Whanganui District Council

Whanganui City-Wide Growth
Wastewater Bulk Supply Investigation (Revisited)

March 2016

Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.4 and the assumptions and qualifications contained throughout the Report.

Wanganui District Council (WDC) has estimated the potential growth up to the year 2065. The growth includes city-wide infill as well as new greenfield development in Springvale and Otamatea.

GHD was engaged to assess the impacts of this population growth on the existing wastewater network. From there a programme of works and preliminary cost estimate was developed that estimated the costs for network upgrades in each area. These costs could then be used in assisting WDC in quantifying the contribution required by developers in order for the network to accommodate growth in those areas.

Prior to this work, GHD was engaged to develop a programme of works to meet the 1 in 1 year target level of service (LOS). Four alternatives for upgrades were considered in this study:

a. M12 gravity upgrades

b. M12 low pressure sewer (LPS)

c. M12 gravity upgrades plus Beach Road Pump Station (BRPS) modifications

d. M12 LPS plus BRPS modifications

Based on the cost estimates presented in that study, WDC selected alternatives a) and b) to be used for assessing the impact of growth. Therefore two sets of options were developed for each growth scenario: 1 in 1 year system improvements with M12 gravity upgrades and 1 in 1 year system improvements with M12 LPS.

In order to determine the costs for each growth area, the following scenarios were analysed for each system improvements option:

1. Springvale greenfield development with gravity wastewater scheme
2. Springvale greenfield development with LPS wastewater scheme
3. Otamatea greenfield development with gravity wastewater scheme
4. Otamatea greenfield development with LPS wastewater scheme
5. Catchment-wide infill

Evaluation of the ten growth scenarios revealed the following:

- The M12 option selected had minimal impact on the growth scenarios.
- The Otamatea gravity greenfield development was found to be the most expensive growth area, and there was marginal difference between the Springvale gravity versus LPS greenfield development options when considering additional costs to developers / customers.
- Growth from infill only had a minor impact on the existing network.

Following the results of the individual growth area assessments, a workshop was held with WDC during which the preferred growth scenarios were chosen. The scenarios selected were as follows:

- 1 in 1 year system improvements with M12 gravity upgrades (option a)

- Springvale greenfield development with gravity network (scenario 1)
- Otamatea greenfield development with LPS (scenario 4)
- Catchment-wide infill (scenario 5)

These scenarios were combined to determine if any additional upgrades were required. Evaluation of the combined growth scenario revealed that, in addition to an increase in storage requirements, Otamatea was the only area that required additional upgrades.

Costs associated with upgrades required to accommodate growth were then allocated to the different growth areas based on their increase in peak flow. Table 1 below summarises the total costs for each growth area and the estimated cost per dwelling. It should be noted that the costs presented are real costs for upgrading the existing network—they do not include developer costs for alternative options such as duplicating mains in lieu of upgrading.

Table 1 Summary of Costs for Each Growth Area

Growth Area	Number of Dwellings	Total Cost	Cost per Dwelling
Springvale Development	417	$202,847	$486
Otamatea Development	179	$248,559	$1,389
Infill			
- Otamatea Infill	455	$165,827	$364
- Springvale Infill	731	$59,971	$82
- Inner City Infill	334	$19,190	$57
- Commercial Infill	197	$8,818	$45
- Other Residential Infill	255	$33,788	$133
TOTAL		**$739,000**	

The cost for upgrades due to combined growth accounts for approximately 5% of the System Improvement upgrades required to meet the target LOS. Although modelling results showed that the individual growth due to infill scenario required minimal pipe upgrades, the storage requirements were much greater than the storage required to accommodate growth from the greenfield developments. The results also showed that Otamatea required the most upgrades, regardless if infill, Otamatea greenfield development, or growth from both areas combined were considered.

It should be noted that the proposed upgrades are contingent on the findings from the M4 investigation as well as re-calibration of the P8 / Liverpool Pump Station catchment. For P8 it is recommended that the flows be re-monitored, the pump station controls be adjusted to reduce the number of pump starts, and the catchment re-calibrated. Similarly, for Central City it is recommended that the model be updated and re-calibrated following the investigation. The re-calibrated model can then be used to modify / confirm the upgrades identified in this report. Once the upgrades have been finalised, the cost per dwelling can be revised. The revised cost can then serve as a guide for WDC in determining the developer contributions.

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1. Introduction

1.1 Background

As part of their strategic planning, Whanganui District Council (WDC) has estimated the potential growth over the next 50 years (up to 2065). The growth areas have been categorized into infill (growth within the existing infrastructure) and greenfield development (new developments and extension of the infrastructure). The impact on the existing wastewater network will determine if the network has sufficient capacity to cope with additional flows associated with growth. If constraints are found, a plan of cost effective upgrades must be identified. The costs associated with the network upgrades will also assist the Council in understanding the economic viability of the future growth in each of the areas identified.

1.2 Purpose of this report

The wastewater network was previously evaluated for several different growth scenarios, the findings of which can be found in the *Wastewater Bulk Supply Investigation* (January 2016) written by GHD. Since that report was written, the 1 in 1 year system improvements included in the model have been revised. GHD was engaged by WDC to re-evaluate the wastewater network's capacity for growth incorporating the revised 1 in 1 year system improvements from the *Revised System Improvements Report* (February 2016).

This is a supplemental report to the January 2016 *Wastewater Bulk Supply Investigation*. The purpose of this report is to document the modelling and resultant options assessment carried out to assess the effects that the proposed growth will have on the wastewater network, and what upgrades are required to accommodate the estimated growth. From there WDC can use the estimated costs for each growth area to quantify the contribution required by developers in order for the network to accommodate growth in that area.

1.3 Previous Modelling and Relevant Reports

1.3.1 System Performance

In 2013-2014 GHD built and calibrated a wastewater model for the entire Whanganui wastewater system. This model has enabled the constraints in the existing system to be better understood and the possibility of augmenting the existing system to cope with the additional flows to be explored in more detail.

During system performance the model predicted significant spilling in Central City (M4 catchment) during relatively minor rain events. Manhole spilling in this area had not been observed in reality to the extent or frequency predicted by the model. This is further discussed in the following reports:

- Whanganui District Council Wastewater Model – System Performance, October 2014
- Whanganui District Council Wastewater System – Infiltration and Inflow Assessment, March 2015

At the time of this report, investigations were underway to locate the source of this anomaly. No changes have been made in this catchment related to the investigation.

1.3.2 System Improvements

In July 2015, and again in February 2016, GHD completed a System Improvements Masterplan utilising the model. The masterplan identified projects required for WDC's wastewater network

to meet the 1 in 1 year level of service (LOS) containment targets for the existing demand on the system.

The base models used in this investigation incorporated the February 2016 system improvements. Multiple options were evaluated relating to the upgrade scheme in M12 (gravity versus LPS) and BRPS maximum discharge flow rate. Improvements and other information can be found in the following reports:

- Whanganui District Council Wastewater Masterplan – System Improvements, July 2015
- Whanganui District Council Wastewater Masterplan – Revised System Improvements, February 2016

The impact of growth was evaluated on both gravity upgrades in M12 and a new LPS in M12; no changes were made to the maximum discharge rate at Beach Road Pumping Station (BRPS).

1.3.3 Wastewater Bulk Supply Investigation

In January 2016, GHD was engaged by WDC to investigate the impact of growth on the network. The base model used in that investigation incorporated the 2015 system improvements, with some amendments. In that investigation, the M12 catchment included gravity upgrades only, and it was assumed that the anomalies in Central City had been addressed and the wet weather response was therefore reduced. Under this investigation no changes have been made to Central City, i.e. the system performs as per the original calibration and therefore has significant spilling in a 1 in 1 year flow event.

This project builds on the information gathered during the initial bulk supply investigation. Background information on the proposed growth areas, delineations, and how it was modelled can be found in the following report:

- Whanganui District Council City-Wide Growth – Wastewater Bulk Supply Investigation, January 2016

1.4 Limitations

This report: has been prepared by GHD for Whanganui District Council and *may only be used and relied on by Whanganui District Council for the purpose agreed between GHD and the Whanganui District Council as set out in the proposal document.*

GHD otherwise disclaims responsibility to any person other than Whanganui District Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Whanganui District Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has prepared the preliminary cost estimates set out in Appendix G and Appendix H of this report using information reasonably available to the GHD employee(s) who prepared this report; and based on assumptions and judgments made by GHD.

The Cost Estimate has been prepared for the purpose of provide an indicate cost of the upgrades infrastructure required and must not be used for any other purpose.

The Cost Estimate is a preliminary estimate only. Actual prices, costs and other variables may be different to those used to prepare the Cost Estimate and may change. Unless as otherwise specified in this report, no detailed quotation has been obtained for actions identified in this report. GHD does not represent, warrant or guarantee that the [works/project] *can or will be undertaken at a cost which is the same or less than the Cost Estimate.*

Where estimates of potential costs are provided with an indicated level of confidence, notwithstanding the conservatism of the level of confidence selected as the planning level, there remains a chance that the cost will be greater than the planning estimate, and any funding would not be adequate. The confidence level considered to be most appropriate for planning purposes will vary depending on the conservatism of the user and the nature of the project. The user should therefore select appropriate confidence levels to suit their particular risk profile.

2. Preliminary Network Assessment

In order to develop an estimate for developer contributions, each growth scenario was first modelled separately.

2.1 Base Model

The base model selected to investigate the proposed urban development was the calibrated model with the revised 1 in 1 year system improvements. WDC chose to evaluate the network under two different improvements options:

1. Spilling in M12 addressed using gravity upgrades (i.e. upgrade of conveyance systems and attenuation through storage)
2. Spilling in M12 addressed by installing a new low pressure sewer (LPS)

Since the submittal of the *Revised System Improvements Report*, two areas were identified that require upgrades that should be included in the 1 in 1 year system improvement programme. Although they were identified during the bulk growth investigation, their upgrades should not be attributed to any of the growth scenarios. These two additional spill areas are discussed in the sections below.

The revised System Improvements spilling overview / plan and cost estimate have been provided in Appendix A. The system improvements to address those spills identified are included in Appendix D, Appendix E and Appendix F.

The following two sub-sections discuss additional areas that should be addressed in the System Improvements programme of work. Maps of these upgrades can be found in Appendix A.

2.1.1 Liverpool Street Pump Station Overflow / Cross Connection

An existing cross connection was found to still be open at the Liverpool Pump Station, in addition to the pump station overflow. Since only the pump station overflow was being checked in the model during System Improvements, the cross connection was overlooked and there was a significant volume found to be leaving the wastewater network. The plan view of the cross connection and pump station overflow can be seen in Figure 1 below.

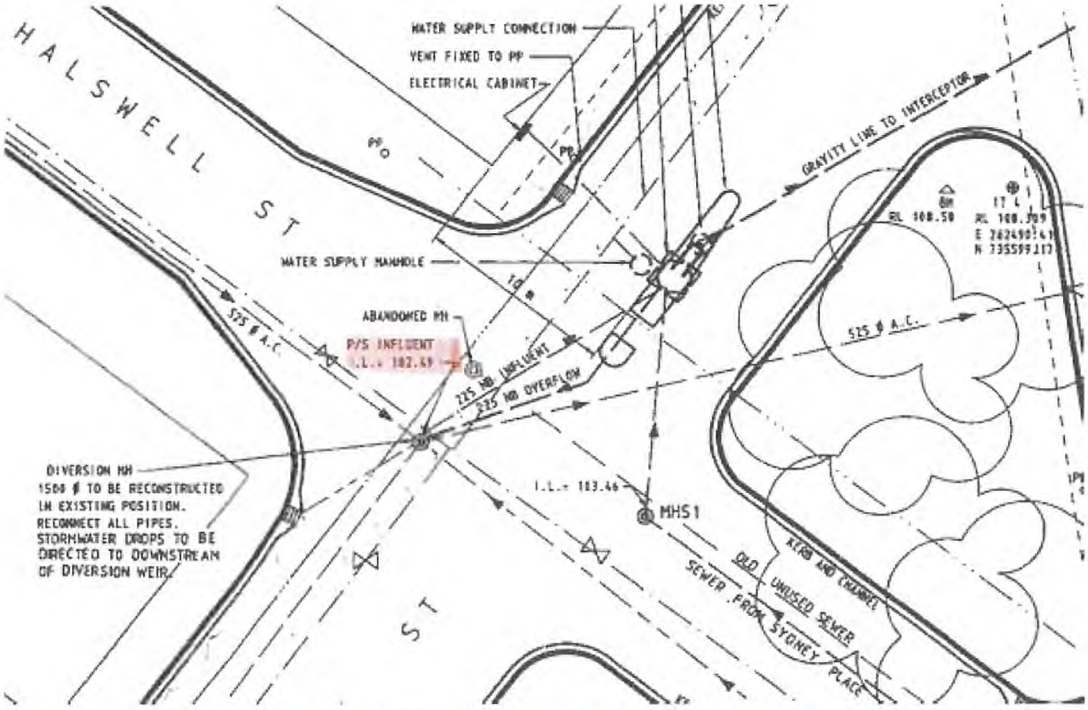


Figure 1 Liverpool Pump Station Cross Connection and Overflow Plan

The System Improvements were amended such that the overflow is no longer occurring. This required closing the cross connection, however leaving the pump station overflow open. With the added flow now being passed downstream, an increase in storage was required at Moutoa Gardens (32 m^3 for the M12 gravity option and 38 m^3 for the M12 LPS option). To minimize the additional storage required, the pump station controls were adjusted to make use of the capacity of the pump station and upstream network.

During the model calibration stage, the pump station data for Liverpool Pump Station showed the pumps frequently turning on and off. The existing pumps have variable speed drives (VSDs), however their control philosophy is unknown. Based on the observed level data of the pump station, it was assumed that the controls could be further optimized to reduce the number of pump starts/stops each day, as well as utilise the upstream network capacity. Figure 2 below shows the existing and improved control philosophy. Note that the control philosophy is only preliminary and represents the pumps discharging at a higher rate at a higher operating level only.

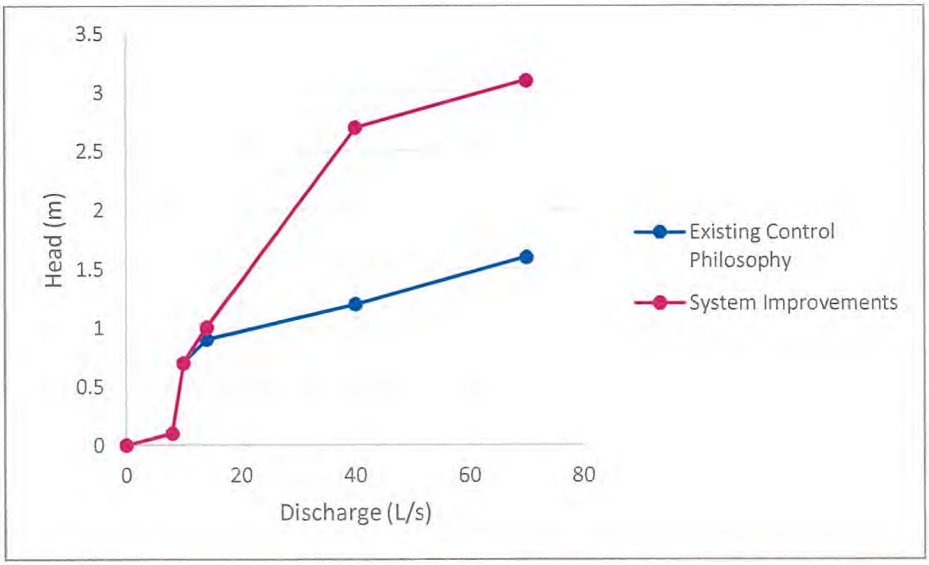


Figure 2 Optimised Liverpool Pump Station Control Philosophy

These improvements (and their associated costs) were incorporated in to the base model for both the M12 gravity upgrades and M12 LPS upgrades. The spill area was identified as Area AA, and the cost estimate was also revised.

It should be noted that the calibration events were once again run and the overflow was triggered in the model. It is therefore recommended that the pump station controls be adjusted, new flow data be collected, and the catchment be re-calibrated. The upgrades discussed above are indicative only until the catchment parameters are better understood.

2.1.2 Heads Road Manhole Spill

The model predicted minor spilling (< 20 m³) near the flow split on Heads Road, however once growth was applied in certain scenarios the spilling tipped over 20 m³. Since the spilling was triggered under the growth scenarios, they are further discussed in Sections 2.3.3 and 2.4. However the costs and upgrades have been incorporated in to the System Improvements programme as the model showed that this site was already spilling (< 20 m³) prior to adding growth.

2.2 Population Growth

As discussed in the previous *Bulk Supply Investigation Report* (January 2016), WDC identified three areas for growth:

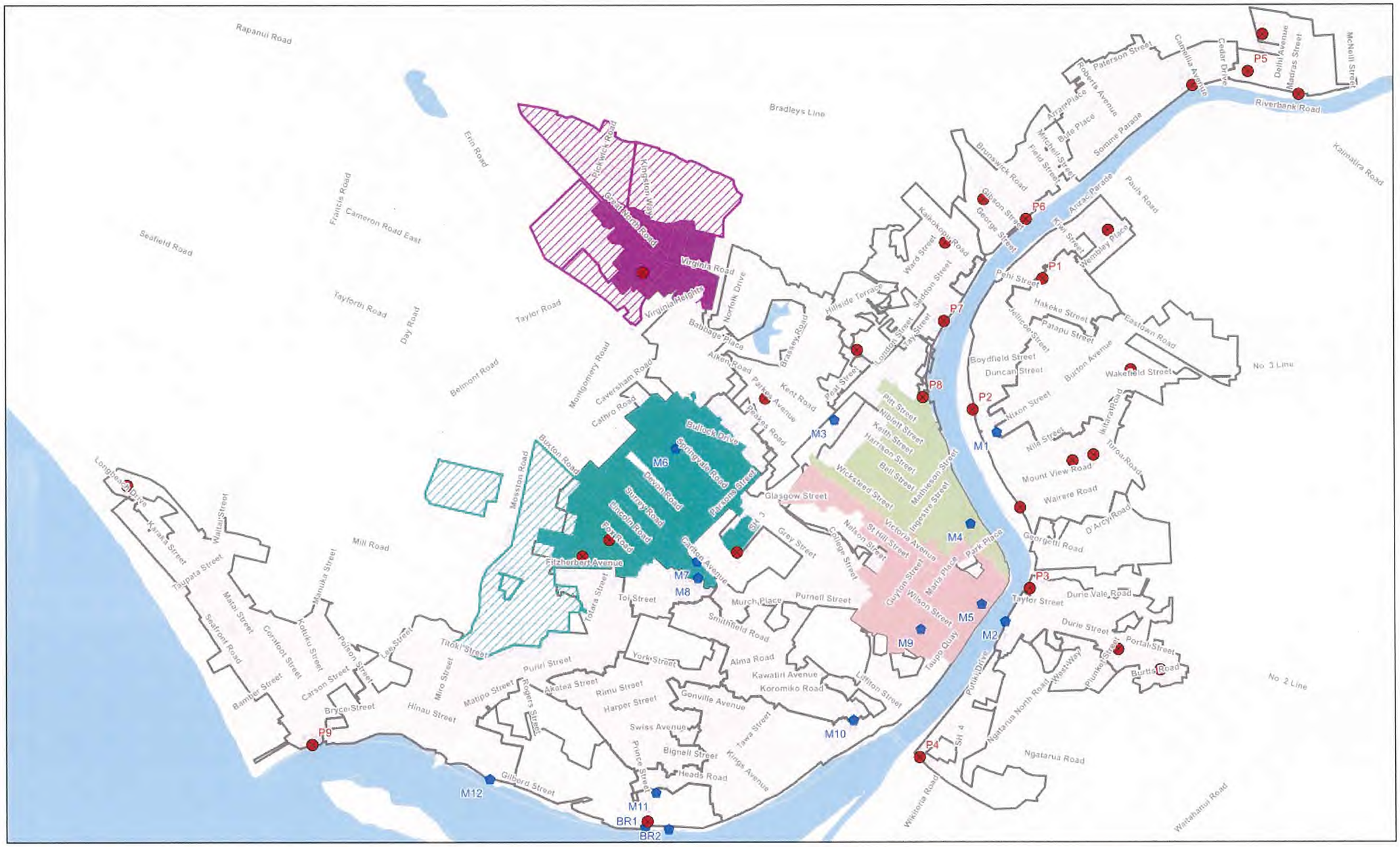
1. General infill
    i) Otamatea (Churton area)
    ii) Springvale
    iii) Inner city (excluding commercial)
    iv) Commercial zone
    v) Other residential
2. Greenfield development
    i) Otamatea
    ii) Springvale

iii) Rural lifestyle zones

3. Rural zone development

Rural lifestyle zones were not included in this project as it will not affect the existing wastewater network. Growth listed under "other residential" was distributed across the remaining sub-catchments as a proportion of the sub-catchment area.

Population numbers and descriptions on how this growth was incorporated in to the model can be found in the previous report. Figure 3 identifies the extents of the growth areas from the District Plan being evaluated.



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

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LEGEND

PREDICTED GROWTH AREAS
- Inner City infill
- Commercial infill
- Otamatea infill
- Springvale infill
- Other Residential Infill
- Otamatea development
- Springvale development

- PUMPSTATION
- FLOWMONITOR

GHD

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater System Performance

Job Number 51-3355700
Revision A
Date 03 Mar 2016

Whanganui Wastewater Network
Predicted Growth Areas

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Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by arbaugham

Level 2, 52 The Square, Palmerston North, 4410 T 64 6 353 1800 F 64 6 353 1801 E palmmail@ghd.com W www.ghd.com

Figure 3 Whanganui City-Wide Growth Areas

2.2.1 Greenfield Development Wastewater Network

Two options were evaluated for the proposed greenfield developments:

1. New gravity sewer, or
2. New LPS

Wastewater Flow

Based on the selected wastewater scheme, the flow from the new developments were added using either a synthetic dry weather diurnal curve or a constant inflow equal to the peak discharge from the LPS.

Background information on the synthetic dry weather curves can be found in the previous *City-Wide Growth Report*, under Section 3.1.1. Refer to the previous report for a description on how the gravity network was set up in the new Springvale development.

For the LPS option, the catchments were assigned a constant flow equal to the maximum peak discharge. The peak discharge was a factor of the number of dwellings within the catchment and the corresponding daily maximum number of pumps running simultaneously based on statistical analysis provided in the EOne publication, *Low Pressure Sewer Systems Using Environment One Grinder Pumps* (included as Appendix B). No population or wastewater profile was assigned to the sub-catchments. Similarly, no wet weather response was added to these catchments. It should be noted that this was considered to be a conservative approach, as the constant inflow is set to the peak discharge and therefore the overall volume from the LPS catchments would be over estimated.

Proposed Development Network Layouts

For the Springvale development, the internal gravity network was modelled since a structure plan had already been developed (refer previous report). For the LPS network, additional discharge points were identified based on the network layout. Table 2 summarises how the Springvale development and LPS was broken up into sub-catchments and where they discharged into the existing network.

Table 2 Springvale LPS Sub-Catchments

Sub-Catchment ID	Sub-Catchment Area (ha)	Number of Dwellings	Existing Network Discharge Point
WWM00429	15.5	67	Rogers Street
WWM00668	2.7	12	Tawhero Street
WWM00827	23.2	99	Fox Road
WWM00827B	21.5	92	Fox Road
WWM00861	7.7	33	Buxton Road
WWM07871	19.1	82	Fitzherbert Avenue
WWM07873	7.6	33	Kelsi Street

For the Otamatea development, no structure plan was provided and therefore the internal wastewater network was not modelled. Four sub-catchments were delineated and assigned to the nearest manhole. The discharge points for the LPS were the same as the gravity network discharge points.

2.2.2 Scenarios

In total, ten scenarios were evaluated. Figure 4 below illustrates the relationship of these scenarios.

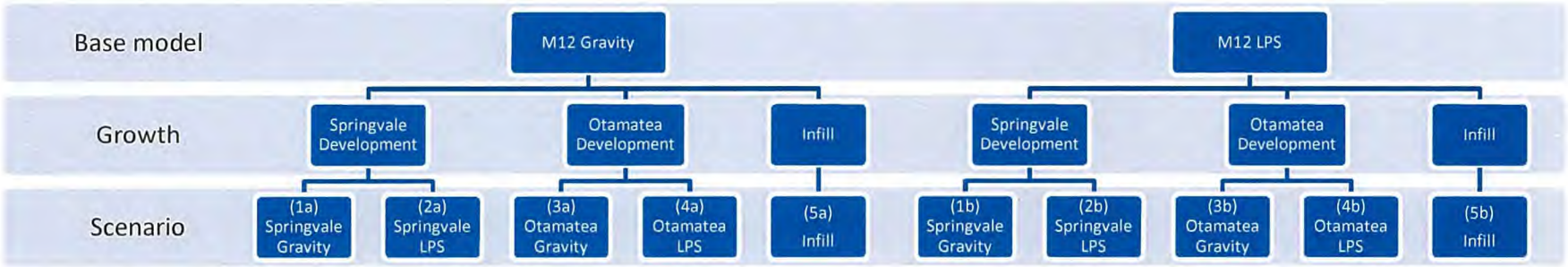


Figure 4 Model Scenario Layout

2.3 Existing Network Capacity Investigation for Growth

2.3.1 Infill Only

The model was first run with the 1 in 1 year system improvements (either with M12 gravity upgrades or M12 LPS) plus infill. This was done to indicate which areas within the network had capacity for infill.

The following results were predicted for both the M12 gravity upgrades and M12 LPS base models:

- The sewer from Otamatea that runs down the hill to Peakes Road and down Springvale Road was now surcharged, resulting in spilling on Virginia Heights / Sandy Lane.
- The Purnell Street sewer from Springvale was near capacity or exceeding.
- The City Interceptor up to Tregenna Pump Station was running at full capacity.
- Approximately 11 m^3 of additional storage was required at Kowhai Park (1,336 m^3 total) and 3 m^3 of additional storage at River Reserve (85 m^3 total).

For the M12 gravity upgrades system improvements only, the following results were predicted:

- The Castlecliff Interceptor was running at full capacity, with minor spilling predicted.
- Approximately 64 m^3 of additional storage was required at Moutoa Gardens (1,433 m^3 total).
- Approximately 7 m^3 of additional storage was required at Bullocks Yard (191 m^3 total).

For the M12 LPS system improvements only, the following results were predicted:

- The Castlecliff Interceptor was running at full capacity, however no additional spilling was observed.
- Approximately 38 m^3 of additional storage was required at Moutoa Gardens (1,109 m^3 total).

Appendix C provides an overview of the spill areas in the network with infill only for both M12 scenarios. With the exception of Otamatea, the model shows that infill has no significant impact on the network.

2.3.2 Greenfield Development

The greenfield development areas were then individually evaluated to accommodate the predicted growth in each area.

The following options were evaluated under each M12 system upgrade scenario:

1. Springvale gravity network
    a. 1 in 1 year system improvements (SI) with M12 gravity upgrades
    b. 1 in 1 year SI with M12 LPS
2. Springvale LPS
    a. 1 in 1 year SI with M12 gravity upgrades
    b. 1 in 1 year SI with M12 LPS
3. Otamatea gravity network
    a. 1 in 1 year SI with M12 gravity upgrades

b. 1 in 1 year SI with M12 LPS

4. Otamatea LPS

a. 1 in 1 year SI with M12 gravity upgrades

b. 1 in 1 year SI with M12 LPS

Appendix C provides a network overview showing the location of each spill area for the different options and scenarios. In general, the upgrades required to resolve predicted spilling due to growth were unaffected by the system improvements M12 option (gravity or LPS). The extent of upgrades, however, was heavily dependent on the network scenario chosen for each greenfield development.

Table 3 below summarises the spilling / overflow results of each of the scenarios. Upgrades to eliminate spilling in the identified areas are discussed in the sections below.

Table 3 Summary of Predicted Spilling

Scenario	Number of Spilling Manholes*	Total volume Spilled (m^3)*
1. Springvale gravity network		
a) M12 gravity	1†	25
b) M12 LPS	1‡	22
2. Springvale LPS network		
a) M12 gravity	2†‡	538
b) M12 LPS	2‡	538
3. Otamatea gravity network		
a) M12 gravity	1†	177
b) M12 LPS	1	175
4. Otamatea LPS network		
a) M12 gravity	1†	30
b) M12 LPS	1	30
5. Infill		
a) M12 gravity	1†	22
b) M12 LPS	1	22

* Manholes were only noted as spilling when the volume lost was greater than 20 m^3.

† Does not include the manhole on Heads Road that was on threshold of spilling (~19 m^3) during System Improvements, but tipped over 20 m^3 in the growth scenario. This spill was addressed, however it was not ultimately attributed to growth and therefore not included in the table. Refer Section 2.3.3.

‡ Manhole(s) were below the threshold for spilling (< 20 m^3) but upgrades were already required for 1 in 1 year System Improvements, so spilling was still addressed.

Installing a new LPS instead of a gravity network eliminates the wastewater diurnal curve and any wet weather response. In Otamatea, the model predicted more spilling in the gravity

network due to the wet weather response and the existing network's capacity to deal with the peaking. In contrast, a new LPS network in Springvale resulted in greater spilling because the LPS allowed the development to tie into the existing network at more points, therefore stressing more areas of the network, one of which was unable to cope with the new flow.

The M12 option (gravity or new LPS) had little to no effect on the growth scenarios.

2.3.3 1 in 1 Year System Improvements Revisions

As briefly mentioned in Table 3, some of the growth scenarios resulted in spilling on Heads Road. During the System Improvements phase, the model predicted spilling in this area, although just below the 20 m^3 threshold. Since some of the growth scenarios tipped the spills just over the threshold volume, it was decided that the upgrades required to resolve spilling in this area be included in the System Improvements programme of work. These upgrades were applied to the base model (1 in 1 year system improvements with M12 gravity or M12 LPS upgrades) for every growth scenario, regardless if additional spilling was predicted by the model after growth was applied. The spill volume in this area was not included in the volume spilled due to growth.

This area was identified as Area BB, following the upgrades at Liverpool Pump Station (refer Section 2.1.1).

2.4 Upgrade Strategy

System upgrades were performed to eliminate spilling in the network for each discharge option for each of the different scenarios. As with System Improvements, the areas identified for improvement are locations where spilling greater than 20 m^3 has been predicted by the model. Spills predicted by the model to be less than 20 m^3 was considered unlikely to create the pressure required to open manhole lids in reality and therefore are unlikely to result in actual spills.

System improvements were chosen to address each spill area identified. There are three options presented in this report to address the spills:

1. Seal the manhole;
2. Upgrade the pipe to increase capacity; or
3. Provide storage.

The option chosen was dependent on the volume that was spilled, location of the spill, and relative cost of the upgrade alternatives.

Descriptions of these upgrade options can be found in the previous *Wastewater Bulk Supply Investigation* report (January 2016).

It should be noted that the maps of the upgrades in this report also include the upgrades required under the 1 in 1 year System Improvements. Refer to the *Revised System Improvements Report* (February 2016) for details of these upgrades.

2.5 System Upgrades for Growth Scenarios

The following sections discuss the upgrades required to meet the LOS containment target for each growth scenario and M12 system improvements option. Individual spill areas identified in the *Revised System Improvements Report* have not been included unless the improvements have changed as a result of growth. Maps of the upgrades common across all scenarios have been included separately in Appendix A and Appendix D. Maps of the upgrades specific to the selected scenario can be found in Appendix E.

Due to minor instabilities within the model, it was found that storage volumes can vary slightly. Therefore no change was noted if the storage volume was within 3 m^3 of the 1 in 1 year System Improvements storage volume. This equates to $4,500, which is a very small portion of the total upgrade costs and was not considered a substantial differentiator when comparing and choosing between scenarios.

2.5.1 Scenario 1a: Springvale Gravity with M12 Gravity System Improvements

Springvale greenfield development with a new gravity sewer resulted in spilling on Rogers Street due to insufficient downstream capacity within the existing network.

Area G-1 – Spilling from Springvale Development

The new Springvale development area discharges to the Raupo Street sewer in the Gonville / M12 catchment and the Fitzherbert Avenue sewer in the M7 catchment. Upgrades at the top of the M12 catchment were required to eliminate spilling in Gonville as follows:

- 229 m of 450 mm diameter gravity main on Puriri Street (WWM00448 to WWM00463)
- 98 m of 225 mm diameter gravity main on Rogers Street (WWM00447 to WWM00448)

In addition, 59 m of 150 mm diameter gravity main needed to be re-laid with a new manhole in order to connect the new development to Rogers Street.

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 10 m^3 of additional storage was required at Moutoa Gardens (1,379 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

Due to the increase in flow from growth, approximately 18 m^3 of additional storage was required at Heads Road (273 m^3 total). No additional storage was required at Hinau Street.

Area W – Spilling Off SH3

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 4 m^3 of additional storage was required at the Bullocks Yard (188 m^3 total).

Area BB – Heads Road Manhole Spill

A flow split with weir was identified by WDC staff on Heads Road, allowing flow directly north of BRPS to be split between the 375 mm Beach Road sewer and the 300 mm sewer that runs parallel to the open drain next to Tasman Tanning. During System Improvements the model predicted spilling here less than 20 m^3, however only just under the threshold level. During this growth scenario the spilling tipped over 20 m^3. Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3).

Spilling in this area was attributed to network constraints on both branches; however the western branch showed greater downstream capacity. Additional flow was therefore directed down the Tasman Tanning sewer by upgrading approximately 239 m with 225 mm diameter gravity sewer (WWM05021 to WWM05076), removing the weir at WWM05035, and relaying the flow split pipe at a steeper grade by matching the inverts of the upstream and downstream manholes and upgrading to 225 mm diameter gravity main (26 m from WWM05035 to WWM05021).

A map of the upgrades has been provided in Appendix A.

2.5.2 Scenario 1b: Springvale Gravity with M12 LPS System Improvements

Under the M12 LPS option, the new Springvale development area discharges to the new Rogers Street / Balgownie Landfill bypass. The Springvale greenfield development, with new gravity sewer, resulted in minor spilling on Rogers Street, both upstream and downstream of the bypass, due to insufficient capacity within the existing network.

Area G-1 – Spilling from Springvale Development

With the new Rogers Street / Balgownie Landfill bypass, all flow from the development is passed through the 375 mm bypass instead of the 375 / 450 mm Raupo / Puriri Street sewer mains. The reduced downstream capacity required upgrades at the top of Rogers Street to eliminate spilling as follows:

- 59 m of 225 mm diameter gravity main laid at a steeper grade from WWM00436 to WWM00429
- 98 m of 225 mm diameter gravity main from WWM00447 to WWM00448

Upgrades at the bottom of Rogers Street between the Balgownie Landfill and Gilberd Street were required as follows:

- 356 m of 450 mm diameter gravity main from WWM00610 to WWM00614

An increase on an upgrade required under the 1 in 1 year system improvements was also required, and has been included under Area T.

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 4 m^3 of additional storage was required at Moutoa Gardens (1,075 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

Due to the increase in flow from growth, 12 m of a 375 mm diameter upgrade for system improvements was increased to 450 mm diameter.

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

2.5.3 Scenario 2a: Springvale LPS with M12 Gravity System Improvements

Under the LPS scenario, the new Springvale development area discharges to the Rogers Street, Tawhero Street, Fox Road, Buxton Road, Fitzherbert Avenue and Kelsi Street sewers. Since flow is distributed across several catchments, spilling in Gonville was not predicted. However the model did show that the Fox Road Pump Station was causing spilling upstream due to the increase in base flow from the development.

Area G-2 – Spilling Upstream of Fox Road Pump Station

Springvale greenfield development with a new LPS resulted in spilling on Fox Road due to the Fox Road Pump Station just downstream. The Fox Road Pump Station has a discharge

capacity of 8 l/s. The peak discharge from the new greenfield development on that branch was approximately 8 l/s, and therefore the pump station was unable to draw down the level in the upstream network. In order to prevent spilling the Fox Road Pump Station had to be increased by 2 l/s in order to accommodate growth and eliminate spilling upstream, for a total capacity of 10 l/s.

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 58 m^3 of additional storage was required at Moutoa Gardens (1,427 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

Due to the increase in flow from growth, approximately 20 m^3 of additional storage was required at Heads Road (275 m^3 total).

No additional storage was required at Hinau Street.

Area W – Spilling Off SH3

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 7 m^3 of additional storage was required at the Bullocks Yard (191 m^3 total).

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

2.5.4 Scenario 2b: Springvale LPS with M12 LPS System Improvements

Under the LPS scenario, the new Springvale development area discharges to the Rogers Street, Tawhero Street, Fox Road, Buxton Road, Fitzherbert Avenue and Kelsi Street sewers. The model showed that the Fox Road Pump Station was causing spilling upstream due to the increase in base flow.

In addition, the M12 LPS option includes a new Rogers Street / Balgownie Landfill bypass. The Springvale greenfield development LPS therefore discharges to the new Balgownie Landfill bypass. This resulted in minor spilling on the M12 bypass connecting Rogers Street North and South due to insufficient downstream capacity.

Area G-1 – Spilling from Springvale Development

Upgrades at the bottom of Rogers Street between the Balgownie Landfill and Gilberd Street were required as follows:

- 140 m of 450 mm diameter gravity main from WWM00613 to WWM00614

An increase on an upgrade required under the 1 in 1 year system improvements was also required, and has been included under Area T.

Area G-2 – Spilling Upstream of Fox Road Pump Station

Springvale greenfield development with a new LPS resulted in spilling on Fox Road due to the Fox Road Pump Station just downstream.

The upgrades required were the same as Scenario 2a, Section 2.5.3.

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 23 m^3 of additional storage was required at Moutoa Gardens (1,094 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

Due to the increase in flow from growth, 12 m of a 375 mm diameter upgrade for system improvements was increased to 450 mm diameter.

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

2.5.5 Scenario 3a: Otamatea Gravity with M12 Gravity System Improvements

In Otamatea spilling was predicted on Great North Road with minor spilling on Sandy Lane due to network capacity constraints.

The Otamatea wastewater network ultimately discharges to Springvale Road, where the elevation drops several times, thereby isolating some of the spill areas. Improvements were therefore required in three different areas: Great North Road, Virginia Heights, and Peakes Road / Springvale Road.

Minor spilling at the top of the catchment was predicted, however the invert levels for these manholes were unknown and assumed to be ground level minus one metre. These were therefore ignored as they were less than 20 m^3 and did not have reliable network information.

Area G-3 – Spilling from Otamatea Development

Pipe Upgrades

The network along Great North Road was upgraded and a bypass was modelled continuing the Great North Road sewer instead of first conveying the flow to Virginia Road before continuing on to Virginia Heights. Upgrades on Virginia Heights and down to Sandy Lane were also required to accommodate the increase in flow. In total the following upgrades were required:

- 72 m of 225 mm diameter gravity main (WWM04405 to WWM04380)
- 134 m of 300 mm diameter gravity main (WWM04380 to WWM04417)
- 28 m long, 225 mm diameter bypass from WWM04417 to WWM04462
- 773 m of 225 mm diameter gravity main (WWM04462 to WWN04479)

Storage

As the sewer drops to Sandy Lane, a storage structure at WWM04479 was required to capture the larger peak flow from upstream without overloading the network downstream. Approximately 93 m^3 of storage was required in the park at the top of Sandy Lane with a 6 m length of 150 mm diameter pipe to serve as a choke.

Area G-4 – Spilling on Sandy Lane

Before spilling was addressed in Area G-3, the model predicted only minor spilling on Sandy Lane (< 4 m³). However once the network upstream was upgraded to handle the additional flow from the Otamatea development, spilling on Sandy Lane and further downstream was predicted by the model.

Approximately 158 m of 225 mm diameter gravity main was required from the new storage structure to the intersection of Sandy Lane and Montgomery Road (WWM04479 to WWM01182).

Upgrades further downstream were then required to handle the increase in flow, as follows:

- 436 m of 300 mm diameter gravity main behind Peakes Road (WWM01188 to WWM01195)
- 597 m of 300 mm diameter gravity main on Springvale Road (WWM01094 to WWM01109)

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 35 m³ of additional storage was required at Moutoa Gardens (1,404 m³ total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

Due to the increase in flow from growth, approximately 4 m³ of additional storage was required at Heads Road (259 m³ total).

No additional storage was required at Hinau Street.

Area W – Spilling Off SH3

No additional storage was required at the Bullocks Yard.

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

2.5.6 Scenario 3b: Otamatea Gravity with M12 LPS System Improvements

Spilling associated with the Otamatea greenfield development was found to be independent of the M12 option. Similar to Scenario 3a, the model predicted spilling on Great North Road with minor spilling on Sandy Lane due to network capacity constraints.

The Otamatea wastewater network ultimately discharges to Springvale Road, where the elevation drops several times, thereby isolating some of the spill areas. Improvements were therefore required in three different areas: Great North Road, Virginia Heights, and Peakes Road / Springvale Road.

Minor spilling at the top of the catchment was predicted, however the invert levels for these manholes were unknown and assumed to be ground level minus one metre. These were therefore ignored as they were less than 20 m³ and did not have reliable network information.

Area G-3 – Spilling from Otamatea Development

Pipe Upgrades

The upgrades required were the same as Scenario 3a, Section 2.5.5.

Storage

As the sewer drops to Sandy Lane, a storage structure at WWM04479 was required to capture the larger peak flow from upstream without overloading the network downstream.

The volume of storage required was the same as Scenario 3a, Section 2.5.5.

Area G-4 – Spilling on Sandy Lane

Before spilling was addressed in Area G-3, the model predicted only minor spilling on Sandy Lane (< 4 m^3). However once the network upstream was upgraded to handle the additional flow from the Otamatea development, spilling on Sandy Lane and further downstream was predicted by the model.

The upgrades required were the same as Scenario 3a, Section 2.5.5.

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 15 m^3 of additional storage was required at Moutoa Gardens (1,086 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

No additional upgrades were required.

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

2.5.7 Scenario 4a: Otamatea LPS with M12 Gravity System Improvements

In Otamatea spilling was predicted on Great North Road with minor spilling on Sandy Lane due to network capacity constraints.

The Otamatea wastewater network ultimately discharges to Springvale Road, where the elevation drops several times, thereby isolating some of the spill areas. Improvements were therefore required in two different areas: Great North Road and Virginia Heights.

Area G-3 – Spilling from Otamatea Development

Spilling occurred just off of Great North Road due to downstream capacity constraints. The existing network conveys flow from the top of Great North Road to Virginia Road before continuing on to Virginia Heights. A 28 m long, 150 mm diameter bypass between WWM04417 and WWM04462 was added at the intersection of Great North Road and Virginia Road, connecting the two separate segments of Great North Road and therefore splitting the flow.

Area G-4 – Spilling on Sandy Lane

Before spilling was addressed in Area G-3, the model predicted only minor spilling on Sandy Lane (< 4 m^3). However once the network upstream was upgraded to handle the additional flow from the Otamatea development, greater spilling on Sandy Lane was predicted by the model.

Approximately 164 m of 225 mm diameter gravity main between WWM04479 and WWM01182 were required to eliminate spilling.

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 46 m^3 of additional storage was required at Moutoa Gardens (1,415 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

Due to the increase in flow from growth, approximately 8 m^3 of additional storage was required at Heads Road (263 m^3 total).

No additional storage was required at Hinau Street.

Area W – Spilling Off SH3

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 5 m^3 of additional storage was required at the Bullocks Yard (189 m^3 total).

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

2.5.8 Scenario 4b: Otamatea LPS with M12 LPS System Improvements

Spilling associated with the Otamatea greenfield development was found to be independent of the M12 option. Similar to Scenario 4a, the model predicted spilling on Great North Road with minor spilling on Sandy Lane due to network capacity constraints. With the exception of storage along the interceptor, the upgrades in Otamatea are the same as Scenario 4a.

The Otamatea wastewater network ultimately discharges to Springvale Road, where the elevation drops several times, thereby isolating some of the spill areas. Improvements were therefore required in two different areas: Great North Road and Virginia Heights.

Area G-3 – Spilling from Otamatea Development

Spilling occurred just off of Great North Road due to downstream capacity constraints.

The upgrades required were the same as Scenario 4a, Section 2.5.7.

Area G-4 – Spilling on Sandy Lane

Before spilling was addressed in Area G-3, the model predicted only minor spilling on Sandy Lane (< 4 m^3). However once the network upstream was upgraded to handle the additional flow from the Otamatea development, spilling on Sandy Lane was predicted by the model.

The upgrades required were the same as Scenario 4a, Section 2.5.7.

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 28 m^3 of additional storage was required at Moutoa Gardens (1,099 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

No additional upgrades were required.

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

2.5.9 Scenario 5a: Infill with M12 Gravity System Improvements

Population was added across the entire Whanganui catchment in accordance with the Strategic Planning growth estimates. Most of the catchment was able to handle the increase in flow, with the exception of the Sandy Lane sewer in Otamatea. Spilling was predicted on Sandy Lane due to downstream capacity constraints.

Additional storage was also required in Wanganui East to accommodate the growth from infill.

Area G-4 – Spilling on Sandy Lane

Spilling was predicted on Sandy Lane at the foot of the hill. In order to eliminate spilling, approximately 69 m of 225 mm diameter gravity main between WWM04480 and WWM01182 were required.

Area B – Spilling and Overflows on Wanganui East Interceptor

Due to the increase in flow from growth from infill, approximately 11 m^3 of additional storage was required at Kowhai Park (1,336 m^3 total).

Similarly, approximately 3 m^3 of additional storage was required at the River Reserve (85 m^3 total).

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 64 m^3 of additional storage was required at Moutoa Gardens (1,433 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

Due to the increase in flow from growth, approximately 14 m^3 of additional storage was required at Heads Road (269 m^3 total).

No additional storage was required at Hinau Street.

Area W – Spilling Off SH3

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 7 m^3 of additional storage was required at the Bullocks Yard (191 m^3 total).

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3).

2.5.10 Scenario 5b: Infill with M12 LPS System Improvements

Population was added across the entire Whanganui catchment in accordance with the Strategic Planning growth estimates. Most of the catchment was able to handle the increase in flow, with the exception of the Sandy Lane network in Otamatea. Similar to Scenario 5a, the model predicted spilling on Sandy Lane due to network capacity constraints.

Additional storage was also required in Wanganui East to accommodate the growth from infill.

Spilling associated with infill was found to be independent of the M12 option. Aside from storage volumes, the network upgrades were the same as those required for Scenario 5a.

Area G-4 – Spilling on Sandy Lane

Spilling was predicted on Sandy Lane at the foot of the hill.

The upgrades required were the same as Scenario 5a, Section 2.5.9.

Area B – Spilling and Overflows on Wanganui East Interceptor

Due to the increase in flow from growth from infill, additional storage was required.

The volume of storage required was the same as Scenario 5a, Section 2.5.9.

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 38 m^3 of additional storage was required at Moutoa Gardens (1,109 m^3 total).

Area T – Spilling in Gonville

No additional upgrades were required.

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

2.6 Summary of Modelling Results

The modelling results show that:

- Flow from the Springvale greenfield development only had a minor impact on the existing network, depending on the servicing option used.
- The network in Otamatea is at full capacity, and any additional growth (infill or greenfield development) required network upgrades.
- Upgrades for infill and Otamatea greenfield development were independent of the City Interceptor (with the exception of storage).

- Excluding Otamatea, growth from infill only had a minor impact on the existing network in the form of larger storage requirements and a single pipe upgrade.

3. Combined Growth Network Assessment

3.1 Workshop Outcomes

Following the preliminary investigation into the individual growth scenarios, a workshop was held on 15 March 2016 with members of GHD and WDC. The System Improvements and associated costs (refer Section 4.1) were presented to WDC in order to identify the preferred network options and determine the final costs associated with all growth being combined.

The following combined growth option was developed:

- 1 in 1 year System Improvements would include the M12 gravity upgrades
- Springvale greenfield development would be comprised of a new gravity network
- Otamatea greenfield development would be comprised of a new LPS
- General infill as previously modelled

3.2 Existing Network Capacity

The model was first run with the 1 in 1 year system improvements for M12 gravity upgrades plus infill (Scenario 5a) upgrades, Springvale Gravity (Scenario 1a) upgrades, and Otamatea LPS (Scenario 4a) upgrades. This was done to indicate which areas within the network had capacity to accommodate all of the growth and if additional upgrades were required.

Appendix C provides an overview of the spill areas in the network for the combined growth scenario. With the exception of Otamatea, the model shows that the combined growth has no significant impact on the network with 1 in 1 year system improvements.

3.3 System Upgrades for Combined Growth

The following sections discuss the upgrades required to meet the LOS containment target for the combined growth option chosen at the WDC workshop. Individual spill areas identified in the *Revised System Improvements Report* have not been included in this section unless the improvements have changed as a result of growth. Maps of the upgrades that have not changed since the 1 in 1 year System Improvements (unaffected by growth) have been included separately in Appendix A and Appendix D. Maps of the upgrades specific to the combined growth scenario can be found in Appendix F. These include the upgrades required under the individual growth scenarios.

Similar to the Preliminary Network Assessment (Section 2), no change in storage was noted if the storage volume was within 3 m^3 of the original 1 in 1 year System Improvements storage volume.

With all of the growth combined (and the upgrades required under each individual growth scenario) the model only predicted spilling in Otamatea.

Area G-1 – Spilling from Springvale Development

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Area G-3 – Spilling from Otamatea Development

Spilling occurred just off of Great North Road due to downstream capacity constraints.

In addition to the upgrades required in Scenario 4a, Section 2.5.7, additional pipe upgrades were then required to accommodate the combined flows from the Otamatea greenfield development and infill, as follows:

- 134 m of 225 mm diameter gravity main between WWM04380 to WWM04417 was required upstream of the new bypass.
- 195 m of 225 mm diameter gravity main between WWM04472 to WWM04474 after the Great North Road and Virginia Road mains connect.

Area G-4 – Spilling on Sandy Lane

Under the Otamatea greenfield development scenario (Scenario 4a Section 2.5.7), approximately 164 m of 225 mm diameter gravity main between WWM04479 and WWM01182 was required to eliminate spilling—less was required under the infill only scenario.

Before spilling from the combined growth was addressed in Area G-3, the model did not predict any spilling further downstream on Springvale Road. However once the network upstream was upgraded to handle the combined flow, spilling on Springvale Road was predicted by the model. Approximately 223 m of 300 mm gravity main on Springvale Road between Sussex Road and Treadwell Street (WWM01098 and WWM01109) was required.

Invert levels upstream of WWM01098 were assumed in the model, resulting in a step change at that manhole. An additional 85 m was upgraded to 300 mm diameter gravity main on Springvale Road from WWM01097 to WWM01098, and was laid at a steeper grade to match the invert level of the downstream manhole.

It should be noted that there is a parallel sewer on Springvale Road. Possible cross connections were investigated, however the depths of the sewers and the large diameter storm drain running between the two sewers did not make this a viable option.

Area B – Spilling and Overflows on Wanganui East Interceptor

Due to the increase in flow from growth from infill, approximately 11 m^3 of additional storage was required at Kowhai Park (1,336 m^3 total).

Similarly, approximately 3 m^3 of additional storage was required at the River Reserve (85 m^3 total).

Area L – Spilling in Central City

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 114 m^3 of additional storage was required at Moutoa Gardens (1,483 m^3 total).

No additional storage was required at Laird Park.

Area T – Spilling in Gonville

Due to the increase in flow from growth, approximately 32 m^3 of additional storage was required at Heads Road (287 m^3 total).

No additional storage was required at Hinau Street.

Area W – Spilling Off SH3

Due to the increase in flow from growth and higher levels in the Interceptor, approximately 13 m^3 of additional storage was required at the Bullocks Yard (197 m^3 total).

Area BB – Heads Road Manhole Spill

The upgrades required were the same as Scenario 1a, Section 2.5.1.

Due to the fact that the spilling attributed to growth is only marginal, it was decided that this spill area be addressed but the costs associated with it be assigned to the System Improvements programme of works (refer Section 3). A map of the upgrades has been provided in Appendix A.

3.4 Summary of Modelling Results

The modelling results show that:

- Aside from storage, additional pipe / network upgrades were only required in Otamatea with all of the growth areas combined.
- No additional upgrades to those required for greenfield development were required in the Springvale development / Gonville area due to infill.
- Approximately 173 m^3 of additional storage was required across the network to accommodate the proposed peak wet weather flows from growth.

4. Costs

The preliminary cost estimates presented in this report have been developed for the purposes of high level budget decisions and should not be used for any other purpose. The scope and quality of the works has not been fully defined and therefore the estimates are not warranted by GHD. These estimates are typically developed based on cost curves, budget quotes for some equipment items, extrapolation of recent similar project pricing, and GHD experience. The accuracy of the estimates is recommended for budget setting purposes only.

The detailed breakdown of the cost estimate has been provided in Appendix G for each of the individual scenarios and Appendix H for the combined growth scenario. As this analysis was conducted following System Improvements, the upgrades previously proposed were revisited and reduced where possible. Any change to the System Improvements cost estimate has been included in the tables below.

As mentioned in Section 2.1.1, Area AA was not included in the costs associated with growth because this overflow was occurring during System Improvements. This cost was incorporated in to the System Improvements base cost.

Similarly, the spill Area BB ultimately was not included in the costs associated with growth, but instead added to the System Improvements costs. This is because spilling in this area during System Improvements was just below the threshold, and growth only marginally increased that spilling to just over the threshold limit of 20 m^3. The costs associated with eliminating spilling in this area have also been included in the System Improvements base cost.

4.1 Individual Growth Scenarios

The following sections provide a preliminary estimate of the costs associated with each growth scenario. They are shown as the difference in cost from the 1 in 1 year System Improvements. These costs only account for existing network upgrades incurred by WDC, and do not include any developer costs.

The detailed breakdown of the cost estimate has been provided in Appendix G for each scenario.

4.1.1 Springvale Greenfield Development

Table 4 summarises the costs associated with the Springvale greenfield development under the various scenarios.

Table 4 Preliminary Springvale Greenfield Development Remedial Works Cost Comparison

Scenario	Pre-Growth System Improvements*	Additional Costs for Growth	Total Cost of Remedial Works	Cost per Dwelling†
1a: Springvale gravity network with M12 gravity system improvements	$13,083,000	$205,000	**$13,288,000**	**$492**
1b: Springvale gravity network with M12 LPS system improvements	$16,724,000	$232,000	**$16,956,000**	**$556**
2a: Springvale LPS network with M12 gravity system improvements	$13,083,000	$186,000	**$13,269,000**	**$446**
2b: Springvale LPS network with M12 LPS system improvements	$16,724,000	$159,000	**$16,883,000**	**$381**

* System Improvements cost includes upgrades required to resolve spilling in Areas AA and BB.

† The number of dwellings used (417) was taken from the District Plan provided by WDC.

The cost estimates show that there was a marginal difference in the cost of growth between the M12 gravity and M12 LPS options, as storage along the interceptor was not greatly affected by growth.

When considering the discharge from the new development area, installing a new LPS in the Springvale greenfield development area would require fewer upgrades than a new gravity network. Although the upgrades would be cheaper for Council, they will likely be much greater for the developer / community. In order to price a new LPS, an estimate of $10,000 has typically been applied for each property. This will likely result in the total development cost being greater than the costs associated with a new gravity sewer.

There are minimal gains in installing a new LPS in the Springvale development area. The exception to this is the additional discharge points that would enable development to occur in different sub-sections. Based on the structure plan used for this investigation, the gravity network involves a small sub-section discharging to the Fitzherbert Avenue sewer, and the majority discharging to a new trunk main that discharges to the Rogers Street sewer. In order to develop this area, construction of the trunk main would first be required. Although an alternative gravity network could be considered that utilises pump stations, this scenario was not modelled as it was outside the scope of work, but could be considered in future analysis.

4.1.1 Otamatea Greenfield Development

Table 4 summarises the costs associated with the Otamatea greenfield development under the various scenarios.

Table 5 Preliminary Otamatea Greenfield Development Remedial Works Cost Comparison

Scenario	Pre-Growth System Improvements*	Additional Costs for Growth	Total Cost of Remedial Works	Cost per Dwelling†
3a: Otamatea gravity network with M12 gravity system improvements	$13,083,000	$1,575,000	**$14,658,000**	**$8,799**
3b: Otamatea gravity network with M12 LPS system improvements	$16,724,000	$1,539,000	**$18,263,000**	**$8,598**
4a: Otamatea LPS network with M12 gravity system improvements	$13,083,000	$154,000	**$13,237,000**	**$860**
4b: Otamatea LPS network with M12 LPS system improvements	$16,724,000	$115,000	**$16,839,000**	**$642**

* System Improvements cost includes upgrades required to resolve spilling in Areas AA and BB.

† The number of dwellings used (179) was taken from the District Plan provided by WDC.

The cost estimates show that there was a marginal difference between the M12 gravity and M12 LPS options, as storage along the interceptor was not greatly affected by growth.

When considering the discharge from the new development area, installing a new LPS in the Otamatea greenfield development area would be significantly less than that of a new gravity network. This is due to the existing network not being able to cope with the additional wet weather response and diurnal peaking factor.

Fewer upgrades were required to accommodate the peak discharge from the LPS system; however the developer / community costs associated with constructing a new LPS were not incorporated in the estimates. In order to price a new LPS, an estimate of $10,000 has typically been applied for each property. Although gravity sewers are typically less expensive than LPS, the Otamatea development area is unique in that the terrain consists of multiple ridges and depressions, particularly in the northern half of the development area. In order to install a new gravity network to service this area, pump stations would likely be required, thereby increasing the cost of a gravity network.

Without creating a structure plan, it appears that a new LPS within the Otamatea development area may be the better solution.

4.1.1 Infill

Table 4 summarises the costs associated with growth due to infill only.

Table 6 Preliminary Infill Remedial Works Cost Comparison

Scenario	Pre-Growth System Improvements*	Additional Costs for Growth	Total Cost of Remedial Works	Cost per Dwelling†
5a: Infill with M12 gravity system improvements	$13,083,000	$173,000	**$13,256,000**	**$88**
5b: Infill with M12 LPS system improvements	$16,724,000	$102,000	**$16,826,000**	**$52**

* System Improvements cost includes upgrades required to resolve spilling in Areas AA and BB.

† The number of dwellings used (1,972) was taken from the District Plan provided by WDC.

The cost estimates show that, when considering growth due to infill only, the cheaper option would be installing a new LPS to address spilling in M12. The LPS in M12 freed up capacity along the interceptor and required less storage. Although infill does not result in a lot of spilling throughout the network, the storage facilities required for the M12 upgrades were utilised, resulting in larger storage volumes.

4.1.2 Summary

After estimating the costs required in the existing wastewater network to accommodate future growth, the following results were found:

- Although the network upgrades required for a new LPS network in the Springvale greenfield development area were less expensive than those required for a new gravity network, the costs incurred by the developer / community would likely be greater for a new LPS. Therefore there are only marginal gains for a LPS network.
- The costs associated with network upgrades for the Otamatea greenfield development area indicated a new LPS serving the area was less expensive than a new gravity sewer. However, given the topography and the significant difference in costs, a structure plan should be developed prior to choosing one of the growth scenarios.
- There was only a marginal difference between the M12 gravity and M12 LPS options when considering growth in the Springvale and Otamatea greenfield development areas.
- When considering growth due to infill, the upgrades required under the M12 LPS option cost less than those required under the M12 gravity option.

4.2 Combined Growth Scenarios

As discussed in Section 3, the individual growth scenarios were presented to WDC at a workshop and a final combined growth scenario was chosen.

The following section provides a preliminary estimate of the costs associated with each growth area, and incorporates any upgrade costs required when all growth areas are present. It should be noted that these costs only account for upgrades to the existing network that the Council would incur, and do not include any developer costs. The upgrades exclude the option of duplicate mains. The costs provided should not be used directly to determine development contribution costs. The calculation of development contributions is outside the scope of this report. Typically, development cost calculations include allowances for the cost of the wastewater network capacity consumed throughout the network (including the existing network

that has sufficient capacity) and likewise consideration for the extent the existing wastewater flows contribute to the capacity of any upgrade required.

The detailed breakdown of the cost estimate has been provided in Appendix H.

Table 7 below summarises the costs for growth of the individual growth scenarios and the scenario where all growth areas are combined. It should be noted that this is a total cost comparison, and therefore the costs for combined growth incorporate the upgrades required under each individual growth area.

Table 7 Comparison of Costs for Growth Scenarios in Each Spill Area

Spill Area	Scenario 1a	Scenario 4a	Scenario 5a	Combined Growth
B	$0	$0	$22,000	$22,000
L	$15,000	$67,000	$94,000	$171,000
T	$27,000	$12,000	$21,000	$48,000
W	$0	$8,000	$11,000	$20,000
G-1	$163,000	-	-	$163,000
G-3	-	$8,000	-	$126,000
G-4	-	$59,000	$25,000	$189,000
TOTAL	**$205,000**	**$154,000**	**$173,000**	**$739,000**

4.2.1 Growth Area Flow Contributions

In Section 4.1 costs were able to be assigned to the individual growth area as each area was modelled and analysed separately. However, once all of the growth areas were combined, additional upgrades were required. In order to assign the additional costs to the appropriate growth area, the change / increase in peak flow due to growth was used. Table 8 below summarises the increase in peak flow due to growth in the different areas. The additional flow is taken from the individual growth scenario modelled minus the peak flow from the base model (existing network with 1 in 1 year system improvements).

Table 8 Additional Flow Attributed to Growth

Growth Area	Land Area (ha)	Number of Dwellings	Additional Flow (l/s)
Springvale Development	92	417	8.95
Otamatea Development	141	179	12.50
Otamatea Infill	58	455	16.13
Springvale Infill	179	731	16.77
Inner City Infill	90	334	8.40
Commercial Infill	116	197	3.86
Other Residential Infill	1,624	255	5.16

A ratio of the additional flows was then used to determine how the upgrades in the different spill areas could be assigned to the individual growth areas. Table 9 provides a breakdown of the allocated costs for upgrades associated with growth for each growth area.

It should be noted that growth due to infill was separated into the categories / areas provided in the Structure Plan. This enabled the spill areas and relevant costs to be better assigned to growth areas based on their proximity and interaction with the spill area. For example, all of the infill has an impact on storage along the interceptor; however the upgrades required for area G-4 were affected by the Otamatea development, Otamatea infill, and Springvale infill only, as only a fraction of the infill growth is upstream of the spill area. Therefore the increase in peak flow due to infill, and hence the cost of upgrades for infill, is more representative of the growth occurring in that area.

Conversely, the "other residential infill" area was not further broken down due to the small growth density. Therefore costs for additional storage required on the east side of the Whanganui River (spill area B) were assigned to the total "other residential infill". Although this growth area encompasses both sides of the river, further delineating the growth area would have minimal impact on the overall costs per dwelling.

Table 10 provides a summary of the costs for growth in each growth area, as well as the cost per dwelling in that growth area.

Table 9 Prorated Costs for Combined Growth in Each Growth Area

Growth Area	Spill Area							Total Cost per Growth Area
	B	L	T	W	G-1	G-3	G-4	
Springvale Development	-	$14,367	$25,480	-	$163,000†	-	-	**$202,847**
Otamatea Development	-	$66,116	$9,877	$8,203	-	$59,519	$104,844	**$248,559**
Otamatea Infill	-	$29,015	$4,052	$3,782	-	$66,481	$62,497	**$165,827**
Springvale Infill	-	$30,167	$4,213	$3,932	-	-	$21,659‡	**$59,971**
Inner City Infill	-	$15,110	$2,110	$1,969	-	-	-	**$19,190**
Commercial Infill	-	$6,944	$970	$905	-	-	-	**$8,818**
Other Residential Infill	$22,000*	$9,281	$1,298	$1,209	-	-	-	**$33,788**
TOTAL GROWTH COSTS	**$22,000**	**$171,000**	**$48,000**	**$20,000**	**$163,000**	**$126,000**	**$189,000**	**$739,000**

**Only a fraction of the dwellings categorized under "other residential infill" would attribute to these costs.*

†Although Other Residential Infill includes catchments in Gonville, no additional upgrades were required here when evaluated individually.

‡Prorated cost was based on 1/3 of the flows in the Springvale infill area only. This is because approximately 1/3 of the Springvale infill area contributed to the flow in this section of the network requiring upgrades.

Table 10 Summary of Costs for each Growth Area

Growth Area	Number of Dwellings	Total Cost	Cost per Dwelling
Springvale Development	417	$202,847	$486
Otamatea Development	179	$248,559	$1,389
Otamatea Infill	455	$165,827	$364
Springvale Infill	731	$59,971	$82
Inner City Infill	334	$19,190	$57
Commercial Infill	197	$8,818	$45
Other Residential Infill	255	$33,788	$133
1 in 1 Year System Improvements	N/A	$13,083,000	N/A
TOTAL		**$13,822,000**	

4.2.2 Summary

After estimating the costs required in the existing wastewater network to accommodate all future growth, the following results were found:

- The area requiring the most upgrades was Otamatea (spill areas G-3 and G-4). When growth from infill and Otamatea greenfield development were evaluated separately, the largest costs were attributed to additional storage in Moutoa Gardens (spill area L). However, when infill and development are combined, the existing network in Otamatea requires additional upgrades that surpass the cost of additional storage requirements in any of the other spill areas.
- The cost per dwelling increased from $860 when considering Otamatea greenfield development only (Scenario 4a) to $1,389 when looking at combined growth. This is still smaller than the estimated Scenario 3a cost per dwelling.
- The average cost per dwelling for infill increased from $88 to $146, largely due to the additional upgrades required in Otamatea.
- When considering infill, the regions that contribute most towards the net upgrades are Otamatea Infill, Springvale Infill and Other Residential Infill. This is due to the fact that Other Residential Infill is the sole contributor to increased storage costs in Wanganui East (spill area B), and because of the upgrades required in Otamatea (spill areas G-3 and G-4) that are only affected by Otamatea and Springvale Infill regions.
- The cost for upgrades due to growth accounts for only 5% of the upgrades required under System Improvements.

5. Prioritisation

Several decisions must be made by the Council before developing a programme of works to address growth. Aside from choosing between the two different M12 upgrade options, previous reports prepared by GHD have highlighted the sensitivity of the upgrades to the Central City (M4 catchment) flows. The model predicted significant spilling in this catchment during relatively minor rain events, which was not observed in reality to the extent or frequency predicted by the model. WDC is currently investigating this catchment to locate and isolate any point of inflow in the public system in the lower reaches of the M4 catchment. The results of this investigation will likely have a significant impact on the 1 in 1 Year System Improvements for this catchment, as well as other areas that are sensitive to the interceptor level—including storage requirements in Moutoa Gardens.

Furthermore, as discussed in Section 4.1.2, additional consideration should be given to the wastewater scheme in Otamatea. As previously discussed, the extent of upgrades in Otamatea for either a gravity scheme or LPS scheme is vastly different. In addition, the topography of the area puts limits on the feasibility of the selected wastewater scheme. It was therefore recommended that a structure plan be developed prior to choosing one of the growth scenarios. This will then affect the storage options along the interceptor, in addition to the upgrades required in Otamatea.

The system upgrades are contingent upon the following:

1. Results from the Central City (M4 catchment) inflow investigation
2. Selection of the M12 / Gonville catchment upgrades
3. Selection of the Springvale development wastewater scheme
4. Selection of the Otamatea development wastewater scheme

During the workshop held on 15 March 2016, WDC indicated their preferred network options for M12 / Gonville, the proposed Springvale development, and the proposed Otamatea development as follows:

- M12 / Gonville gravity network upgrades
- Springvale gravity wastewater scheme
- Otamatea LPS wastewater scheme

As mentioned above, these preferred options are contingent on the results from the M4 investigation, as well as further investigation into the greenfield development wastewater schemes. There are, however, portions of the improvement plan that are not affected by the issues highlighted above. WDC can commence works on the following areas:

- M1 investigations (currently underway)
- Carry out inflow reduction through Level 1 works for the catchments identified in the 2015 *System Improvements Report*
- Carry out BRPS control optimisation
- Commence upgrades for the following areas:
  - Area I: Spilling at top of Halswell Street
  - Area J: Spilling in Peak Park
  - Area O: Overflow at Plunket Street Pump Station

- Area S: Spilling in Kings Avenue Area
- Area BB: Heads Road Manhole Spill

The cost associated with this specific programme of works is approximately $3.8M. While these are underway the M4, M12, and Otamatea upgrades can be addressed and the remaining programme of works be updated accordingly.

6. Conclusions

Following the assessment of the impact that the additional wastewater flows from the proposed infill and development areas will have on the existing wastewater network, the following conclusions have been reached:

1. Cost estimates indicated a gravity wastewater scheme in Springvale to be marginally better when considering additional costs incurred by the developer / community. On the other hand, a LPS wastewater scheme in Otamatea was found to require less network upgrades than a gravity wastewater scheme.
2. Infill development was likely to have minimal impact on the existing network as the only resultant additional flows to the network are expected to be normal foul water flows (dry weather flows) which only make up a small proportion of the peak flow (wet weather flows). When considering infill alone, the costs for additional storage were greater than the costs required for additional storage for the greenfield developments.
3. Greenfield developments required additional infrastructure. The Otamatea greenfield development was identified as the growth area that required the most network upgrades, however an increase in storage was required for both greenfield development areas.
4. The existing network in Otamatea is at / near full capacity, and any additional growth in this area (infill or greenfield development) required network upgrades.
5. There was only a marginal difference in cost between the M12 gravity and M12 LPS options when considering growth from the Springvale and Otamatea greenfield development areas.
6. When considering the combined growth scenario, Otamatea still required additional network upgrades; no additional upgrades were required for the Springvale greenfield / Gonville area.

7. Recommendations

Following the growth related capacity investigation the following is recommended:

1. Once the outcomes of the M4 inflow investigations are known, the model be re-calibrated for this catchment and the updated model be used to modify / confirm and finalise the upgrades identified in this report.
2. The Liverpool Pump Station controls be adjusted and additional flow data be collected to re-calibrate the P8 catchment in the model. The updated model shall then be used to modify / confirm and finalise the upgrades identified in this report.
3. WDC develop a structure plan for the Otamatea greenfield development area to better estimate the network upgrade requirements.
4. While the M4 inflow investigations are being carried out and the Otamatea wastewater scheme confirmed, WDC commence works on the portions of the improvement plan that are not affected by the aforementioned areas. These include:
   - Carrying out inflow reduction through Level 1 works for those catchments identified in the 2015 *System Improvements Report*
   - Carry out BRPS control optimisation
   - Physical upgrades in Areas I, J, O, S and BB, which are independent of the City and Castlecliff Interceptors.
5. Once the model has been re-calibrated and the upgrades finalised following the M4 inflow investigations, WDC use the costs per dwelling as a guide only in assigning developer contributions.

Appendices

Appendix A – Revised System Improvements

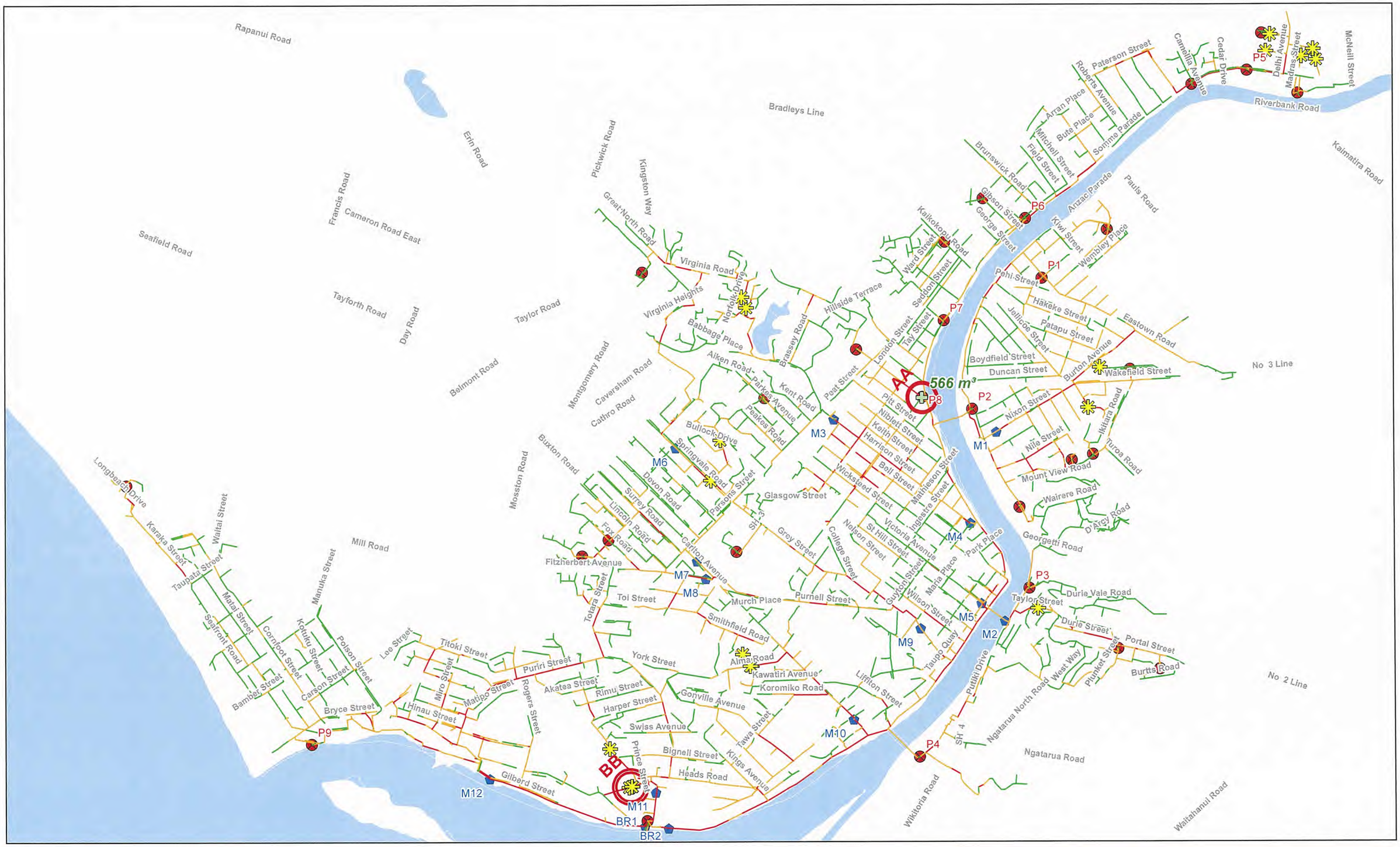
1 in 1 Year Spill Areas for Existing Network

Area AA

Area BB

System Improvements with M12 Gravity Upgrades Cost Estimate

System Improvements with M12 LPS Upgrade Cost Estimate



Paper Size A3

0 145 290 580 870 1,160

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

PIPE CAPACITY
- Not Surcharged
- Surcharged due to backwatering
- Surcharged due to insufficient capacity

MANHOLES PREDICTED TO SPILL
- Possible Spill (0.1 to 20 m³)
- Moderate Spill (20 to 100 m³)
- Large Spill (100 m³ +)

- CONSTRUCTED OVERFLOW OPERATES
- PUMPSTATION
- FLOWMONITOR

Wanganui District Council
Wastewater System Performance

Job Number	51-33557-00
Revision	A
Date	18 Mar 2016

M12 Gravity System Improvements
1 Year Flow Event

G:\51\3355700\GIS\Maps\Working\513355700_M12 Gravity System Improvements_Base Model.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 2 4 8 12 16

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole
Raise Overflow Weir
Remove Overflow Weir
Pump station improvements

PIPE UPGRADES
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

PIPE UPGRADES 1 in 1 Year
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

Existing WW pipes
Diameter
<250mm
250 - 600 mm
>600 mm

PUMPSTATION
MANHOLES

GHD

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

Job Number 51-33557-00
Revision A
Date 21 Mar 2016

System Improvements - Area AA
1 Year Flow Event

G:\51\33557\00\GIS\Maps\Working\Common Upgrades\513355700_System Improvements - Issue AA.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

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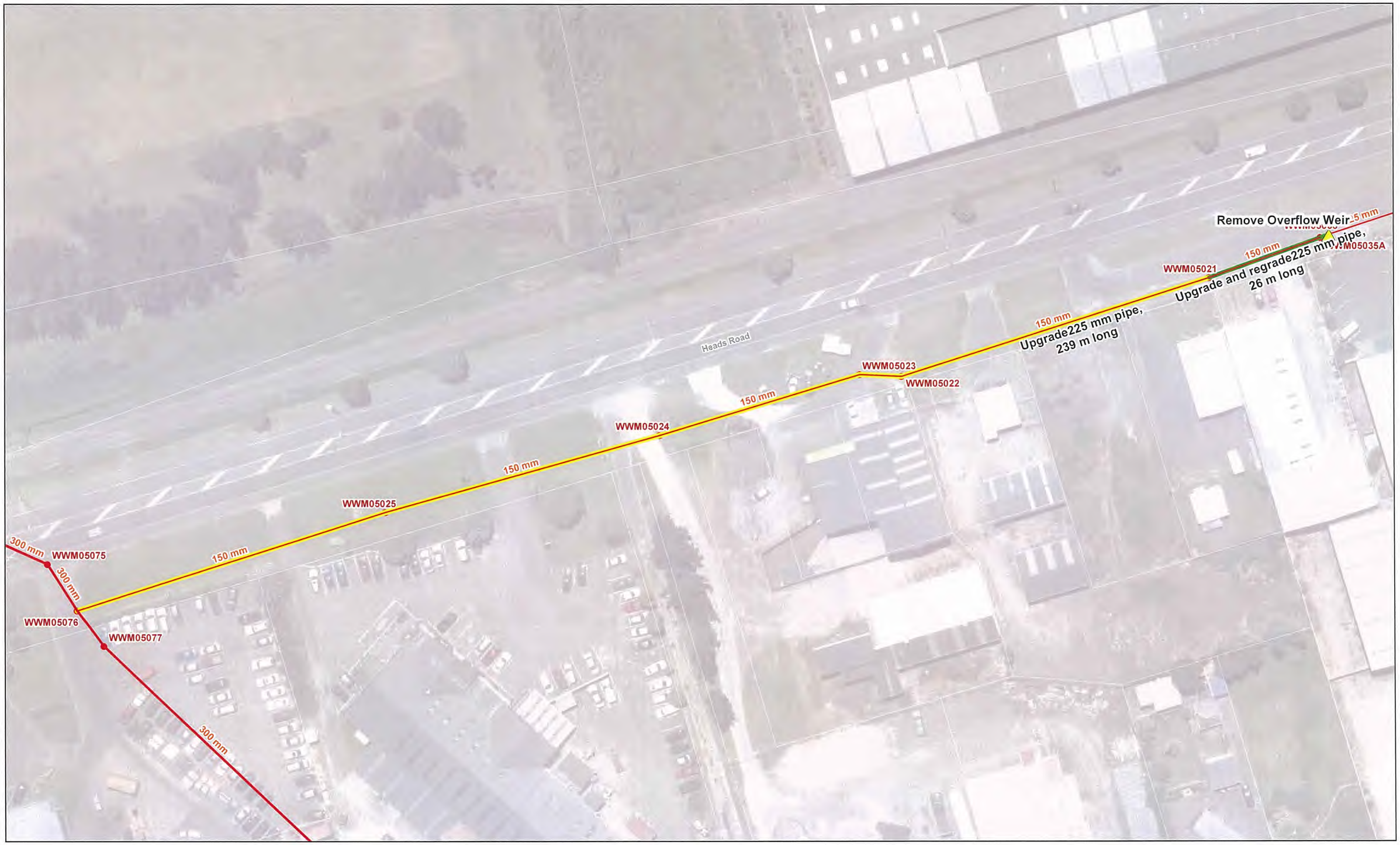


Paper Size A3

0 3.5 7 14 21 28

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole
Remove overflow

PIPE UPGRADES Existing WW pipes

Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

Diameter

<250mm
250 - 600 mm
>600 mm

PUMPSTATION
MANHOLES

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

Job Number	51-3355700
Revision	A
Date	31 Mar 2016

System Improvements - Area BB
1 Year Flow Event

G:\51\3355700\GIS\Maps\Working\Common Upgrades\513355700_System Improvements - Issue BB.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Schedule of Quantities
Wanganui District Council: Wastewater Masterplan

Option 1:
1 in 1Y with M12 gravity upgrades

Prepared By/Checked By : ARBaugham / CJAnderson

DESCRIPTION	UNIT	QTY	RATE	AMOUNT	TOTAL
All costs allow for design, project management and professional fees, supply of materials, physical works and contract supervision/administration for the described works					
Locate and Resolve Inflow Source Upstream of Nixon Street (M1)					
Investigation and medial works	LS	1	$ 100,000	$ 100,000	
Total M1 Point Inflow Reduction					**$ 100,000**
Level 1 I/I Remedial Works - INFLOW REDUCTION					
Churton School Pump Station Catchment	ha	47	$ 5,000	$ 235,000	
Russell Street Pump Station Catchment	ha	68	$ 5,000	$ 340,000	
Anaua Pump Station Catchment	ha	70	$ 5,000	$ 350,000	
Beach Road City Catchment	ha	210	$ 5,000	$ 1,050,000	
M9 Catchment	ha	105	$ 5,000	$ 525,000	
M8	ha	32	$ 5,000	$ 160,000	
M5	ha	18	$ 5,000	$ 90,000	
M2	ha	128	$ 5,000	$ 640,000	
Total I/I Reduction					**$ 3,390,000**
Beach Road Pump Station Controls					
Pump Station Upgrades					
Modify control system to optimise use of interceptor	LS	1	$ 30,000	$ 30,000	
Total Beach Road Modifications					**$ 30,000**
Area A - Talbolt Street Pump Station Overflow					
Pump Station Upgrades					
Two new pumps with combined capacity of 10 l/s	each	2	$ 15,000	$ 30,000	
Installation and Misc. pipe and power upgrades at pump station	LS	1	$ 30,000	$ 30,000	
Total Area A					**$ 60,000**
Area B - Spilling and Overflows on Wanganui East Interceptor					
Pipe Upgrades					
DN300mm Gravity Main	m	75	$ 423	$ 32,000	
DN450mm Gravity Main	m	38	$ 480	$ 18,000	
Storage					
Kowhai Park	m^3	1325	$ 1,500	$ 1,988,000	
River Reserve, near Young Street Intersection	m^3	82	$ 1,500	$ 122,000	
Total Area B					**$ 2,160,000**
Area C - Anzac Pump Station Overflow					
Storage					
Anzac Parade	m^3	23	$ 1,500	$ 34,000	
Pump Station Upgrades					
Two new pumps with combined capacity of 13 l/s	each	2	$ 7,000	$ 14,000	
Installation and Misc. pipe and power upgrades at pump station	LS	1	$ 25,000	$ 25,000	
Total Area C					**$ 73,000**
Area D - Spilling on Anzac Parade, near Taylor Street					
Pipe Upgrades					
DN300mm Gravity Main	m	269	$ 423	$ 114,000	
Total Area D					**$ 114,000**

Area E - Overflow Off Putiki Drive					
Modify Overflow					
Monitor overflow, check levels of associated houses and raise overflow weir if required (model shows 50 mm rise required)	LS	1	$ 15,000	$ 15,000	
Pipe Upgrades					
DN150mm Gravity Main	m	3	$ 300	$ 1,000	
DN225mm Gravity Main	m	638	$ 360	$ 230,000	
Total Area E					**$ 246,000**
Area F - Overflow and Spill Upstream of Anaua Street Pump Station					
Pump Station Upgrades					
Two new pumps with combined capacity of 32 l/s	each	2	$ 8,000	$ 16,000	
Installation and Misc. pipe and power upgrades at pump station	LS	1	$ 30,000	$ 30,000	
Total Area F					**$ 46,000**
Area G - Spilling on Quick Avenue					
Pipe Upgrades					
DN300mm Gravity Main	m	222	$ 423	$ 94,000	
DN375mm Gravity Main	m	182	$ 455	$ 83,000	
Total Area G					**$ 177,000**
Area H - Spilling and Overflow Upstream of Boyd Pump Station					
Storage					
River Reserve, near Brunswick Road	m^3	256	$ 1,500	$ 384,000	
Total Area H					**$ 384,000**
Area I - Spilling Top of Halswell Street					
Seal Manholes					
Seal Manholes	each	1	$ 10,000	$ 10,000	
Total Area I					**$ 10,000**
Area J - Spilling in Peak Park					
Pipe Upgrades					
DN150mm Gravity Main	m	24	$ 300	$ 7,000	
Total Area J					**$ 7,000**
Area K - Spilling near Virginia Lake					
Seal Manholes					
Seal Manholes	each	3	$ 10,000	$ 30,000	
Pipe Upgrades					
DN225mm Gravity Main	m	206	$ 360	$ 74,000	
Total Area K					**$ 104,000**
Area L - Spilling in Central City					
Pipe Upgrades					
DN300mm Gravity Main	m	123	$ 423	$ 52,000	
DN375mm Gravity Main	m	118	$ 455	$ 54,000	
DN525mm Gravity Main	m	453	$ 600	$ 272,000	
DN675mm Gravity Main	m	213	$ 680	$ 145,000	
DN750mm Gravity Main	m	612	$ 725	$ 444,000	
Clean pipe	m	57	$ 30	$ 2,000	
Storage					
Laird Park	m^3	69	$ 1,500	$ 104,000	
Moutoa Gardens	m^3	1369	$ 1,500	$ 2,054,000	
Total Area L					**$ 3,127,000**
Area M - Spilling in Lower Carlton Avenue					
Pipe Upgrades					
DN375mm Gravity Main	m	345	$ 525	$ 181,000	
Total Area M					**$ 181,000**
Area N - Spilling in Top of Wanganui East					
Nil - Model anomaly resolved					

Area O - Overflow at Plunket Street Pump Station					
Storage					
Near Pump Station	m^3	33	$ 1,500	$ 50,000	
Total Area O					**$ 50,000**
Area P - Overflow at Aramoho Park Pump Station					
Pump Station Upgrades					
Commission 2nd pump to get combined capacity of 5 l/s	LS	1	$ 10,000	$ 10,000	
Total Area P					**$ 10,000**
Area Q - Spilling at Back of Properties in Fitzherbert Ave					
Pipe Upgrades					
DN225mm Gravity Main	m	435	$ 360	$ 157,000	
Total Area Q					**$ 157,000**
Area R - Spilling on Smithfield Road					
Pipe Upgrades					
DN225mm Gravity Main	m	400	$ 360	$ 144,000	
DN300mm Gravity Main	m	190	$ 423	$ 80,000	
Total Area R					**$ 224,000**
Area S - Spilling in Kings Avenue Area					
Pipe Upgrades					
DN300mm Gravity Main	m	58	$ 423	$ 25,000	
Total Area S					**$ 25,000**
Area T - Spilling in Gonville					
Seal Manholes					
Seal Manholes	each	1	$ 10,000	$ 10,000	
Pipe Upgrades					
DN225mm Gravity Main	m	175	$ 360	$ 63,000	
DN300mm Gravity Main	m	574	$ 423	$ 243,000	
DN375mm Gravity Main	m	240	$ 455	$ 109,000	
DN450mm Gravity Main	m	749	$ 480	$ 360,000	
DN525mm Gravity Main	m	135	$ 600	$ 81,000	
DN750mm Gravity Main	m	222	$ 725	$ 161,000	
DN825mm Gravity Main	m	8	$ 750	$ 6,000	
Clean pipe	m	113	$ 30	$ 3,000	
Storage					
Heads Road	m^3	255	$ 1,500	$ 383,000	
Hinau Street	m^3	395	$ 1,500	$ 593,000	
Total Area T					**$ 2,012,000**
Area W - Spilling Off SH3					
Storage					
Bullocks Yard	m^3	184	$ 1,500	$ 276,000	
Total Area W					**$ 276,000**
Area AA - Liverpool Pump Station Cross Connection					
Pump Station Upgrades					
Modify control system to optimise use of upstream network	LS	1	$ 15,000	$ 15,000	
Total Area AA					**$ 15,000**
Area BB - Heads Road Manhole Spilling					
Modify Overflow					
Monitor flow split, check levels of associated houses and remove weir	LS	1	$ 10,000	$ 10,000	
Pipe Upgrades					
DN225mm Gravity Main	m	265	$ 360	$ 95,000	
Total Area BB					**$ 105,000**
			TOTAL		**$ 13,083,000**

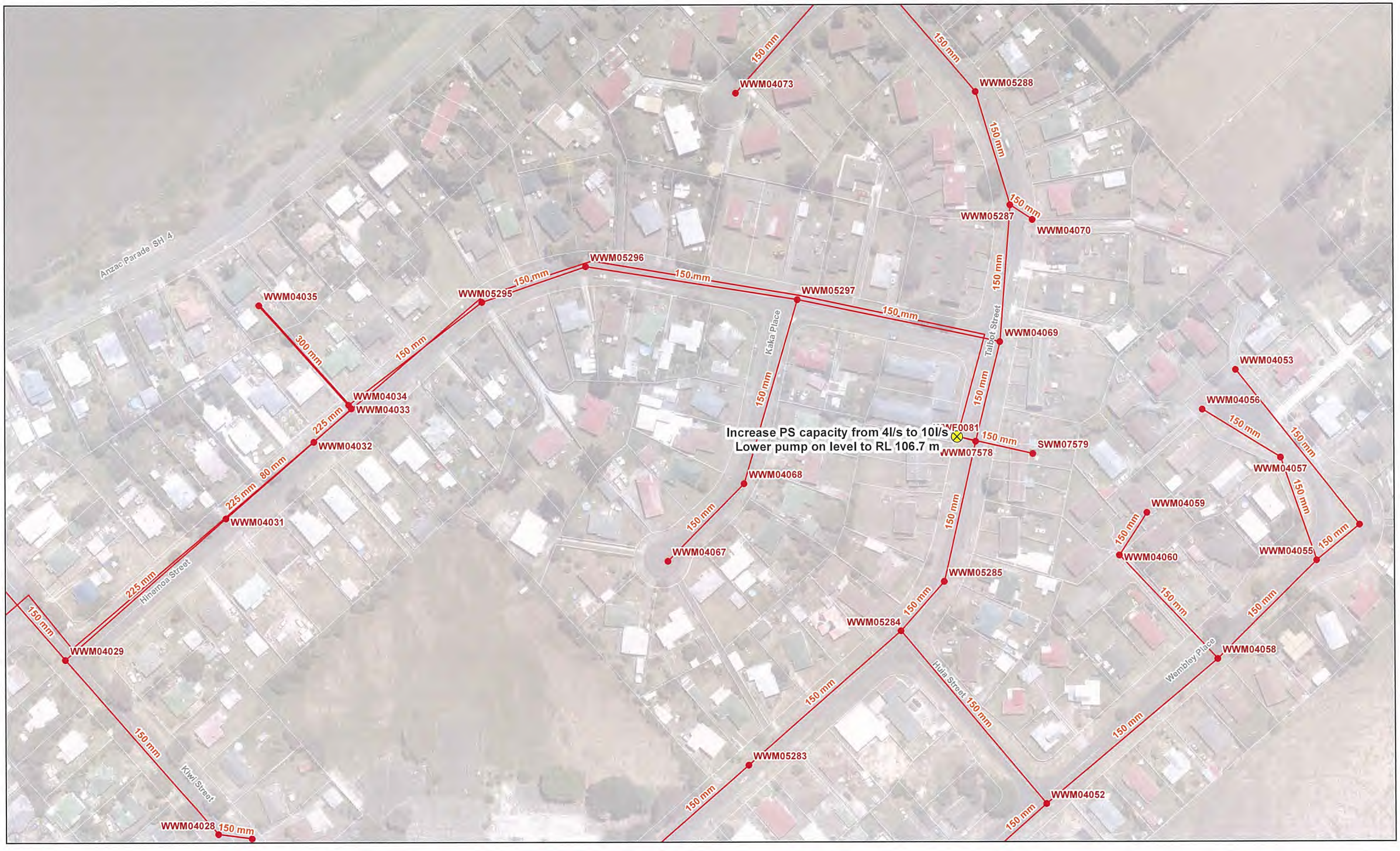
Appendix D – Common Upgrades

Area A

Areas C thru K

Area M

Area O thru S



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

Seal manhole
New storage
Pump station improvements

PIPE UPGRADES
Flow split
Regrade
Remove sediment
Upgrade
Upgrade and regrade

Existing WW pipes
Diameter
<250mm
250 - 600 mm
>600 mm

PUMPSTATION
Manholes

Wanganui District Council
Wastewater Masterplan

Job Number	51-31851-05
Revision	A
Date	06 Mar 2015

System Improvements - Area A
1 Year Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area A.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 3.5 7 14 21 28

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES
- Decomission pipe
- Remove sediment
- Upgrade
- Upgrade and regrade

Existing WW pipes

Diameter
- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

System Improvements - Area C Option 1

Job Number	51-31851-08
Revision	A
Date	17 Feb 2016

G:\51\3185108\GIS\Maps\Working\Option 1\513185108_Option 1 - Area C.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES Existing WW pipes

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Diameter

- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area D
1 Year Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area D.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements
- Raise Overflow Weir *Seal manhole*

PIPE UPGRADES Existing WW pipes

SysImp
- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Diameter
- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area E
1 Year Flow Event

G:\51\31851071GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area E.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Existing WW pipes

Diameter

- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

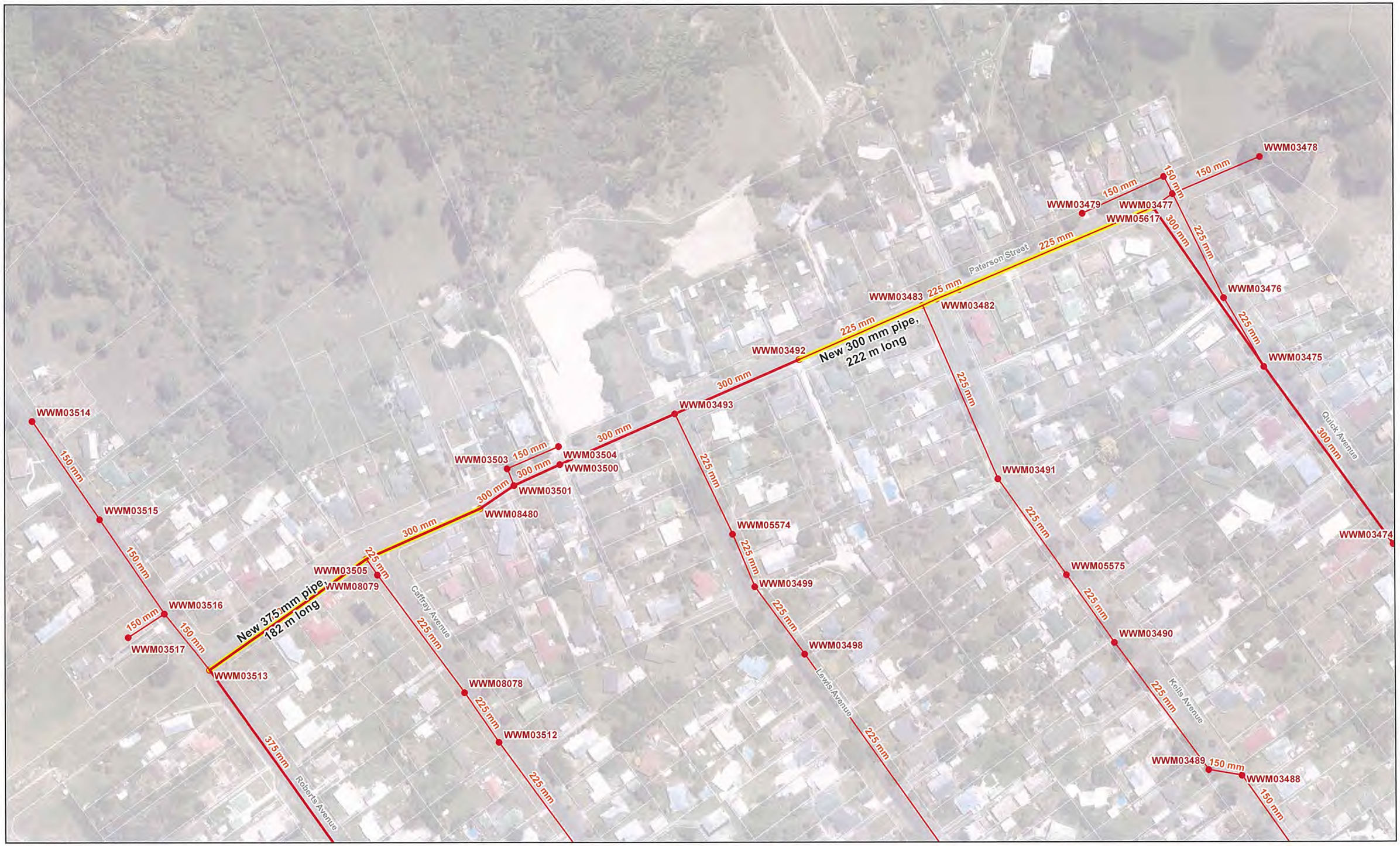
Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area F
1 Year Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area F.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES Existing WW pipes

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Diameter

- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area G
1 Year Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area G.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole

PIPE UPGRADES 1 in 1 Year
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

Existing WW pipes
Diameter
<250mm
250 - 600 mm
>600 mm

PUMPSTATION
MANHOLES

Wanganui District Council
Wastewater Masterplan

Job Number 51-33557-00
Revision A
Date 24 Mar 2016

System Improvements - Area H
1 Year Flow Event

G:\51\3355700\GIS\Maps\Working\Common Upgrades\513355700_System Improvements - Issue H.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by arbaugham

Level 2, 52 The Square, Palmerston North, 4410 T 64 6 353 1800 F 64 6 353 1801 E palmmail@ghd.com W www.ghd.com

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES
- Flow split
- Raise overflow weir
- Remove sediment
- Upgrade

Existing WW pipes

Diameter
- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area I
6 Month Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 6 Month\1 in 6 Month Area I.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 2.5 5 10 15 20

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

Seal manhole
New storage
Pump station improvements

PIPE UPGRADES Existing WW pipes

Flow split
Raise overflow weir
Remove sediment
Upgrade

Diameter

<250mm
250 - 600 mm
>600 mm

PUMPSTATION
Manholes

Wanganui District Council
Wastewater Masterplan

Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area J
6 Month Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 6 Month\1 in 6 Month Area J.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 10 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES Existing WW pipes

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Diameter

- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area K
1 Year Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area K.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 T 64 6 353 1800 F 64 6 353 1801 E palmmail@ghd.com W www.ghd.com

Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES Existing WW pipes

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Diameter

- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

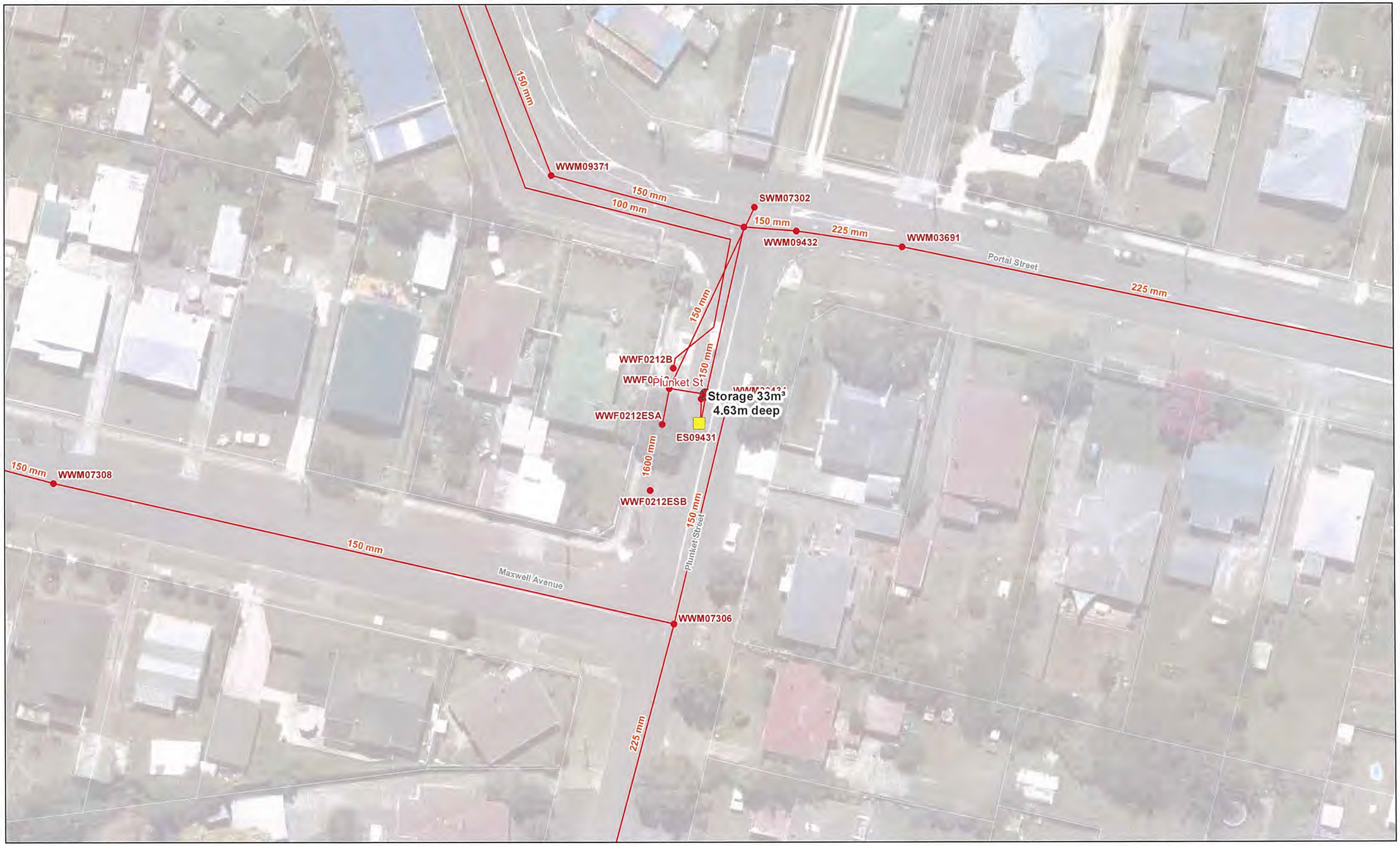
Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area M
1 Year Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area M.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole

PIPE UPGRADES 1 in 1 Year

Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

Existing WW pipes

Diameter
<250mm
250 - 600 mm
>600 mm

PUMPSTATION
MANHOLES

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

Job Number 51-33557-00
Revision A
Date 24 Mar 2016

System Improvements - Area O
1 Year Flow Event

G:\51\3355700\GIS\Maps\Working\Common Upgrades\513355700_System Improvements - Issue O.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES Existing WW pipes

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Diameter

- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

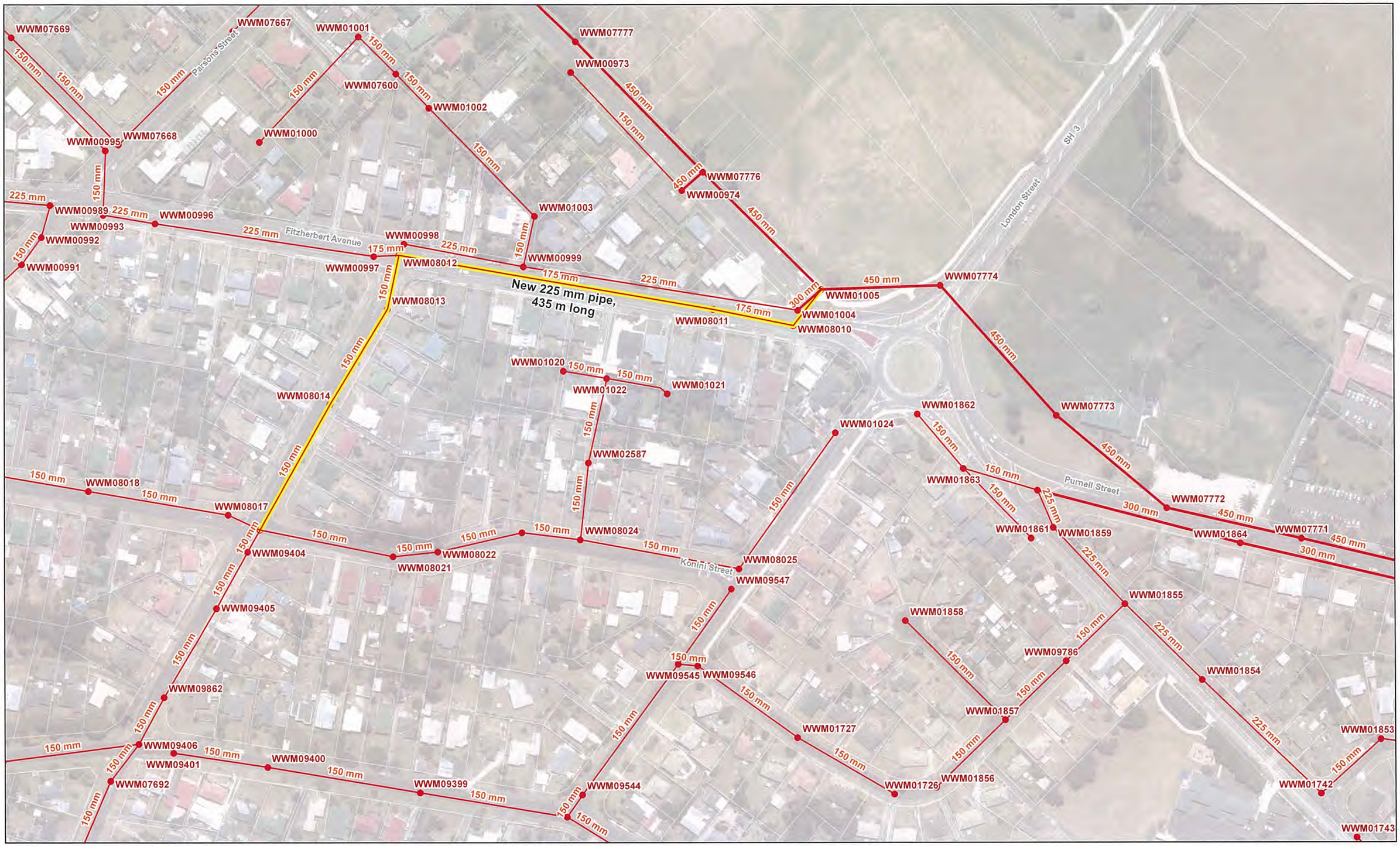
Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area P
1 Year Flow Event

G:\51\31851\07\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area P.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Existing WW pipes

Diameter
- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

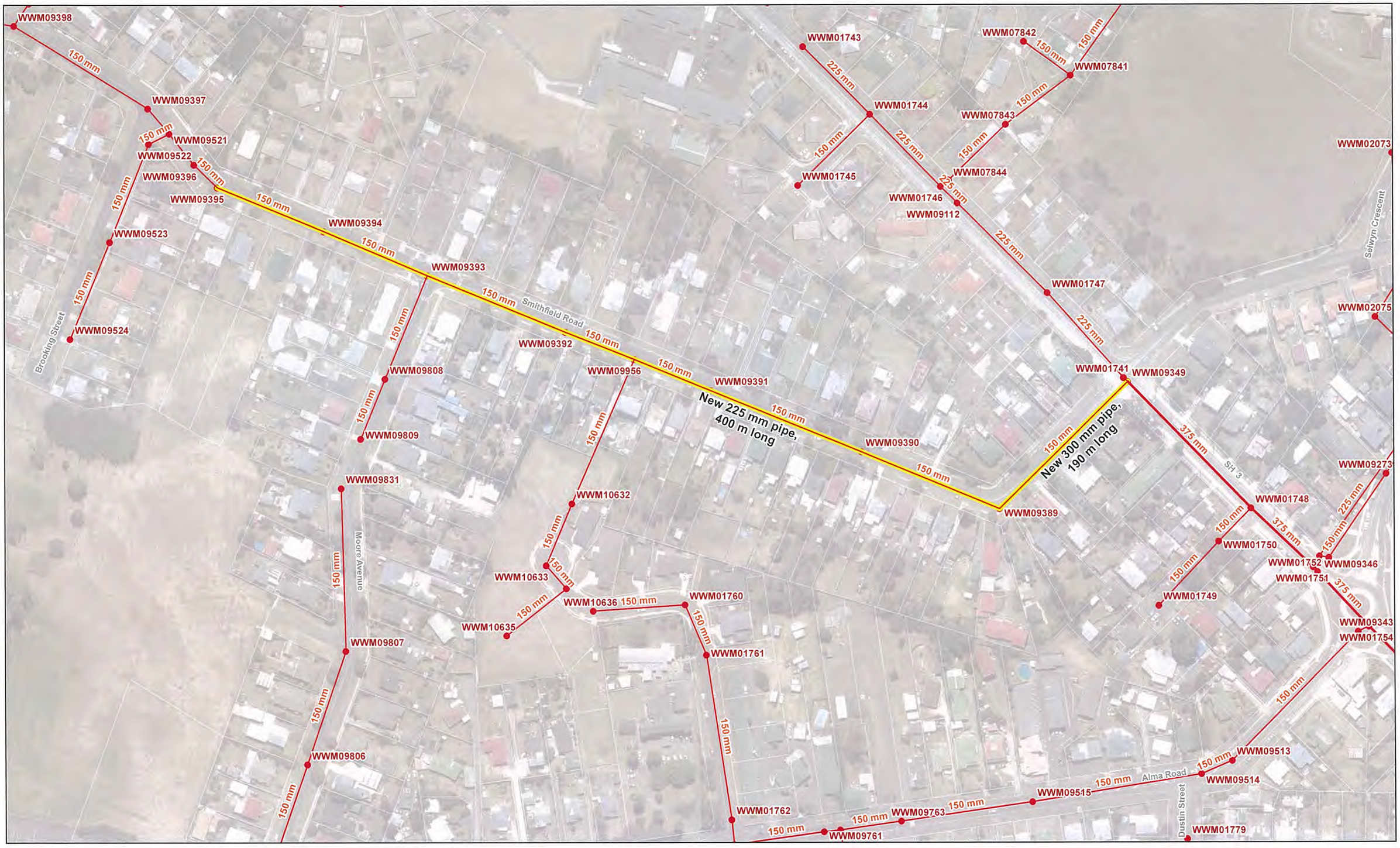
Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area Q
1 Year Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area Q.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES Existing WW pipes

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Diameter

- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area R
1 Year Flow Event

G:\51\31851\07\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area R.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 T 64 6 353 1800 F 64 6 353 1801 E palmmail@ghd.com W www.ghd.com

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

- Seal manhole
- New storage
- Pump station improvements

PIPE UPGRADES Existing WW pipes

- Flow split
- Regrade
- Remove sediment
- Upgrade
- Upgrade and regrade

Diameter

- <250mm
- 250 - 600 mm
- >600 mm

- PUMPSTATION
- Manholes

Wanganui District Council
Wastewater Masterplan

Job Number 51-31851-05
Revision A
Date 06 Mar 2015

System Improvements - Area S
1 Year Flow Event

G:\51\3185107\GIS\Maps\Working\System Improvements Plots\1 in 1 Year\1 in 1 Year Area S.mxd

Data source: Data Custodian; Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Appendix F – Combined Growth Upgrades

Area B

Area L

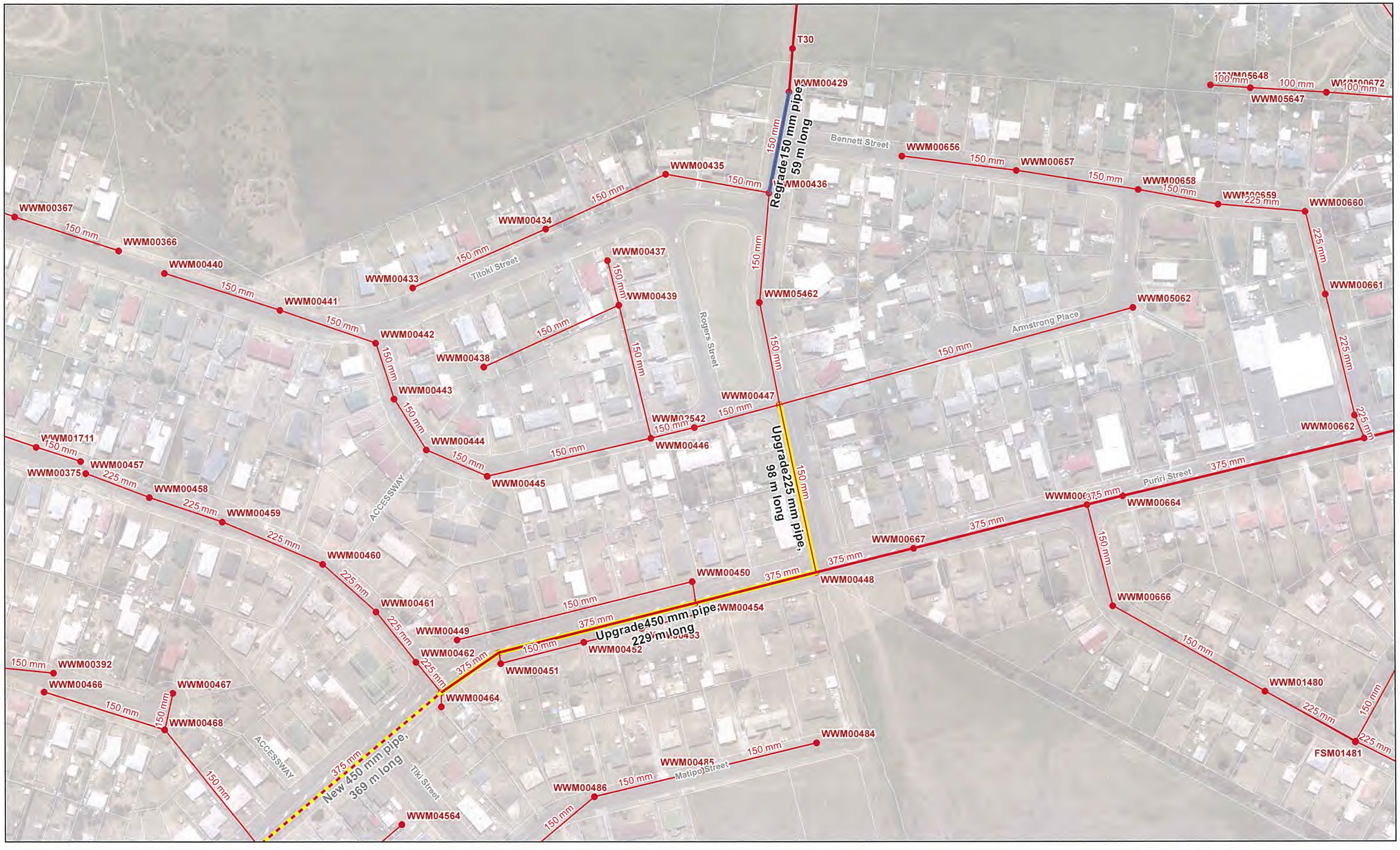
Area T

Area W

G-1

G-3

G-4



Paper Size A3

0 10 20 40 60 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole

PIPE UPGRADES
Upgrade
Regrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

PIPE UPGRADES 1 in 1 Year
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

Existing WW pipes
Diameter
<250mm
250 - 600 mm
>600 mm

Existing WW pipes
Diameter
<250mm
250 - 600 mm
>600 mm

PUMPSTATION
MANHOLES

GHD

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

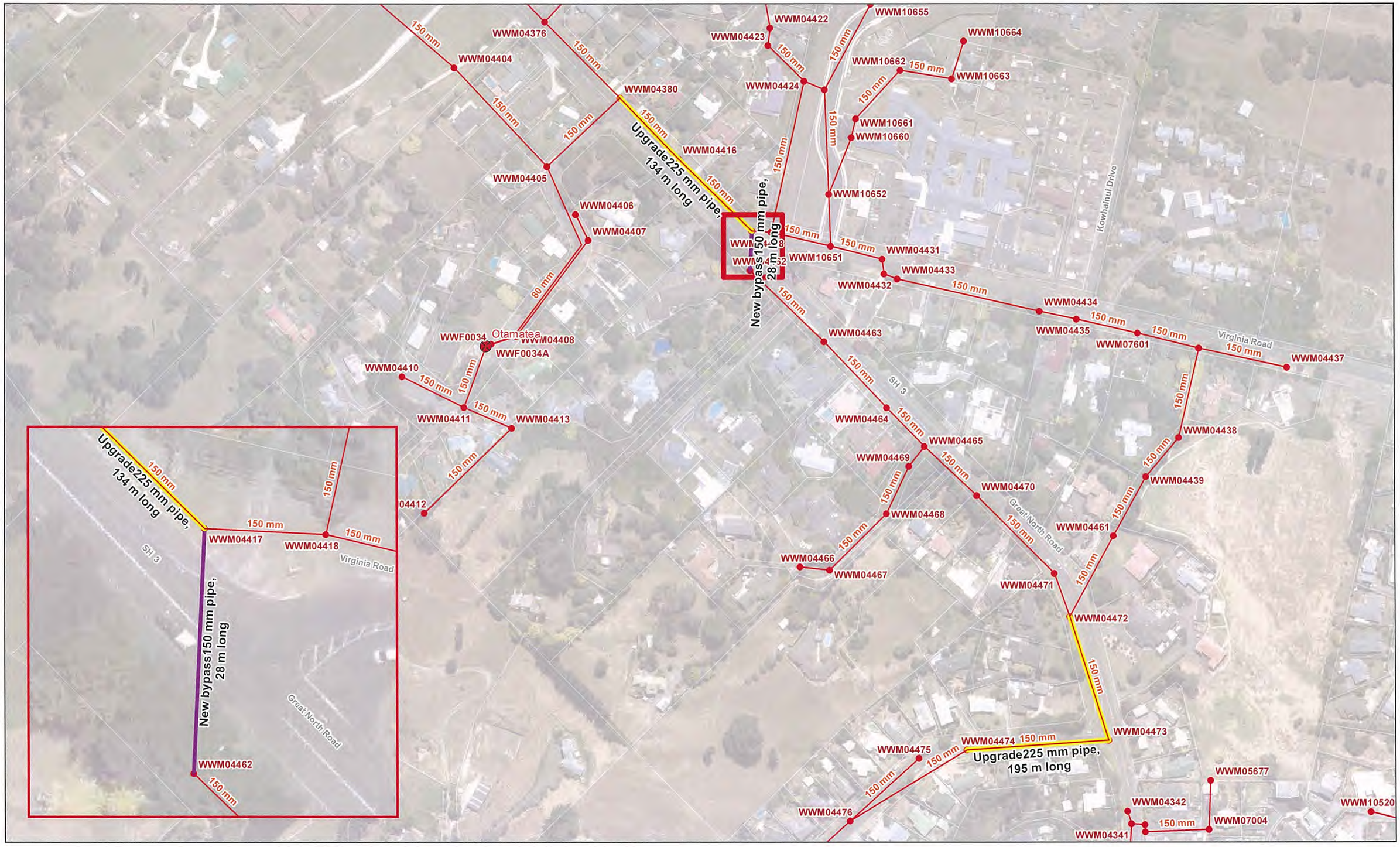
Combined Growth System Improvements - Area G-1

Job Number	51-33557-00
Revision	A
Date	21 Mar 2016

G:\51\3355700\GIS\Maps\Working\Combined Growth\513355700_Combined Growth_System Improvements - Issue G-1.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com



Paper Size A3

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole

PIPE UPGRADES PIPE UPGRADES 1 in 1 Year Existing WW pipes

Upgrade	Upgrade
Upgrade and regrade	Upgrade and regrade
Downgrade	Downgrade
New bypass	New bypass
Relay	Relay
Remove sediment	Remove sediment

Diameter
- <250mm
- 250 - 600 mm
- >600 mm

PUMPSTATION
MANHOLES

Wanganui District Council
Wastewater Masterplan

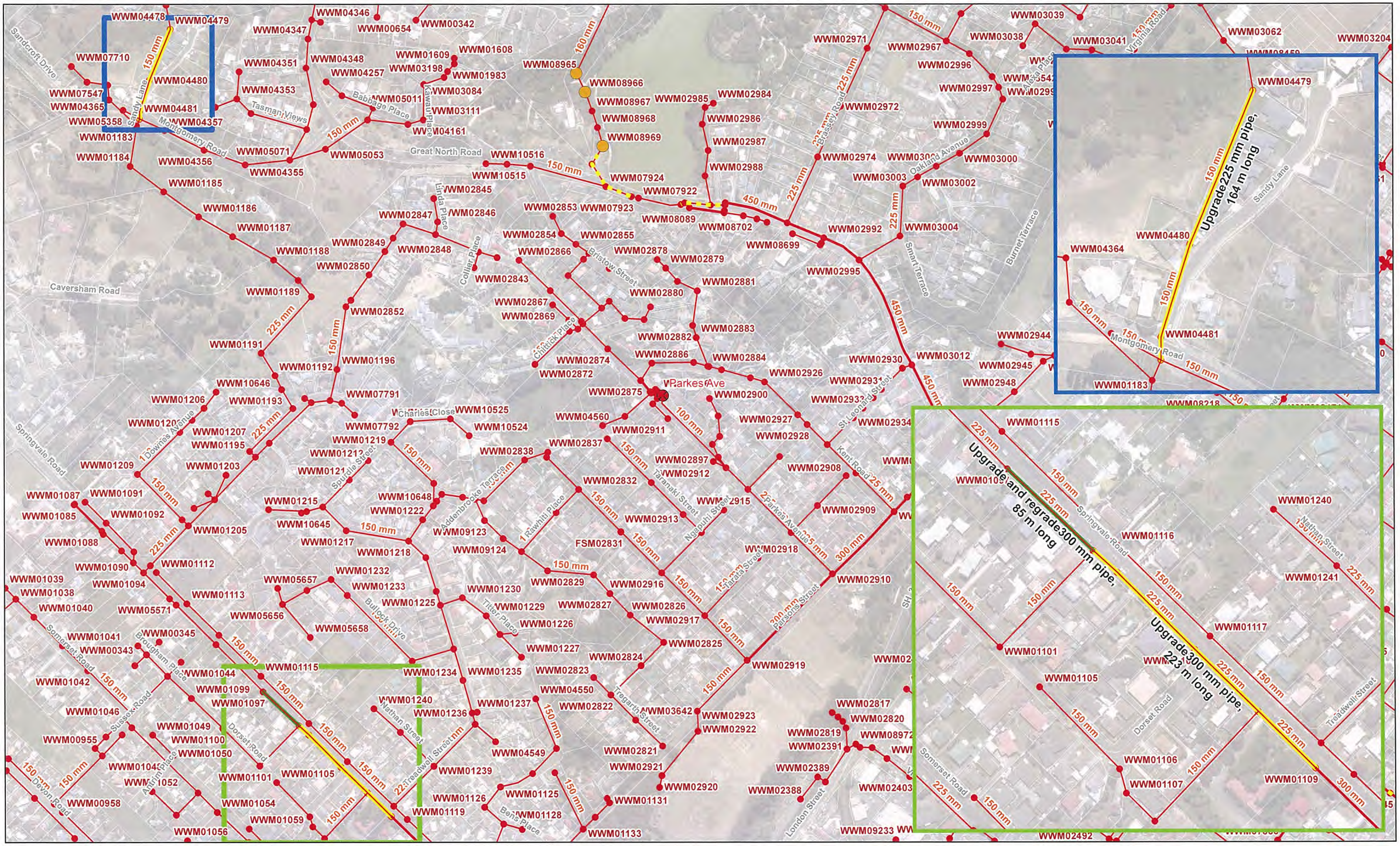
Combined Growth System Improvements - Area G-3

Job Number 51-33557-00
Revision A
Date 21 Mar 2016

G:\51\33557\00\GIS\Maps\Working\Combined Growth\51335700_Combined Growth_System Improvements - Issue G-3.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com



Paper Size A3

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole

PIPE UPGRADES
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

PIPE UPGRADES 1 in 1 Year
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

Existing WW pipes
Diameter
<250mm
250 - 600 mm
>600 mm

PUMPSTATION
MANHOLES

GHD

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

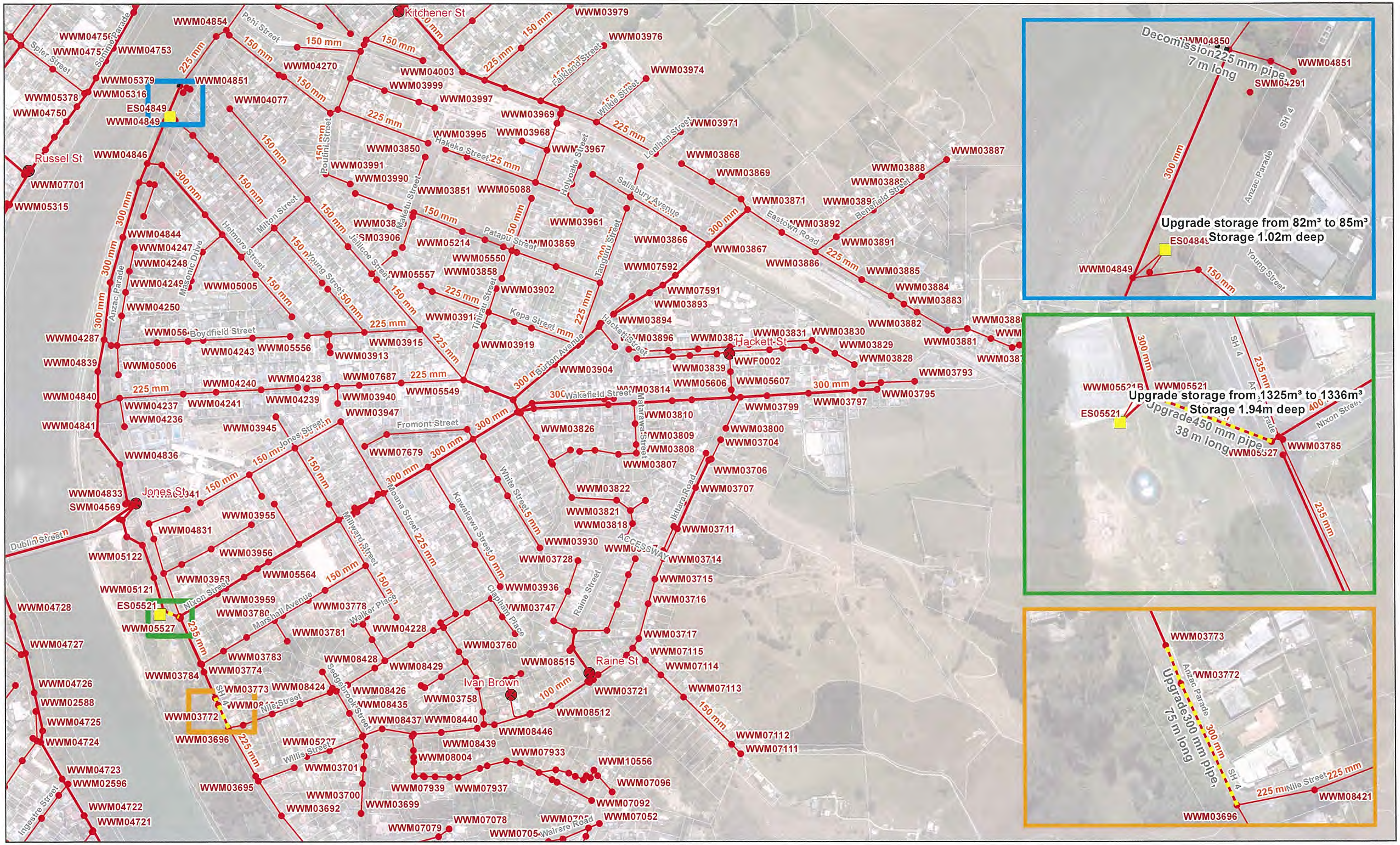
Job Number 51-33557-00
Revision A
Date 21 Mar 2016

Combined Growth System Improvements - Area G-4

G:\51\3355700\GIS\Maps\Working\Combined Growth\513355700_Combined Growth_System Improvements - Issue G-4.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by: arbaugham

Level 2, 52 The Square, Palmerston North, 4410 T 64 6 353 1800 F 64 6 353 1801 E palmmail@ghd.com W www.ghd.com



Paper Size A3

0 37.5 75 150 225 300

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

	PIPE UPGRADES	PIPE UPGRADES 1 in 1 Year	Existing WW pipes	
New manhole	Upgrade	Upgrade	Diameter	PUMPSTATION
New storage	Upgrade and regrade	Upgrade and regrade	<250mm	MANHOLES
Seal manhole	Downgrade	Downgrade	250 - 600 mm	
	New bypass	New bypass	>600 mm	
	Relay	Relay		
	Remove sediment	Remove sediment		
		Decomission		

GHD

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

Combined Growth System Improvements - Area B

Job Number	51-33557-00
Revision	A
Date	21 Mar 2016

G:\51\33557\GIS\Maps\Working\Combined Growth\5133557_Combined Growth_System Improvements - Issue B.mxd

Level 2, 52 The Square, Palmerston North, 4410 T 64 6 353 1800 F 64 6 353 1801 E palmmail@ghd.com W www.ghd.com

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by arbaughan

Clean 57 m of pipe

Upgrade 375mm pipe, 118 m long

Upgrade 525 mm pipe, 307 m long

Upgrade 300 mm pipe, 123 m long

Upgrade 525mm pipe, 146 m long

Upgrade 675 mm pipe, 213 m long

Upgrade 750 mm pipe, 612 m long

Upgrade 450 mm pipe, 38 m long

Upgrade 300 mm pipe, 75 m long

Decomission 150mm pipe, 1 m long

Storage 69m³
2.37m deep

Upgrade storage from 1369m³ to 1483m³
Storage 3.4m deep

Paper Size A3

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole

PIPE UPGRADES
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

PIPE UPGRADES 1 in 1 Year
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment
Decomission

Existing WW pipes
Diameter
<250mm
250 - 600 mm
>600 mm

PUMPSTATION
MANHOLES

Wanganui District Council
Wastewater Masterplan

Combined Growth System Improvements - Area L

Job Number 51-33557-00
Revision A
Date 21 Mar 2016

G:\51\3355700\GIS\Maps\Working\Combined Growth\513355700_Combined Growth_System Improvements - Issue L.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Upgrade450 mm pipe, 126 m long
WWM00402
WWM00496
Storage 395m³
1.39m deep
WWM00493
Hinau Street
Mosston Road
Miro Street
ACCESSWAY
Gibbons Crescent
Puriri Street
Tongariro Street
Upgrade300 mm pipe, 242 m long
Upgrade375 mm pipe, 240 m long
Upgrade450 mm pipe, 369 m long
Tiki Street
Rogers Street
SERVICE LANE
Bryce Street
Upgrade225 mm pipe, 31 m long
Upgrade225 mm pipe, 144 m long
Upgrade300 mm pipe, 106m long
Upgrade300 mm pipe, 226 m long
Upgrade450 mm pipe, 126 m long
Upgrade525 mm pipe, 135 m long
Kirk Street
Tod Street
Clean 113 m of pipe
Upgrade450 mm pipe, 254 m long
Raupō Street
Upgrade storage from 255m³ to 287m³
Storage 2.28m deep
Upgrade750 mm pipe, 222 m long
Heads Road
Seal MH
Upgrade825 mm pipe, 8m long
Upgrade825 mm pipe, 87m long
Upgrade storage from 255m³ to 287m³
Storage 2.28m deep

Paper Size A3

0 15 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole

PIPE UPGRADES PIPE UPGRADES 1 in 1 Year

- Upgrade
- Upgrade and regrade
- Downgrade
- New bypass
- Relay
- Remove sediment

- Upgrade
- Upgrade and regrade
- Downgrade
- New bypass
- Relay
- Remove sediment

Existing WW pipes

Diameter
- <250mm
- 250 - 600 mm
- >600 mm

PUMPSTATION
MANHOLES

GHD

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

Job Number 51-33557-00
Revision A
Date 21 Mar 2016

Combined Growth System Improvements - Area T

G:\51\3355700\GIS\Maps\Working\Combined Growth\513355700_Combined Growth_System Improvements - Issue T.mxd

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: New Zealand 1949
Grid: NZGD 1949 Wanganui Circuit

N

LEGEND

New manhole
New storage
Seal manhole

PIPE UPGRADES
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

PIPE UPGRADES 1 in 1 Year
Upgrade
Upgrade and regrade
Downgrade
New bypass
Relay
Remove sediment

Existing WW pipes
Diameter
<250mm
250 - 600 mm
>600 mm

PUMPSTATION
MANHOLES

GHD

WHANGANUI DISTRICT COUNCIL
Te Kaunihera a Rohe o Whanganui

Wanganui District Council
Wastewater Masterplan

Combined Growth System Improvements - Area W

Job Number	51-33557-00
Revision	A
Date	21 Mar 2016

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Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:arbaugham

Level 2, 52 The Square, Palmerston North, 4410 **T** 64 6 353 1800 **F** 64 6 353 1801 **E** palmmail@ghd.com **W** www.ghd.com

Appendix H – Combined Growth Cost Estimate

Combined Growth with M12 Gravity System Improvements

Schedule of Quantities

Wanganui District Council: Wastewater Masterplan

Combined Growth Scenario w/ M12 Gravity SI

Prepared By/Checked By : ARBaugham / CJAnderson

DESCRIPTION	UNIT	QTY	RATE	AMOUNT	TOTAL
All costs allow for design, project management and professional fees, supply of materials, physical works and contract supervision/administration for the described works					
Locate and Resolve Inflow Source Upstream of Nixon Street (M1)					
Investigation and medial works	LS	1	$ 100,000	$ 100,000	
Total M1 Point Inflow Reduction					**$ 100,000**
Level 1 I/I Remedial Works - INFLOW REDUCTION					
Churton School Pump Station Catchment	ha	47	$ 5,000	$ 235,000	
Russell Street Pump Station Catchment	ha	68	$ 5,000	$ 340,000	
Anaua Pump Station Catchment	ha	70	$ 5,000	$ 350,000	
Beach Road City Catchment	ha	210	$ 5,000	$ 1,050,000	
M9 Catchment	ha	105	$ 5,000	$ 525,000	
M8	ha	32	$ 5,000	$ 160,000	
M5	ha	18	$ 5,000	$ 90,000	
M2	ha	128	$ 5,000	$ 640,000	
Total I/I Reduction					**$ 3,390,000**
Beach Road Pump Station Controls					
Pump Station Upgrades					
Modify control system to optimise use of interceptor	LS	1	$ 30,000	$ 30,000	
Total Beach Road Modifications					**$ 30,000**
Area A - Talbolt Street Pump Station Overflow					
Pump Station Upgrades					
Two new pumps with combined capacity of 10 l/s	each	2	$ 15,000	$ 30,000	
Installation and Misc. pipe and power upgrades at pump station	LS	1	$ 30,000	$ 30,000	
Total Area A					**$ 60,000**
Area B - Spilling and Overflows on Wanganui East Interceptor					
Pipe Upgrades					
DN300mm Gravity Main	m	75	$ 423	$ 32,000	
DN450mm Gravity Main	m	38	$ 480	$ 18,000	
Storage					
Kowhai Park	m^3	1336	$ 1,500	$ 2,004,000	
River Reserve, near Young Street Intersection	m^3	85	$ 1,500	$ 128,000	
Total Area B					**$ 2,182,000**
Area C - Anzac Pump Station Overflow					
Storage					
Anzac Parade	m^3	23	$ 1,500	$ 34,000	
Pump Station Upgrades					
Two new pumps with combined capacity of 13 l/s	each	2	$ 7,000	$ 14,000	
Installation and Misc. pipe and power upgrades at pump station	LS	1	$ 25,000	$ 25,000	
Total Area C					**$ 73,000**
Area D - Spilling on Anzac Parade, near Taylor Street					
Pipe Upgrades					
DN300mm Gravity Main	m	269	$ 423	$ 114,000	
Total Area D					**$ 114,000**

Area E - Overflow Off Putiki Drive					
Modify Overflow					
Monitor overflow, check levels of associated houses and raise overflow weir if required (model shows 50 mm rise required)	LS	1	$ 15,000	$ 15,000	
Pipe Upgrades					
DN150mm Gravity Main	m	3	$ 300	$ 1,000	
DN225mm Gravity Main	m	638	$ 360	$ 230,000	
Total Area E					**$ 246,000**
Area F - Overflow and Spill Upstream of Anaua Street Pump Station					
Pump Station Upgrades					
Two new pumps with combined capacity of 32 l/s	each	2	$ 8,000	$ 16,000	
Installation and Misc. pipe and power upgrades at pump station	LS	1	$ 30,000	$ 30,000	
Total Area F					**$ 46,000**
Area G - Spilling on Quick Avenue					
Pipe Upgrades					
DN300mm Gravity Main	m	222	$ 423	$ 94,000	
DN375mm Gravity Main	m	182	$ 455	$ 83,000	
Total Area G					**$ 177,000**
Area H - Spilling and Overflow Upstream of Boyd Pump Station					
Storage					
River Reserve, near Brunswick Road	m^3	256	$ 1,500	$ 384,000	
Total Area H					**$ 384,000**
Area I - Spilling Top of Halswell Street					
Seal Manholes					
Seal Manholes	each	1	$ 10,000	$ 10,000	
Total Area I					**$ 10,000**
Area J - Spilling in Peak Park					
Pipe Upgrades					
DN150mm Gravity Main	m	24	$ 300	$ 7,000	
Total Area J					**$ 7,000**
Area K - Spilling near Virginia Lake					
Seal Manholes					
Seal Manholes	each	3	$ 10,000	$ 30,000	
Pipe Upgrades					
DN225mm Gravity Main	m	206	$ 360	$ 74,000	
Total Area K					**$ 104,000**
Area L - Spilling in Central City					
Pipe Upgrades					
DN300mm Gravity Main	m	123	$ 423	$ 52,000	
DN375mm Gravity Main	m	118	$ 455	$ 54,000	
DN525mm Gravity Main	m	453	$ 600	$ 272,000	
DN675mm Gravity Main	m	213	$ 680	$ 145,000	
DN750mm Gravity Main	m	612	$ 725	$ 444,000	
Clean pipe	m	57	$ 30	$ 2,000	
Storage					
Laird Park	m^3	69	$ 1,500	$ 104,000	
Moutoa Gardens	m^3	1483	$ 1,500	$ 2,225,000	
Total Area L					**$ 3,298,000**
Area M - Spilling in Lower Carlton Avenue					
Pipe Upgrades					
DN375mm Gravity Main	m	345	$ 525	$ 181,000	
Total Area M					**$ 181,000**
Area N - Spilling in Top of Wanganui East					
Nil - Model anomaly resolved					

Area O - Overflow at Plunket Street Pump Station					
Storage					
Near Pump Station	m^3	33	$ 1,500	$ 50,000	
Total Area O					**$ 50,000**
Area P - Overflow at Aramoho Park Pump Station					
Pump Station Upgrades					
Commission 2nd pump to get combined capacity of 5 l/s	LS	1	$ 10,000	$ 10,000	
Total Area P					**$ 10,000**
Area Q - Spilling at Back of Properties in Fitzherbert Ave					
Pipe Upgrades					
DN225mm Gravity Main	m	435	$ 360	$ 157,000	
Total Area Q					**$ 157,000**
Area R - Spilling on Smithfield Road					
Pipe Upgrades					
DN225mm Gravity Main	m	400	$ 360	$ 144,000	
DN300mm Gravity Main	m	190	$ 423	$ 80,000	
Total Area R					**$ 224,000**
Area S - Spilling in Kings Avenue Area					
Pipe Upgrades					
DN300mm Gravity Main	m	58	$ 423	$ 25,000	
Total Area S					**$ 25,000**
Area T - Spilling in Gonville					
Seal Manholes					
Seal Manholes	each	1	$ 10,000	$ 10,000	
Pipe Upgrades					
DN225mm Gravity Main	m	175	$ 360	$ 63,000	
DN300mm Gravity Main	m	574	$ 423	$ 243,000	
DN375mm Gravity Main	m	240	$ 455	$ 109,000	
DN450mm Gravity Main	m	749	$ 480	$ 360,000	
DN525mm Gravity Main	m	135	$ 600	$ 81,000	
DN750mm Gravity Main	m	222	$ 725	$ 161,000	
DN825mm Gravity Main	m	8	$ 750	$ 6,000	
Clean pipe	m	113	$ 30	$ 3,000	
Storage					
Heads Road	m^3	287	$ 1,500	$ 431,000	
Hinau Street	m^3	395	$ 1,500	$ 593,000	
Total Area T					**$ 2,060,000**
Area W - Spilling Off SH3					
Storage					
Bullocks Yard	m^3	197	$ 1,500	$ 296,000	
Total Area W					**$ 296,000**
Area AA - Liverpool Pump Station Cross Connection					
Pump Station Upgrades					
Modify control system to optimise use of upstream network	LS	1	$ 15,000	$ 15,000	
Total Area AA					**$ 15,000**
Area BB - Heads Road Manhole Spilling					
Modify Overflow					
Monitor flow split, check levels of associated houses and remove weir	LS	1	$ 10,000	$ 10,000	
Pipe Upgrades					
DN225mm Gravity Main	m	265	$ 360	$ 95,000	
Total Area BB					**$ 105,000**

Area G-1 - Spilling from Springvale Development / Rogers Street					
Pipe Upgrades					
DN150mm Gravity Main	m	59	$ 300	$ 18,000	
DN225mm Gravity Main	m	98	$ 360	$ 35,000	
DN450mm Gravity Main	m	229	$ 480	$ 110,000	
Total Area G-1					**$ 163,000**
Area G-2 - Spilling Upstream of Fox Road Pump Station					
N/A					
Area G-3 - Spilling from Otamatea Development					
Pipe Upgrades					
DN150mm Gravity Main	m	28	$ 300	$ 8,000	
DN225mm Gravity Main	m	329	$ 360	$ 118,000	
Total Area G-3					**$ 126,000**
Area G-4 - Spilling on Sandy Lane					
Pipe Upgrades					
DN225mm Gravity Main	m	164	$ 360	$ 59,000	
DN300mm Gravity Main	m	308	$ 423	$ 130,000	
Total Area G-4					**$ 189,000**
			TOTAL		**$ 13,822,000**

GHD

Level 2, 52 The Square
Palmerston North 4410
T: 64 6 353 1800 F: 64 6 353 1801 E: palmmail@ghd.com

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	ARBaugham	CAnderson		BRudsits		1/4/16

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