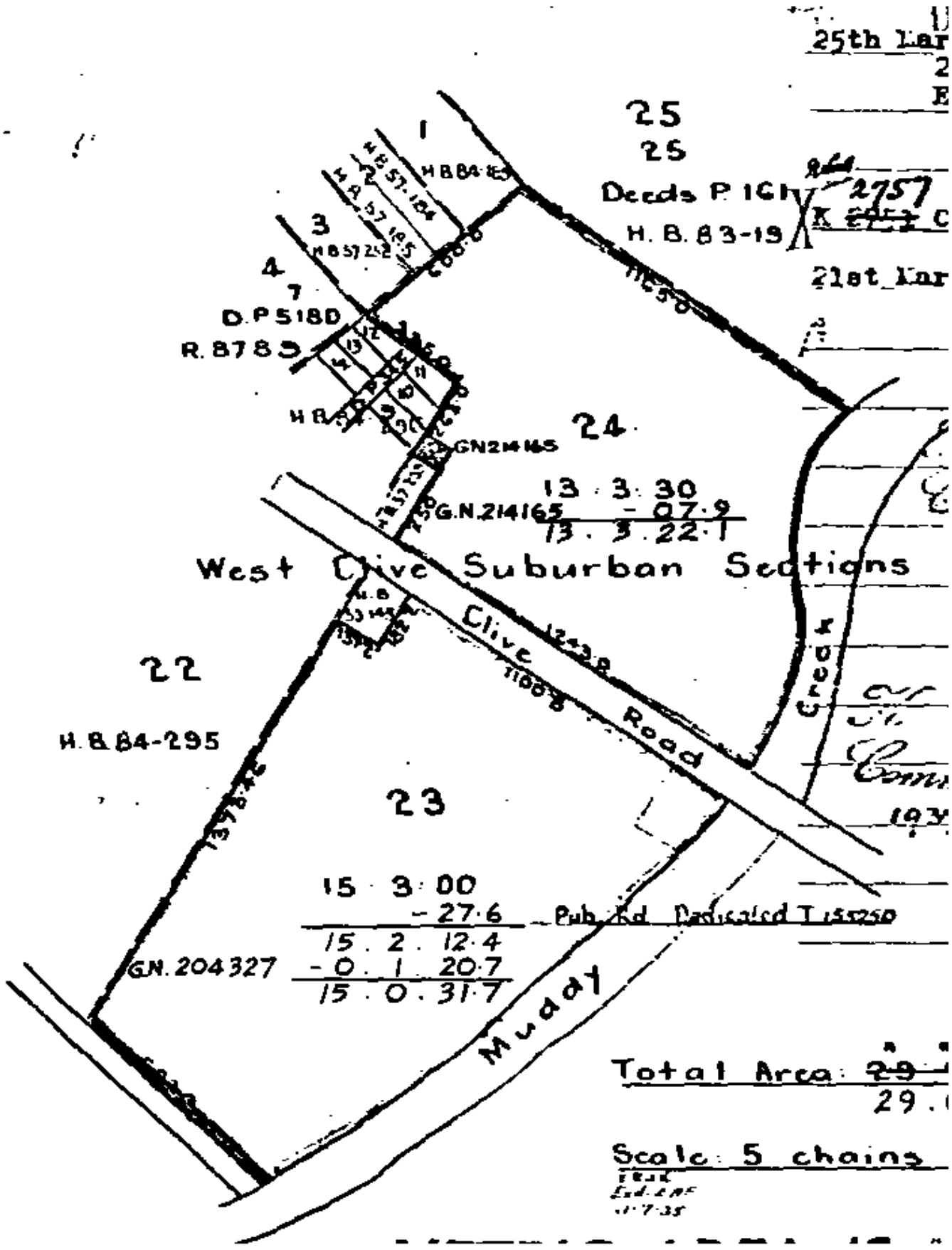
Interests

155250 Transfer being dedication of part Suburban Section 23 West Clive shown coloured red on diagram herein as being public street & highway forever 19.5.1960 at 12.00 pm

204327 Gazette Notice declaring part within land containing 1 rood 20.7 perches taken for a teachers residence - 7.6.1966 at 10.30 am

214165 Gazette Notice declaring part within land containing 7.9 perches shown hatched in red on diagram hereon taken for a sewerage pump station and shall vest in The Hawke's Bay County Council - 27.7.1967 at 10.40 am

11795630.1 Compensation Certificate pursuant to Section 19 Public Works Act 1981 by Hastings District Council - 8.7.2020 at 10:13 am


25th Lar
25
25
Deeds P 161
H. B. 83-19
2757
21st Lar
D.P 5180
R. 8789
24
GN 214165
13 . 3 . 30
- 07 . 9
13 . 3 . 22 . 1
West Clive Suburban Sections
Clive
Road
22
H. B. 84-295
23
15 . 3 . 00
- 27 . 6
15 . 2 . 12 . 4
- 0 . 1 . 20 . 7
15 . 0 . 31 . 7
GN. 204327
Muddy
Total Area: 29
Scale: 5 chains

SCHOOL ROAD, CLIVE

ENCLOSURE B

STRATEGIC BACKGROUND OVERVIEW

INTRODUCTION

The Site and Context

The subject site is located in Clive, a residential suburb of Hastings located approximately 10 kilometres from the city centres of both Hastings and Napier. Clive sits on State Highway 51 (referred to as Main Road as it bisects Clive) and adjoins and straddles the Clive River approximately 1.7 km from its point of discharge into the Pacific Ocean. Clive is serviced by both public and school transport as well as the cycle trails linking the suburb to the services and facilities of both cities and their wider surrounds. Locally, Clive benefits from a primary school, shopping facilities, sports fields, tennis courts, indoor swimming pool, canoe polo, rugby club, rowing club, waka ama club, dedicated area for motorised watercraft recreational activities and a strong local community spirit.

As can be seen in aerial images of the land provided within the site description (Enclosure B), development of the land is a logical 'infill' extension to the suburban area of Clive, confirming and completing Muddy Creek as the defined and consistent southern edge to the suburb. The proposed development site links directly to established residential dwellings within Clive on all other boundaries to the west, north and east, albeit bisected through the centre by School Road forming two distinct and separate development areas for the proposed development.

Historically the area of Clive has been subject to flooding events. Most notably in 1974 the area suffered extensive flooding as a result of a coastal storm breaching the coastal shingle bank in East Clive. Following this event, a series of stopbanks and seawalls around Clive were established to mitigate against the form and level of flooding experienced in 1974. This mitigation methodology is common across the Heretaunga Plains area.

Despite the construction of flood control schemes and enhanced pumping systems following the 1974 flooding event, concerns about flooding hazards in Clive remain and have resulted in a precautionary approach to urban growth within the suburb. Engineered solutions to mitigate potential flooding have been required to free up land for development. Notwithstanding the potential flooding issues there have been several reasonably substantial developments consented since 2000, collectively providing approximately 150 new dwellings on greenfield sites identified on previous growth plans. These developments all involved the addition of engineered fill to provide a minimum height of ground level above modelled flood water and an additional freeboard for dwelling floor levels above this. None of the newer developed areas have experienced flooding.

Previous Growth Strategies and Plans

The suitability of the proposed development site to support houses and its logical context within the urban limits of Clive have been recognised in previous urban development strategies and District Plans.

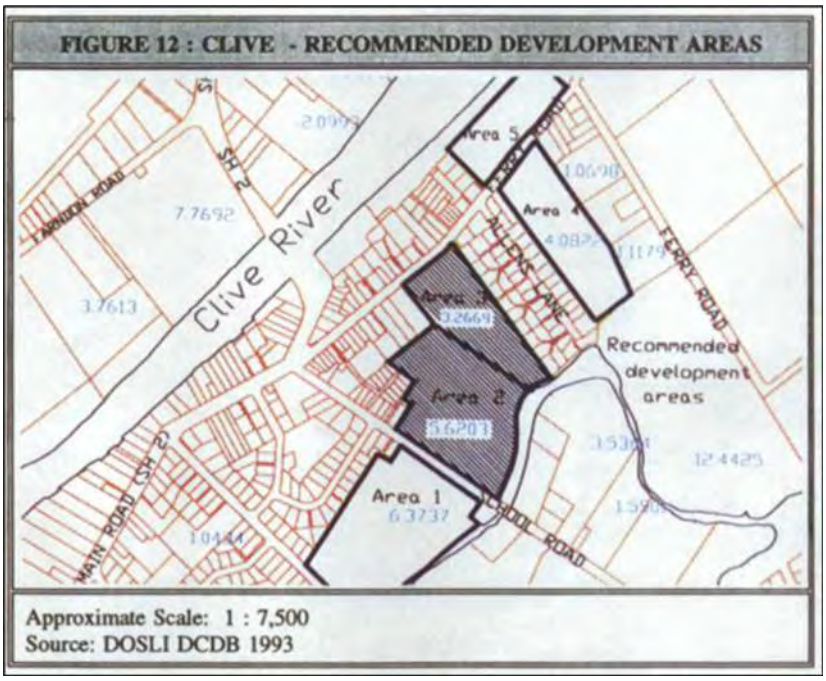
Hastings Urban Development Strategy (HUDS)

HUDS 1995 (reviewed in 1999) included the land in its preferred growth areas for Clive. Five areas considered logical extensions were recommended as development areas for the growth of Clive including the land subject to this proposal (Area 1 & 2). Flooding however, has always been recognised as a potential limiting factor unless the risk can be mitigated to an acceptable extent. With respect to the subject land Section 5.2.2.9 of the Strategy stated:

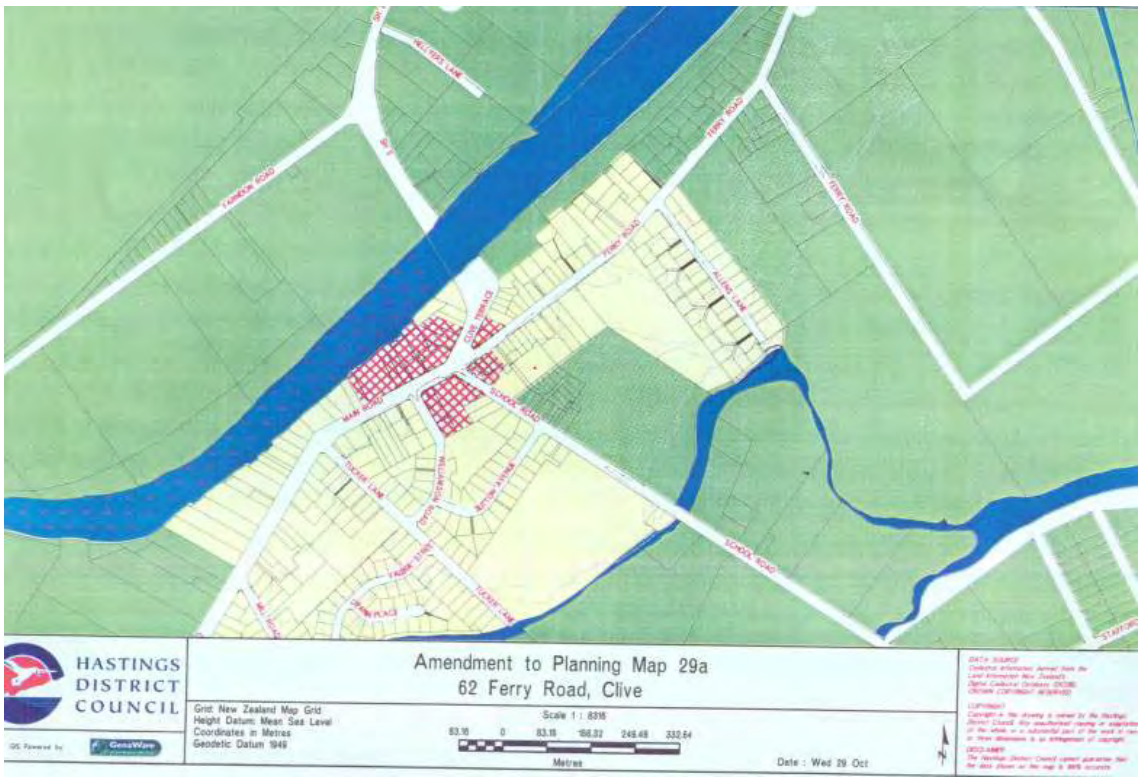
> "*It is recommended that two titles (Pt Sbrn 23 and Pt Sbrn 24) be identified as the major growth area at this stage, provided that flood constraints can be overcome"*

As shown below Pt Suburban Section 23 West Clive is the Tucker Road block to the west of

School Road (Area 1- southern block) and Pt Suburban Section 24 West Clive is the 49 School Road block to the east of School Road (Area 2- northern block).



Area 1 was zoned 'General Residential' in the previous iteration of the District Plan (proposed in July 2000 and declared operative in 2003), while Area 2 was identified as a proposed new urban development area. Both areas were intended to be developed within the life of that District Plan in response to projected demand for additional housing in Clive.



Clive Urban Development Strategy 2002-2026 (CUDS)

Subsequent to notification of the proposed District Plan in 2000, and in response to increased interest for rezoning land for residential use in Clive, HDC decided to review the conclusions and recommendations of HUDS as they related to Clive, eventually adopting a bespoke urban development strategy for Clive in 2002, CUDS.

CUDS reviewed population projections in light of the 2001 census and projected future household growth levels based on these through until 2026 to project anticipated demand for residential land.

Ultimately a low household growth projection was adopted for CUDS resulting in a corresponding low projection of demand for an additional 165 households over a 25 year period (or just under 7 lots per year) comprised of both greenfield and infill. The main rationale given for adopting a low growth scenario was that it was closest to the historical trends for rates of household growth in Clive. This conservative approach to growth planning was despite the stated purpose of the review being in response to increased interest for residential development in Clive.

CUDS assessed the potential number of additional sites available within the residential area of Clive as 152, with the majority (124) being infill sites. At the time of preparing CUDS, Area 5 had already obtained resource consent as a non-complying activity for land use and subdivision (hearing held in September 2001) creating 19 additional residential lots. Evidence presented at the time discussed pent up unrealised demand being the driving factor for the resource consent. Discounting 12 lots that had already been presold prior to preparing CUDS the subdivision of Area 5 was deemed to provide 7 of the available (152) sites.

CUDS assumed that only about two thirds of the full infill potential (83) would likely be reached so concluded that (some) additional greenfield sites would be required through until 2026.

The 5 growth areas identified in HUDS remained as the scope for greenfield options for growth in Clive, although as discussed above Area 5 had already obtained resource consent by this stage so wasn't further assessed. Contrary to HUDS, CUDS concluded that Areas 3 & 4 (rather than 1 & 2) were the most appropriate areas for greenfield residential development, based on stormwater runoff and potential flooding being the critical factors.

While all 4 areas were modelled to be affected by localised flooding during a storm event it was concluded that Areas 3 & 4 experienced localised flooding to a lesser extent than Areas 1 & 2, consequently required less earthworks to raise the land above the modelled flood level and therefore would have less potential impact on adjoining properties once developed. Areas 3 & 4 were assessed as providing an additional 66 sites (using traditional yields and taking into account standard setbacks applied to zone boundaries).

Areas 3 & 4 were recommended in CUDS to be rezoned General Residential to meet the needs of future household growth demands over the period 2002-2026 while Area 1 was recommended to be rezoned back to Plains Zone and Area 2 recommended to remain as Plains Zone.

Such was the pent-up demand for residential development sites in Clive that by March 2003 a private plan change was lodged with Council to rezone Area 3 (62 Ferry Road – 39 sites) from Plains to General Residential. By June of that same year (2003) a second private plan change was also lodged with Council to rezone Area 4 (74 Ferry Road – 41 sites) from Plains to General Residential. Both plan changes were notified for submissions in June 2003 and hearings held for both in October 2003.

Both plan changes were approved contemporaneously by Council in November 2003, having demonstrated solutions to the stormwater and flooding issues. The land was lifted above the modelled flood level and an additional freeboard added for floor height in residential buildings.

Despite being rezoned, subdivided and sold concurrently both developments received strong demand with all sections sold immediately around 2004, and virtually all of the 80 new dwellings being built between 2004 and 2008. This equates to the construction of approximately 20 new dwellings per year, just for these developments alone.

The conservative approach adopted in CUDS to forward planning for growth in Clive using low growth projections (165 new households over a 25-year period between 2002 and 2026 or just under 7 lots per year) proved to be woefully inadequate to meet demand. All greenfield land was exhausted within 6 years (including having all sections built on) leaving a 20 plus year deficit for greenfield land that was unanticipated by CUDS.

A compounding factor to the unrealised market demand for dwellings in Clive is also likely to lay in the optimistic assumptions regarding infill subdivision delivering most of the new dwellings.

CUDS failed to recognise that the same stormwater and flooding issues that impacts on greenfield areas also impacts on infill subdivision. Infill development sites have less feasible options available than greenfield sites to engineer solutions for existing stormwater and flooding problems without affecting adjacent properties. Relying on infill subdivision as the primary method of providing for growth in Clive was unrealistic, especially in the absence of a council provided network solution to solve stormwater and flooding problems.

Simply put CUDS:

- failed to anticipate demand for housing (despite evidence of strong market demand at the time of its preparation)
- failed to provide for some form of buffer in case of unanticipated demand (taking an ultra-conservative approach to strategic planning for a 25-year horizon with its attendant uncertainties proved to be woefully inadequate)
- placed too much reliance on infill subdivision to provide for growth (with multiple micro

solutions required to address catchment problems), and

- made forward planning recommendations that precluded future development options for the extended 25 year horizon (recommended both down zoning of land (Area 1) and not up zoning of land (Area 2)).

The repercussions of the inadequacy of CUDS to provide for housing in Clive and overstate perceived stormwater and flooding problems in the area are still felt to this day, over twenty years later.

Current Growth Strategy (HPUDS)

Following the preceding period when each Council did their own growth planning in isolation Hawke's Bay Regional Council, the Hastings District and Napier City Councils decided that a sub-regional approach over a longer term was the most appropriate method for considering urban growth issues. The Heretaunga Plains Urban Development Strategy (HPUDS) was completed in 2010 and reviewed in 2017 and provides for the growth needs of the two cities through the period 2015 to 2045.

The original 2010 HPUDS stated that in terms of Clive:

> *"The Clive Development Strategy (a subset of HUDS) which was undertaken in 2002 looked at the servicing aspects of future growth to ascertain the potential for future growth. Stormwater is the major issue for Clive and a number of sites were identified for future growth that were outside the potential flood hazard areas. Since that time these sites have largely been developed. There has been no stormwater upgrading and therefore it is recommended that no growth be provided for in Clive due to stormwater servicing issues"*

Following completion of the 2010 strategy the partner Councils agreed relevant recommendations from HPUDS should be incorporated into the Regional Policy Statement (RPS) to provide some regulatory backing to the strategy. The RPS outlines five 'Principal Outcomes' to reflect HPUDS recommendations:

- *Providing for development, both urban and business, while retaining versatile land, ensuring efficient utilisation of existing infrastructure and discouraging or avoiding ad hoc residential development or further rezoning for rural residential.*
- *Achieving containment of urban activities by identifying appropriate and inappropriate growth areas.*
- *Encouraging intensification of urban activity.*
- *Achieving strategic integration of infrastructure with land use. This requires the sequencing of growth areas and the drafting of structure plans.*
- *On-going monitoring and review of development in the Heretaunga Plains sub-region.*

In accordance with the second bullet point, Clive and East Clive (among others) were identified as areas deemed 'inappropriate for residential greenfield growth' in the RPS (POL UD4.4). See Enclosure G.

The 2016 review of HPUDS provided the opportunity to test the assumptions and findings of the original HPUDS to ensure the strategy remained relevant. A number of changes were made to the 2010 version of HPUDS during the review including:

> *Two areas identified in the 'Inappropriate Areas for development' list in HPUDS have had some of the issues that might preclude development addressed since the adoption of HPUDS in 2010. These are:*
>
> *a) Clive South (an area off the end of Read Crescent between SH2 and Muddy Creek); and*

b) Whirinaki.

Both were originally identified as inappropriate areas because of servicing issues. The Whirinaki area also has potential issues in respect of reverse sensitivity. The 2016 HPUDS Review concludes that both areas warrant removal from the 'inappropriate' list, however only the smaller South Clive area warranted inclusion as a greenfield growth area in HPUDS. It is noted that removing an area from the 'inappropriate' list doesn't suggest that it is necessarily appropriate for greenfield development. That would still require further assessment.

The intervening years between the original 2010 HPUDS and its review in 2016 demonstrated that loose geographic descriptions of large land areas based on perceived impediments were not sufficiently robust and accurate enough to be used to preclude development options in all instances. They can indicate a general or primary concern for an area, but specific proposals need to be tested against site specific solutions to determine whether these concerns or hazards exist in the first place for all sites, and if they do whether they can be appropriately mitigated.

The Clive South land which had never previously been considered for development in either HUDS or CUDS, was accepted at a strategic level that it be exempted from the inappropriate areas list in HPUDS. However, the report that recommended that it should be exempted and considered a 'Reserve Area' in HPUDS (Alternative Greenfield Sites and Review of the HPUDS Settlement Pattern June 2016 Opus International Consultants) stated a range of environmental effects (including stormwater and flooding) that needed to be addressed as part of testing against other relevant provisions of the RPS and through a district plan change and structure planning process prior to any decision. During confirmation of the final HPUDS 2017 it was decided South Clive should progress immediately to an approved area rather than a Reserve Area with an anticipated 40 dwellings.

In what can be described as an example of history repeating itself, pent up demand for new housing options in Clive was such that by November 2018 a non-complying resource consent was lodged for residential development of the South Clive property rather than through a plan change and structure planning process. A similar noncomplying activity was lodged for a separate (albeit much smaller) development also on the southern edge of Clive now known as Plumtree Lane at around the same time. Both resource consents were approved, the land subdivided, lots sold, and a significant number of dwellings now constructed.

What is evident is from all the recent residential developments in Clive is that the urban growth strategies and traditional planning processes have not properly anticipated or pre-empted market driven demand for housing in the area. Despite being encumbered with a perception of stormwater and flood risks all these developments were able to develop solutions that provided solutions and mitigated risks. In the absence of Council led processes the market has sought, obtained approval, and enabled new housing that meets demand.

While HPUDS2010 has now been superseded by the new 2017 HPUDS document, unfortunately the RPS has not yet been changed to accommodate or reference the 2017 HPUDS document and in that regard the RPS is to some degree now 'out of sync' with HPUDS2017. POL UD4.2 does, however, provide recognition and opportunity for new residential greenfield areas (not identified as suitable) to be included within urban limits subject to assessment against general criteria. See Enclosure H.

The request to obtain subdivision and land use consent for approximately 173 new dwellings at 49 School Road is simply the latest example of a developer led proposal for residential housing in Clive. This proposal should be considered against the general criteria in POL UD4.2 rather than being arbitrarily deemed inappropriate due to an ill-defined association with a large geographic area deemed 'inappropriate', especially given the dearth of supporting evidential information that accurately defines the flooding problem in Clive.

Current Situation

Ownership of the proposed development site has now transferred through estate settlement and the site has been made available for reconsideration of its potential to support residential dwellings.

Both areas of the development site have been rezoned to Plains Production Zone in the current now partially operative District Plan and are no longer identified as future growth options for Clive.

The application seeks to develop the site in response to the critical housing shortages being experienced locally and regionally as it can be demonstrated that the proposal is in accordance with the policy framework of the RPS and higher order statutory documents. The evidence provided to support this application will also demonstrate that the proposal will not generate adverse effects on the environment.

The relevant provisions of the Hawke's Bay Regional Policy Statement and the Hastings District Plan direct that development of new greenfield land be undertaken in a comprehensive manner, including the provision of a structure plan to demonstrate the strategic integration of infrastructure with land use.

Pursuant to the required approach, a comprehensive residential-led subdivision of the site to provide up to 173 homes has been prepared by the Applicant. The subdivision application will be based on division of the lot arrangement across the site into a logical staged development and release of lots for housing construction.

To provide a clear understanding of the form and nature of the proposed development for the purposes of this referral application, indicative building development plans based on the lot arrangement are provided at Enclosure D. The supporting plans provide indicative development detail of how individual lots can be developed and demonstrates how the proposed development quantum can be readily accommodated within the site.

Detail of the proposed engineering servicing and geotechnical assessment of the subdivision is provided at Enclosure E. Importantly, an economic analysis is attached (Enclosure E) outlining the economic benefits and job creation that will be created by existing unmet need for homes within the local housing market.

The subdivision scheme plan details a road layout for the site and the resulting formation of development blocks (Enclosure D).

Resource consent for approval of the staged subdivision is sought in the interests of timely progression of the development relative to the existing unmet demand for affordable healthy homes within the region. This is considered reasonable given the need for Clive as a distinct community to meet locational and market sector demand for good quality housing in this area.

The development benefits from mid-point location between the cities of Napier and Hastings on a key transport corridor offering significant public transport options for schooling, commuting and intercity travel. Reduced reliance on private vehicle use is further enhanced by the ease of direct access to off road travel between the cities and elsewhere for recreational activities by virtue of the interlinked cycleway network across the region. Clear logical and defendable boundaries for urban development within Clive will also result in reducing the risk of reverse sensitivity effects currently present with multiple residential activities interfacing directly with low intensity productive uses.

Approval is sought for the staged scheme of subdivision across the site, including site formation earthworks, to create a road and lot layout providing for an upper development limit of 173 homes of varying typology, a network of streets, and a large low impact hydraulically neutral stormwater detention and treatment area.

Approval is also sought to provide for the subsequent residential development on the created lots in relation to the underlying Plains Production Zone of the District Plan. Development details will be provided to support (blanket) land use consent for the 173 homes infringing Plains Production Zone standards relating to density, building coverage and yard setbacks

with the final detailed layout, design and external appearance of the built development on these lots to accord with an approved design guide secured by way of a condition of consent.

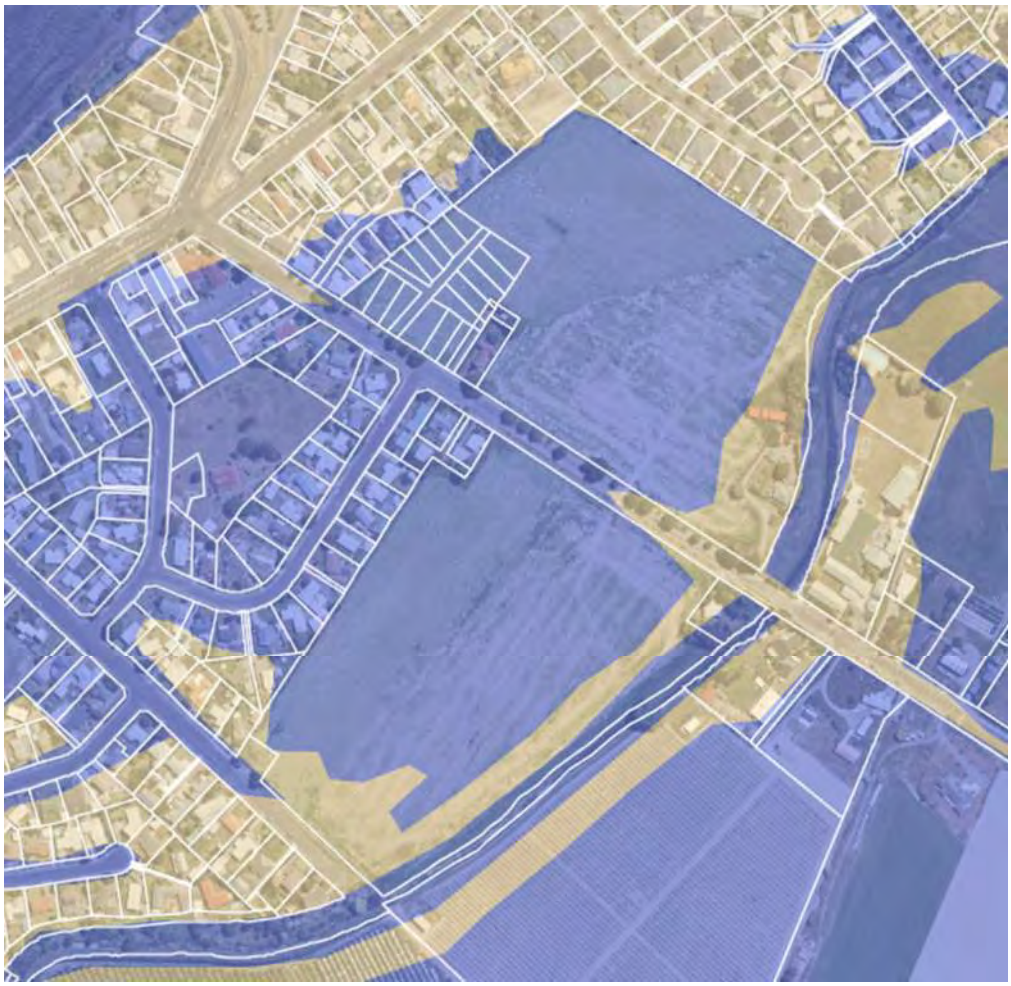
The homes will be of mixed typology and height including detached, and semi-detached, and terrace building format ranging from single to two storeys in scale.

The subdivision layout provides an Open Space area with strong linkages to Muddy Creek, encouraging use for amenity, recreation and movement, in addition to its primary purpose of stormwater detention and resilience during high rainfall events. The generous road corridors provide significant potential for the incorporation of suburban landscaping to soften the site and create a distinctive green character.

As has previously been discussed, Clive has historically experienced flooding events, most significantly being in 1974 when sea water breached the shingle bank because of a coastal storm with seawater flooding 300 hectares of horticultural and urban land between East Clive and Clive. Since 1974 as explained, a series of stop banks, sea walls and stormwater pumping network has been put in place.

The site is currently low lying with the majority of the existing ground levels sitting below the established HBRC 50-year flood level of RL = 11.50 (Hawke's Bay local authority datum +10m MSL). Figure 2 below shows the extent of flood risk in the area. It is understood that this flood modelling was undertaken around 2002 and is due for an update.

Figure (2) below demonstrates that flooding on the subject property and within the adjacent urban area is not directly hydraulically connected to spillover flooding from Muddy Creek. Flooding in Clive is the result of localized ponding, rather than out of channel spillover from Muddy Creek.



Initial discussions with Hawke's Bay Regional Council (HBRC) highlighted the need to mitigate the inherent flood risk in the area to enable any future development. The proposal to lift the sites above the flood level with imported fill was presented to HBRC engineers who indicated that this approach could displace flood water onto adjacent land. Therefore, additional storage volume is proposed to be provided within the development to mitigate the effects of water displacement.

Following this meeting, the concept of lifting one section (development site) above flood level and cutting down the existing ground level of the other section to provide stormwater attenuation was developed. This approach allows for the material required to lift one of the sites to be sourced from the other site and the cutting of this material will provide the necessary stormwater storage required.

Due to the uncertainties with historic modelling, additional flood modelling was commissioned and completed by *Infir* Limited (Report dated April 2022 completed by Johan Elders) to determine the 100-year flood level of the area. This report can be found in within Enclosure E. The report concluded that a conservative 100-year flood level of **RL = 11.70m** (Hawke's Bay local authority datum +10m MSL) can be assumed for any potential development occurring in the area.

The application proposes to raise the land to no less than RL 11.8, 100 mm above the modelled 1/100-year flood level, with additional freeboard, as necessary, added to the floor level of buildings (by way of consent notice). Hydraulic neutrality for the site will be achieved through the proposed engineered solution, incorporating onsite retention and detention prior to discharge and therefore no displacement of flood water will occur as a result of the proposed development.

As shown in the context plans (Enclosure C) the development will provide for efficient residential utilisation of an area forming a logical extension to the Clive urban area and will create an attractive and liveable community based on compact housing that will be able to be delivered at a lower cost than the standard single storey detached large lot housing that is predominant across the Region.

While the site is suited to residential development and there is an obvious need within the market for additional housing, two prominent factors have prevented any previous proposals being formulated. The former landowner had no interest in development and clearly stated this position through strategic planning reviews. This former owner has since passed away. The second factor relates to uncertainty of the flooding potential of the site or the potential role that the site may offer in terms of flood water storage in storm events. This uncertain flood risk is informed by historic modelling of questionable accuracy when compared to contemporary assessment standards utilising advances in technology.

SCHOOL ROAD, CLIVE

ENCLOSURE C

CONTEXT PLANS AND PROJECT LOCATION

LOCAL CONTEXT

NOTES:

- This plan has been produced for discussion purposes only.
- Final boundaries are subject to resource consent approval and final land transfer survey.
- Easements may be necessary for cross boundary services.

17/08/2022 Revision A [H20210092]

School Road, Clive - **SITE CONTEXT PLAN**

DEVELOPMENT NOUS
SURVEYING • URBAN DESIGN • ENGINEERING • TOWN PLANNING
ENVIRONMENTAL • LANDSCAPE ARCHITECTURE

THREE-WATERS CONNECTIONS

NOTES:

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17/08/2022 Revision A [H20210092]

School Road, Clive - **SITE CONTEXT PLAN**

DEVELOPMENT NOUS
SURVEYING • URBAN DESIGN • ENGINEERING • TOWN PLANNING
ENVIRONMENTAL • LANDSCAPE ARCHITECTURE

SCHOOL ROAD, CLIVE

ENCLOSURE D

SUBDIVISION AND DEVELOPMENT PLANS

SUBDIVISION DETAILS

NUMBER OF LOTS: 173

LOT AVERAGE: 340m²

LOTS PER HECTARE: 13.2

RESERVE AREA: 49,628m²

Additional Growth Area (Subject to Stormwater Requirements)

Stormwater Detention & Park Area (Subject to Stormwater Requirements)

FERRY ROAD

SCHOOL ROAD

SUTTON AVENUE

TUCKER LANE

MUDDY CREEK

Water Treatment and Storage

Road Continuation

Potential Pedestrian Bridge Connection to Clive School

PRELIMINARY ONLY - SUBJECT TO AMENDMENTS

N

0 20 40 60 80 100 200m

Scale 1:2000 @ A3

NOTES:

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23/08/2022 Revision D [H20210092]

School Road - **PRELIMINARY DEVELOPMENT OPTION**

DEVELOPMENT NOUS

SURVEYING • URBAN DESIGN • ENGINEERING • TOWN PLANNING
ENVIRONMENTAL • LANDSCAPE ARCHITECTURE

SUBDIVISION DETAILS - SOUTH

NUMBER OF LOTS: 134

LOT AVERAGE: 330m²

LOTS PER HECTARE: 20.3

RESERVE AREA: 5259m²

SCHOOL ROAD

SUTTON AVENUE

School Road

Sutton Avenue

Additional Growth Area (Subject to Stormwater Requirements)

Water Treatment and Storage

Road Continuation

TUCKER LANE

Tucker Lane

MUDDY CREEK

PRELIMINARY ONLY - SUBJECT TO AMENDMENTS

N

0 10 20 30 40 50m

Scale 1:1500 @ A3

NOTES:

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23/08/2022 Revision D [H20210092]

School Road - **PRELIMINARY DEVELOPMENT OPTION**

DEVELOPMENT NOUS

SURVEYING • URBAN DESIGN • ENGINEERING • TOWN PLANNING
ENVIRONMENTAL • LANDSCAPE ARCHITECTURE

BUILDING TYPOLOGY PLAN

NOTES:

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23/08/2022 Revision B [H20210092]

School Road, Clive - **BUILDING TYPOLOGIES**

DEVELOPMENT NOUS
SURVEYING • URBAN DESIGN • ENGINEERING • TOWN PLANNING
ENVIRONMENTAL • LANDSCAPE ARCHITECTURE

SURROUNDING BUILDING CHARACTER

TUCKER LANE



HEYNES PLACE



SUTTON AVENUE



SCHOOL ROAD



NOTES:

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23/08/2022 Revision B [H20210092]

School Road, Clive - **BUILDING TYPOLOGIES**

DEVELOPMENT NOUS

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ENVIRONMENTAL • LANDSCAPE ARCHITECTURE

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NOTES:

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School Road, Clive - **BUILDING TYPOLOGIES**

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School Road, Clive - **BUILDING TYPOLOGIES**

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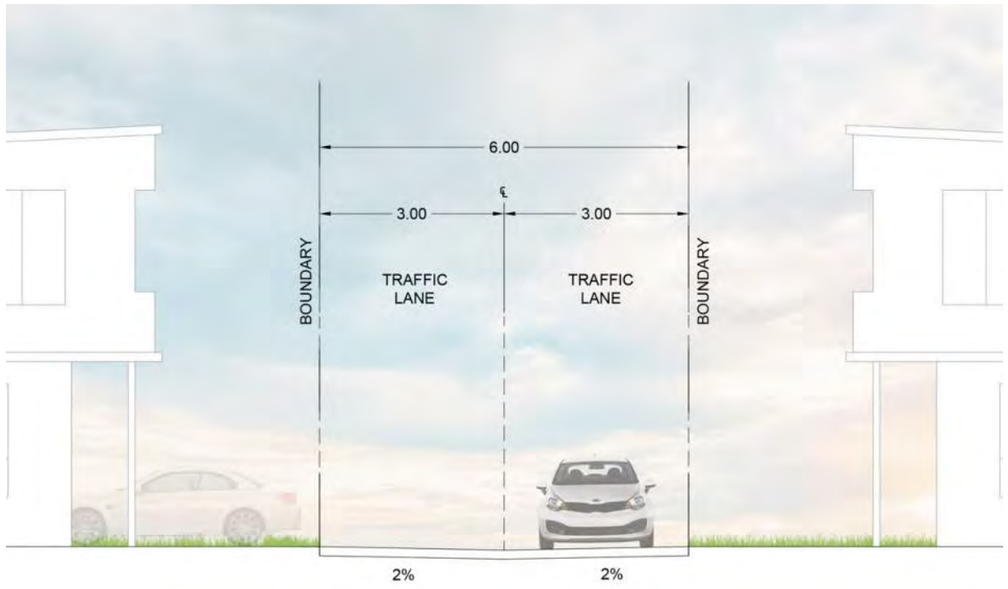
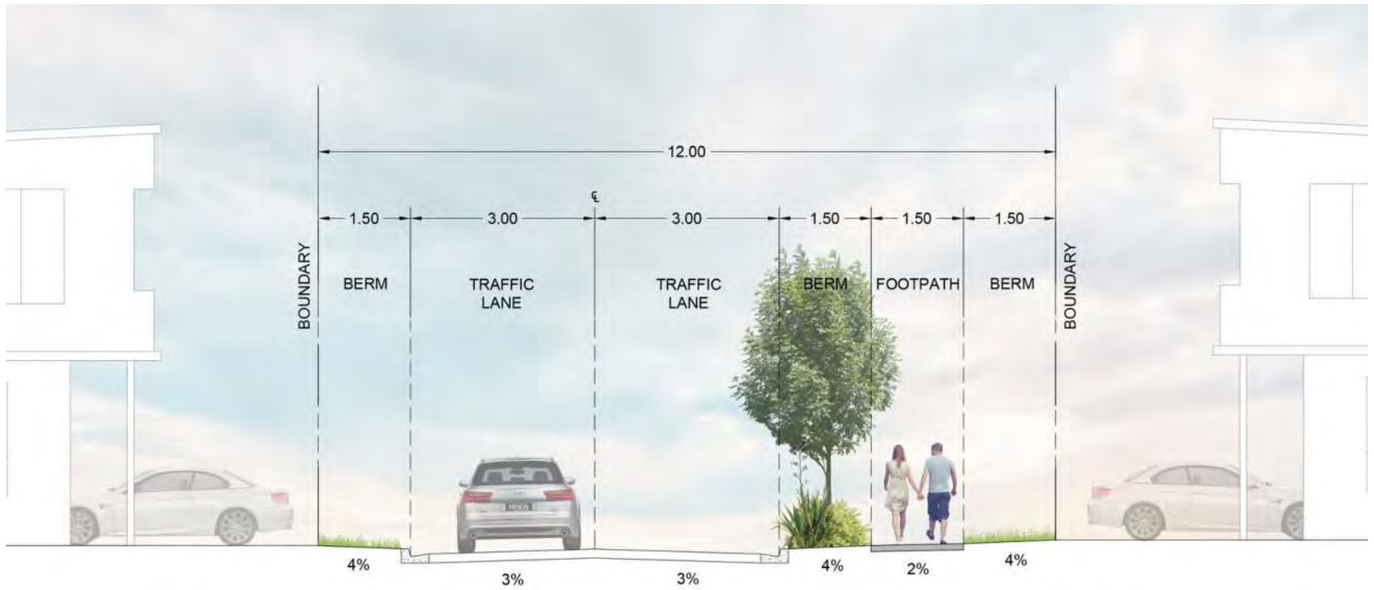


6M WIDE ACCESS LANE



12M WIDE ACCESS ROAD

15M WIDE ACCESS ROAD

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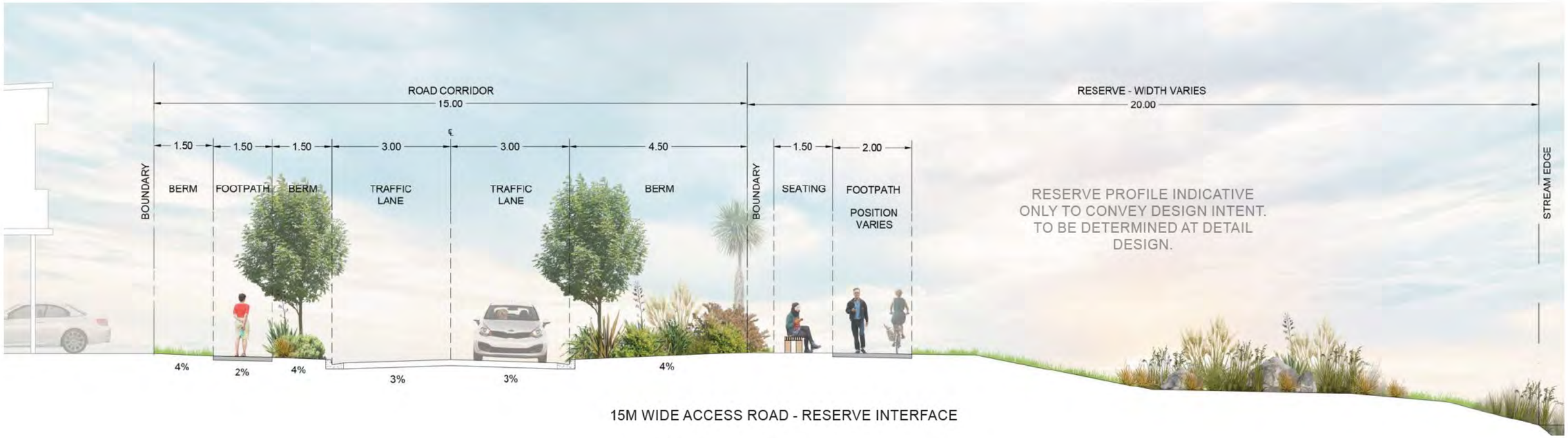
0 1 2 3 4 5m

Scale 1:100 @ A3

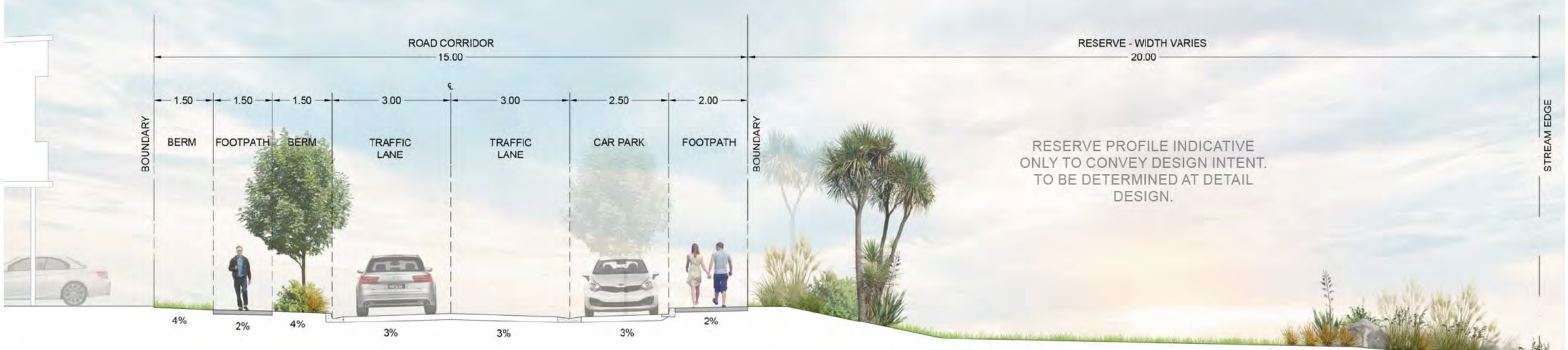
16/08/2022 Revision A [H20210092]

School Road, Clive - **ROAD HIERARCHY SECTIONS**

DEVELOPMENT NOUS



15M WIDE ACCESS ROAD - RESERVE INTERFACE



15M WIDE ACCESS ROAD (PARKING) - RESERVE INTERFACE

NOTES:

- This plan has been produced for approval only.
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0 1 2 3 4 5m

Scale 1:100 @ A3

16/08/2022 Revision A [H20210092]

School Road, Clive - **ROAD HIERARCHY SECTIONS**

DEVELOPMENT NOUS

SCHOOL ROAD, CLIVE

ENCLOSURE E

ENGINEERING REPORTS - THREE WATERS AND GEOTECHNICAL

TECHNICAL MEMORANDUM

Development Nous Ltd
502 Karamu Road North
Hastings 4122
New Zealand
06 876 2159

Project: 49 School Road, Clive
Date: 05/10/2021
DNL Reference: H20210092
HDC Reference: TBD.

School Road, Clive – **Earthworks & Three Waters**

1. INTRODUCTION

This technical memorandum, prepared on behalf of *Tomorrow Capital Limited*, is to support the application for the proposed residential development at 49 School Road, Clive.

Development Nous has been engaged by the Applicant to undertake an investigation of the serviceability of a proposed development site and prepare an earthworks strategy to enable residential development. This memorandum details the work completed to determine the development's viability and the proposed strategy for mitigating the flood displacement and the risk present in the area for the development. Also included is discussion on the ability to service the site for three waters services.

2. SITE AND BACKGROUND

The application site is located at 49 School Road, Clive (Pt Sub Sec 24 Clive Lots 1-5 10-16 Pts 6-9 DP 345 & Closed Rd). **Figure 1** below indicates the location of the proposed development. The south-eastern edge of the site is bordered by Muddy creek, a slow moving meandering waterway that eventually flows into the foreshore estury. Currently, the site is zoned plains production and is surrounded by residential zoning on three sides. For purposes of clarity, the northern most parcel will be referred to as the northern site and the southernmost parcel will be referred to as the southern site as shown in Figure 1.

Figure 1: 2022 Aerial Site Photo (Source: Hastings District Council (HDC) GIS)

Initial discussions with Hawke's Bay Regional Council (HBRC) highlighted the need to mitigate the inherent flood risk in the area to enable any future development. The proposal to lift the sites above the flood level with imported fill was presented to HBRC engineers who indicated that this approach would displace flood water into the adjacent land. Therefore, additional storage volume must be provided within the development to mitigate the water displacement.

Following this meeting, the concept of providing compensatory cut within the bounds of the development to provide storage for the displaced flood water. This approach allows for the material required to lift a portion of the site (to meet minimum flood level requirements) to be sourced from the portion of the site being lowered to provide the flood storage required to mitigate any displacement.

3. STORMWATER INVESTIGATION

The site is currently low lying with the majority of the existing ground levels sitting below the established HBRC 50-year flood level of RL = 11.60 (Hawke's Bay local authority datum +10m MSL). **Figure 2** below shows the extent of flood risk in the area presented on HBRC's *Flood Hazard Portal*. In 2003, HBRC undertook an assessment of Muddy Creek to determine flood extents and levels for design rainfall events. This investigation determined the 100 year flood level associated with Muddy Creek and its catchment to be more accurately defined as RL = 10.50.

Figure 2: Flooding extents (Source: Hastings Regional council Hazard portal)

To meet the minimum freeboard requirements in accordance with NZ4404:2010, further investigation was required to determine the 100-year ARI flood level. To determine this level, additional flood analysis was completed by Infir Limited to determine the 100-year flood level of the area. This report concluded that a conservative 100-year flood level of **RL = 11.70m** (Hawke's Bay local authority datum +10m MSL) can be assumed for any potential development occurring in the area. For further details of this assessment refer to Infir's *49 School Road – Stormwater Management Report* (ref: J21152/2, dated 20 April 2022) in **Appendix A**.

A site-specific earthworks assessment with consideration of the flooding requirements has been provided in **Section 6**.

4. GEOTECHNCIAL & GROUNDWATER INVESTIGATION

Geotechnical specialists Initia, completed a site investigation to assess the suitability of the site for land development, the in-situ site material makeup and the water table level. The *Clive Subdivision – Geotechnical Report for Recourse Consent* (ref P-001403 Rev 2 dated July 2022) is presented in **Appendix B**.

The Initia report concluded that "*Based on the preliminary geotechnical investigations of the site and analysis, we consider that the site is suitable for residential subdivision in accordance with the proposed scheme."*

Initia, as part of their investigation completed 2 No. Machine Boreholes, 16 No. Cone Penetration Tests (CPT's) and 10 test pits.

These investigations concluded that:

- We have recently carried out test pits and obtained near surface samples for the material that is to be potentially used as fill. As expected, the natural moisture content of the material is between 8% and 16% above the optimum moisture content of this soil type. This will require 'drying back' to achieve compaction to an engineered fill standard. We would recommend that these earthworks are undertaken in summer to enable drying to take place.
- To accommodate the anticipated levels of deformation during a design seismic event, raft (TC2 type) foundations are recommended for the proposed dwellings.
- Groundwater levels during the winter period were at RL = 9.

5. PROPOSED EARTHWORKS

A preliminary earthworks design was completed for two scenarios to determine the viability of a development occurring in the area. The assessment determined the volume of fill required to lift a portion of the site 100mm above the 100-year flood level and drop the remaining portion to a level above the ground water level.

Further detailing required for the development and achieving minimum finished floor level immunity will be determined at the next phase of the development when a scheme plan has been prepared.

These two scenarios are:

- Option 1 - Fill from the existing ground level of the southern site to RL = 11.80, excavate the northern site to RL = 10.50
- Option 2 - Fill from the existing ground level of the northern site to RL = 11.80, excavate the southern site to RL = 10.50

The above scenarios were modelled in 12d, and a cut fill analysis undertaken to compare the earthworks volumes between the two options. In each scenario, the embankments of the

earthworks were modelled with fill/cut slopes set at 1:5. *Table 1* below outlines the cut and fill analysis results.

Table 1: Option 1 & 2 cut and fill volumes

Option 1 – Cut and Fill Volumes	
Cut from EG to 10.5	40,316 m^3
Fill EG to 11.8	32,026 m^3
Balance	8,316 m^3
Option 2 – Cut and Fill Volumes	
Cut	49,351 m3
Fill	41,757 m3
Balance	7,594 m3

**Note, EG refers to Existing Ground.*

The fill areas shown on the plans in **Appendix C** are designed to sit at RL 11.8, 100mm above the modelled 1-100-year flood level. The cut/fill volumes demonstrate that for both options less fill volume is required than will be cut from the opposing site.

When the detailed design is undertaken it is likely the additional balance material reflected on the plans will be spread over the fill area. As the fill area will then already be above the 1-100-year flood level this will not affect the net SW balance.

6. STORMWATER RETENTION & DETENTION

Infir's design report comments that *"Raising the site will displace flood water, lowering the site will increase storage volume. The development itself will increase impermeable areas and therefore increase runoff. The volumetric stormwater effects of the development will be mitigated if the increased storage volume is not less than the sum of volume of the displaced flood water and the increased runoff."*

Thus, the storage volume lost by filling must be less than the storage volume gained by cutting. Further storage volume is required for peak flow mitigation (ie, attenuation). The combination of the fill volume + attenuation volume must be less than the cut volume.

Analysis of the proposed design has been completed to show the additional stormwater attenuation capacity available after implementing the proposed cut/fill earthworks options. These are shown in **Table 2** below.

Table 2: Option 1 & 2 net stormwater increase attenuation volume

Option 1 – Net Stormwater attenuation Increase	
Storage lost by filling (EG to RL 11.7)	28,671m^3
Storage gained by cutting from EG to cut level (EG to RL 10.5) *	38,634 m^3
Additional Storage Available	9,963 m^3
Option 2 – Net Stormwater attenuation Increase	
Storage lost by filling (EG to RL 11.7)	36,480m^3
Storage gained by cutting from EG to cut level (EG to RL 10.5) *	48,143m^3
Additional Storage Available	11,663 m^3

**Storage gained excludes volumes of cut above the flood level.*

Infir's report further comments that:

The volumetric stormwater effects of the proposed development at 49 School Road can be mitigated by managing the development's runoff coefficient to be no greater than 0.68, thereby limiting the additional runoff during a 1 in 100-year 4-day duration event to 6,336m³.

"The additional storage that will be created by excavating the area north of School Road is more than sufficient to offset the displacement of stormwater that will occur due to raising ground levels south of School Road and the additional runoff that will be generated during a 4-day duration 1 in 100-year climate adjusted rain event."

"Further analysis will be required at detailed design stage when a subdivision layout is available to ensure that flow paths are maintained and to confirm the water balance. Given the conservative nature of the analysis presented in this report (refer section 7) it is possible that the extent of the development may be able to be expanded."

As demonstrated in **Table 2**, the additional storage available in both options exceed the post-development "additional runoff = 6,336m³" determined in Infir's report. Therefore, both options provide enough storage to mitigate flood displacement caused from filling AND to provide attenuation required for peak flow mitigation.

Should the runoff coefficient be greater than 0.68 once a layout is developed, a larger attenuation volume will be required. Based on the excess available storage determined in **Table 2** and ability to cut deeper (to the groundwater level or RL 9) we confirm that sufficient stormwater attenuation will be available to mitigate the impacts of the development on the existing stormwater system servicing the development.

7. SITE SERVICING

7.1 WASTEWATER

Clive's wastewater network is currently serviced by a pump station located on the Northern block of the proposed development site. It is intended that this pump station will be used to service the proposed new development.

The preliminary design loads based on the HDC code of practice for green fields residential development are shown in **Table 3** below.

Table 3: Sewer Demand

Design Flow	
Equivalent person per dwelling (EP)	3.5
Average dry weather flow ADWF	250 L/p/EP
Dilution / Infiltration factor (IF)	2
Peak factor (PF)	2.5
Estimated Density Lots/HA	13
Development Area HA	6.3
Dwellings	157
Peak wet weather flow PWWF	686.87 KL/Day

7.2 WATER

Clive's water is currently serviced via a holding tank and pump system which is located off Tucker Lane located in the south-eastern corner of the Southern site. It is intended for that the new developments water supply could be fed from this system.

An existing DN150mm in School Road terminates approximately 25m short of the Eastern extent of the Northern Site**.**

Supplementary to this supply, there is also an existing DN100mm looped water main in Sutton Avenue approximate 45m away from the proposed development site.

It is proposed either of these, or a combination of all these systems could be used to service the proposed development.

8. CONCLUSION

We believe the proposed development at 49 School Road is suitable for residential development due to the geotechnical suitability of the land, ability to achieve pre-existing stormwater neutrality and stormwater displacement generated by the development. Furthermore, the proximity of existing wastewater and water networks to the proposed development provide the necessary servicing opportunities.

Yours faithfully
Development Nous Ltd

Author:

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Senior Project Engineer
s 9(2)(a)

Reviewed and Approved:

Mitchell Pal
Senior Civil Engineer
s 9(2)(a)

Attachments: **Appendix A – Infir - *49 School Road – Stormwater Management Report***
Appendix B – Initia – *Clive Subdivision Geotechnical Report*
Appendix C – Preliminary Design Drawings

APPENDIX A

Infir - 49 School Road – Stormwater Management Report

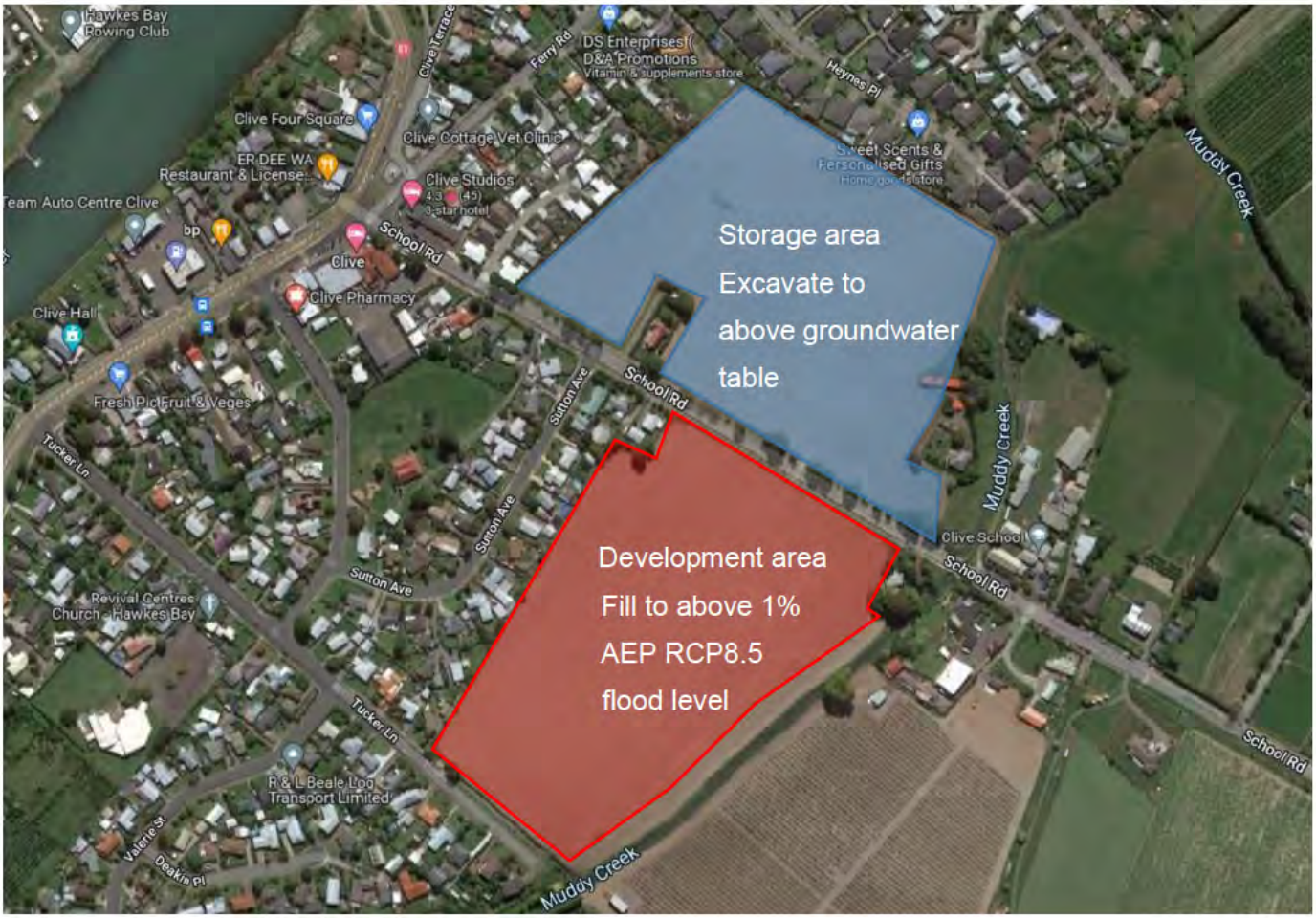
49 SCHOOL ROAD – STORMWATER MANAGEMENT

REPORT J21152/2

FOR RESOURCE CONSENT

Report prepared by Johan Ehlers

20 April 2022



INFIR

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PO Box 7335 Taradale 4141 p 06 650 5565 e admin@infir.nz www.infir.nz

PREPARED BY		
Johan Ehlers	11 April 2022	For Resource Consent
	20 April 2022	J21152/2

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1 Brief

Infir Limited has been engaged by Tomorrow Capital Limited to prepare a concept stormwater management solution for a proposed residential development at 49 School Road, Clive, for Resource Consent purposes.

2 Background

Most of the site is inside a flood zone. Hawke's Bay Regional Council document the results of a review of the hydrologic and hydraulic performances of the Clive, Muddy Creek and East Clive catchments to determine the flood levels and extents for design rainfall events. The review report found that the 50-year flood level is at RL11.50 and recommended that Hastings District Council be advised that when setting house floor levels, no floor should be set below RL11.6m (based on 50-year flood level with pump outages), plus a freeboard appropriately determined for the particular site. The HBRC report is attached in Appendix A.

This report provides a basis for adjusting the 1 in 50-year flood level of RL11.50 with no provision for the effects of climate change, to a 1 in 100-year flood level with allowance for climate change scenario RCP8.5 for the period 2080 to 2100. RCP8.5 is considered appropriate in this instance because the area is close to the coast and RCP8.5 is the most conservative scenario (biggest climate change effect).

3 Consenting requirements

The information presented in this report is at concept level for resource consent purposes only. Further work will be required for resource consents to carry out work in or near stream beds, disposal of stormwater, engineering approvals and building consents.

4 HBRC's 2003 analysis

The HBRC report describes the Muddy Creek system as a 14km^2 catchment serviced by three pump stations. The HBRC GIS website contains a layer that show catchment boundaries.

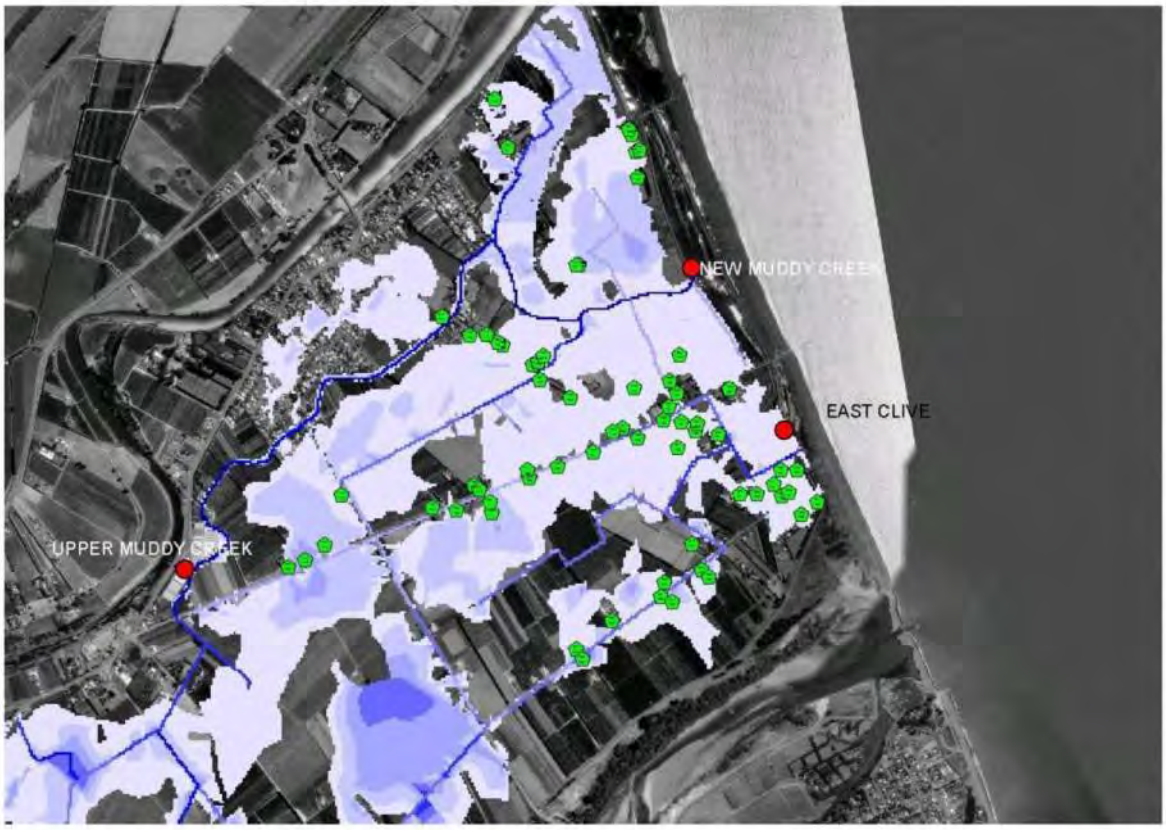


Figure 1: Sample Flood Extent Map – 50 Year Design Storm – Green Points Indicate Location of Surveyed Floor Levels

Figure 1 - Pump station locations and flood extent - 2003 HBRC report

5 Catchment boundary

The catchment associated with the Muddy Creek system measures as 16.5km^2. The 2003 HBRC report mentions a 14km^2 catchment. It is not unreasonable for minor discrepancies such as this and the flood level adjustment calculation will be more conservative if a larger catchment is used, because more runoff will be generated by a larger catchment. The catchment boundary from the GIS website is shown on Figure 2.

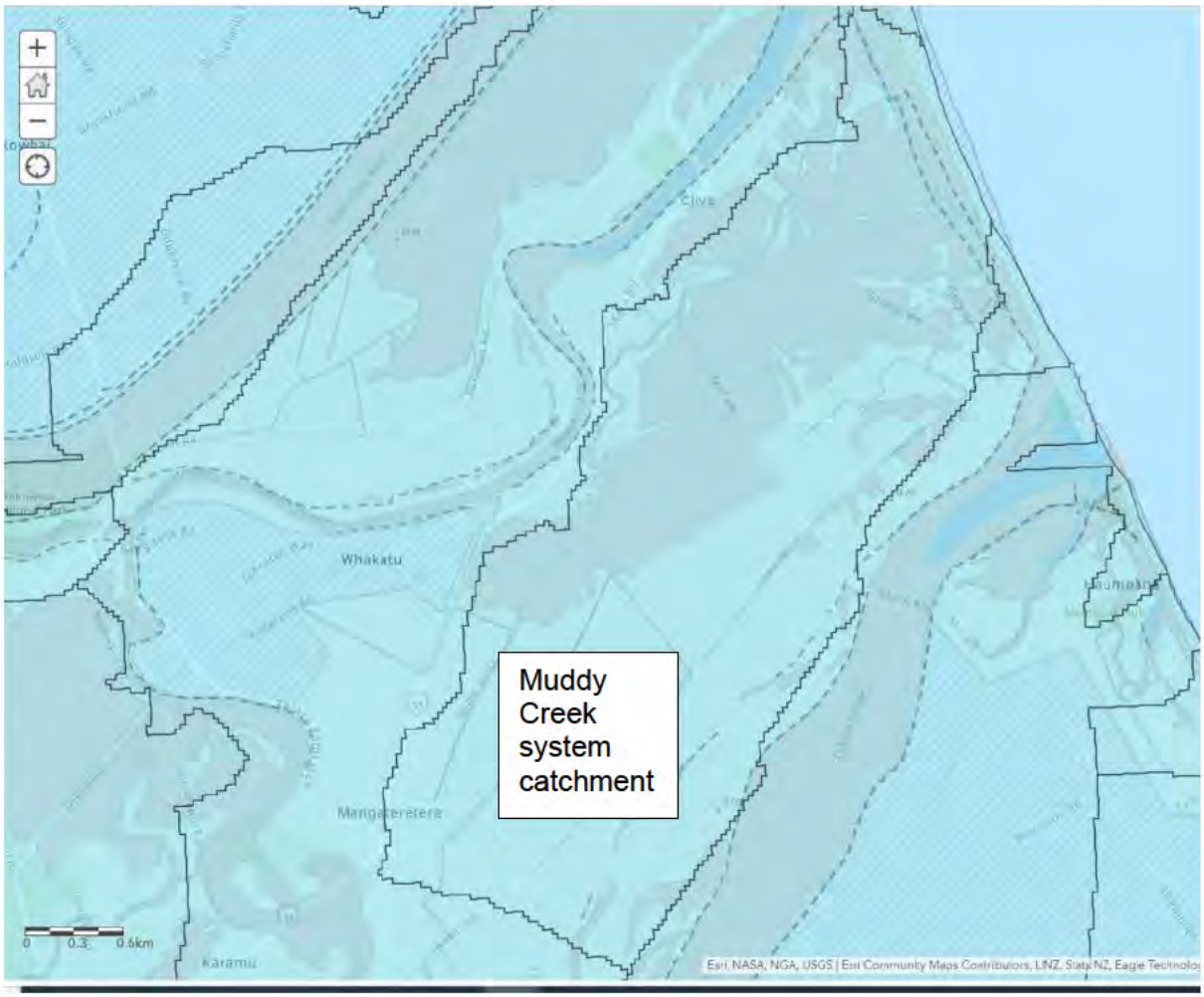


Figure 2 - Muddy Creek system catchment

6 Datum levels

The flood level of RL11.5 is in Local Authority Datum 1972. RL11.5 can be expressed as follows in the other relevant datums:

- Hawke's Bay Datum 1962: RL1.50 (10m vertical offset)
- NZGD2000: RL1.28 (0.222m offset from Hawke's Bay Datum 1962)

NZGD2000 is relevant because HBRC provided updated LIDAR data that was recently flown, in NZGD2000 datum. The 2011 HBRC LIDAR data was in Hawke's Bay Datum 1962 and Local Authority Datum 1972.

To avoid confusion, all levels in the remainder of this report are in Local Authority Datum 1972. This is consistent with the 2003 HBRC report.

7 Flood level adjustment

The 2003 HBRC report states that the flood level peaks during day 4 of the design flood event. To adjust from historical 1 in 50-year flood levels without provision for climate change to 1 in 100-year flood levels with provision for climate change, HIRDS4 data from NIWA was used as follows:

	Historical	RCP8.5 2081-2100
2% AEP 4-day rainfall depth (50-year)	216mm	
1% AEP 4-day rainfall depth (100-year)		280mm

Figure 3 - Rainfall depths

To make the adjustment it can be assumed that the only thing that changes is the rainfall depth. All other things such as the volume that is pumped out stay the same.

The catchment will be wet so marginal runoff coefficient of 0.5 has been used to assess the additional runoff volume due to the increased rain depth. Usually, a runoff coefficient closer to 0.25 would be used but in this case a higher coefficient is more appropriate.

An additional 528,000m^3 of water will run off from a 16.5km^2 catchment with a marginal runoff coefficient of 0.5 and an additional 62mm precipitation. The flood level in the catchment must rise to accommodate the additional volume. The total storage in the catchment for various flood levels is shown on Figure 4.

RL	Pond volume	Difference	Increased storage compared with RL11.5
	m^3	m^3	m^3
11.5	1,193,880		
11.6	1,481,500	287,620	287,620
11.7	1,818,994	337,494	625,114

Figure 4 - Catchment storage curve

A 1 in 100-year flood level of RL11.70 can therefore safely be adopted for climate change scenario RCP8.5, for the period from 2081 to 2100. Note that the increased storage at RL11.70 is 625,114m^3 which exceeds the required 528,000m^3 by some 97,000m^3. The actual 1 in 100-year flood level is therefore below RL11.70 and likely closer to RL11.68. This report adopted a 1 in 100-year flood level of RL11.70 in the interests of conservatism.

8 Development of 49 School Road for RL11.70 flood level

Most of the 49 School Road site is below RL11.70. It is also known from past monitoring that the groundwater table in the area is generally above RL10.60. The stormwater effects of the development can be mitigated by raising part of the site to RL11.70 and lowering the remainder to RL10.60.

Raising the site will displace flood water. Lowering the site will increase storage volume. The development itself will increase impermeable areas and therefore increase runoff. The volumetric stormwater effects of the development will be mitigated if the increased storage volume is not less than the sum of volume of the displaced flood water and the increased runoff.Development proposal

It is proposed to use the land north of School Road for increased storage and to develop the land to the south of School Road.

An additional 32,088m^3 storage can be created north of School Road by lowering the surface level of the land to RL10.6.

25,740m^3 flood water will be displaced if the surface level of 5.955 hectares of the land south of School Road is raised to RL11.70.

This creates a net increase in storage volume of 6,348m^3.

An additional 6,336m^3 runoff can be expected to from the site during a 4-day duration 1 in 100-year event with the effects of climate change taken into account, if the runoff coefficient for the development as a whole is managed to be not more than 0.68. The marginal runoff coefficient of 0.5 referred to in section 7 is an average for the entire catchment and includes large undeveloped areas. The purpose of the marginal runoff coefficient is to facilitate the adjustment from a 1 in 50-year to a 1 in 100-year flood level.

Table 1 - Pre- and post-development runoff

	c	i	**A**	**cA**	**Runoff**
		mm	*ha*	*ha*	*m^3*
Pre-development	0.3	280	5.955	1.7865	5,002
Post development	0.68	280	5.955	4.0494	11,338
Increase					6,336

9 Conclusion

The volumetric stormwater effects of the proposed development at 49 School Road can be mitigated by:

- Excavate the area north of School Road to RL10.60 to provide 32,088m^3 additional storage.
- Raise 5.955 hectares of land south of School Road to RL11.70 to be clear of the 1 in 100-year flood level, thereby displacing 25,740m^3 of ponding volume.
- Manage the development's runoff coefficient to be no greater than 0.68, thereby limiting the additional runoff during a 1 in 100-year 4-day duration event to 6,336m^3.

The net result of the points listed above is a water volume balance. The additional storage that will be created by excavating the area north of School Road is more than sufficient to offset the displacement of stormwater that will occur due to raising ground levels south of School Road and the additional runoff that will be generated during a 4-day duration 1 in 100-year climate adjusted rain event:

Table 2 - Water volume balance

Debit	**Balance**	**Credit**
Storage displacement: 25,740m^3 Additional runoff: 6,336m^3	32,088 – 25,740 – 6,336 = 12m^3 credit	Additional storage: 32,088m^3

Further analysis will be required at detailed design stage when a subdivision layout is available to ensure that flow paths are maintained and to confirm the water balance. Given the conservative nature of the analysis presented in this report (refer section 7) it is possible that the extent of the development may be able to be expanded.

10 Appendices

Appendix A HBRC Clive, Muddy Creek and East Clive Catchments - Update on Analysis

June, 2003

Clive, Muddy Creek and East Clive Catchments Update on Analysis

1. Background

The hydrologic and hydraulic performances of the Clive, Muddy Creek and East Clive catchments were reviewed in order to study the flood risks and determine the flood levels and extents for design rainfall events. As part of the recommendation from the original analysis, a series of floor levels was obtained in order to better quantify the potential cost and risk associated with pump outages, or to determine if additional pumping capacity would provide cost effective benefit to the area.

2. Catchment Details

The catchment area (14 km^2) is serviced by three pumping stations, New Muddy Creek, Upper Muddy Creek, and East Clive, shown in Figure 1.

The series of house floor level locations is shown on Figure 1 as green points.

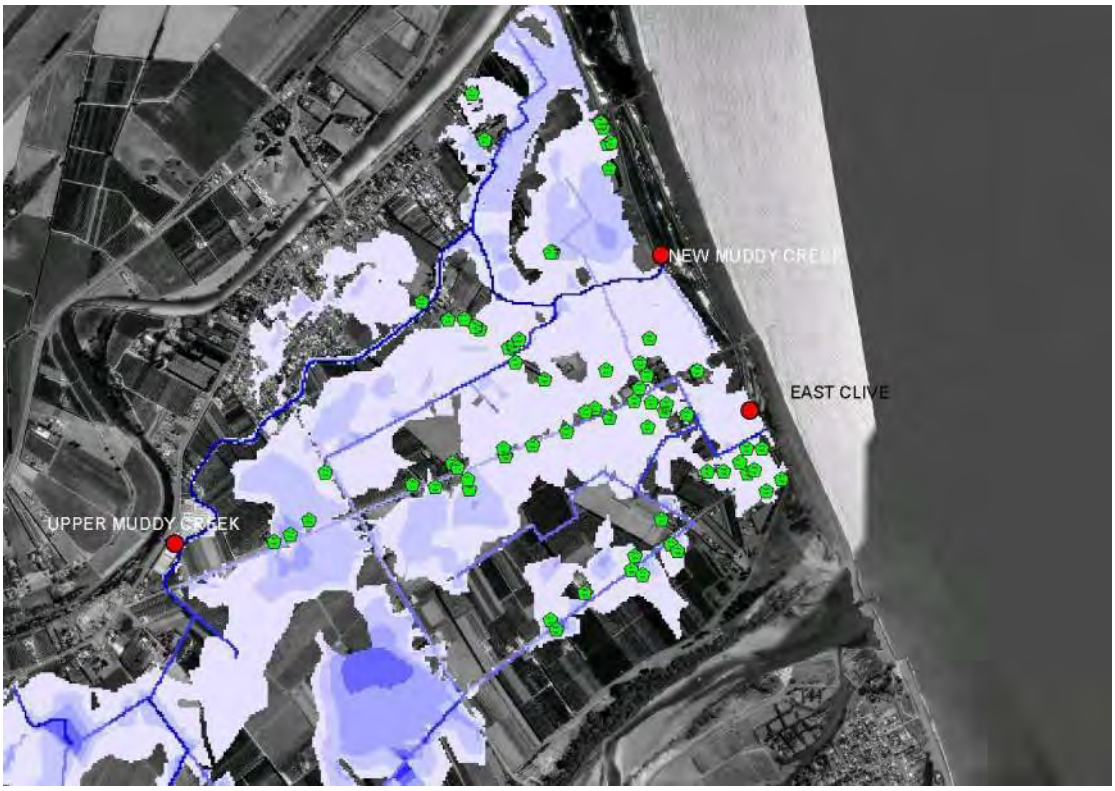


Figure 1: Sample Flood Extent Map – 50 Year Design Storm – Green Points Indicate Location of Surveyed Floor Levels

3. Analysis

In general, the floor levels surveyed are above the 50 year flood level of RL 11.5 m. Most properties have floor levels around RL 12 or above, however, several are between RL 11.5 and RL 12.0 m. Several sheds were surveyed which have floor levels of less than RL 11.5 m. This indicates that most dwellings would be protected in the event of a 50 year event.

3.1. Vulnerability to Pump Outages

Modelling results indicated that with pump outages during a severe event, the water level may increase by approximately 0.3 m to RL 11.6 m (over quite a widespread area). These results indicate that most dwellings would still be protected during such a coincidence of events (pump outage during severe event).

3.2. Increased Pumping Capacity

As part of the previous modelling, several tests were made to determine if increased pumping capacity would provide additional benefit from the flooding risk. Results indicated that increased capacity would be unlikely to reduce the flood level during a severe event, however, the duration of flooding may be reduced slightly (say from 4 days to 3.5 days). With the floor level information recently obtained, it would appear that the benefit of increasing the pumping capacity would not be significant, compared to the potential cost of such an operation.

3.3. Recommended Minimum Floor Levels

Prior to the implementation of the Building Act, the setting of floor levels in the Clive area was based on observed flood levels during the major sea inundation of 1974 (see photo 1). The decision was to set floor levels to the greater of RL 11.5 or 0.5 m above surrounding ground level.

Photo 1: Flooding in Clive, 1974

It was also recommended that an appropriate freeboard be applied to this flood level, The Building Act indicates that habitable dwellings should be protected from a 2% AEP event (50 year return period). The previous level of RL 11.5 m would appear to be inadequate protection, in the event of pump outages, or other circumstances which may raise the local flood level, such as debris build-up at the pumping station screens, or vehicle or boat wash.

It should be noted as well, that the flood level provided from the computer modelling assumes the 'best-case scenario', where during the rainfall event, there is no excessive weed build-up in the channels, no culverts blocked, and the rainfall is uniform over the catchment. In reality, it is likely that there will be some circumstances which cause increased localised flooding.

Since this area is quite vulnerable to flooding, it is recommended that the 50 year flood level of RL 11.6 m be used, in order to accommodate the possibility of pump outages during an extreme event. An appropriate freeboard should also be added to this level, to be determined for each particular site by the consenting agency.

3.4. Flood Hazard Maps showing Vulnerable areas

In order to convey the flood hazard information, a set of detailed maps will be produced, showing property boundaries, aerial photos, and minimum floor levels for the Clive area. This information will be provided to HDC to be included in their planning documents.

4. Pumping Station Screens

The amount of weed that arrives at the pumping stations during flood events is generally quite substantial and causes the screens to become quickly clogged, which in turn limits the possible discharge through the pumping station. The system of removing the weed is dependant on access to the pumping station, as well as the availability of personnel and equipment at the correct time. This reliance on access, personnel and equipment increases the vulnerability of the system to failure. In order to better manage this vulnerability, a telemetry system has recently been installed on the New Muddy Creek pumping station. The system measures the water level upstream and downstream of the screens, and relays the information to the HBRC. This enables the managers of the system to better utilise the resources needed to clean the screens and maintain the system in optimum operating state.

5. Proposed Acquisition of Ground Data (Aerial Laser Survey)

The recent decision by the HBRC to obtain ground data by means of aerial laser surveying will provide additional data which could alter the flood extents plotted in the area. Prior to producing flood extent maps for the area, the new data will be reviewed and incorporated into the results.

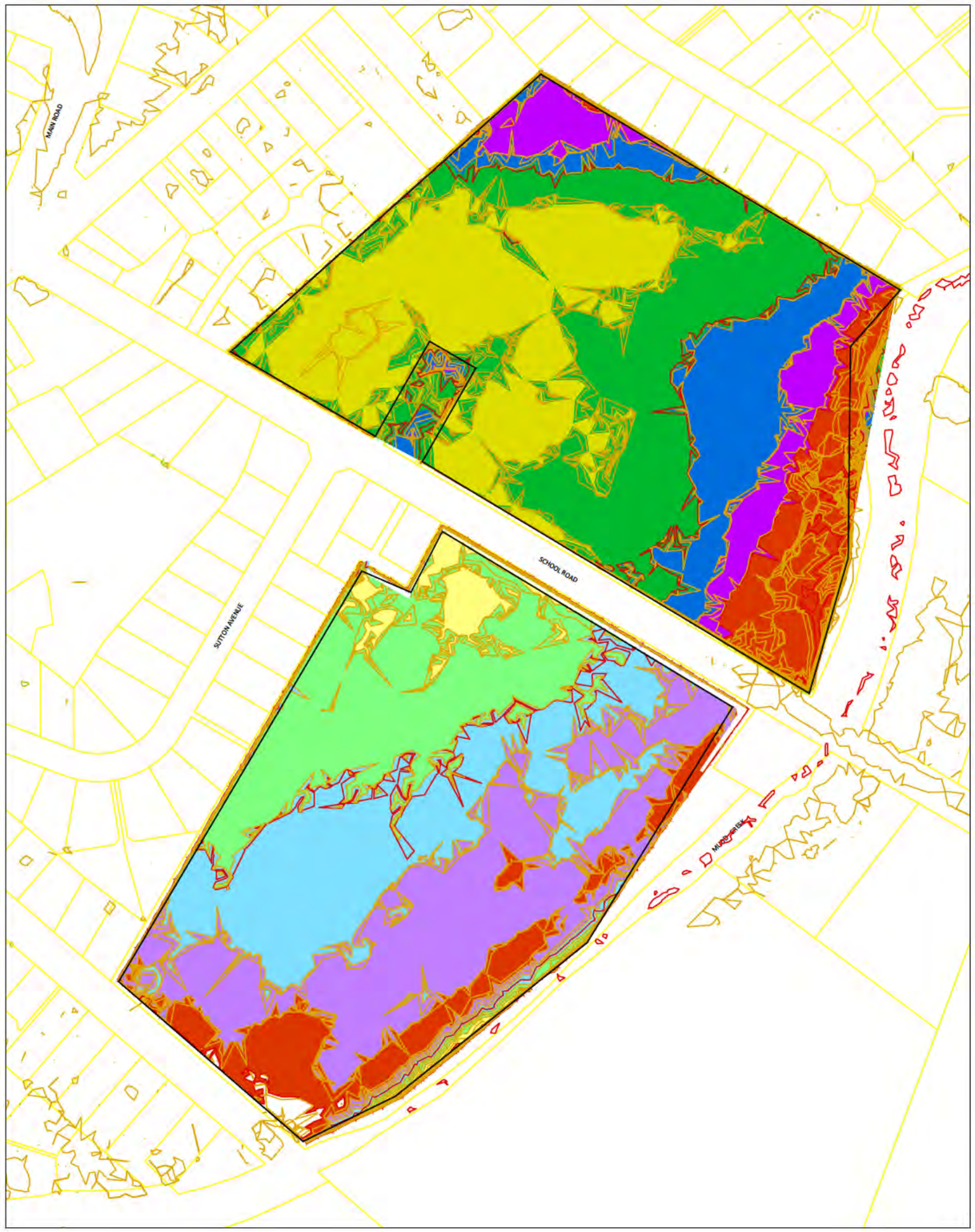
6. Recommendations

As a result of the current study, the following are recommended:

1. The Hastings District Council be advised that when setting house floor levels, no floor should be set below RL 11.6 m (based on 50 year flood level with pump outages), plus a freeboard appropriately determined for the particular site.

Prepared By: Craig Goodier, Senior Design Engineer
and Gary Clode, Engineering Manager

Appendix B Flood extent maps



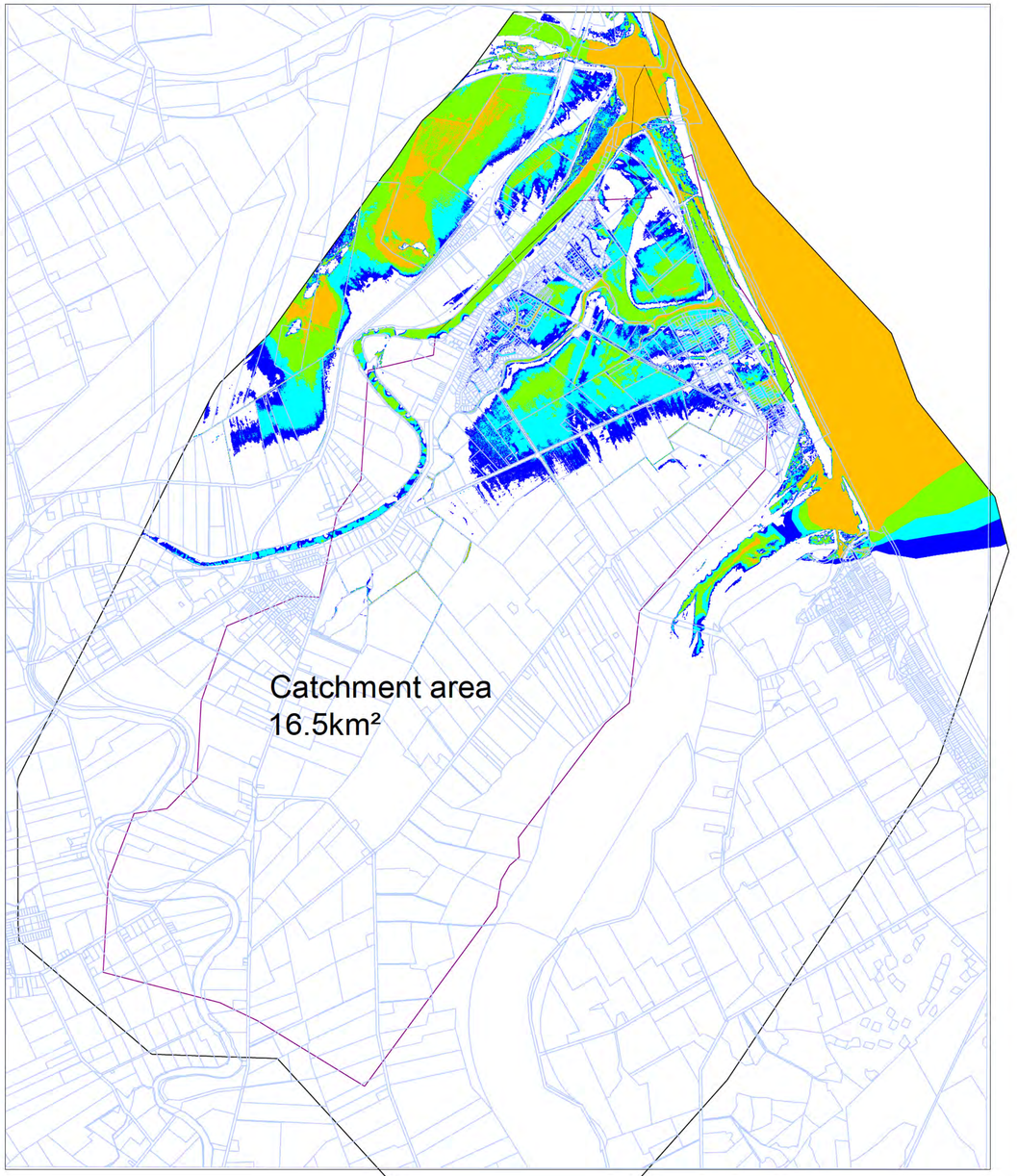
LEGEND				
RANGE #	MINIMUM ELEVATION (R.L)	MAXIMUM ELEVATION (R.L)	VOLUME (m³)	COLOUR
1	-2.15	-1.00	1975.67	
2	-1.00	-0.75	2376.48	
3	-0.75	-0.55	3522.80	
4	-0.55	-0.25	10765.85	
5	-0.25	0.00	15987.36	

LEGEND				
RANGE #	MINIMUM ELEVATION (R.L)	MAXIMUM ELEVATION (R.L)	VOLUME (m³)	COLOUR
1	0.00	0.20	11412.53	
2	0.20	0.40	8535.53	
3	0.40	0.60	4763.88	
4	0.60	0.80	1521.46	
5	0.80	1.08	110.39	

Cut and fill volumes for School Road development

Northern area cut to RL10.6. Cut volume shown on table is for entire surface area from existing LIDAR ground level to RL10.60. Cut volume inside the black polygon is 32,088m³.

Southern area fill to RL11.7. Fill volume shown on table is for entire surface area from existing LIDAR ground level to RL11.70. Fill volume inside the black polygon is 25,740m³.



Flood depths (m)			
Number	Minimum Elevation	Maximum Elevation	Color
1	0.000	0.250	
2	0.250	0.500	
3	0.500	1.000	
4	1.000	2.500	

Flood level at RL11.50 local authority datum 1972 and RL1.28 NZVD2016

Flood pond volume inside catchment: 1,193,880m³

FOR RESOURCE CONSENT

REV	DESCRIPTION TO REVISION	REV BY	DATE
0	Original	JPE	11.04.2022

NOTES :

1% AEP Flood level: RL11.7 (to be confirmed)

Groundwater table level: RL 10.6

0m 25m 50m

ORIGINAL SCALE (A1) = 1 : 1,250

CLIENT: TOMORROW CAPITAL LIMITED

PROJECT: STORMWATER ATTENUATION ASSESSMENT
SCHOOL ROAD,
CLIVE

INFRASTRUCTURE SOLUTIONS ‖ PROJECT MANAGEMENT
PO Box 7335, Taradale 4141
Phone : 06 650 5565 Email : admin@infir.nz

DRAWING TITLE: FLOOD EXTENT
FLOOD LEVEL AT LAD 1972: RL11.50

PROPOSAL CHECKED :	JPE	CAD CHECKED :	JPE	PROPOSAL APPROVED :	JPE	CLIENT APPROVED :	-	ENGINEER APPROVED :	JPE
DRAWN BY :	JPE	A1 DWG SCALE :	SCALE	PROJ / DWG / SHEET :	J21152 / 109	REVISION :	0		

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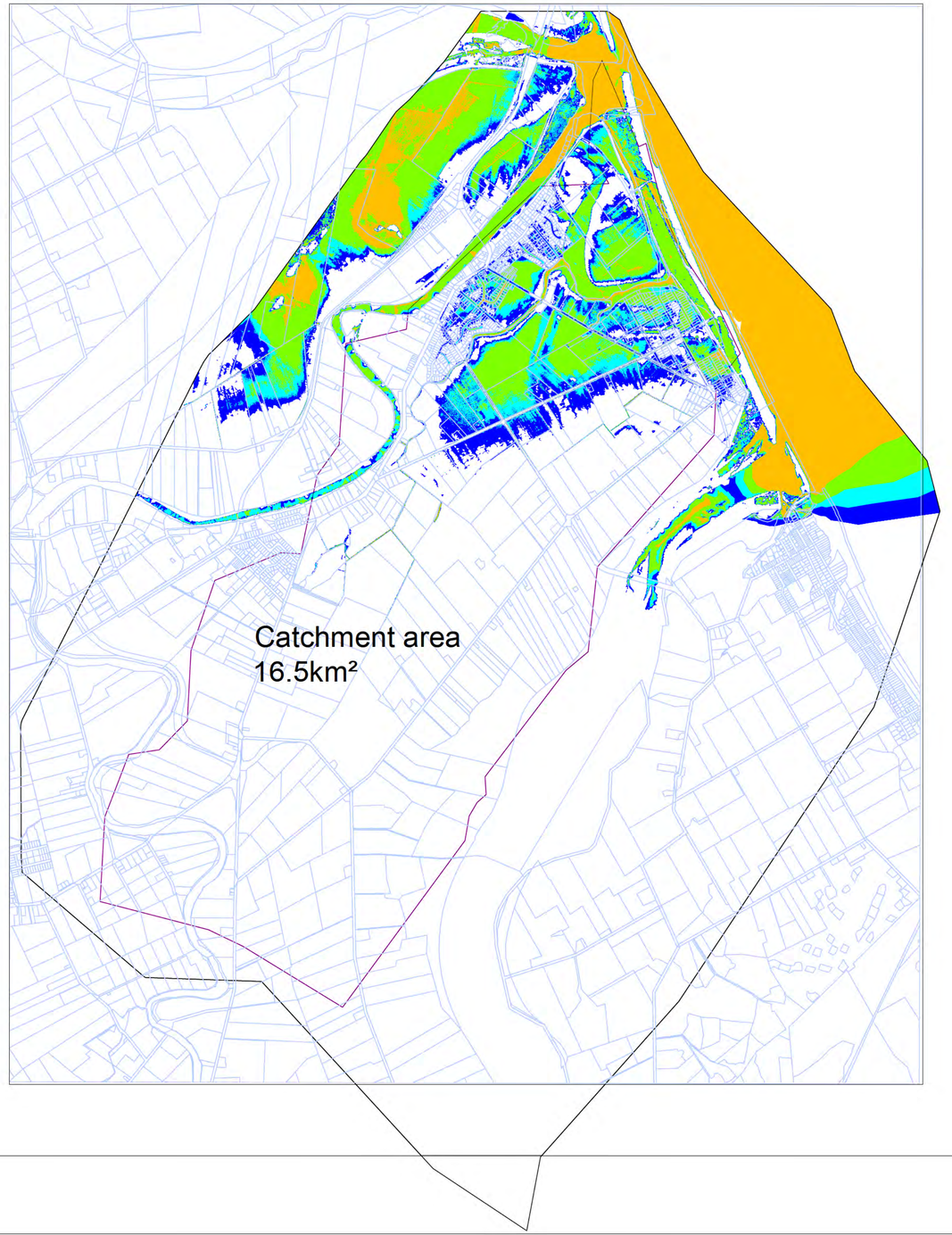

Flood depths (m)			
Number	Minimum Elevation	Maximum Elevation	Color
1	0.000	0.250	
2	0.250	0.500	
3	0.500	1.000	
4	1.000	2.500	

Flood level at RL11.60 local authority datum 1972 and RL1.38 NZVD2016

Flood pond volume inside catchment: 1,481,500m³

FOR RESOURCE CONSENT

REV	DESCRIPTION TO REVISION	REV BY	DATE
0	Original	JPE	11.04.2022

NOTES :

1% AEP Flood level: RL11.7 (to be confirmed)

Groundwater table level: RL 10.6

0m 25m 50m

ORIGINAL SCALE (A1) = 1 : 1,250

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DRAWING TITLE: FLOOD EXTENT
FLOOD LEVEL AT LAD 1972: RL11.60

PROPOSAL CHECKED :	JPE	CAD CHECKED :	JPE	PROPOSAL APPROVED :	JPE	CLIENT APPROVED :	-	ENGINEER APPROVED :	JPE
DRAWN BY :	JPE	A1 DWG SCALE :	SCALE	PROJ / DWG / SHEET :	J21152 / 110	REVISION :	0		

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