

# **FLOOD LEVEL ANALYSIS**

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### Person assigned to manage the Project & Report

Name Dr Steven Joynes

Organisation GOLOVIN

### **Distribution List**

Name	Project Designation	Organisation
Dr Steven Joynes	Modeller	Golovin
Kewwa Low	Surveyor	Geotec Low
R Smith and J Jones		Clients

# **1 INTRODUCTION**

#### 1.1 Statement of Issues

The request from Waikato District Council was:

- LC2 The current and future owners of Lot I shall be advised that when any future development on the site is proposed, the following matters will need to be addressed at the time of Building Consent application prior to any development taking place:
  - a) An assessment of any existing stormwater overland flow paths and details of any new necessary stormwater overland flow paths in the immediate areas of the proposed development (i.e. building platform, effluent disposal site including reserve area and access from the public road to the proposed building site) is to be provided by a Chartered Professional Engineer, or other suitably qualified and competent professional having specific professional indemnity insurance in this field (proof of qualification, experience and professional indemnity insurance may be required by the Waikato District Council's Senior Development Engineer for approval).

The extent of flow paths is to cater for the 1%AEP event with a 20% allowance for climate change factored in. No modification of the existing ground profile, plantings, fencing or structures of any kind will be permitted within any overland flow path unless a specific design has been done by a Chartered Professional Engineer, or other suitably qualified and experienced

professional having specific professional indemnity insurance in this field (proof of qualification, experience and professional indemnity insurance may be required by the Waikato District Council's Senior Development Engineer for approval) which mitigates the effects of the obstruction and is approved in writing by the Waikato District Council's Senior Development Engineer.

#### 1.2 Target audience

The quality, quantity and tenure of the report should consider the following audience.

- a) WDC engineering staff
- b) Geotec Low staff

#### 1.3 Site Location

The site is 34 Waitakere Road, Tirau. There is an existing house located at the road frontage. The proposed dwelling is located down a driveway to the west of the property on a hill.

#### 1.4 Sources of data

Attribute	Organisation
Catchment Plans	www.topomap.co.nz
Contours	www.topomap.co.nz
Hydrology sites	None
Rainfall gauging	None
Ground spot heights	Geotec Low Surveyors
Flow & WL data	Not available
Flood level evidence	Not available

Table 1.1 – Source of Dat
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### **1.5 Calibration Locations**

There is no calibration locations identified.

#### 1.6 Site Visit

The modeller made a site visit to examine the ground levels, catchment boundaries and how hydraulic structures may impede flow.

# **2 METHODOLOGY and RESULTS**

#### 2.1 Previous Reports

There have been no previous studies of this catchment.

#### 2.2 **Operational Reports**

There are no operational reports available that might affect the conclusions of this report.

#### 2.3 Methodology

The general approach undertaken was to determine peak flow from the catchment and determine the floodplain extent and depths across property.

#### 2.4 Catchment Size

The total catchment is approximately 59ha. This was based on using a planimeter of a catchment map. Figure 2.1 shows the catchment boundary. The catchment has been divided into A and B to reflect the differences in time of concentrations of the contributing streams. Both catchments have small farm reservoirs that would theoretically create storage and attenuate peak flows. The effect of the reservoirs has been ignored thereby making the calculated flows conservative.



#### Figure 2.1 – Catchment Boundary (red line)

Table 2.1 gives the catchment details.

	Catchment A	Catchment B
Area (ha)	32	27
Length (km)	1.0	0.56
Slope (m/m)	0.045 (4.5%)	0.117 (11.7%)
Time of concentration (minutes)	40	20

#### 2.5 Survey

A spot height survey was done by Geotec Low. Figure 2.2 shows the spot height locations. This allowed for the creation of cross-sections across the floodplain on the property and the Waitakere Road profile that controls flows from the east.





#### 2.6 Scenarios to Model

WDC require that the 100 year return period flood be analysed allowing for climate change (+20%).

#### 2.7 Hydrological Methodology and Parameters

Appendix A of the Waikato District Council Code of Practice Code requires the following:

- Discharge to be calculated by the "Rational Method".
- Run-off C factor for Dairy Farmland to be 0.2.
- Time of concentration is given by Figure 1.
- Rainfall depth from the Ruakura gauge site.

HIRDS2.0 was used to generate the rainfall depths instead of the Ruakura gauging. The output is shown in Figure 2.3. This is a superior method because it is based on real gaugings in the northern Waikato region and accounts for the strong west-to-east movement of storm clouds. The 100-year climate change rainfall depth used was 204.6mm.

Te Kauwhata: Latitude 37° 24' S, Longitude 175° 6' E										
R <u>a</u> infall Depths (mm)		Standa	rd <u>E</u> rrors (n	nm)						
Duration										
ARI	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
2	9.6	13.8	17.0	24.5	30.5	43.2	53.8	67.0	78.3	85.7
10	13.2	19.0	23.5	33.9	42.8	61.7	77.8	98.0	112.9	122.6
20	15.1	21.8	27.0	38.9	49.3	71.7	90.8	115.0	131.6	142.5
30	16.4	23.6	29.3	42.2	53.6	78.4	99.6	126.5	144.3	155.9
40	17.4	25.0	31.0	44.8	57.0	83.6	106.5	135.6	154.3	166.4
50	18.2	26.2	32.5	46.9	59.8	88.0	112.3	143.2	162.6	175.2
60	18.9	27.2	33.8	48.7	62.3	91.8	117.3	149.8	169.8	182.8
70	19.5	28.1	34.9	50.4	64.4	95.2	121.7	155.7	176.2	189.5
80	20.1	28.9	35.9	51.9	66.4	98.2	125.8	161.0	182.1	195.6
100	21.0	30.4	37.7	54.4	69.8	103.6	132.9	170.5	192.3	206.4
125	22.1	31.9	39.6	57.2	73.5	109.4	140.6	180.6	203.3	217.9
150	23.0	33.2	41.2	59.6	76.7	114.4	147.2	189.5	213.0	228.0
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#### Figure 2.3 – HIRDS output for the catchment

A Curve number of 61 was used as the soils are predominantly alluvial sediments. This

curve number is more conservative and realistic than the C factor of 0.2.

Using the 24 hour storm duration means all shorter term rain depths are considered. Figure 2.4 shows the rainfall distribution used.



Figure 2.4 – Distribution Used for 24 hour, 100 year, climate change rainfall

The Rational Method was not used because it calculates the peak on an average intensity. Instead a time-area method was used using a 24 hour rainfall profile with a peak intensity at about 12 hours. This is the Auckland Council TP108 method using HEC-HMS software developed by the US Army Corps. This means that the change in infiltration changes with storm duration and accounts for storage in the catchment. Using the HEC-HMS software the peak flows for the 24 hour storm generated 7.3m<sup>3</sup>/s. This compares to 1.3m<sup>3</sup>/s and 2.2m<sup>3</sup>/s for the "Rational Method" rainfall for the 20 minute and 40 minute respective storms when using HEC-HMS. The actual inflow hydrograph is given in Figure 2.5





### 2.8 Hydraulic Analysis

HEC-RAS software was used to generate flood levels across the property. The setup is shown in Figure 2.6. The key features are

- Waikare Road weir barrier, see profile in Figure 2.7
- Overflow at low-point to southern neighbour
- Control point at western end of main paddock.
- The drain under Waikare Road heading south-west has not been considered due to its size and thus creating a conservative solution.
- The hydraulic analysis is a "dynamic" solution allowing for storage to be evaluated as well as conveyance.





Figure 2.7 - Profile of Waikare Road crest (north to south)



Figure 2.8 shows the flow hydrograph along the floodplain. Figure 2.9 shows the profile along the floodplain. Waitakere Road is shown as the grey weir on the right. The 100-year flood level upstream of Waitakere Road is RL50.06m. This makes the maximum depth across the road 0.22m and will be about 90m long. No water exits the western boundary meaning all floodwaters follow the general line of the drain to the south-west. Figure 2.10 shows the floodplain.



Figure 2.8 – Flood hydrograph just downstream of Waitakere Road





### Figure 2.10 – Floodplain Shape



# 3 Summary

A hydrological and hydraulic analysis has been done for 34 Waitakere Road. The upstream catchment peak flow is 7.3m<sup>3</sup>/s passing through the property. Waikare Road acts as a barrier but only attenuates the flow by about 5%. The existing and proposed houses are not in the floodplain with the existing house above the 500mm freeboard requirement. All the flow follows the existing drain in the south-westerly direction and away from this property.

It should be noted that the results are conservative because:

- 1. The culvert under Waitakere Road is assumed blocked
- 2. The south-westerly drain is assumed to have no capacity
- A 24-hour storm is used which has a greater volume than the typical Rational Method shorter duration approach
- 4. A higher run-off factor is used.
- 5. The attenuation effects of the reservoirs in the run-off catchments have been ignored.