Civil Engineering Assessment

Cashmere Oaks Drive, Masterton

RILEY

Civil Engineering Assessment
Proposed Plan Change
Cashmere Oaks Drive, Masterton

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Issue	Details	Date
1.0	Civil Engineering Assessment (Final)	20 April 2022

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1.0 Introduction

The following report has been prepared by Riley Consultants Ltd (Riley) at the request of Welhom Developments Limited. It details the findings of a preliminary civil engineering assessment of the above site. The report has been prepared to support a private plan change request to Masterton District Council (MDC) for rezoning the site for residential use.

This report includes assessment of earthworks, stormwater, wastewater, water supply and roading servicing for the site. The report is to be read in conjunction with other Riley reports covering the environmental preliminary/detailed site investigation (refer Riley Ref: 210422-H) and geotechnical assessment (refer Riley Ref: 210422-E).

2.0 Summary

The possible future development of the land as a result of this plan change for residential use, including the option of a retirement village, which can be serviced by the Council wastewater/water supply infrastructure, stormwater discharge to ground, and communications/power supply by the surrounding networks. In order to achieve these connections, the following works will be required on-site:

- Minor earthworks will be required across the site to form new roads, infrastructure and to improve finished contours across the site.
- Stormwater reticulation will be required to collect and convey stormwater to treatment and soakage systems within the site. Stormwater measures within the site will be required to treat, and attenuate and dispose stormwater to ground in order to achieve pre-development flow conditions.
- Wastewater reticulation systems will be required to collect, and direct wastewater generated from the site to the proposed new wastewater pump station located within the Cashmere Oaks subdivision.
- Water supply reticulation systems will be required to service the site from the proposed 200mm-diameter main extension within the Cashmere Oaks subdivision.

- Council water supply reticulation mains have capacity to provide sufficient water supply volumes, however, have limited pressures to meet normal potable and firefighting demands.
- Programmed off-site upgrades to wastewater and water supply infrastructure will be required to be undertaken by MDC to ensure adequate capacity and security is provided within the public network to service future development within the site.
- Civil engineering works required at the site to form a residential subdivision can be undertaken in accordance with NZS 4404:2010 Land Development and Subdivision Infrastructure.
- Communications services will require an extension of the existing fibre service mains as reticulated by Chorus.
- Electrical services will require an extension of the existing primary mains as reticulated by Powerco.

Providing these works are completed at the necessary time (future subdivision consent, resource consent or building consent) the servicing of the proposed site use can be appropriately achieved.

3.0 Proposal

It is proposed to change the zoning of the site from the current Rural (Primary Production) zoning to a Residential zoning. We understand that the site may yield up to approximately 254 residential lots under existing District Plan density standards for the Residential zone. We understand that provision will also be provided for retirement village activities within the site.

The intention of the assessments to support the rezoning is to provide certainty regarding key requirements for any future residential activity on the site, whilst allowing flexibility as the detailed design phases evolve in the future.

Future servicing options have been assessed and have confirmed that servicing of the land can be achieved in an appropriate manner to meet MDC requirements. Servicing of the site includes water and wastewater, which is to be provided through connections to future extensions of the public reticulated network. Stormwater will be collected and directed to on site storage and soakage systems similar to existing neighbouring residential subdivisions. Telecommunications and power will be supplied from the surrounding networks. The specific design for these services will be determined at the time of future subdivision or land use consents of the land.

4.0 Site Description

The proposed 14.7ha greenfield site is located north of Cashmere Oaks Subdivision and Cashmere Oaks Drive, Lansdowne, Masterton – west of State Highway 2 (SH2) (site). It is approximately 2km north of the Masterton Town Centre and lies at the edge of the Masterton Township urban area. Specifically, it consists of Part Lot 9 DP 65445, Lot 1 DP 69308, Lot 3 DP 516269 and Lot 36 DP 429991. The plan change is for the 14.7ha site and is proposed to be subdivided into two new lots (Lots 1 and 2 with site areas of 10.4ha and 4.3ha, respectively). The location of the proposed development is shown in Figure 1.

Figure 1: Site Location (Source: Google Earth)

The proposed site is a flat-lying rural block. Contours derived from site survey from Tomlinson and Carruthers indicate a maximum ground surface elevation of approximately RL 134m at the north-eastern boundary and a minimum elevation of approximately RL 131m along the western boundary.

Much of the site is currently grassed, with periodic shelter belts and a single-dwelling and shed located on the eastern side of the site. Low density residential property is located south of site with rural properties bounding the east and northern ends. The remainder of the site to the west is bounded by the Wairarapa Railway Line.

5.0 Preliminary Engineering Assessment

5.1 Earthworks

Future development of the site should consider the landform and site contours to minimise the extent of earthworks required to achieve desired finished site levels.

The natural site gradient is generally consistent and approximately 1 in 100 from the north-east corner to the western boundary of the site. As the site is relatively flat and with a consistent fall it is envisaged that earthworks will be limited to the formation of new road corridors, stormwater management measures (such as soakage basins), infrastructure and localised earthworks to improve finished landform.

As a result, typical cut to fill depths will likely range from 0.5m to 1.0m and any fill will need to be placed to an engineered standard in accordance with geotechnical recommendations. The depth of cut is expected to increase locally due to the formation of soakage basins used to manage and dispose of stormwater runoff to ground.

Fill material for any future site development will likely be sourced from on-site excavations. The underlying subsoils are considered suitable for reuse on-site. The depth of topsoil varies over the site up to 0.3m.

Any earthworks will require staging in order to minimise exposure of stripped surfaces to the weather. Additionally, dust and sediment control measures will be required under dry or windy conditions.

Design and construction of Erosion and Sediment Control (E&SC) measures may include a combination of a temporary sediment pond, silt fencing, bunding and clean water diversions. The design and construction of these measures shall be in accordance with Greater Wellington Regional Councils (GWRC) "Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region".

5.2 Site Access and Roading

We understand that the site will be accessed directly from the proposed extension of Cashmere Oaks Drive which is part of the Cashmere Oaks subdivision. The subdivision plan for the Cashmere Oaks subdivision suggests a 20m wide road reserve, which we anticipate will be extended through the site with adjoining roads to service new residential lots. This road reserve will include a 11m wide carriageway.

The gradients of new roads or right of ways will be similar to the existing site gradients (i.e., 1 in 100).

It is envisaged that the roads will be formed with a flexible pavement, similar to the surrounding subdivisions roads. It is anticipated that the underlying strength of the soil will have a CBR of approximately 4%. This may require some subgrade improvement (e.g., lime stabilisation) or increased pavement depths for the roads. Our Geotechnical Assessment (Riley Ref: 210422-E) provides more information on the anticipated geotechnical conditions for foundations and structures.

5.3 Stormwater Management

There is currently no reticulated stormwater network servicing this site. Stormwater runoff sheet flows across existing ground profiles from the eastern to western boundary which is shared with the railway line. There are no distinguished overland flow paths through the site with localised depressions crossing the western boundary.

Roading networks within neighbouring residential subdivisions are typically serviced by short runs of public stormwater drainage which are directed to soakage systems. Residential lots appear to be serviced by private on-site soakage systems. A similar approach is envisaged for the site where all stormwater management systems would consider a low impact design approach in accordance with NZS 4404:2010 Land Development and Subdivision Infrastructure.

Any future development of the site will require stormwater runoff to be directed to primary systems (i.e., reticulation and on-site stormwater disposal systems) to dispose stormwater up to the 10-year storm event and ensure that pre-development flow conditions are maintained along the lower western boundary for up to the 100-year event.

5.3.1 Stormwater Management Options

A range of standard stormwater management measures are available for future development of the Site, as outlined below.

Soakage to Ground

Geotechnical testing at the site has found the upper 1m to 1.5m of soils are generally composed of topsoil and silt. Beneath the silty layers there is a silty gravel present to allow for soakage of stormwater to ground. Testing at the top of the gravel layer indicated that the upper half metre of this interface is likely too silty to drain stormwater. Deeper borehole investigations have found better draining gravels are present at a depth of 2m to 3m below ground level (bgl). Groundwater was also encountered at typically 0.9m below existing ground levels. Although the drainage properties at depth were much better than the shallow hand auger tests, consideration of the groundwater levels will need to be taken into account.

Discussions with Mac Fauvel of Cameron Fauvel Projects (Civil Engineer for the neighbouring Cashmere Oaks Subdivision) indicated that similar stormwater disposal properties were found within the Cashmere Oaks subdivision during construction. These discussions also indicated that the upper layers of gravels have limited soakage and that better draining soils can be found at depths of 2m to 3m depending on the variations found on each site.

Utilising the testing data received from site and confirmation from the development to the south, we recommend a factored infiltration rate of 150mm/hour is adopted for the purpose of designing soakage systems for future development of the site. The factored rate considers local variations in the soils and the risk of soakage devices being clogged over time.

Soakage Basins and Pits

Based on the infiltration rates, soakage basins or pits can be incorporated into the future development roading network and reserves. Soakage pits can be incorporated into residential lots. These soakage devices will be formed to have engagement with gravels at an approximate depth of 1.5m to 2.0m. The shape and storage of the devices can be managed to provide the required soakage/storage to dispose of stormwater and to achieve pre-development flow rate conditions. Storage can also be achieved through the construction of underground chambers such as CIRTEX Triton or RainSmart, or similar.

MDC has advised that soakage to the ground would be acceptable for this site and no vertical separation is required from groundwater provided that it can be demonstrated that sufficient soakage is achievable.

Stormwater Treatment

Treatment of stormwater runoff from trafficked pavements should be provided prior to drainage to ground. NZS 4404 prefers low impact design methods, which utilise vegetation and soil media to provide treatment solutions. These methods could consist of filter cesspit bags, grass swales, rain gardens, and wetlands. Alternative methods such as proprietary treatment devices (SW360 treatment vaults or similar) can also provide the necessary treatment.

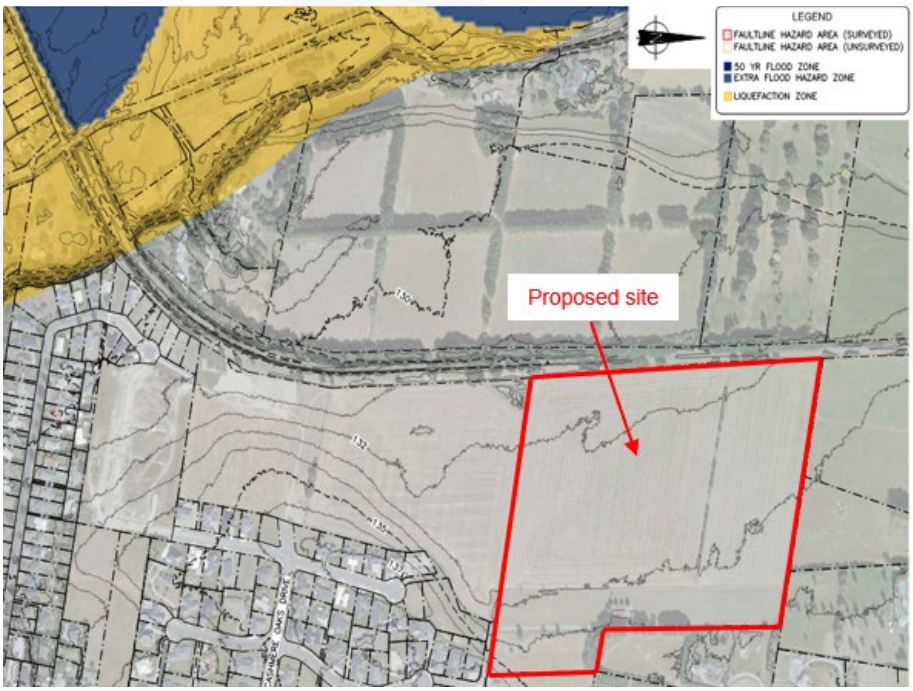
Overland Flows

Stormwater overland flow should be directed to the public roads and reserves and safely away from any future residential lots. Overland flow should be directed to the western boundary where flows would be distributed and dispersed across the boundary to pre-development flow rates.

Flood Hazards

The GWRC Hazard Map shows the flood hazard near the site based on the 2% and 1% Annual Exceedance Probability (AEP), or 50/100-year return period rainfall flood event, as shown in Figure 2.

Figure 2: Wellington Regional Council Flood Hazard Map



This mapping indicates that the site is well outside the flood hazard flooding zones.

There is no recorded history of site flooding. The existing site contour also indicates positive surface drainage towards the western boundary with no obvious depressions/low lying areas within the site that may result in localised flooding/ponding. Therefore, minimum floor levels for any new dwelling on the site should meet the minimum requirements under E1 of the New Zealand Building Code.

5.4 Wastewater

A proposed public wastewater pumpstation (PS) and 150mm-diameter gravity wastewater main are to be constructed for Stage 2 of the proposed Cashmere Oaks Subdivision. This PS is intended to service 52 new residential lots within the Cashmere Oaks subdivision and future development within the site.

Gravity reticulation is intended to be extended into the site from the Cashmere Oaks subdivision, which will provide service connections for future development. Reticulation will be designed and constructed in accordance with NZS 4404:2010.

5.4.1 Envisaged Wastewater Demands

Riley has carried out a preliminary estimate of anticipated wastewater flows generated from the site based on residential use, including the proposed 52-Lots within the Cashmere Oaks subdivision. These flows were calculated in accordance with the NZS 4404:2010, Section 5.

In determining the wastewater flows, the following assumptions were made:

- Number of people per dwelling: 3
- Per capita average dry weather flow allowance of 250 litres per person per day (L/p/d) for Residential use.
- Peak to average daily flow ratio (PF) of 2.5 as per NZS4404:2010 5.3.5.1 a) ii).
- Dilution/infiltration factor of 2 for wet weather as per NZS4404:2010 5.3.5.1 a) iii).

Based on the above assumptions and the envisaged number of new residential lots within the site, the anticipated wastewater flows for the development as per Table 1:

Table 1: Development Wastewater Estimates

	Future Residential Development	Cashmere Oaks Stage 2	Totals
Number of Lots	254	52	
People/Dwelling	3	3	-
Population	762	156	918
Loading Rate (litre/day)	250	250	-
Average Daily Flow (m^3 per day)	190.5	39	229.5
Average Daily Flow Rate (litres per sec)	2.20	0.45	2.66
Peak Daily Flow Factor	2.50	2.50	-
Peak Daily Flow (litres per sec)	5.51	1.13	6.64
Dilution/Infiltration, Wet Weather Factor	2.00	2.00	-
Peak Wet Weather (litres per sec)	11.02	2.26	13.28

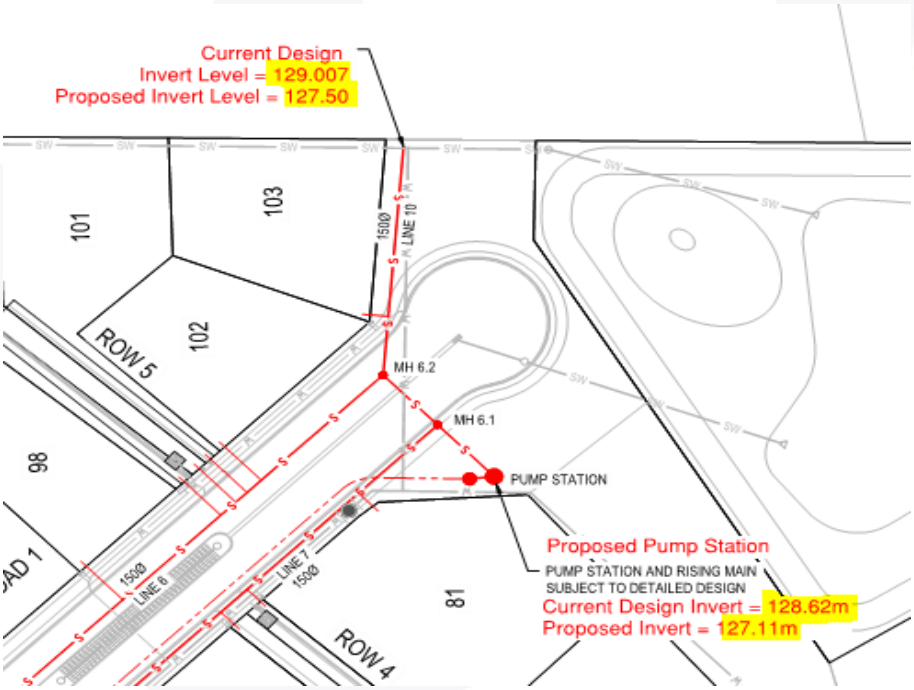
Review of the Cashmere Oaks Stage 2 Infrastructure Report, prepared by Cameron Fauvel Projects Limited (CFPL) (ref 21002-LD1-01, dated 07 July 2021) indicated that the proposed wastewater PS has been designed for a population of 786 people. The estimated peak flow to the PS by CFPL is 13.4L/sec. This estimate is similar to the flows assessed outlined in Table 1. However, assessments carried out by CFPL apply different loading rates and peaking factors (appears similar to factors applied under Watercare's Code of Practice). Final designs of the PS are currently being confirmed with CFPL to ensure that the new PS has sufficient capacity for both sites.

Preliminary assessments of a mixed use of residential and retirement village activities at the site indicated the wastewater demands will be less than outlined above in Table 1 and can be accommodated in the proposed network.

Cashmere Oaks Wastewater Reticulation and Pump Station

Preliminary assessments of possible gravity reticulation layouts at the site have been undertaken based on a constant pipe gradient of 1 in 200 and providing contingency depth for changes to alignments and pipe clashes. From this assessment, it confirmed that the design levels set for the proposed PS and immediate gravity reticulation would not be sufficient to service the entire site. These assessments confirmed that the PS and reticulation would need to be lowered by approximately 1.5m from the current design depths as shown in Figure 3.

Figure 3: Changes to Wastewater Inverts



The above details have been used for updated designs for the PS and immediate reticulation to ensure future extensions of the public wastewater reticulation will adequately service the site.

Council Wastewater upgrades

The proposed PS discharges to a gravity main that connects to a 150mm-diameter main in Opaki Road (SH2). MDC has advised this main will be upgraded in the near future to a 225mm main based on flows from Stage 2 Cashmere Oaks subdivision. The main is expected to extend from Fourth Street down to 45 Opaki Road. Discussions with Council regarding the possible wastewater demands from the site indicated that an upgrade to a 300mm main may be required to accommodate the additional flows.

5.5 Water Supply

5.5.1 Potable Water Supply

Correspondence with MDC Engineers confirmed that the existing 300mm-diameter trunk water main is not available for connection as it services Lansdowne/Masterton City Centres. The existing 200mm-diameter water main is the primary service for this site and is fed from the Titoki Street Water reservoir. This reservoir connects to this main via gravity feed and is approximately 20m higher than the site. There is approximately 2,300m3 of storage within the reservoir with proposed upgrades planned for later this year to increase this storage to 3,800m3 (see Figure 4).

Figure 4: Titoki Street Water Tank

This 200mm water main is to be extended to service the site from the Cashmere Oaks Stage 2 Subdivision. Reports from the MDC engineer have indicated that there was sufficient water volume for future development within the site, but current static pressures around 200kPa would be stressed during peak demand times. Council should be encouraged to place booster pumps at the reservoir during the planned upgrade to ensure greater security around supply pressures within the public network.

The design potable water usage requirements for residential dwellings are 250L/p/day based on the NZS 4404:2010 6.3.5.6 a). Based on peaking factors, the estimated peak hourly demand for a residential development at the site will be approximately 13.28L/sec. As indicated earlier, the potable water supply demands for a mixed use of residential and retirement village activities at the site can be accommodated within these estimated demands.

5.5.2 Fire Supply

The required firefighting flows have been determined in accordance with SNZ PAS 4509:2008 (Tables 1, 2, and C1), and based on a fire classification of FW2, the required firefighting flow is 12.5L/sec from a hydrant within 135m with another 12.5L/sec from a hydrant within 270m, residual pressure greater than 100kPa. This pressure would unlikely be able to be achieve as the current static pressures are no greater than 200kPa.

As previously outlined, a booster pump station will likely be required to maintain pressure to the hydrant and reticulated supply around the site. Council should be encouraged to construct booster pumps at the reservoir during planned upgrade to ensure greater security around supply pressures within the public network.

Detailed analysis and design of the firefighting requirements for the development will be undertaken by a suitably qualified fire engineer and in consultation with the New Zealand Fire Service.

5.6 Proposed Utilities

5.6.1 Electrical Service

Underground three-phase power supply is proposed to be extended to near the southern boundary of the site as part of the Cashmere Oaks subdivision. We have requested confirmation from the local electrical provider Powerco Limited that this network can be extended to service a residential land use at the site.

5.6.2 Communications Service

The communication network (Chorus NZ Limited) is proposed to be extended to near the southern boundary of the site as part of the Cashmere Oaks subdivision. We have requested confirmation from Chorus that this network can be extended to service a residential land use at the site.

6.0 Limitation

This report has been prepared solely for the benefit of Welhom Developments Limited as our client with respect to the brief for the due diligence assessment. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal or planning opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate advice.

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