MWH

BUILDING A BETTER WORLD

ASSESSMENT REPORT

Feilding Urban Growth Strategy - Engineering Services Assessment

Prepared for Manawatu District Council

10 June 2013

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Manawatu District Council

Feilding Urban Growth Strategy - Engineering Services Assessment

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1 Introduction

Manawatu District Council (MDC) in collaboration with Boffa Miskell has been preparing a strategy for accommodating both residential and industrial growth within Feilding over the foreseeable future. This work has focussed on the development of a Framework Plan which defines the spatial planning strategy for Feilding growth. The plan has identified five growth areas or precincts.

The precincts comprise three residential areas on the western side of Feilding (Precinct 1 – Awahuri; Precinct 2 – Ranfurly–Sandon; Precinct 3 – Halcombe North), a fourth residential area on flat land to the north of town (Precinct 4 – Pharazyn Street), and an expanded industrial area (Precinct 5 – Turners Road Industrial) centred on the Kawakawa Road industrial area. Figure 1 outlines the locations and extents of the various precincts.

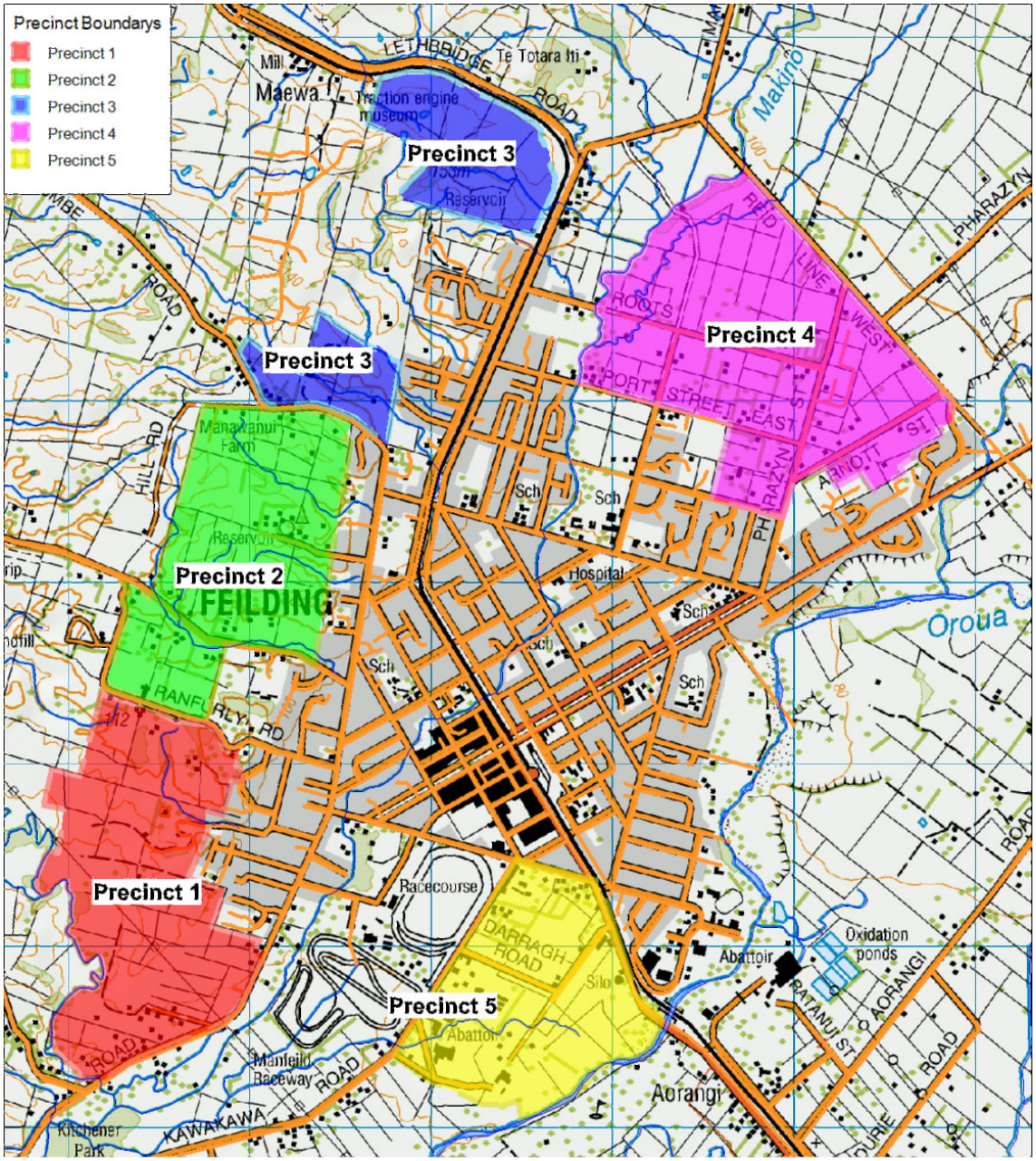


Figure 1-1 Feilding Growth Areas

In support of framework planning, MDC commissioned MWH to assist with providing technical advice on geotechnical issues, as well as scoping of primary roading, stormwater and wastewater services to support the growth areas. On 13 May 2011 MWH submitted a summary report outlining the work completed in respect of:

- geotechnical investigations,
- assessment of services requirements,
- core services required,
- assumptions on which the services plans were based,
- a discussion on what had not been considered, and
- recommendation of further work to be done, following adoption of the framework plan.

As part of the implementation of the Framework Plan (a strategy document) MDC is promulgating a District Plan change. Part of that plan change includes Structure Plans which provide a high level spatial structure for the five precincts described above. These structure plans are very simplified versions of the versions of the edge growth “concepts” for the five precincts described in the Framework Plan. The District Plan change referred to above also includes rules and Design Guidelines for subdivisions. The aim for urban growth set out in the Framework Plan strategy is intended to be implemented through the various provisions of Rules, Guidelines and Structure Plans in the District Plan and the provision of development contributions, works and services (e.g. roading, infrastructure as part of the Long Term Plan and Asset Management Plans.

2 Scope of Work Completed

2.1 Sequence of Activities

Initial work by MWH started in 2010 and key interactions and deliverables completed through the engagement include the following:

- Start-up meeting between, MDC, Boffa Miskell and MWH – 17 December 2010.
- Preparation of preliminary structure plans and design assumptions report - 21 December 2010
- Follow-up review meeting to discuss initial findings – 9 February 2011.
- Completion of initial services assessments for precincts 1 to 5 – April 2011.
- Assessment of servicing constraints and requirements – precincts 6 and 7 – May 2011.
- Interactive workshop between MDC, Boffa Miskell and MWH to confirm draft framework plans and servicing – October 2011.
- Submission of initial summary report – 13 May 2011 including further matters for consideration – e.g. liquefaction.
- MDC structure plans – 14 March 2013.
- Submission of structure plan services assessment report - 26 April 2013.

2.2 Scope of the Assessment

The engineering assessments completed are at a high level and provide layouts and key design criteria for network services to meet the future demands of residential and commercial development based on the indicative density and location of each of the proposed growth precincts. Outputs from the work include:

- Locations, layouts and sizing for roading, wastewater and stormwater services,
- Discussion of the outstanding issues and further work recommended,

2.3 Key Assumptions

Specific design and services assumptions are outlined in each specific services section, however general assumptions applied in respect of the services assessment include:

- Ground steeper than 1 in 3 has been excluded for building purposes and is largely captured in open space areas.
- Roading provision was designed to promote connectivity wherever practical, providing more than 1 entry and exit point to each growth area.
- Provision of water supply and services such as power and telecommunications were not assessed on the basis that it was considered practical to provide these services wherever required.
- Existing wastewater trunk mains receiving flows from the proposed precincts can be economically upgraded to cope with the additional flows.
- Remote low-lying areas may be serviced by pressure sewer systems discharging to gravity wastewater trunk mains. All associated costs will be covered by the developer.
- Internal roading and reticulated services provision within individual subdivisions will be the responsibility of the developer.
- Peak stormwater discharge flows were to be unchanged in respect of pre and post-development, although further assessment is required to address existing flooding risks within Precinct 4.
- The feasibility and cost of providing structure services along with upgrading of downstream trunk services e.g. up-sizing wastewater mains, upsizing the wastewater treatment plant (WWTP) and intersection improvements for roads is not a constraint and can be funded by way of development contributions.

3 This Report

3.1 Contents

The report describes the findings of an assessment of the requirements for and constraints associated with the development of and provision of core structure plan level services (roading, stormwater and wastewater) to support growth in the five precincts described in the Framework Plan. The report describes very limited initial services layouts, which are expected to be developed further in response to specific development proposals within each of the growth 'precincts'.

3.2 Structure

The report includes a brief recap on the previous work undertaken to consider service requirements in each precinct by way of background. Chapter 2 summarises the scope of work done.

Chapter 4 summarises the findings of earlier work looking at geotechnical and land assessment issues and how these are likely to impact on the feasibility and likely lot yield which can be achieved in each of the proposed growth precincts. Chapters 5, 6 and 7 outline the specific assumptions, risks and constraints identified and used in the services assessments completed for stormwater, transportation and wastewater respectively. Chapter 8 describes in more detail specific services assessments for each of the five growth precincts. In each case the scope of specific services, drains, storage ponds, sewers etc are quantified.

The report concludes with a brief summary and recommendations for Council on further work to consolidate understanding and planning for the future infrastructure requirements to support the potential development.

4 Geotechnical and Land Assessment

4.1 Scope of Assessment

The geotechnical assessment completed to date considered four areas of land stability comprising slope stability, earthquake risks including ground shaking and liquefaction, land and soil resources, and potential land contamination risks.

This assessment has not amended the work completed to date, as the background information remains unchanged. A brief summary of the key findings is included for completeness. Further detail can be found in the earlier assessment report – 13 May 2011. The relevant section is appended.

The May 2011 work included an assessment of potential land contamination under the then proposed National Environmental Standard. The contamination assessment should be reviewed in the light of the adoption of the NES.

4.2 Assumptions

Key assumptions and information sources on which the geotechnical assessment is based include:

- The regional geology, land resource and soils have been assessed by reference to the following information sources:
    - Geology of the Taranaki Area; Townsend, Vonk and Kamp; GNS Science; 1: 250,000 Geological Map.
    - New Zealand Land Resource Inventory Worksheet N144 – Feilding and N149 – Palmerston North
    - Soils of Palmerston North City & Environs, New Zealand; J.D. Cowie, NZ Soil Survey Report 24, DSIR 1974.
- As a general guide based on the type of soils underlying the proposed precincts, slopes steeper than approximately 1 vertical to 3 horizontal tend to be more prone to landslip. However, the stability of individual properties would need to be investigated in more detail at the time of applying for subdivision consent.
- Liquefaction potential has been assessed by reference to the underlying soil type (silts and fine sands are more prone to liquefaction), depth to groundwater (occurs in saturated soils with more potential for damage to be propagated to the surface when the depth to groundwater is shallow) and proximity to fault lines as well as by reference to the Horizons Regional Council Lifelines Project liquefaction potential map.
- Potential contamination risk was assessed by MDC and presented in the earlier May 2011 report. Reference should be made to this report.

4.3 Regional Geology

The regional geological map confirms a predominance of recent alluvial and older sedimentary parent material across Precincts 1 – 5 as follows:

- Q1a – river gravel alluvium (Precincts 1 & 5).
- Q2a – river gravel and fan deposits (Precincts 1, 4 & 5).
- Q3a – river gravel and fan deposits (Precinct 2).
- Q9b – beach deposits – marine terrace cover beds – conglomerate, sand, peat, clay (Prec 1, 2 & 3).
- mQs – Shakespeare group – sandstone, siltstone, limestone shell-beds, conglomerate (Prec 1, 2 & 3).

The presence of a number of earthquake fault lines within the region:

- Raouterangi Fault (concealed thrust fault – in-active) along the eastern boundary of Precincts 1, 2 & 3.
- Feilding anticline lies through Precincts 1, 2 & 3.
- Major active faults in the region are:
    - Wellington fault – 23km to south-east.
    - Mohaka fault – 23km to east-south-east.

- Ruahine fault – 24km to east-south-east.

The proximity of the major faults, particularly the Ruahine and Mohaka faults, is such that Feilding is considered to have a high seismic hazard risk. The risk is the strong ground shaking that would occur from an earthquake and the hazard of damage to buildings, occupants and utilities, According to the Earthquake Loading standard (*AS/NZS 1170.5*) for the purpose of building construction Feilding site is considered to have a hazard factor of approximately 0.37.

4.4 Land and Soil Resources

A review of applicable land resource inventory worksheets shows the following:

- Soils are typically recent soils and yellow-grey earths.
- Soil erosion risk is nil to slight for Precincts 4 and 5 with slight to moderate sheet and rill erosion risks for the hill slopes of Precincts 1,2 and 3 in the event the soils are cultivated.
- Underlying rock in Precincts 1 – 3 is predominantly loess over massive sandstone or siltstone, whilst Precincts 4 and 5 are underlain by undifferentiated flood plain alluvium and gravels.
- All areas have seasonal limitations to agricultural use due to seasonal soil moisture deficiencies which are more pronounced in Precinct 5 with more rapidly draining soils.
- In Precincts 1 to 3, the soils are all described as moderately to very poorly drained with significant areas of imperfectly to very poorly drained soils in Precincts 4 and 5.
- Precinct 5 alone has significant areas of excessively to moderately well drained soils associated with the recent alluvial gravel parent material.

The key constraints comprise drainage limitations for both stormwater and effluent in the soils in Precincts 1 – 3. As a result sustainable disposal of effluent or stormwater on-site will require a conservative soakage rate of 3 mm/hour as defined for soil category 5 in Table M1 of AS/NZS 1547:2012 –"On-site domestic wastewater management." The soils underlying Precincts 4 and 5 do not have the same drainage limitations, however the depth to groundwater in those precincts is shallow which will limit the depth of stormwater detention ponds and the effectiveness of stormwater soakage systems.

4.5 Land Stability

Land areas steeper than 30% were identified and mapped within Precincts 1 to 5 using GIS. Precincts 1-3 have much higher areas >30% slope (21-44%). In these precincts the lot yield has been adjusted to exclude construction on steep areas. Higher density development is provided for only where there are extensive areas of easier slopes. In Precincts 4 and 5, the very small areas of steeper slopes are associated with steep river or stream banks. The respective areas of each precinct with slopes greater than 30% are summarised in Table 3.1 below.

Table 4-1: Summary of Land Areas with Slopes > 30%

Precinct	Total Area (ha)	Area of Slope > 30% (ha)	Percentage > 30%
1	166.6	35.0	21%
2	143.8	63.9	44.4%
3	87.8	32.2	36.6%
4	208.9	1.5	0.7%
5	113.1	1.5	1.4%
Total	**720.2**	**134.1**	**18.6%**

4.6 Liquefaction Potential

Liquefaction potential is related to underlying soil type, groundwater level and seismic risk hazard. A Lifelines Project that was carried out for Horizons Regional Council has identified that at a very broad level the liquefaction potential of the elevated terrace land encompassing Precincts 1, 2 and 3 is very low, whilst Precincts 4 and 5 have moderate susceptibility to liquefaction.

Following the Christchurch earthquakes more prescriptive requirements for liquefaction assessment is likely to emerge as are changes in legislation / codes / guidelines to mitigate these risks. To assist Council understand the extent of risk in Precincts 4 and 5, it is recommended a high level liquefaction risk assessment be undertaken.

4.7 Summary of Geotechnical and Land Assessment

A brief summary of the key findings in relation to the geotechnical and land assessment for the 5 precincts is summarised in Table 3.2.

Table 4-2: Summary of Geotechnical and Land Related Risks and Constraints

Geotechnical Feature	Precinct				
	1 - Awahuri	2 – Ranfurly - Sandon	3 – Halcombe North	4 – Pharazyn Street	5 – Turners Road / Industrial
Geology	River gravel alluvium Beach gravel deposits and massive sandstone	Beach gravel deposits and massive sandstone	Beach gravel deposits and massive sandstone	River gravel alluvium	River gravel alluvium
Soil Erosion Risk	Slight to moderate sheet and rill erosion	Slight to moderate sheet and rill erosion	Slight to moderate sheet and rill erosion	Nil to slight	Nil to slight
Drainage Limitation	Moderate to poorly drained soils / on-site soakage	Moderate to poorly drained soils / on-site soakage	Moderate to poorly drained soils / on-site soakage	Imperfect to very poorly drained soils / on-site soakage)	Balance of very poorly drained and moderately to excessively well drained soils
Seismic Hazard	High (hazard factor 0.37)	High (hazard factor 0.37)	High (hazard factor 0.37)	High (hazard factor 0.37)	High (hazard factor 0.37)
Slope Stability Risk	Moderate (>20% steep areas)	High (40% steep areas)	High (40% steep areas)	Low (<2% steep areas)	Low (<2% steep areas)
Liquefaction Risk	Low	Low	Low	Moderate	Moderate
Areas Requiring Further Assessment Prior to Subdivision	Slope stability risk / on-site soakage	Slope stability risk / on-site soakage	Slope stability risk / on-site soakage	liquefaction risk and out of area flood risk	Within precinct flooding

5 Stormwater Services Assessment

5.1 Stormwater Management Approach

The stormwater services assessment originally undertaken is outlined in the earlier assessment report – 13 May 2011. The assessment work has not been repeated for the purpose of this latest assessment. The iterative process of developing the Feilding urban growth strategy and planning documents has seen changes in road lengths and widths that result in increases in both peak runoff flows and volumes. However the assessment completed to date has confirmed that it is possible to achieve adequate management of stormwater using property level storage tanks and distributed detention ponds.

As previously the stormwater services are based on the following key components:

1. On-site storage of stormwater of at least 16 m^3 typically in one tank to capture roof water (6 hour event) with provision for re-use of the captured water resource.
2. Local swales and detention / detention basins to manage road runoff.
3. Secondary flow paths will be within the road where kerb and channel are provided and within existing gully and ephemeral water channels where swale drains are provided.
4. A combination of concrete dish drains, kerb and channel drainage, and catchpits will discharge to separate open drains provided along the roads. The open drains will terminate in detention ponds located adjacent to roads or within existing local watercourses. The open drains would provide for property access to ensure egress is maintained in the event of a flooding event.

5.2 Design Assumptions

Key assumptions include:

- Hydraulic neutrality such that post development peak runoff flows shall be no greater than pre development runoff flows, although total runoff is increased post-development.
- Q_{200} average recurrence interval used as the design level of service including climate change effects on the basis that the Q_{200} ARI storm will become the Q_{100} ARI event following climate change.
- Stormwater management designed to allow for safe egress for residents from dwellings during storm events, by restricting the maximum depth of ponding in road corridors.
- Stormwater runoff analysis completed using the HEC-HMS model, based on a 24 hour storm to cover the full range of rainfall intensities.
- Stormwater detention basins sized to cope with a 6 hour duration event on the basis that this is the critical event duration for mitigating effects on the Toanui Basin.
- Hydraulic neutrality using a roof stormwater tank depends on an assumed ratio of roof and paving areas, such that if paved areas are significantly greater then achieving neutrality will not be possible using rain tanks alone.
- In Precinct 4, the stormwater network downstream of the conveyance channels has been assumed to be adequately sized, or that if undersized the flooding consequences will not impact on Precinct 4.
- Detention pond locations will be selected by developers, however it is assumed they will be located in lower areas within existing drainage flowpaths.
- Runoff from existing roads and structures has been included in the existing flow assessment.

- Reference has been made to the following publications:
  - (1) NZS 4404: 2010 Land Development and Subdivision Engineering.
  - (2) MWD – Culvert manual Vol 1.
  - (3) IPENZ - A Guideline and Procedure for Hydrological Design of Urban Stormwater Systems.
  - (4) NZ Building Code.
  - (5) TP108.
  - (6) TP10 – Auckland Regional Council.

5.3 Residual Risks and Uncertainties

Remaining risks and uncertainties with respect to the stormwater assessment include:

- The impact of the detention design on intense storm events with durations of < 2 hrs events. The design basis for stormwater detention in Precincts 1 to 4 is the 6 hour event based on the potential impact on ponding in the Taonui basin. Localised flooding risk is associated with events of < 2 hours discharging through existing drainage networks (channels and pipes) to the Makino Stream. It is considered that detention ponds can be modified by throttling discharge flows to mitigate effects of short duration rainfall events. The detail of the pond design is still to be confirmed.
- Current flood risks and level of service deficiencies: The proposed stormwater services will not address current flooding risks or level of service deficiencies. In Precinct 4, existing development in the Pharazyn Street area is within the ponding area. In the absence of an effective secondary flow path localised flooding currently occurs.
- Future building level requirements: MDC and HRC will need to set future building levels, with a minimum freeboard of 0.5m for habitable building floors and 0.3m for commercial and industrial buildings above a local Q_{200}. A number of existing dwellings within the already developed areas of Precinct 4 are well below road level and have little or no freeboard. Council will need to consider whether any additional stormwater protection must be provided to mitigate potential flooding impacts in these areas.
- Consenting issues associated with diversion of watercourse. Specific requirements for resource consents to allow for diversion of watercourses in Precinct 4 have not been considered. These will need to be addressed along with the design feasibility for any diverted watercourses.
- Stormwater treatment: The assessment has not considered the requirements for stormwater treatment although the installation of catch-pits in the road and grass swales will achieve significant treatment.

6 Transportation Services Assessment

6.1 Roading Design Approach

Road design has been based on the MDC provided cross-sections for 'access road' and 'arterial road' as shown in figure 5.1 and 5.2 below. The extent of each type of road is based on the proposed structure plans. Key features of each road type are as follows:

- Local Street (less than 2000 VPD)– live and play with operating speed of 50km.hr. The road reserve width is 20m, and includes 1.4-2.0m each side for pedestrians, 5.7m for movement lanes, shared parking in movement lane or separate recessed parking of 2 x 2.5m each side. Total carriageway width is 10.7m

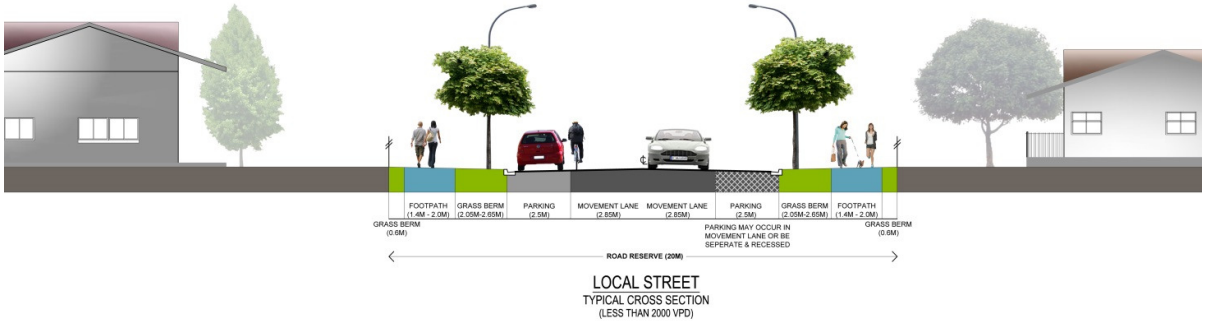


Figure 6-1: Local Street – Typical Cross-Section

- Urban Collector Road (2000 – 8000 VPD) – live and play with the target operating speed of 50km/hr. The road reserve width is 20m, maximum grades of 10%, and includes 1.4-2.0m wide footpaths on both sides of the road, 2 x 4.2m movement lanes, 2 x 2.5m grassed parking lanes. The total carriageway width is 8.4m.

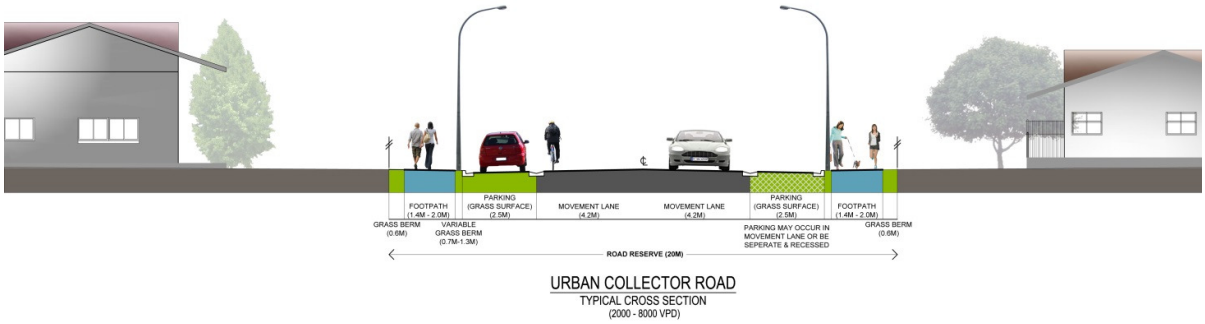


Figure 6-2: Urban Collector Road – Typical Cross-Section

An objective of the Framework Plan is to provide for connectivity within each precinct such that there are at least two separate entry and exit points. The Edge Growth concept plans in the Framework Plan describe this potential. The structure plans show less of the roading network hierarchy. This recognises the arterial roading network connections but leaves lower order network connections to the development phase.

In a number of locations the high cost and difficulty of constructing connecting roads given the topography and the difficulty of achieving safe connections to existing roads restricts what is possible. While road access may not be possible, creation of links for cycle and pedestrians is still strongly recommended including:

- A connection within Precinct 2 from the Ranfurly flats to the Sandon Basin and then through to Highfield Road from the Sandon Basin.
- Access from the top to the bottom of each of the two development parcels within Precinct 3.

At this stage specific traffic impact assessments have not been completed. However, one area highlighted for further assessment is:

- the road connection point from Precinct 2 onto Halcombe Road.

6.2 Key Assumptions

Other key assumptions used to develop the roading costs include:

- LIDAR data collected in 2010 was used to establish grades.
- Road slopes are between 10 – 12.5% for the main arterial links.
- Kerb and channel is provided along all roads. Catchpit sumps placed on both sides of the road at 100m intervals. 225mm catchpit leads shall drain to open drains.
- Open drains are provided to convey flows and provide limited detention and treatment of stormwater. Open drains will be located within the 20m road corridors.

7 Wastewater Services Assessment

7.1 Wastewater Design Approach

Key features of the design approach include:

1. Services are designed to enable all new lots created to be provided with reticulated wastewater services.
2. On-site disposal can only occur for lots with an area of 5000 m^2 or greater.
3. Gravity wastewater services to be provided wherever possible on the basis that they minimise the length of new sewers to be provided.
4. Staging of precinct development will require pumping of initial development flows until such time as the full road corridor is constructed allowing for the gravity main to be installed
5. A pump station will be provided only where the majority of properties cannot be serviced by gravity connections. Pressure sewer systems are an option for isolated or low lying properties.

7.2 Assumptions

Key design assumptions include:

- Daily wastewater volumes and flows have been based on MDC figures used in the development contribution analysis of 210 l/pers/day x 2.5 persons per dwelling. Peak dry weather flows are based on a peaking factor of 2.5 x ADWF, while the wet weather peak is based on 5 x ADWF.
- Precinct 5, design allows for flows of 0.5 l/s/ha sufficient for dry industry and commercial activities. Wet industry is not provided for.
- New gravity pipes have been sized to carry peak wet weather flows without surcharging.
- All new sewers will be installed in the road reserve where practical. Where pipes need to be installed outside the road reserve they will be within registered easements with suitable provision for access for maintenance purposes. Ideally easements should be at least 6m width and combined with walkways where possible although installation within 3m easements through private land is provided for.
- All new sewers will be either 150 or 225mm pipes based on allowing for peak wet weather flows without surcharging.
- Upgrades to the downstream receiving network and wastewater treatment plant are as identified in the development contributions report (MDC 2009, W Hodson). In assessing the share of any network and treatment upgrade costs, it has been assumed that 50% of the requirement will be related to growth in occurring in the new growth areas, with the balance 50% associated with additional infill development and servicing of existing but undeveloped residential zoned land.

7.3 Constraints/Risks

Significant constraints in respect of providing wastewater servicing to the proposed precincts include:

- Significant areas of the type 1 density (>2000 m^2) have very steep slopes restricting areas available for location of on-site disposal systems. The slope limitations associated with installing wastewater treatment and disposal limitations may reduce further the effective numbers of lots which can be created in Precincts 2 and 3. Effective lot numbers have been adjusted to take account of the area of land over 30% slope in each precinct.
- The practical limit for depth of new sewers in Churcher and Pharazyn Streets will limit the east-west extent of the gravity sewer network in Precinct 4, such that some areas close to the Makino Stream may require a pumped system. No allowance has been made for provision of pumping systems at this time.
- Water tables are elevated in Precincts 4 and 5 which will result in higher costs for sewer installation through the requirement for de-watering and an increasing risk of there being significant infiltration flows

to the sewer during and following significant rainfall events. Use of PE pipelines could assist to mitigate this risk.

- Sections of the proposed gravity network in the road, may not achieve minimum slope so that some sections of sewer may need to be installed outside the road reserve, or at a greater depth than currently allowed for.
- Proposed gravity sewers in steep green reserve areas at the rear of Precinct 2 may prove to be impractical or uneconomic to construct requiring an alternative pumped solution for these areas.

8 Precinct Structure Plan Assessment

8.1 Introduction

The following sections of the assessment describe the design assumptions and servicing requirements for the effective servicing of the five precinct structure plan areas. The design assumptions and the services proposals will require small elements of the structure plans to be adjusted. Many of the design assumptions are detailed matters that MDC will need to provide for in asset planning to match the demands for servicing in the growth areas. Similarly there are design and servicing requirements that will fall to land developers to provide for in subdivision design.

This section should be read in conjunction with the spatial structure plans for each precinct contained in Appendix A of this report.

8.2 Precinct 1 - Awahuri

8.2.1 Existing Situation

Current development within the area of Precinct 1 is limited to small subdivisions within flatter areas adjacent to Awahuri Road and easy sloping land adjacent to Ranfurly Road. The remainder of the precinct is largely rural with isolated dwellings. There are no existing reticulated services aside from a small sub-division off Awahuri Road.

Aside from some of the area which falls towards the western boundary of the existing residential development, most of the stormwater runoff is in a south-westerly direction towards the Mangaone Stream.

8.2.2 Future Growth

8.2.2.1 Overview

The proposed structure plan provides for two residential development densities. Effective areas and lot numbers for these areas net of reserve and open space areas are summarised in Table 8-1 below for land to be re-zoned immediately and deferred.

Table 8-1: Precinct 1 Areas and Lot Yield

Development Type	Zoning Status	Area (ha)	Lot Yield (Max)
Residential Density 1	Immediate	0	0
	Deferred	63	320
Residential Density 2	Immediate	30	380
	Deferred	25	310
Open Space		35	
Reserve		6	
Total		**159**	**1,010**

The northern half of the precinct has been identified for smaller lot development (density 2) with 50% of this area adjacent to Ranfurly Road proposed for immediate zoning as residential. Aside from a small block adjacent to Ranfurly Road which is zoned for immediate intensive development, the balance of the zone is shown as lower density and deferred.

8.2.2.2 Transportation Services

The transportation network set out in the proposed structure plan comprises the following:

- A central collector road extending from Awahuri Road through the middle of the zone and exiting onto Ranfurly Road at the mid-point of the upper flat.
- A second collector road extending Glasgow Terrace to connect through to the new central collector. Glasgow Terrace provides a lower grade (7%) connection.
- No roading connection is shown along the southern boundary of the zone with the Mangaone Stream. It is recommended that a walkway / cycleway corridor be provided within the reserve strip.

Specific transportation infrastructure to meet the proposed structure plan requirements in Precinct 1 comprise:

- 2500m of collector road
- 350m of local road
- 600m of existing road (assumed to require upgrade)

8.2.2.3 Stormwater

As outlined stormwater management has been based on the provision of stormwater collection and dry/wet pond detention to ensure hydrological neutrality (peak stormwater discharges post development are no greater than pre-development peak flows for a 6 hour event). This has been achieved by means of:

- Providing 16 m^3 of property level on-site stormwater tank storage which discharges via orifice control to 10m of 'french' drain or soakaway drain within each property.
- Roadside open drains to collect road runoff, directed to detention ponds located at a sub-catchment level to attenuate the flows.

Specific stormwater infrastructure to meet the proposed structure plan requirements in Precinct 1 comprises:

- 1010 property level stormwater detention tanks (min 16 m^3 each),
- five (5) detention ponds storing a total of 2500 m^3 of road stormwater runoff (based on previous assessment only)
- 3400m of roadside open drains with a cross-section of 1.0 m^2,
- 4200m of open drains within designated open spaces or private property, with a cross-section of 1.0 m^2,
- One each of 600mm, 750mm and 1050mm road culverts taking stormwater from one side of the road to the other,
- 68 nos of catchpits with 225mm catchpit leads draining to adjacent open drains.

8.2.2.4 Wastewater

Service provision is based on provided reticulated wastewater services for all potential lots, although it is considered likely that a proportion of lots created within density 1 areas will be able to utilise on-site wastewater treatment and disposal. While the area is broken, the majority of the land falls towards the south-west and the Mangaone Stream.

The wastewater network is based on the following:

- The north-eastern quadrant of the higher density area (12 ha) utilising gravity sewers draining to existing sewers extended from the western limit of the existing residential area including sewers in Glasgow, Tiritoa and Windsor Terraces.
- The western area of the precinct (remaining area of Ranfurly flats - 52 ha) discharging to a new core gravity sewer laid in the new collector road and discharging at its lowest point to a new pump station north-east of the Mangaone Stream. The pump station would pump to the high-point on the collector road west of its connection to Awahuri Road before gravitating to the trunk sewer in Awahuri Road.
- Lower lying areas south of the new collector road and close to the Mangaone Stream could pump from local gravity networks back to the collector road sewer, if they are not able to use on-site treatment and disposal. The soil on the lower terrace area, near the stream, is classified as Ohakea Silt Loam with silt loam to clay loam texture and considered imperfectly drained.

- On-site wastewater systems which meet Horizons Regional Council requirements including secondary treatment system with a maximum application rate of 3mm/day and a typical footprint of 550 m^2 for disposal area including 50% reserve area.

Specific wastewater infrastructure to meet the proposed structure plan requirements in Precinct 1 comprises:

- 4700m of 150mm sewer.
- 850m of 225mm sewer.
- Pump station designed for 15 to 16 l/s peak wet weather flow and 4hrs dry weather storage.
- 600m of 100mm PE rising main.

8.3 Precinct 2 – Ranfurly - Sandon

8.3.1 Existing Situation

Current development within the area of Precinct 2 is limited to small subdivisions within flatter areas north of Ranfurly Road and south off Halcombe Road. The remainder of the precinct is largely rural with isolated dwellings. Existing reticulated services are limited to sewers laid within both Ranfurly and Sandon Roads up to the south-eastern corner of the precinct.

Stormwater drainage is largely northwards from Ranfurly Road to the Sandon basin. The areas to the rear of the precinct and on the north side of Sandon Road also drain back southwards to the Sandon Basin and then eventually to the Makino Stream. The north eastern parts of the precinct drain and fall eastwards to the Feilding urban area and the Makino Stream.

8.3.2 Future Growth

8.3.2.1 Overview

Precinct 2 is a difficult area to service particularly in respect to roading given there are three distinct landforms. To the south is the flat terrace area bounded by Ranfurly Road. Dropping off the terrace to the north and south of Sandon Road is a basin area with nodular hills, while further to the north are areas of elevated terrace top or “fingers” of land accessed from Highfield Road and Halcombe Road to the north.

The proposed structure plan provides for two residential development densities. Effective areas and lot numbers for these areas net of reserve and open space areas are summarised in Table 8-2 below for land to be re-zoned immediately and deferred.

Table 8-2: Precinct 2 Areas and Lot Yield

Development Type	Zoning Status	Area (ha)	Lot Yield (Max)
Residential Density 1	Immediate	0	0
	Deferred	45	230
Residential Density 2	Immediate	13	160
	Deferred	14	180
Open Space		64	
Reserve		0	
Total		**136**	**570**

The southern portion of the precinct close to Ranfurly Road has been identified for smaller lot development (density 2). A second higher density development area on the flatter land beyond the current end of Highfield Road is identified for deferred development. The remainder of the precinct comprising more broken and sloping areas is designated deferred density 1.

A significant portion of the density 1 area is included as open space reflecting the large areas with slopes over 30%.

8.3.2.2 Transportation

The transportation network set out in the proposed structure plan includes the following:

- A local road network within the Ranfurly flat area, providing for three entry and exit points onto Ranfurly Road. Road alignment allows for development of north facing lots on each road.
- A central collector road extending from Awahuri Road through the middle of the zone and exiting onto Ranfurly Road at the mid-point of the upper flat.
- A collector road comprising an extension of Highfield Road through to the north to link up with Hill Road and then onto Halcombe Road. Providing a separate junction with Hill Road prior to exiting onto Halcombe Road will minimise the potential conflict at the main Halcombe road intersection.
- A short section of local road is provided to connect with Highfield Road on the upper flats to access a large ridge top flat to the south.
- No specific roading infrastructure or connections are shown in the Sandon Basin on the basis that specific roading services will be developed in consultation with developers. Control over the number of access points off the road is recommended to mitigate traffic movement risks.
- Roading connectivity between Ranfurly flats, Sandon Basin and Highfield Road could not be practically achieved given the steep slopes present. However it is strongly recommended that a walkway / cycleway corridor be provided to connect these areas.

Specific transportation infrastructure to meet the proposed structure plan requirements in Precinct 2 comprise:

- 2050m of local road
- 1400m of existing road (assumed to require upgrade)
- 220m of 2m high retaining walls (average height) adjacent to roads aligned through areas with steep crossfall
- 200m of 4m high retaining walls (average height) adjacent to roads aligned through areas with steep crossfall

- At the intersection with the Halcombe Road corner further assessment of upgrading and traffic management options will be required to ensure safe traffic entry and exit at this point. Some of the strategies to be considered include removal of the passing lane, reduction in the speeds and construction of a roundabout junction. Currently there are 2000-4000 vehicles using this section of road per day. Further engineering analysis of this intersection is recommended.

8.3.2.3 Stormwater

As outlined earlier stormwater management has been based on the provision of stormwater collection and dry/wet pond detention to ensure hydrological neutrality (peak stormwater discharges post development are no greater than pre-development peak flows for a 6 hour event). This has been achieved by means of:

- Providing a minimum of 16 m^3 of property level on-site stormwater tank storage which discharges via orifice control to 10m of 'french' drain or soakaway drain within each property
- Roadside open drains to collect road runoff, directed to detention ponds located at a sub-catchment level to attenuate the flows

Specific stormwater infrastructure to meet the proposed structure plan requirements in Precinct 2 comprise:

- 570 property level stormwater detention tanks (16 m^3 each)

- three (3) detention ponds storing a maximum total of 1275 m^3 of road stormwater runoff (based on previous assessment only)
- 4000m of roadside open drains with a cross-section of 1.0 $m^2$4546m of open drains within designated open spaces or private property, with a cross-section of 1.0 m^2
- Three 450mm and one 1050mm road culverts taking stormwater from one side of the road to the other
- 68 nos of catchpits with 225mm catchpit leads draining to adjacent open drains

8.3.2.4 Wastewater

Service provision is based on provided reticulated wastewater services for all potential lots, although it is considered likely that a proportion of lots created within density 1 areas will be able to utilise on-site wastewater treatment and disposal. In respect of wastewater servicing the area is broken into several areas, namely the Ranfurly flats, Sandon Basin and Highfield heights, with each requiring independent servicing arrangements. While the area is broken, the majority of the land falls towards the south-west and the Mangaone Stream.

The wastewater network is based on the following:

- A gravity sewer network in the road network serving the Ranfurly flats area, draining to a trunk sewer in Ranfurly Road. While the majority of the area should be capable of gravity service, a portion of the area will require pumping or a gravity sewer connection down to Sandon Road on the north side.
- It is expected that some development in the Sandon basin will require reticulated wastewater so an extension of the wastewater main within Sandon Road has been suggested.
- A new sewer up Highfield Road with extensions up towards the Hill Road and down the local road to the south. The sewer would be laid as deep as practical to maximise the extent of gravity service to the elevated terrace areas.
- For lots of sufficient size (>5000 m^2) to utilize on-site wastewater systems, requirements for meeting Horizons Regional Council standards will include:
    - Secondary treatment systems with a maximum application rate of 3mm/day (Halcombe and Halcombe Hill soils) and 2mm/day for Marton silt Loam soils
    - Disposal area footprints of 550 m^2 and 700 m^2 for the Halcombe and Marton soils respectively including allowance for the reserve area.

Specific wastewater infrastructure to meet the proposed structure plan requirements in Precinct 2 comprises:

- 5100 m of 150mm sewer

8.4 Precinct 3 – Halcombe North

8.4.1 Existing Situation

Current development within the area of Precinct 3 is limited to some isolated dwellings and semi-rural properties off Halcombe Road and the western extent of residential development off West Street. The drainage pattern in the two development areas defined within the precinct is to the east off the hills towards the Feilding urban area.

8.4.2 Future Growth

8.4.2.1 Overview

Precinct 3 is also a challenging area to develop and service, comprising as it does undulating gully landforms extending down from the higher terrace flats to the west to the Feilding urban area alongside the Makino Stream.

The precinct comprises two areas identified for future development and both classified as deferred. The first area comprises a gully area bounded by Halcombe Road to the south, the Mount Taylor sub-division to the west and the eastern extent of the Feilding urban area. The second larger area is north of this and bounded by Lethbridge Road to the north, Makino Road to the east and the Mt Taylor, Tichbon and Jackland developments to the west and south.

The effective area and lot numbers for the deferred residential development density 1 land in Precinct 3 net of reserve and open space is summarised in table 8-3 below.

Table 8-3: Precinct 3 Areas and Lot Yield

Development Type	Zoning Status	Area (ha)	Lot Yield (Max)
Residential Density 1 (>2000 sq.m)	Deferred	56	280
Open Space		32	
Reserve		0	
Total		**88**	**280**

A significant portion of the density 1 area is included as open space reflecting the large areas with slopes over 30%.

8.4.2.2 Transportation

The transportation network set out in the structure plan comprises the following:

- No specific road infrastructure in the southern area, although it is recommended that connectivity be provided by means of a road connecting the Mt Taylor development to Parkview Ave in the east, by way of negotiated agreement with developers. No connections to Halcombe Road are recommended given the traffic safety issues arising.
- A connector road extending from the existing northern extent of Leithbridge Street up through the development to connect to Mt Taylor via the Tichbon development. This requires acquisition of existing Lot 215 (DP 377496) within Mt Taylor.

Specific transportation infrastructure to meet the proposed structure plan requirements in Precinct 3 comprise:

- 1450m of local road
- 75m of 2m high retaining walls (average height) adjacent to roads aligned through areas with steep crossfall

- 750m of 4m high retaining walls (average height) adjacent to roads aligned through areas with steep crossfall

8.4.2.3 Stormwater

As outlined earlier stormwater management has been based on the provision of stormwater collection and dry/wet pond detention to ensure hydrological neutrality (peak stormwater discharges post development are no greater than pre-development peak flows for a 6 hour event). This has been achieved by means of:

- Providing 16 m^3 of property level on-site stormwater tank storage which discharges via orifice control to 10m of 'french' drain or soakaway drain within each property
- Roadside open drains to collect road runoff, directed to detention ponds located at a sub-catchment level to attenuate the flows

Specific stormwater infrastructure to meet the proposed structure plan requirements in Precinct 3 comprises:

- 280 property level stormwater detention tanks (16 m^3 each)
- Seven (7) detention ponds storing a maximum total of 3500 m^3 of road stormwater runoff (based on previous work only)
- 1300m of roadside open drains with a cross-section of 0.12 m^2
- 1750m of open drains within designated open spaces or private property, with a cross-section of 1.0 m^2
- One each of 750mm and 1050mm road culverts taking stormwater from one side of the road to the other
- 30 nos of catchpits with 225mm catchpit leads draining to adjacent open drains

8.4.2.4 Wastewater

Service provision is based on provided reticulated wastewater services for all potential lots, although it is considered likely that a significant proportion of the lots created within the precinct will utilise on-site wastewater treatment and disposal.

Specific wastewater servicing proposed includes:

- A gravity sewer laid in the stormwater drainage easement following the existing gully drainage path through the southern parcel of land. This has been provided on the expectation that this will be the future alignment for a connector road. In the absence of any gravity outlet to the Feilding network, a pump station and rising main discharging to the sewer network in lower Halcombe Road has been provided for.
- For the more northerly parcel of land, a gravity sewer has been laid in the eastward falling portion of the new connector road, discharging to the northern end of Leithbridge Street.
- Some local pump stations or individual pressure sewer connections to service properties beyond the reach of the gravity network.
- For properties in the northern western area of the precinct, which falls away from any existing Feilding wastewater infrastructure, a local pump station and rising main discharging to the existing sewer network in the Mt Taylor subdivision has been provided for. If this isn't feasible this could be pumped back along the connector road to the new gravity system.
- For lots of sufficient size (>5000 m^2) to utilize on-site wastewater systems, requirements for meeting Horizons Regional Council standards will include:
    - Secondary treatment systems with a maximum application rate of 3mm/day based on Halcombe and Halcombe Hill soils most likely to be present across the area and
    - A disposal area footprint of 550 m^2 including allowance for the reserve area.

Specific wastewater infrastructure to meet the proposed structure plan requirements in Precinct 3 comprises:

- 2050m of 150mm sewer
- 2 small pump stations (1x optional alternative)
- 450m of 100mm sewer rising main

8.5 Precinct 4 – Pharazyn Street

8.5.1 Existing Situation

There are a number of large lot subdivisions within the precinct boundary along Pharazyn, Roots and Arnott Streets e.g. Bella Crescent. The majority of the precinct is largely rural with isolated dwellings particularly in the area bounded by Roots Street, Reids Line and the Makino Stream. Reticulated services include piped sewer, water and stormwater have been extended a significant distance up Pharazyn and Arnott Streets, as well as Church Street. The grid like roading pattern in the precinct is already largely established.

Historically stormwater drainage across the area has followed local shallow watercourses which drain in a south-westerly direction towards the Makino Stream. These water courses are now intercepted by road swale drains leading more directly to the stream. Construction of the Reids Line diversion channel to take stormwater from the Makino Stream to the Oroua River has interrupted a majority of upstream drainage. However gates, under the channel, provide for release of stormwater in the event of a significant rain event.

The existing roads are elevated above adjacent land in many areas (e.g. Pharazyn Street) such that a number of dwellings have floor levels at or below road and swale levels, resulting in flooding risks. Roads such as Roots and Port Street, running in a west east direction, acts as barriers to overland flow resulting in ponding where culverts or piped roading drainage capacities are too small.

8.5.2 Future Growth

8.5.2.1 Overview

Precinct 4 has been enlarged during the planning phase taking the precinct boundary to Reid's Line. While the area is gently sloping in a south-westerly direction, drainage pathways run at diagonals to the roading network, such that lower lying areas are located some distance from the road boundaries.

Trunk sewer and stormwater infrastructure has already been upgraded in Pharazyn and Arnott Streets. However the western section of the precinct does not easily connect with trunk sewers at the southern boundary. Stormwater drainage can be directed to the Makino Stream.

The proposed structure plan provides for large areas of high intensity (density 2) residential land to be zoned for immediate development on the eastern and southern extents of the precinct. Deferred areas are along the northern and western sides of the precinct. Effective areas and lot numbers for these areas net of reserve and open space areas are summarised in Table 8-4 below.

Table 8-4: Precinct 4 Areas and Lot Yield

Development Type	Zoning Status	Area (ha)	Lot Yield (Max)
Residential Density 1 > 2000 sq.m	Immediate	20	100
	Deferred	71	350
Residential Density 2 800 sq.m	Immediate	77	970
	Deferred	15	180
Open Space		0	
Reserve		4	
Total		**187**	**1,600**

A centrally located area has been designed as open space for the purpose of a future community recreation centre. There is an absence of any significant areas with slopes over 30%. Low lying areas

associated with the existing overland stormwater drainage channels may increase the areas that need to set aside for stormwater conveyance and detention storage.

8.5.2.2 Transportation

The transportation network set out in the structure plan includes:

- An additional local road half way between Churcher Street and Pharazyn Street extending due north from Sherwill Street to Roots Street and then running diagonally to intersect Reids line at the perpendicular.
- An additional local road running westwards from Pharazyn Street to the Makino Stream, but parallel to Roots Streets. The road would begin just south of the Pharazyn / Reids Line junction and following the line of property parcel boundaries.
- Extending Church Street as a new collector road beyond Roots Street to connect to the new western local road and then diagonally to Reids Line
- Provide a new local road along the entire western boundary of the precinct, on the eastern boundary of the Makino Stream connecting Reid's Line to Port Street East
- Upgrade the western section of Roots Street to the Makino stream and construct a new bridge over the Makino Stream to provide for connectivity to the western side of Feilding.
- Extension of Accolade Street to complete a complete ring with Pharazyn Street and provision of a connection through to Arnott Street.

8.5.2.3 Stormwater

In addition to stormwater generated from rainfall within the precinct, Precinct 4 also receives stormwater from catchment areas up gradient of the Reid's Line diversion. The Regional Council has undertaken flood hazard mapping and modelling for the 1 in 200 year event. For regional flood events between 1:10 yr AEP and 1:200yr AEP the Reid Line diversion operates preventing flows passing through to Precinct 4. However for small events up to 1:10yr AEP the culvert flap gates along the diversion are open and release water into Precinct 4. It is this additional stormwater that is likely to create flooding in this area, however the depth and extent of this flooding is currently unknown. It is understood that Council will engage Horizons Regional Council to undertake flood modelling for small events up to 1:10yr AEP.

No provision has been made for addressing existing flooding risks posed by regional flood events and out of precinct stormwater flows. Mitigation for these issues has the potential to increase the cost of stormwater management within the precinct. The stormwater assessment has also not considered impacts of the latest expansion of the zone.

As with Precincts 1,2 and 3 stormwater management has been based on the provision of stormwater collection and dry/wet pond detention to ensure hydrological neutrality (peak stormwater discharges post development are no greater than pre-development peak flows for a 6 hour event). This has been achieved by means of:

- Providing 16 m^3 of property level on-site stormwater tank storage which discharges via orifice control to 10m of 'french' drain or soakaway drain within each property
- Roadside open drains to collect road runoff, directed to detention ponds located at a sub-catchment level to attenuate the flows

Specific stormwater infrastructure to meet the proposed structure plan requirements in Precinct 4 comprise:

- 1600 property level stormwater detention tanks (16 m^3 each)
- Three (3) detention ponds storing 670 m^3 each (total 2010 m3) along the southern boundary of the precinct and preferably on the upstream side of Sherwill Street (excludes additional area to Reids Line)
- 10,200m of roadside open drains with an average cross-section of 1.0 m^2

- One 450mm, six 600mm, sixteen 750mm, and four 1050mm road culverts taking stormwater from one side of the road to the other
- 230 nos of catchpits with 225mm catchpit leads draining to adjacent open drains

8.5.2.4 Wastewater

Service provision is based on providing reticulated wastewater services for all potential lots, as the majority of the area is proposed for small lot development. Some larger lots may be developed in the western and northern sections such that lot area will allow for on-site wastewater treatment and disposal.

Specific wastewater servicing proposed includes:

- New gravity sewers laid in all the existing and new roads to be constructed. New sewers have already been constructed part way up Arnott and Pharazyn Streets in anticipation of new development and to service several new residential developments. However given the elevation of Pharazyn Street, the limit of gravity servicing in a westerly direction is approximately two lots deep. Beyond this wastewater will flow westwards by gravity.
- A new trunk sewer laid along the extension of Churcher Street, laid as deep as practical, to provide for servicing areas west of Pharazyn Streets. This may require an upgrade of the existing Churcher Street sewer downstream of the connection, or installation of a separate trunk main connecting to the existing downstream trunk sewer network.

Specific wastewater infrastructure to meet the proposed structure plan requirements in Precinct 4 comprises:

- 11,400m of 150mm sewer
- 450m of 225mm sewer

8.6 Precinct 5 – Turners Road / Industrial

8.6.1 Existing Situation

Precinct 5 comprises both the existing industrial area and a proposed extension between the current industrial estate and the Oroua River. The existing industrial estate is developed to around 20% of its total area, with a significant area yet to be developed. There are several existing wet industries including Ovation (meat processing) and Feilding Skins.

The existing roads of Darragh and Turner Roads, provide access to the middle and rear of the area, while most enterprises in the southern portion of the zone are accessed from Kawakawa Road. There is existing sewer and stormwater infrastructure in the roads, although the capacity is limited. Wet industries fronting on Kawakawa Road can discharge directly to the trunk sewer in Kawakawa Road.

8.6.2 Future Growth

8.6.2.1 Overview

The proposed services assessment has considered the requirement for servicing for both the existing industrial zone and the extension comprising a total of 113 ha. Allowing for road reserves, environmental reserves and some extension of stormwater swales the effective area of the zone is 97 ha.

8.6.2.2 Transportation

The transportation network set out in the structure plan includes:

- Retention of the existing Turners and Darragh Roads already formed.
- Extension of Turners Road in a southerly direction and then along the western boundary to link with Kawakawa Road to provide access along the entire southern boundary. The road formalises part of a track already used by Weber Wools to access their site.
- Two internal local roads, one parallel to the southern half of Turners Road and one to give access to the middle of the northern part of the zone. Again both roads follow access tracks currently used by existing businesses. These roads would provide routes for stormwater piped services and sewers.
- A new loop road allowing access into the middle of the extended area of the zone close to the Oroua River. The road would come off Turners Road in the north and link back to Turners Road in the south.
- The reserve area between the zone and the Oroua River will provide for future stop banking, riparian planning and creation of a walking / cycling track.

8.6.2.3 Stormwater

The key challenge in Precinct 5 is management of the very large volumes of stormwater generated from the large footprint industrial sites (assuming 0.9 runoff coefficient) to achieve hydrological neutrality. As with other precincts, stormwater flows are intended to be managed by providing detention storage, although provision of within lot detention will be limited to storage in parking and hard stand areas, as well as on-site soakage where soils allow.

Upgrades to the stormwater system have been designed around conveying stormwater from the development and through the precinct by way of large open drains. The drains can provide for some attenuation storage however additional detention storage is still required. Given the high runoff coefficient the total detention storage required (off and on-site) is estimated to be 60,000 m^3.

Specific stormwater infrastructure to meet the proposed structure plan requirements in Precinct 5 comprises:

- Detention storage comprising 60,000 m^3 provided by way of a combination of on-lot detention storage and out of precinct detention storage (based on previous assessment work only)
- 5500m of roadside open drains
- Five 750mm, and three 1200mm road culverts taking stormwater from one side of the road to the other
- 90 nos of catchpits with 225mm catchpit leads draining to adjacent open drains

8.6.2.4 Wastewater

The industrial precinct is located at the bottom of the sewer network, with the trunk sewer running along the western side of the zone in Kawakawa Road. High volume wet industries will be required to discharge directly to the trunk sewer.

Key assumptions for the wastewater infrastructure include:

- Industrial wastewater flows are based on the medium wastewater servicing category in NZS4404 of 0.5 l/s/ha.
- All new sewers are in or along road corridors

The estimated new infrastructure requirements include:

- 5700m of 150mm sewer

9 Summary

This services assessment has confirmed the infrastructure requirements associated with the proposed structure plan layouts, based on the potential precinct development densities and areas to provide for servicing requirements for full development. There are two residential density types (800 sq.m and >2000 sq.m). Council have identified significant areas of the precincts as deferred.

The extent of Council provided or specified services within the structure plans is limited with an emphasis on developer negotiated infrastructure planning. The shape, connectivity, style and pattern of development will depend heavily on the development guidelines and the requirements imposed on developers by Council.

In all cases the required infrastructure services provision is considered feasible, although in a number of locations where no roads have been indicated, corridors for stormwater and gravity wastewater will depend on securing negotiated easements during development discussions.

Plans of the layout and extent of the core infrastructure have been prepared and are included in Appendix A. In completing the assessment of proposed structure plan services, a number of areas of uncertainty remain including:

- The impact of the low lot yields arising from large areas of land with slopes in excess of 30% in Precincts 1, 2 and 3. Low lot yields coupled with significant infrastructure costs is likely to contribute to increased development costs per lot, impacting on the attractiveness of development in these areas.
- The precise extent of flooding risks posed by regional flood events and out of precinct stormwater flows past the Reid Line diversion and into Precinct 4 has yet to be confirmed. Addressing additional flows is likely to increase the cost of stormwater management within the precinct.
- Proposed stormwater management strategies and requirements for large footprint industrial sites in Precinct 5 remain unclear. Provisions for sustainable stormwater management practices (SUDS) including on-site soakage and within lot detention, have the potential to significantly reduce Council infrastructure requirements to achieve enhanced levels of services. It is recommended that Council clarify requirements as part of the development rules.
- Traffic safety issues associated with the proposed northern exit from Precinct 2 onto Halcombe Road, may trigger significant modification and upgrade requirements to Halcombe Road not currently included within this assessment.
- Other infrastructure costs which have not been included such as the cost of water supply reticulation and additional reservoir storage, construction of cycling and walking routes and higher costs associated with developer level infrastructure services to steeply sloping areas particularly in Precincts 1,2 and 3, may impact on the affordability and attractiveness of development in some precincts. It is recommended that Council develop a more comprehensive assessment of servicing costs.

There are very significant infrastructure costs associated with providing services to facilitate development in all five precincts. The deferred zoning status for significant areas has the potential to encourage targeted development, provided appropriate triggers and thresholds are set to control when development of these areas can be initiated. The structure plans propose significant areas of land for immediate re-zoning. When these are combined with existing lots and development proposals currently in process, there appears to be available development land well in excess of the foreseeable future demand.

10 Recommendations

The services assessment has identified six (6) key recommendations relating to further work as part of the structure planning process including:

1. Council proceeds with engaging Horizons Regional council to assess the stormwater flows which will drain through the open culverts in the Reid Line diversion and add to stormwater flows to be managed within Precinct 4. A further revision of the stormwater assessment should be undertaken for both the regional flows and the additional stormwater runoff volumes generated by the expanded zone. This change will impact on the nature and cost of stormwater solutions within the precinct.

2. Council promotes sustainable stormwater management practices within both its District Plan and Subdivision Code of Practice as a cost effective way of minimising the requirement for Council provision of stormwater infrastructure.

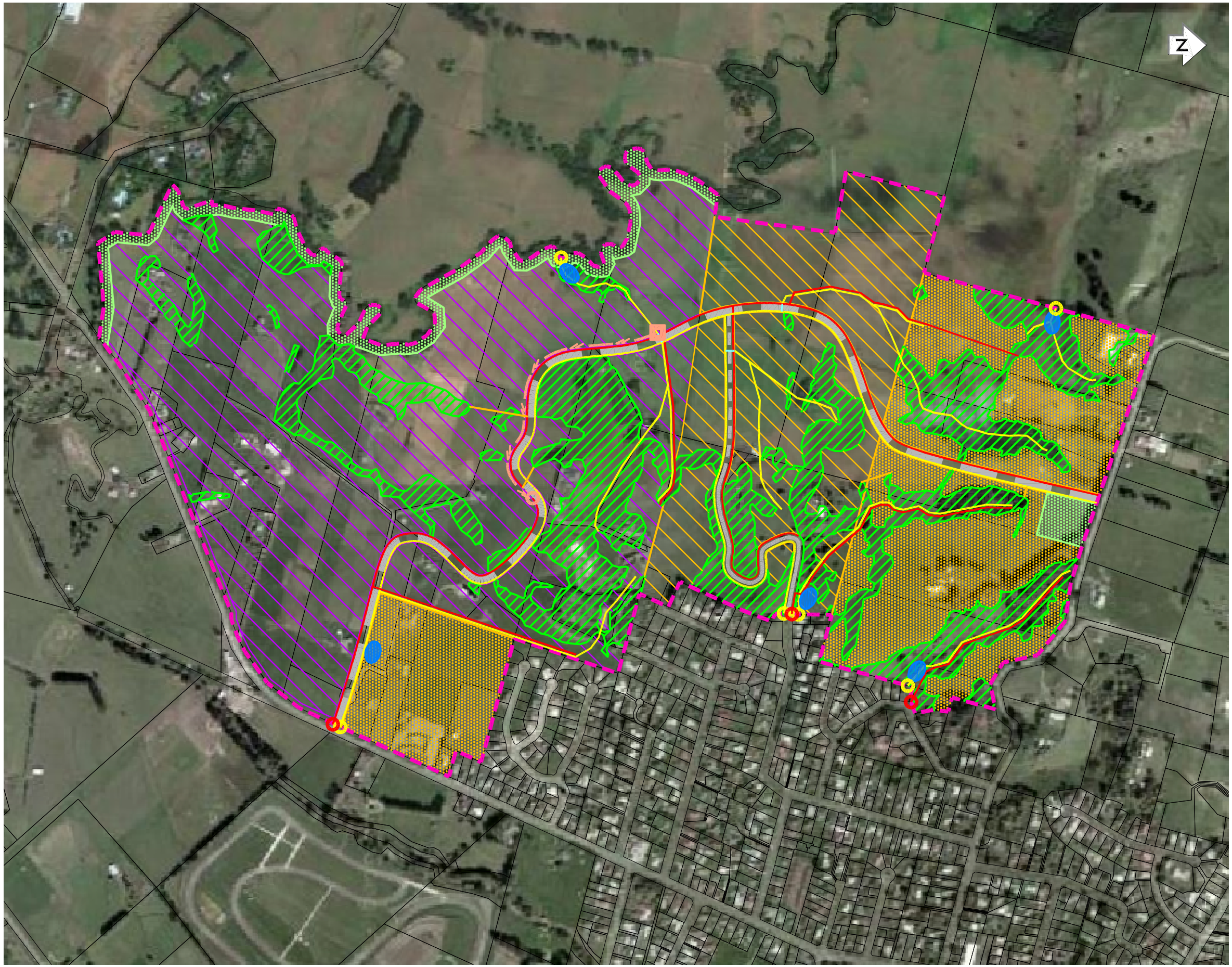
3. Council undertakes traffic safety assessment of the proposed northern exit from Precinct 2 onto Halcombe Road, prior to Precinct 2 being developed, as additional traffic volumes may trigger the requirement for significant additional cost to modify and upgrade the intersection and Halcombe Road.

4. Council ensures that other infrastructure costs required for each Precinct such as the provision of new water supply reticulation and additional reservoir storage are appropriately scoped, costed and included in asset management planning to enable accurate development contributions and rates assessments to be made.

5. Council prioritises the adoption of the structure plan particularly in areas where development is already occurring (e.g. Precincts 4 and 5) to ensure that options for connectivity and sustainable stormwater management solutions are not lost. In the absence of new infrastructure investment, current development runs the risk of increasing local flooding risks in the short term.

6. Council undertakes further prioritisation of the areas for immediate rezoning for development to limit further Council obligation in respect of investing in new infrastructure to service any development.

Appendix A Infrastructure Service Plans



LEGEND

PRECINCT BOUNDARY

- REGION

DEVELOPMENT AREAS

- RESIDENTIAL DENSITY 1 > 2000 sq.m
- RESIDENTIAL DENSITY 1 > 2000 sq.m (DEFERRED)
- RESIDENTIAL DENSITY 2 800 sq.m
- RESIDENTIAL DENSITY 2 800 sq.m (DEFERRED)
- EXISTING INDUSTRIAL
- INDUSTRIAL (DEFERRED)
- RESERVE
- OPEN SPACE / SLOPE / BUFFER AREA

ROADS

- EXISTING ROAD
- LOCAL ROAD
- COLLECTOR ROAD

SERVICES

- STORMWATER MAIN
- STORMWATER OPEN DRAIN
- STORMWATER STORAGE POND
- OPEN DRAIN DISCHARGE POINT
- WASTEWATER GRAVITY MAIN
- WASTEWATER DISCHARGE POINT
- WASTEWATER PUMP STATION
- WASTEWATER RISING MAIN
- RISING MAIN DISCHARGE POINT

DO NOT SCALE – IF IN DOUBT, ASK

240 mm

ORIGINAL SIZE A1

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
B	STORMWATER STORAGE PONDS ADDED	CM			12/06/13
A	ISSUED FOR INFORMATION	CM	GT		26/04/13

SURVEYED		
DESIGNED	Chris Minnee	20/04/2013
DRAWN	Chris Minnee	20/04/2013
CAD REVIEW	Garfield Toro	23/04/2013
DESIGN CHECK	Robert vanBentum	25/04/2013
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

MWH

Client: Manawatu District Council

FEILDING GROWTH PLAN

PRECINCT ONE
STRUCTURE PLAN

Status Stamp: **FOR INFORMATION**

Date Stamp: **12/06/2013**

Scales: (A1) 1:4000

Drawing No.: Z1818902-01-001-SK01

Rev.: B

LEGEND

PRECINCT BOUNDARY

- REGION

DEVELOPMENT AREAS

- RESIDENTIAL DENSITY 1 > 2000 sq.m
- RESIDENTIAL DENSITY 1 > 2000 sq.m (DEFERRED)
- RESIDENTIAL DENSITY 2 800 sq.m
- RESIDENTIAL DENSITY 2 800 sq.m (DEFERRED)
- EXISTING INDUSTRIAL
- INDUSTRIAL (DEFERRED)
- RESERVE
- OPEN SPACE / SLOPE / BUFFER AREA

ROADS

- EXISTING ROAD
- LOCAL ROAD
- COLLECTOR ROAD

SERVICES

- STORMWATER MAIN
- STORMWATER OPEN DRAIN
- STORMWATER STORAGE POND
- OPEN DRAIN DISCHARGE POINT
- WASTEWATER GRAVITY MAIN
- WASTEWATER DISCHARGE POINT
- WASTEWATER PUMP STATION
- WASTEWATER RISING MAIN
- RISING MAIN DISCHARGE POINT

NOT FOR CONSTRUCTION

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	REVISIONS	DRN	CHK	APP	DATE
B	STORMWATER STORAGE PONDS ADDED	CM			12/06/13
A	ISSUED FOR INFORMATION	CM	GT		26/04/13

SURVEYED		
DESIGNED	Chris Minnee	20/04/2013
DRAWN	Chris Minnee	20/04/2013
CAD REVIEW	Garfield Toro	23/04/2013
DESIGN CHECK	Robert vanBentum	25/04/2013
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

MWH

Client: Manawatu District Council

FEILDING GROWTH PLAN

PRECINCT TWO
STRUCTURE PLAN

Status Stamp: **FOR INFORMATION**

Date Stamp: **12/06/2013**

Scales: (A1) 1:4000

Drawing No.: Z1818902-01-001-SK02

Rev.: B

LEGEND

PRECINCT BOUNDARY

- REGION

DEVELOPMENT AREAS

- RESIDENTIAL DENSITY 1 > 2000 sq.m
- RESIDENTIAL DENSITY 1 > 2000 sq.m (DEFERRED)
- RESIDENTIAL DENSITY 2 800 sq.m
- RESIDENTIAL DENSITY 2 800 sq.m (DEFERRED)
- EXISTING INDUSTRIAL
- INDUSTRIAL (DEFERRED)
- RESERVE
- OPEN SPACE / SLOPE / BUFFER AREA

ROADS

- EXISTING ROAD
- LOCAL ROAD
- COLLECTOR ROAD

SERVICES

- STORMWATER MAIN
- STORMWATER OPEN DRAIN
- STORMWATER STORAGE POND
- OPEN DRAIN DISCHARGE POINT
- WASTEWATER GRAVITY MAIN
- WASTEWATER DISCHARGE POINT
- WASTEWATER PUMP STATION
- WASTEWATER RISING MAIN
- RISING MAIN DISCHARGE POINT

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
B	STORMWATER STORAGE PONDS ADDED	CM			12/06/13
A	ISSUED FOR INFORMATION	CM	GT		26/04/13

SURVEYED		
DESIGNED	Chris Minnee	20/04/2013
DRAWN	Chris Minnee	20/04/2013
CAD REVIEW	Garfield Toro	23/04/2013
DESIGN CHECK	Robert vanBentum	25/04/2013
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

MWH

Client: Manawatu District Council

FEILDING GROWTH PLAN

PRECINCT THREE
STRUCTURE PLAN

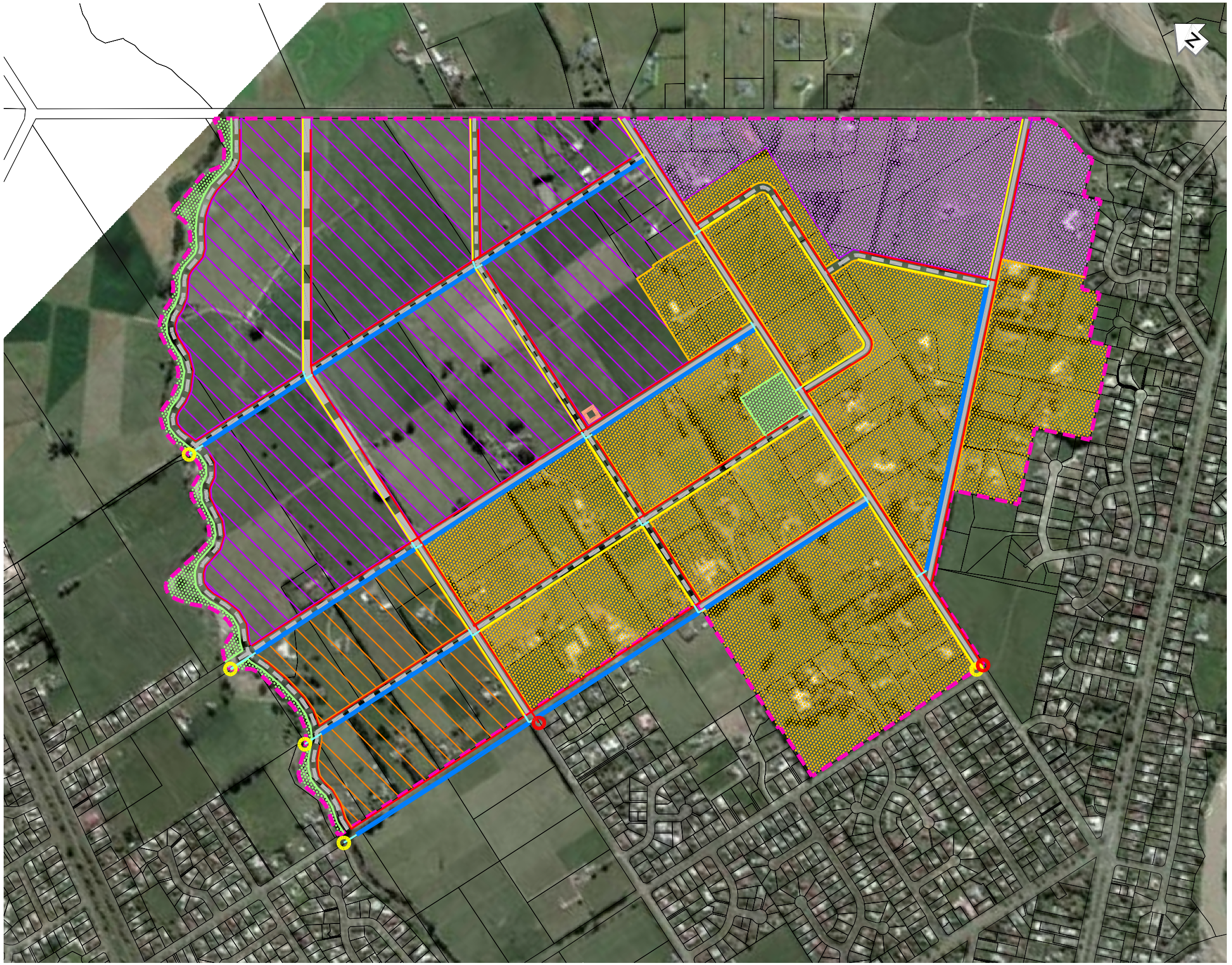
Status Stamp: **FOR INFORMATION**

Date Stamp: **12/06/2013**

Scales: (A1) 1:4000

Drawing No.: Z1818902-01-001-SK03

Rev.: B



LEGEND

PRECINCT BOUNDARY

- REGION

DEVELOPMENT AREAS

- RESIDENTIAL DENSITY 1 > 2000 sq.m
- RESIDENTIAL DENSITY 1 > 2000 sq.m (DEFERRED)
- RESIDENTIAL DENSITY 2 800 sq.m
- RESIDENTIAL DENSITY 2 800 sq.m (DEFERRED)
- EXISTING INDUSTRIAL
- INDUSTRIAL (DEFERRED)
- RESERVE
- OPEN SPACE / SLOPE / BUFFER AREA

ROADS

- EXISTING ROAD
- LOCAL ROAD
- COLLECTOR ROAD

SERVICES

- STORMWATER MAIN
- STORMWATER OPEN DRAIN
- STORMWATER STORAGE DRAIN
- OPEN DRAIN DISCHARGE POINT
- WASTEWATER GRAVITY MAIN
- WASTEWATER DISCHARGE POINT
- WASTEWATER PUMP STATION
- WASTEWATER RISING MAIN
- RISING MAIN DISCHARGE POINT

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
B	STORMWATER STORAGE DRAINS ADDED	CM			12/06/13
A	ISSUED FOR INFORMATION	CM	GT		26/04/13

SURVEYED		
DESIGNED	Chris Minnee	20/04/2013
DRAWN	Chris Minnee	20/04/2013
CAD REVIEW	Garfield Toro	23/04/2013
DESIGN CHECK	Robert vanBentum	25/04/2013
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

MWH

Client: Manawatu District Council

FEILDING GROWTH PLAN

PRECINCT FOUR
STRUCTURE PLAN

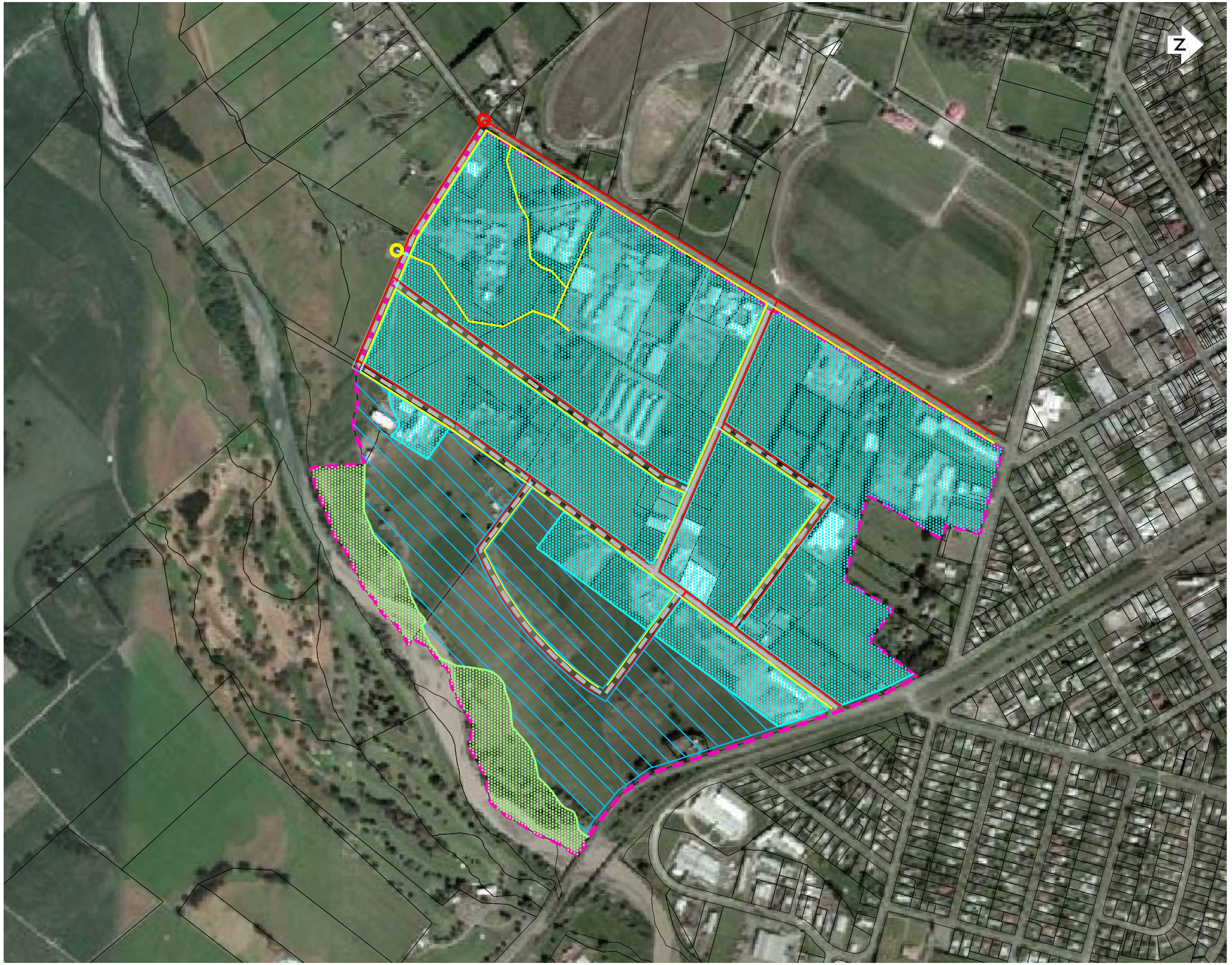
Status Stamp: **FOR INFORMATION**

Date Stamp: **12/06/2013**

Scales: (A1) 1:4000

Drawing No.: Z1818902-01-001-SK04

Rev.: B



LEGEND

PRECINCT BOUNDARY

- REGION

DEVELOPMENT AREAS

- RESIDENTIAL DENSITY 1 > 2000 sq.m
- RESIDENTIAL DENSITY 1 > 2000 sq.m (DEFERRED)
- RESIDENTIAL DENSITY 2 800 sq.m
- RESIDENTIAL DENSITY 2 800 sq.m (DEFERRED)
- EXISTING INDUSTRIAL
- INDUSTRIAL (DEFERRED)
- RESERVE
- OPEN SPACE / SLOPE / BUFFER AREA

ROADS

- EXISTING ROAD
- LOCAL ROAD
- COLLECTOR ROAD

SERVICES

- STORMWATER MAIN
- STORMWATER OPEN DRAIN
- OPEN DRAIN DISCHARGE POINT
- WASTEWATER GRAVITY MAIN
- WASTEWATER DISCHARGE POINT
- WASTEWATER PUMP STATION
- WASTEWATER RISING MAIN
- RISING MAIN DISCHARGE POINT

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

NOT FOR CONSTRUCTION

REV	REVISIONS	DRN	CHK	APP	DATE
A	ISSUED FOR INFORMATION	CM	GT		26/04/13

SURVEYED		
DESIGNED	Chris Minnee	20/04/2013
DRAWN	Chris Minnee	20/04/2013
CAD REVIEW	Garfield Toro	23/04/2013
DESIGN CHECK	Robert vanBentum	25/04/2013
DESIGN REVIEW		
APPROVED		
PROF REGISTRATION:		

MWH

Client: Manawatu District Council

FEILDING GROWTH PLAN

PRECINCT FIVE
STRUCTURE PLAN

Status Stamp: **FOR INFORMATION**

Date Stamp: **26/04/2013**

Scales: (A1) 1:4000

Drawing No.: Z1818902-01-001-SK05

Rev.: A

MWH

BUILDING A BETTER WORLD

ABOUT MWH IN NEW ZEALAND

MWH in New Zealand has been providing private and public sector clients with infrastructure and environmental expertise for over 100 years.

Our offices across New Zealand are part of a global operation of 7000 staff in 35 countries giving us an unparalleled ability to combine local knowledge with international expertise.

Around the world our purpose is to work with clients and communities to help build a better world.

In New Zealand our extensive range of services covers the following disciplines:

- Asset Management
- Business Solutions
- Civil and Structural Engineering
- Energy Generation
- Environmental Science and Management
- Geoscience and Geotechnical
- Mechanical, Electrical and Building Services
- Programme Management
- Planning: Statutory and Strategic
- Roads and Highways
- Solid Waste
- Stormwater
- Surveying
- Transport Planning
- Water Resources
- Water Supply
- Wastewater

To find out more about what we do and how we can assist visit www.mwhglobal.co.nz or www.mwhglobal.com