Tonkin & Taylor

T&T job no: 61143
20 August 2007

Boffa Miskell Ltd
P O Box 11 340
Wellington

Attention: Mr M. Baily

Dear Marc

Nelson - Richmond Combined Structure Plan

1 Introduction

Boffa Miskell Ltd has engaged Tonkin & Taylor to assist with the engineering and environmental aspects associated with the development of a combined structure plan for the Nelson – Richmond area. This letter report summarises the findings of our preliminary assessment into the environmental and engineering matters associated with development of the structure plan area.

Boffa Miskell Ltd has prepared a draft land use plan that shows a range of residential development types, other land uses, and indicative road access points and alignments.

A copy of the draft plan is provided in Appendix A, and shows:

- The location of some 100 hectares (ha) of land identified for standard density residential development;
- Approximately 33 ha of low density residential land with lot sizes in the order of 2,000 square metres (m^2) on average;
- Approximately 15 ha of mixed-density land;
- Recreation and education land situated around Saxton Fields; and
- A rural greenbelt to provide separation between Nelson and Richmond and to maintain a natural backdrop to the structure plan area.

2 Methodology

Tonkin & Taylor has undertaken a preliminary assessment of the likely natural and physical resources, and engineering constraints to development of the structure plan area. This work was predominantly a desk top exercise (drawing on the local knowledge of the structure plan area), discussions with relevant council staff, and site inspections of selected areas.

The tasks undertaken by Tonkin & Taylor included the following:

- An analysis of aerial photographs and topographic maps covering the structure plan area;
- Review of geological and geo-morphological information held by Tonkin & Taylor Ltd;
- Identification of surface water resources in the structure plan area including catchments, stream channels, and existing dams and ponds etc;
- Review of existing water supply, wastewater and stormwater infrastructure;
- Workshops with Tasman District Council (TDC) and Nelson City Council (NCC) staff to identify infrastructural matters associated with development of the structure plan area;
- Review of relevant engineering reports provided by NCC and TDC;
- Site inspections and limited discussions with selected landowners regarding the development potential of the land; and
- Review of the relevant statutory plans and engineering design standards for the area.

The information collected above has been set out in a series of annotated plans for the structure plan area showing:

- Current level of service for water supply and options to service the structure plan area (Map 1)
- Options for the provision of wastewater services for the area (Map 1);
- Location of surface water resources, main surface water catchments and possible stormwater works required to service the structure plan area (Map 2);
- The location of horticultural land and other potential hazardous areas (Map 3);
- The location of faults etc (Map 4).
- The location of possible upgrade works required for the Hill Street area (Map 5).

These plans are provided in Appendix B.

A summary plan is provided in Appendix C.

This letter report sets out the basis for the options selected and some criteria for the sustainable development of the structure plan area. It also outlines the further work that may be necessary to address current areas of uncertainty.

It is our expectation that the annotated maps will be used by Boffa Miskell Ltd to assist them to complete the structure plan maps and that the information presented in this report will be used by Boffa Miskell in its final report to both councils.

2.1 Limitations of the study

The engineering and development options considered in this report are formed on the basis of a draft structure plan developed by Boffa Miskell, and it must be recognised that changes to the structure plan may have implications for the conclusions and recommendations set out

in this report. Our calculations are based on a likely yield of some 200 lots or dwelling units in the TDC area and 770 lots or dwelling units in the NCC area.

It needs to be recognised that the scope of this work is limited. Accordingly, the information and conclusions in this report are not sufficient for design, or detailed costing purposes without further investigation and assessment.

Landscape and ecological values are addressed by others.

3 Water supply

Map 1 shows the extent of water supply to the structure plan area that can be achieved by TDC and NCC at present.

NCC advises it would be difficult to supply water with its existing water supply infrastructure. TDC advises that it has sufficient bulk supply to service the area but at present, it can only service up to approximately 40m above sea level and has insufficient capacity for 24 hours of storage as required by TDC's current engineering standards.

The Champion Road reservoir is located on a fault scarp and piped stream channel, and as a result is relatively vulnerable to damage from seismic or significant flood events.

A new reservoir would be required to service the structure plan area, and a general location for a reservoir is shown in Map 1. It would be desirable to locate the reservoir close to the existing Champion Road site but at an elevation that could service the entire structure plan area by gravity. This is likely to place it at an elevation of approximately 140 m above sea level, to provide sufficient head to meet TDC's design level of service (30 m) and to allow for likely head losses in the reticulation system[1].

A pumping station and rising main from Champion Road reservoir would also be required. The reservoir itself would require a volume of some 800,000 litres to provide 24 hours of storage to the structure plan area. Given that the current Champion Road reservoir is unable to provide sufficient storage to meet TDC's desired levels of service, it may be advisable to further increase the storage of the new reservoir to provide for this.

4 Wastewater management

The draft plan provided by Boffa Miskell Ltd was used to estimate the amount of wastewater likely to be generated from the structure plan area. The wastewater generation rates were established using Method VI, as set out in the Nelson City Council Engineering Standards 2003. The result of this assessment are summarised in Table 1 below.

[1] This distance from the proposed reservoir to the furthermost point of the structure plan area is approximately 4,000 m. At a maximum allowable head loss of 2 m per 1,000 m of pipeline, total reticulation head losses could be up to 8 m.

Table 1: Wastewater flows for Nelson Richmond Structure Plan area.

	Area (ha)	Flow (L/s)
Nelson City		
Residential	43.8	30
Low density residential	9.9	6
High density residential	16.9	14
Total	**-**	**50**
Tasman District		
Residential	54.6	37
Low density residential	23.3	14
Total	**-**	**51**

This method was checked and verified by calculating average wastewater flows based on population densities and average water consumption figures. Peak daily flows and peak wet weather flows were also calculated for comparative purposes, and this indicated that the flows estimated above take into account peak flows, which will occur from the two catchments from time to time.

Wastewater connections are available at Hill Street (200 mm diameter) and from Saxton Field (300 mm diameter).

It is possible that development of the TDC area of the structure plan in the vicinity of Park Drive will require the existing wastewater network to be upgraded, along part of Hill Street and Park Drive (a total length of approximately 240 m) to accommodate increased flows from increased density of development in this part of the structure plan area, as shown in annotated maps.

However, it is possible that development of the NCC area of the structure plan area can discharge to the existing 300 mm diameter connection without modification.

We understand that the Nelson Regional Sewerage Business Unit is undertaking a review of the capacity of the regional wastewater network and recommend that increases in flows likely to be brought about by the development of the structure plan area are taken into account.

It is likely that all of the structure plan area can be serviced by a gravity system.

5 Surface water resources and stormwater management

The structure plan area sits within three natural surface water catchments that drain to Reservoir Creek, Saxton Creek and Orphanage Stream. The urban parts of these catchments are shown in Map 2. Urban development however is most likely to be concentrated in the catchments of Reservoir Creek and Saxton Creek. As only minor development is likely to

occur in the Orphanage Stream catchment, no assessment of this catchment has been undertaken.

5.1 Reservoir Creek

Reservoir Creek (upstream of Stoke /Salisbury Road) has a catchment area of approximately 230 hectares. It ranges in elevation from near sea level to 500 m above sea level some 4 km inland. The catchment is relatively flat in its lower urban reaches but steepens significantly towards its headwaters.

Calculations of rainfall run off indicate that the 50-year return period peak discharge from the catchment (at Stoke Road) is in the order of 11 cubic metres per second (m^3/s). Following full development of the structure plan area, peak flows are likely to increase to approximately 13 m^3/s for a 50-year return period event.

Reservoir Creek is piped under several roads and residential areas, and development of the catchment will need to consider the effects of the relatively minor increase in peak flow on their capacity.

At a detailed level, it is likely that the area south of Hill Street and Champion Roads will require a specific assessment of the local stormwater infrastructure to ensure that increased density of lots proposed by the draft plan can be accommodated within the existing stormwater infrastructure, or to identify any necessary improvement works to existing infrastructure. Because this area has already undergone some residential development (albeit relatively large lots) it would be undesirable to construct (effectively retro-fit) a stormwater detention pond or similar device in this area. Should any upgrade works prove unfeasible TDC may need to consider on-site measures (such as the use of rain water tanks) to manage stormwater run off.

5.2 Saxton Creek

Saxton Creek (upstream of Stoke /Salisbury Road) has a catchment area of nearly 600 ha that ranges in elevation from near sea level to 500 m above sea level some 3.5 to 4 km inland. The catchment is relatively flat in its lower reaches but steepens significantly towards its headwaters.

Calculations of rainfall run off indicate that the 50-year return period peak discharge from the catchment (at Stoke Road) is in the order of 24 m^3/s. It is unlikely that urban development will result in increased peak flows at Stoke Road in a 50-year return period event, but there may well be some local adverse effects on the Creek associated with the discharge of stormwater from urban land.

An assessment of the hydraulics of the Saxton Creek catchment has been undertaken by Cameron Gibson & Wells Ltd (2004)[2], and upgrades to the existing irrigation pond on Saxton Creek were proposed in the report to manage the effects of development of the lower part o the Saxton Creek Catchment.

[2] Cameron Gibson & Wells Ltd, October 2004, Report for Nelson City Council, Saxton Creek detention requirements for the Saxton Field development.

NCC has advised that these improvement works provide management for the lower part of the catchment only and additional works would be needed to manage peak flows from residential development south of Hill Street North.

The Hill Street North area can be divided into two small urban sub-catchments draining to the main stem and a tributary of Saxton Creek as shown in Map 2. Here some detention of stormwater would likely be needed to manage peak flows at a local level. These devices should be off-line to avoid adverse effects (increased stream temperatures, barriers to fish migration) on stream ecology. The size and location of these devices is the subject of further detailed design.

5.3 Management of existing ponds and dams

The aerial photographs and maps used in this study identify a number of farm ponds that are located upstream of the structure plan area. Those ponds that have been formed through the construction of a dam[3] will be subject to an increase management regime in the near future under the Building Act.

This will require ongoing management and maintenance that is in proportion to the potential impact that the dam may have on people and property downstream. At present, the downstream environments are predominantly rural but with the development in the structure plan area the potential impact that these dams may have will increase. This could require a greater level of management input (including necessary upgrades) by their owners, and could be seen as a reverse sensitivity issue.

5.4 Climate change

Finally, the management of stormwater and flooding requires the consideration of the effects of climate change on the nature and frequency of extreme rainfall events in the long-term. It would be prudent to consider the projected effects of climate change on existing infrastructure to ensure that the cumulative effects of development within the structure plan area are addressed.

5.5 Management of existing riparian corridors

A riparian margin around identified surface water bodies is recommended to assist in the management and protection of the stream channel and its riparian margins. This margin should be sufficient to provide for the maintenance and enhancement of in stream and riparian ecology and to allow for access along these watercourses.

6 Contaminated sites

The structure plan area has been the subject of significant historic and current horticultural land use, with more extensive livestock farming on the more elevated ground. Both land use

[3] Under the Building Act (2004) a dam is defined as an artificial barrier or a significantly modified natural feature that retains more than 3 metres water depth and holds more than 20,000 cubic metres of water.

practices can have resulted in the contamination of the soil which could make parts of the structure plan area unsuitable for residential development without remedial works.

Both TDC and NCC have policies and rules for the management of contaminated land. We consider that these are sufficient to manage development of the structure plan area.

7 Geotechnical hazards

The structure plan area generally consists of flat land that extends for about 1km to the east of the Waimea Inlet, gently rolling foothill slopes that extend along the toe of the Barnicoat range, and moderately steep to steep hill slopes that form the western flank of the Barnicoat range. The transition between each landform is generally sharp marked by a notable change in slope gradient. Gullies, which are deeply incised into the steeper slopes fall to the west and southwest and progressively converge into three stream systems, Reservoir, Saxton and Orphanage Creeks. These streams have formed coalescing alluvial fans that prograde from the foothills to the coast.

The geology of the structure plan area is covered by New Zealand Geological Survey, Map sheet N27 (part) Richmond (Johnston, MR 1982). The geomorphology strongly reflects the underlying geology as shown on this map. An outline of the geology from the oldest to youngest formations is provided below. A sketch of the main geological units is provided in Appendix B.

The oldest rocks are indurated sandstones and siltstones of the Maitai Group. These form the steepest slopes in the southeast corner of the structure plan area and all of the higher slopes of the Barnicoat Range upslope of the structure plan area.

The Eighty-eight Fault separates the Maitai Group rocks from the Triassic age Richmond Group rocks. These are indurated, although often shattered and highly weathered rocks, and include a variety of lithologies, including siltstone, sandstone conglomerate and occasional andesite and are widespread on the lower slopes of the range.

Tertiary age “soft” rocks form the foothills and gentle to moderately inclined slopes at the base of the Barnicoat range. They are separated from the older rocks by the Waimea Fault, the trace of which is generally discernable by a pronounced step in the ground profile where the gentle to moderately inclined foothill slope give way to moderately steep to steep Barnicoat range slopes. The Marsden Coal Measures Formation is the oldest of the Tertiary rocks and is exposed in the foothill slopes immediately to the north and south of Champion road. It consists of sandstone, siltstone and mudstone with occasional thin bituminous coal seams. Port Hills Gravel formation, dominated by claybound gravel, with occasional beds of siltstone and lignite is the predominant rock unit in the central part of the structure plan area, and extends just to the south of Champion Road. Moutere Gravel Formation has been mapped in a low north west trending spur to the south of Champion Road and in a small area just to the north of Champion Road. It consists of weathered greywacke sandstone gravel in a silty matrix.

Quaternary age Stoke Fan Gravel Formation and recent stream alluvium, include unconsolidated stream laid deposits of typically fine platy gravels infill the gully floors and form the gentle fan surfaces that extend out to the present day coastline.

7.1 Seismic hazards

The Eighty-eight Fault and the Waimea Fault both cross the structure plan area. The approximate location of these faults is provided on the annotated map in Appendix B. These faults are part of the Waimea-Flaxmore Fault System that extends north from the Alpine Fault near Lake Rotoiti and accounts for the progressive uplift of rock units to form the Barnicoat Range and Richmond Ranges. Evidence suggests that activity of the Waimea-Flaxmore Fault System decreases northwards away from the Alpine Fault.

However, evidence of rupture of the ground surface exits within the Waimea-Flaxmore Fault system in the vicinity of the structure plan area and both the Waimea and Eighty-eight faults and are considered to be active faults for planning purposes. Both faults are shown on the Nelson Resource Management Plan and the Tasman Resource Management Plan, and where the faults can be located, a building setback zone is specified in the plans (5m in Nelson and 10m in Richmond).

Strong ground shaking arising from an earthquake on the Waimea-Flaxmore Fault system or from the Alpine Fault, located approximately 25km east of the study area is considered a more likely hazard than direct ground rupture. Therefore the seismic hazard for the entire structure plan area is similar.

7.2 Slope stability

Slope stability is mainly influenced by bedrock geology and structure (the nature and inclination of layering, including bedding and defects including faults within the bedrock), proximity to faults, and the slope inclination. Areas of moderate to high slope stability risk in the structure plan area are indicated on the attached annotated map in Appendix B.

Slopes to the east of the Eighty-eight Fault, are stable and although underlain by competent rock, are steep and difficult to access.

Slopes between the Eighty-eight and Waimea Faults are generally stable, although the steeper gully side slopes show evidence of localised shallow instability. Provided, access is feasible, the scale of instability and slope gradients should not preclude development.

The foothill slopes show varying development of instability. This is most notable along a corridor adjacent to the location of the Waimea Fault, and where Marsden Coal Measure Formation is exposed on moderately steep slopes to the south of Champion Road. Elsewhere, there is localised shallow instability along gully sides, particularly where Port Hills Gravel Formation is folded about the Marsden syncline. With care and provided specialist geotechnical input is provided, it can be feasible, although expensive, to develop land where instability is noted.

8 Other matters

8.1 Electricity transmission lines

There are several electricity transmission lines running through the study area, as shown in Map 3. The Ministry for the Environment has released a Proposed National Policy Statement

(NPS) on Electricity Transmission[4]. The objective of the proposed NPS is to recognise the national significance of the electricity transmission network. With regard to development in the vicinity of electricity transmission lines, policy 4 states:

Any new development that is sensitive to the effects of the electricity transmission network should be managed in a way that does not compromise efficient operation of the electricity transmission network.

The final land use patterns and supporting policies, objectives and rules that are established through this structure plan process will need to be consistent with the proposed national policy statement.

8.2 Planning considerations

NCC has a small area of landscape overlay in the northern corner of the study area. Development is restricted in this area under the Resource Management Plan due to aesthetic issues associated with the site.

TDC has a proposed upland urban boundary in the southern corner of the study area. This is designed to protect the aesthetics of the hill country above Richmond.

8.3 Roading

The draft plan shows a number of road access points and proposed alignments. Development of the structure plan area will most likely require an upgrade to Champion Road and the roundabout at Champion and Stoke Roads. The effect of residential development on the Champion Road Stoke Road intersection and SH6 would also need to be considered in further detail.

The provision of an extension from Hill Street North (TDC) to Suffolk Road (NCC) across the back of Saxton Field would have benefits in respect of connectivity to Nelson City for new households in the structure plan area. However, there is a risk in such a connection that this will direct traffic from this and other areas of north Richmond that would otherwise use the arterials of SH6 and Main Road Stoke and create an unplanned short cut that would be detrimental to the planned road hierarchy and the amenity in the Stoke area. Such a connection, unless achievable within the public land of Saxton Field would also require the acquisition of private land to achieve and this may be a difficult and lengthy process. At this time it is suggested that the connection between Hill Street North and Suffolk Road be made for cycling and walking and that vehicular traffic connection be considered in the future and in association with the subject landowner (Raine) in tandem with the detailed planning for the mixed density area on the structure plan (shown as Area E).

[4] Ministry for the Environment, May 2007, Proposed National Policy Statement on Electricity Transmission, Ministry for the Environment, Wellington.

9 Applicability

This letter report has been prepared for Boffa Miskell Ltd as our client, in respect of a preliminary study into natural and physical resources and constraints to development of the Nelson Richmond structure plan area. This report shall not be used for any other purpose or by any other person without our prior review and approval.

TONKIN & TAYLOR LTD

Environmental and Engineering Consultants

Report prepared by:

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P/P

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Authorised for Tonkin & Taylor by:

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P/P

Peter Cochrane

Project Coordinator

20-Aug-07
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Appendix A: Richmond East Draft Structure Plan

Appendix B: Annotated maps

Appendix C: Summary Draft Structure Plan

Draft For Discussion

SK-101 revision 00

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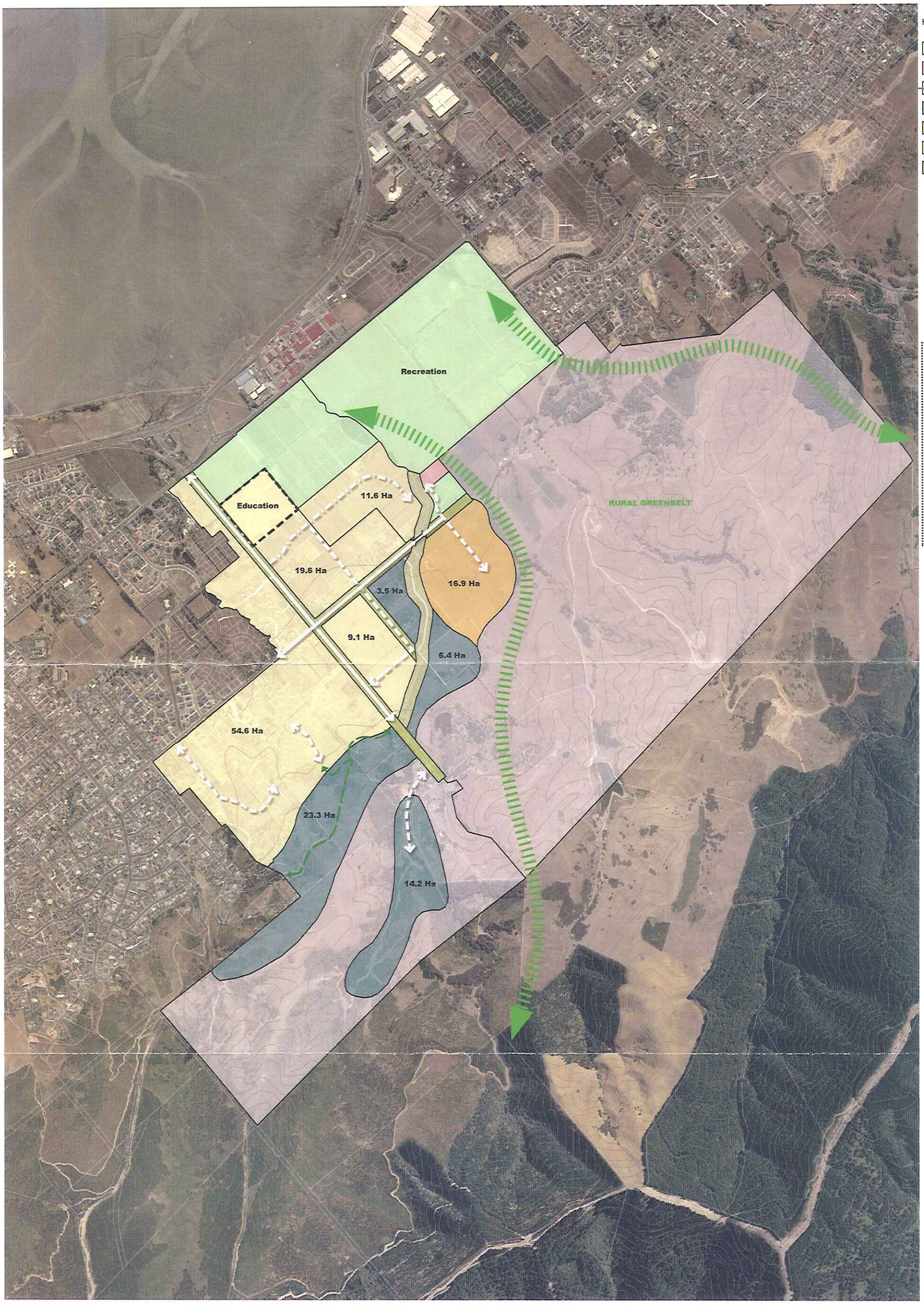


KEY

- Recreation
- Commercial
- Greenway with Stormwater Channel
- Greenbelt Residential
- Mixed Density Residential
- Residential
- Green Lane
- Bridge
- Main Highway
- Collector Road
- Local Feeder Road
- Pedestrian Linkages

SERVICES & TREES - TBC

- Stormwater Infrastructure
- Existing Wastewater Infrastructure
- Proposed Wastewater Infrastructure
- PS Wastewater Pump Shed
- Existing Water Infrastructure
- Significant Existing Tree Blocks- to be retained

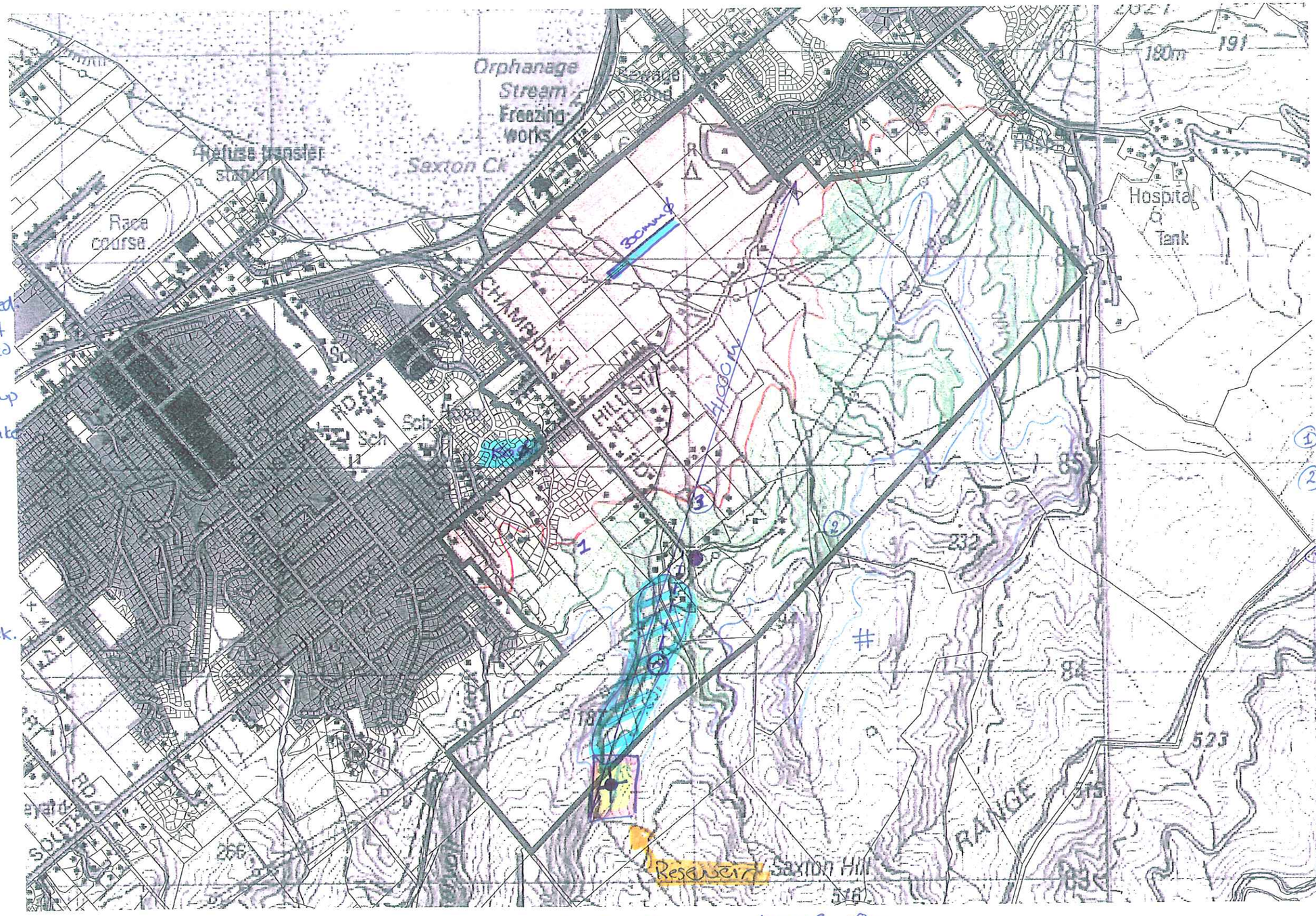
Boffa Miskell

Richmond East Structure Plan

Reference: W07037

4 JULY 2007

Reference: W07037_ME_RichmondEast/Graphics/indesign



NCC comment:

Upgraded A1 option preferred.
- avoids fault
- " restricted build
- provide backup wrt fault rupture / Equake

⊕ to supply SP area.

w/water 300mm ϕ to Wahanga details to check.

TDC

H2O supply.

Opt A upgrade •
A1 serve ⊕ +
B serve SP #
Area:

1 m3 / household 24 hr storage.

could be located along forestry access Road (pvt)

① Dunstn Dam to go
② Raine Dam
- increase risk
- inspected + assessed.
③ Rick Griffen dam.

WWater

Growth area OK to service 54.6 ha.

⊕ area may req pls & rm + transitia to gravity Main to service.

30 els

NCC = 43.8 ha RS
= 6.9 ha ⊕ res 14 els
= 99 ha low ρ res 66 els.

TDC 54.6 ha - 37 els.
77.5 ha - 22 els

Total 110 els DW Flow: ∴ 60 els.

level 100
30
8 m
~ 14cm

4,000 x 2 = 8m.

40m
100m
130m

0-40m
40-100m

Tonkin & Taylor Environmental & Engineering Consultants ■ Hamilton □ Auckland □ Christchurch □ Nelson □ Wellington □ Whangarei	DRAWN	XXX	Jun.07
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RICHMOND–NELSON STRUCTURE PLAN
Water Supply

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NCC:
- Saxton Creek culvert not being upgraded
- Orphanage St upgraded + cycle way.

Agreed that:
Saxton Field pond manage land NW Hill St
Land S/W Hill St need to be managed on-site.

NCC:
TDC to upgrade Champion Road.

H2O + s/water
Existing Dams
① Filled-in
② Assess wrt Building Act.
③ Assess wrt Building Act

Saxton Catchment.
- 57 ha res land to Saxton Creek. Boffa
- cf 474 rural
  122 res
  596 ha total
- upgrade irrigation pond
- possible u/stream effects.

urban s/w catchments
- Saxton
- Hill St (1)
- " " (2)
- Park Ave

Flow paths to surface water bodies.
Stormwater management Areas

Reservoir Creek
Saxton Creek Catchment
Orphanage Stream Catchment

Flood path - 15 m wide (NCC Resource Management Plan)
Surface water bodies
Approx. catchment boundaries
Potentially limiting s/w infastructure

Tonkin & Taylor
Environmental & Engineering Consultants
Hamilton
Auckland Christchurch
Nelson Wellington Whangarei

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RICHMOND–NELSON STRUCTURE PLAN
Water Management

FIG. No. Map2 REV. I 0

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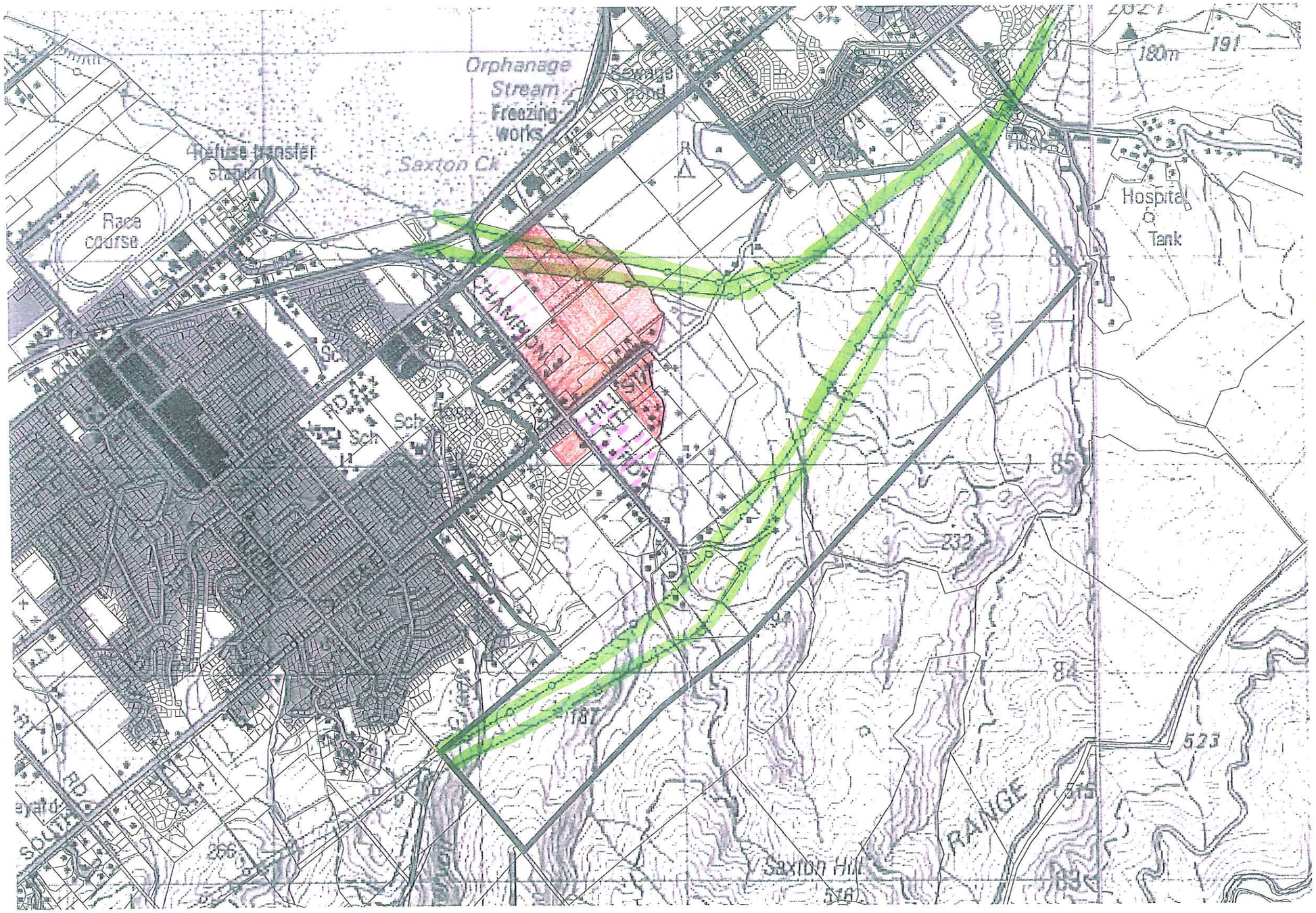

HT Power lines

horticulture

Inferred H/culture land

Tonkin & Taylor Environmental & Engineering Consultants Hamilton Auckland · Christchurch Nelson · Wellington · Whangarei	DRAWN	XXX	Jun.07
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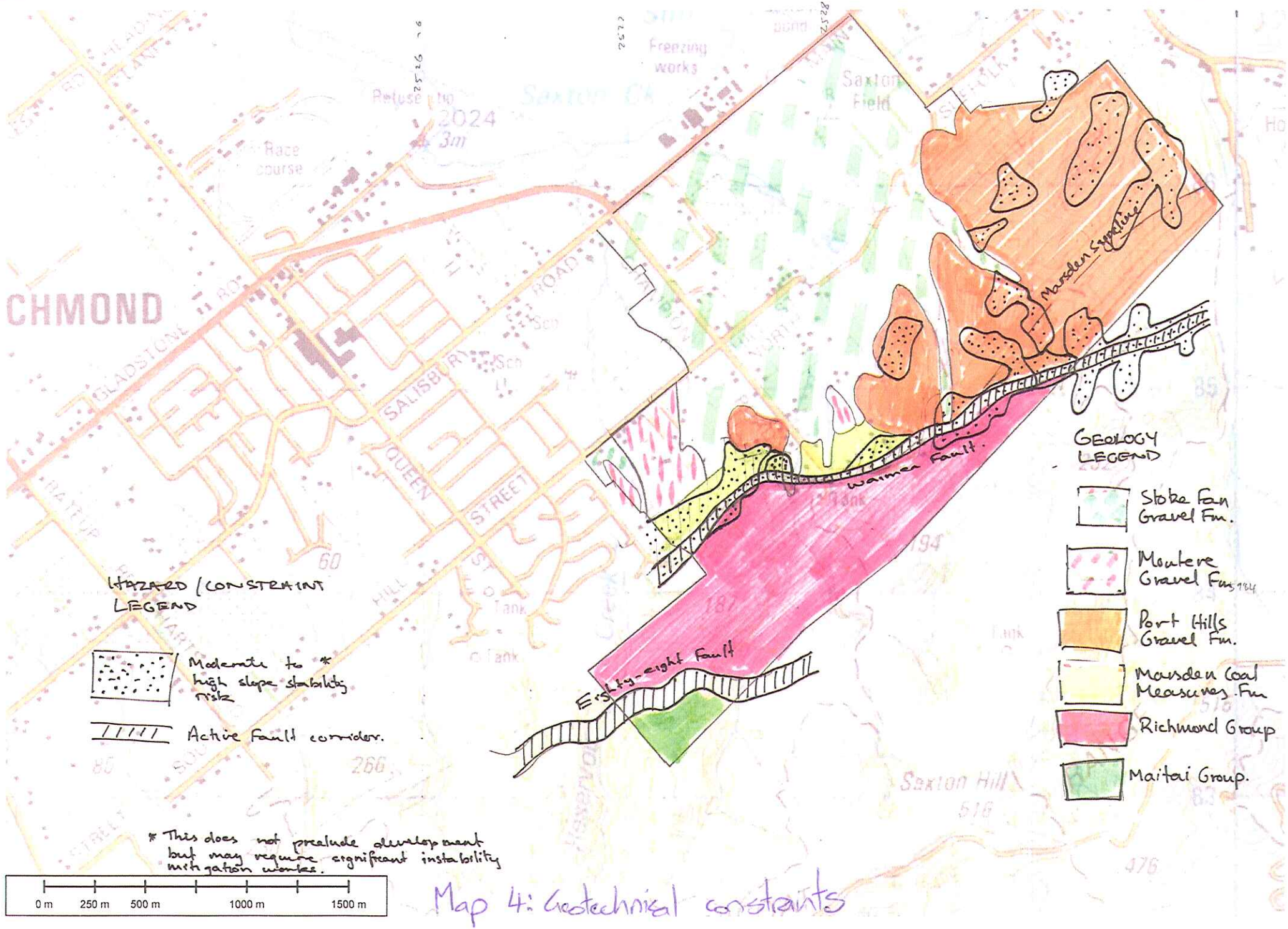
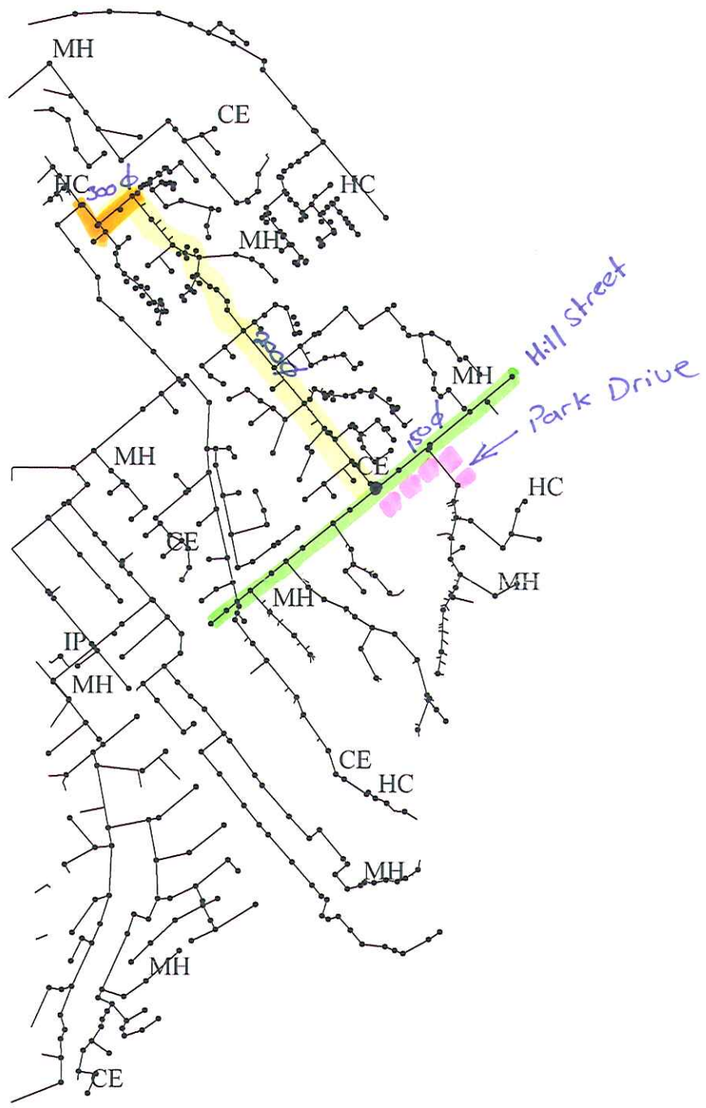
RICHMOND–NELSON STRUCTURE PLAN

Contaminated land
Technological Hazards



Map 4: Geotechnical constraints

Waste Water



Pipe sizes

- 300 mm dia
- 200 mm dia
- 150 mm dia
- upgrade from 150 mm (existing) to 200 mm diameter.

upgrade length

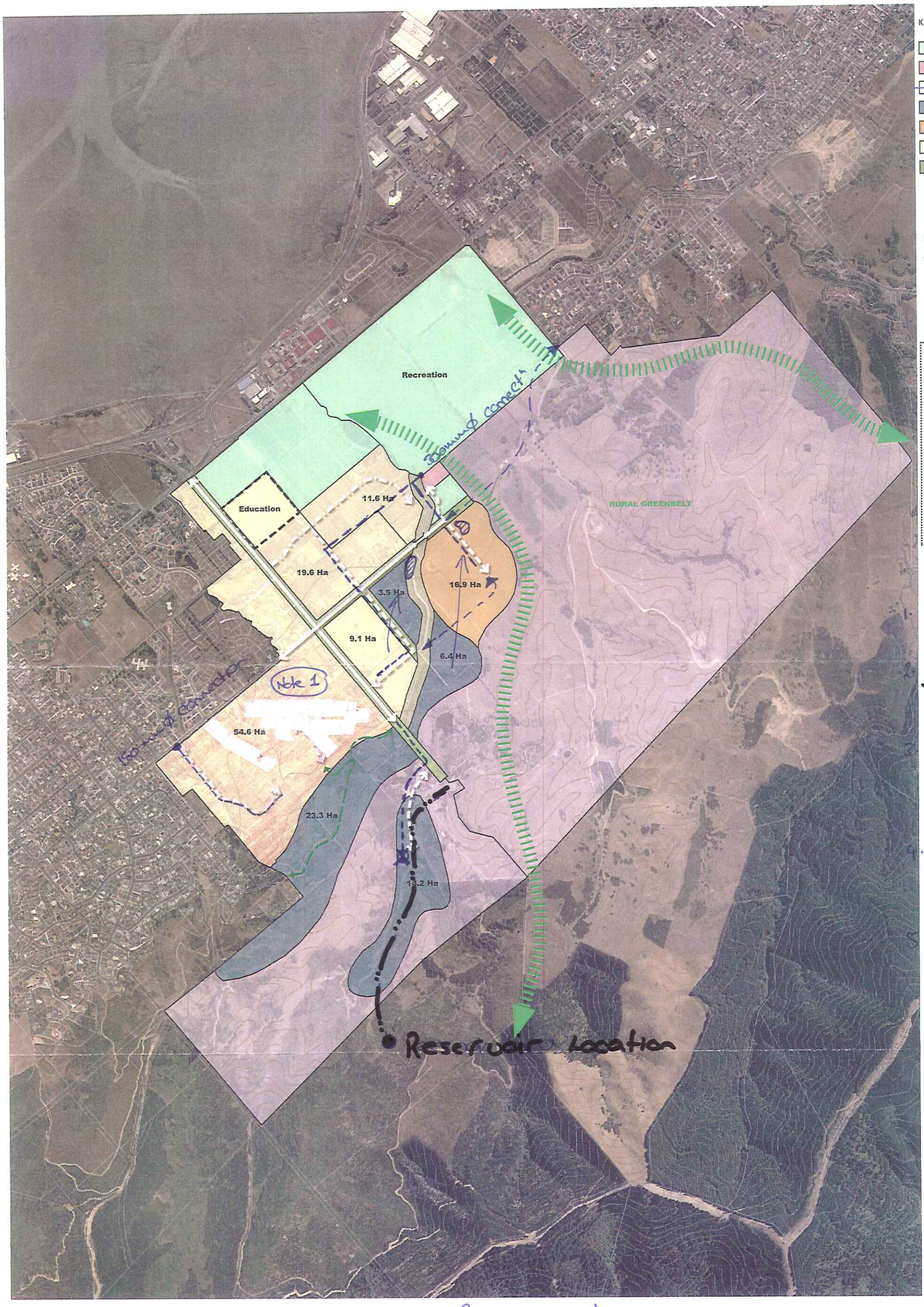
95m P Drive
143 m Hill St.
238 m Total

Approx 240 m.

Map 5: Wastewater

0 m 250 m 500 m 750 m 1000 m 1250 m

Draft For Discussion



Wastewater
--- main
⊗ pump st

Water Supply
main
reservoir

Stormwater
pond
→ urban catchments

4. Road
←→ Access points.

5. Riparian Management

Provide for riparian strips to manage impacts and provide access ecological enhancement opportunities.

Note 1 : Existing wastewater infrastructure to be identified

Stormwater disposal:
- Assess effects of dev on existing infrastructure
- identify upgrade works as necessary: