MASTER PLANNING OF WASTEWATER SERVICES FOR THE EASTERN SUBURBS OF MANUKAU CITY

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ABSTRACT

With a population of approximately 347,000, Manukau is New Zealand's third largest city and the fastest growing, Much of the wastewater network infrastructure in this area was built between the 1960s and 1980s, with more recent development post-2000.

Watercare Services Limited and Manukau Water Limited operate the bulk and local wastewater networks respectively. The companies jointly commissioned a study to develop a wastewater master plan for the Eastern Suburbs of Manukau City.

This paper describes the development of this master plan, including challenges associated with the quality and quantity of data and how these were overcome It gives an overview of the options considered for providing increased trunk wastewater network conveyance and will comment on the regional implications of such a development and the phasing of upgrading works. It will also discuss how staff from across the organisations collectively identified issues and the development of solutions.

Primary elements to achieving an integrated master plan were the corroboration of existing data for wholesale and retail systems, identifying individual and common drivers and identifying constraints to current and future upgrades. This allowed effective prioritisation of existing network problems and those predicted by the demand being placed on the assets for growth.

KEYWORDS

Integration, planning, population growth future, operator involvement

1 INTRODUCTION

1.1 BACKGROUND

Manukau City is New Zealand's third largest city and is the fastest growing. Much of this growth is expected to happen within the eastern suburbs of the city, particularly in the Flat Bush area. The population of Manuakau City in 2007 was 335,000, with approximately 45% in the eastern suburbs area.

The eastern suburbs area covers 770ha of varying land uses which include residential, commercial and industrial areas. This equates to approximately half of the developed area in Manukau City. The growth in Eastern Suburbs is predicted to increase by 120% by 2061. It is likely that this growth will be focused on particular growth nodes in the eastern suburbs area according to Manukau City Council's growth predictions.

Manukau currently has several development restricted areas where population density is limited to 35 persons per hectare (one dwelling per quarter acre section). These areas have insufficient wastewater network capacity to provide for higher development rates than already provided for without impacting the current level of service. The original wastewater pipes were sized for a lower population density. Over half of these development restricted areas are located in the eastern suburbs of Manukau, therefore the areas have been prioritised for master planning to provide capacity in these areas to allow the continuing growth.

It was recognised that a wastewater master plan was required to allow Manukau Water and Watercare to determine the requirements of wastewater infrastructure to accommodate growth and to achieve currently aspired levels of service. CH2M Beca was commissioned to undertake the master plan for the eastern suburbs.. The study and investigations which lead to the development of the master plan are designed to identify the key network responses under various dry and wet weather conditions and to identify the primary operating issues in the study area.

This allows high level solutions to be developed, from which the outcome will be a detailed investigation into the identified issue and solution. The primary benefit of this level of master planning, is the ability to prioritise network issues, identify relationships between issues and solutions and assess the regional implications of proposed solutions. While the approach to both issues and solutions is at high level only, a number of factors can be considered, resulting in a robust framework for progressing network upgrades.

The aim of this project was to produce a master plan for the provision of wastewater services for the eastern suburbs of Manukau until 2061 and the boundaries of the study area are illustrated on Figure 1 below.

Figure 1: Manukau Eastern Suburbs Study Boundary

1.2 LEVEL OF DETAIL

The purpose of the master plan study is to identify the issues and likely solutions, rather than determine the detailed size and design. In order to ensure sufficient detail was included in problem areas, significant effort was put into identifying the areas that have current performance issues, high expected growth and operational issues.

During the development of the hydraulic model for eastern suburbs, areas that had no known or expected issues were simplified, while detail was retained in the areas known to have issues. This ensured a good understanding of the problem areas was obtained without over complicating the model and related problems associated with this.

Sufficient detail was provided to identify and prioritise problem areas, assess the likely cause of the constraint and recommend the most probable solution for the network.

1.3 EXPECTED OUTCOMES

The expected outcomes of this study were as follows;

- Identify current network performance deficiencies and those deficiencies which are predicted to occur as a consequence of future population growth and the demands this growth will place on the sewer infrastructure;
- Develop solutions to meet the required level of service;
- Determine cost estimates for solutions considered
- Ensure that any 'buildability' issues are identified for each of the solutions considered
- Ensure that all possible solutions are investigated
- Select preferred solutions through a triple bottom line approach; and
- Develop a phased implementation plan such that both short and long term upgrading solutions are considered and are consistent and the benefits of their implementation are optimised

The overall findings of this study would identify the areas where detailed analysis was required and assess the priority of these areas.

The key aspects of this master plan were identifying regional effects and solutions within the eastern suburbs and determine how to best optimise the network capacity to resolve network performance issues and development constraints.

2 REGIONAL INTEGRATED PLANNING

As part of their ongoing responsibility and commitment to provide sustainable wastewater collection and treatment services to the Auckland Region, Watercare and Manukau Water continuously work together on joint studies to develop integrated concepts and plans to meet future demands on their infrastructure.

It is well recognised that a comprehensive cooperative planning approach is required to address region wide wastewater issues in an integrated fashion and this is being progressed through the Regional Three Waters Project. (Watercare Services Limited, 2008)

This study built on the planning work completed to date by further developing possible future concepts for wastewater collection and treatment for the eastern suburbs of Manukau. The outcomes of the study were incorporated into the respective asset management plans of each organisation.

2.1 KEY NETWORK ISSUES

The key long-term wastewater requirements for the eastern suburbs of the Manukau is are to provide the additional capacity required through a phased upgrades programme to meet the forecast future demands for the area. In addition to this, development restrictions are currently in place in certain areas of the study area due to current capacity constraints in the wastewater network. There is an immediate need to identify solutions for these development restricted areas that are consistent with the longer term solution, which can be implemented in the short term to permit development to proceed.

Throughout the project, ownership of assets and asset boundaries was not specifically considered, with a "best for region" approach adopted. The required level of service target used in the master plan was one spill per year. This is the higher of the requirements of the bulk and local operators. The difference in regulatory requirements was taken into account when reviewing options. This approach to the network and the analysis has ensured a comprehensive, region wide assessment of the performance of the existing assets. This results in the study being directly transferable to the expected change in the management of water services in the Auckland Region. The study does however, highlight the issues of different regulatory requirements of the two networks, as they are currently operated.

Integrated planning of the wastewater infrastructure avoids piecemeal development and investment, as set out in the Proposed Regional Plan: Air Land & Water. (Watercare Service Limited, 2008a) It ensures the effectiveness of the planned upgrades through ensuring the upgrade is sufficient to provide the conveyance requirement and also checking any downstream effect of increasing the network capacity.

Assessing the network as a single entity, allowed the identification of related issues and the wider causes. Clusters of problems were identified, including both local network and trunk sewer issues that were either caused by the same constraint or dependant on a downstream capacity issue.

This allowed a better and more holistic view of potential solutions to network capacity issues. In areas, a single solution could be identified that would have regional benefits, alleviating capacity issues throughout several catchments. These solutions would not have been so readily identified without the regional assessment of the network.

2.2 OPTION CONSIDERATION

Assessing the regional response to dry and wet weather flows, highlights the areas that have insufficient capacity, while also identifying areas that have spare capacity. This allows upgrades to be planned to make the best use of existing assets. Additionally, taking a high level view of the network provides opportunities to amalgamate recommended projects to benefit the greatest possible area.

The downstream effects of peak flow reducing options such as inflow and infiltration control and storage tanks can be fully quantified, allowing any downstream upgrades to be appropriately scaled. This is an important factor as changes in one catchment can greatly affect the performance of another.

2.3 PLAN DEVELOPMENT

Developing a strategic plan for the Eastern Suburbs required identification of priorities and key phasing limitations for the area. This lead to a series of interim projects being identified to ensure level of service and development requirements were met without increasing downstream pressure prior to completion of larger projects.

Cost estimates produced alongside project phasing resulted in a long term investment plan that could be integrated with the Manukau Water and Watercare asset management plans

3 PROJECT CHALLENGES

Throughout the development of the master plan project, several challenges were indentified and methods developed for their resolution. Primary challenges encountered related to the scale of the study area and the high level of growth both currently encountered and predicted in the future. The predicted level of growth in the area was unique to this study and had implications throughout the study. Some of the project challenges and how they were overcome are described below.

3.1 REVIEWING AND UNDERSTANDING DATA

Through the initial part of the study, significant effort was put into understanding the operation of network through assessing the available data information. The study area contains 13 discrete catchments and 2 network operators and as a result a significant amount of date was available. This included:

- Existing network models;
- Asset data;
- Outputs and data from previous catchment studies;
- Flow survey data and associated reports;
- Detailed options and design reports.

The data was of varying quality and had been collected over a wide range of dates and in order to fully document and understand the available data, a catalogue known as a technical memorandum detailing the available data assembled, recording on a catchment by catchment basis the following:

- The key information available;
- The identified problems in the catchment;
- The flow surveys completed; and

- The important asset data such as pumping stations, storage tanks and constructed overflows.

The technical memorandum resulted in a good understanding of the network, and its operations was further solidified through a workshop held with operations staff, discussing and identifying network issues and operational problems.

3.2 FLOW SURVEYS AND CALIBRATION

The data review concluded that there had been a large number of flow surveys throughout the study area over the years, with a total of 27 flow surveys completed between 2001 and 2007.

The flow data was not comprehensive across the study area with each survey typically covering only individual catchments. The only comprehensive flow data set was that recorded on the Watercare trunk network, that was gathered as part of Project Storm 2, a trunk sewer modelling project completed in 2008. High resolution rainfall data was not plentiful with rainfall typically only measured at one location within each catchment. The size of the study area meant that it was important that the spatial variation of rainfall was understood and accounted for. Due to the lack of raingauge coverage, problems were encountered in the model calibration process.

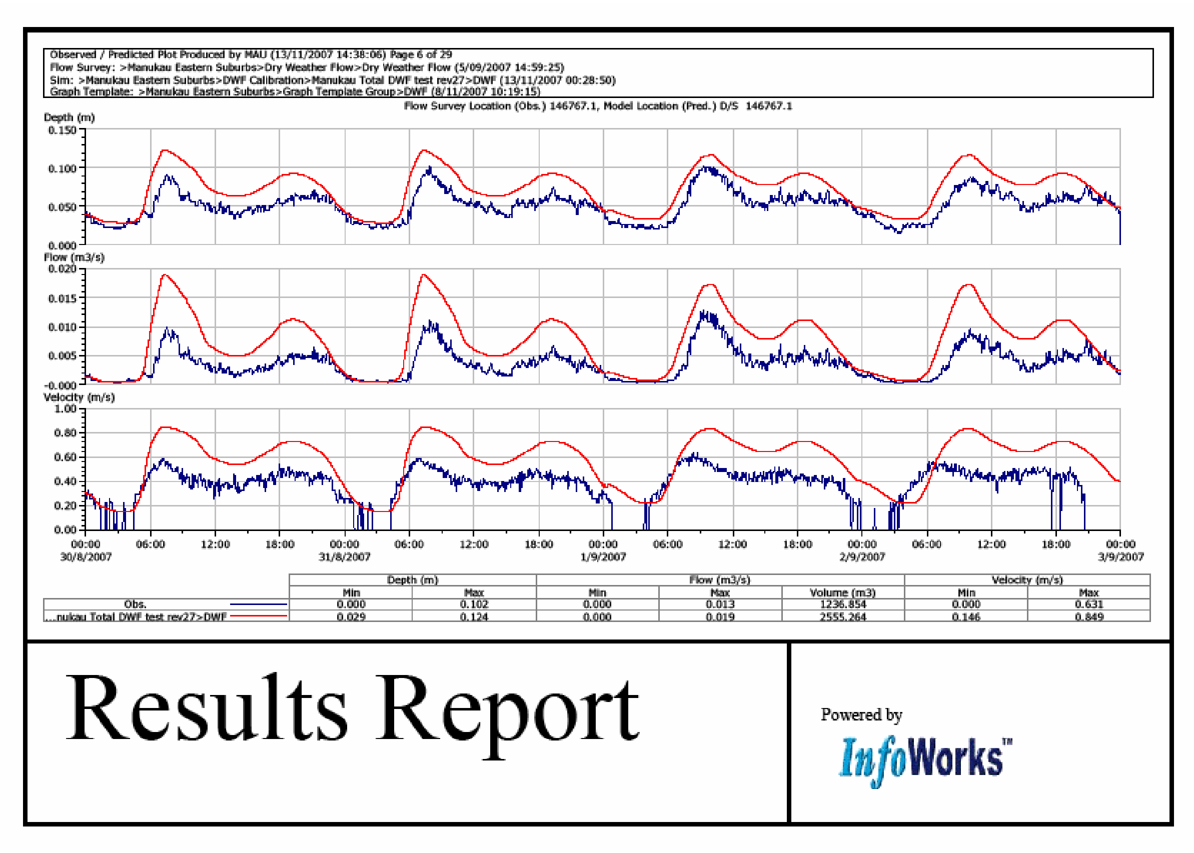
Flow surveys used were selected based on how recent the data was and the quality of the flow data captured during the survey. Either 2 or 3 flow gauge locations were selected for each catchment that had high quality data and gave a good reference point for the catchment in addition to using all of the Project Storm 2 flow survey data. This ensured that both the local in-catchment response was accurately represented as well as the wider trunk network response.

It was clear from the flow surveys that some areas of the study area had experienced a high amount of growth since the most recent flow survey was completed. This was particularly noticeable in some areas of Bucklands Beach, for which the flow survey was completed in 2001 and Otara, which borders the large Flat Bush development.

Year 2006 census population with typical demand data was used by the model to predict the dry weather flows. When the model was simulated with this data and then compared with flow data recorded only a few years ago, in some cases there was a significant difference which could not be explained by a normal range of wastewater demand value. An example of the level of these discrepancies is illustrated on Figure 2, with the model prediction (the red trace) being approximately double that of the observed data (the blue trace).

Further investigation showed both large population changes in these areas between census data records and sections of new infrastructure built since the most recent flow survey. In some areas the population change was as high as 3,000 people, which largely invalidated available flow data for both dry and wet weather conditions in describing present day conditions.

Figure 2: Effect of population growth on dry weather flow calibration



3.2.1 WET WEATHER CALIBRATION

It is normal practice to undertake a calibration process from upstream to downstream with the response to each consecutive flow gauge calibrated in turn. This approach was not adopted in this case because of the dominance of backwater effects from the interceptors. A three step process was undertaken instead.

- Firstly a coarse calibration was carried out with the model to attempt to match observed and predicted data in the interceptors.
- Secondly a traditional 'upstream to downstream' calibration process was undertaken
- Finally the coarse calibration of the interceptor flow data was checked using the upstream calibration parameters

The coarse calibration of the interceptors was successful and gave good results and a good match was obtained between predicted and observed results.

The 'upstream to downstream' calibration was less successful, largely due to the fact that region wide rainfall information was not available for the process and the model representing the whole of the study area network was 'driven' by one raingauge in the local catchment. This resulted in a poor prediction of interceptor response for each event and therefore made identifying the influence of the interceptor on the local catchment very difficult.

Additionally, some catchments had very large storm events recorded up to 1 to 2 year annual recurrence interval (ARI) storm events, whereas others only recorded relatively small events at 3 month ARI. This meant that some catchments were calibrated well for large events but had a poor confidence for small events and vice versa.

A large amount of work went into working with the flow surveys and the peer reviewer to resolve the issues during the calibration process. However in several areas, an acceptable tolerance in calibration could not be achieved based on flow survey data. In these areas, the catchments were assessed against historical manhole spilling performance data. The model was simulated with a 1 year ARI storm and its results were compared with historical records. The comparison gave a good match in places and in these areas increased the confidence in the model's predictive capabilities.

3.3 MODEL INTEGRATION

The existing models used in this study were originally built using the MOUSE and Infoworks CS software platforms. The MOUSE models were imported into Infoworks using the data import centre which provided the basis of the model.

Due to differences in the way the models treat pumping stations and overflows, a large amount of effort went into ensuring these were modelled accurately. Each pumping station was remodelled based on pump files held by Manukau Water. This ensured the most up to date information was utilised in the model and the correct methodology was used.

Spills from manholes are treated differently in the two software packages. As the MOUSE model represents these as weirs it was difficult to distinguish between manhole spills and constructed overflows. Constructed overflows had to be specifically identified through network data and historical reports to confirm these as accurately as possible and ensure no errors in the data transfer.

Additionally, there were isolated cases where the levels between the local and bulk networks did not align. Where this was the case, GIS data was reviewed as a first step and 'as built' records were checked if further confirmation was required.

3.4 LEVEL OF DETAIL MAINTAINED

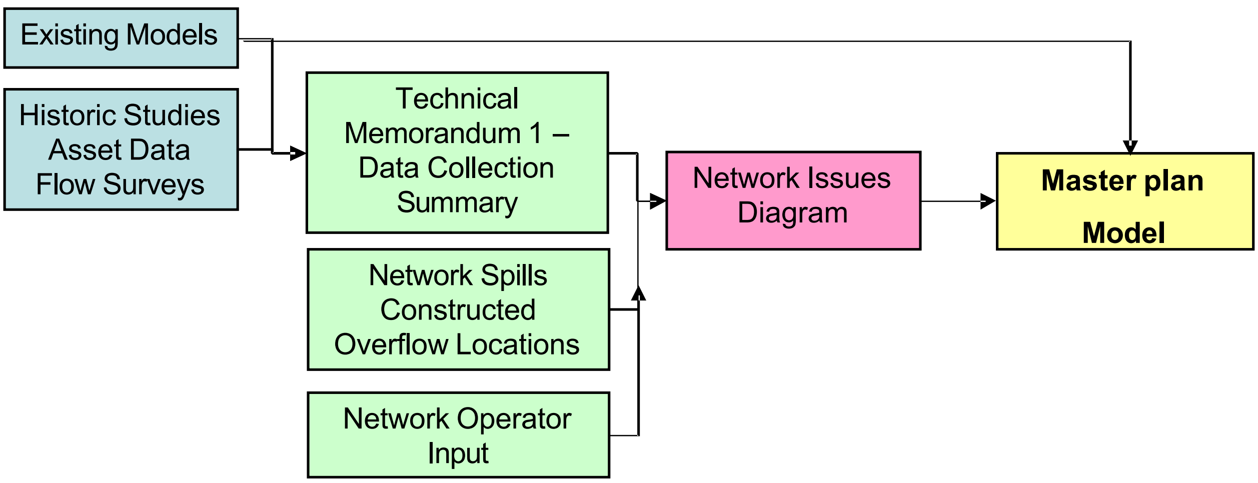
The existing models incorporated into the master plan model were catchment models of a high level of detail. This gave a much higher level of detail than was required for master planning purposes.

Retaining the high level of detail would have resulted in very long simulation times and only minimal benefits from retaining the data. It was considered to be of high importance to retain detail in problem areas to gain a better understanding of the issues and potential solutions. A detailed analysis of existing issues, faults, operational issues and high growth areas was completed, carrying on from the manhole spills and constructed overflows identified in the data assessment stage.

A workshop was held with network operations staff to confirm problem areas and a map was generated, detailing issues throughout the network. This was used as a background layer in the model during network simplification; ensuring areas where problems existed or where growth was expected to be high were maintained in the model, while other areas were simplified to improve model simulation times.

The workshop played a significant part in model development and the process utilised is displayed in figure 3 below.

Figure 3 – Data analyses methodology

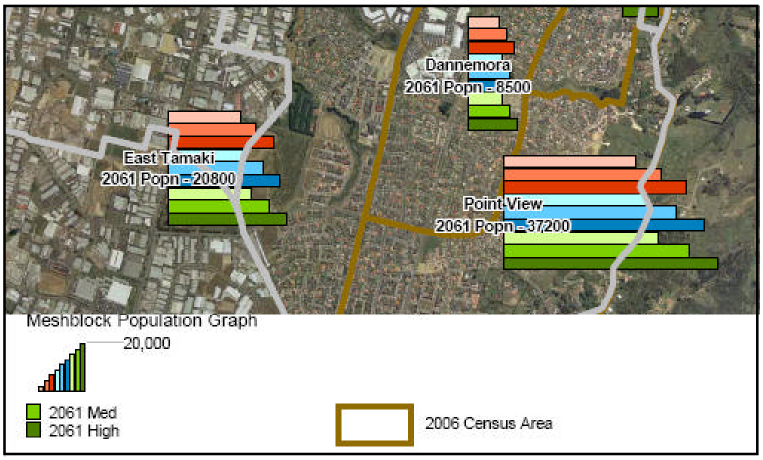


3.5 SCALE OF AREA AND GROWTH PROJECTIONS

The level of predicted growth in most catchment planning and master planning exercises is modest and planning for this growth normally means that, the majority of the wastewater network remains unchanged. During the development of this master plan, when the level of predicted population growth was applied, there were instances where the model was predicting surcharge and manhole spills under dry weather at the head of the model network. This indicated that master plan study should not merely consider solutions 'titivating' to add to the existing network but should consider a new network or means of conveyance.

Because the projected growth is so large, the lack of resolution of precisely where growth is going to occur is important. In the case of eastern suburbs there is a need to increase this resolution of population predictions and for more integration of the town planners and infrastructure planners.

Figure 4: Growth Scenarios Applied to the Study Area



Further to this, the model predictions for dry weather flow provided a reality check on the level of conservatism used for population predictions. It was later established during the detailed investigation of the Otara wastewater catchment that population predictions for Otara approximately 10,000 people higher than could reasonably fit within the catchment under the proposed town planning rules.

4 OUTCOMES

A key outcome for the master plan was to identify the phased upgrades required to meet the network level of service requirements, while allowing for continuing population growth. By completing an integrated master plan, regional solutions could be identified, optimising the existing assets and identifying solutions that would benefit multiple catchments.

4.1 IDENTIFICATION OF FUTURE CAPACITY SHORTFALLS

The master plan study identified several key regional and local projects that would provide significant capacity upgrades and make the best use of the existing infrastructure (CH2M Beca, 2008). The high level issues restricting the ability to meet level of service requirements both now and in the future were identified as follows:

- Insufficient wet weather capacity in the Howick interceptor (HIN) which services the top half of the study area and restricts any upgrades to the Bucklands Beach branch sewer(BBH);
- Capacity of the East Tamaki East Interceptor (TIN) is not fully utilised;
- Insufficient wet weather capacity in the BBH branch sewer to allow local network upgrades and capacity growth; and
- Insufficient capacity in the local and bulk network (OTB) to provide for predicted growth in Otara, in both dry and wet weather flow conditions.

In addition to these there were local issues identified which require local solutions.

4.1.1 BOTANY DIVERSION

The Howick interceptor is under significant pressure during wet weather flows in existing conditions, which is predicted to be further exacerbated by population growth within the upstream catchments. The interceptor is the primary collector for 8 catchments in the study area and provides a significant constriction on any upstream upgrades required to meet local network capacity requirements. The Howick interceptor is 7km in length and runs primarily through residential areas, including below properties and along highly trafficked roads. Any upgrades to this interceptor would be difficult due to both cost and the impact on the community during construction.

It was identified that there would still be capacity available in the Tamaki East interceptor (TIN) to the south of the Howick interceptor. There is an existing connection from the Howick interceptor to the TIN interceptor through the Botany diversion (BOT). The existing diversion has a weir structure at the junction with the Howick interceptor and reduces pressure on the Howick interceptor through taking high wet weather flows upstream of the BBH branch sewer.

As there are capacity issues in both the Howick and BBH sewers, it was proposed that the full capacity of the TIN interceptor be utilised to remove high upstream flows from the Howick interceptor. The proposed project would duplicate the Botany diversion, taking high flows from the BBH interceptor through to the TIN interceptor. This removes a high proportion of flow from the Howick interceptor, allowing local network upgrades to be progressed, while also providing additional downstream capacity for the BBH interceptor. Initial assessments indicated that this pipeline would likely be feasible to build, as the majority would go through a golf course and park corridor. This project is to be taken forward for detailed investigation by Watercare in the near future and provides a key output for the integrated planning in the study area.

4.1.2 BUCKLANDS BEACH BRANCH SEWER

The Bucklands beach branch sewer (BBH) receives flow from 3 catchments and discharges to the Howick interceptor. Currently there is insufficient capacity to meet level of service requirements during wet weather flows due to a combination of backwater effects from the Howick interceptor and insufficient capacity in the BBH branch sewer. Two of the catchments are pumped into the interceptor, one at the upstream end of the interceptor and the second part way down.

The peak flow rate from the catchments served by the BBH interceptor cannot be increased until additional capacity has been made available downstream. Interim measures are therefore required to ensure spilling is remedied as much as is feasible and growth is not unnecessarily restricted.

The provisions of a large storage tank was identified as the preferred solution for the downstream catchment, with a control regime reducing the peak flow during wet weather periods. Additional flow from the catchment would spill to the storage tank, resulting in a decreased demand on the sewer. This tank would be sized based on population growth to the construction of the Botany diversion rather than total population growth. The upstream contributing catchment already has a storage tank and it is recommended that a study be completed to optimise the available storage.

Long-term, it is recommended that a duplicate interceptor be provided, picking up the lower contributing catchment and other local network connections it bisects. This would connect straight into the Botany Duplicate interceptor, removing load from both the BBH branch sewer and Howick interceptor.

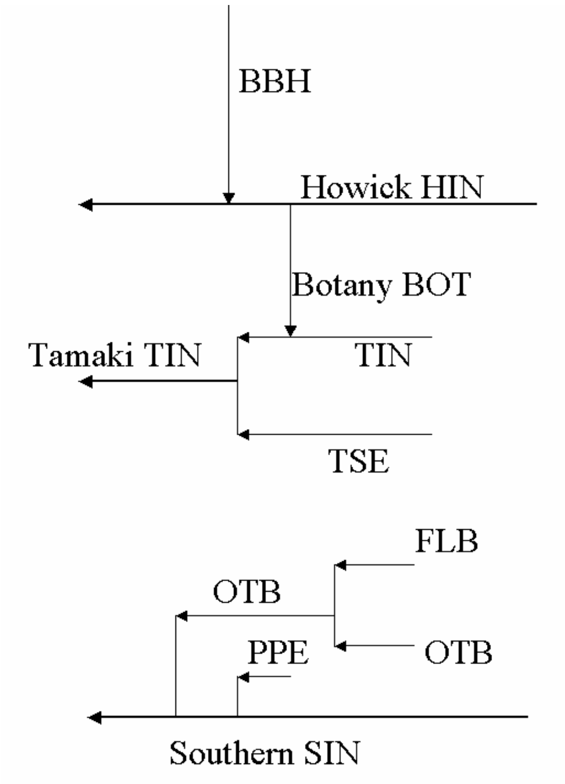
4.1.3 OTARA

Population predictions showed a very high growth profile for the Otara catchment. Otara is adjacent to the new Flat Bush development and is a significant growth node for Manukau City. Model predictions for the future population showed the network would have insufficient capacity to provide for dry weather flows in the catchment. Currently there are frequent wet weather overflows occurring in the catchment.

Due to the networks inability to convey predicted future dry weather flows in the catchment, new infrastructure would be required rather than upgrades and optimisation of the existing network. The flows have implications downstream, with a large section of the Otara interceptor unable to convey these flows.

Priority upgrades for the catchment are to remedy existing overflow locations throughout the catchment, with a large storage tank recommended at the start of the Otara interceptor. Detailed investigation is required to assess feasible methods for providing a widespread infrastructure solution. Watercare is currently investigating the Otara catchment in greater detail to confirm upgrade requirements and timing. The latest investigations have shown population predictions provided for the master plan to be beyond the realistic capacity of the catchment by approximately 10,000 people.

Figure 5: Network flow diagram for Manukau Eastern Suburbs Interceptors



BBH – Bucklands Beach Branch Sewer
HIN – Howick Interceptor
BOT – Botany Diversion
TIN – Tamaki East Interceptor
TSE - Tamaki South East Branch Sewer
OTB – Otara Interceptor
FLB – Flat Bush Branch Sewer
PPE – Papatoetoe East Branch Sewer
SIN – Southern Interceptor

4.2 PROJECT PHASING AND PRIOITISATION

There were three primary phases assigned to the identified projects within the master plan study. These were bulk network upgrades, focused on increasing the downstream conveyance capacity of the system, interim upgrades, these applied to both the local and trunk system and provided improved level of service compliance and development capacity and the final was long term, growth driven upgrades.

The trunk network upgrades were dependant on the capacity available in the Eastern Interceptor, which is downstream of the study area. Currently no additional capacity is available for increased flows from the study area. The central interceptor project is expected to reduce flows to the eastern interceptor, allowing an increase in total conveyance from this system. It was assumed that capacity would be available in the eastern interceptor by the year 2020 and phasing of bulk network upgrades was set around this timeframe.

Interim and local solutions provide immediate benefits to the catchment in terms of wet weather capacity and include solutions such as storage tanks and inflow and infiltration control. These solutions will improve development restricted zones within the eastern suburbs along with reduced spilling frequency and volumes above level of service provisions. The sizing of these projects is based on what is required until downstream upgrades are completed rather than the long term peak requirements. That being said, they will reduce the peak conveyance required of the future system.

The priorities for interceptor solutions were primarily based on the phasing of downstream projects. Interim and local solutions were prioritised based on the expected benefits to the catchment, the expected growth in the area and the dependence on downstream upgrades. Upgrade solutions that only addressed growth issues rather than existing network issues were given the lowest priority.

A phased upgrade plan was developed based on the above priorities, giving recommended upgrades for the 0-5, 5-10, 20-20, 20-35 and 35-50 year time periods. Figures were developed showing the progressive network development through the 50 year master plan. The cost estimates associated with these upgrades provided a phased estimate of the financial expenditure associated with these upgrades. The cost estimates were developed using Watercare's unit rates and allows budget provisions for projects to be included within the Manukau Water's and Watercare's asset management plans.

5 LESSONS LEARNT

There were a number of lessons learnt by the integrated project team that relate to how master plan studies should be better scoped and conducted and a series of successes which were realised in this project which could be applied to future studies or are a direct result of this study.

5.1 SCOPING AND CONDUCTING MASTER PLAN STUDIES

5.1.1 QUALITY AND QUANTITY OF DATA

Going into the master plan study, the full implications of the volume of data were not fully understood. A large amount of time was spent identifying the available data and its relevance. Additionally, as some reporting was contradictory it became difficult to clarify the correct network facts at times.

Subsequent studies completed by Manukau Water and Watercare have included a gap analysis as part of scoping the project. This has proven to be effective for both parties in ensuring efficient running of master plan studies.

5.1.2 PEER REVIEWER INVOLVEMENT

An external peer reviewer was involved early on in the model development and calibration phase of this project and proved beneficial to the resulting model quality. Involvement of the peer reviewer ensured a clearer focus on calibration outcomes and ensured an outside perspective was present throughout the model development. It also reduced the amount of re-work required and provided confidence to Manukau Water and Watercare that the calibration of the model was meeting the required standard.

5.2 KEY SUCCESSES

5.2.1 IDENTIFICATION OF REGIONAL SOLUTIONS

Key projects identified through this study clearly show the benefits of integrated regional planning. Solutions identified, optimise the use of existing infrastructure, provide improvements to local network issues without aggravating the regional network and identified areas where detailed investigation was needed.

The regional focus of the study has ensured that upgrades are not done on a piecemeal basis, resulting in greater improvements to the overall network and reducing capital expenditure. The results of this study are directly transferable to the proposed change in wastewater management structure of the Auckland region as solutions are independent of network ownership.

5.2.2 METHODOLOGY FOR FUTURE STUDIES FURTHER REFINED

The challenges in this project have resulted in improved gap analysis and scoping of projects for both Manukau Water and Watercare. The importance of fully understanding the scale of the project along with the quality and quantity of data was fully realised in this project with positive outcomes for future studies.

5.2.3 OPERATOR INPUT

Involving network operators from both Manukau Water and Watercare provided a significant resource in understanding the network behaviour, assessing and identifying the network issues and considering potential problems with recommended upgrades.

Direct input from the network operators ensured the best possible accuracy was achieved during the problem identification and model build phase of the project. As the identified issues played a significant role in developing the model and later, in prioritising works, it was a key to the success of the project that the issues and their causes were well understood.

Further to this, valuable input was provided on the suggested solutions to network issues. This included input into problems with locations, potential effects on downstream network and previously considered options within the area.

6 BENEFITS

There are a series of benefits which have acrued from development of this master plan to Watercare and Manukau Water, which could also be applied to master plan studies conducted in a similar way. These can be summarised as follows.

6.1 THE REGIONAL PICTURE

The integrated master plan process allowed the network to be assessed in terms of the bigger picture. The issues identified in the existing network form a different picture when viewed regionally, rather than catchment by catchment. This lead to a better understanding of the issues and potential solutions across the Manukau eastern suburbs and to an early realisation of these issues and their implications for regional capital expenditure

6.2 IDENTIFICATION OF FUTURE ISSUES

Several key studies have originated from this master plan analysis, resulting from issues and solutions identified. Detailed investigations are being pursued into recommended solutions and the scale and scope of these projects.

6.3 REALITY CHECK ON EXISTING ASSUMPTIONS

Completing long term planning studies requires a high level of assumptions in order to estimate the long term changes in capacity. Modelling of the future network resulted in growth assumptions to be reviewed subsequent to this study.

6.4 OPTIMISATION OF FUTURE INVESTMENT

Developing a 50 year master plan allows early upgrade recommendations to be considered in respect to the long term state of the network as well as the existing conditions. This ensures upgrades are not oversized relative to the long term need. Additionally, regional integrated planning ensures that upgrades provide the maximum benefit to the overall system and do not have negative implications for the adjacent areas. This integrated planning prevents piecemeal development of the wastewater infrastructure and unnecessary expenditure.

7 CONCLUSIONS AND RECOMMENDATIONS

The Manukau eastern suburbs master plan presented some unique challenges due to its very high growth rate, the quantity of data available and the separate management of the local and trunk wastewater network. Through completing integrated studies and planning, Manukau Water and Watercare have ensured a framework that will provide for the high level of growth within the study area and meet the level of service requirements for the network.

The study identified regional solutions that will assist in achieving sustainable growth within the study area, through making the best use of existing assets. The regional approach to planning will prevent piecemeal development, optimizing investment and providing a phased upgrade approach that is not affected by changes in the network management that are currently foreseen.

Key outcomes that have resulted from this project are as follows:

- Gap analysis should be completed at the outset of large studies to ensure proper scoping and a good understanding of the scale of the project;
- When using multiple flow surveys, the implication of different data ages and qualities needs to be well understood and should be reflected in the calibration plan and the expected calibration parameters;
- Early peer reviewer input was important in achieving adequate model confidence and maintaining focus on calibration outcomes during the model development;
- Direct involvement by network operator staff significantly improved the understanding of the network performance and the overall quality of the model and master plan results. Involvement both in identifying network issues and assessing potential options ensured fast accurate feedback and robust solutions;
- Regional integrated planning identified several projects that would not have been clearly visible through individual network and catchment studies. These have lead to the implementation of detailed investigations in these areas.

REFERENCES

Auckland Regional Council (Notified 23 October 2001): Proposed Auckland Regional Plan: Air, Land and Water

Watercare Services Limited (2008) Three Waters Final 2008 Strategic Plan, Retrieved from www.water.co.nz on 15/07/2009.

CH2M Beca Ltd (2008) Manukau Eastern Suburbs Master Plan