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Sustainable Integrated Planning Approach Case Study: NORSGA, Waitakere City, Auckland.

Category: Sustainable Infrastructure and Buildings

Abstract
The Northern Strategic Growth Area (NORSGA) is one of the largest remaining greenfield areas for development within Waitakere City Council, Auckland, New Zealand. NORSGA is approximately 2,700 hectares of undulating rural land surrounded by an inner harbour environment on two sides. The strategic planning timeframe is to the year 2050.

Traditionally, land use and infrastructure planning have occurred as separate processes. Under the traditional model infrastructure decisions are made based on a pre-determined land use (i.e. zonings in a District Plan). However, with sustainability being a key goal it becomes essential that land use and water cycle management planning are closely linked. Sustainable management of Waitakere City's 3-waters (water supply, wastewater and stormwater) has been a major focus of the city since proclaiming it an Eco-City in the early 1990's.

This paper presents the process and preliminary outcomes for the planning of appropriate water cycle management infrastructure solutions (for water supply, wastewater and stormwater) for the 2,700 hectares of greenfield development. The "Local water Agenda" project is only one of the many issues being considered in the overall strategic direction for this greenfield area. The project itself is unusual in that the technical team comprises a consortium of consultants and research bodies working closely with key stakeholders.

1 Introduction and Background

The Northern Strategic Growth Area (NORSGA) is a key growth area in the Waitakere region. Through the Northern and Western Sector Agreement process there is agreement in principle for a staged extension of the Metropolitan Urban Limits in this part of Waitakere City. The area covered by the study is presented in Figure 1 below:

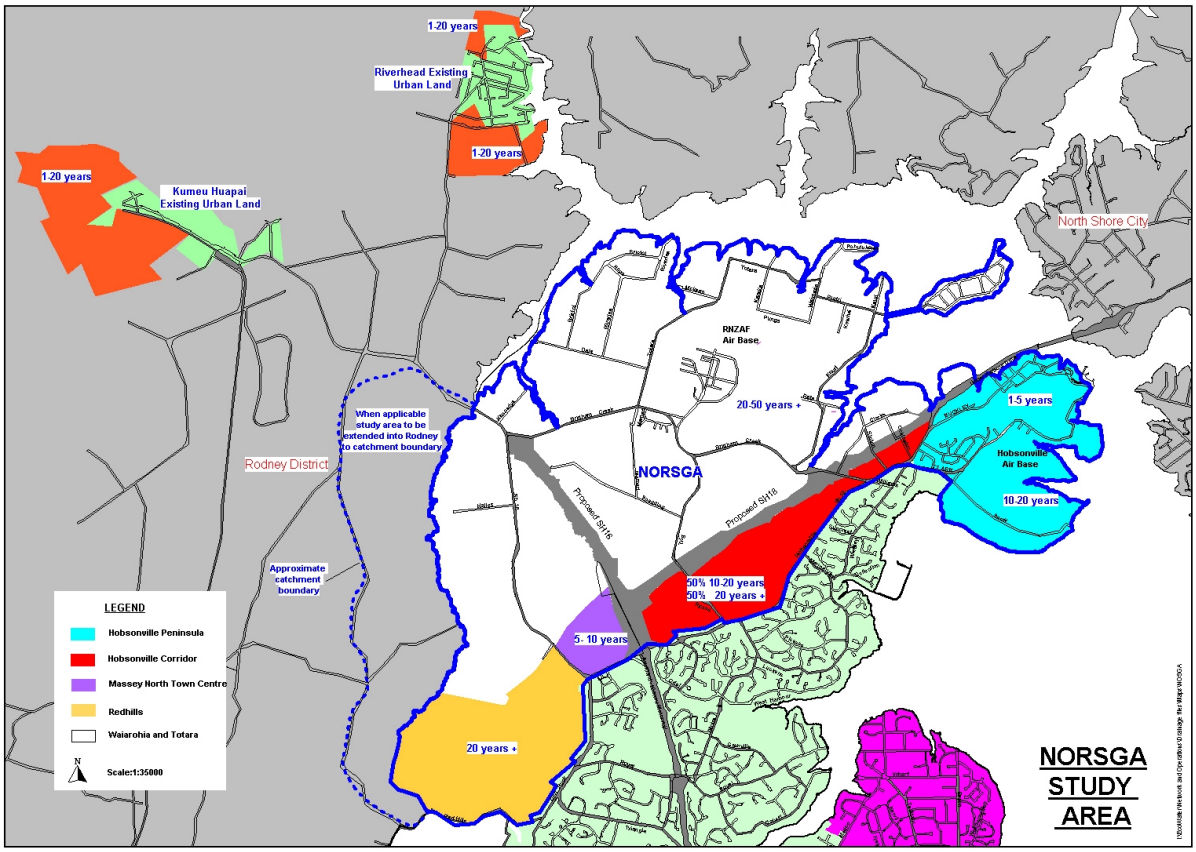

Figure 1 - Northern Strategic Growth Area

The exact "boundaries" of new urban development are yet to be defined and the new State Highways and possible changes in the use of Whenuapai and Hobsonville airbase may mean that the assumptions upon which the Sector Agreement are predicated are incorrect and do not provide for sustainable development of the City. Based on current population projections and the City's consolidation strategy, the area will need to provide for around 30,000 persons over a 50 year period.

Traditionally in Waitakere land use and infrastructure planning have proceeded largely in isolation. This often results in development that meets short-term objectives but fails to meet the long-term economic, environmental and social needs of both the local area and the City as a whole.

In the past ten years a more sustainable approach to managing water has emerged and this has provided the framework for Council's Water Cycle Strategy, which aims to manage the development of the Three Waters in a more coordinated and sustainable manner. Adopted by Waitakere City Council in 1995, the strategy aims to:

- Reduce long-term costs;
- Enhance environmental quality; and

- Achieve social benefits.

2 Purpose of the Project

Currently, land use planning for the NORSGA area has resulted in a number of different options (scenarios) for land use in the area. WCC planners identified the four possible scenarios for this project, and they vary in both population and land use.

This project, Stage Two of the NORSGA Local Water Agenda (LWA) aims to take into account economic, social, cultural and environmental issues in order to analyse and select the most sustainable water cycle option for four given land use development scenarios.

It is recognised that sustainability is a journey, and the LWA will need robust and flexible strategies that provide for long-term management solutions while conforming to Council's Vision of sustainability and its strategic objectives.

It was also essential that the project involve extensive liaison and team-work between the planning and engineering sections of Waitakere City Council. Because water-cycle decision making is only one of many issues to be considered for the area (in conjunction with transport, energy etc), This project has aimed to use a more integrated approach from the outset.

3 Key Project Stages

One of the key aspects of this project was developing a new approach to the way water related projects are assessed. The traditional approach to water management entails comparison of options through a limited suite of parameters with cost being a key component. This study incorporated a number of stages including:

- Options Development
- Water Balance Modelling;
- Contaminant Load Modelling;
- Water management options review; and
- Life Cycle Cost Analysis
- Quadruple Bottom Line Decision making matrix

This project provides one set of information required for decision making with respect to water cycle management planning. There are many other aspects to be considered, and it is also expected that as issues are investigated further, changes to the proposed land uses may be made. In addition, further information gathered with respect to water cycle options and their effects may also shift the balance in terms of the final water cycle option chosen. It is therefore essential that the decision making process developed is robust, and able to be re-visited

Figure 2 outlines the study process.

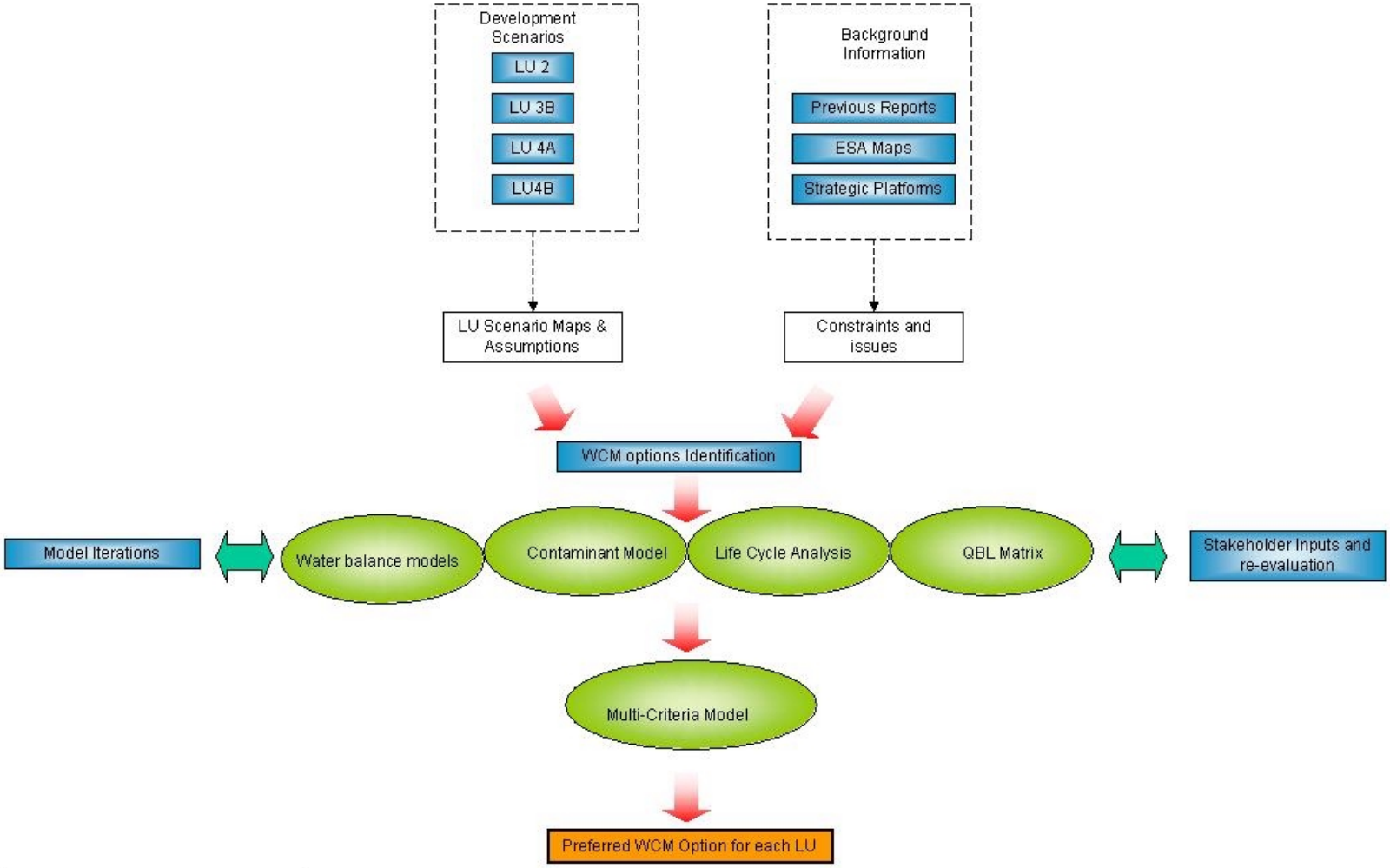

Figure 2. NORSGA LWA Study Approach

4 Methodology

As the project progressed, it became a workshop - based process focussing on the decision making process, and the integration of the council departments, with the technical details being undertaken by a range of different people. The following describes the methodology involved in each stage of the project.

4.1 Objectives Establishment

Early on in the project, it was essential to set clear boundaries for the process. As this was essentially a water-based project, the assessment of water management options had to be constrained within this context. While it was also possible to use the decision making matrix structure to make other decisions (i.e. land use planning decisions), the information required to do so was extensive, and beyond the current scope of the project.

Decision- making objectives were related back to Waitakere City Council's nine strategic platforms, which are:

- Urban and Rural Villages
- Integrated Transport and Communication
- Strong Innovative Economy
- Strong Communities
- Active Democracy
- Green Network
- Three Waters
- Sustainable Energy and Clean Air
- Zero Waste

While clearly, one of these platforms is 'three waters', this assessment also needed to be cognisant of the other eight platforms, in order to come up with a solution that was acceptable to the City and in line with its vision.

4.2 Options Identification

The description of options for water management included stormwater management, water supply management, and wastewater management (treatment, disposal and biosolids)

Each of the land use scenarios had four broad options identified, catered to the individual population and land use details, but based around the following categories:

- Option 1 – 'Village Based' - this option incorporates localised 3 – water management, and typically includes rain tanks for water supply and stormwater management, and decentralised wastewater treatment and disposal.

- Option 2 – 'Village / nodal based' – this option includes some of the aspects of the village based option, but also takes advantage of 'nodal' centre type treatment and disposal of wastewater (i.e. satellite plants).
- Option 3 – 'nodal/regional based' – This option still includes some nodal based characteristics, such as rain tanks, but also incorporates some use of the regional bulk water and wastewater services offered by Watercare Services Ltd.
- Option 4 – 'Centralised' – This option almost exclusively utilises the regional based water and wastewater supply. Stormwater management is still undertaken in a low-impact fashion (as a result of regional regulations), but attention was not paid to reusing and recycling water.

In some cases, the options were limited for a particular area. For example, two of the 'catchments' within the study area were so sparsely populated in every scenario, that the only option considered for wastewater treatment and disposal was at the decentralised level. Also, because of the conceptual nature of this project, limited detail was developed for each option.

4.3 Water Balance and Contaminant Loading Modelling

Water Balance and contaminant loading models were developed in order to identify the advantages / disadvantages of each option in terms of the indicators used for comparison. The modelling involved looking at the water cycle at both an individual lot level (for different land uses), and area-wide. The water cycle modelling was specifically targeted at identifying the water requirements for a household, and how much of the water requirements could be satisfied through the use of reuse and recycling techniques promoted in option 1. Equally, the amount of water supply required to support the area was also calculated in order to quantify option 4 in comparison.

Contaminant loadings were calculated based on the amount of water estimated to be discharged into the receiving environment on an annual basis. This included stormwater and wastewater contaminants, and was highly dependent on the impact of water reduction and re-use.

4.4 Life Cycle Costing

Life-cycle costs were estimated for each option, over a 50 year timescale. During the initial stages of the project, the use of life cycle analysis was discussed, which would include a monetary 'equivalent' value being placed on environmental and social benefits. However, as the costing component is one indicator of a number of others in the QBL matrix (discussed below), it was determined that the costing should only incorporate capital and maintenance costs for the options.

The cost data available for the various options has a range of certainty, and this was estimated in order to determine a valid cost 'range' for each project.

4.5 Quadruple Bottom Line Decision Making Matrix

Outputs from the above fed into a matrix for evaluation of options that is aligned with a Quadruple Bottom Line (QBL) approach i.e. taking into account the social, financial, environmental and economic aspects of options.

The evaluation matrix was developed in conjunction with a team of WCC stakeholders and uses Councils Strategic Platforms as a basis. The strategic platforms were interpreted into water cycle objectives, which in turn lead to the selection of indicators in order to measure the extent to which an option met the objectives. The following 10 key indicators were used in the comparison of the options for each land use scenario:

1. Infrastructure facilitates growth in a timely manner.
2. Minimises whole of life costs while incorporating best practice options.
3. Minimises risk to council and/or community.
4. Contributes to exciting, innovative and vibrant urban and rural centres.
5. Provides a high level of acceptance by the community and by iwi.
6. Reduces environmental footprint.
7. Supports strategic economic objectives.
8. Maintains and enhances and where possible replicates natural systems that minimise stormwater flows and contamination from roads.
9. Provides future proofing.
10. Supports demand and waste management and water conservation.

Each of the presented options was then 'scored' against the indicators, by identifying which of the four options was the 'best' or 'worst' case with respect to meeting the objective of the indicator. This scoring was undertaken by the technical team on an individual basis, and then collated.

5 Results

The scoring of each option against the indicators set was undertaken for each of the four land use scenarios. The following is a summary of the results. Also depicted are the results as they appear after weighting of the indicators.

Table 1: Preferred option for each land use scenario

	Base Case	**Weighted Indicators**	**LCA 100% weighting**
Scenario 2	Option1	Option1	Option 4
Scenario 3B	Option 1	Option 2	Option 4
Scenario 4A	Option 1	Option 2	Option 4
Scenario 4B	Option 1	Option1	Option 4

It can be seen in the table above that the regional based, or more conventional, water management option is the least expensive. However, when taking the objectives of Ecowater and the Waitakere City Council's strategic platform into account through

the application of the QBL indicators, the more decentralised options become more preferable.

6 Challenges

This project presented two major challenges:

1. Establishing a decision – making framework for a 'part' of a project – looking at the water cycle within the context of a much broader land – use planning decision making environment.
2. Working with a diverse team of consultants and internal council stakeholders.

This water cycle management analysis is subject to potential future changes and 're-visitation' as more information is gathered. It was therefore essential that this process be robust enough to enable re-evaluation of different options under the same decision making framework. The results from this stage of the project are very much a 'first pass', and it is possible that the preferred solution may change in the future.

The project required the interaction and cooperation of a range of people – the consultant consortia undertaking the project consisted of three different organisations, and a number of separate council teams were involved in the workshops. Each team or organisation has specific key skill areas, and while this provides a good cross – section of information, it can be challenging when reaching decisions. It did, however, have a very positive outcome in terms of bringing together the separate council groups, and broadening each teams' understanding of other drivers and decision – making criteria.

Traditionally, engineers alone would be making the water cycle decisions. This project, by involving other council groups and stakeholders, expanded the decision – making criteria - the consultants developed an initial set of indicators, which were highly quantitative based on the study objectives, and made extensive use of the models being developed. When the council team further reviewed the study objectives, an alternative set of indicators was developed based on a 'paired weightings' system, whereby the team selected the objectives they felt were the most important. The final indicators selected were therefore quite qualitative.

Initially, there were no weighting values assigned to the individual indicators; it was considered that the indicators should be of equal value to achieve a 'balanced' result; in essence, the choice of indicators by panel had already skewed the indicators in terms of the panels' view of the most important objectives. Following the revelation of results, it was requested that the indicators be re-weighted based on 1) cost only, and 2) further 'weights' assigned by the team.

The use of qualitative indicators can lead to larger error bands, and inconsistency in results. It is identified that some of the more qualitative indicators may need additional expert analysis.

7 Conclusions and Way Forward

While one of the key aspects of this project was developing a new approach to the way water related projects are assessed land use planning is very much an iterative process with many different issues to be considered, e.g. economic growth, transportation, energy use etc. A sustainable environment can only be achieved if all

aspects of landuse planning are considered as an integrated package rather than in isolation.

While robust decision-making techniques such as the use of a QBL matrix can assist in identifying preferred solutions, the political aspect of decision-making, and inclusion of a wide range of stakeholders and community groups cannot be ignored, particularly by councils.

For this particular project the key outcomes of the water-cycle analysis are to be used as technical background, supporting the wider decision making process and providing input to wider community consultation. Hence it is expected that the options and assessment will require further 'iterations' as:

- Land use scenarios and options are expanded and developed further;
- Further expert advice is sought and technical investigations are undertaken; and
- A result of wider stakeholder and community consultation.

One of the key challenges with respect to the future of this project is to incorporate other landuse issues into a similarly robust decision – making process, and move the land use planning forward in a fully integrated manner.

Breaking down the barriers between the different technical and organisational teams involved with landuse planning is essential in reaching this goal and thereby achieving a sustainable solution.