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Report on Wastewater Disposal
For the
Amberfield Development
Peacockes Structure Plan Area, Hamilton South

Prepared for
Weston Lea Ltd

16 May 2018

TABLE OF CONTENTS

Table of Contents

1	INTRODUCTION	1
2	THE SITE.....	1
3	WASTEWATER COLLECTION WITHIN THE AMBERFIELD DEVELOPMENT.....	2
4	CONNECTION TO COUNCIL'S INTERCEPTOR SYSTEM	3
4.1	OVERVIEW OF OPTIONS FOR A CONNECTION POINT FOR THE PEACOCKES STRUCTURE PLAN AREA.....	3
4.2	OPTIONS FOR CONNECTION OF THE WESTON LEA LTD AMBERFIELD DEVELOPMENT	4
5	DISCUSSION.....	8
6	CONCLUSIONS	9

Appendix 1 – AECOM Western Option Wastewater Modelling Report

Appendix 2 – Jacob Report on Western Option Wastewater Modelling

Appendix 3 – Concept Plan for Waikato River Pipe Crossing

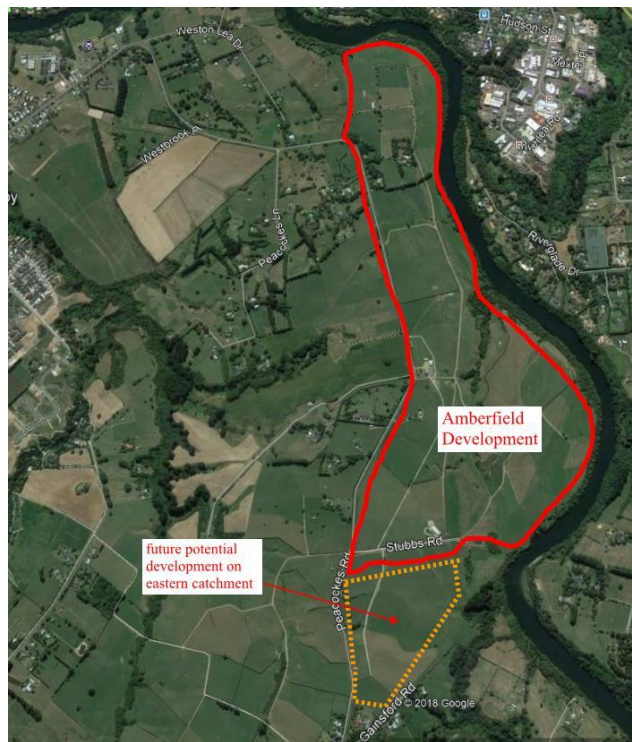
1 INTRODUCTION

This report has been prepared to support the Application for Resource Consents for the Amberfield development, proposed by Weston Lea Ltd. The Amberfield development is within the Peacockes Structure Plan Area (SPA), in south Hamilton. The Amberfield development comprises a residential area containing approximately 1,000 lots and a retail/commercial neighbourhood centre. The proposed solutions for wastewater disposal form part of the sub-catchment ICMP process and the resource consent process.

This Report describes the outcome of investigations on options for the disposal of wastewater from the development to Hamilton City Council's (HCC) main bulk wastewater system. The report also outlines why the preferred solution is to convey wastewater from the development to Council's Far Eastern Interceptor at Crosby Road. This preferred solution requires a pipe crossing of the Waikato River and requires integration with Council's wastewater solution servicing the rest of the Peacockes SPA.

2 THE SITE

The Amberfield development area lies on the eastern side of Peacockes Road and is bounded on the eastern and northern boundary by the Waikato River, as shown in the diagram below:

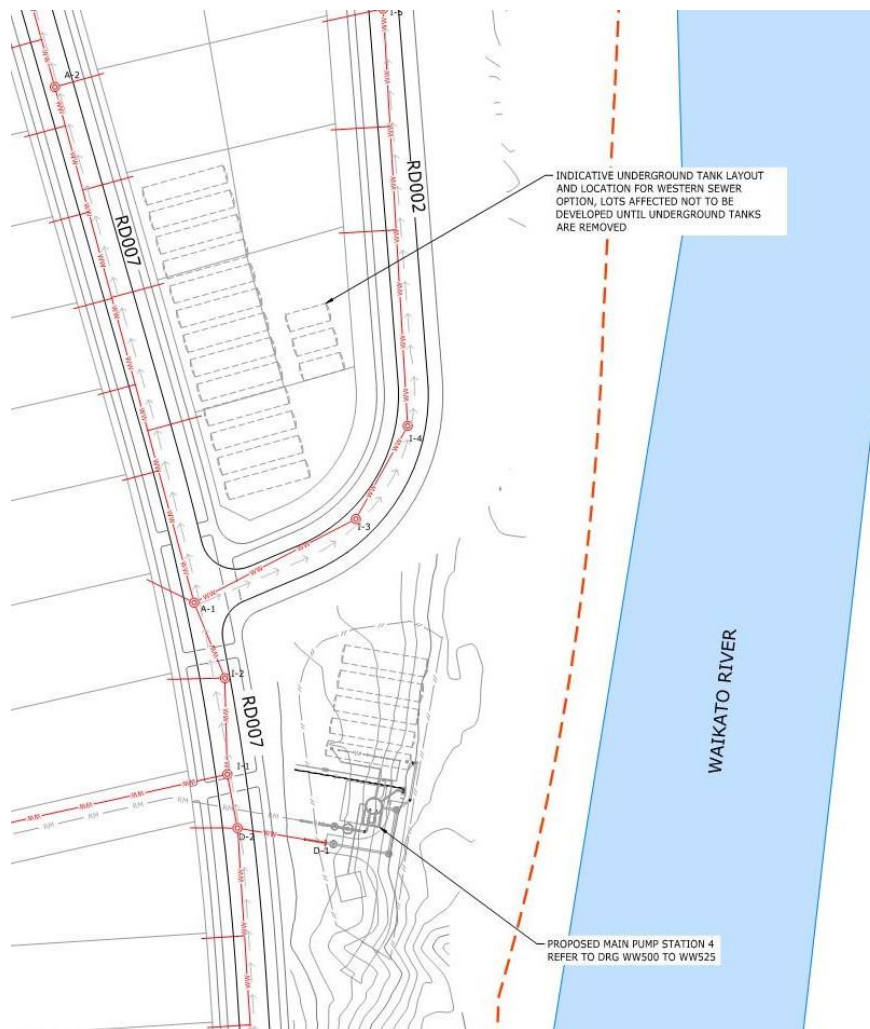


The site generally slopes from Peacockes Road towards the Waikato River with Peacockes Road being at a level that varies generally from RL45m to RL50m. The land within the development along the River edge, sits at a level of generally between RL20m and RL30m. There is also a natural fall towards the northern end, consistent with the gradient of the River. The area to the south of the Amberfield development area, shown in the diagram above, is outside the catchment of the sub-catchment ICMP and is not part of the development area for the Application for resource consents.

3 WASTEWATER COLLECTION WITHIN THE AMBERFIELD DEVELOPMENT

The wastewater reticulation within the Amberfield development is described in detail in the Civil Infrastructure Report, prepared by Harrison Grierson Ltd. The details of the reticulation are also shown in the Harrison Grierson drawings attached to the Application. It is described briefly below to give some context to the overall assessment of the preferred solution for wastewater connection to the HCC bulk interceptor system.

In summary, wastewater will be collected by a conventional gravity reticulation system complying to Hamilton City Council's Infrastructure Technical Specifications (ITS). Due to the slope of the site and the long, narrow shape of the site, it is not feasible to drain all the Amberfield development area to a single collection point by gravity. The existing gully through a large part of the middle of the development area also creates a separated wastewater sub-catchment on the island area to the east. It is therefore proposed to construct gravity mains and 3 smaller local wastewater pump stations that will convey the wastewater towards a single collection point in the northern area of the site. The location of the main Amberfield pump station is shown indicatively by Harrison Grierson drawing 141842-3004, of which an insert of this drawing is shown below. There is a small stream in the general location of the pump station site that is to be avoided. The final design of the pump station, the access to it and the underground storage will ensure that they are located clear of the stream. In the figure below, it is only the southern part of the access that affects the stream, and this will be realigned during detailed design to the north to avoid the stream.



The smaller, internal pump stations will have emergency storage tanks to manage wastewater flows at times of power failure, stand-by pumps in case of pump failure and telemetry to ensure automated operation and monitoring. The large main pump station will also have a stand-by emergency electrical generator to ensure the pumps can operate in a prolonged power failure.

The pump station facilities will include an odour treatment bio-filter at each station to avoid nuisance to neighbours from offensive odour. All pumps will be submersible pumps and thus there is not expected to be noticeable noise emitted from the pump stations. The pump stations will form part of Council's public infrastructure once they become operational as part of the development of each stage with the Amberfield development.

Preliminary concept drawings of the 4 pump stations are shown by Harrison Grierson drawings 141842-PS100, 200, 300 & 400.

4 CONNECTION TO COUNCIL'S INTERCEPTOR SYSTEM

4.1 OVERVIEW OF OPTIONS FOR A CONNECTION POINT FOR THE PEACOCKES STRUCTURE PLAN AREA

Wastewater collected at the Amberfield Main Pump Station will be pumped to the Council's Bulk Interceptor system. Council has three interceptors within this general area of the City and the connection points to these are:

1. The Western Interceptor, potential connection at Lorne Street Pump Station
2. The Eastern Interceptor, potential connection at Clyde Street
3. The Far Eastern Interceptor, potential connection near Crosby Road

The location of these is shown in the diagram below:



When Council advanced the Peacockes Structure Plan Area (SPA), they assessed the wastewater disposal options for servicing the zone and concluded that the wastewater from the majority of the zone would need to be discharged to the Far Eastern Interceptor near Crosby Road. They allowed the first stage of the Peacockes SPA, being approximately 800 lots in the Waterford Road/Dixon Road area, to connect to the Western Interceptor as the infrastructure required to connect to the Far Eastern Interceptor was too significant and cost prohibitive for the first stage. Council envisaged a connection to the Far Eastern Interceptor being available in circa 2025 and intends to redirect the first stage of the Peacockes SPA to the Far Eastern Interceptor infrastructure once it is operational.

Council's preference for the Peacockes SPA to be discharged to the Far Eastern Interceptor is due to capacity problems with the Western Interceptor and in the Eastern Interceptor. The Western Interceptor has had notable new development connections to it and, even with some duplication in recent years, it does not have the capacity to cope with the additional flow from the full Peacockes SPA. It was deemed by Council to be un-economic to duplicate it all the way to the Peacockes SPA. Council concluded that it was technically better, and more economic, to connect the Peacockes SPA to the Far Eastern Interceptor in time. This same logic applied to the Eastern Interceptor as it was not economic to duplicate the Eastern Interceptor when the Far Eastern Interceptor offered a better, longer term, infrastructure solution.

Conveyance of wastewater from the Peacockes SPA to the Far Eastern Interceptor would require a large Transfer Pump Station in the lower part of the Peacockes SPA, near the water treatment plant. Council envisages a Stage 1 wastewater conveyance system comprising the Transfer pump station with some pumps installed and a Stage 1 transfer pipeline going across the proposed Southern Links bridge and extending generally within the park area on the eastern side of Wairere Drive and the northern section of the pipeline being installed in Trafalgar Street and connecting into the Far Eastern Interceptor near Crosby Road. The Stage 1 pipeline is likely to be a 355mm diameter pipe. The Stage 2 pipeline, servicing the remainder of the Peacockes SPA is expected to be approximately 600mm diameter.

All interceptors discharge to Council's wastewater treatment plant at the northern side of Hamilton. Therefore, all wastewater from the Amberfield development, and Peacockes SPA will be treated at the wastewater treatment plant and discharged to its consented outfall.

4.2 OPTIONS FOR CONNECTION OF THE WESTON LEA LTD AMBERFIELD DEVELOPMENT

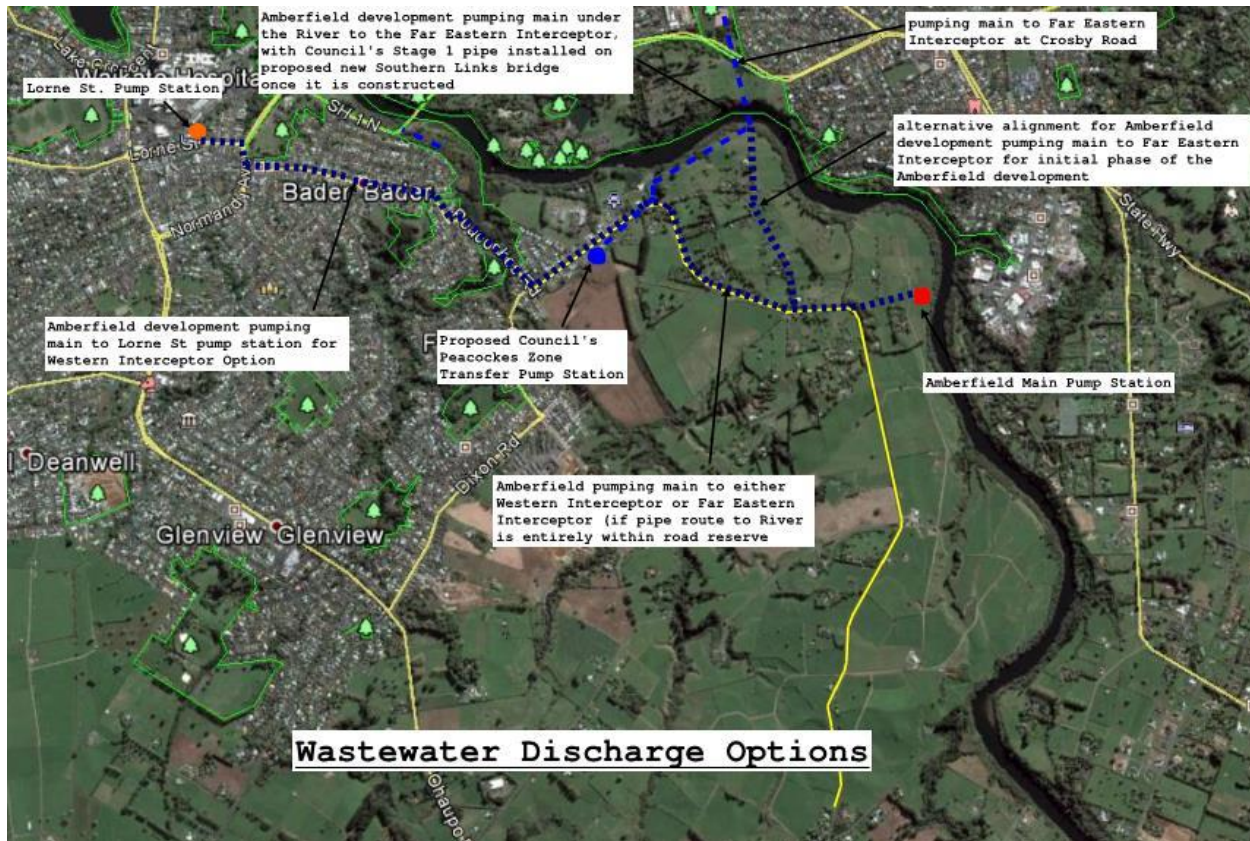
Weston Lea Ltd are advancing its Amberfield development ahead of Council's timeframe for the construction of the reticulation to connect the Peacockes SPA to the Far Eastern Interceptor. Weston Lea Ltd have therefore assessed the options of where to connect to the Councils bulk wastewater infrastructure. That assessment has focused on the following two options:

1. Western Option – connection to the Western Interceptor at Lorne Street pump station, and
2. Eastern Option – connection to the Far Eastern Interceptor, near Crosby Road.

The Western Interceptor is a 600mm diameter pipe downstream of the Lorne Street pump station. The Far Eastern Interceptor is a 900mm diameter pipe, at the connection point, near Crosby Road.

An option of connecting to the Eastern Interceptor, at Clyde Street, was not pursued due to capacity restrictions in that interceptor. It was considered that if a solution to the reticulation system on the eastern side of the River could be implemented, it was preferred to extend it all the way to the Far Eastern Interceptor, as that did not have capacity problems.

The above two options are shown in the diagram below and are described in more detail below;



Western Option – Connection to the Western Interceptor

The option of connecting to the Western Interceptor was assessed on the basis that it would be an interim solution, until Council had constructed its proposed Peacocks SPA Transfer Pump Station and the pumping main across the Waikato River and extending 6km north to Crosby Road, to connect into the Far Eastern Interceptor.

The connection to the Western Interceptor requires a pumping main from the Amberfield site to the Lorne Street pump station, a distance of approximately 4.5km. The pumping main would be a 250mm diameter HDPE pipe.

The Western Interceptor is known to have several overflows occurring in heavy wet weather, due to excess inflow and infiltration into the system. The premise of a western option was that the flow from the Amberfield development would be controlled in a manner that ensured that the existing overflow situation was not made worse when the Amberfield development flow was added.

An extensive modelling exercise has been carried out to assess the existing performance of the Western Interceptor during storm events. The modelling work was carried out by AECOM Ltd, for HCC, but in close liaison with Jacobs Ltd and O'Callaghan Design Ltd. The modelling was carried out to an agreed set of parameters and established modeling methods. The model output predicted where surcharging occurred in the system, where overflows are predicted to occur and established an estimate of the frequency, duration and volume discharged at overflow points. AECOM then re-ran the model, with the addition of the flows from the Amberfield development, to assess the expected impact on the Western Interceptor performance. An iterative process was followed that allowed subsequent model runs to incorporate a greater flow control on the Amberfield pump station and to simulate sufficient storage of flows at the Amberfield development main pump station such that the existing overflow volume and frequency in the Western Interceptor was not increased.

The modelling process and results are set out in the AECOM Report titled “Development Wastewater Impact Assessment, dated 19th January 2018. This report is attached in Appendix 1. The Report refers to the Adare project, which was the former name for the project prior to the adoption of the name Amberfield development. The key conclusions from the AECOM Report are:

- a. For both the 2021 and 2041 horizons no detriment to the existing network during DWF is predicted. The results show the Adare Development will cause an increase in the dry weather pipe utilisation in the Western Interceptor. The increase is likely to satisfy the requirement of the pipe utilisation being no more than 50 percent pipe full (with some minor, short term acceptable exceptions likely to occur). No increase in the peak pipe filling is predicted.
- b. No existing manhole spills are predicted to get worse, no existing pump station overflows are predicted to get worse and no new overflow locations are predicted for either of the modelled horizons during wet weather.
- c. In the 2021 horizon the maximum allowed daily discharge into the existing network during dry weather, which is driven by the applied controls, is approximately 890 m³. The 1,000 lot Adare Development generates approximately 780 m³ of daily wastewater volume under DWF conditions. This means that all wastewater generated by the Adare Development can be accommodated into the existing system during dry weather.
- d. In the 2041 horizon the maximum allowed daily discharge into the existing network during dry weather, which is driven by the applied controls, is approximately 770 m³. However, the 1,000 lot Adare Development generates approximately 840 m³ of daily wastewater volume under DWF conditions. This results in a shortfall of approximately 70 m³ per day, causing the Adare storage to fill on a daily basis with an inability to completely empty the stored volume during dry weather.
- e. Negative impact on the discharge routines of the consented trade waste holders (Dairy Goat Limited, and RJ Hill Laboratories) is not predicted during DWF or WWF. No detriment to the discharge volumes of these consented trade waste holders is predicted.

Based on (b), (c) and (e) above, the proposed arrangement does not have an adverse impact on the network and the pump station and storage function adequately in the 2021 horizon. Based on (b), (d) and (e) above, the proposed arrangement does not have an adverse impact on the network but the pump station and storage do not function adequately in the 2041 horizon; the model results indicate the proposed storage may not empty.

The key conclusion from the report, with respect to managing wet weather overflows in the Western Interceptor, is conclusion (b)& (e) – the disposal of flows from the development are not expected to cause additional overflows during wet weather. The reports note that there may be an effect on overflows in the 2041 horizon. However, this solution is an interim solution, until HCC implement its transfer pump station and pipeline to the Far Eastern Interceptor and so it is not expected that the Amberfield development would discharge to the Western Interceptor for more than a few years, assuming this Western option was adopted.

The AECOM report noted that the modeled storage capacity of 2,827m³ was exceeded on some occasions and thus this Western Option is estimated to require a storage volume of approximately 3,000m³.

Conceptually, the pumps at the main pump station at the Amberfield development would be controlled by the water level in the Western Interceptor, downstream of the Lorne Street pump station. Once the water level at the control site reached a pre-set level that related to a “near full” Western Interceptor, the Amberfield main pumps would be turned off. The flows arriving at the Amberfield main pump station pump station would be stored in the storage tanks during the rain event. After the rain had subdued, and the water level in the Western Interceptor began to drop to the required level, the Amberfield pumps would be turned back on and could then empty the storage tanks.

The modelling carried out by AECOM on the Western Option has also been reviewed by Jacobs Ltd. Jacobs set out their findings on the Western Option assessment in their report dated 6th April, which is attached in

Appendix 2. The Jacobs report concludes that the option of discharging to the Western Interceptor, as an interim solution, is a feasible solution using commonly accepted infrastructure components and standards.

The modelling and assessment of the Western Option has confirmed the feasibility of connecting to the Western Interceptor. However, this solution requires a pumping main to Lorne Street of approximately 4.5km and a storage system at the Amberfield development of approximately 3,000m³. The construction cost of this option is notable but still acceptable. The storage system would require specific management practices to avoid operational problems such as septicity in the wastewater during prolonged storage periods.

The Western Option, involving an interim connection to the Western Interceptor, can therefore be considered as feasible but is only an interim option until a connection to the Far Eastern Interceptor is functioning.

Eastern Option – Connection to the Far Eastern Interceptor

This option is Council's preferred option, but its expected construction/implementation timeframe does not suit Weston Lea Ltd. Therefore, this option has been assessed on the basis that Weston Lea Ltd would construct its pumping main to the Waikato River and install its interim pipe beneath the River, almost to Cobham Drive. The 6km pipeline from the Cobham Drive to Crosby Road is expected to be constructed in partnership with Council as Council sees this as an opportunity to construct its Stage 1 Peacockes SPA pumping main immediately. Council may also elect to include the section of pipe beneath the river as a joint pipe. There are financial benefits to both parties in approaching the section of the pumping main that would form part of Council's Peacockes SPA system as a jointly funded pipe.

Initial preliminary design has concluded that a pipe of approximately 280mm (OD) would be required for the Amberfield flows to Cobham Drive. Beyond the connection point to the joint Peacockes SPA pipe, it is expected that a pipe of 355mm (OD) would be used. However, these pipe sizes are being refined as part of on-going investigations and detailed design might result in slightly larger or smaller pipes.

This Eastern Option does not require additional storage at the Amberfield main pump station above the normal 9 hours storage requirement specified in Council's ITS because the Far Eastern Interceptor does not have capacity constraints. This storage volume is approximately 370m³ for the full Amberfield development.

The pipe beneath the Waikato River would only be used until Council had completed the proposed Southern Links bridge and installed the Peacockes SPA Stage 1 pipe on the bridge. At that time, the Amberfield pipeline under the River would be decommissioned but still maintained in a potentially operational mode so that it could be used in an emergency, if a problem arose with the pipe on the bridge. This would have long term resilience benefits.

In order to confirm the technical feasibility of a sewer pipe drilled beneath the Waikato River, Council has carried out a preliminary assessment with subsequent additional work and Weston Lea Ltd have carried out an independent assessment and have discussed the construction with pipe drilling contractors and received proposals from them. Both Council's and Weston Lea Ltd.'s investigations have confirmed that the construction of a pipeline beneath the River is both technically feasible and cost effective. The pipe would be installed approximately 10m beneath the bed of the river to avoid any risk to the pipeline. There are several similar pipes beneath the Waikato river between Taupo and the mouth of the river and drilling pipes of this size beneath rivers and estuaries is now common. Discussions with contractors have also confirmed the feasibility of constructing the 6km pipeline from Cobham Drive to Crosby Road. Initial consultation with iwi regarding the construction of the pipe beneath the river has taken place. A concept plan for the pipe beneath the river is attached in Appendix 3.

The indicative pipeline route from Cobham Drive to Crosby Road is shown by Harrison Grierson drawings 141842-WW500 – 514. The route would be refined with HCC during detailed design, taking into account

restrictions from other services, access, reinstatement issues etc. The final route selection is not critical for the resource consent application because it is accepted that a pipe between Cobham Drive and Crosby Road can be constructed and no consents are required for the construction of the pipeline.

The connection of the Amberfield development, to the far Eastern Interceptor near Crosby Road, is therefore, considered to both technically and financially feasible.

5 DISCUSSION

As described above, both the Western Option and the Eastern Option are considered to be technically feasible. A comparison of the two options is set out in the table below:

	Western Option	Eastern Option	Comment
Avoidance of overflows	Yes, but requires large storage, controlled pump operation	Yes, with no special requirements	Large storage requirements for Western Option raises operational issues for HCC
Impact on downstream capacity in Interceptor	Some impact likely if unaccounted for (in the 2021 & 2041 modelled horizons) additional connections were to be discharged to the Western Interceptor in the future	Unlikely to be any impact if unaccounted for connections were made as FEI has spare capacity	More resilience for unexpected future connection with the Eastern Option
Fit with Long Term Strategy	Does not fit with LTS, an interim solution until HCC have implemented their Peacockes SPA solution	Good fit with HCC LTS.	
Rising main lengths	4.5km	8km	Of the 8km for the Eastern Option, it is likely that 6km would be a "joint shared" pipe with HCC, in terms of construction and cost, to provide benefits to both parties
Pump Station requirements	Slightly lower pumping head than Eastern Option	Slightly higher pumping head until HCC's Transfer pump station became operative	Low impact on decision
Storage requirements	Approximately 3,000m ³	Approximately 370m ³	Significant cost of storage for the Western Option (if it were required before HCC's Transfer pump station became operative). Large storage also raises some operational complexities and risks of septicity in the mains.
Redundant infrastructure	The section of pumping main from the Transfer pump station site to Lorne Street could be largely redundant (but could be used to send some Lorne Street flow back to the Transfer pump station)	The interim pipe under the River would be taken out of service but it could provide an emergency pipe in the case of problems with the pipe on the bridge	

The key aspects above are maximum avoidance of risk of additional overflows of wastewater to the Waikato River and avoidance of operational problems within the network that could trigger failures in the infrastructure. In addition, the issue of cost could be brought into the assessment however, there is not a significant cost advantage to either option and so cost has been ignored from the assessment.

The weighing up of the two options needs to be done on the assumption that HCC's Transfer pump station and Peacockes SPA solution to the Far Eastern Interceptor is not implemented prior to the completion of the Amberfield development because there is no certainty of it being completed within a committed period. It is hoped that it may be constructed within a few years, if Council proceeds with the Housing Infrastructure Fund, but that is not a commitment of Council at this time.

In light of the above, the Eastern Option offers greater certainty for avoidance of overflows, eliminates the risks associated with relying on large storage associated with the Western Option (noting that it would still be an acceptable risk if the Western Option had to be adopted), minimizes the risk of future restrictions on unknown/unaccounted for future connections to the Interceptors and fits better with Council's Long Term Wastewater Strategy. The Eastern Option is therefore preferred over the Western Option. However, if, for some reason, the Eastern Option became unavailable, the Western Option could be implemented as it has been concluded that it is not expected to result in additional overflows during wet weather.

6 CONCLUSIONS

The assessment of the wastewater disposal options for the Amberfield development and for the catchment area covered by the sub-catchment ICMP has concluded the following:

1. The wastewater flows within the Amberfield development (and the sub-catchment ICMP) will be collected in a conventional gravity system with 3 internal pump stations to convey the flows to a main Amberfield Pump Station at the northern part of the Amberfield development;
2. The Amberfield main pump station could discharge to the Western Interceptor at Lorne Street. However, this solution requires large storage at the Amberfield main pump station to enable the pumps to be turned off during wet weather. This is required to avoid additional overflows of wastewater from the Western Interceptor, to the Waikato River, during heavy rainfall events. Discharge to the Western Interceptor is also only an interim solution until Council have constructed its Peacockes SPA Transfer Pump Station and pumping main to the far Eastern Interceptor, near Crosby Road;
3. The Amberfield main pump station could pump the flows to the Far Eastern Interceptor via an interim pipe under the Waikato River and a joint pipe from the River crossing to Crosby Road. This fits with Council's design solution for the Peacockes SPA and does not require large storage at the pump station. This option would involve an interim pipe beneath the Waikato River until Council has completed the Southern Links bridge and associated Peacockes pumping main installation on the bridge.
4. The preferred option is the Eastern Option, discharging to the Far Eastern Interceptor as it minimizes the risk of overflows to the Waikato River during wet weather, has less operational risks and fits with Council's Long-Term Wastewater Strategy.



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APPENDIX 1 – AECOM WESTERN OPTION WASTEWATER MODELLING REPORT

Development Wastewater Impact Assessment

Discharge of 1000 Lots Downstream of SPS044

Development Wastewater Impact Assessment

Discharge of 1000 Lots Downstream of SPS044

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Quality Information

Document Development Wastewater Impact Assessment

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			Name/Position	Signature
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Table of Contents

1.0	Introduction	1
2.0	Assumptions and Limitations	1
3.0	Assessment Methodology	2
3.1	Stage 1	2
3.2	Stage 2	2
3.3	Adare Development Model	3
4.0	Model Outputs	3
5.0	Conclusions	4
6.0	Recommendations	5
Appendix A		
	Stage 1 Assessment	A

1.0 Introduction

In December 2017, AECOM New Zealand Limited (AECOM) was engaged by Jacobs New Zealand Limited (Jacobs) on behalf of The Adare Company Limited to carry out a wastewater impact assessment for a proposed 1,000 lot development block within the Peacocke Stage 2 future development zone (the Adare Development).

This assessment is a continuum of the previous modelling undertaken for the Adare Development. Refer to the contract between AECOM and Jacobs signed on 5 July 2016 and subsequent variations VPA1 signed on 29 August 2016, VPA2 signed on 21 October 2016 and VPA3 signed on 18 November 2016.

The objective of the assessments is to demonstrate the impact the Adare Development has on the existing wastewater network in the 2021 and 2041 horizons. The assessment assumes the Adare Development discharges into the Western Interceptor via existing manhole WWU21018 located downstream of the Lorne Street pump station (SPS044). This location has been identified by Jacobs.

The assessment was carried out using the Hamilton City Council (HCC) Wastewater Model (the Model) under the terms and conditions from the agreement between AECOM and the Hamilton City Council dated 2 September 2016, which covers the use of the model for third party clients.

2.0 Assumptions and Limitations

The following assumptions and limitations apply to this assessment:

- a. Modelling was undertaken using the Model Version 3. The Model includes 2017 infrastructure and population updates for the existing development. The population density and occupancy assumptions for future growth areas (i.e. Peacocke, Temple View and Rotokauri) have not been updated as part of the recent population updates.
- b. The operation of the Lorne Pump Station (SPS044) was updated with Real Time Control (RTC) as provided by Jackie Colliar of HCC in an email dated 23 November 2017.
- c. Developed flows from the proposed Adare Development were determined and modelled in accordance with the HCC ITS, and the standard approach adopted by the model.
- d. The 10 year rainfall time series and future growth projections were applied to the model for the 2021 and 2041 horizons.
- e. The proposed development was assessed based on 1,000 lots with an equivalent of 3,500 people. These figures were provided by Jacobs.
- f. The Adare Development was modelled as a satellite catchment. The satellite catchment discharges into the Adare pump station via a conceptual one pipe loading network. A future gravity collection network within the Adare Development was not modelled.
- g. Wastewater from the Adare Development is pumped to the existing network (directly into manhole ID WWU21018) from a pump station within the Adare Development. This is a conceptual pump station. No rising main has been modelled, therefore no friction losses have been accounted for.
- h. Additional storage of approximately 3,000 m³ was modelled at the top of the Adare pump station wet well. It satisfies the requirement of 2,500 m³ storage volume given by Jacobs.
- i. No allowance has been made for modelling alternative options.
- j. This agreement does not allow for the modelling of proposed future network upgrades or consented increases to discharges elsewhere in the network, other than those listed in the modelling brief.
- k. Only overflows larger than 25 m³ per overflow event will be considered with the model margin of accuracy and therefore analysed. Overflows less than 25 m³ per overflow event are uncertain and will be ignored. This approach is consistent with the system performance analysis carried out for Hamilton City Council when developing the Model.

- l. Increases in overflows will be reported regardless of the scale of the increase, provided the total overflow is over 25 m³.
- m. Results have been presented for affected locations only, not the entire network.
- n. Impact assessment on the discharge routines of the consented trade waste holders is provided only for Dairy Goat Limited, and RJ Hill Laboratories. No other trade waste holders included in the Model are assumed to be at a risk of being impacted by the Adare Development discharge.

3.0 Assessment Methodology

The intent of the modelling was to demonstrate that the wastewater discharge from the Adare development to the Western Interceptor can be accommodated without any adverse effects on the existing network. Adverse effects are defined as follows:

- Increase in dry weather flow (DWF) pipe utilisation above 50 percent pipe full.
- New pump station overflow locations or manhole spill locations in addition to those predicted by the Model.
- Increase in volume or frequency of an existing manhole spill or pump station overflow predicted by the Model.
- Negative impact on the discharge routines of the consented trade waste holders (for example Dairy Goat Limited, RJ Hill Laboratories).

The modelling assessment was undertaken in two stages.

3.1 Stage 1

Stage 1 identified controls for the Adare pump station operation. These controls were established from the Model results for the 2041 horizon. The controls are a set of conditions controlling the proposed Adare pump station operation. The same set of conditions controlling the proposed Adare pump station operation were set for both the 2021 and 2041 horizons.

The methodology and outcomes of Stage 1 is provided in Appendix A.

3.2 Stage 2

Controls identified in Stage 1 were tested using the hydraulic model. The modelling assessment was undertaken by comparing system performance results of the following development scenarios:

- a. Baseline model: This scenario represents the wastewater system without the Adare Development updates and was used in order to quantify the implication of the proposed development.
- b. Development model: This scenario represents the wastewater system inclusive of the increase in wastewater flows due to the proposed Adare Development. The network performance implications of this scenario were assessed by comparing the Baseline model results with the results from the Development model for the same horizons.

The assessment was undertaken for two development horizons and two flow conditions. These were:

- i. Development Horizons:
 - 2021
 - 2041
- ii. Flow Conditions
 - Dry Weather Flow (DWF)
 - Wet Weather Flow (WWF)

3.3 Adare Development Model

The developed scenario utilises the baseline model with the following updates:

- i. The Adare Development was modelled as a 5.23 hectare satellite catchment. The catchment area is conceptual and doesn't influence the amount of the DWF or WWF produced.
- ii. DWF is based on the population and is modelled in accordance with the ITS and HCC future growth projections.
- iii. A production rate of 200 L/person/day was applied to the model with the diurnal pattern adopted for the future development areas. The diurnal pattern has a peaking factor of 2.61.
- iv. The approach to determine the ground water infiltration parameter (GWI) and rainfall induced rainfall modelled in the future horizon for the development is derived based on the number of dwellings and is consistent with the methodology applied in the Model. For more information about the methodology applied refer to sections 2.3.1 and 2.3.2 of the *Hamilton City Wastewater Model, Model Development and System Performance Report, 6 Mar 2015, AECOM*.
- v. The Adare Development is pumped to the existing network from a conceptual pump station. The conceptual pump station was modelled as a 2 m diameter wet-well, with start and stop levels 0.5 m apart. One pump was modelled with a constant pump rate of 24 L/s discharging directly into manhole WWU21018 as requested by Jacobs.
- vi. Additional storage was modelled at the top of the Adare pump station wet well. The total volume of the Adare pump station and storage is approximately 3,000 m³. The storage was modelled as a wet well extension on top of the Adare pump station. The additional storage is 30 m in diameter and 4 m high. This arrangement is modelled by applying basin geometry to the Adare pump station. It satisfies the requirement of 2,500 m³ storage volume given by Jacobs.
- vii. Adare pump station controls were modelled as follows:
 - Adare pump station start and stop are based on the wet well level as per the previous model (Start at RL 18.8m; Stop at RL 18.3m).
 - IF the water level at manhole WWU18019 is less than RL 35.23m then the Adare pump is allowed to turn ON (the Adare pump will then turn ON if the level controls at the Adare pump trigger it), OTHERWISE next bullet point.
 - IF the water level at manhole WWU18019 is greater or equal to RL 35.23m then the Adare pump is OFF (the Adare pump is OFF irrespective of whether or not the controls at the Adare pump allow it).

4.0 Model Outputs

The following system performance outputs were provided to Jacobs and HCC:

- *1000 Lots Model Change Log.xlsx*: this spreadsheet documents edits made to the model for the purpose of this modelling.
- *Adare Wet Well Water Level Time Series.xlsx*: this spreadsheet contains the 10 year simulation water level time series for both 2021 and 2041 horizons at Adare pump station.

It also contains the storage volume time series (note that storage volume excludes the wet well volume; and applies only for water levels between RLs 23m and 27m, which are considered to be within the storage).

It also provides the maximum storage volume achieved for the particular simulation year. It is noted that for a number of events the storage is predicted to overflow (storage exceeds 2,827 m³).

- *2021_DWF Pipe Utilization Results.xlsx*: this spreadsheet contains the pipe filling time series results for 2021 horizon DWF simulation at four locations on the Western Interceptor.

It also contains a graph summarising the time series as well as longitudinal profile showing the maximum water level.

- *2041_DWF Pipe Utilization Results.xlsx*: this spreadsheet contains the pipe filling time series results for 2021 horizon DWF simulation at four locations on the Western Interceptor.

It also contains a graph summarising the time series as well as longitudinal profile showing the maximum water level.

- *Adare PS Discharge Time Series.xlsx*: this spreadsheet contains the 10 year simulation discharge time series out of the Adare pump station (pump discharge time series) computed by the model for the 2021 and 2041 horizons.
- *2021_WWU21018_Q_WL.xlsx*: this spreadsheet contains the 10 year simulation water level time series in the existing manhole WWU21018 and the discharge time series in the pipe with ID 266798 (outlet pipe for manhole WWU21018) computed by the model for the baseline model and the development model for the 2021 horizon.
- *2041_WWU21018_Q_WL.xlsx*: this spreadsheet contains the 10 year simulation water level time series in the existing manhole WWU21018 and discharge time series in the pipe with ID 266798 (outlet pipe for manhole WWU21018) computed by the model for the baseline model and the development model for the 2041 horizon.

A GIS map has not been provided because no existing manhole spills are predicted to get worse, no existing pump station overflows are predicted to get worse and no new overflow locations are predicted for either of the modelled horizons.

5.0 Conclusions

Based on the model outputs, taking into account the assumptions and limitations, it is concluded that:

- For both the 2021 and 2041 horizons no detriment to the existing network during DWF is predicted. The results show the Adare Development will cause an increase in the dry weather pipe utilisation in the Western Interceptor. The increase is likely to satisfy the requirement of the pipe utilisation being no more than 50 percent pipe full (with some minor, short term acceptable exceptions likely to occur). No increase in the peak pipe filling is predicted.
- No existing manhole spills are predicted to get worse, no existing pump station overflows are predicted to get worse and no new overflow locations are predicted for either of the modelled horizons during wet weather.
- In the 2021 horizon the maximum allowed daily discharge into the existing network during dry weather, which is driven by the applied controls, is approximately 890 m³. The 1,000 lot Adare Development generates approximately 780 m³ of daily wastewater volume under DWF conditions. This means that all wastewater generated by the Adare Development can be accommodated into the existing system during dry weather.
- In the 2041 horizon the maximum allowed daily discharge into the existing network during dry weather, which is driven by the applied controls, is approximately 770 m³. However, the 1,000 lot Adare Development generates approximately 840 m³ of daily wastewater volume under DWF conditions. This results in a shortfall of approximately 70 m³ per day, causing the Adare storage to fill on a daily basis with an inability to completely empty the stored volume during dry weather.
- Negative impact on the discharge routines of the consented trade waste holders (Dairy Goat Limited, and RJ Hill Laboratories) is not predicted during DWF or WWF. No detriment to the discharge volumes of these consented trade waste holders is predicted.

Based on (b), (c) and (e) above, the proposed arrangement does not have an adverse impact on the network and the pump station and storage function adequately in the 2021 horizon. Based on (b), (d) and (e) above, the proposed arrangement does not have an adverse impact on the network but the pump station and storage do not function adequately in the 2041 horizon; the model results indicate the proposed storage may not empty.

6.0 Recommendations

Consent has not been provided by HCC to provide recommendations regarding the infrastructure requirements to service the development. Therefore recommendations have not been assessed or provided in this report. Refer to Section 3.3 of the agreement between the Consultant and Hamilton City Council dated 2 September 2016.

Appendix A

Stage 1 Assessment

15 June 2018

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11 December 2017

Peter Kinley
Principal Modeller
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Parnell
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Dear Peter

Adare Wastewater Modelling - VPA4 - Stage 1 Assessment

1.0 Introduction

In December 2017 AECOM was engaged by Jacobs New Zealand Limited (Jacobs) to carry out a wastewater impact assessment for a proposed 1,000 lot development within the Peacocke Stage 2 future development zone for your client, Adare Property Developments.

The objective of the assessment is to demonstrate the impact that the proposed development will have on the existing wastewater network.

Jacobs has identified a need for additional modelling to be undertaken to assess the preferred location of the Adare development discharge from 350 lots and 1,000 lots development discharging at manhole WWU21018 located downstream of SPS044 Lorne Street pump station.

The intent of the modelling is to demonstrate that the wastewater discharge from the Adare development to the Western Interceptor (WI) can be accommodated without any adverse effects on the existing network. The adverse effects are:

- Increase in dry weather flow (DWF) pipe utilization above 50% pipe full.
- New pump station overflow locations or manhole spill locations in addition to those predicted by the Model.
- Increase in volume or frequency of an existing manhole spill or pump station overflow predicted by the Model.
- Negative impact on the discharge routines of the consented trade waste holders (for example Dairy Goat Limited, RJ Hills Laboratories).

In order to satisfy the above criteria, a real time control (RTC) is required to control the Adare pump station operation.

The assessment will be undertaken in two stages:

- Stage 1 is to identify RTC controls for the Adare Pump Station operation.
- Stage 2 is to test the RTC controls using the hydraulic model.

The objective of this letter was to provide outcomes of the Stage 1 assessment. This assessment was a desktop assessment utilising the existing DWF simulation model results (without Adare development flows) for the 2041 horizon.

2.0 Outcomes

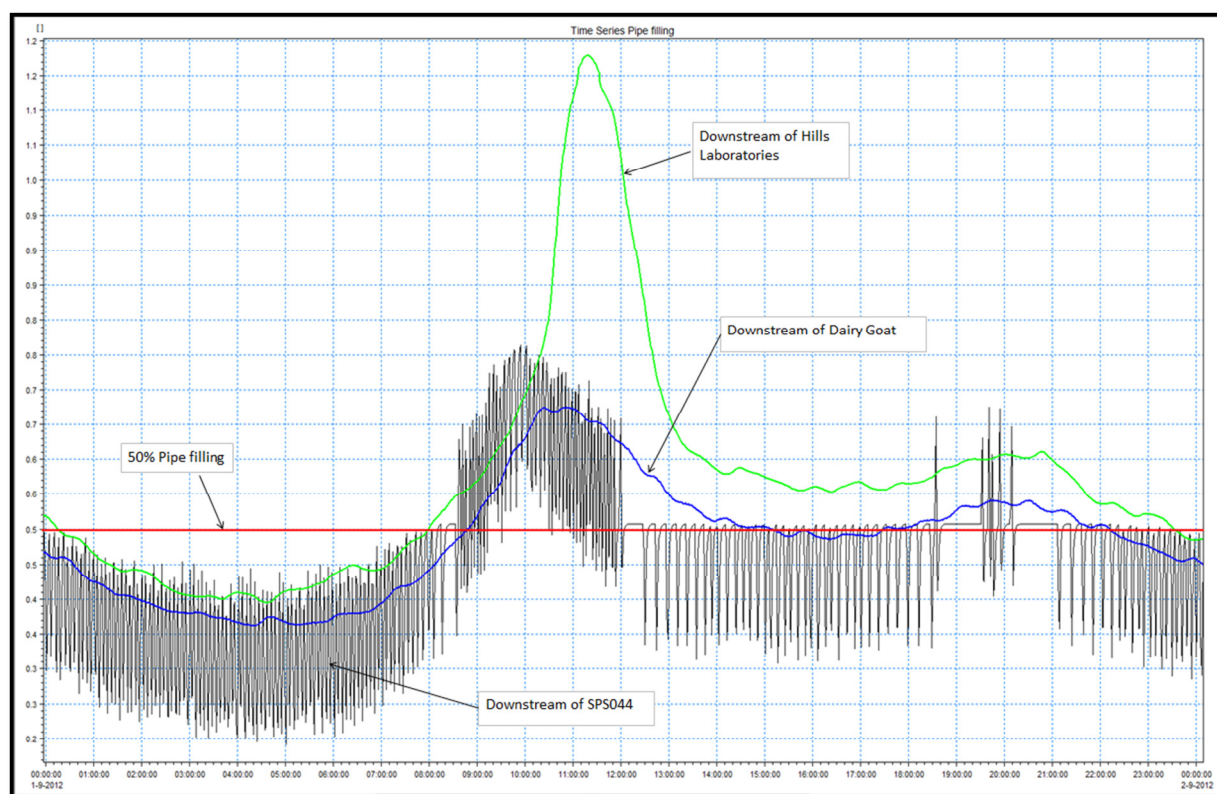
The 2041 horizon model predicts the peak DWF pipe filling exceeds the 50% pipe full threshold for the vast majority of the WI upstream of SPS021 Dinsdale pump station.

Table 1 shows the approximate duration of pipe being less than 50% full for three selected locations along the WI. It is estimated that there is sufficient time per day available for the Adare development to discharge the estimated 840m³ of daily DWF volume (including a groundwater infiltration allowance) Figure 1 shows the pipe filling hydrographs at three selected locations.

Table 1 Available time and volumes for three selected sites on the WI.

Location	Available time in hours (WI pipe utilisation is under 50% pipe full)	Estimated available volume (m ³) assuming Adare pump station rate of 24L/s
Downstream of SPS044	18	1,555
Downstream of Dairy Goat	9.8	849
Downstream of Hills Laboratories	8.5	734

Figure 1 Pipe filling hydrographs for three selected sites on the WI.



3.0 Recommendations

Based on the 2041 horizon model results, it is recommended that the manhole WWU18019 is used as the control manhole ruling the Adare pump station operation. This manhole is located on the WI, downstream of Dairy Goat discharge point.

The following RTC setting is recommended:

- IF water level at manhole WWU18019 is less than 35.23m RL THAN Adare pump station is ON,
- IF water level at manhole WWU18019 is greater or equal to 35.23m RL THAN Adare pump station is OFF.

Received
PLANNING GUIDANCE

15 June 2018

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Yours sincerely



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APPENDIX 2 – JACOBS REPORT ON WESTERN OPTION WASTEWATER MODELLING



Amberfield Development

Weston Lea Ltd

Waste Water Network Modelling

Revision 2 | 1

4 May 2018

Project Name

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Document Title:
Document No.: 1
Revision: 2
Date: 4 May 2018
Client Name: Weston Lea Ltd
Client No: Amberfield Development
Project Manager: Alan Hockey
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Contents

1.	Executive Summary	3
2.	Concept	4
3.	Modelling	5
3.1	Modelling Approach	5
3.2	Results of Modelling.....	5
3.2.1	Effects on Overflow Performance	5
3.2.2	Effects on Pipe Utilisation during Dry Weather Flow	6
4.	Conclusion	7
5.	Recommendation	8

1. Executive Summary

Jacobs was engaged by Weston Lea Ltd to identify a waste water concept for an overall first stage of 1,000 lots to be developed within the Peacocke Growth Zone. Our brief included confirming model scenarios, briefing Hamilton City Council's modelling service provider, AECOM, on the scenarios so they could run the model, reviewing the results provided by AECOM and reporting the outcomes.

Through this process, Jacobs have developed a waste water solution the uses a temporary connection to the Western Interceptor to service the development area. The solution is to provide:

- a pumped discharge to the Lorne St Pump Station wetwell,
- overflow storage of approximately 3,000m³, and
- real time controls to manage the pump station / storage operation.

Sufficient work has been undertaken and presented to demonstrate with confidence that a wastewater solution utilising pumping with overflow storage and real-time control will have effects of wastewater on the environment that are no more than minor. The infrastructure required and proposed will meet commonly accepted standards and can be able to be planned and constructed in a manner that integrates into Hamilton City's wastewater network in an efficient and effective manner until a long term connection to either the Eastern Interceptor or the Far Eastern Interceptor can be commissioned.

The modelling brief and parameters were agreed with Hamilton City Council. Jacobs' technical team liaised with the Council during the modelling, and once the modelling had been completed we arrived at a technically feasible solution.

The Western Option has been evaluated in parallel with an alternative Eastern Option, which would involve a discharge to either the Eastern Interceptor or Far Eastern Interceptor. The Eastern Options are addressed in a separate report.

2. Concept

Jacobs original concept was storage and a pump station, discharging to the Fitzroy Pump Station. Discharging to Fitzroy Pump Station was discounted as a result of initial modelling.

Following further optioneering a concept solution of providing a pump station with capacity in the order of 24 L/s and storage in the order of 2500 m³ with pressure main discharge into the Lorne Street Pump Station was developed.

Jacobs developed a real time control strategy for the Amberfield Pump Station, in consultation with Hamilton City Council and AECOM. The purpose of the real time control strategy is to prevent an increase in overflows from the existing Western Interceptor catchment. Implementing the real time control strategy involves setting rules that control the operation of the pump at the proposed Amberfield Pump Station based on levels in the wastewater network at two locations. These locations are:

- In the wetwell of the proposed Amberfield Pump Station, and
- At manhole WWU18019, which is on Kahikatea Drive and adjacent to the North Island Main Trunk Line.

Ordinarily the proposed Amberfield Pump Station will start and stop based on water levels in its wetwell. The modelled start level is 18.8m RL and the modelled stop level is 18.3m RL. If the water level at WWU18019 is above 35.23m RL then the pumps at the Amberfield Pump Station will be set to STOP irrespective of the water level in the wetwell.

This real time control strategy is design to prevent flows from the proposed Amberfield development from entering the Western Interceptor catchment when flows in the Western Interceptor catchment are high. Flows entering the wetwell from the proposed Amberfield development will be sent to the emergency storage at the Amberfield Pump Station while the pumps are set to STOP due to high water levels at WWU18019.

3. Modelling

3.1 Modelling Approach

AECOM were briefed by Jacobs to undertake hydraulic modelling to confirm the concept solution developed by Jacobs. The brief for the modelling was agreed with HCC.

Early modelling focussed on discharging to Fitzroy Pump Station. When this was identified as not feasible, the solution was modified to storage and a pump station discharging to Lorne Street Pump Station.

Wastewater network modelling completed to date includes:

- i. 1000-Lots to Lorne Street without storage or control
- ii. 1000-Lots to Lorne Street with storage and level control based on Lorne Street Pump Station

The progression of modelling has utilised knowledge gained from prior modelling to target the location, duration and timing of overflows in order to implement real time controls to manage the use of the pump station servicing the Amberfield development.

For the latest round of modelling, the flows from 1000-Lots of the Amberfield development have been modelled discharging to the Lorne Street Pump Station, with the following controls in place:

- Level control at manhole WWU180195 – The Amberfield Pump Station can operate normally when the water level in WWU18019 is below 35.23m RL, and the Amberfield Pump Station pumps will stop when the water level in WWU18019 is at or above 35.23m RL.
- Pump flow rate for the Amberfield Pump Station = 24 L/s
- Emergency storage of 2,827m³ available at the Amberfield Pump Station to be used when the water level at WWU18019 is at or above 35.23m RL.
- Hamilton City's 2021 and 2041 wastewater model, with 10-year rainfall series applied.

3.2 Results of Modelling

The viability of the proposed real time control strategy was assessed in terms of overflow performance and in terms of pipe utilisation during dry weather flow. A summary of the AECOM model outputs is reported in Appendix A. AECOM's report refers to the Adare development which was the former name of this project. The key findings of AECOM's work are described below.

3.2.1 Effects on Overflow Performance

The modelling has identified that the real time control strategy:

- Will not have an adverse effect on existing overflows from manholes.
- Will not have an adverse effect on existing overflows from pump stations
- Will not create new overflow sites.

In this report the definition of an adverse effect on existing overflows includes increases to the overflow volume or overflow frequency. Notwithstanding this, AECOM noted the following in their report:

- The final design of the storage would need to be larger than the modelled 2,827m³ volume in order to contain all the flows at the Amberfield Pump Station to avoid overflows at the site.
- The emptying cycle for the Amberfield Pump Station was not fully assessed, and will need further assessment if this option was adopted. The preferred method for this assessment is to use a smaller set of longer time series events.

3.2.2 Effects on Pipe Utilisation during Dry Weather Flow

The modelling has identified that the peak utilisation for dry weather flow is not affected by the addition of the flow from the Amberfield development. Average pipe utilisation is increased.

4. Conclusion

Based on the information discussed above, we consider that the option of discharging to the Western Interceptor and an interim solution is a feasible solution using commonly accepted infrastructure components and standards for the development of the first 1,000 lots.

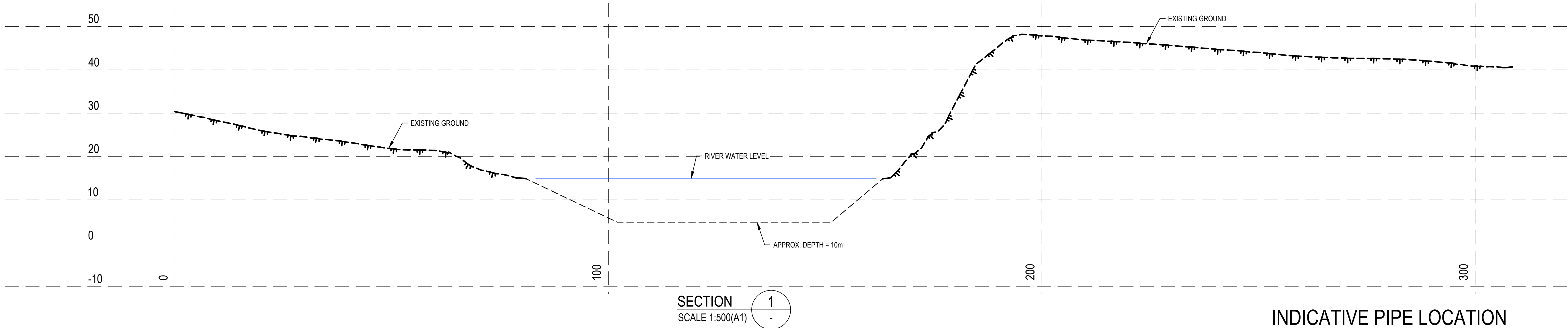
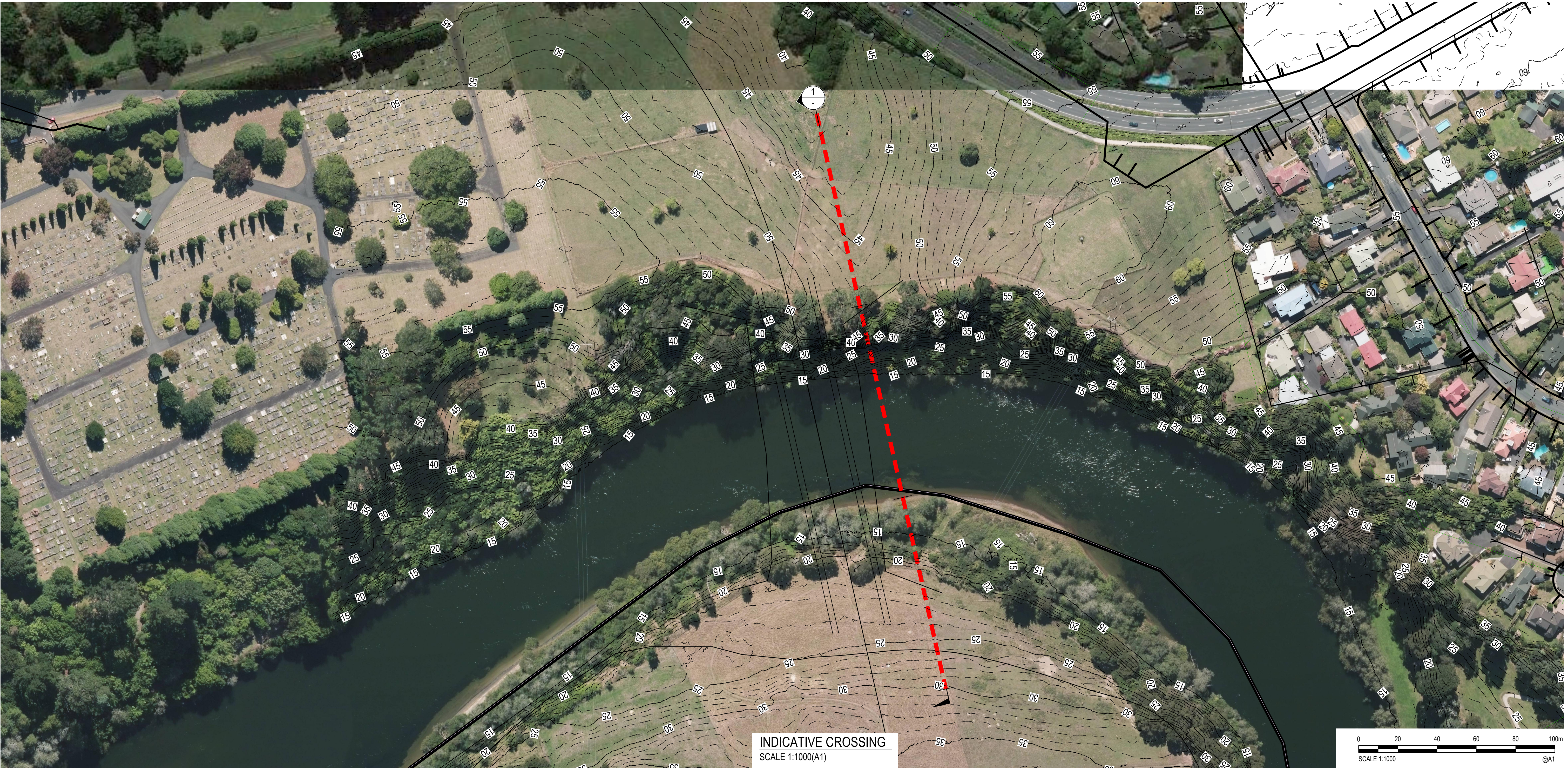
This solution would require large storage volumes during large wet weather events, with associated management of septicity to avoid operational issues downstream. It would also require appropriate design elements for the management of the storage system, cleaning after events that used the storage and refining the sizing of the storage system to deal with all wet weather flows when the Amberfield Pump Station pumps are turned off.

5. Recommendation

We recommend that if the Western Option is adopted as the preferred solution for a temporary discharge point for wastewater from the Amberfield Development, the final design and operational details of the pumping and storage facilities are collaboratively optimised with HCC taking into account the final masterplan prepared for the development.

APPENDIX A – AECOM Modelling Report (January 2018)

APPENDIX 3 – CONCEPT PLAN OF WAIKATO RIVER PIPE CROSSING



INDICATIVE PIPE LOCATION