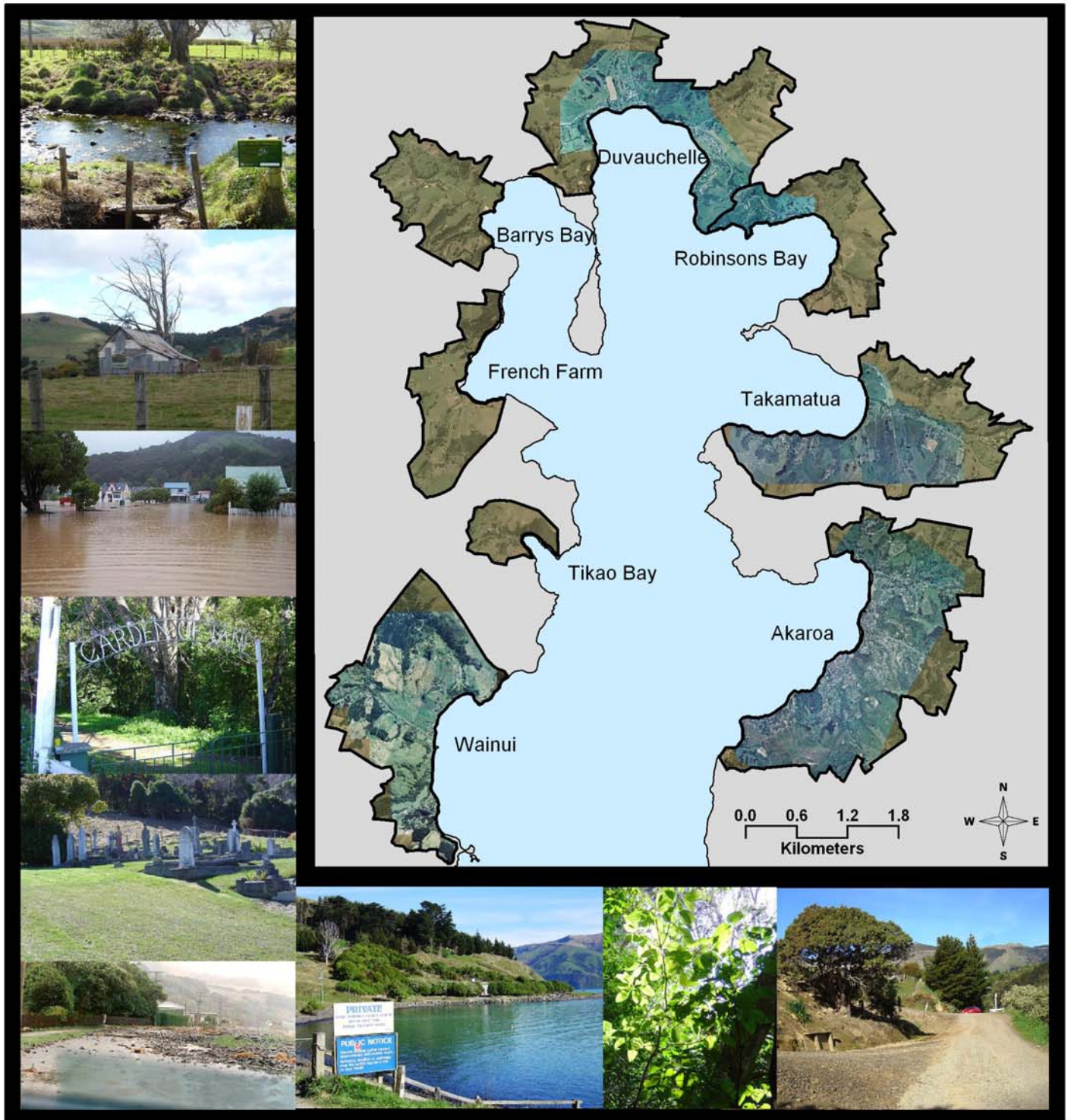


# AKAROA HARBOUR BASIN SETTLEMENTS STUDY

Sieve mapping report – constraints and opportunities

*September 2008*



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The contribution of the following Christchurch City Council staff in the development of this report is acknowledged:

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- Kyle Dow and Shelley Sutcliffe (IM & CT Unit)

Acknowledgement is also extended to Helen Grant at Environment Canterbury, whose assistance with commissioning and reviewing technical reports on land instability, historical flooding and coastal hazards was appreciated.

***Disclaimer***

The Council does not guarantee the accuracy of the data or information contained in this report or accompanying maps. Whilst every endeavour has been made to compile data and information that is up to date and relevant, not all data has been, or is capable of being verified. This report and accompanying maps should not be relied upon for the purposes of any proposed property transaction or to support applications and/or decisions for land use approvals and building consents. The recommendations provided in this report do not guarantee that any or all of the land is suitable for development. In addition, the status of some land may change over time, which could invalidate the findings of this report with regard to this land (eg due to a significant change to an individual constraint score or scores).

## **Executive Summary**

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Christchurch City Council is undertaking a study of the eight urban settlements of the Akaroa Harbour Basin (Wainui, Tikao Bay, French Farm, Barrys Bay, Duvauchelle, Robinsons Bay, Takamatua and Akaroa). The study takes a strategic, long-term view and identifies issues and options for settlement planning. The first step in this study was the identification of a range of broad issues, based on existing information, public feedback and technical reports on a range of topics (refer to the document 'Statement of Issues', prepared by the Strategy and Planning Group in June 2008).

As part of the Settlements Study, sieve mapping was deemed necessary in order to provide information on areas around the harbour basin that pose constraints (or opportunities) to future settlement consolidation. This would then inform options for settlement growth management.

### **Methodology**

'Sieve mapping' is a constraints and opportunities mapping process that builds up a number of geographical layers to produce a visual representation of areas that show less (or more) potential for future settlement growth. While there is no current intent to encourage growth of any of the harbour basin settlements, the information presented in this report will help to inform proactive growth management priorities.

### **Constraint layers and scoring**

Layers that have been applied in the sieve mapping process are listed below. Layers marked with an asterisk (\*) have been mapped as 'potential opportunities layers'; all other layers are constraints.

- Slope instability hazards
- Historic flooding hazard
- Waterways
- Landscape protection areas
- Areas of lesser landscape value\*
- Reserves
- Covenants
- Recommended Areas for Protection
- Areas within 250m of a reticulated water supply\*
- Areas within 250m of a reticulated wastewater scheme\*
- Coastal hazards: storm surge and tsunami (including sea-level rise)
- Potentially contaminating (past or present) land uses
- Protected Trees
- Slopes that receive the least (or most\*) sun
- Historic buildings, sites objects and areas
- Sacred sites (silent files) and Waahi Tapu areas
- Archaeological sites
- Roads, including State Highway setbacks
- Community water supply protection zones
- Setbacks from wastewater treatment plants
- Designations

Each layer has been assigned a score depending on the degree to which the constraint or opportunity is likely to limit (or benefit) built development. Detailed information on how scores were assigned to each layer of constraint can be found in Section 1 and Appendix B of this report.

### **Mapping and comparison of constraints and opportunities**

A final constraints map, which overlays all the constraints across the settlement study areas, has been produced by using a Geographic Information System (GIS) and a grid-based data model (refer Figure 2, Section 4). A final opportunities map has also been produced to show areas with greater opportunity (refer Figure 3, Section 4). The constraints and opportunities maps have then been compared by identifying areas that have:

- a) few constraints; and
- b) one or more potential opportunity layers.

Figures 3 and 4 in Section 4 of this report show the results of this comparison.

### **Assessment of the potential for infill and expansion**

In a final step, the constraints and opportunities maps have been compared with existing residential zoning patterns and non-spatial constraints (refer Section 5 of this report). This has enabled conclusions to be drawn regarding the potential for settlement consolidation through 'infill' (further development within existing residential zoning) and/or 'expansion' (development adjacent to the existing urban edge).

## Key findings

Some settlements have shown greater potential than others for long-term consolidation, which would therefore need to be managed appropriately. A summary of the overall potential for the consolidation of each settlement is outlined in the table below:

Settlement	Potential for infill	Potential for expansion/ connecting*
Wainui	High	High
Tikao Bay	None	Very low
French Farm	None	Low
Barrys Bay	None	Low
Duvauchelle	High	Moderate
Robinsons Bay	High	Low
Takamatua	Very low	Moderate
Akaroa	Moderate	Low

\*Considers both the potential for the expansion of existing urban zones, as well as the potential for such expansion to connect existing pockets of urban zoning.

Refer to Section 5 of this report for more detailed assessments for each settlement.

### **Areas with the most/least potential for infill or expansion**

**Infill:** Duvauchelle, Robinsons Bay and Wainui have the highest potential for development within existing residential zones.

**Expansion:** It is preferable that any future settlement growth would lead to a more consolidated urban form by 'linking up' existing areas of residential zoning where possible. For this reason, Wainui displays the best potential for settlement consolidation, followed by Duvauchelle and Takamatua. Most settlements, with the possible exception of Tikao Bay, could theoretically tolerate some minor settlement expansion, provided that this occurs: (a) adjacent to existing Residential or Small Settlements zoning; and (b) in areas where there are few (or no) constraints.

**Least potential:** Tikao Bay, French Farm, Barrys Bay and Robinsons Bay show the least potential for settlement consolidation. This is primarily due to the already 'scattered' or significantly constrained settlement pattern and a general lack of reticulated services.

### **Areas with potential for rural-residential development**

French Farm, Robinsons Bay and the upper valleys of Duvauchelle show greater long-term suitability for rural-residential development. This is because in these areas: (a) there is limited access to reticulated services; (b) there are substantial areas of lower constraint; and (c) there are particular opportunities present (eg sunny slopes and areas with lesser landscape value). Further investigation of these areas would require an expansion of the study areas beyond those analysed in this report.

## Cautionary comments

This report takes a broad-scale view of land use constraints and opportunities for each settlement and as such the information in this report should not be used to make decisions regarding specific sites. The sieve mapping exercise is purely an information gathering and assessment exercise, and in no way suggests that certain land should or could be approved for development.

In addition to the general limitations above, this report does not take into account the preferences of landowners and residents of harbour basin settlements, in terms of where and how future growth should be absorbed. Further information gathering and detailed planning will be necessary for any investigations into areas where the management of settlement growth is deemed a priority. This process would include community involvement in identifying growth management preferences. Such detailed planning investigations would need to be undertaken prior to any decisions on whether growth should occur, to what extent and when.

*The limitations of the sieve mapping process are outlined in more detail under Section 1.3.5 of this report.*

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## ***List of Abbreviations***

<b>AHA</b>	Akaroa Historic Area
<b>BPCT</b>	Banks Peninsula Conservation Trust
<b>CNCL</b>	Coastal Natural Character Landscape
<b>CDA</b>	Comprehensive Development Area
<b>DoC</b>	Department of Conservation
<b>EECA</b>	Energy Efficiency and Conservation Authority
<b>GIS</b>	Geographic Information system
<b>NZ HPT</b>	New Zealand Historic Places Trust
<b>LUC</b>	Land Use Classification
<b>MHWS</b>	Mean High Water Springs
<b>NRRP</b>	Natural Resources Regional Plan
<b>ONL</b>	Outstanding Natural Landscape
<b>RAL</b>	Rural Amenity Landscape
<b>RAP</b>	Recommended Area for Protection
<b>RC</b>	Residential Conservation Zone
<b>RMA</b>	Resource Management Act 1991
<b>SH 75</b>	State Highway 75
<b>TC</b>	Town Centre Zone
<b>WWTP</b>	Wastewater Treatment Plant

# 1 Introduction

The settlements of the Akaroa Harbour Basin are composed of a number of small pockets of urban settlement focussed around particular bays and valleys. A popular holiday destination, there is currently very little in the way of a strategic framework that identifies how the settlements should be allowed to grow and change (if at all) into the future.

In response to a general lack of understanding of the broad issues facing the harbour basin communities, the Christchurch City Council is currently undertaking a long-term, strategic planning study of these settlements (the 'Akaroa Harbour Basin Settlements Study'), to identify issues and options for settlement planning over the next 25-30 years. This study specifically focuses on the eight settlements within the harbour basin that currently have some urban zoning (refer Figure 1):

- Akaroa
- Takamatua
- Robinsons Bay
- Duvauchelle
- Barrys Bay
- French Farm
- Tikao Bay
- Wainui

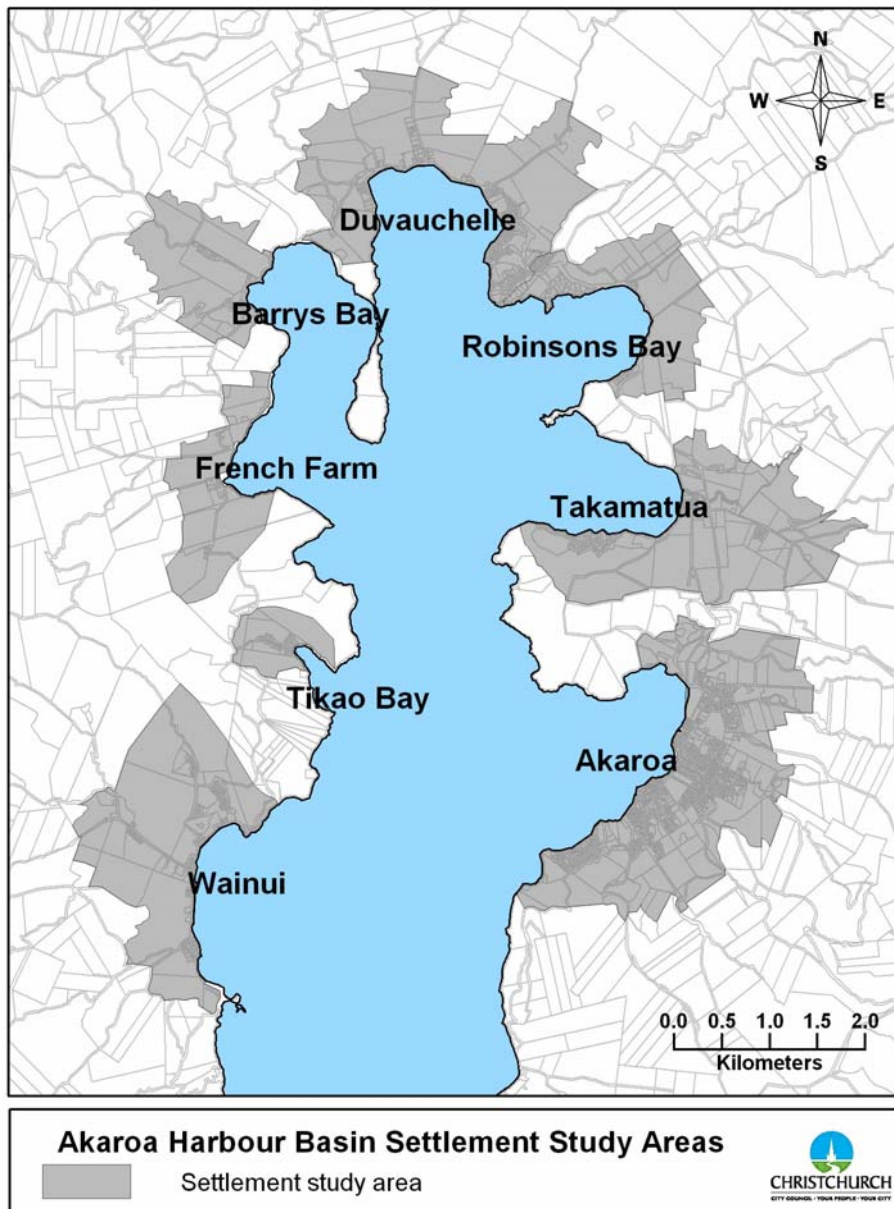


Figure 1: Outline of settlement study areas

The first output of the Settlements Study was a discussion document identifying the key strategic issues for the harbour basin. This was released for public consultation in October 2007. One of the key issues identified in this document is a general lack of direction regarding future urban change and preferred settlement patterns. For example, it was found that:

- there are existing un-developed or under-developed zones for residential activity; these are perhaps not located in an area of actual/potential demand, or capable of servicing with infrastructure;
- the District Plan does not articulate a preferred settlement pattern to manage long-term urban change, relying instead on the existing zone boundaries and provisions; this opens up potentially inappropriate development options; and
- the resident population is stable overall, while dwelling and visitor numbers are increasing. In the absence of an agreed direction for settlement growth, this may lead to pressure to develop housing in inappropriate or sensitive locations in the long-term.

The discussion document also identifies a range of natural, social and physical environment constraints that may impose restrictions on future land development potential. These include:

- natural hazards such as land instability and land prone to flooding and coastal inundation;
- areas with high landscape, recreational and/or ecological value;
- areas with high cultural heritage value, for example Waahi Tapu sites/areas, the Akaroa Historic Area, heritage buildings and archaeological sites; and
- past or current land use activities which may restrict future development, for example: landfills, reserves and infrastructural facilities such as wastewater treatment plants and community water supply protection zones.

This report represents the first step in identifying settlements that have the least/most potential for future consolidation by analysing the natural and physical constraints and opportunities to future urban development within and around the existing settlements of the harbour basin.

## 1.1 Purpose

'Sieve mapping' involves overlaying maps displaying layers of constraint to produce a visual representation of areas with lesser or greater potential to sustain development.

The purpose of this sieve mapping exercise is to get a general picture of the suitability, or otherwise, of different areas around the harbour basin settlements for long-term urban consolidation. This information will be used to identify areas where further investigation may be warranted in the long-term, in conjunction with the local communities' preferences on how settlement change or growth should be managed.

This sieve mapping exercise is purely an information gathering and assessment exercise, and in no way suggests that certain land should or could be approved for development.

## 1.2 Scope

This sieve mapping exercise takes a broad-scale view of land use constraints within the identified Settlement study areas<sup>1</sup> (refer Figure 1). In reality there are very few natural, cultural or physical features in the harbour basin that pose *absolute* constraints to settlement growth. Many areas may be suitable for future development with some form of mitigation. There are, however, many areas where development is generally less desirable due to the presence of significant natural or cultural values. At this level of mapping, it is important to identify those areas that are most suitable in terms of factors such as the efficient provision of Council services and where mitigation requirements would be minimal.

Areas that show a lack of constraint are, in one sense, opportunity areas. However there are also areas that present identifiable opportunity values that make them more desirable for built development

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<sup>1</sup> Some constraints outside of the settlement study areas have also been mapped to provide a wider context.



(eg areas with 'lesser' landscape value or sites that receive all-day sun). These have been mapped and scored in a separate mapping process (see 1.3.3 below).

Constraints and opportunities for existing urban areas have not been excluded from this analysis, as there is, theoretically, potential for these areas to be further developed through infill or other land use change.

### 1.3 Methodology

Traditionally, sieve mapping is undertaken by overlaying transparencies of maps that identify different constraint or opportunity areas. From this, a visual analysis is undertaken to determine areas most suitable for development. In this mapping exercise, a Geographic Information System (GIS) is used to build up computer-generated layers of constraint in a similar manner. GIS also allows us to score different layers to show varying *degrees* of constraint.

The sieve mapping process has been undertaken in two parts:

- (1) identifying, categorising and mapping development constraint layers; and
- (2) scoring and overlaying these layers, according to their level of constraint, to create a final 'sieve map' which identifies areas subject to one or more constraints.

A similar process is followed for identified potential opportunity areas, and a comparison is made between the opportunity and constraints maps (refer to Section 4 of this report for more information on this process).

#### 1.3.1 Identifying and categorising constraint and opportunity layers

The 'Identifying the Issues' discussion document highlighted a number of planning factors that are likely to influence future urban change within the identified settlement study areas. Most of these factors can be expressed in a spatial<sup>2</sup> GIS format. Layers that have been factored into the sieve mapping process are set out in Table 2 on the following page.

#### 1.3.2 Overlaying, scoring and analysing constraint layers

Because some planning factors present a greater limitation to development than others, a scoring system using values ranging from 1 to 5, or 'very low' to 'very high', was applied to each layer of constraint (Table 1).

Level of constraint	Score
Very Low	1
Low	2
Moderate	3
High	4
Very High	5

**Table 1** - Relative constraints and scores

<sup>2</sup> The term 'spatial' is used in a geographical sense in that it refers to the distribution of phenomena (eg landslide hazard or historic objects) over an area or 'space'. Because the location and/or attributes of spatial objects vary over an identified area, they can be mapped and analysed (ie 'spatial analysis'). Conversely, the term 'non-spatial' refers to things that cannot be easily mapped. The availability of water supply sources and the capacity of wastewater treatment plants are examples of non-spatial constraints or opportunities.

**Table 2 - constraints and potential opportunities factored into sieve mapping process**

Planning factor	Constraint	Potential opportunity
Hazards	<ul style="list-style-type: none"> <li>- Areas of immediate, locally significant or significant slope instability</li> <li>- Bedrock landslides and potential liquefaction areas</li> <li>- Storm surge inundation hazard areas</li> <li>- 2m and 4m tsunami hazard areas</li> <li>- Areas where flooding has occurred in the past</li> </ul>	
Watercourse	<ul style="list-style-type: none"> <li>- Watercourses and 10m waterway setbacks</li> </ul>	
Landscape	<ul style="list-style-type: none"> <li>- Coastal Natural Character Landscapes / Outstanding Natural Landscapes</li> <li>- Rural Amenity Landscape (RAL): <ul style="list-style-type: none"> <li>o Areas within 20m (vertical) of a prominent ridgeline</li> <li>o Areas above 160m contour</li> <li>o Areas within 40m of Mean High Water Springs</li> </ul> </li> </ul>	-Areas with lesser landscape value
Ecological	<ul style="list-style-type: none"> <li>- Council / Department of Conservation reserves</li> <li>- Covenanted areas (QEII national trust)</li> <li>- Recommended Areas for Protection (District Plan)</li> <li>- Protected trees (District Plan)</li> </ul>	
Soils	<ul style="list-style-type: none"> <li>- Versatile soils (Land Use Capability classes)</li> </ul>	
Contaminated land	<ul style="list-style-type: none"> <li>- Potentially contaminating activity (past or present)</li> <li>- Closed (and monitored) landfills</li> <li>- Sites where contamination has been recorded</li> </ul>	
Topography	<ul style="list-style-type: none"> <li>- Slopes that receive the least sun (insolation)</li> </ul>	-Slopes that receive the most sun
Built heritage	<ul style="list-style-type: none"> <li>- Category I and II NZ Historic Places Trust (NZ HPT) listed sites</li> <li>- Akaroa Historic Area</li> <li>- Notable sites, objects and buildings (District Plan)</li> </ul>	
Sacred sites	<ul style="list-style-type: none"> <li>- Silent file areas (District Plan)</li> <li>- Takapuneke Waahi Tapu Area (NZ HPT)</li> </ul>	
Archaeological sites	<ul style="list-style-type: none"> <li>- Areas where archaeological sites may be found (District Plan)</li> </ul>	
Roads	<ul style="list-style-type: none"> <li>- State Highway 75 (SH 75)</li> <li>- SH 75 setbacks - Environmental Buffer Area and Road Noise Effects Area</li> <li>- Local roads</li> <li>- Unformed (paper) roads</li> </ul>	
Community water supply	<ul style="list-style-type: none"> <li>- Community water supply protection zones</li> </ul>	-Land within 250m of a water supply main
Wastewater	<ul style="list-style-type: none"> <li>- Setbacks from wastewater treatment plants</li> </ul>	-Land within 250m of a wastewater main
Other infrastructure	<ul style="list-style-type: none"> <li>- Designations (includes cemeteries, substations/telecommunications, police station, schools and waste transfer stations)</li> </ul>	

For each constraint, a score was assigned by analysing:

- a) the degree to which the constraint is legally recognised and enforceable, for example in the Resource Management Act 1991, District Plan, Building Act 2004, or in other relevant legislation or plans;
- b) the degree to which the constraint has been accurately identified, researched and mapped; and
- c) the degree to which the constraint is:
  - (i) likely to require extensive and/or costly mitigation measures; or
  - (ii) is necessary to protect important public infrastructure.

Some constraints incorporate a range of different constraint scores, due to the variation within the constraints layer (eg zones of slope instability hazard range from 'very low' constraint through to 'high' constraint).

It is also of note that constraints vary in terms of their spatial scale. Some features are site specific (eg a heritage building), whereas other features are expansive in scale (eg a landscape protection area).

Large-scale constraints are useful in delineating broad areas where development is generally restricted. Constraints at the more detailed scale, on the other hand, are most useful when examining specific areas that might otherwise appear constraint-free.

An 'on-balance' approach has been used to assign final scores to the constraints layers. For example, although a layer might initially be considered a 'high' level of constraint due to the degree to which it is protected in the District Plan, if the constraint is poorly researched, mapped, or there is uncertainty about its location and/or distribution, then a lower (eg 'low'–'moderate') level of constraint is warranted. The overall score reflects a number of factors, and is based on the current information available. Scores are also relative, so it is possible to compare between different constraint layers.

***For more information on how scores were assigned, a matrix assessment of each constraint, against the four criteria discussed above (legal recognition and enforceability, accuracy and data quality, degree of mitigation required and the need to protect public infrastructure) is provided in Appendix B of this report.***

### 1.3.3 Analysing areas of potential opportunity

In addition to identifying areas that pose the least constraint, an additional analysis has been carried out for areas with identified potential opportunity values. Refer to Table 2 for the list of potential opportunity layers used in this analysis.

The final maps produced in this sieve mapping exercise show areas of least constraint, overlapping areas of potential opportunity (refer Section 4 of this report).

### 1.3.4 Technical information

The GIS software used in this analysis is GeoMedia Standard and GeoMedia Grid, produced by the InterGraph Corporation. The workflow of the GIS analysis using GeoMedia is outlined in Appendix A.

In undertaking the sieve mapping analysis, all layers have been converted into a grid with a 2 metre cell resolution. This cell resolution provides a reasonably high level of detail without overwhelming the processing capabilities of the GIS software.

### 1.3.5 Limitations

The information contained in this report and on the accompanying maps has been prepared to aid in the strategic planning for the existing harbour basin settlements. ***The location of the features and boundaries on these maps are approximate only, and may be subject to change based on new or updated information.***

Specific limitations to the accuracy of this report and maps include:

- *Poor quality, old, or incomplete data* – Some of the data presently available has errors, or has not been updated at a scale suitable for detailed mapping. Efforts to improve the quality of GIS information on Banks Peninsula are ongoing. Where relevant, data issues and errors have been noted within this report.
- *Generalisations made in assigning scores to constraints* – It is inherently difficult to compare different types of constraint by using a scoring system, particularly where uncertainty or a lack of knowledge exists about the location or extent of some constraints.
- *Final constraints and opportunities map* – The final maps combine all the constraints and opportunities into single map layers. During this process, a significant amount of detail about individual constraint and opportunity layers is lost. It is strongly recommended that the reader refers to the constraint and opportunity 'base' maps regarding specific areas of interest in order to identify the layers that contributed to the final constraint scores (refer Appendices C to H).

***Due to the broad scale of this project and limitations on information available in the area, the maps in this report should not be relied upon as indicating land suitable for development.***

This study is only the first step (ie a preliminary assessment) in a series of strategic planning projects that would be necessary before any rural land would be considered appropriate for long-term settlement growth.

Should any areas show more potential for future growth and development, a form of an 'Area Plan' process may be recommended. Area Plans are prepared in conjunction with community input, and require more detailed information on the location and extent of land use constraints and opportunities to be collected, mapped and analysed. Area Plans may encompass large areas of land (eg Belfast Area Plan) or smaller areas (eg Bridle Path Road Area Plan). Equally, they may focus on greenfield areas or address long-term land use issues for an existing urbanised area.

## 2 Development Constraints

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This section of the report looks at the various constraint layers used in the sieve mapping analysis. These have been grouped under headings which reflect similar or related categories of constraint. A description of each constraint layer is provided, followed by a brief outline of how the constraint has been scored.

**For a more thorough assessment of how the constraints have been scored, please refer to Appendix B.**

### 2.1 Natural hazard constraints

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Prior to the initiation of the Settlements Study, there was very little recorded information available on hazards in the Akaroa Harbour Basin. As part of the information gathering process, three studies were commissioned to determine the spatial variability of hazard risk for the three types of natural hazards that are most likely to impact on future urban form:

- landslide susceptibility (including the potential for liquefaction);
- historical flood events; and
- coastal erosion and inundation.

*Maps showing land instability, historic flooding and coastal inundation areas are attached in Appendix C.*

#### 2.1.1 Land instability

Development on land subject in slope instability and erosion is a major issue in the harbour basin. While it is possible to develop most unstable slopes with some form of mitigation, the cost-effectiveness of the necessary investigation and construction of mitigation measures generally increases with instability risk. This cost is borne not only by the private developer, but also in any development and maintenance of servicing infrastructure.

In 2007/2008, Tonkin and Taylor undertook a slope hazard susceptibility assessment for the harbour basin settlements. Four degrees of slope hazard zoning were identified:

Slope hazard zone	General description
<i>Minor-negligible</i> (24% of study area)	Valley floors and some gentle ridge crests
<i>Intermediate</i> (42% of total study area)	Gentle slopes, or valley floors where debris run-out is likely
<i>Locally significant</i> (32% of total study area)	Areas characterised by active gullies (maximum depth of movement about 3m)
<i>Significant</i> (2% of total study area)	Generally existing large bedrock/loess landslides.

Deep-seated, ancient bedrock landslides were identified in addition to the hazard zones above. Although the impact of bedrock landslides on slope instability is unclear, they are thought to add a layer of complexity to the slope and the potential for slope movements. These are not factored into the hazard zoning, but require specific consideration for any future development and can overlay any of the hazard zones identified above.

Tonkin and Taylor also identified areas where liquefaction is 'possible', based on their expert knowledge and judgement. These areas are generally located on valley floors, adjacent to the coast where mudflat-type sediments are likely to occur and/or in areas of landfill or reclamation.

Constraint scores of 'very low' to 'moderate' have been assigned to hazard zones 'intermediate' through to 'significant'. Constraint scores are also assigned to bedrock landslide and liquefaction layers. Although the hazard zone scores are relatively low on their own, the additional scores assigned to bedrock landslides mean that in some areas, the overall level of constraint can increase to 'high' where a significant hazard zone overlays a bedrock landslide.

Slope hazard zone constraint	Level of constraint	Score
Intermediate	Very low	1
Locally significant	Low	2
Significant	Moderate	3

Instability 'overlay' constraint	Level of constraint	Score
Bedrock landslide	Very low	1
Possible liquefaction	Very low	1

### 2.1.2 Historic flooding

Buildings which experience flooding lose value, and there are health and safety concerns with the possibility of loss of life and dwellings being contaminated by flood waters. Therefore, areas identified as having been flooded in the past should generally be avoided in terms of any future urban development, unless subsequently comprehensively mitigated. There is currently no accessible information regarding any engineering works that may reduce the risk of repeat flooding events in the harbour basin.

A research report on historical flooding (with maps), utilising residents' memories and Akaroa Mail news articles, was prepared by Peninsula Projects. Where there was sufficient information to attempt to define historical areas of inundation, these were mapped.

An overall level of constraint of **very low** has been assigned to areas identified and mapped as having been flooded in the past. This low score recognises that the historical flooding areas are primarily based on subjective information and that the problem that led to the flooding in the first place may have been subsequently mitigated (eg stormwater drainage improvements).

Hazard constraint	Level of constraint	Score
Area identified as having flooded in the past	Very low	1

### 2.1.3 Coastal hazards

The coastal environment is dynamic and hazards can arise when coastal processes interact with human activities, property or infrastructure. Two key effects occur, by way of: (a) erosion processes; and (b) inundation by sea level rise, storm surge and tsunami.

A study of coastal erosion and inundation hazards for the settlement study areas was completed by DTec Ltd in May 2008. This report mapped four different types of coastal hazard that could affect the settlements in the future:

Map layer	Methodology/Comments
50-year coastal erosion (taking into account sea-level rise)	<ul style="list-style-type: none"> <li>Extent of erosion estimated using the 'Bruun Rule'. Likely to 'over-estimate' the extent of erosion, as this does not take into account the presence of coastal protection works.</li> <li>The assessment is based solely on predicted sea-level rise (due to climate change) only, as the study found there was no evidence of long-term coastal shoreline retreat.</li> </ul>
Storm surge inundation (taking into account sea-level rise)	<ul style="list-style-type: none"> <li>Estimated through the combination of extreme water levels from tides, sea-level rise, storm surge and the wave run-up (which varies depending on the nature of the shoreline).</li> <li>Inundation was assumed to occur where the predicted extreme water levels would exceed the elevation of the coastal protection works or beach/hinterland boundary.</li> </ul>
2m tsunami hazard	<ul style="list-style-type: none"> <li>Based on predictions of a 100-year tsunami event of 2-4 metres.</li> </ul>
4m tsunami hazard	<ul style="list-style-type: none"> <li>Estimated using 'Bath-type' approach (areas generally below the 2m and 4m contour.)</li> </ul>

Of these layers, only the 50-year coastal erosion layer has not been mapped as a layer of constraint. This is because (in general) only coastal roads and coastal road reserves will be affected by the 50-

year erosion estimates. Hence, there is very little direct impact on privately owned coastal land (as opposed to the potential impacts of storm surge inundation or tsunami). The implications of predicted coastal erosion for each settlement are discussed in more detail in Section 5 of this report.

The three other layers associated with coastal hazard have each been given a **very low** level of constraint.

Hazard constraint	Level of constraint	Score
2m tsunami	Very low	1
4m tsunami	Very low	1
Storm surge inundation	Very low	1

Where the two or three coastal hazard layers overlap, the overall coastal hazard score increases to 'low' or 'moderate' respectively, indicating a general higher level of hazard risk.

## 2.2 Natural environment constraints

Features such as waterways, reserves and prominent landscapes warrant some degree of acknowledgement and protection from land use change in order to preserve or enhance the natural values of the inner harbour basin area.

**For a more thorough assessment of how the constraints have been scored, please refer to Appendix B.**

*Maps displaying the natural environment constraints in the harbour basin, as described below, are attached in Appendix D.*

### 2.2.1 Waterways

In order to protect the function of a stream or river, a suitable buffer (eg a riparian strip) adjacent to waterways is usually required. For new subdivisions under the District Plan, an Esplanade Reserve or Esplanade Strip of 20 metres width adjacent to a waterway *may* be required as a condition on a subdivision consent if one or more of the criteria set out in the Plan are met. This includes, for example, where an esplanade reserve or strip would enhance an existing reserve, provide appropriate access to a significant environmental feature, or would otherwise enhance water quality or aquatic habitat value.

Whilst the constraint posed by waterways is high, the accuracy of existing maps showing the location of waterways is only fair at best; therefore, a **moderate** level of constraint is assigned to these features, with a 10m setback subsequently having a **low** score.

Natural environment constraint	Level of constraint	Score
Waterway	Moderate	3
Waterway 10m setback	Low	2

### 2.2.2 Protected trees

The Akaroa Harbour Basin contains a number of individual trees or stands of trees that contribute to the amenity and character of the area. These trees have been identified in a Schedule to the District Plan as 'notable trees' due to their botanical, functional, historic and/or cultural value, and are protected from damage, removal and inappropriate modification. Most of these trees are located within Akaroa settlement and contribute to the heritage landscape of this township. Isolated notable trees or tree stands are also recorded within the Takamatua and Wainui study areas.

The District Plan applies discretionary restrictions to activities that occur within a notable tree's drip-line<sup>3</sup>. Activities that occur in the vicinity of a particularly notable tree may affect root systems and/or the amenity value of that tree.

Using an estimate of a 4m diameter drip-line, a buffer has been used to identify areas where land use activities would be affected by the presence of the tree. Due to the certainty of their location and the restrictions imposed by the District Plan, notable trees and their 4m buffer areas have been assigned a **moderate** level of constraint.

Natural environment constraint	Level of constraint	Score
Protected tree + 4m buffer (drip-line)	Moderate	3

<sup>3</sup> *Drip-line*: The area between the trunk and the outermost branch tips of a tree.



### 2.2.3 Landscape character

In 2007, Boffa Miskell identified 'Coastal Natural Character Landscapes' (CNCLs) and 'Outstanding Natural Landscapes' (ONLs) as part of a landscape character study to identify significant landscapes in the Banks Peninsula area. The Boffa Miskell report also recommended subdivision restrictions for land above the 160m contour and near prominent ridgelines within the Rural Amenity Landscape (RAL)<sup>4</sup>. These recommendations were substantially adopted by the Environment Court in May 2008 in its consideration of an appeal to the Proposed District Plan regarding significant landscape value areas in rural zones.

Within CNCLs and ONLs, built development outside an existing building cluster is a non-complying activity, hence these have been assigned a **high** level of constraint.

Within the RAL, built development is generally permitted, subject to performance standards, where:

- a) there is only one residential dwelling per 40 ha site below the 160m contour (subdivision below 10 ha is a non-complying activity);
- b) there is only one residential dwelling per 100 ha site above the 160m contour;
- c) buildings are set-back 40m from the coast/MHWS (otherwise a restricted discretionary activity); and
- d) buildings are not located within 20m of a prominent ridgeline, if beyond 100m from an existing building cluster (otherwise a restricted discretionary activity).

The 40m setback from the MHWS and areas within 20m vertical from a prominent ridgeline have been assigned a **low** level of constraint, as a reflection of the activity status within these areas (compared to ONLs or CNCLs). Areas above the 160m contour have also been assigned a low level of constraint, recognising the general preference for lower building densities above this elevation.

At the time this sieve mapping exercise was being undertaken, the period for further appeals to the Environment Court decision had not closed, nor had the final landscape provisions and maps been integrated into the District Plan. Once the provisions and maps have been incorporated into the Plan, the scores and maps relating to CNCLs, ONLs and the RAL will be reviewed and adjusted, if necessary.

Natural environment constraint	Level of constraint	Score
CNCL or ONL	High	4
RAL: above 160m contour	Low	2
RAL: within 20m below prominent ridgeline	Low	2
RAL: within 40m of MHWS	Low	2

### 2.2.4 Reserves

Public reserves owned by the Department of Conservation (DoC) or the Council have intrinsic, amenity, recreation and/or conservation values that are usually protected by both District Plan zoning and under the Reserves Act 1977. It is very unlikely (but not entirely impossible) that areas set aside as a reserve would be made available for residential development. All reserves are therefore assigned a **high** level of constraint.

Natural environment constraint	Level of constraint	Score
Reserve	High	4

### 2.2.5 Recommended Areas of Protection

In 1992, a Protected Natural Areas Programme Survey of Banks Peninsula was undertaken by Hugh Wilson on behalf of the Department of Conservation. This survey identified 'Recommended Areas for Protection' (RAPs), two of which are located within or across the boundaries of the settlement study areas.

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<sup>4</sup> The Rural Amenity Landscape applies to the balance of the Rural Zone which are not included within the Outstanding Natural Landscapes or the Coastal Natural Character Landscapes.

Initially incorporated into District Plan rules, references to RAPs in the Rural Zone rules have largely been removed through appeal to the Environment Court. RAP areas are now only retained in the Plan as an assessment matter. From a strategic planning perspective, RAPs are still relevant as these are the only areas where significant indigenous vegetation has been identified, albeit they carry a **very low** level of constraint from a District Plan perspective. Further work by the City Plan team may, in the future, identify new or amended areas of significant indigenous vegetation which may be a more suitable feature to map in any later, more detailed sieve mapping process.

Natural environment constraint	Level of constraint	Score
Recommended Area for Protection	Very low	1

**2.2.6 Covenanted areas**

In the harbour basin, landowners have pursued the protection of natural features on private land through covenants with the Banks Peninsula Conservation Trust (BPCT) and the QEII National Trust. Whilst the details of covenants held with the BPCT are unavailable to the Council, a number of QEII covenants have been identified within the boundaries of the settlement study areas.

A QEII covenant is a legally binding protection agreement, which is registered on the title of the land and binds all subsequent landowners to the conditions of that covenant. As such QEII covenants are assigned a **high** level of constraint to future development.

Natural environment constraint	Level of constraint	Score
QEII covenant	High	4

**2.2.7 Land Use Capability**

Land Use Capability (LUC) maps<sup>5</sup> provide information on the land’s capacity for sustained productive use, taking into account physical limitations, soil conservation needs and management requirements. Where possible, it is preferable that areas with higher versatility are reserved for rural land uses such as pasture, cropping or forestry, hence these areas have been assigned as a constraint to future residential development.

LUC classes can be used to identify areas in the harbour basin that would be more versatile for horticultural or agricultural uses than other areas. There are no Class I or II (high versatility) soils in the settlement study areas. There are, however, pockets of Class III<sup>6</sup> soils in French Farm, Duvauchelle (Pawsons Valley), Robnsons Bay and Takamatua.

At the moment, there are no legislative requirements that restrict non-rural activities on the Class III soils of the harbour basin. However, the general irreversibility of development on the most versatile soils in the harbour basin could limit options for the future productivity and sustainability of the area. Hence a **very low** level of constraint is assigned to areas classified LUC Class III.

Natural environment constraint	Level of constraint	Score
LUC class III (3w1)	Very low	1

**2.2.8 Areas that receive the least sun**

In order to promote sustainable and efficient development, new building or subdivisions should ideally be located and/or orientated in order to take into account principles of energy conservation. Energy efficiency and the use of renewable energy (eg passive solar heating) also have a direct impact on health and social well-being and amenity values, and indirectly lessen the impact of climate change.

<sup>5</sup> LUC maps and descriptions have been prepared by Landcare Research New Zealand Ltd from data in the NZ Land Resources Inventory (NZLRI), a national spatial database of rock type, soil units, slope groups, erosion type/degree and vegetation cover.

<sup>6</sup> The full description of this class is ‘3w1’: “land with moderate limitations for arable use, but suitable for cultivated crops, pasture or forestry.” The subclass ‘w’ indicates that these soils are susceptible to wetness.

At a strategic level, this can be best achieved by avoiding large-scale type developments in areas that are more unlikely to get much sun, particularly during the shorter days of the year.

Using GIS, it was possible to estimate (based on a surface elevation model<sup>7</sup>) the amount of solar radiation received throughout the day, with a clear sky, on any particular site in the harbour basin. Using this tool, also known as ‘insolation’, solar radiation received at hourly intervals between 10 am and 4 pm on the shortest day of the year (22 June) was calculated. The total sun exposure, or ‘insolation’ was then calculated by adding up the hourly insolation values.

Two layers were digitised based on the areas of (a) lowest and (b) highest overall insolation. These layers have been labelled ‘shady slopes’ and ‘sunny slopes’ respectively. The layer ‘shady slopes’ has been assigned a **very low** level of constraint, in recognition of the limitations of the elevation and insolation modelling. The layer ‘sunny slopes’ has been used as an opportunity layer, and is discussed in more detail later in this report.

Natural environment constraint	Level of constraint	Score
Areas that receive the least sun	Very low	1

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<sup>7</sup> A ‘digital surface model’ (DSM), which provides ‘spot’ elevations across the study area, was interpolated from the available contour data using the ‘Spline’ tool<sup>7</sup>. This approach carries a couple of limitations: (A) Most of Wainui, Duvauchelle, Takamatua and Akaroa settlements are covered by 2m contour data. All other areas have 20m contour data. Hence, the potential for errors is greater and the ability to accurately define ‘shady’ or ‘sunny’ slopes is significantly limited in areas covered by the 20m contour. This is because the method of interpolation used ‘Spline’ is less effective in areas where contour data is sparse (eg 20m contour areas or flat areas where contours are wide spaced), leading to a ‘terraced’ effect along contour lines. (B) In addition, the DSM was created for the settlement study areas plus a 20m buffer only, due to limitations on the processing capability of the GIS software when carrying out the spline. Hence, the effect of shading caused by hilltops and the crater rims above the study areas on insolation has not been taken into account. *For more information on how the DSM or insolation layers were created, please refer to Appendix A.*

## 2.3 Cultural and historic heritage constraints

The District Plan has identified a number of sites and areas within the settlements as having significant cultural or historic value. These values can be compromised if subject to development pressures, particularly if these features are not appropriately acknowledged when planning for the future.

**For a more thorough assessment of how the cultural and historic heritage constraints have been scored, please refer to Appendix B.**

*Maps displaying the cultural and historic heritage constraints described below are located in Appendix E.*

### 2.3.1 Sacred site areas (silent files)

'Silent file' areas indicate the general location of particular sites or features of significance to the local Runanga. The extent of the silent file delineation is necessary so that the precise location of certain Waahi Tapu<sup>8</sup> are not revealed. Under the District Plan, a resource consent is required to undertake activities in these areas in order to avoid compromising the cultural significance of the land and to ensure that appropriate consultation with tangata whenua occurs. Land development is not necessarily precluded from these areas, simply, the proposed siting of activities needs to be undertaken in consultation with Runanga.

Although consent is required for most development activities in silent file areas, the silent file areas cover large tracts of land and the exact location and nature of the feature(s) that the silent files seek to protect are unknown. The constraint imposed by silent files is therefore regarded as **low**.

Cultural/historic constraint	Level of constraint	Score
Sacred site (silent file) area	Low	2

### 2.3.2 Waahi Tapu registered area: Takapuneke

Takapuneke is a site of considerable local and national historical, archaeological, and cultural value located within the settlement study area<sup>9</sup>. The site is registered under the Historic Places Act 1993 as a 'Waahi Tapu' or 'a place sacred to Maori in the traditional, religious, ritual or mythological sense'. Although extremely significant to local Maori, the Waahi Tapu registration does not provide automatic legal protection over the area. The Waahi Tapu registration has been one factor, however, that has prompted the City Council to gazette the Takapuneke site as a historic reserve. A **moderate** level of constraint is therefore assigned to this area in terms of its significance to Tangata Whenua.

Cultural/historic constraint	Level of constraint	Score
NZHPT Waahi Tapu site/area	Moderate	3

*It is of note that in addition to the Waahi Tapu listing, Takapuneke is also identified as a reserve or park, placing an additional layer of constraint over this site (refer to Section 2.2.4 of this report).*

### 2.3.3 Archaeological sites

Ten archaeological sites have been identified within or near the settlement study areas. The District Plan requires that resource consent is obtained if an archaeological site or object is modified in any way, or if a new building is constructed on a site containing an archaeological feature. The Historic Places Act 1993 also makes it unlawful for any person to destroy, damage or modify the whole or part of an archaeological site without the prior authority of the New Zealand Historic Places Trust (NZHPT).

<sup>8</sup> Waahi Tapu: a place or area identified by Tangata Whenua as culturally or spiritually important.

<sup>9</sup> Although it is the only site within the settlement study areas, Takapuneke is not the only Waahi Tapu area or site within the harbour basin that is registered with the Historic Places Trust. Onawe Peninsula/Pa is also registered as a Waahi Tapu site.

The District Plan states that archaeological sites may be located within a 100m radius of their point location as marked on planning maps. This radius has been chosen because: (a) the exact locations of the sites are not known by the Council; and (b) there may be other sites within the vicinity of the marked site. For long-term planning purposes, the best indication of the extent and influence of archaeological features is a 100m buffer around the archaeological sites identified in the District Plan. Within this area, a **moderate** level of constraint to development exists, given the high level of uncertainty regarding the exact location of these features within the buffer area.

Cultural/historic constraint	Level of constraint	Score
Archaeological site and 100m buffer	Moderate	3

### 2.3.4 Heritage objects, buildings and sites

Heritage buildings, sites and objects can act as a constraint to the intensification of urban development. Almost all the heritage sites and buildings recognised in the District Plan and within the study area are located in Akaroa. In this settlement, the retention of heritage character will affect the long-term capacity and density of the town as a whole.

The District Plan currently recognises three levels of protection for heritage buildings and sites (in order from the highest to lowest level of protection):

- *NZ Historic Places Trust Category I building, object or site*: Places of special or outstanding historical or cultural heritage significance or value.
- *NZ Historic Places Trust Category II building, object or site (or historical area)*: Places of historical or cultural heritage significance or value.
- *Notable buildings, objects and sites*: These features are considered worthy of preservation but have not been registered by the NZHPT.

The constraint to development posed by historic buildings, sites and objects varies depending on the degree to which the historic feature is protected under the District Plan. Category I buildings pose a **high** level of constraint, whereas Category II and notable buildings pose **moderate** and **low** levels of constraints respectively.

Cultural/historic constraint	Level of constraint	Score
NZHPT Category 1 building, site or object	High	4
NZHPT Category 2 building, site or object	Moderate	3
Notable building, site or object (District Plan)	Low	2

### 2.3.5 The Akaroa Historic Area

The Akaroa Historic Area (AHA) is an area in Akaroa that has been identified as having significant historic character that is worthy of protection and was registered by the NZHPT in 1999 as a Historic Area. Currently there are only two rules in the District Plan that are directly applicable to the Historic Area: one limiting the length of buildings facing a street and one generally seeking that garages not face the street.

The Council is currently reviewing the District Plan provisions in relation to the AHA. This review work may result in changes to the boundaries of the Historic Area and/or changes to the rules that apply to new buildings, alterations to existing buildings and demolition; both within and surrounding the Historic Area. Until the Council completes this review, the AHA is regarded as posing a **very low** level of constraint to new development within Akaroa. However it is noted that the Historic Area contains a number of heritage listed buildings, which pose an additional layer of constraint in these areas (refer Section 2.3.4 above).

Cultural/historic constraint	Level of constraint	Score
Akaroa Historic Area	Very low <sup>10</sup>	1

<sup>10</sup> Important note: where the AHA overlaps TC or RC zoning an overall constraint score of 'low' is applied. This is because the restrictions in the heritage provision of the TC and RC zones generally include discretion over such matters as the AHA provisions seek to protect.

### 2.3.6 Akaroa heritage zoning provisions

Both the Residential Conservation (RC) and Town Centre (TC) zones in Akaroa are subject to rules in the District Plan that seek to conserve the existing historic pattern of subdivision, streetscape and building form. Activities that involve altering, demolishing or adding to existing buildings, or creating new buildings are restricted discretionary, with the Council restricting discretion on design matters such as the form, design, cladding and siting of new buildings. The District Plan also contains design guidelines<sup>11</sup>, outlining the issues the Council would take into account when assessing a resource consent application for design and appearance reasons.

Although the heritage provisions of the TC and RC zones do not necessarily restrict future development activities, they will limit options for the intensification of residential or commercial activity. The overall constraint assigned to the TC and RC zones is **low**, in light of the restrictions on the design and appearance (and hence the ability to design higher density development) in the District Plan.

Cultural/historic constraint	Level of constraint	Score
Town Centre or Residential Conservation zone	Low	2

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<sup>11</sup> Appendix XI of the District Plan

## 2.4 Physical infrastructure constraints

Physical infrastructure can pose a variety of constraints to further development both in terms of location and capacity. The spatial nature of this sieve mapping exercise means that the location of infrastructure can not only be mapped to show areas of constraint (eg land immediately adjacent to the State Highway) but areas of opportunity as well (eg the location of existing water supply lines). The opportunity component of existing and proposed infrastructure will be discussed later in this report (refer Section 3 of this report).

Please note that the constraints identified and mapped below in relation to water supply and wastewater represent Council-owned and/or Council-operated systems only.

**For a thorough assessment of the rationale behind the physical infrastructure constraint scores, please refer to Appendix B.**

*Maps displaying the physical infrastructure constraints are attached in Appendix F.*

### 2.4.1 Roading

It is critical to integrate the transport network with adjacent land use activities. Sensitive land use activities such as residential housing adjoining major roads may suffer from the effect of noise, vibration and pollution generated by activity on the road. Any new development should be set back from the road for this reason.

#### *State Highway 75 reverse sensitivity*

State Highway 75 (SH 75), from Hilltop to Akaroa, is managed by Transit New Zealand as a strategic road route. Transit recommends the following setbacks between the State Highway road edge and habitable buildings, in order to avoid reverse sensitivity effects on new development:

Distance from road edge <sup>12</sup>	Zone name	Potential effects on housing development
0 – 20 metres	<i>Environmental Buffer Area</i>	High potential for adverse effects on new development; noise-sensitive activities discouraged.
20 – 80 metres	<i>Road Noise Effects Area</i>	Potential for reverse sensitivity effects. Noise assessment recommended. Mitigation may be required in order for new development to meet internal noise standards.

Using Transit's recommendations, land identified within the 'Environmental Buffer Area' (within 20m of the State Highway) would pose a **moderate** level of constraint to residential development. There are also rules in the Rural Zone of the Proposed District Plan that generally require buildings to be set-back 20m from a State Highway.

Transit guidelines recommend that the establishment of new noise-sensitive activities (eg housing) within the 'Road Noise Effects Area' should require a noise assessment and, where deemed necessary, the mitigation of noise caused by the State Highway. The level of constraint assigned to this zone is **very low**, as this guideline has not (as yet) been translated into the District Plan or any other statutory planning process.

The State Highway itself has been give a **very high** constraint value, recognising its strategic transportation role.

#### *Local Roads*

Local roads provide a higher level of access and less through-movement than the State Highway and have been assigned a **very high** level of constraint. Other than requiring setbacks between retail sales activities and rural roads, the District Plan does not specify or recommend setbacks from local roads.

<sup>12</sup> The location of the State Highway road edge was estimated by creating a 4m buffer along the Highway's centreline.

### Unformed paper roads

Some unformed 'paper' roads, particularly those that are currently double-fenced, provide opportunities for public access into the hinterland surrounding the (settlement) study areas. There are also many paper roads that are not clearly delineated and may provide for convenient public access in the future (for example through road formation or an alternative recreational use).

GIS data showing the location and extent of paper roads is currently not available, so using the editing functions available with GeoMedia Grid, a 'proxy' layer of paper roads has been created by selecting areas mapped as a road reserve, but where no formed road currently exists. Because of difficulties in accurately delineating the present location of the coast, coastal paper roads were not mapped as part of this process. A **moderate** level of constraint has been assigned to paper roads.

Physical infrastructure constraint	Level of constraint	Score
SH 75 (extent of road)	Very high	5
SH 75 Environmental Buffer Area ((0-20m from road edge)	Moderate	3
SH 75 Road Noise Effects Area (20-80m from road edge)	Very low	1
Local roads	Very high	5
Paper roads	Moderate	3

### 2.4.2 Community water supply sources

There are three Council-managed community water supply intakes (all wells) *within* the settlement study areas:

- 1) Wainui: a community water supply well (92m deep) at the site of the YMCA.
- 2) Akaroa, Settlers Hill: a community water supply well (42.1m deep) at Settlers Hill.
- 3) Akaroa, Aylmers Valley: a new community water supply well (138 m deep).

The Water Quality Chapter of Environment Canterbury's Natural Resource Regional Plan (NRRP) identifies Community Drinking Water Supply Protection Zones, within which contamination resulting from sewage, stormwater and other types of hazardous discharges are to be avoided. The extent of the protection zone varies depending on the depth of the well. For a community water supply well greater than 70m deep (Wainui and Aylmers Valley), the extent of the water supply protection zone is estimated by defining a circle with a radius of 100m from the centre of the well. For a well between 30m and 70m deep (Settlers Hill), a formula is used to create a protection zone that varies from 500m upwards from the direction of groundwater flow to 200m below.

While the bore in Wainui is relied upon for water supply in this community, the two bores in Akaroa are only used to supplement stream sources during summer months, with the long-term sustainable yield of this resource being uncertain and unreliable. Groundwater is not viewed in Akaroa as a viable long-term water source and other, more reliable water sources are currently being investigated. On balance therefore, community water supply protection zones have been assigned a **very low** level of constraint.

Physical infrastructure constraint	Level of constraint	Score
Community water supply well protection zone	Very low	1

### 2.4.3 Wastewater

Wastewater treatment plants (WWTPs) for reticulated wastewater schemes are located in Wainui, Tikao Bay, Duvauchelle and Akaroa. A new WWTP and reticulation system is currently proposed for Wainui, which would link up all properties within Small Settlements and Residential zones, many of which currently have on-site treatment and disposal systems.

Under the District Plan, the building of a WWTP within 300 metres of Small Settlements or Residential zoning is a discretionary activity. Although a resource consent is not required to build a dwelling within this buffer zone, it is possible that the presence of the existing WWTP could cause a reverse sensitivity issue. Land within a 300m distance of existing (or proposed) WWTP has therefore been assigned a **very low** level of constraint to further development.



Physical infrastructure constraint	Level of constraint	Score
Land within 300m of existing WWTP	Very low	1

#### 2.4.4 Other infrastructure (designated activities)

A designation is a form of land use control which is available to a requiring authority. The effect of designating land is to give notice of the designated purpose and generally limit the use of land to that purpose. Within the settlement study areas, land has been designated for the following purposes: electricity substation, police station and residence, telecommunications, secondary school, cemetery, and waste transfer station.

Almost all designated sites within the study areas are owned by the requiring authority for whom the land was designated. Hence although designations lapse after five years of inclusion in the District Plan, the land use activity to which the designation relates is likely to continue. Designated sites therefore pose a **high** level of constraint to further development.

Physical infrastructure constraint	Level of constraint	Score
Designation	High	4

## 2.5 Other land use constraints

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### 2.5.1 Identified contaminated sites

Identifying and investigating sites that have been contaminated by hazardous substances in the past is vital if sensitive land uses are allowed to expand into areas that have previously been developed for industrial, agricultural or horticultural purposes. Without some sort of remediation, contaminated sites are generally unsuitable for residential or other activities.

The former Barrys Bay Gun Club site on Moores Road is the only site (other than the landfills – see below) where contamination has been investigated and verified. Overshot from the Gun Club site has resulted in lead contamination of rural land near the ridgeline north of the French Farm study area. Without remediation, this land potentially poses a **moderate** level of constraint to residential activities.

### 2.5.2 Closed and monitored landfills

Sites that were previously used as landfills are generally not suitable for residential development due to land instability and contamination.

Only the former Akaroa landfill on Onuku Road<sup>13</sup> has been identified in Council mapping systems within the settlement study areas, and is deemed to pose a **very high** level of constraint to development due to the potential for contamination and land subsidence.

Other landfills are known to have existed in Akaroa and Wainui, however the extent and location of these sites has not been delineated in a GIS format. The approximate locations of these sites have been mapped as a 'land use activity (past and present) that may limit future development options' (see below).

### 2.5.3 Land uses (past and present) that may limit future development options

A number of sites around the harbour basin settlements have been identified as once being the location of an activity or industry (eg petrol pumps / petrol station) that has had the potential to cause contamination. As far as known, none of these sites has been investigated, and their inclusion in this report should not be taken to imply that any contamination exists. Because further information is required to clearly identify the location of these sites and whether any contamination exists, the level of constraint posed by these areas is **very low**.

Land use constraint	Level of constraint	Score
Sites with recorded contamination (Barrys Bay Gun Club)	Moderate	3
Monitored (former) landfill	Very high	5
Land use activity (past or present) that may limit future development options	Very low	1

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<sup>13</sup> The former Barrys Bay landfill is also identified and monitored by the Council, however this lies just outside the settlement study area for Duvauchelle.

## 2.6 Summary of constraints

Each constraint, and their relative rankings and scores, is displayed below.

	Constraint ranking				
	Very low (1)	Low (2)	Moderate (3)	High (4)	Very High (5)
Natural hazard constraints	Intermediate slope hazard	Locally significant slope hazard	Significant slope hazard		
	Bedrock landslide				
	Possible liquefaction area				
	Area identified as flooded in the past				
	2m tsunami hazard				
	4m tsunami hazard				
	Storm surge inundation area				
Natural environment constraints		10m waterway setback	Waterway		
			Protected tree		
				CNCL / ONL	
		RAL: areas above 160m contour			
		RAL: within 20m below prominent ridgeline			
		RAL: within 40m of MHWS			
				Reserve	
		RAP			
				QEII covenant	
		LUC class III soil			
	Areas that receive the least sun (insolation)				
Cultural/historic heritage constraint		Sacred site (silent file)			
			Waahi Tapu area (Takapuneke)		
			Archaeological site (including 100m buffer)		
		Notable building, object or site	HPT Cat. II site	HPT Cat. I site	
	Akaroa Historic Area				
	TC or RC zone				
Physical environment constraint	20-80m buffer of SH 75 (Noise Effects Area)		20m buffer of SH 75 (Environmental Buffer Area)		State Highway 75
			Unformed 'paper' roads		Other formed roads
	Community Drinking Water Supply Zones				
	WWTP 300m buffer				
				Designation	
Other	Land use activity (past or present) that may limit future development options		Recorded contamination – Barrys Bay Gun Club		Closed and monitored landfill

## 3 Potential opportunity areas

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This section of the report looks at areas that possess favourable natural or physical qualities for built development.

The potential opportunity areas listed below do not take into account any underlying constraints, and should not be interpreted as areas where settlement growth should occur as of right. A map showing the opportunity areas described below is located in Appendix H of this report.

### 3.1 Areas with lesser landscape value

A report produced last year by Boffa Miskell identifies areas that have lesser landscape value and hence more potential than other areas to absorb land use intensification and built development. Boffa Miskell notes that these areas are indicative only, and further investigation is necessary to determine the boundaries for any area of change.

### 3.2 Water supply and wastewater reticulation

Any new development will require a water supply and wastewater disposal systems. Areas that already have reticulated water supply and/or wastewater disposal present greater opportunities in terms of the ease and cost-effectiveness in which supply/disposal can be provided. To show this on a map, areas within a 250m of an existing Water Supply or Wastewater Main Pipe have been identified as potential opportunity areas.

**Please note, the identification of areas with potential to integrate into existing reticulated water and wastewater does not take into account the capacity of existing water supply sources or WWTPs, or any terrain constraints that may limit the efficiency of these services.** The potential of existing or proposed water supply sources and WWTP is discussed in more detail in Section 5 of this report.

### 3.3 Areas that maximise passive solar gain

The Council is required to have particular regard to the effects of climate change and the efficiency and end-use of energy under the Resource Management Act 1991. In order to promote sustainable and efficient development, new building or subdivisions should ideally be located and/or orientated in order to take into account principles of energy conservation. Energy efficiency and the use of renewable energy (eg passive solar heating) also have a direct impact on health and social well-being, amenity values and indirectly lessen the impact of climate change.

A technical report on real estate demand in the harbour basin also identified that properties with north or west facing aspects (slopes) are more desirable by property purchasers or developers due to sun exposure during the day and afternoon.

Areas that receive the most sun during the shortest day have therefore been identified as opportunity areas. (Please refer to Section 2.2.8 of this report: 'Areas that receive the least sun' under 'Development Constraints' for an outline of how the 'sunny slopes' layer was created.)

### 3.4 Opportunity scoring and overlay

Each of the areas defined by an opportunity layer described above has been assigned an equal value. A colour scheme has then been applied to differentiate between different levels of opportunity (refer Appendix H)

## 4 Mapping and analysis

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This section of the report outlines how the constraints and opportunities layers were combined, mapped and compared.

### 4.1 GIS data preparation and analysis

Each constraint or opportunity layer had to go through a process of data preparation and conversion before the constraint/opportunity layers could be mapped and the final sieve map prepared. This process is outlined in more detail both below and in Appendix A.

#### 4.1.1 Preparation for mapping:

For each constraint, the correct data had to be sourced and prepared for both (a) mapping (eg Appendices C through to G); and (b) sieve analysis:

- a) *Sourcing the appropriate information*— for most information that was mapped, data was available through the Council's GIS database, however some data was also collected through consultants working specifically to obtain information for the settlements study.
- b) *Preparation of the data*— Some GIS layers were ready to map, while other layers required some form of processing in order to be useful. This involved using such tools as buffering, spatial or attribute selecting and editing.

#### 4.1.2 Preparation for 'sieve analysis':

Before the sieve analysis could be undertaken, each map layer had to be converted from the standard 'point', 'line' or 'polygon' format into a 'grid-based' data format<sup>14</sup>. This involved:

- a) *converting* the layers to the Grid format; then
- b) *re-coding* the Grid layers into a 'binary' format, so that for cells where constraint/opportunity was present = '1', and cells where the constraint/opportunity was not present = '0'

#### 4.1.3 Carrying out the 'sieve' analysis (overlying constraints or opportunities):

The grid-based calculator was used to 'add-up' the constraint or opportunity layers. This required:

- a) *multiplying* the constraint/opportunity by its score, then
- b) *adding* together the constraint/opportunity layers.

### 4.2 Final constraints and opportunities maps

The final constraints and opportunities maps are attached as Figures 2 and 3 on the following pages. The legend for these maps describes the total amount of 'constraint' or 'opportunity' present at specific locations, based on the sum of all the constraints/opportunities present at that location.

For the final constraints map, areas of constraint have been categorised between 'no constraint' (constraint value = 0) and 'extremely high constraint' (constraint value is greater than '6').

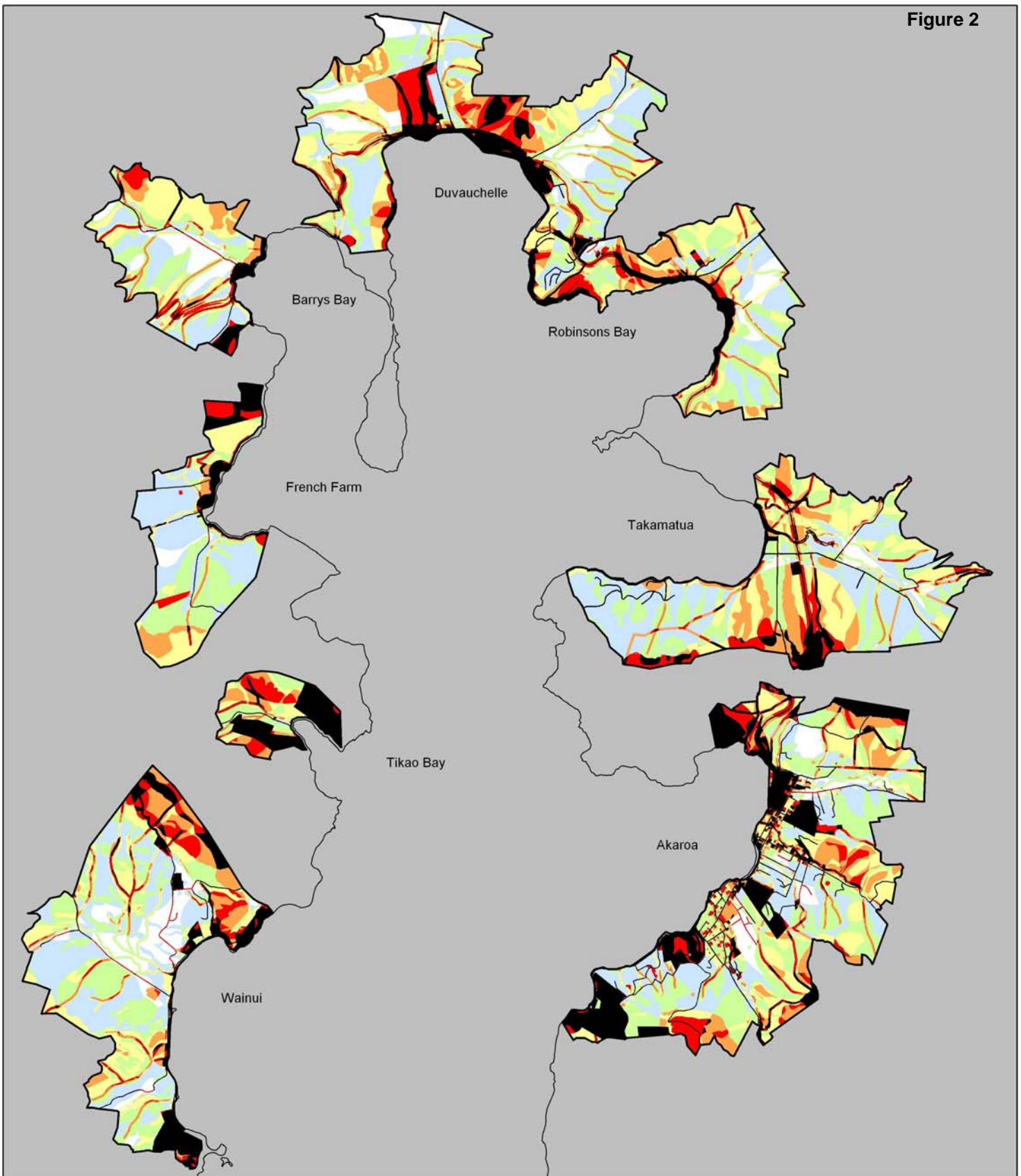
### 4.3 Comparison of constraints and opportunities

Figures 4 and 5 provide a comparison between the constraint and opportunity areas by 'blacking out' areas of low (2), moderate (3) or higher constraint (>4) and highlighting areas with higher opportunity value.








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<sup>14</sup> Sometimes referred to as a 'raster' data format, a grid-based data structure breaks an image or map into square grid cells of equal size, in this instance into 2m by 2m cells. Each grid cell contains a value that represents a condition that exists in the equivalent square parcel in the real world (eg a constraint).

Figure 2



**LEGEND: degree of total constraint**

	0	No constraint
	1	Very low constraint
	2	Low constraint
	3	Moderate constraint
	4	High constraint
	5	Very high constraint
	6 - 23	Extremely high constraint

**Akaroa Harbour Basin Settlements Study:  
Sum of all constraints**



0.0 0.4 0.8 1.2 1.6 2.0  
Kilometers

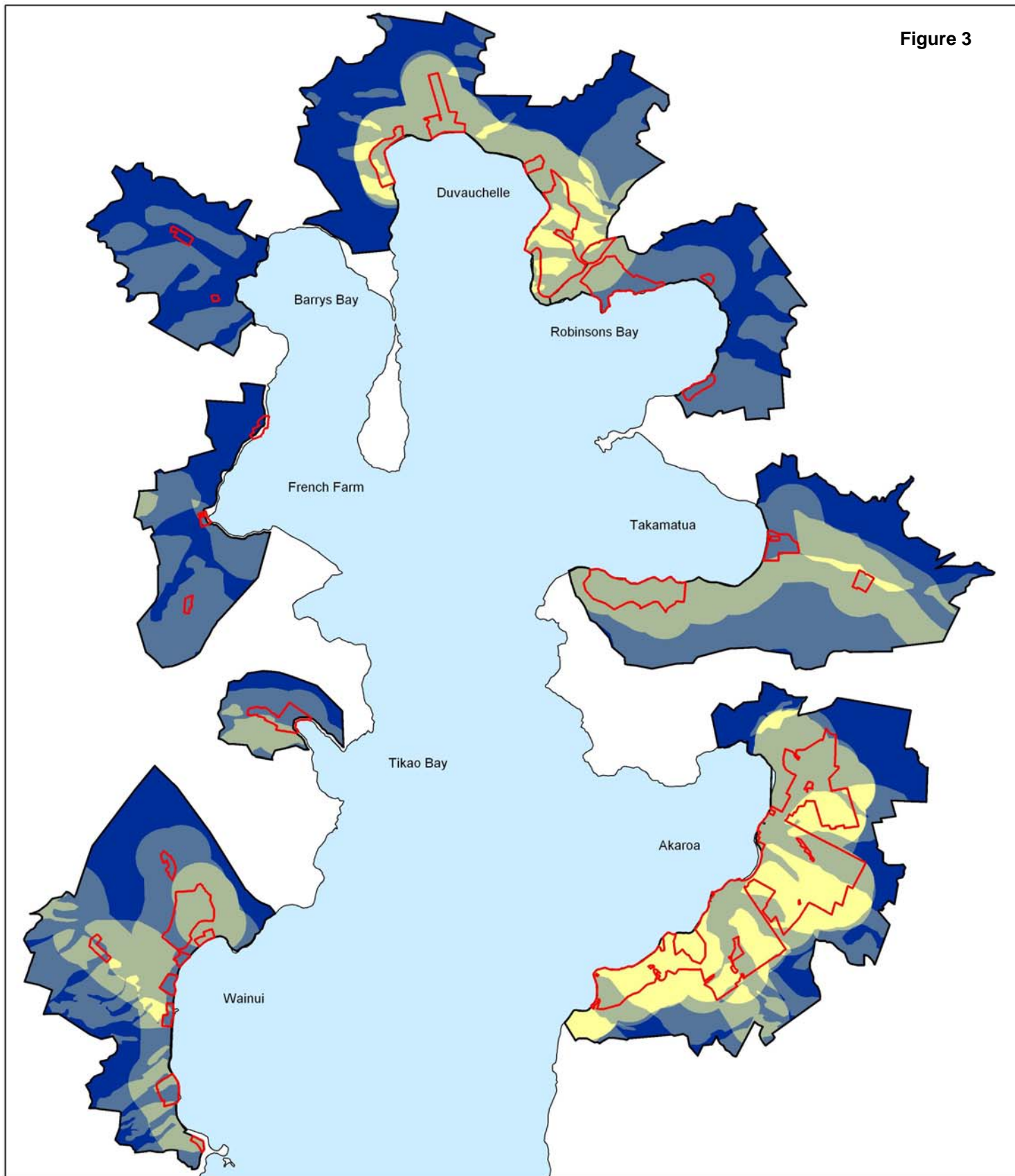
Scale : 1:32,000



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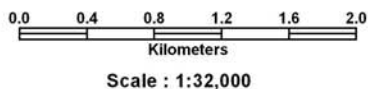
Figure 3



**Akaroa Harbour Basin Settlements Study: Sum of potential opportunity layers**

**LEGEND**

- Extent of residential-type zoning
- Settlement study area
- Degree of potential opportunity:*
- 0 No opportunity layers present
- 1 One layer of opportunity present
- 2 Two layers of opportunity present
- 3 Three layers of opportunity present

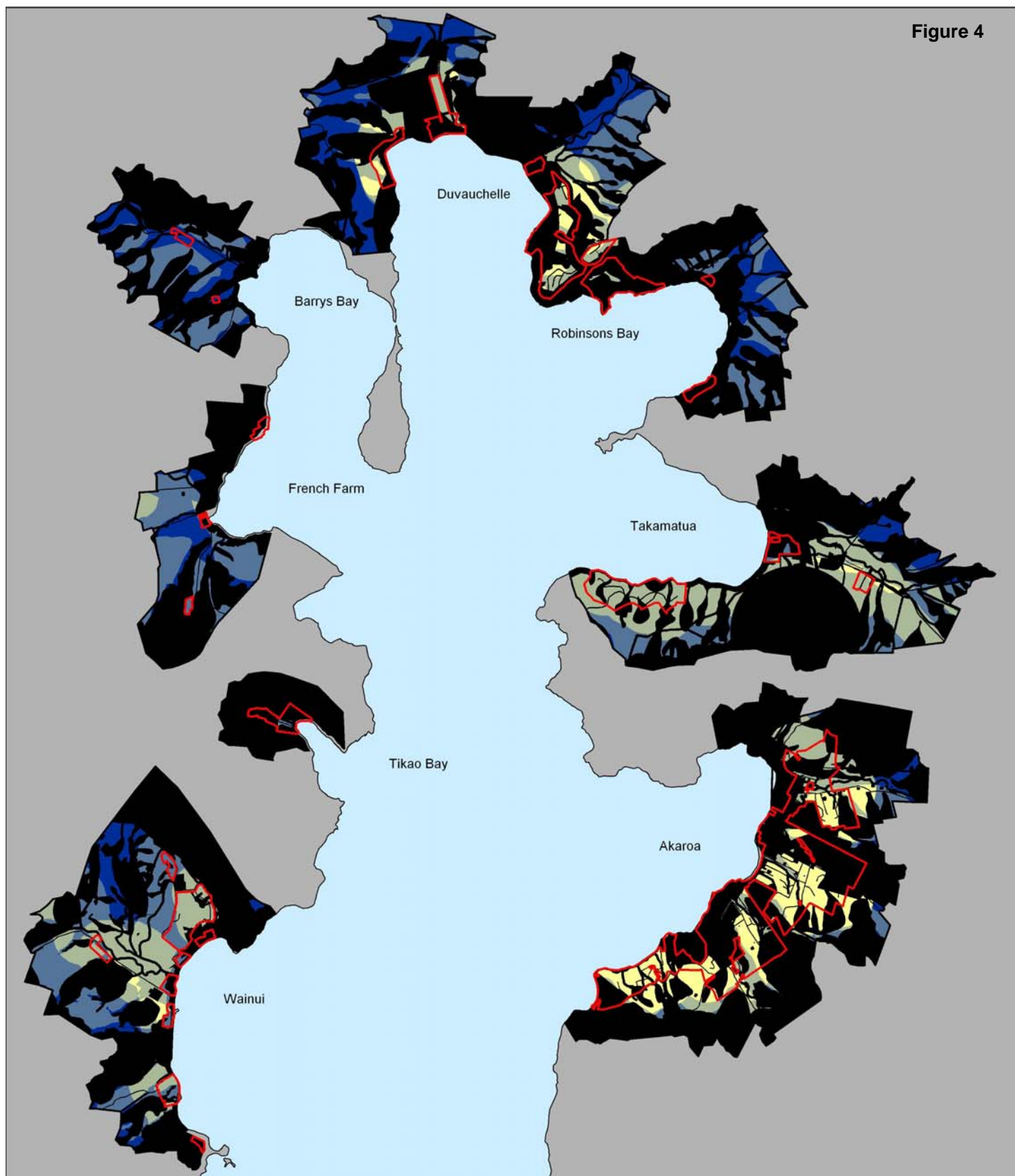


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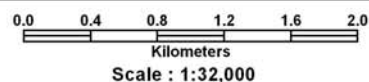


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Figure 4




**Akaroa Harbour Basin Settlements Study:  
Potential opportunity areas within areas of 'very low' or 'no' constraint**







**Legend**

-  Settlement study area
-  Extent of residential-type zoning

Constraint overlay:

-  Areas of low - extremely high constraint

Degree of potential opportunity:

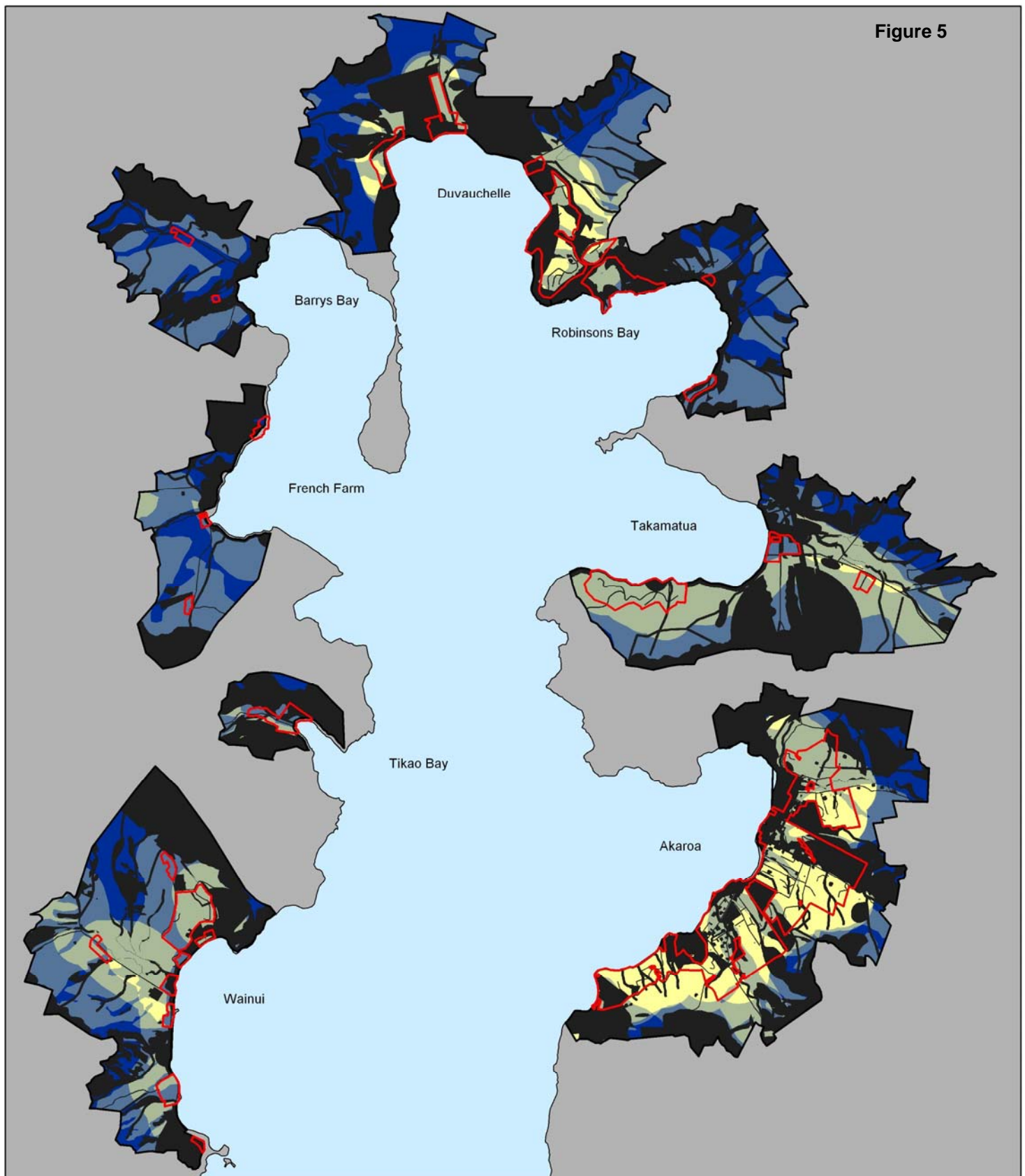
-  No opportunity layers present
-  One layer of opportunity present
-  Two layers of opportunity present
-  Three layers of opportunity present



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

Figure 5




**Akaroa Harbour Basin Settlements Study:**  
**Potential opportunity areas within areas of 'low', 'very low' or 'no' constraint**







**Legend**

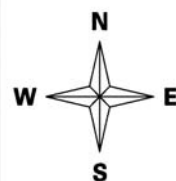
-  Settlement study area
-  Extent of residential-type zoning

Constraint overlay:

-  Areas of moderate or higher constraint

Degree of potential opportunity:

-  No opportunity layers present
-  One layer of opportunity present
-  Two layers of opportunity present
-  Three layers of opportunity present



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## 5 Settlement-specific constraints and opportunities

This section looks at all the constraints and opportunities facing each settlement (including non-spatial constraints and opportunities) in order to draw conclusions regarding the potential for settlement consolidation through ‘infill’ (further development within existing residential zoning) and/or ‘expansion’ (development adjacent to the existing urban edge).

### Non-spatial constraints and opportunities

Non spatial factors such as real estate demand, accessibility, broadband availability and the capacity of reticulated services can be either constraints or opportunities, depending on the settlement. For example, a lack of business activity (and a significant distance to the nearest commercial centre) is a constraint that may limit long-term growth in Wainui, whereas existing business activity in Duvauchelle and Akaroa is an ‘opportunity’ for these areas.

A full list of the non-spatial factors taken into account, including a discussion of the data source (where relevant) is provided in the table below.

Non-spatial constraint, opportunity or other factor	Comments
Vacant land	Information on the amount of vacant residential and for each settlement was collected by Council planning staff in 2006. This assessment includes deferred zones and does not take into account topographical or access constraints.
Population/household figures <sup>15</sup>	Population and household figures have been sourced from both Response Planning’s ‘usually resident population’ figures <sup>16</sup> for serviced communities (2005) and from 2006 census data (refer ‘Akaroa Harbour Basin Settlements Study: Demographic Research Project’, 2007).
Commercial/business activities	Information source: ‘Akaroa Harbour Basin Settlements Study: Identifying the Issues’ report, Oct 2007
Community and visitor facilities	Information sourced from an inventory of CCC or community owned/operated facilities. Includes beaches and coastal facilities.
Access and roading	Information sources:
Wastewater disposal capacity	<ul style="list-style-type: none"> <li>Banks Peninsula Water Supply (2006) and Wastewater (2005) Activity Management Plans; in ‘Akaroa Harbour Basin Settlements Study: Identifying the Issues’ report, Oct 2007;</li> <li>Akaroa Water Management Strategy: Part 4 ‘Akaroa Water Supply and Treatment Options, February 2008.</li> </ul>
Water supply capacity	
Broadband internet supply	Information based on Telecom’s broadband network and the location of DSLAMs <sup>17</sup> – devices that enable internet services through the telephone network.
Real estate demand	Information source: ‘Akaroa Harbour Basin Settlements Study Research Project: Real Estate Market’ (Simes Ltd), February 2008
Business land assessment	Information source: ‘Akaroa Basin Business Land Assessment’ (Property Economics), 2008
Coastal erosion impacts	Information source: ‘Akaroa Harbour Basin Settlements Study – Coastal Erosion and Inundation Project’ (DTec Consulting Ltd), May 2008

### Potential for settlement infill or expansion

In order to show the potential for the infill and/or expansion of each settlement, four maps were prepared for each study area (with Tikao Bay and French Farm combined):

1. **Base (Topographic) map.** This map shows the settlement study area and existing residential-type zoning in relation to topographical features such as roads, coastal facilities and contours. ‘Areas of interest’ have been circled and labelled on these maps. These areas are referred to in the

<sup>15</sup> Although not so much of a constraint or an opportunity, population and household figures for each settlement have been included in order to provide some context to the scale and size of the current settled areas and assist in understanding the capacity of reticulated services.

<sup>16</sup> Although based on census data, the ‘usually resident population’ estimates in the Response Planning report are more accurate as the statistical units for the census (‘meshblocks’) generally do not coincide with the extent of the serviced areas.

<sup>17</sup> DSLAM: Digital Subscriber Line Access Multiplexers. The further a customer lives from the DSLAM, the slower the speed of the internet connection until a point is reached where no service is available. It is acknowledged that the speed and quality of broadband internet can also be affected by the quality of the telephone cable and external interferences.

subsequent text. It is worth noting, however, that the underlying Topographic map was produced in 1998 and hence some aspects of the mapping may now be inaccurate.

2. Constraints map: This map shows all the constraints across the study area. 'Areas of interest' have also been circled and labelled on these maps.

Two further maps show where areas of 'very low' or 'no' constraint overlay potential opportunity areas. Additional layers have then been mapped on top to show the potential for infill and expansion:

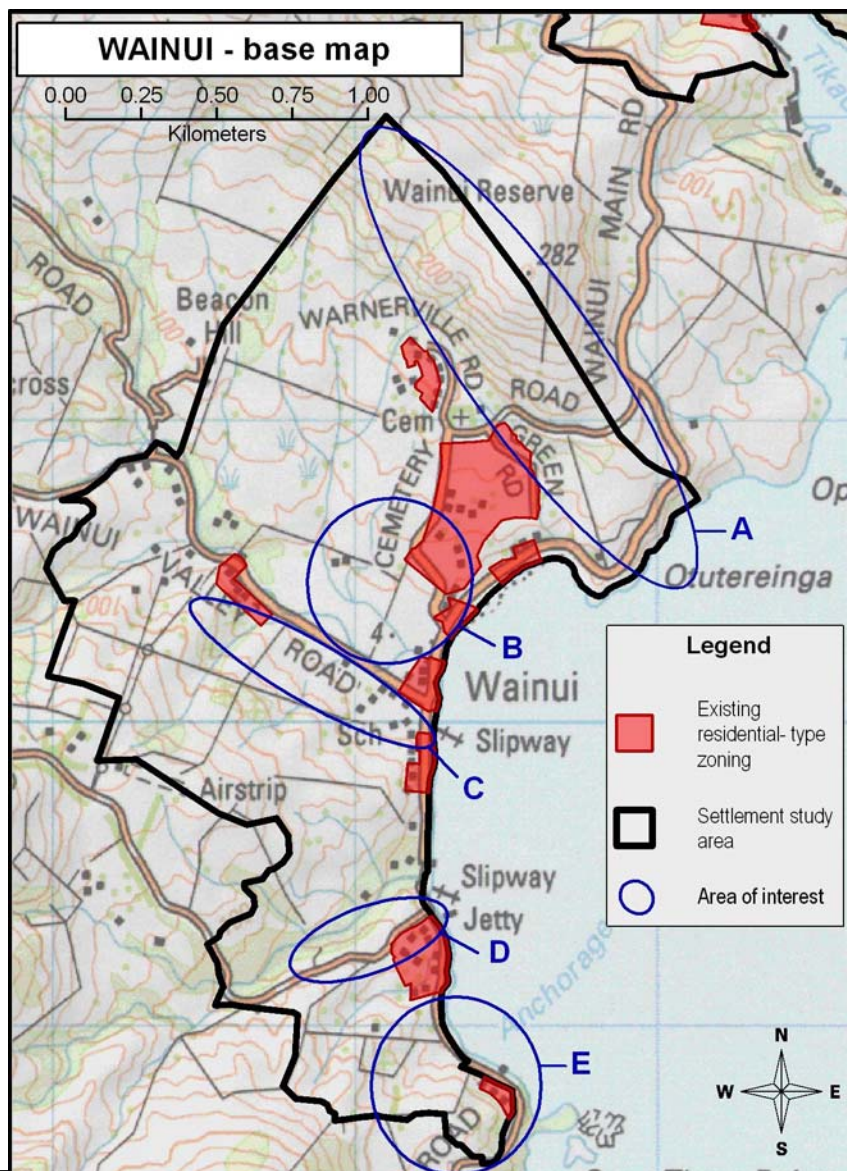
3. Potential for infill map: The largest residentially-zoned parcels have been identified and mapped to illustrate the ability of existing residentially-zoned areas to be further subdivided to support potential future demand for settlement growth.
4. Potential for expansion map: This map displays the current extent of residential-type zoning in order to show the potential (or otherwise) for a settlement to expand beyond the existing urban boundary, given the surrounding constraints/opportunities.

## 5.1 Wainui

### Settlement and community characteristics:

Vacant land assessment	8.21 ha (Residential zone)
Population/household estimate	Usually resident population (Response Planning, 2001): 80-90 people. Wainui, Tikao Bay and most of French Farm (2006 census): 135 people or 60 households
Commercial activities	None.
Community / visitor facilities	Facilities include: YMCA camp, community hall, domain, church, tennis courts, wharf and slipway. The swimming beach has good water quality and is popular with day visitors.
Access and roading	Access via Wainui Main Road, which is narrow and windy in parts. The settlement is difficult to access without a vehicle and is isolated from community and commercial services.
Wastewater disposal	Current WWTP services only part of the Residential zone, has no spare capacity and existing consent to discharge to the Harbour expires in 2009. New plant with capacity to service all Residential and Small Settlements zones is currently being planned.
Water supply	Groundwater bore (Wainui Valley Road) services all Small Settlements and Residential zones. System capacity 302 connections and designed for 875 people. All properties on restricted supplies (1m3/day). Sustainable yield of bore unknown.
Broadband availability	Poor or non-existent
Real estate demand	Although supply of land and potential for growth is high, demand for real estate is no higher than in other settlements.
Business land assessment	Lack of broadband a major constraint to growth. Approximately 320 residential households would be required for a 500 sqm commercial centre to be viable.
Coastal erosion concerns	Estimated 2-8m shoreline retreat due to sea-level rise in next 50 years, most likely to affect the long-term viability of parts of Wainui Main Road.

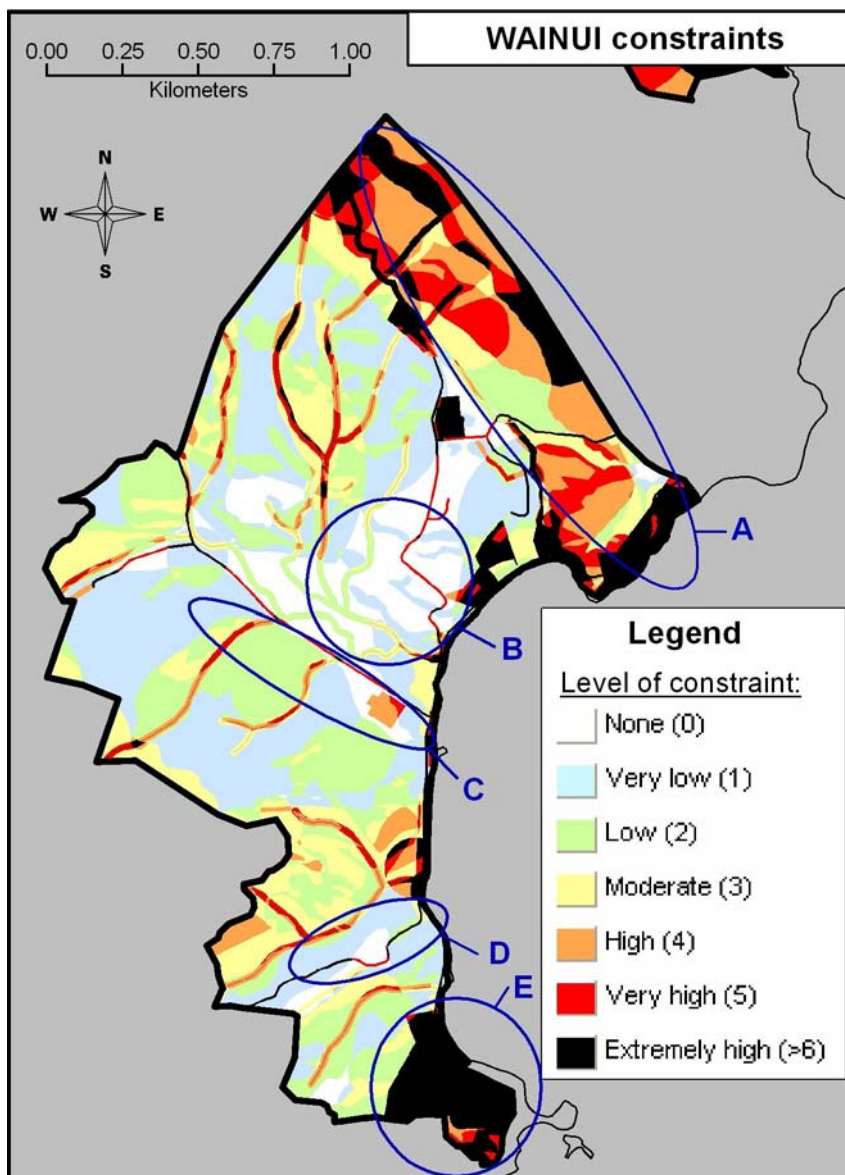
### Base map\*:



\*Topomap sourced from Land Information New Zealand Topographic Map N36 and N37 (Akaroa). Crown Copyright Reserved.

### Constraints map:

Mapped areas of constraint in Wainui are generally clustered along the northern and southern-most extents of the study area, with the central, lower Wainui valley area being largely constraint free.



#### Northern ridgeline (Area A)

Future development in this area is heavily restricted (moderate – higher constraint) by:

- Shaded slopes;
- Intermediate – significant slope hazards and bedrock landslides;
- Landscape constraints: the 160m contour and a prominent ridgeline.

#### Central / lower Wainui Valley (Areas B and C)

This area is largely constraint free, however there are a number of waterways that cross through this area, and it is suspected that parts of this area may be prone to flooding during high rainfall events. The coastal hazard assessment indicates that portions of the coastal area, primarily between Wainui Valley and Cemetery Roads (refer base map), are prone to coastal inundation hazards (storm surge and tsunami).

The hillside immediately south of Wainui Valley Road (Area C) is slightly more constrained (very low – moderate constraint), primarily due to intermediate – locally significant slope hazards.

#### Southern Wainui (Areas D and E)

The levels of constraint towards the southern end of the Wainui study area vary. The Coastal Natural Character Landscape at Cape Three Points greatly restricts development in this area (Area E). Pockets of land adjacent to Jubilee Road are generally constraint free (Area D).

### Summary of opportunities

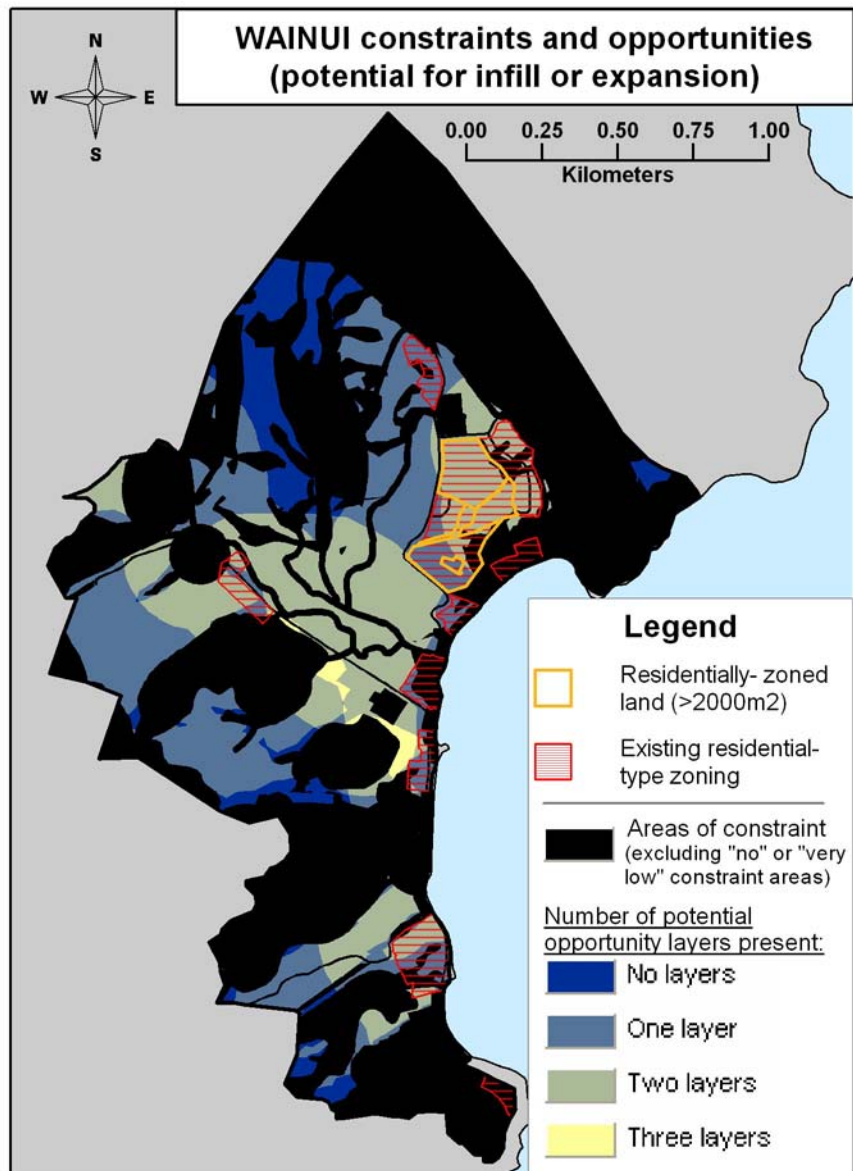
Moderate density residential activity is already permitted in Wainui's Residential zone, and there are also a number of pockets of Small Settlements zoning. Assuming the proposed WWTP is built, the entire settlement will be serviced for water and wastewater. In addition, the area (broadly) between Wainui Valley Road and Cemetery Road (refer base map) has been identified as an area of 'lesser landscape value', indicating that the area could absorb additional residential development without a significant impact on the greater landscape values.

### Potential for expansion or infill:

Wainui has large areas of under-developed residential zoning, hence there is significant potential for infill within existing zoning. The proposed wastewater treatment plant and reticulation system will service this Residential area. It is also possible that the development of the proposed WWTP could result in pressure to rezone the Small Settlements zones to Residential, thereby slightly increasing<sup>18</sup> the potential for infill in these areas.

An area of no - very low constraint and moderate-high opportunity exists between lower Cemetery Road and Wainui Valley Road (Area B on base map), as well as pockets of higher opportunity south of Wainui Valley Road (Area C on base map), where residential activity could logically expand from the existing Residentially-zoned area and 'connect-up' with the Small Settlements zones

Another possible expansion area is to the south of the settlement study area, just north of Jubilee Road (Area D on base map). This piece of land appears to be reasonably flat, and could possibly be consolidated with the existing pocket of Small Settlements zoning.



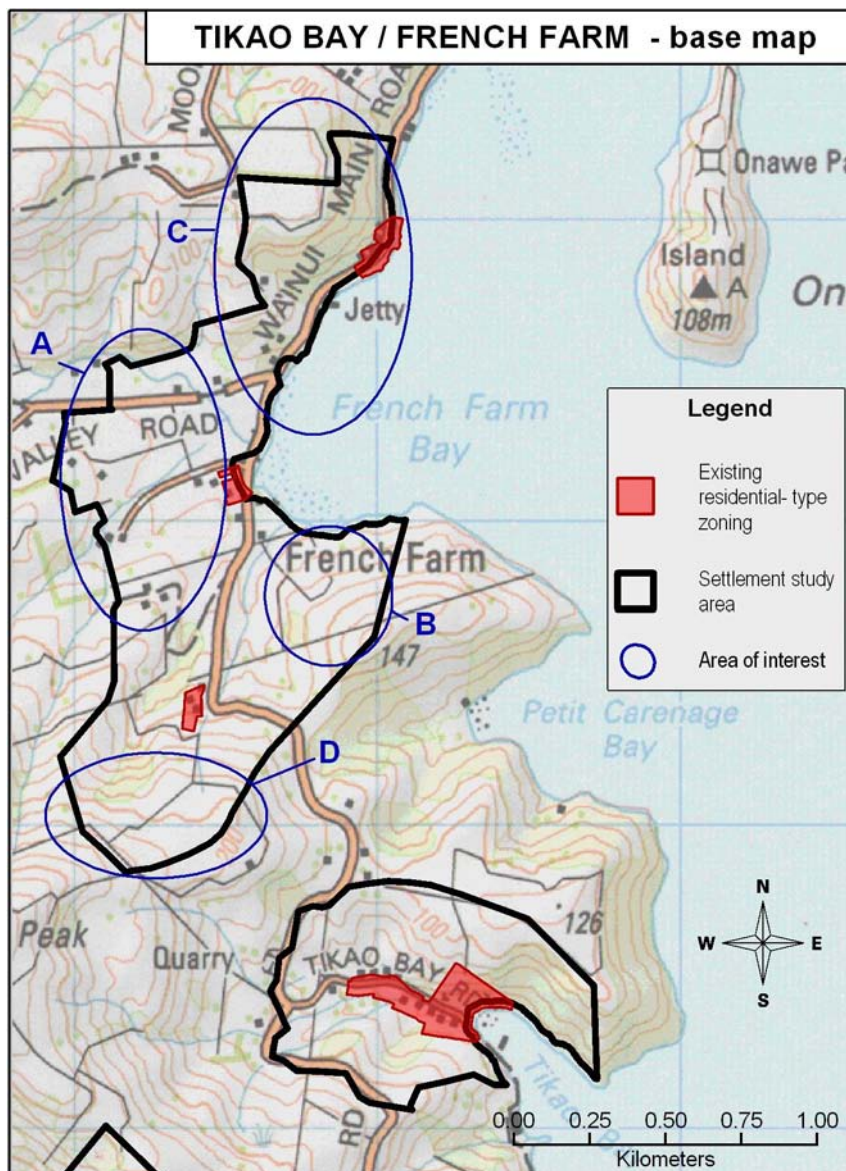
<sup>18</sup> It is of note that there are no Small Settlements zoned properties larger than 2000m<sup>2</sup>. 97% of properties in the Small Settlements zone are less than 1500m<sup>2</sup> in size and 73% less than 1000m<sup>2</sup> in size. Hence, the potential for infill in these areas, if rezoned to 'Residential', would be minimal.

## 5.2 Tikao Bay and French Farm

### Settlement /community characteristics:

Vacant land assessment	n/a
Population/household estimate	Wainui, Tikao Bay and most of French Farm (2006 census): 135 people and 60 households.
Commercial activities	None, except for French Farm Winery
Community / visitor facilities	Tikao Bay jetty and boating clubrooms; French Farm Boating Club Jetty. Swimming water quality: Tikao Beach (fair), French Farm (good)
Access and roading	Access via Wainui Main Road, which is narrow and winding in parts. The settlements would be difficult to access without a vehicle and are somewhat isolated from community and commercial services (closest being Duvauchelle).
Wastewater disposal	<i>Tikao Bay</i> : 36 connections to reticulated Wastewater system with land disposal (no spare capacity). <i>French Farm</i> : onsite wastewater disposal systems only.
Water supply	Tikao Bay: water supplied from a spring and creek to 36 baches (private supply) with no spare capacity. Water quality generally not good. French Farm: water sources unknown, likely to be wells, springs and/or rainwater.
Broadband availability	Poor or non-existent
Real estate demand	Low real estate demand
Business land assessment	n/a
Coastal erosion concerns	Limited coastal erosion in Tikao Bay. Estimated 15m of shoreline retreat due to sea-level rise over next 50 years in French Farm, which is most likely to affect Wainui Main Road.

### Base map\*:

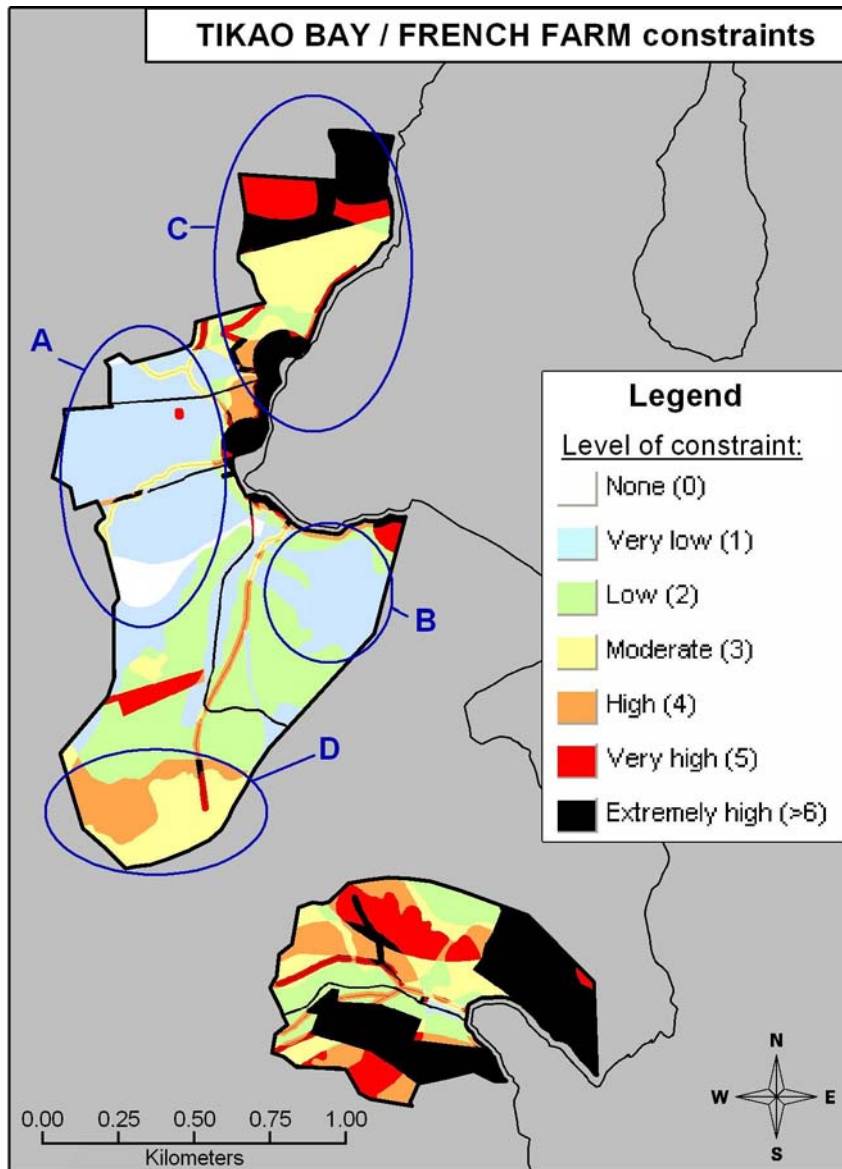


\*Topomap sourced from Land Information New Zealand Topographic Map N36 and N37 (Akaroa). Crown Copyright Reserved.

## Constraints map:

### Tikao Bay

Tikao Bay is highly constrained for a number of reasons. The most significant constraints relate to the CNCL areas to the north and south of the Small Settlements zoning, silent files to the north and south and large areas of intermediate and locally significant slope hazard. The topography of Tikao Bay generally restricts future expansion or development in this area, although potentially there could be additional, small-scale development on flatter areas to the north and upper areas of the Bay.



### French Farm

French Farm is less constrained, with significant areas of 'no' or 'very low' constraint on most of the valley floor area (Area A). There is also an area of 'very low' constraint on the north-facing slopes east of Wainui Main Road (Area B).

A number of constraints limit the potential for development of coastal areas around French Farm (including three archaeological sites, coastal hazards, recorded historical flooding and the location of Wainui Main Road). Areas of higher constraint are also concentrated to the north and south of the settlement (Areas C and D), where slope instability is a major limiting factor, along with landscape and shading constraints (above 160m contour, prominent ridgeline to the north). Lead overshoot contamination from the former Gun Club is also a limiting factor to the north of the settlement.



**Summary of opportunities:**

Although Tikao Bay has reticulated wastewater and a private water supply, there are very few opportunities for this area.

The French Farm Valley floor has been identified as an area of ‘lesser landscape value’. French Farm also has extensive northerly-facing slopes, although these are likely to be highly visible to the north and east of the settlement.

**Potential for expansion or infill:**

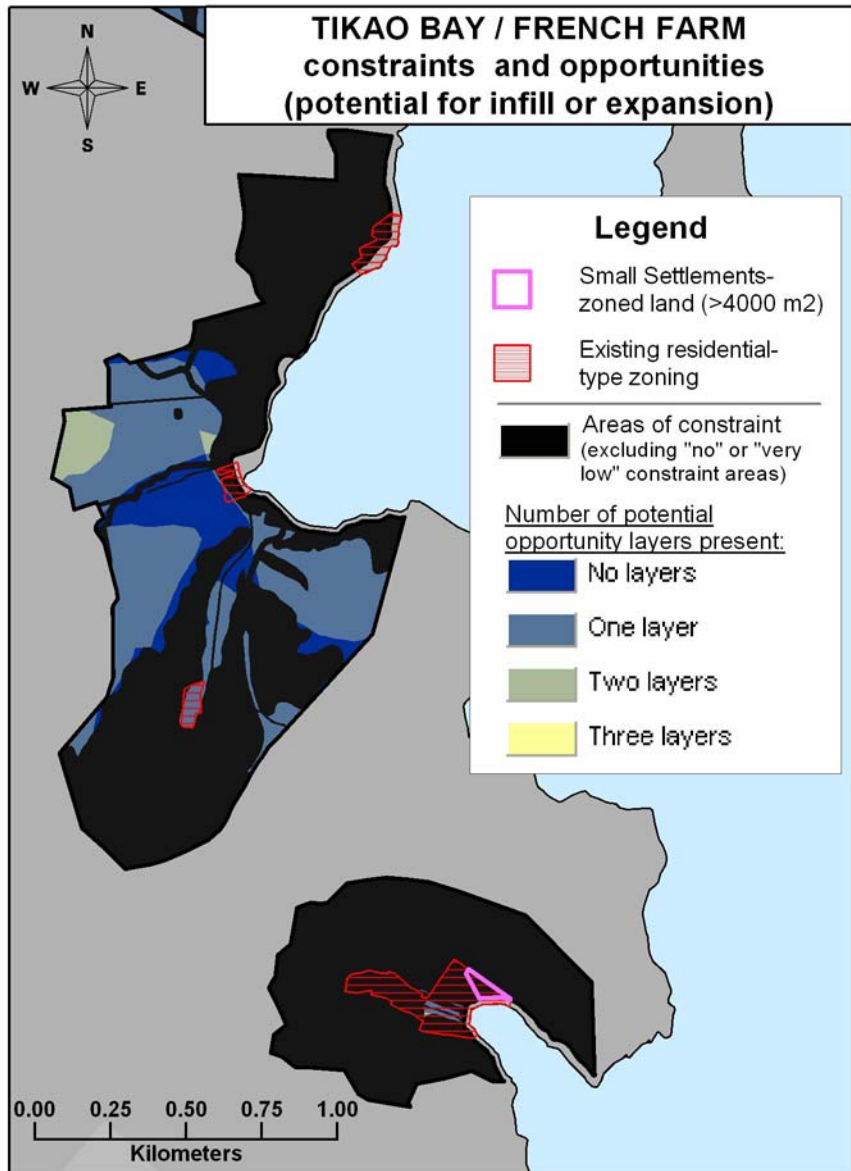
Tikao Bay

There is no potential for infill in Tikao Bay settlement, and very limited potential for expansion. The settlement already has a compact urban form.

French Farm

French Farm settlement is composed of three small (and separate) pockets of Small Settlements zoning. The consolidation (linking) of these pockets is unlikely, due to the distance between the zones, the existing low population and the inefficiencies associated with the provision of reticulated services.

There may be some potential for expansion, possibly of rural-residential activity, up French Farm Valley where there are reasonably versatile soils, an undulating topography and an area of identified lesser landscape value.

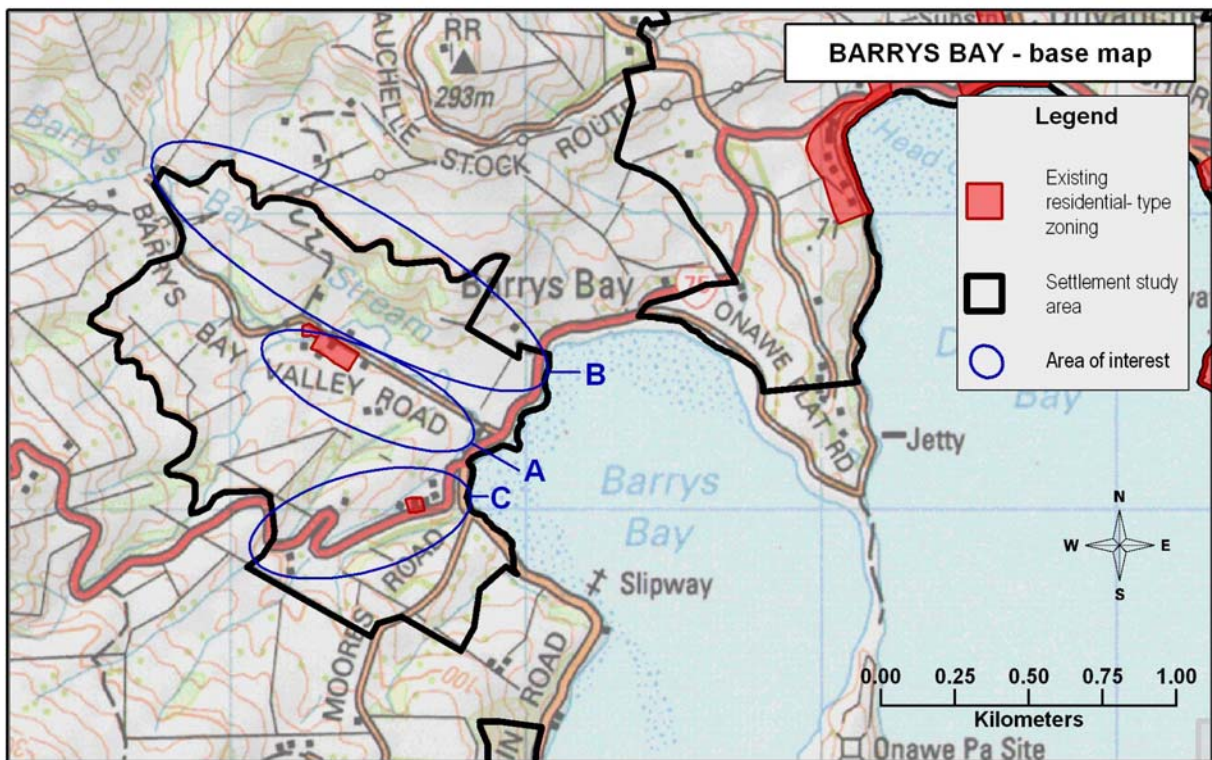


### 5.3 Barrys Bay

#### Settlement /community characteristics:

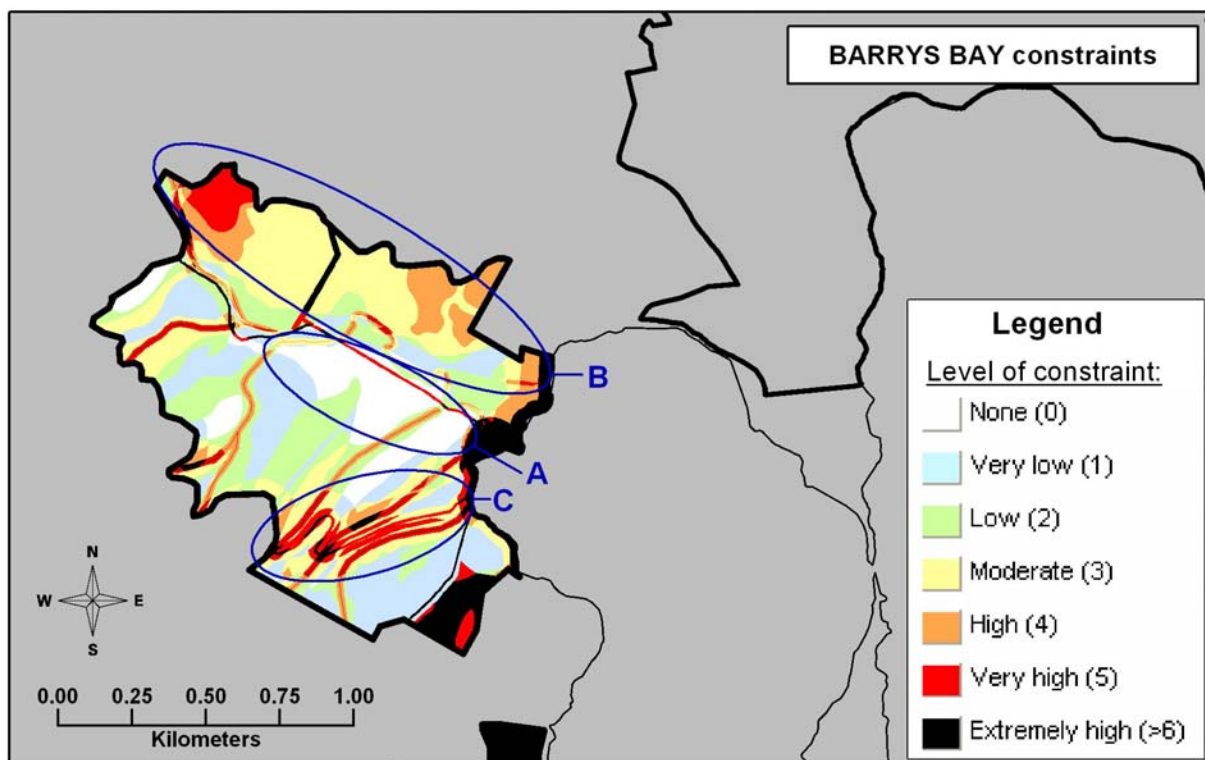
Vacant land assessment	n/a
Population/household estimate	Barrys Bay including western Duvauchelle (2006 census): 93 people or 36 households.
Commercial activities	Cheese factory (and store)
Community / visitor facilities	No community / visitor facilities, except for Half Moon Cottage (backpackers). Extensive mudflats, which although ecologically significant, limit coastal recreation opportunities.
Access and roading	Barrys Bay is the first settlement reached after passing through Hilltop on SH 75. There are no off-road walkways to adjacent settlements.
Wastewater disposal	No reticulated wastewater disposal (on-site systems only)
Water supply	Water supply sources unknown, likely to be wells, springs and/or rainwater.
Broadband availability	Yes (Duvauchelle DSLAM)
Real estate demand	Low real estate demand
Business land assessment	n/a
Coastal erosion concerns	Estimated 20m shoreline retreat due to sea-level rise over the next 50 years, which may cause slumping along Wainui Main Road.

#### Base map\*:



\*Topomap sourced from Land Information New Zealand Topographic Map N36 and N37 (Akaroa). Crown Copyright Reserved.

### Constraints map:



There is a significant large constraint-free area on the valley floor, south of Barrys Bay Valley Road. Areas of very low – low constraint also feature widely on the valley slopes to the south (Area A).

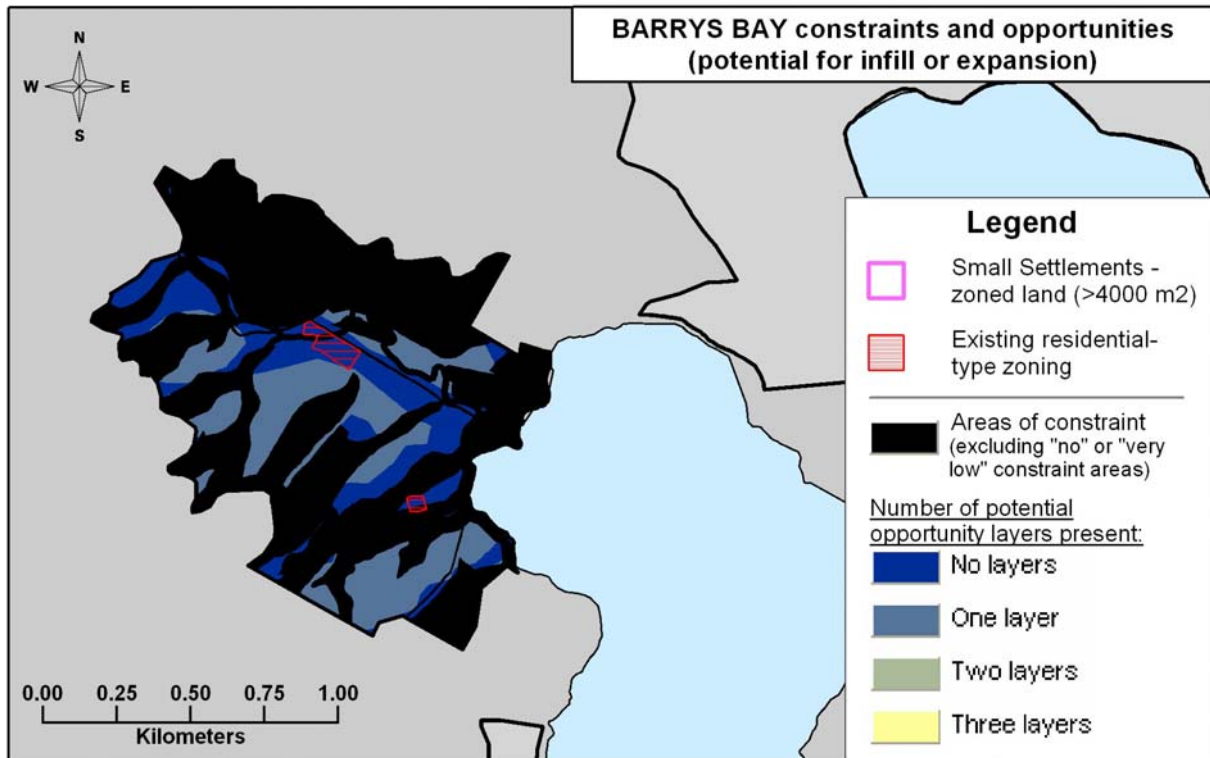
The northern slopes of Barrys Bay are more constrained (Area B), due to the shaded slopes, a large bedrock landslide and intermediate – significant slope hazards. Areas adjacent to the coast and SH 75 are also more heavily constrained (refer Area C for constraints related to the State Highway).

### Summary of opportunities:

Other than sunny, north facing slopes on the south side of the settlement, there are few mappable opportunities for this area.

There may be an opportunity to consolidate commercial/niche industrial activity around the existing cheese factory. This could be combined with visitor opportunities, including (for example) a short walkway around the remnant of Podocarp forest adjacent to the highway. At the moment, a resource consent or plan change would be required to allow additional commercial or industrial activities within the existing Rural Zone.

**Potential for expansion or infill:**



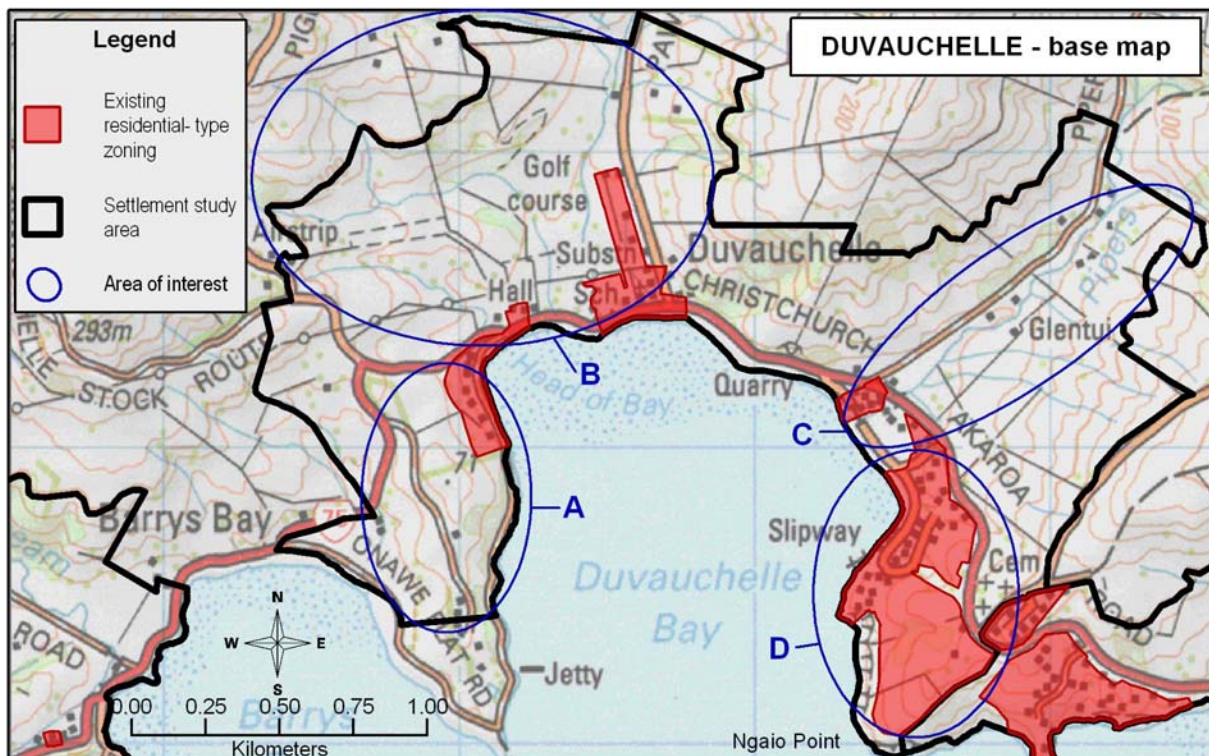
According to the map above, there is almost no opportunity for infill within the existing Small Settlements zoning. There is also little significant scope for settlement expansion, due to a low real estate demand, low population base, few opportunities (eg reticulated wastewater or water supply) and the difficulty in trying to link together the existing pockets of Small Settlement zoning.

## 5.4 Duvauchelle

### Settlement /community characteristics:

Vacant land assessment	13.93 ha (Residential zone – figure includes part of Robinsons Bay)
Population/household estimate	Usually resident population (2001): 220 people Duvauchelle and Barrys Bay (2006 census: 207 people or 87 households)
Commercial activities	Small established commercial and servicing centre including a general store, hotel, garage and camping ground.
Community / visitor facilities	Duvauchelle has a number of community / visitor facilities, including a Church, Primary School, Community Hall, A & P Showgrounds, Golf Club, as well as a slipway, jetty and wharf. The water quality of the beach is generally good.
Access and roading	The settlement is located on SH 75, which divides the town in some areas (eg Onawe Flat Road and Ngaio Point). Good connectivity with Robinsons Bay and potential to provide off-road walking opportunities within the settlement. Onawe Flat Road is also prone to flooding during storm events.
Wastewater disposal	A wastewater treatment plant, with capacity for 900 people, discharges treated wastewater to the harbour. Consent for this discharge expires in 2010. There have been problems with the wastewater treatment processes due to fluctuating populations.
Water supply	Water is sourced from the Pipers Stream catchment. There is approximately 500m <sup>3</sup> of water storage in the network and restricted supplies. The water supply is designed to supply 860 people.
Broadband availability	Yes (Duvauchelle DSLAM)
Real estate demand	4-6 new houses are built every year, with potential to meet market demand within existing residentially-zoned land for the next 25-30 years.
Business land assessment	Any increase in commercial activity demand resulting from urban growth can be met by more efficient use of land already utilised for commercial activity.
Coastal erosion concerns	n/a

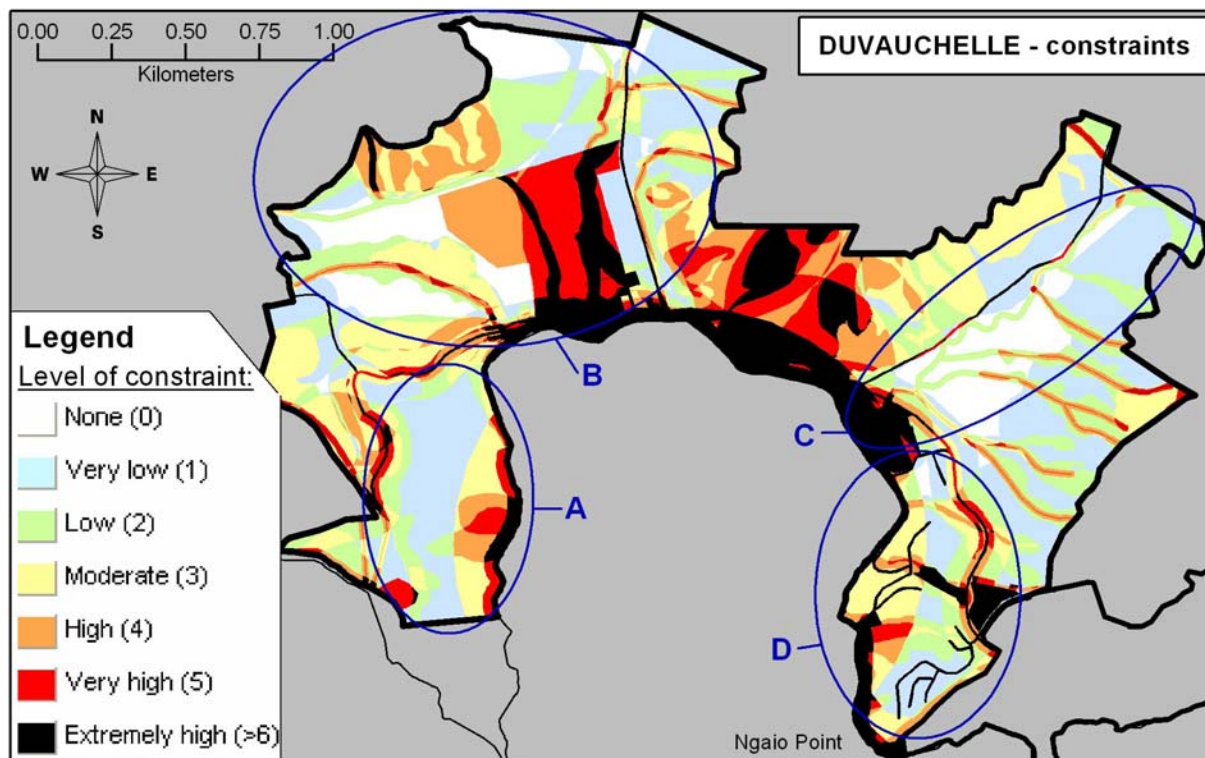
### Base map\*:



\*Topomap sourced from Land Information New Zealand Topographic Map N36 and N37 (Akaroa). Crown Copyright Reserved.

### Constraints map:

The Duvauchelle study area displays a complex mix of constraints and opportunities. Most of the study area is affected by coastal constraints, which includes a silent file around the harbour edge, archaeological sites and coastal hazards (tsunami and storm inundation). The study area is also affected by the State Highway, with the central town centre and older residential areas being located on the opposite side of the Highway from residential activity along Onawe Flat Road and near Ngaio Point (refer to the base map on the previous page). This constraint will be examined in more detail under 'potential for expansion or infill' on the following page.



#### West Duvauchelle (Area A - Onawe and south of SH 75)

SH 75 divides residential activity along Onawe Flat Road from the town centre (Area A). Stormwater disposal and flooding during storm inundations are key issues for this area, with the only constraint-free areas being on the upper, flatter slopes of this headland.

#### Duvauchelle town centre / Pawsons Valley (Area B)

This part of the study area is characterised by the A & P Showgrounds and golf course, business activity adjacent to the State Highway and older residential activity extending from the hotel, along the coastline and up Pawsons Valley (refer base map). The constraints map shows areas of no constraint extending inland to the north-west. However these areas are separated from the existing residential area by the golf course and Showgrounds, which are a significant constraint to efficient settlement expansion in this area.

Areas of low or very low constraint north of the golf course show potential for development, however the remote location and distance from the existing residential centre suggest a rural-residential type activity might be more suitable in this area.

The ridgeline between Pipers and Pawsons Valleys (between Areas B and C) appears generally unsuitable for residential activity, with significant slope hazards, the wastewater treatment plant, a prominent ridgeline and steep slopes posing significant constraints to residential activity.

#### Pipers Valley (Area C)

The Pipers Valley area includes older coastal subdivisions, the camping ground, as well as the relatively undeveloped mid-upper valley areas north of SH 75. The most constraint-free areas are on the valley floor to the east of Pipers Valley Road, with the severity of constraints increasing up the valley slopes and near waterways and gully areas.

### Ngaio ridgeline (Area D)

The area extending eastward of the camping ground and beyond to Ngaio Point (south of SH 75) varies in terms of the degree of constraint. This area is characterised by areas of 'very low' constraint, which increases to 'moderate' towards the harbour edge due to a silient file. An RAP and foreshore reserve around Ngaio Point shows up as a significant (black) constraint.

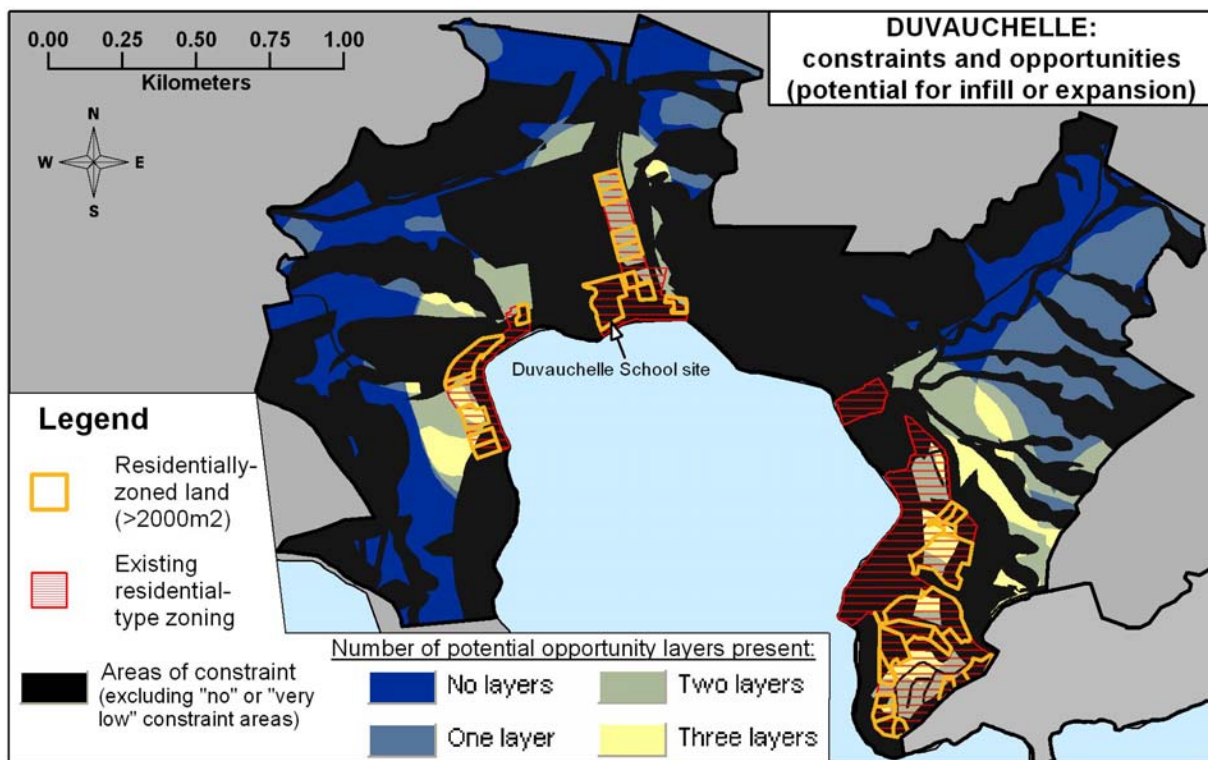
### **Summary of opportunities:**

Duvauchelle has several opportunities for settlement expansion or infill. Most notably, the settlement has reticulated water supply and wastewater systems that have been designed to handle an estimated 50% increase in population. The fact that treated wastewater is discharged into the harbour, however, could be an issue in the future.

The best opportunity areas are located around the existing residential zoning. Pipers Valley is particularly constraint free (Area B), with the eastern slopes having an aspect that maximises sun exposure. The mid to upper valley areas of Pipers and Pawsons Valleys, where reticulated wastewater and water supply may not be readily available, present potential opportunities for rural-residential development.

### **Potential for infill or expansion:**

Duvauchelle shows significant potential for infill development. The Real Estate Market report completed for the Settlements Study indicates that at the current rate of section sales and house construction, the existing Residentially-zoned land has potential for a further 300 allotments which should meet market demand for some time. It is also of note that in the Ngaio Point subdivision, most sections have covenants restricting further subdivision until 2011.



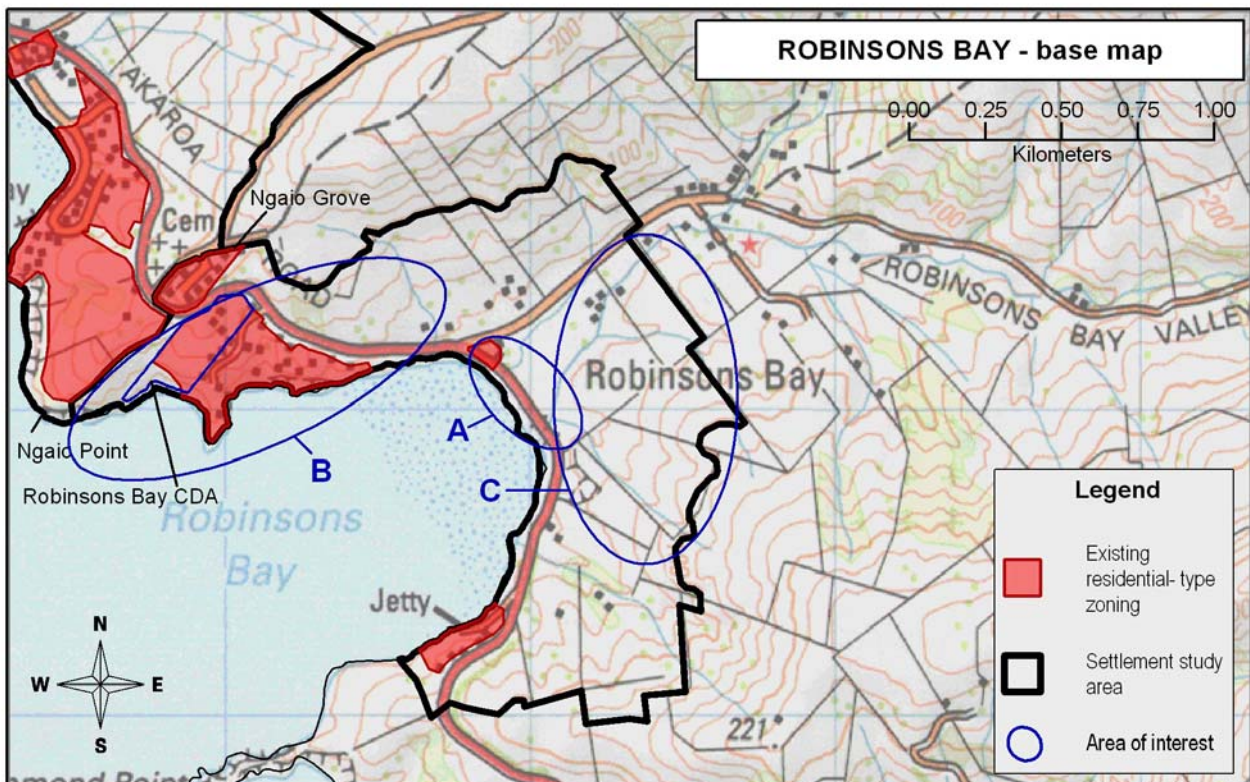
The potential for settlement consolidation is somewhat limited by geographical features, for example the ridgeline between Pipers and Pawsons Valleys and the central location of the golf course and Show Grounds. The State Highway is also a significant factor for any settlement expansion; for example, although the valley floor and eastern slopes of Pipers Valley show good potential for development, a number of significant issues regarding connectivity across the State Highway and road safety issues would need to be resolved.

## 5.5 Robynsons Bay

### Settlement /community characteristics:

Vacant land assessment	1.31 ha (Small Settlements zone), 16.93 ha (Residential zone – figure includes Duvauchelle)
Population/household estimate	2006 census: 96 people or 36 households
Commercial activities	None.
Community / visitor facilities	Robynsons Bay wharf and beach (water quality not recorded)
Access and roading	The settlement is located on SH 75, with most of the settlement located on the seaward side of the Highway. A number of accidents have occurred near Archdalls and Robynsons Bay Valley Roads, including one fatal between 2002-2006. An off-road walking track around Ngaio Point provides access to Duvauchelle.
Wastewater disposal	Reticulated wastewater disposal and water supply (connected to the Duvauchelle systems) are available in the Ngaio Grove (Residential zone) subdivision. Water supply is also reticulated through the Robynsons Bay CDA (the Archdalls Road Small Settlements zone) and to the pocket of Small Settlements zoning on the valley floor adjacent to the coast.
Water supply	
Broadband availability	Available at Ngaio Grove and Archdalls Road through the Duvauchelle DSLAM. Elsewhere, availability is limited or unavailable.
Real estate demand	Low real estate demand
Business land assessment	n/a
Coastal erosion concerns	20m of shoreline retreat due to sea-level rise estimated over the next 50 years, which is most likely to affect coastal roads.

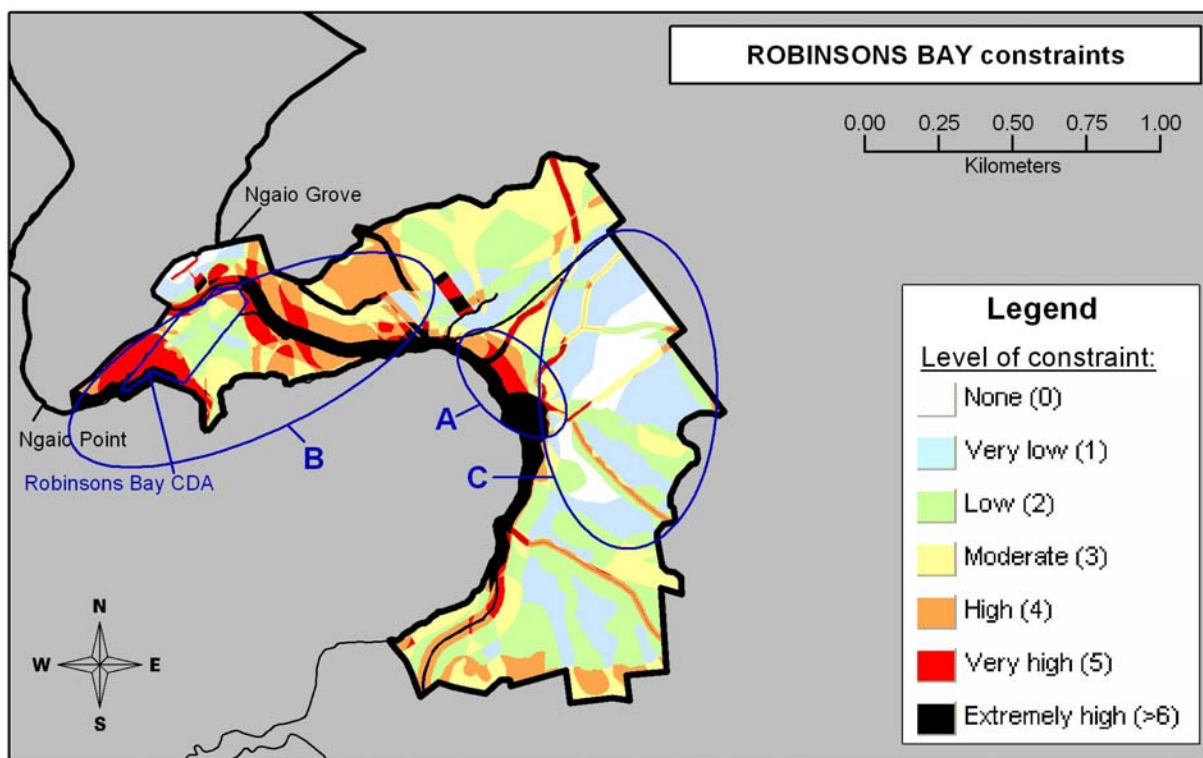
### Base map\*:



\*Topomap sourced from Land Information New Zealand Topographic Map N36 and N37 (Akaroa). Crown Copyright Reserved.



## Constraints map:



### State Highway / Coastal valley floor (Area A)

The location of the State Highway along much of the coast, combined with observed flooding and ponding in the past, the possibility of liquefaction, coastal hazards and the likely extent of coastline retreat, means the coastal valley floor has an overall high level of constraint.

### Eastward of Ngaio Grove (Area B)

The area to the south and east of Ngaio Grove (eg Archdalls Road) is also subject to a number of constraints including a bedrock landslide, an RAP, locally significant land instability features and shading, as well as being influenced by setbacks from the State Highway.

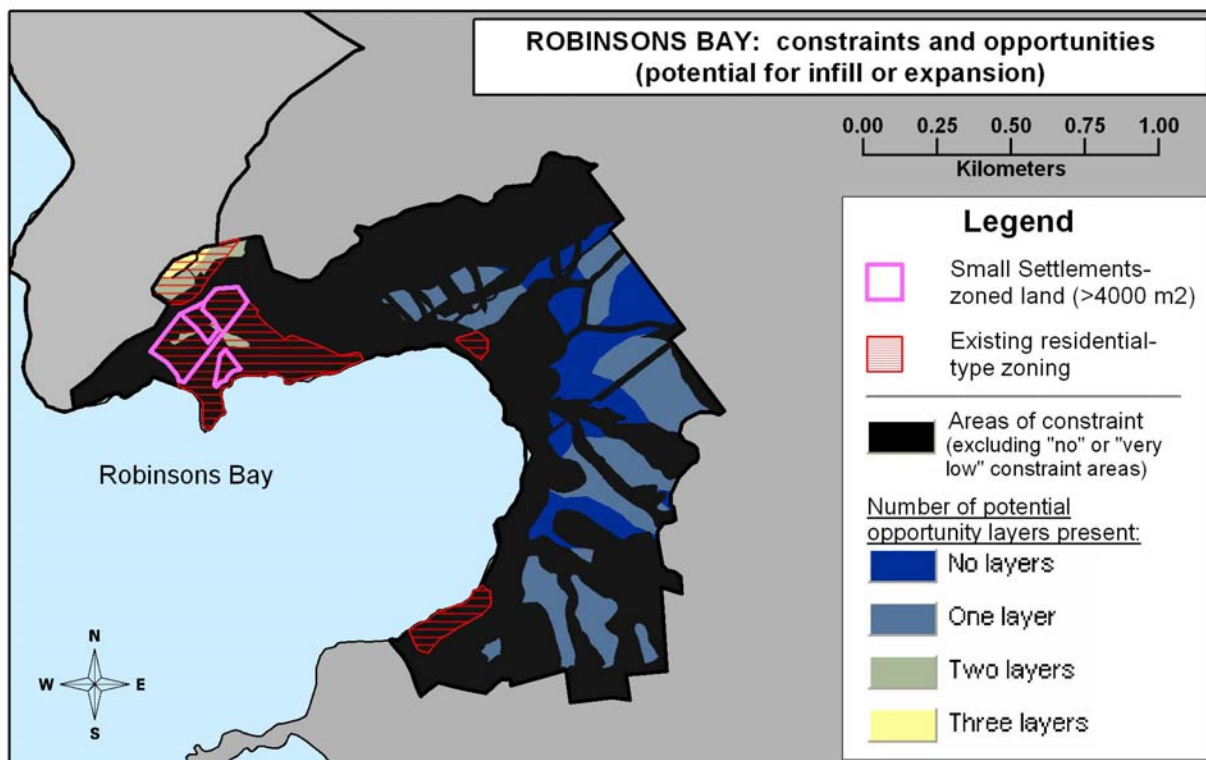
### Valley floor and lower slopes (Area C)

Most of the valley floor and lower slope areas, particularly eastward of Robinsons Bay Valley Road, have no or a very low level of constraint.

## **Summary of opportunities:**

Reticulated water supply is available to existing areas of Residential or Small Settlements zoning, except for the area of Small Settlements zone to the south of the settlement. An area of 'lesser landscape value' is located further up the valley and the slopes to the east of the settlement have a sunny, northerly aspect.

**Potential for infill or expansion:**



An area of Small Settlements zoning (approximately 5.5 ha) between Ngaio Point and the inner bay around Archdalls Road, identified in the District Plan as the Robinsons Bay Comprehensive Development Area (refer base map), is largely undeveloped.

Almost all of the existing areas of Small Settlements zoning are located on the seaward side of SH 75, where there is very little room for expansion adjacent to existing residential zoning. The most suitable area for expansion would be the valley floor near the existing Small Settlements zone, although there are significant constraints on the Valley floor near the coast and expansion in this direction will create a settlement pattern fragmented by the State Highway.

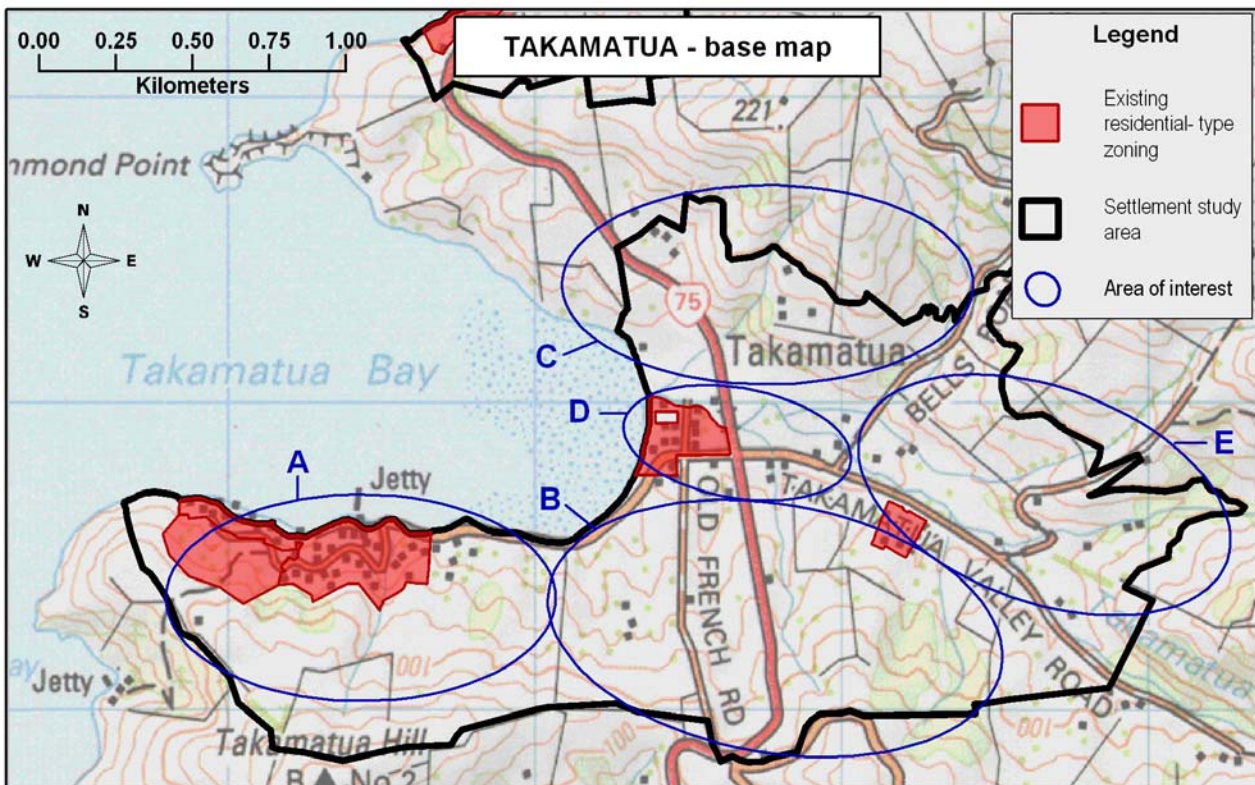
Alternatively, rural-residential activity could be located within the valley area, particularly in areas that receive good sun, have good quality soils (LUC) and/or lesser landscape values. The upper valley area meets all or most of these requirements, with the potential for rural-residential development extending beyond the study area. The investigation of these areas for rural-residential use would hence require a re-evaluation of the Settlement Study's boundaries.

## 5.6 Takamatua

### Settlement /community characteristics:

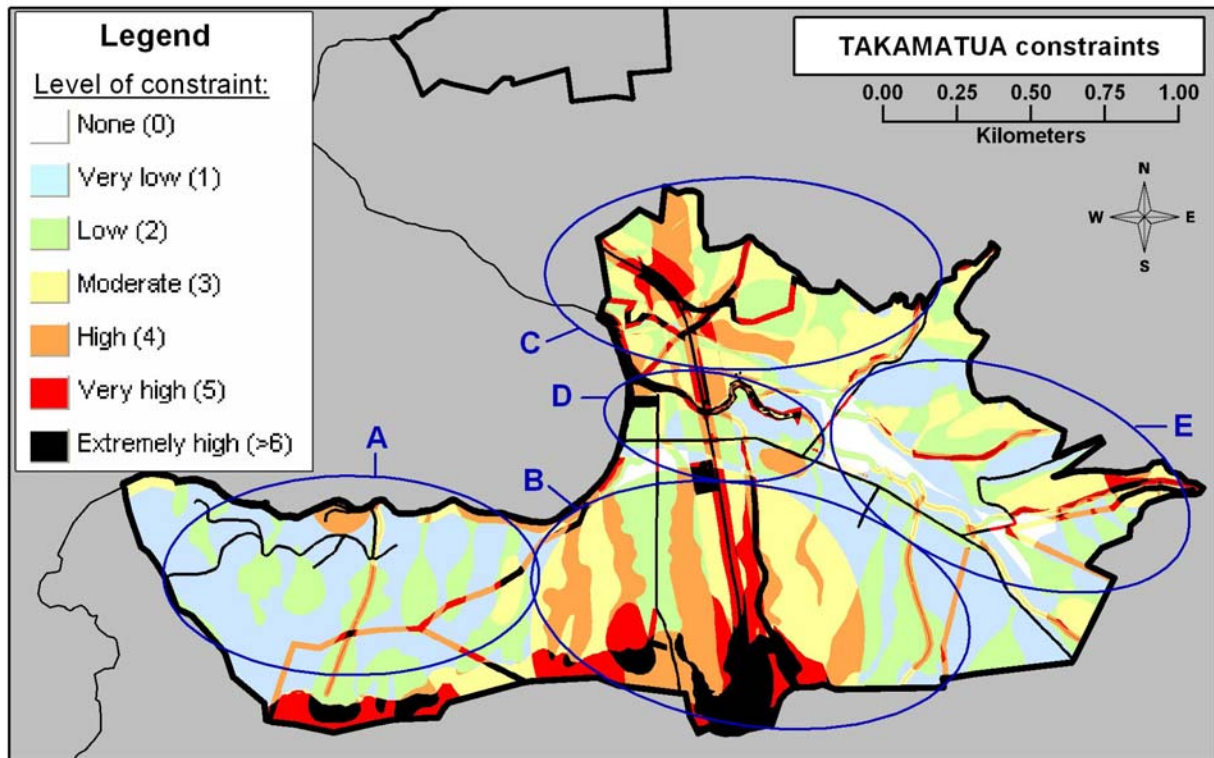
Vacant land assessment	6.34 ha (Small Settlements zone) – most of this has since been subdivided (eg Kingfisher Point)
Population/household estimate	Usually resident population 2001: 60 people Census 2006: 132 people or 63 households
Commercial activities	None, except for a seasonal fruit and vegetable store.
Community / visitor facilities	Jetty and Slipway (although anecdotal evidence suggests an upgraded slipway would be necessary to accommodate increased demand through settlement growth and tourism). Fair swimming quality. The settlement is also very close to Akaroa, the main commercial and servicing hub in the harbour basin.
Access and roading	The settlement is accessed via SH 75. Intersections with the State Highway at the bottom the valley (Takamatua Valley and Takamatua Bay Roads) and on the ridgeline to the south of the settlement (Long Bay / Old French / Old Coach Roads) are accident-prone and have been identified as requiring upgrades, should further development pressure arise.
Wastewater disposal	On-site wastewater disposal only
Water supply	Reticulated water supply relying on Takamatua Stream. Little storage is available in the network, which is designed for 1500 residents. The system currently meets demand. Water supply in Takamatua is being considered as part of the Akaroa Water Supply strategy, which is looking at (amongst other alternatives) utilising the north branch of the Takamatua Stream as a new water supply source.
Broadband availability	Yes (Akaroa DSLAM)
Real estate demand	Due to the settlement's close proximity to Akaroa, steady demand for property is predicted to increase over the next 30 years.
Business land assessment	Given Akaroa's position as a business destination, it is unlikely that any significant 'over-flow' of business land demand will find its way to Takamatua.
Coastal erosion concerns	Estimated 15m of shoreline retreat due to sea-level rise over the next 50 years. This could have a significant impact on coastal roads, particularly Takamatua Bay Road.

### Base map\*:



\*Topomap sourced from Land Information New Zealand Topographic Map N36 and N37 (Akaroa). Crown Copyright Reserved.

## Constraints map:



### North-facing slopes (Areas A and B)

Areas of least constraint are generally focused on the more northerly facing slopes, although locally significant land instability hazards fragment the potential for extensive development on these slopes. A silent file and the location of the State Highway increases the level of constraint on the central, southern slopes (Area B). On Takamatua Headland, the prominent ridgeline and 160m contour create a natural boundary to future development (Area A).

### South-facing slopes (Area C)

The south-facing slopes to the north of the settlement are moderate-highly constrained, due to the shaded slopes, a bedrock landslide, the State Highway and varying degrees of land instability.

### Coastal valley floor (Area D)

The coastal valley floor area appears prone to flooding and coastal inundation, particularly adjacent to Takamatua Stream, hence there is a higher level of constraint in this area. This area also has good soils, and possibly could be affected by liquefaction during an earthquake.

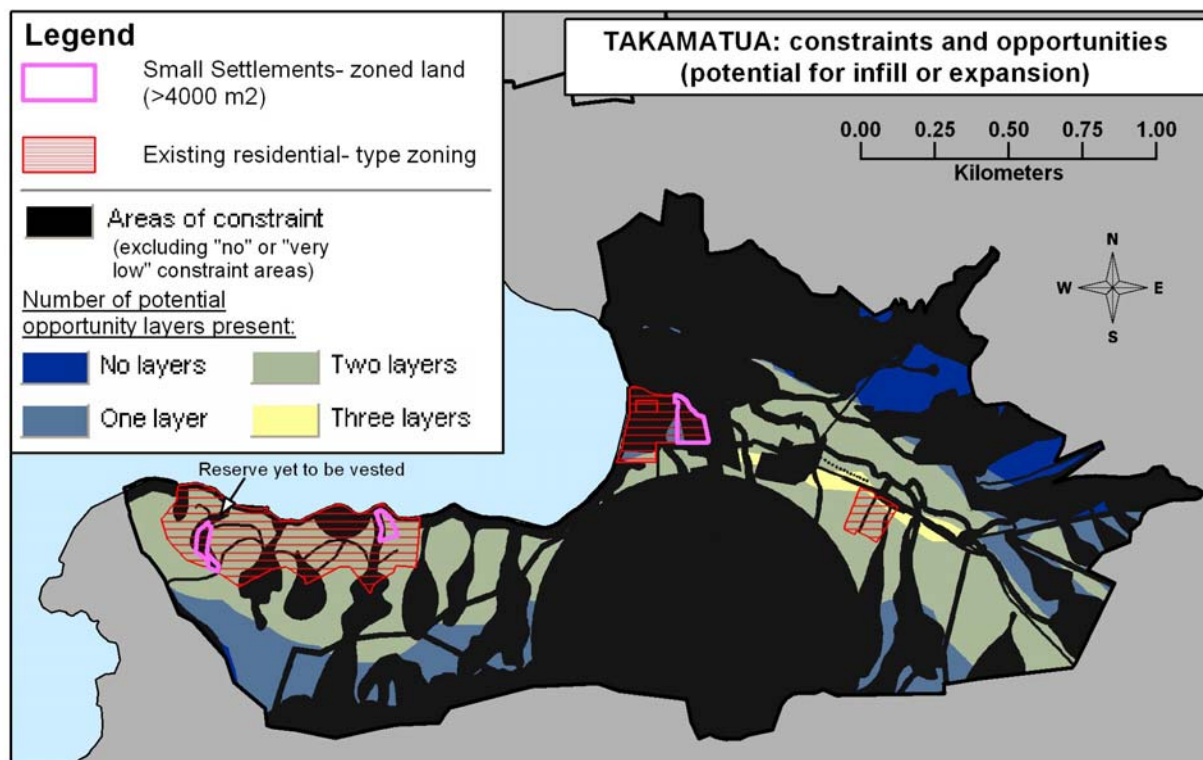
### Upper valley floor (Area E)

The upper valley floor and lower slopes generally show very low or no constraint.

## **Summary of opportunities:**

There are a number of opportunities for Takamatua, including sunny north-facing slopes, reticulated water supply, a reasonably high residential demand and close proximity to Akaroa.

## Potential for infill or expansion:



Potential for infill is limited, with only one site of a reasonable size with potential for subdivision on the valley floor (approximately 1.17 ha).

The best opportunities for settlement expansion are:

- *Adjacent to the Small Settlements zone on Takamatua Valley Road (refer base map)*
- *Expansion (uphill and west) of the Small Settlement zone on Takamatua headland, although any development of this land must take into account:*
  - potential impacts on the landscape, particularly when viewed across the harbour;
  - building site restrictions due to locally significant land instability features (eg tunnel gullies);
  - long-term viability of Takamatua Bay Road due to coastal erosion; and
  - previous negotiated agreements with the local community regarding the development of the existing Small Settlement zone (Takamatua CDA).
- *Lower valley slopes, south of the Small Settlement zone at the mouth of the valley.* Development in this area is shown as being constrained by a silent file area (Area B on base map). If this is removed from consideration, this land shows good potential for settlement expansion, and would promote a consolidated settlement form on the seaward side of the State Highway. Consideration of this land for residential activity must therefore be undertaken in consultation with the local Runanga, in order to mitigate any impacts on the cultural features the silent file seeks to protect.

In general, opportunities for settlement expansion are most likely to be limited by:

- Coastal erosion restricting access along coastal roads (eg Takamatua Bay Road).
- No reticulated wastewater disposal.
- State Highway 75 that cuts between the coastal and valley Small Settlements zones, reducing connectivity across the settlement.
- The need for improved coastal recreation facilities.

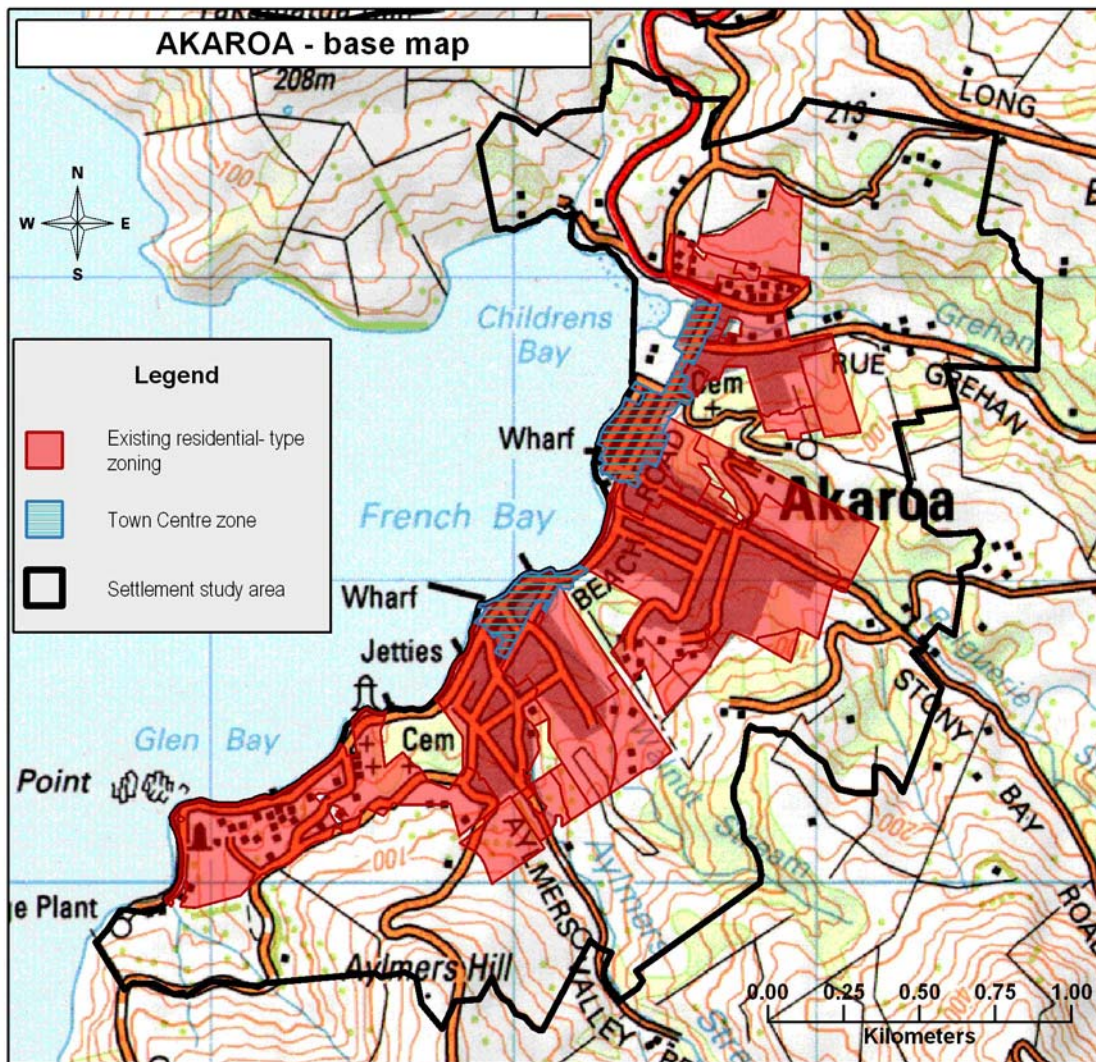
Any growth will also require further studies into the capacity of the water supply source and network due to there being little storage in the network, and on-site water storage not always having been provided in the older subdivisions.

## 5.7 Akaroa

### Settlement /community characteristics:

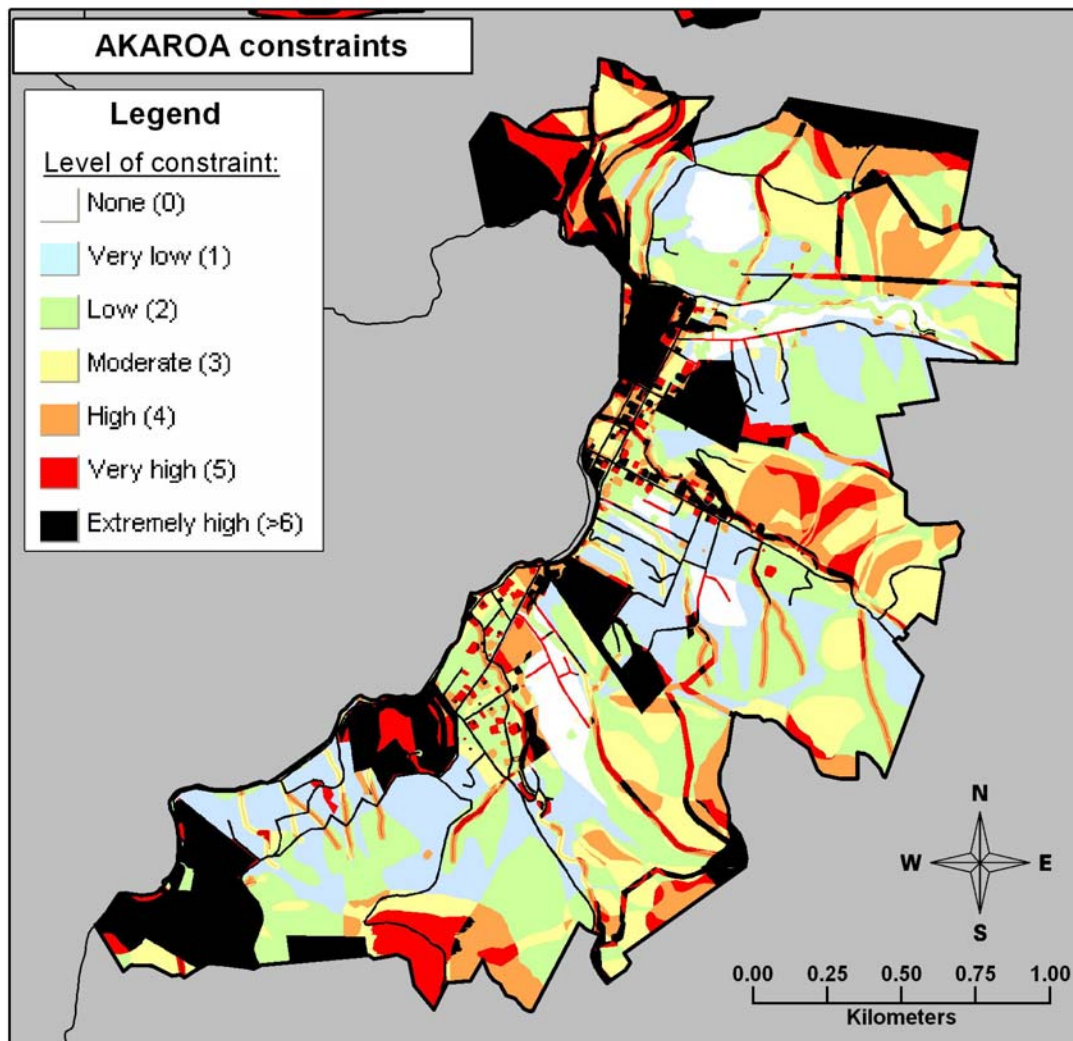
Vacant land assessment	12.9 ha (Residential zone); 27.39 ha (Hill Slopes zone); 0.58 ha (Residential Conservation zone). These figures include the Residential zone at Takapuneke, which has now been vested as a Reserve.
Population/household estimate	Usually resident population 2001: 650-690 people. 2006 census: 699 people or 306 households.
Commercial activities	Akaroa is the largest commercial and servicing centre (for both residents and visitors) in the harbour basin as well as being the only settlement with zoning for business activity (the Town Centre zone).
Community / visitor facilities	Akaroa has a number of community and visitor facilities and services, including an Area School, library, service centre, churches, police and fire service, theatre, Marae, health centre and hospital, various community groups, recreation ground, boat storage and a number of wharves, jetties and slipways. Akaroa also has a good swimming beach, with fair (but improving) water quality.
Access and roading	The settlement is located at the end of SH 75. Historic streets are narrow and can be very busy during peak periods, particularly for tourists and other visitors. Akaroa, as with the other settlements along SH 75, can be accessed by bus and shuttle services from Christchurch.
Wastewater disposal	The reticulated wastewater system has little spare capacity and currently discharges into the harbour. The treatment plant is old and has had problems with stormwater infiltration overloading the treatment processes. The Akaroa Water study is looking at alternative treatment and disposal options, as the extension to the discharge consent expires in 2012.
Water supply	<ul style="list-style-type: none"> <li>Water is sourced primarily from streams, with a very small groundwater supply. Low flows during summer mean that water restrictions are required during peak periods.</li> <li>The Akaroa Water Strategy currently being prepared looks at (amongst other things) alternative water sources and wastewater reuse.</li> <li>Water pressure decreases with elevation.</li> </ul>
Broadband availability	Yes
Real estate demand	<ul style="list-style-type: none"> <li>The majority of property transactions that occur in the harbour basin are in Akaroa, and long-term growth in the harbour basin is expected to be focussed here.</li> <li>Housing growth is estimated at 10 houses per year, with an estimated capacity for 339 sections on both vacant and/or large sections with potential for subdivision (although this includes deferred zones and many sections may not be available for development for one reason or another).</li> <li>The historic character of the settlement is important in influencing real estate demand and community/visitor expectations.</li> </ul>
Business land assessment	<ul style="list-style-type: none"> <li>It is desirable to locate harbour basin business activity within, or in close proximity, to the Akaroa Town Centre, due to the existing retail and accommodation activity and associated services and businesses located there.</li> <li>Less than half the Town Centre zone is utilised for business activity, with recreational, residential and community uses absorbing 53% of land available in this zone.</li> <li>Business growth in Akaroa is limited by a number of factors, including: <ul style="list-style-type: none"> <li>The division of the Town Centre into two nodes, the integration of which would be extremely difficult due to the residential activity in between;</li> <li>high property values for residential properties (which means that these properties are unlikely to convert to a commercial use); and</li> <li>heritage restrictions limiting the intensification of existing commercial activity.</li> </ul> </li> <li>It is predicted that a further 0.7ha and 2.33ha of land will be required within the harbour basin for commercial and accommodation activities respectively. Most of this needing to be located within Akaroa.</li> </ul>
Coastal erosion concerns	An estimated 2-8m of shoreline retreat is estimated over the next 50 years, due to sea-level rise. This is likely to affect coastal roads, where a number of coastal protection structures are currently showing signs of failure.

Base map\*:



\*Topomap sourced from Land Information New Zealand Topographic Map N36 and N37 (Akaroa). Crown Copyright Reserved.

## Constraints map:



Akaroa is, in general, composed primarily of areas of mostly low or very low constraint, with a number of very high or extremely high (black) constraints in certain locations. Most of the extremely high constraints are due to reserves (Takapuneke, Green Point, Akaroa Cemetery, Garden of Tane, Stanley Park, L'Aube Hill reserve and the Recreation Ground).

Heritage constraints (eg the Akaroa Historic Area, historic buildings and sites, and the Residential Conservation and Town Centre zones) have contributed to areas of low – high constraint in central Akaroa.

Areas of 'no' constraint to 'low' constraint appear to be concentrated in valley areas, on gentle slopes and on the crest of ridgelines. Slope instability is a limiting factor on the higher slopes.

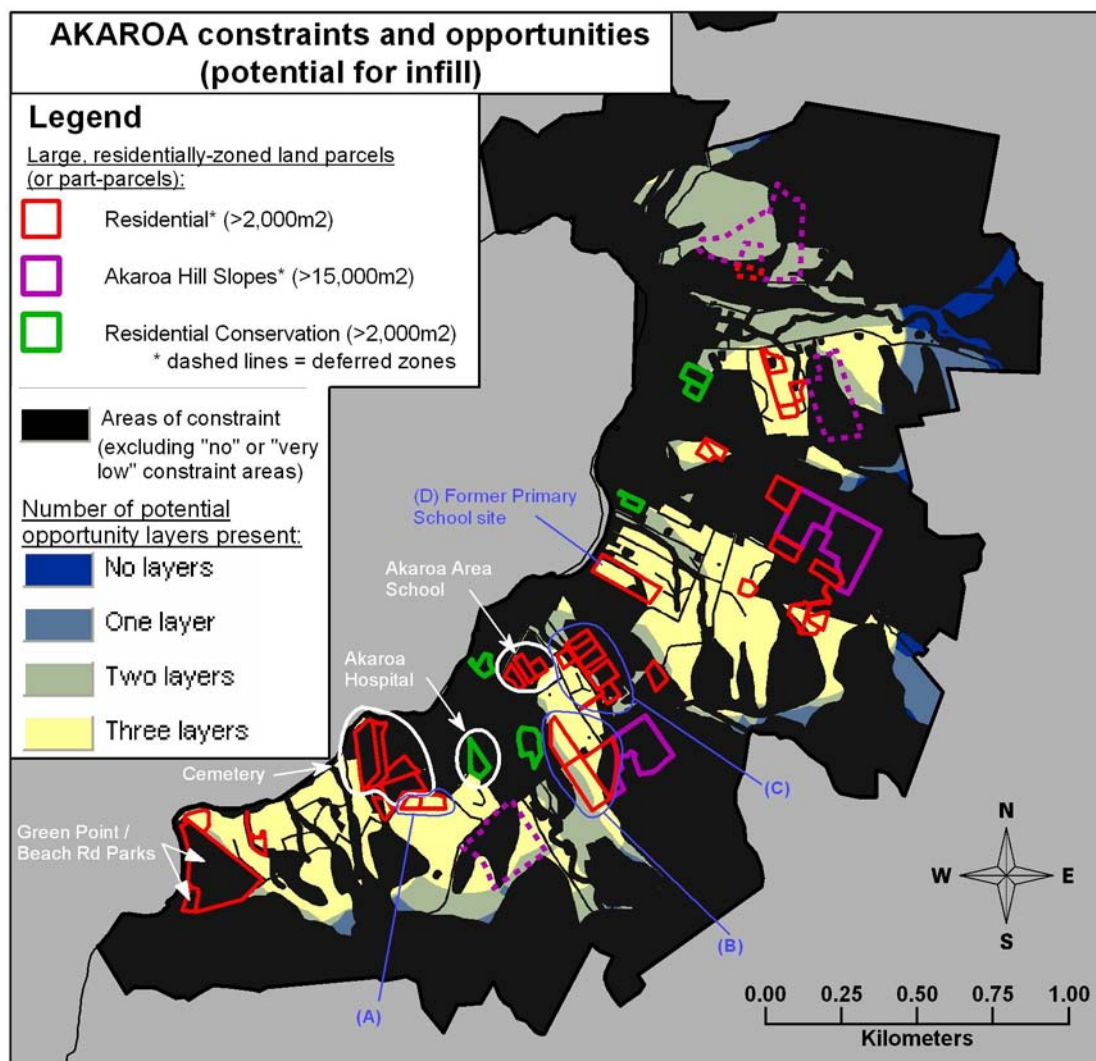
### Summary of opportunities:

Most of the township has a northerly-facing aspect. Opportunities for Akaroa also include a high demand for residential activity, particularly for the holiday home market for whom good access to cafes and recreational activities is important. Businesses also provide employment opportunities for residents.

Although areas within 250m of a wastewater and/or water supply have been identified as potential opportunity areas, the ability of the wastewater plant and water supply to service these areas is limited for a number of reasons including: limited water supply sources, wastewater treatment plant inefficiencies, and difficulties in providing reticulated services in certain (eg higher elevation) sites.



## Potential for infill:



### Residential Conservation zone

The map above shows very little potential for infill in Residential Conservation zones near the Town Centre. Infill development in these areas, without suitable urban design or heritage controls, could also have an adverse impact on the heritage character of the settlement.

### Residential zone

Many of the large, Residentially-zoned sections are significantly constrained by their existing use (Green Point, the Cemetery and the School being examples of existing non-residential land use activities within Residential zones).

Of the sites that are able to be developed, those that show the best potential for infill are:

- two sites uphill of Onuku Road (Area 'A' on map above - approximately 0.58 ha in total);
- three large sites at the end of Selwyn Street (Area 'B' on map above - approx. 3.2 ha in total); and
- a number of smaller sites adjacent to Rue Noyer, although steepness may be an issue here (Area 'C' on map above - 5 sections between 2,300 and 5,000 m<sup>2</sup>).

Plans to develop another large site, the former Primary School, (Area 'D' on the map above) are underway.

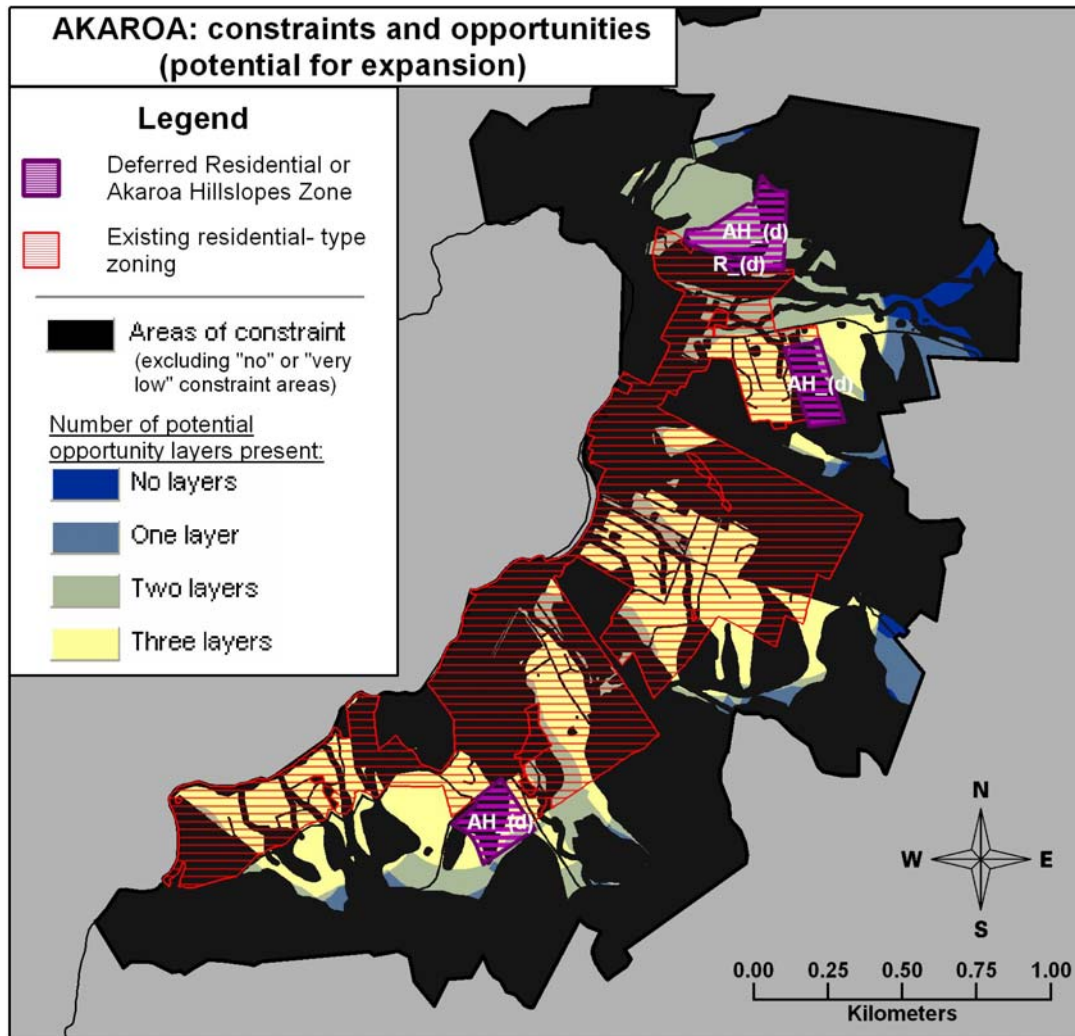
Although the map above shows a number of sites with potential for infill, the Simes Real Estate report suggests that, as a general observation, many of the larger sections still available to be developed have some constraints (eg being very steep, shaded or lacking views). This is also reflected in the constraints mapping. An analysis of the constraints map in relation to the large residentially-zoned sections shows that heritage buildings, the location of waterways relative to site boundaries and slope instability are also factors that would make some sites difficult (if not impossible) to subdivide further.

### Akaroa Hill Slopes zone

The minimum section size in the Akaroa Hill Slopes zone is 5,000m<sup>2</sup>. The larger minimum section size (compared to residential zones) implies that constraints such as waterways and slope instability are not so much of an issue for subdivision in this zone as it would be in the Residential zone, and as such higher levels of constraint can be tolerated here.

In total, there is about 19 ha of Hill Slopes zone (including 12 ha of deferred zoning) that could be subdivided further, assuming that these areas can be serviced by a water supply. A subdivision consent application has recently been received by the Council to subdivide the deferred Akaroa Hill Slopes zone to the far north of the settlement.

### Potential for expansion:



In general, areas that seem more suitable for settlement growth are located on the higher slopes and ridgelines of the settlement (eg uphill from Onuku Road) or upper valley areas (eg Grehan Valley). The higher slope areas tend to be more prone to land instability hazards and any investigation into the suitability of these areas for residential development would need to take into account potential impacts on the landscape and the ability to service these sites. Care must be taken to ensure that Akaroa's picturesque appeal is not eroded by inappropriate development on areas of local landscape value.

Development up the valleys would have a lesser visual impact, however the lack of views and the distance from the Town Centre means there is likely to be less demand for holiday real estate in these areas (and hence may be more suited for affordable housing or rural-residential type developments).

The overall potential for settlement growth is restricted by the ability of reticulated wastewater and water supply to service this growth.

## 6 Conclusions

The sieve mapping analysis has identified areas of greater constraint that are best avoided or would require significant mitigation before any development could occur. There are different levels of constraints, with some being 'no-go' areas (eg areas of 'extremely high' constraint), and other areas needing careful management before any future management could occur (eg areas with low – moderate constraint).

Taking into account both spatial and non-spatial constraints and opportunities, there are clearly some areas, and indeed some settlements, that show greater potential for long-term growth which would need to be managed appropriately. A summary of the overall potential for the consolidation of each settlement is outlined in the table below:

Settlement	Potential for infill	Potential for expansion/connecting*
<i>Wainui</i>	High	High
<i>Tikao Bay</i>	None	Very low
<i>French Farm</i>	None	Low
<i>Barrys Bay</i>	None	Low
<i>Duvauchelle</i>	High	Moderate
<i>Robinsons Bay</i>	High	Low
<i>Takamatua</i>	Very low	Moderate
<i>Akaroa</i>	Moderate	Low

\*Considers both the potential for the expansion of existing urban zones, as well as the potential for such expansion to connect existing pockets of urban-type zoning.

### 6.1 Areas with the most/least potential for infill or expansion

Duvauchelle, Robinsons Bay and Wainui have the highest potential for development within existing residential zones (ie infill development).

Most settlements, with the possible exception of Tikao Bay, could tolerate some very minor settlement expansion, provided that this occurs (a) adjacent to existing Residential or Small Settlements zoning; and (b) in areas where there are few (or no) constraints. It is preferable, however, that any future expansion would lead to a more consolidated urban form; 'linking up' existing areas of residential zoning where possible. For this reason, Wainui displays the best potential for consolidation, followed by Duvauchelle and Takamatua. Detailed planning investigations would be needed for these settlements prior to any decisions on whether growth should occur, its extent and its timing.

Akaroa shows moderate potential for infill, although possible expansion areas include the upper slopes/ridgelines or valley areas. Further planning studies would be necessary to determine the impact of rezoning and development of any potential expansions areas on land instability, visual amenity, and the historic and natural character of the Akaroa area.

Tikao Bay, French Farm, Barrys Bay and Robinsons Bay show the *least* potential for expansion and consolidation. This is primarily due to the already 'scattered' or significantly constrained settlement pattern and a general lack of reticulated services.

### 6.2 Areas with potential for rural-residential development

Some of the settlement study areas include land which may have greater long-term suitability for rural-residential development. This is because: (a) there is limited access to reticulated services; (b) there are significant areas of 'no'-low' constraint; and (c) there are particular opportunities present (eg sunny slopes and areas with lesser landscape value). The settlements where rural-residential activity would be most suitable are French Farm, the upper valleys of Duvauchelle and Robinsons Bay. Further investigation of these areas would require an expansion of the study areas beyond those analysed in this report. Any further analysis of areas with potential for this type of development must take into account (amongst other things):

- areas with lesser landscape value;
- slope instability;
- the availability of potable water;
- the ability to dispose of wastewater on-site;

- soil versatility;
- areas that receive moderate to high amounts of sunlight; and
- reverse sensitivity (compatibility with existing rural activities)

### **6.3 Community preferences**

This report has not taken into account the preferences of landowners and residents of harbour basin settlements, in terms of where and how future growth should be absorbed. Further information gathering and detailed planning will be necessary for any investigations into areas where the management of settlement growth is deemed a priority.

## Bibliography

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- Banks Peninsula District Council, 'Proposed Banks Peninsula District Plan', 1997 (last updated January 2008).
- Boffa Miskell, 'Banks Peninsula Landscape Study: Final Report', May 2007
- Christchurch City Council, 'Akaroa Harbour Basin Settlements Study: Demographic Research Report', Sept 2007.
- Christchurch City Council, 'Akaroa Harbour Basin Settlements Study: Identifying the Issues', Oct 2007
- Christchurch City Council, 'Akaroa Harbour Basin Settlements Study: Statement of Issues', June 2008
- Christchurch City Council, 'Akaroa Water Management Strategy, Part 4: Water Supply and Treatment Options' (prepared by MWH New Zealand Ltd), Feb 2007.
- DTec Consulting Ltd, 'Akaroa Harbour Basin Settlements Study – Coastal Erosion and Inundation Project', May 2008.
- Environment Canterbury, 'Proposed Natural Resources Regional Plan'
- Environment Canterbury, 'Regional Coastal Environment Plan for the Canterbury Region', 2005
- Newsome, P F J; Wilde, R H; and Willoughby, E J (Landcare Research New Zealand Ltd), 'Land resource information system spatial data layers. Volume 1: 'Label Format'', 2000
- Property Economics, 'Akaroa Basin Business Land Assessment', 2008
- Response Planning, 'Serviced areas: Population and Visitor Projections', Report for BPDC, 2005.
- Simes Limited, 'Akaroa Harbour Basin Settlements Study Research Project: Real Estate Market', February 2008
- Tonkin and Taylor Ltd, 'Slope hazard susceptibility assessment: Akaroa Harbour Settlements', March 2008
- Tonkin and Taylor, 'Preliminary Assessment of Historical Flooding: Akaroa Harbour Settlements', prepared for Christchurch City Council, May 2008.
- Thomson, Suky (Peninsula Projects), 'Historical Flooding Research and Mapping Project', prepared for Strategy and Planning Group, Christchurch City Council, February 2008.
- Transit New Zealand, 'Policy Planning Manual – for integrated planning & development of State Highways' (version 1) Aug 2007
- Wilson, H. D 'Banks Ecological Region, survey report for the New Zealand Protected Natural Areas Programme', produced for Department of Conservation, 1992

### **Relevant legislation:**

Building Act 2004  
Historic Places Act 1993  
Local Government Act 1974  
Local Government Act 2002  
Resource Management Act 1991  
Reserves Act 1977



# Appendices





## Appendix A: GIS workflow (preparation of data)

A general outline of the GIS analysis process is presented in Section 4 of this report. Further information on the source and preparation of data prior to the sieve analysis is outlined below.

All the data used in the sieve analysis originated as a point, line or polygon feature. In order to undertake the analysis, each layer had to be prepared as a Grid layer with a binary data format. That is, cells where the constraint or opportunity were present = '1', cells where the constraint or opportunity were not present = '0'.

The tables below describe the source of each data layer, and how the data was prepared for sieve analysis both prior to and after conversion into the raster or 'Grid' format.

### General layers created or used throughout sieve analysis:

Layer	Original data source	Preparation of data (prior to conversion to Grid layer)	Preparation of data (after conversion to Grid layer)
Settlement study area	Layer created during scoping stage of Settlements Study	n/a	Recode to binary data format, where '1' = within settlement study area.
Digital Surface Model (DSM)	2m and 20m contour lines.	<ul style="list-style-type: none"> <li>20m contour lines removed where 2m contour data was present (due to higher degree of accuracy)</li> <li>Contour data clipped to settlement study areas with an additional 10m buffer.</li> </ul>	<ul style="list-style-type: none"> <li>Number of contour data cells reduced by randomly selecting 200,000 cells</li> <li>'Spline' surface interpolation.</li> <li>Smoothing of Spline layer (using average value, 9 cell diameter window)</li> </ul>
Insolation (amount of sunlight)	DSM (above)	<ul style="list-style-type: none"> <li>In Grid and using the DSM as the surface layer, insolation tool was used to estimate the amount of sunlight that would reach each cell at hourly intervals between 10 am and 4 pm on the shortest day of the year (22 June) in the New Zealand time zone. Insolation was measured in Watts per m<sup>2</sup></li> <li>Hourly insolation layers were then added up to get an idea of total insolation over the day for each cell in the Grid.</li> </ul>	

### Preparation of constraints layers

Constraint layer	Original data source	Preparation of data (prior to conversion to Grid layer)	Preparation of data (after conversion to Grid layer)
Land instability zones (intermediate, locally significant, significant)	Tonkin and Taylor (2008) " <i>Slope Hazard Susceptibility Assessment</i> " technical report	n/a	Recode land instability areas to create three separated binary GRID layers for each hazard zone
Bedrock landslide	As above	n/a	Recode to binary data format
'Possible' liquefaction	As above	n/a	Recode to binary data format
Areas identified as having flooded in the past	Tonkin and Taylor (2008) " <i>Historic flooding research and assessment</i> " technical report	n/a	Recode to binary data format
2m tsunami	DTec Consulting Ltd (2008) " <i>Coastal erosion and inundation project</i> " technical report	Convert 'extent of inundation' poly-lines to a polygon format which extends between the landward limit of inundation and the coast	Recode to binary data format
4m tsunami	As above	As above	Recode to binary data format
Storm surge inundation	As above	As above	Recode to binary data format
Watercourse	CCC GIS database	n/a	Recode to binary data format
10m setback from watercourse	As above	Buffer watercourse by 10m.	Combine with Watercourse layer and recode to remove overlap between the watercourse and its 10m setback.
Protected trees	District Plan maps	Buffer 4m to estimate drip-line	Recode to binary data format
Landscape: CNCL / ONL	Boffa Miskell " <i>Banks Peninsula Landscape Study</i> ", incorporating amendments required by Environment Court processes	n/a	Recode to binary data format

Constraint layer	Original data source	Preparation of data (prior to conversion to Grid layer)	Preparation of data (after conversion to a Grid layer)
Landscape: areas 20m vertical below prominent ridgelines	As above – for ridgeline layers. DSM used as surface model	'Spatial intersection' to clip the portions of the prominent ridgelines that lie within the settlement study areas	<ul style="list-style-type: none"> <li>• Recode ridgelines to binary data format</li> <li>• Multiply ridgelines layer by DSM layer to obtain spot heights along ridgeline. Then subtract 20m from this layer (to model the 20m height difference).</li> <li>• Buffer the new ridgeline minus 20m layer by 400m, ensuring that cells at right-angles to the ridgeline carry the same height value as the input ridgeline layer.</li> <li>• Subtract the ridgeline buffer layer from the DSM to identify areas between 0 and 20m below the ridgeline</li> <li>• Recode result to binary data format.</li> <li>• Final layer checked against original ridgeline and contour data.</li> </ul>
Landscape: RAL 40m setback from MHWS	<ul style="list-style-type: none"> <li>• District Plan zoning layer,</li> <li>• Boffa Miskell ONL and CNCL layers, and</li> <li>• MHWS/coast layer</li> </ul>	<p><i>Defining the RAL:</i></p> <ul style="list-style-type: none"> <li>• Select the rural zone from the zoning layer;</li> <li>• Use spatial difference query to subtract ONLs and CNCLs;</li> </ul> <p><i>Identifying 40m setback from coast:</i></p> <ul style="list-style-type: none"> <li>• Select areas of coastline that adjoin or cross the RAL</li> <li>• Buffer 40m</li> <li>• Clip by settlement study area to exclude parts of buffer that extend into the harbour.</li> </ul>	Recode to binary data format.
Landscape: areas above 160m contour	Contour data	Select 160m contour	Use Grid editing tools to 'fill-in' areas above the 160m contour. Recode to binary data format.
Reserve or park	CCC parks GIS database and DoC estate layer	DoC estate layer against CCC parks layer to ensure that both CCC and DoC reserves accounted for.	Recode to binary data format.
Recommended Areas of Protection (RAPs)	District Plan (prior to the RAPs being removed on appeal)	n/a	Recode to binary data format
QEII covenant	QEII covenant layer (last updated mid 2007)	n/a	Recode to binary data format
Land Use Capability (class 3)	Land Use Capability layer (Landcare Research)	Select areas where LUC = 3w1	Recode to binary data format
Areas that receive the least sun	Insolation layer	<ul style="list-style-type: none"> <li>• Using statistics tool, the range of the lowest quartile (of insolation values across the study areas) was found (0 – 1095 W/m<sup>2</sup>).</li> <li>• Using the lowest quartile areas as a guide, contiguous areas that received the least sun were digitised as a polygon layer.</li> <li>• The final digitised layer was converted back into a grid format and recoded as a binary layer.</li> </ul>	
Sacred sites (silent files)	As per District Plan mapping	n/a	Recode to binary data format
Waahi Tapu area: Takapuneke	As per legal description of sites identified by HPT as part of Waahi Tapu area	Select land parcels affected by Waahi Tapu area	Recode to binary data format
Archaeological sites	As per District Plan mapping	Sites buffered 100m	Recode to binary data format
HPT Category I and II objects, buildings and sites	As per District Plan mapping and current HPT listings database	<p>Sites buffered 10m and:</p> <ul style="list-style-type: none"> <li>• If within a land parcel, clipped to the extent of this parcel</li> <li>• If located within paper road or the coast, clipped to exclude overlap with neighbouring parcels</li> </ul>	Recode to create two separate binary GRID layers for each HPT category listing (I or II)
Notable objects, buildings and sites	As above	As above	Recode to binary data format
Akaroa Historic Area	As per District Plan mapping.	n/a	Recode to binary data format. Combine with, and subtract from heritage zoning provisions (to exclude areas that are both AHA and RC/TC zones)

Constraint layer	Original data source	Preparation of data (prior to conversion to Grid layer)	Preparation of data (after conversion to a Grid layer)
Akaroa heritage zoning provisions	Zoning layers (as per District Plan)	Select Town Centre or Residential Conservation zones	Recode to binary data format
SH 75	CCC GIS street centreline layer	Select SH then buffer centreline by 4m to estimate the Highway edge	Recode to binary data format
SH 75 (Environmental Buffer Area – EBA)	As above	Buffer SH 75 layer (see above) by 20m	Recode to binary data format. Check that EBA area does not overlap with SH 75 or RNEA area below
SH 75 (Road Noise Effects Area - RNEA)	As above	Buffer SH 75 (EBA) by 60m (see above)	Recode to binary data format. Check that RNEA area does not overlap with SH75 or EBA area.
Local roads	As above	Buffer 4m to estimate extent of local road	Recode to binary data format. Check that local road layer does not overlap with SH 75.
Unformed paper roads	Land parcels layer (to delineate areas of road reserve) and CCC GIS street centreline layer	n/a	<ul style="list-style-type: none"> <li>• Recode parcels layer to binary, where 1 = road reserve</li> <li>• Overlay road reserve layer with GIS street centreline layer</li> <li>• Delete areas where road reserve overlaps a formed road.</li> </ul>
Community water supply protection zones	Well locations, CCC GIS database	Buffer or otherwise delineate well protection zones based on provisions in NRRP	Recode to binary data format
Wastewater treatment plant setbacks	Location of WWTP, CCC GIS database	300m buffer of WWTPs	Recode to binary data format
Designations	CCC GIS database	n/a	Recode to binary data format.

### Preparation of opportunity layers

Opportunity layer	Original data source	Preparation of data (prior to conversion to Grid layer)	Preparation of data (after conversion to Grid layer)
Areas of lesser landscape value	Boffa Miskell, <i>Banks Peninsula Landscape Study</i> , 2007	n/a	Recode to binary data format
Areas within 250m of wastewater main pipe	CCC GIS database - wastewater infrastructure	Select wastewater main and buffer 250m. Buffer areas clipped to Settlement Study areas	Recode to binary data format.
Areas within 250m of water supply main pipe	CCC GIS database - water supply infrastructure	Select water supply main and buffer 250m. Buffer areas clipped to Settlement Study areas	Recode to binary data format.
Areas that receive the most sun	Insolation layer	<ul style="list-style-type: none"> <li>• Using statistics tool, the range of the highest quartile (of insolation values across the study areas) was found (&gt;1783 W/m<sup>2</sup>).</li> <li>• Using areas that fall with the highest quartile for sun exposure as a guide, contiguous areas that received the least sun were digitised as a polygon layer.</li> <li>• The final digitised layer was converted back into a grid format and recoded as a binary layer.</li> </ul>	



## Appendix B: Constraints assessment and scoring

The tables in this appendix set out how the scores for each constraint layer were reached, taking into account (on balance) the following factors:

- a) the degree to which the constraint is legally recognised and enforceable, for example in the Resource Management Act 1991, District Plan, Building Act 2004 or in other relevant legislation;
- b) the degree to which the constraint, including any variation within the constraint layer, can be accurately identified and researched and mapped;
- c) the degree to which the constraint is:
  - (i) likely to require extensive and/or costly mitigation measures; or
  - (ii) is necessary to protect important public infrastructure.

For (a) and (b) above, a 'ranking' has been assigned to indicate the degree of legal constraint or accuracy in relation to these factors:

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism)</b>	
	<i>For example</i>
<b>Very low</b>	- constraint is an assessment matter only in District Plan; and/or - constraint is based on a study/map that has no legal weighting but provides information of interest from a strategic planning perspective; and/or - constraint is identified as an 'other matter' (s 7) in the RMA as a matter to which particular regard should be had for
<b>Low</b>	- constraint involves controlled or restricted discretionary activities; and/or - constraint is recognised as important/valued resource in a non-RMA document or other legislation (eg Historic Places Act 1993); and/or - constraint is recognised as matter of national importance (s. 6) of the RMA.
<b>Moderate (Mod.)</b>	- constraint involves a discretionary activity; and/or - legal weighting of constraint likely to increase in the near future (eg subject to plan change)
<b>High</b>	- constraint involves a non-complying activity in a District or Regional Plan; and/or - significant legal protection provided under non-RMA instrument (eg covenant)
<b>Very high</b>	- subject to a range of significant legislative constraints (eg RMA and Local Government Act); and/or - constraint involves very significant building and/or subdivision restrictions in District Plan.

<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped</b>	
	<i>For example:</i>
<b>Very poor</b>	- information on constraint is significantly out-of-date; and/or - constraint is inaccurately mapped, in places
<b>Poor</b>	- constraint mapped, but background information is lacking; and/or - significant estimations made as to the extent of the constraint
<b>Fair</b>	- some components of the constraint must be estimated (eg drip-lines, road edges) - mapping carried out at moderate level of scale (eg 1:50,000), some error possible - methodology used to calculate extent of constraint carries one or more sources of error
<b>Good</b>	- constraint clearly mapped; some variation within constraint layer is likely; and/or - some minor mapping errors exist
<b>Very good</b>	- constraint clearly mapped; little variation exists within constraint layer

### Important note:

An 'on-balance' approach is used to assign a final score to the constraints layers. For example, although a layer might initially be considered a high level of constraint due to the degree to which it is protected in the District Plan, if the constraint is poorly researched, mapped, or there is uncertainty about its location and/or distribution, then a lower (eg low-moderate) level of constraint is warranted. The overall score reflects a number of factors, and is based on the current information available. Scores are also relative, so it is possible to compare between different constraint layers.

The tables in this appendix are organised by constraint type:

- B.1 Natural hazard constraints
- B.2 Natural environment constraints
- B.3 Cultural environment constraints
- B.4 Physical environment constraints
- B.5 Other land use constraints

## B.1 Natural hazard constraints

### B.1.1 Coastal Hazard: Storm surge inundation and tsunami hazard (incorporating sea-level rise)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low</b>	<p><u>RMA and District Plan:</u></p> <ul style="list-style-type: none"> <li>• S. 7(i) of the RMA requires Councils to have particular regard to the 'effects of climate change' in relation to the use, development and protection of natural and physical resources</li> <li>• S. 106 of the RMA allows Councils to refuse subdivision consent where the land is likely to be subject to erosion, subsidence, slippage or inundation from any source.</li> <li>• Coastal erosion and inundation (eg tsunami) identified as an issue in the District Plan, but no specific rules apply.</li> </ul> <p><u>Building Act 2004:</u> This Act places restrictions (eg building consents and conditions) on the construction of buildings on land subject to natural hazards.</p>
	<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>
<b>Fair</b>	<p>Areas likely to be affected by coastal erosion and inundation were identified in a technical report completed by DTec Ltd (for the Settlements Study), in 2008:</p> <ul style="list-style-type: none"> <li>- Storm surge inundation was assumed to occur where predicted extreme water levels would exceed the elevation of the coastal protection works or the beach/hinterland boundary.</li> <li>- Uncertainties and errors for storm surge inundation projections can be attributed to the use of estimates for maximum water levels, wave heights, and wave run-up elevations. There is also limited elevation data for the beach and near-shore; elevation errors for the height of coastal protection structures may be as high as +/- 0.2m.</li> <li>- Tsunami hazard areas have been estimated using a 'bath-type' model, which does not account for surface roughness or ground slope, and is therefore likely to have over-estimated inundation areas in areas of low slope.</li> </ul> <p>The technical report takes into account sea-level rise based on climate change estimates. Some uncertainty exists about the rates and magnitude of future sea-level rise.</p>
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
<p>Constructing/maintaining new coastal protection structures to protect against storm surge inundation (and coastal erosion) can be expensive, depending on the degree of mitigation required. Avoiding development in areas prone to coastal hazards will reduce or remove the need for mitigation measures. It can be costly to relocate coastal infrastructure that is affected by coastal erosion or inundation (for example roads), especially where there is increased demand on these roads due to inappropriate or poorly planned development.</p>	
<b>OVERALL ASSESSMENT OF CONSTRAINT</b>	
<p>The storm surge inundation, 2m and 4m tsunami layers have <i>each</i> been assigned a constraint score of <b>very low</b>, given the indicative nature of the coastal erosion/inundation assessment and that there is currently little ability in the legislative and/or District/Regional planning context to prevent residential development from occurring in these areas due to coastal hazard risk.</p> <p>*Where two or more layers of coastal hazard exist in the same area, the subsequent total coastal hazard constraint increases to the sum of these constraints (eg 2 coastal hazard constraints = 'low' overall constraint; 3 coastal hazard constraints = 'moderate' overall constraint).</p>	

### B.1.2 Historical flooding

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low</b>	<p><u>RMA / District Plan</u></p> <ul style="list-style-type: none"> <li>• S. 31(b) of the RMA requires Council to control the use of land for the avoidance of <i>natural hazards</i> through District Plan and resource consents (eg assessment matters for subdivision consent).</li> <li>• S. 106 of RMA allows Council to refuse subdivision consent where the land is likely to be subject to erosion, subsidence, slippage, inundation from any source.</li> </ul> <p><u>Building Act 2004:</u> Places restrictions (eg building consents and conditions) on the construction of buildings on land subject to natural hazards.</p>
	<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>
<b>Poor</b>	<p>A research report on historical flooding (with maps), based on residents' memories and news articles in the Akaroa Mail, was undertaken by Peninsula Projects to identify areas that have flooded in the past. Where there was sufficient information to attempt to define areas of inundation, these were mapped and subsequently converted to a GIS format (by Tonkin and Taylor Ltd).</p> <p>Because the mapping relies on memories and news articles, there is likely to be a number of errors in this information. For example, only areas where flooding has been observed in the past have been recorded, or residents might have incorrectly recalled the extent of the flooding.</p> <p>In addition, some of the areas identified in Peninsula Projects report may have been mitigated against flooding (eg removal of channel obstructions) and unlikely to flood again.</p>
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
<p>Mitigation costs for flooding will vary, depending on likely cause of flooding (eg channel obstruction vs. lower catchment ponding areas). There may also be a cost to Council for mitigating or providing/upgrading infrastructure (eg removing bridge obstructions).</p>	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
<p>While a useful insight into past flooding events, the research identifying areas where flooding has occurred in the past provides only an initial indication of where flooding is likely to occur in the future. Hence, a <b>'very low'</b> level of constraint is applied to any areas where flooding has been recorded in the past (on at least one occasion).</p>	

### B.1.3 Land instability (slope hazard and liquefaction)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low – Mod.</b>	<p><u>RMA / District Plan</u></p> <ul style="list-style-type: none"> <li>• S. 31(b) of the RMA requires Council to control the use of land for the avoidance of <i>natural hazards</i> through District Plan and resource consents (eg assessment matters for subdivision consent).</li> <li>• S. 106 of RMA allows Council to refuse subdivision consent where the land is likely to be subject to erosion, subsidence, or slippage from any source.</li> <li>• Rules in District Plan restrict subdivision within identified instability hazard areas (is a discretionary activity, but only for instability areas identified on planning maps). It is of note that the land instability information gathered for this project is of higher quality than the current District Plan instability hazard areas and therefore the existing provisions have not be included in the sieve mapping.</li> </ul> <p><u>Building Act 2004</u> The Building Act places restrictions (eg building consents and conditions) on the construction of buildings on land subject to natural hazards.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Fair - good</b>	<p>Complete technical report recently completed by Tonkin &amp; Taylor (2008) at 1:10,000 scale. Accuracy of hazard and liquefaction zones estimated +/- 30m. Three different types of slope instability identified:</p> <ol style="list-style-type: none"> <li>1. <b>slope hazard</b> (four categories indicating differing degrees of slope hazard:             <ol style="list-style-type: none"> <li>a. <u>minor-negligible</u> (generally valley floors)</li> <li>b. <u>intermediate</u> (general slopes)</li> <li>c. <u>locally significant</u> (primarily active gullies)</li> <li>d. <u>significant</u> (existing large loess/bedrock landslides)</li> </ol> </li> <li>2. <b>bedrock landslides</b> - ancient bedrock failures, role in slope hazard zoning uncertain. These features do not contribute to the hazard zoning, but add complexity to the potential for slope movement and require specific consideration for new development.</li> <li>3. <b>possible liquefaction</b> – assessment of liquefaction potential is based on expert knowledge and judgement, in the absence of any useful site information.</li> </ol> <p>The consultant report indicates that the hazard zoning should be used only as a guide to developing consenting ‘rules’ that require more rigorous investigation to be carried out for higher susceptibility zones.</p>
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
<p>In general, a higher susceptibility zone indicates relatively greater difficulty (and therefore cost) for development, for example:</p> <ul style="list-style-type: none"> <li>• <i>Private</i>: costs to investigate and engineer hazard mitigation structures</li> <li>• <i>Council</i>: costs to provide and maintain infrastructure over or through hazard prone land.</li> </ul>	
<b>OVERALL ASSESSMENT OF CONSTRAINT</b>	
<p><u>Slope hazard</u></p> <ul style="list-style-type: none"> <li>- intermediate: <b>very low constraint</b></li> <li>- locally significant: <b>low constraint</b></li> <li>- significant: <b>moderate constraint</b></li> </ul> <p>The constraints applied to the hazard zones recognise the relative degree of investigation and mitigation required, together with the risks to life and property of landslide activity, for each hazard zones.</p> <p>In addition to the slope hazard layer, additional constraints are applied for the following features:</p> <ul style="list-style-type: none"> <li>- <u>bedrock landslides</u> – <b>very low constraint</b></li> <li>- <u>possible liquefaction</u> – <b>very low constraint</b></li> </ul> <p><i>Note:</i> although hazard zone scores may seem low, the additional constraint layers above will increase the overall slope hazard score (in some areas) by one degree. The highest possible slope hazard constraint is therefore ‘high’ where a ‘<i>significant</i>’ hazard zone overlays a ‘<i>bedrock landslide</i>’. An overall score of ‘very high’ is avoided due to data accuracy limitations and the consideration that with sufficient mitigation and stabilisation, all landslide hazard zones could be developed to some degree.</p>	

## B.2 Natural environment constraints

### B.2.1 Waterways

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
High	<u>RMA/District Plan:</u>
	<ul style="list-style-type: none"> <li>Restrictions in S.13 of the RMA prevent certain activities (eg building a new structure) on the beds of rivers<sup>19</sup>.</li> <li>In the District Plan, subdivision policies and rules regarding building platforms and the shape, size and orientation of sites make it unlikely that the Council would grant consent for a subdivision that allowed development in the path of a waterway.</li> </ul> <p>Proposed Natural Resources Regional Plan (Variation 1): This Plan restricts the erection or placement of structures in, on, or over the bed of a river, particularly where this is likely to increase the potential for flooding or increase erosion of the river.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
Fair	Current waterway maps are generally of moderate quality, with some watercourses occasionally inaccurately located.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Mitigation measures will be required as per any resource consent conditions for activities that contravene the relevant rules in the District Plan.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Waterways impose a very significant land use constraint. However because of a number of mapping inaccuracies, it is not possible to apply anything more than a <b>moderate</b> constraint score to waterway layers.	

### B.2.2 Waterway setback (10m buffer)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
Low-mod.	<u>District Plan:</u> The erection of a building or structure in a Rural Zone within 10m of any stream or river is a discretionary activity. Esplanade reserves or Esplanade strips of 20m width adjacent to a waterway (average width 3m or greater) <i>may</i> be required as a condition on subdivision consent, if one or more of the criteria set out in the Plan are met.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
Poor-fair	<ul style="list-style-type: none"> <li>Current waterway maps are generally of moderate quality, with some watercourse occasionally inaccurately located.</li> <li>The degree of setback also varies depending on zoning and other natural attributes such as topography, making it difficult to assign a standard setback value.</li> </ul>
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Mitigation measures will be required as per resource consent conditions for activities that contravene the rules in the District Plan.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Setbacks, in most instances, are necessary to protect the riparian and other values of waterways. Due to mapping inaccuracies and the difficulty in assigning a standard setback distance, a 10m setback assigned to all waterways is accorded a <b>low</b> level of constraint.	

### B.2.3 Notable trees

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
Mod.	<u>District Plan:</u> Cutting, damaging, altering, destroying or partially destroying a scheduled tree, or undertaking certain activities <sup>20</sup> within the drip-line of a scheduled tree, is a discretionary activity.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
Fair - good	Scheduled trees have been accurately mapped, however the extent of the drip-line for each tree is unknown and must be estimated. A standard drip-line buffer of 4m (radius) from the point location of the tree has been assigned.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Mitigation measures will be required as per any resource consent conditions for activities that contravene the relevant rules in the District Plan	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
A <b>moderate</b> level of constraint is assigned to notable trees due to the discretionary nature of activities within the drip-line of these trees.	

### B.2.5 Covenants

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
High	<u>QEII National Trust:</u> A QEII covenant is a legally binding protection agreement which is registered on the title of the land and binds all subsequent landowners to the conditions of that covenant. The size, shape and terms of agreement of the covenant depend on what is being protected and the landowners' aspirations. Information on other covenanted areas (eg Banks Peninsula Conservation Trust) is currently not available for mapping.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
Fair - good	Layers showing QEII covenants were last updated mid-2007
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Any activity that is contrary to the terms of the covenant will be restricted. The degree of this restriction and the ability to overturn this restriction will depend on covenant's conditions and will require the agreement of all parties to the covenant.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
A <b>high</b> level of constraint is assigned to areas where a QEII covenant exists, due to the restrictions on land use activities that such a covenant are likely to create.	

<sup>19</sup> Such activities include: using, erecting, reconstructing, placing, altering, extending, removing, or demolishing any structure or part of any structure in, on, under, or over the bed of a river... in a manner that contravenes a rule in a regional plan or resource consent.

<sup>20</sup> These activities include: altering soil levels or water table by addition or excavation; storing materials, vehicles or machinery; discharging or dispersing any toxic substance or putting in place any weed control membrane; undertaking any excavation, construction work or activity.



## B.2.4 Reserves

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Very high</b>	<p><b>Reserves Act 1977:</b> Areas are provided and managed as reserves under this Act in order to protect a range of special features or values, including recreational, historical and community ones.</p> <p><b>District Plan:</b> Most reserves within the settlement study areas are also zoned as recreational or conservation reserve in the District Plan. Reserve zone rules place heavy restrictions on land use activities not associated with recreational or conservation activities.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Good</b>	Areas set aside as reserves are clearly identified. It is assumed that all reserves carry the same relative weight in terms of their community, heritage and/or conservation value.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Although possible, in order to use a reserve for any purpose other than as a reserve (eg residential) an applicant would, at the very least, need to seek a plan change or resource consent for non-compliance with the existing plan provisions.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
A <b>high</b> level of constraint is assigned to reserves due to the legal restrictions protecting reserves and the special values associated with these areas.	

## B.2.5 Covenants

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>High</b>	<p><b>QEII National Trust:</b> A QEII covenant is a legally binding protection agreement which is registered on the title of the land and binds all subsequent landowners to the conditions of that covenant. The size, shape and terms of agreement of the covenant depend on what is being protected and the landowners' aspirations. Information on other covenanted areas (eg Banks Peninsula Conservation Trust) is currently not available for mapping.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Fair - good</b>	Layers showing QEII covenants were last updated mid-2007
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Any activity that is contrary to the terms of the covenant will be restricted. The degree of this restriction and the ability to overturn this restriction will depend on covenant's conditions and will require the agreement of all parties to the covenant.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
A <b>high</b> level of constraint is assigned to areas where a QEII covenant exists, due to the restrictions on land use activities that such a covenant are likely to create.	

## B.2.6 Landscape value areas

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low-high (varies)</b>	<p><b>RMA/District Plan/Boffa Miskell Landscape report:</b></p> <ul style="list-style-type: none"> <li>• S. 6(b) of the RMA requires the Council to recognise and provide for the protection of natural features and landscapes from inappropriate subdivision, use and development as a matter of national importance.</li> <li>• Within a Coastal Natural Character Landscape (CNCL) or Outstanding Natural Landscape (ONL) the erection of a building or structure outside of an existing 'building cluster' is a non-complying activity.</li> <li>• Within the Rural Amenity Landscape (RAL)<sup>21</sup>, the erection of a building: <ul style="list-style-type: none"> <li>○ Within 40m of the MHWS</li> <li>○ Within 20m (vertical) of a prominent ridgeline, if beyond 100m of an existing building cluster</li> <li>○ Above the 160m contour (at a density of one dwelling on a 10 ha - 100 ha site)</li> </ul> </li> </ul> <p>are restricted discretionary activities.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Fair - good</b>	<ul style="list-style-type: none"> <li>• At the time this sieve mapping was undertaken, the final landscape provisions and maps (as required by an appeal to the Environment Court) have not yet been approved by the Court for entry into the District Plan. Until this occurs, the new landscape protection areas and provisions (and hence their scores) cannot be completely finalised.</li> <li>• Areas within 20m (vertical) of a prominent ridgeline have been estimated by overlaying the ridgelines with a Digital Surface Model (DSM). The DSM had been modelled using existing contour data, which varies from 20m to 2m contours around the harbour basin (and hence the accuracy of the DSM varies within and between each Study area)</li> </ul>
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Restrictions on subdivision and building in landscape protection areas greatly restricts the potential for residential activity in these areas. Mitigating measures such as planting, landscaping, and careful design of the appearance, colour, scale and location of buildings may be required.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
A <b>high</b> level of constraint is assigned to CNCL and ONLs (although it is of note that no ONLs occur within the eight Study areas). A <b>low</b> level of constraint has been assigned to areas within 20m vertical of a prominent ridgeline, within 40m of the MHWS or above the 160m contour, noting that building within these areas is generally a restricted discretionary activity (outside of existing building clusters).	

<sup>21</sup> The Rural Amenity Landscape applies to the balance of the Rural Zone which are not included within the Outstanding Natural Landscapes or the Coastal Natural Character Landscapes.

### B.2.7 Land Use Capability / Soil versatility

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
Very low	<p><u>Land Use Capability (LUC) mapping</u>: LUC classes can be used to identify areas in the harbour basin that would be more versatile for horticultural or agricultural uses than other areas. No Class I or II (highly versatile, few limitations) soils exist within the study area, however there are pockets of class III and IV soils (moderate versatility, moderate limitations)</p> <p><u>Canterbury Regional Policy Statement (CRPS)</u>: The CRPS requires that regard be given to versatile soils when the development of versatile land is considered. The CRPS defines versatile soils as those being classified as Class I or Class II.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
Fair	LUC mapped at 1:50,000 scale. Some limitations exist. LUC classification is based on an inventory of five physical factors basic to the assessment of land resources: Rock type; Soil type; Slope; Erosion degree and type; and Vegetation. In addition to an assessment of climate information, the LUC also considers the effects of past land use and the potential for erosion.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Once built upon, it is very difficult to reverse the process and make the land available once again for agricultural activity. Where a proposed activity will irreversibly affect land comprising versatile soils and there is a choice in the locality between such activity occurring on such land and on land having less versatile soils, preference should be to protect versatile soils from such activity unless the proposed activity would better achieve the purpose of the RMA.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
A <b>very low</b> level of constraint is assigned to Class III soils in the study areas. There is nothing, legally, to restrict land use activities on the basis of the presence of versatile soils. However, as Class III soils are the most versatile within the harbour basin, their protection could have an impact on future productivity and sustainability of local communities. The general irreversibility of development on good quality soils also warrants the Class III soils receiving some attention as a potential constraint.	

### B.2.8 Areas that receive little sun (solar gain)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
Very low	<p><u>Resource Management Act 1991</u>: Under S. 7(ba) of the RMA, the Council is required to have particular regard to the efficiency and end-use of energy. Ideally, urban development should be directed into areas where energy efficiency can be enhanced through passive solar design.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
Poor - fair	<p>Calculated by estimating the amount of sun (insolation) that a site would receive at hourly intervals between 10 am and 4 pm on the shortest day of the year. Areas that receive the least sun were determined by examining areas where the insolation levels fall (on average) below 1095 Watts/m<sup>2</sup> (insolation levels in the lowest quartile)</p> <p>Insolation was estimated by creating a 'digital surface model' (DSM) which provides 'spot' elevations across the study area. This was interpolated from the available contour data using the 'Spline' tool. This approach carries a couple of limitations:</p> <p>(a) Most of Wainui, Duvauchelle, Takamatua and Akaroa settlements are covered by 2m contour data. All other areas have 20m contour data. Hence, the potential for errors is greater and the ability to accurately define 'shady' or 'sunny' slopes is significantly limited in areas covered by the 20m contour. This is because the method of interpolation used 'Spline' is less effective in areas where contour data is sparse (eg 20m contour areas or flat areas where contours are wide spaced), leading to a 'terraced' effect along contour lines.</p> <p>(b) In addition, the DSM was created for the settlement study areas plus a 20m buffer only, due to limitations on the processing capability of the GIS software when carrying out the spline. Hence, the effect of shading caused by hilltops and the crater rims above the study areas on insolation has not been taken into account.</p>
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Compared to development in sunny areas, urban development located in shaded areas is likely to place a higher demand for heating through electricity or solid fuel, increasing costs for both households and the greater environment (eg increased demand on the power grid and power plants, releasing carbon dioxide and other air pollutants etc).	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Because: (a) there is little legislative support to require new development in areas with higher solar gain; and (b) there are likely to be significant errors in calculating areas of lower insolation, areas that receive the least sun have been assigned a <b>very low</b> level of constraint.	

## B.3 Cultural environment constraints

### B.3.1 Archaeological sites

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>High</b>	<b>District Plan:</b> Modification of a archaeological site/object or the construction of a new building on a site containing an archaeological object is a restricted discretionary activity. Discretion is restricted to the form, design, siting, size and appearance of buildings and structures. Excavation, destruction, removal, alteration, or damage to an object or site is a discretionary activity.
	<b>Historic Places Act 1993:</b> This Act makes it unlawful for any person to destroy, damage or modify the whole or any part of an archaeological site without the prior authority of the NZ Historic Places Trust (NZHPT). This is the case regardless of whether the land on which the site is located is designated, or the activity is permitted under the District or Regional Plan or a resource or building consent has been granted.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Poor - fair</b>	The District Plan states that archaeological sites may be located within a 100m radius of their location as marked on planning maps. This radius has been chosen because the exact locations of the sites are not known by the Council and because there may be other sites within the vicinity of the marked site
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Mitigation measures may be required as a condition of a resource consent so that proper investigation of the site is carried out and unnecessary damage to the archaeological site or object avoided. If the Historic Places Trust decides to grant an authority to disturb an archaeological site, some mitigation may be required for the loss of or damage of the site. This may involve an archaeologist monitoring the work that affects the site and recording any information, or an archaeological investigation of the site.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
As for silent files, a high level of uncertainty exists about the location of archaeological features within the 100m radius identified by the District Plan. However this uncertainty brings about a higher level of constraint due to the implications under the Historic Places Act of such a site being discovered. The higher level of uncertainty and legal protection assigned to archaeological sites warrants a <b>moderate</b> level of constraint.	

### B.3.2 Sacred sites

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low – mod.</b>	<b>RMA:</b> Section 6(e) of the RMA requires the Council to recognise and provide for the relationship of Maori and their culture and traditions with their ancestral lands, water, sites and waahi tapu, and other taonga as a matter of national importance.
	<b>District Plan:</b> Resource consent is required for earthworks, planting or removal of trees, or the establishment of any building or structure within a silent file area <sup>22</sup> in the District Plan. However, discretion is only restricted to conditions which recognise and provide for the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Good</b>	Silent file areas clearly identified in planning maps, however silent files cover large areas and the extent and nature of sacred site(s) that the silent files seek to protect are not identified.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Consultation with tangata whenua is necessary if applying for resource consent under (a). Mitigation measures (eg consent conditions) may be required to avoid damaging cultural treasures.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
While there will be areas within each silent file locality where a very high level of constraint would exist, the exact location is unknown. Therefore, given the large area of land concerned, the constraint score of silent files, on balance, is <b>low</b> .	

### B.3.3 Waahi Tapu area (Takapuneke)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low – mod.</b>	<b>New Zealand Historic Places Trust:</b> The Takapuneke Waahi Tapu area <sup>23</sup> is registered with the NZHPT and serves as an identification and recognition tool only. The Council must advise the NZHPT of receipt of an application for a PIM where the application affects the Waahi Tapu area.
	<b>RMA / District Plan:</b> Although there are no specific provisions in the District Plan regarding NZHPT Waahi Tapu areas, the Council has an obligation, which is recognised in the objectives and policies in the Plan and in the Principles of the RMA (s.6 and s.8), to recognise and provide for the relationship of the local runanga with their waahi tapu sites.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Very good</b>	The Waahi Tapu area is clearly identified.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
As a minimum, 'mitigation' would involve consultation with Tangata Whenua. Tangata Whenua would also advise on any measures necessary to avoid adverse effects on the Waahi Tapu site.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Registration as a Waahi Tapu area provides a firm indication that the land is considered to be of immense value to local runanga. Therefore, despite the absence of strict rules denying any building on the land, the indications from applying the RMA and the HPT registrations would warrant a <b>moderate</b> level of constraint for this area. It should be noted that this land is also designated as a historic reserve and will be assigned an additional layer of constraint because of this.	

<sup>22</sup> Except where the activity is being undertaken by the Runanga in relation to features of cultural value to Maori and this activity will not adversely affect any feature of cultural value located within the 'silent file' area.

<sup>23</sup> Takapuneke is not the only Waahi Tapu area in the vicinity of the settlements. Onawe Pa is also a Waahi Tapu feature, but lies just outside of the settlement study areas.

### B.3.4 HPT I registered site, object or building

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
High	<u>New Zealand Historic Places Trust:</u> These sites, objects or buildings are registered with the NZHPT as having 'special or outstanding historical or cultural heritage significance or value'. The Council must advise the HPT of receipt of an application for a PIM where the application affects the registered building, object or site.
	<u>District Plan/RMA:</u> <ul style="list-style-type: none"> <li>Alteration, addition, or damage to registered feature, or the construction of a new building on the same site is a discretionary activity.</li> <li>Demolition or removal of the feature is a non-complying activity.</li> </ul> In addition to District Plan and/or NZHPT provisions, Section 6(f) of the RMA requires the Council to recognise and provide for the protection of 'historic heritage' from inappropriate subdivision, use, and development as a matter of national importance.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
Good	The greater the restriction on the heritage listing in the District Plan, the more stringent the conditions (and hence mitigation measures) are likely to be if consent is granted. There is also a higher likelihood that resource consent for land use and/or subdivision would be declined.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
The greater the restriction on the heritage listing in the District Plan, the more stringent the conditions (and hence mitigation measures) are likely to be if consent is granted. There is also a higher likelihood that resource consent for land use and/or subdivision would be declined.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
HPT Category 1 buildings, sites or objects (and their associated buffer areas) have been assigned a <b>high</b> level of constraint in recognition of the status assigned to these buildings, sites and objects in the District Plan and the status of these features in relation to other categories of protection for historic heritage.	
While re-use of heritage features for residential purposes would not result in a 'constraint' for sieve mapping purposes, these features would greatly limit intensification of the site for residential purposes.	

### B.3.5 HPT II registered site, object or building

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
Mod. - High	<u>New Zealand Historic Places Trust:</u> These sites, objects or buildings are registered with the NZHPT as having 'historical or cultural heritage significance or value'. The Council must advise the HPT of receipt of an application for a PIM where the application affects the registered building, object or site.
	<u>District Plan/RMA:</u> <ul style="list-style-type: none"> <li>Alteration, addition or damage to any building, object or site in the District Plan's Schedule of Protected Buildings Objects and Sites is a restricted discretionary activity. Discretion limited to the form, design, siting, size and appearance of buildings and structures</li> <li>Destruction, removal of heritage feature, or the construction of a new building on the same site is a discretionary activity.</li> </ul> In addition to District Plan and/or NZHPT provisions, Section 6(f) of the RMA requires the Council to recognise and provide for the protection of 'historic heritage' from inappropriate subdivision, use, and development as a matter of national importance.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
As for HPT 1 registered sites, objects or buildings (see above table B.3.4)	
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
As for HPT 1 registered sites, objects or buildings (see above table B.3.4)	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
NZHPT Category 2 buildings, sites or objects (and their associated buffer areas) have been assigned a <b>moderate</b> level of constraint in recognition of the status assigned to these sites, buildings and objects in the District Plan and the status of these features in relation to other categories of protection for historic heritage.	
While re-use of heritage features for residential purposes would not result in a 'constraint' for sieve mapping purposes, these features would limit intensification of the site for residential purposes.	

### B.3.6 Notable building, site or object

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
Low	<u>District Plan/RMA:</u> <ul style="list-style-type: none"> <li>External modification, demolition or removal; or construction of any new building on the same site (where building is outside the Residential Conservation or Town Centre Zone) is a restricted discretionary activity. Discretion is restricted to the form, design, siting, size and appearance of buildings and structures.</li> </ul> In addition to District Plan provisions, Section 6(f) of the RMA requires the Council to recognise and provide for the protection of 'historic heritage' from inappropriate subdivision, use, and development as a matter of national importance.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
As for HPT 1 registered sites, objects or buildings (see table B.3.4 above)	
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
As for HPT 1 registered sites, objects or buildings (see table B.3.4 above)	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Notable buildings, sites or objects (and their associated buffer areas) have been assigned a <b>low</b> level of constraint in recognition of the status assigned to these buildings, sites or objects in the District Plan. Notable features must also carry a lower level of constraint than NZHPT Category I or II historic features.	

### B.3.7 Heritage-related zoning provisions

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low</b>	<p><u>District Plan:</u> Both the <i>Town Centre</i> (TC) and <i>Residential Conservation</i> (RC) zones have rules that seek to conserve the existing pattern of subdivision, streetscape and building form in Akaroa township. Alterations, additions to, or demolition of existing buildings, or the erection of new buildings, are restricted discretionary activities. Discretion is primarily limited to the form, design, cladding and siting of buildings and the location of car parking. The Plan also includes design guidelines for buildings within these two zones (Appendix XI).</p> <p><u>RMA:</u> In addition to District Plan provisions, Section 6(f) of the RMA requires the Council to recognise and provide for the protection of 'historic heritage' from inappropriate subdivision, use, and development as a matter of national importance.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Very good</b>	The TC and RC zones are clearly identifiable, as per District Plan mapping.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Design of any activity under (a) is generally limited by the design guidelines in the District Plan, hence mitigation may involve modifying the design and layout of any new development.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Although the heritage provisions of the TC and RC zones don't necessarily restrict future development activities, they may limit the options for intensification of residential or commercial activity. Therefore the overall constraint assigned to the TC and RC zones is <b>low</b> . It is of note that the TC and RC zones include most of Akaroa's heritage buildings, with these features also carrying an additional <i>low</i> , <i>moderate</i> or <i>high</i> level of constraint.	

### B.3.8 Akaroa Historic Area (AHA)<sup>24</sup>

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Very low - low</b>	<p><u>New Zealand Historic Places Trust:</u> The AHA is registered with the NZHPT and serves as an heritage identification and recognition tool only. The Council must advise the NZHPT of receipt of an application for a PIM where the application affects any registered historic area.</p> <p><u>District Plan:</u> While the District Plan includes a map of the AHA, there are no restrictions on general residential activity. Construction of a wall over 20m in length facing a street frontage or building a garage facing the street (and not behind a dwelling) are discretionary activities within the AHA under the District Plan<sup>25</sup>.</p> <p><u>RMA:</u> In addition to District Plan and/or NZHPT provisions, the RMA requires the Council to recognise and provide for the protection of 'historic heritage' from inappropriate subdivision, use, and development as a matter of national importance.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Good</b>	The AHA is clearly identified and mapped, however the boundary of the Historic Area may change as a result of the current review of provisions in the District Plan relating to the AHA.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Mitigation measures (eg design changes) may be required as a condition of a resource consent.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
The provisions of the Plan regarding the AHA would suggest a <b>very low</b> level of constraint is suitable, given that although the area is recognised by the Historic Places Trust, the provisions relating to the AHA in the District Plan don't restrict general residential development. <i>Important note: where the AHA overlaps TC or RC zoning (see Table B.3.7 above), an overall constraint score of 'low' is applied. This is because the heritage restrictions in the TC and RC zones generally include discretion over such matters as the AHA provisions seek to protect – see 'Heritage-related zoning provisions' above.</i>	

<sup>24</sup> The Akaroa Historic Area is not the only 'Historic Area' in the vicinity of a harbour basin settlement. The Akaroa Waterfront Historic Area borders, and in some places crosses the Akaroa settlement study area. This area has not been included in the sieve mapping exercise because the effect of the historic area registration has an extremely low level of impact on the settlement study area.

<sup>25</sup> The Council is currently undertaking a review of District Plan provisions in relation to the AHA. This review may result in changes to the boundaries of the Historic Area and/or changes to the rules that apply to new buildings, alterations to existing buildings and demolition.

## B.4 Physical environment constraints

### B.4.1 State Highway 75 (SH 75)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Very high</b>	<u>Local Government Act 1974:</u> Any activity carried out on a road is permitted where it involves the exercise of public's right of passage or where it is authorised by the road controlling authority (eg Transit NZ) in the exercise of its power in relation to roads.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Good</b>	The extent of the carriageway was estimated by creating a 4m buffer of the Highway's centreline. Hence there is likely to be some minor error (approx +/- 2m) as to the actual extent of the road.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
<ul style="list-style-type: none"> <li>State Highway 75 plays a strategic role in moving people and goods into, around and beyond the harbour basin. Activities that limit the functioning and safety of the State Highway should be avoided or mitigated where possible. Any deviation of the State Highway would be expensive and difficult in most areas due to the harbour basin topography.</li> <li>The only way to use a State Highway for any purpose other than as a road is to request that all or part of the Highway be stopped. This is very unlikely to happen, particularly having regard to limitations (the coast and the hilly topography) on where the State Highway could be re-directed or re-aligned.</li> <li>Transit's general recommendations for mitigating the environmental effects of the State Highway include building setbacks, 'no-complaints' instruments on land title, acoustic insulation, screening, barriers, bunding and building orientation.</li> <li>The degree of mitigation necessary decreases with distance from the State Highway, with Transit generally being happy to support noise sensitive development (eg residential activity) in the Road Noise Effects Area so long as a noise assessment is undertaken and a <i>no-complaints</i> instrument is registered on the certificate of title.</li> </ul>	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Due to the strategic nature and functioning of the State Highway, together with topographical constraints that limit where the Highway is located, a <b>very high</b> level of constraint is warranted.	

### B.4.2 State Highway 75 (set-backs)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low – Mod.</b>	<p><u>District Plan:</u> Construction of a building in a Rural Zone within 20m of the State Highway is a discretionary activity in the Plan. Noise effects and setbacks from the State Highway may be considered on application for subdivision consent.</p> <p><u>Transit NZ Planning and Policy Manual:</u> Transit recognises the reverse sensitivity of the State Highway as an issue for future development in the harbour basin. In this document, Transit identifies two buffer zones where land use development should be restricted. These zones are the:</p> <ul style="list-style-type: none"> <li>'<i>Environmental Buffer Area</i>' (where potential effects of the State Highway are high); and the</li> <li>'<i>Road Noise Effects Area</i>' (where there is some potential for adverse noise effects on sensitive activities).</li> </ul> <p>Transit advocates to have these buffer setbacks incorporated into District planning documents. If consulted as an affected party to a resource consent, it is possible that Transit would advocate for setbacks and/or seek mitigation against the effects of State Highway activity within these buffer areas.</p>
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Good</b>	Transit's buffer zones are estimated by measuring a 20m and 80m distance from the edge of the State Highway. The edge of the State Highway was estimated by creating a 4m buffer of the Highway's centreline. Hence there is likely to be some minor error (approx +/- 2m) as to the exact location of the road edge.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
As for the SH 75 (carriageway) constraint – see above table B.4.1	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Due to the strategic nature and functioning of the State Highway, the following constraints scores are applied to the identified SH 75 buffer areas:	
<ul style="list-style-type: none"> <li>Environmental Buffer Area (0 – 20 metres from edge of SH) = <b>moderate</b> constraint</li> <li>Noise Effects Area (20 – 80 m from road edge) = <b>very low</b> constraint.</li> </ul> <p>The Noise Effects Area is assigned a lower level of constraint than the Environmental Buffer Area, due to the significantly reduced level of mitigation specified by Transit. These areas are much less likely to be affected by vibration, noise and other environmental effects of the State Highway.</p>	

### B.4.3 Other formed roads

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Very high</b>	<u>Local Government Act 1974:</u> Any activity carried out on a road is permitted where it involves the exercise of public's right of passage or where it is authorised by the road controlling authority in the exercise of its power in relation to roads.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Fair - good</b>	Road centrelines are generally well mapped. The extent of the road width has been estimated by creating a 3m buffer of this centreline. Hence there is likely to be some minor error (approx +/- 2m) as to the exact location of the road boundary
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
<ul style="list-style-type: none"> <li>Formed roads highly valuable for providing access and movement between, within and beyond the settlement study areas.</li> <li>The only way to use road for any purpose other than as a road is to request that all or part of a road be stopped. This involves public notification and extensive consultation. Under these provisions it is a low likelihood that any road, currently formed and in use, would be stopped unless an alternative road access can be provided</li> </ul>	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
The value of local roads is significant, and as such a <b>very high</b> level of constraint is warranted.	

#### B.4.4 Unformed (paper) roads

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>High</b>	Paper roads are legal roads and are subject to the same legislation as formed roads (see table B.4.3 above).
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Fair</b>	A map of paper roads was made by identifying areas where a road reserve exists, but no road has been formed. Coastal paper road has not been mapped due to difficulties in clearly identifying the location of the road in relation to the coast. It is assumed that all paper roads are of the same actual or potential value as a public resource
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
<ul style="list-style-type: none"> <li>The only way to use a paper road for any purpose other than as a road is to request that all or part of an unformed road be stopped. This involves public notification, which can be a lengthy process.</li> <li>Some paper roads could potentially be (and some currently are) utilised for public access opportunities (eg walking, mountain biking or a link to a new subdivision) and as such have some value as public infrastructure.</li> <li>Some paper roads, however, may not be located in suitable areas for road formation or other use, and hence the value of paper roads as public infrastructure is generally lower for paper roads than formed roads.</li> </ul>	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
On the balance of factors, a <b>moderate</b> level of constraint is assigned to paper roads.	

#### B.4.5 Water supply sources

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Mod.</b>	NRRP: The Water Quality Chapter of the NRRP places restrictions on activities that involve (or may lead to) the discharge of contaminants over land or into the groundwater system within a Community Drinking Water Supply Protection Zone. This includes discharges from on-site sewage treatment systems, stormwater discharges and the storage of hazardous substances. Although the restrictions in the NRRP are significant, the range of activities that are actually restricted is minimal and in most instances, unlikely to occur within the settlement study areas, most of which overlay residential zoning.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Fair</b>	The NRRP provides direction as to how the extent of the Community Drinking Water Supply Protection Zone can be estimated based on the depth of the water supply bore and the direction of groundwater flow. Local variations in groundwater flows, topography and geology would mean a site-specific investigation may be required to determine a more precise map of the protection zones.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Although water supply bores are relied upon for community water supply in Wainui (and to date this bore has proved reasonably reliable), the two bores in Akaroa are only used to supplement stream sources during summer months, with long-term sustainable yield uncertain. Groundwater is not viewed in Akaroa as a viable long-term water source and other, more reliable water sources are currently being investigated. Community water supply protection zones should not, therefore, be considered a significant constraint to future urban development, although mitigation measures may be required for activities within the protection zones, as per the relevant rules in the NRRP	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Although restrictions in the NRRP are high, they are limited to activities involving the discharge and/or storage of hazardous activities only. These activities are <i>usually</i> not associated with residential land use and as such do not pose a significant constraint to residential development. In addition, water supply bores in Akaroa are not regarded as a significant and reliable long-term water source and therefore, on balance, community water supply protection zones have been assigned a <b>very low</b> level of constraint.	

#### B.4.6 Wastewater treatment plant set-back (WWTP)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Low</b>	District Plan: The establishment of a package sewage treatment plant, including any effluent ponds, within 300 metres of a Small Settlements / Residential zone is a discretionary activity. Although a resource consent is not required to build a dwelling within this buffer zone, it is possible that the presence of existing WWTP would cause a reverse sensitivity issue.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Good</b>	Zoning and WWTP locations clearly identified. Assumes no differences between WWTP type or size have been distinguished. Although not an 'existing' WWTP, the site of the proposed Wainui WWTP and disposal fields have also been included in the sieve mapping, in the anticipation that this plant will become on-line in the next couple of years.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Complaints by residents of dwellings built in close proximity to a WWTP may require mitigation at the site of the WWTP in order to eliminate or reduce noise, odour and visual pollution. It is desirable that residential activity is set back from WWTP in order to protect the functioning of the plant.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
A 300m buffer of WWTPs is assigned a <b>very low</b> level of constraint due to there being no legal restrictions, other than zoning, that prevent residential development near WWTP. However, reverse sensitivity of new residential activity near a WWTP could be an issue. Although not an 'existing' WWTP, the site of the proposed Wainui WWTP and disposal fields have also been included in the sieve mapping, in the anticipation that this plant will become on-line in the next couple of years.	

### B.4.7 Other infrastructure (designated activities)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>Mod.</b>	RMA / District Plan: Designated sites, other than those already identified as a constraint, are a form of land use control which generally limit the use of land to the purpose identified in the designation. A designation lapses on the expiry of 5 years after the date it was included in the District Plan. Within the settlement study areas, land has been designated for the following purposes: electricity substation, police station and residence, telecommunications, secondary school, cemetery, and waste transfer station.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Good</b>	Designated parcels are clearly identified. It is assumed that all designations present the same level of constraint.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Designations usually protect activities of some value to the community. In most instances in the harbour basin, designated land is owned by the requiring authority, and the activity to which the designation relates has already been given effect to. The RMA prohibits any work on land covered by the designation unless the consent of the requiring authority (authority responsible for the designation) is obtained.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
A <b>high</b> level of constraint is assigned to designated land, taking all factors into account. This is particularly relevant in light of the purpose and ownership of land currently designated.	



## B.5 Other land use constraints

### B.5.1 Sites where contamination has been recorded

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>High</b>	<u>RMA:</u> <ul style="list-style-type: none"> <li>S. 31(b) of the RMA requires the City Council to control the use of land for the prevention or mitigation of any adverse effects of the development, subdivision, or use of contaminated land.</li> <li>The RMA enables regional authorities (eg Environment Canterbury) to investigate land for the purposes of identifying and monitoring contaminated land (s. 30 (ca)).</li> </ul>
	<u>NRRP (underground petrol tanks):</u> The removal of an underground petrol tanks is a permitted activity, so long as: (a) Ecan is informed of the activity; and (b) a site investigation is carried out to determine whether there has been any contamination (the findings of which must be forwarded to Ecan).
	<u>NRRP (investigation of contaminated sites):</u> An investigation is generally necessary at sites that accommodate, or historically accommodated, activities listed on the Hazardous Activities and Industries List HAIL where redevelopment work, change of ownership, spills or leaks occur, or when information becomes available suggesting that contamination may be present.
	<u>Building Act 2004:</u> The Building Code requires that “buildings shall be constructed to avoid the likelihood of people within the building being adversely affected by hazardous agents or contaminants on the site.”
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Good</b> Lead contamination at the Gun Club site has been confirmed through site visit and soil analysis.	
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
The degree of contamination across the site and the remediation required (in any) to make the site suitable for a change of use (eg residential) is not known.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
The Barrys Bay Gun Club has been identified as a contaminated site. Remediation of the site may be required (subject to further investigation) for any new residential developments. Due to the uncertainty of the extent of contamination and remediation (compared to landfills, for example) a <b>moderate</b> constraint score has been applied.	

### B.5.2 Potentially contaminating land use (past or present)

<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
As for ‘Sites where contamination has been recorded’ (see above table B.5.1)	
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Very low</b>	Neither the presence of soil or groundwater contamination nor the location or extent of the potentially contaminating activity has been confirmed.
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Because contamination has not been confirmed at these sites, any future development may require an assessment of potential contamination. This will then determine whether contamination exists, the degree of any contamination and whether remediation is required.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Because contamination has not been confirmed at any of these sites, and the location and extent of the potentially contaminating activities uncertain, the lowest level of constraint ( <b>very low</b> ) is warranted.	

### B.5.3 Closed and monitored landfills (Onuku and Barrys Bay)

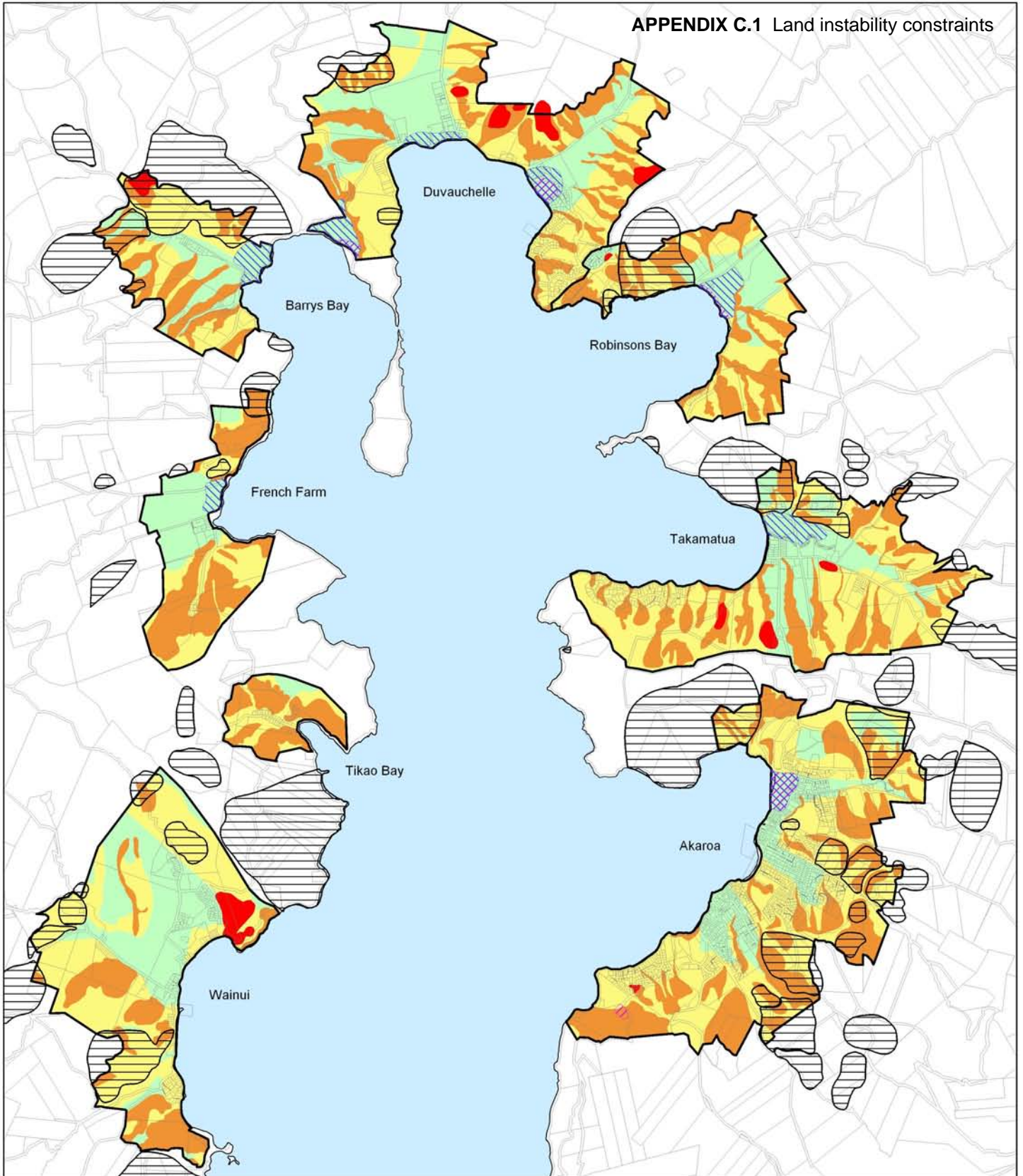
<b>(a) Degree to which constraint is legally recognised and enforceable (eg RMA, District Plan, other mechanism):</b>	
<b>High</b>	<u>RMA:</u> <ul style="list-style-type: none"> <li>S. 31(b) of the RMA requires the City Council to control the use of land for the prevention or mitigation of any adverse effects of the development, subdivision, or use of contaminated land.</li> <li>S. 106 of RMA allows the Council to refuse subdivision consent where the land is likely to be subject to... subsidence.</li> <li>The RMA enables regional authorities (eg Environment Canterbury) to investigate land for the purposes of identifying and monitoring contaminated land (s. 30 (ca)).</li> </ul>
	<u>NRRP (water quality):</u> Discharge of contaminants from a closed landfill a controlled or discretionary activity under the NRRP, with the Onuku and Barrys Bay landfills subject to ongoing monitoring as a condition of their discharge consents.
	<u>Building Act 2004:</u> The Building Code requires that “buildings shall be constructed to avoid the likelihood of people within the building being adversely affected by hazardous agents or contaminants on the site.” The Building Act also places restrictions (eg building consents and conditions) on the construction of buildings on land subject to subsidence.
<b>(b) Degree to which constraint layers, including variations within constraint layers, can be accurately researched, identified and mapped:</b>	
<b>Very good</b> Location and extent of closed and monitored landfills clearly identified.	
<b>(c) Degree to which constraint is: (i) likely to require extensive and/or costly mitigation measures; or (ii) is necessary to protect important public infrastructure</b>	
Significant mitigation would be necessary to make landfills suitable for an future development, due to the instability (risk of subsidence) and contamination hazards. The cost of remediation to make the land suitable for building on is likely to be prohibitive, however the land may be suitable as reserve, as is the case at the present.	
<b>OVERALL ASSESSMENT OF CONSTRAINT:</b>	
Closed landfills that are currently monitored for resource consent purposes have been clearly identified. The use of these sites for built development is constrained by both legal constraints (the RMA, Building Act and NRRP) as well as the prohibitive costs associated with remediation. A <b>very high</b> level of constraint is warranted for these sites.	



## ***Appendix C - H: Individual constraint and opportunity maps***

The maps in this appendix are organised as follows:

- C.1: Land instability constraints
- C.2: Historical flooding constraints
- C.3: Coastal hazard constraints
- D.1: Natural environment constraints
- D.2: Landscape value constraints
- E: Cultural and historic heritage constraints
- F.1: Transportation and roading constraints
- F.2: Other infrastructural constraints
- G: Former land uses that may limit development options
- H: Map of potential opportunity areas



**Akaroa Harbour Basin Settlements Study: landslide and slope hazard constraints**

**Legend**

Slope hazard ranking:

- Minor Negligible
- Intermediate
- Locally Significant
- Significant

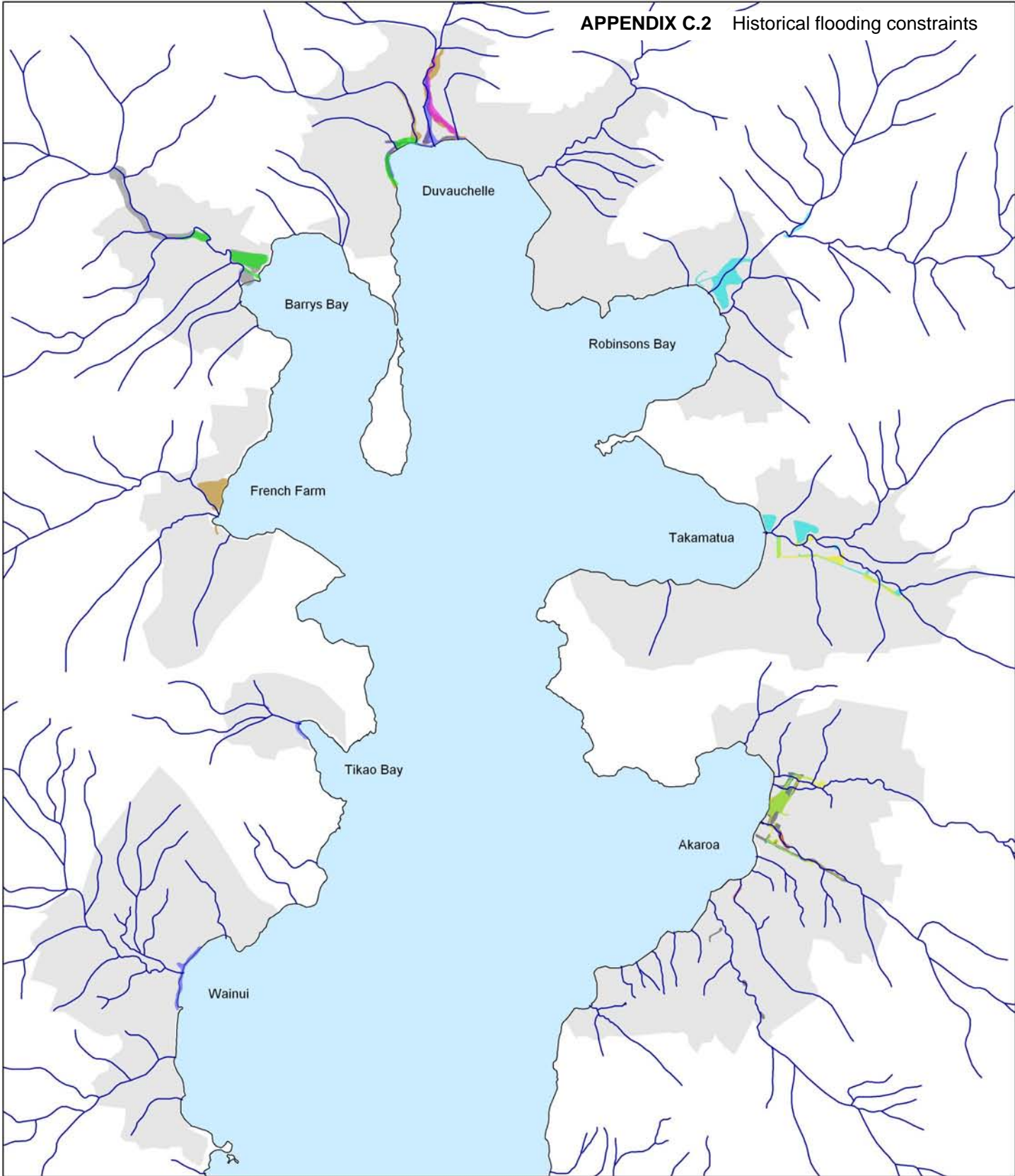
- Settlement study area
- Bedrock landslide
- Possible Liquefaction
- Landfill or Reclamation



Scale : 1:32,000

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**Legend**

Settlement study area

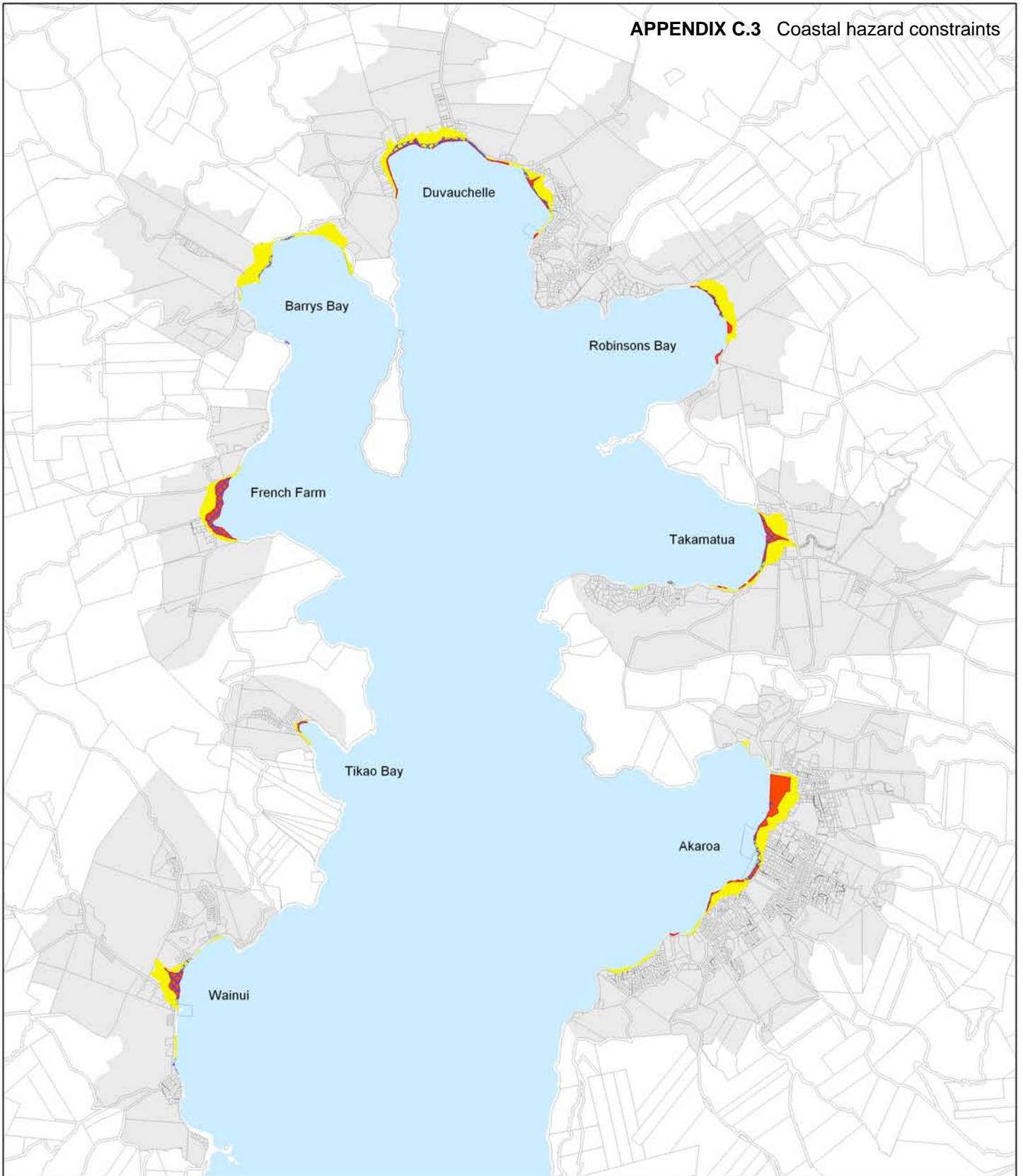
**Flood event (year)**

<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #808080; border: 1px solid black;"></span> 1936</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #a9a9a9; border: 1px solid black;"></span> 1963</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #c08040; border: 1px solid black;"></span> 1968</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #e04040; border: 1px solid black;"></span> 1981</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #e040e0; border: 1px solid black;"></span> 1986</li> </ul>	<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #8000ff; border: 1px solid black;"></span> 1992</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #00ffff; border: 1px solid black;"></span> 1994</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #00ff00; border: 1px solid black;"></span> 2000</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: #ffff00; border: 1px solid black;"></span> 2002</li> </ul>
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**Akaroa Harbour Basin Settlements Study:  
Researched historic flood events**

Scale : 1:32,000

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**Akaroa Harbour Basin Settlements Study: Coastal inundation hazards**

**Legend**

- 2m tsunami inundation
- 4m tsunami inundation
- Storm surge inundation (incl. sea-level rise)
- Settlement study area

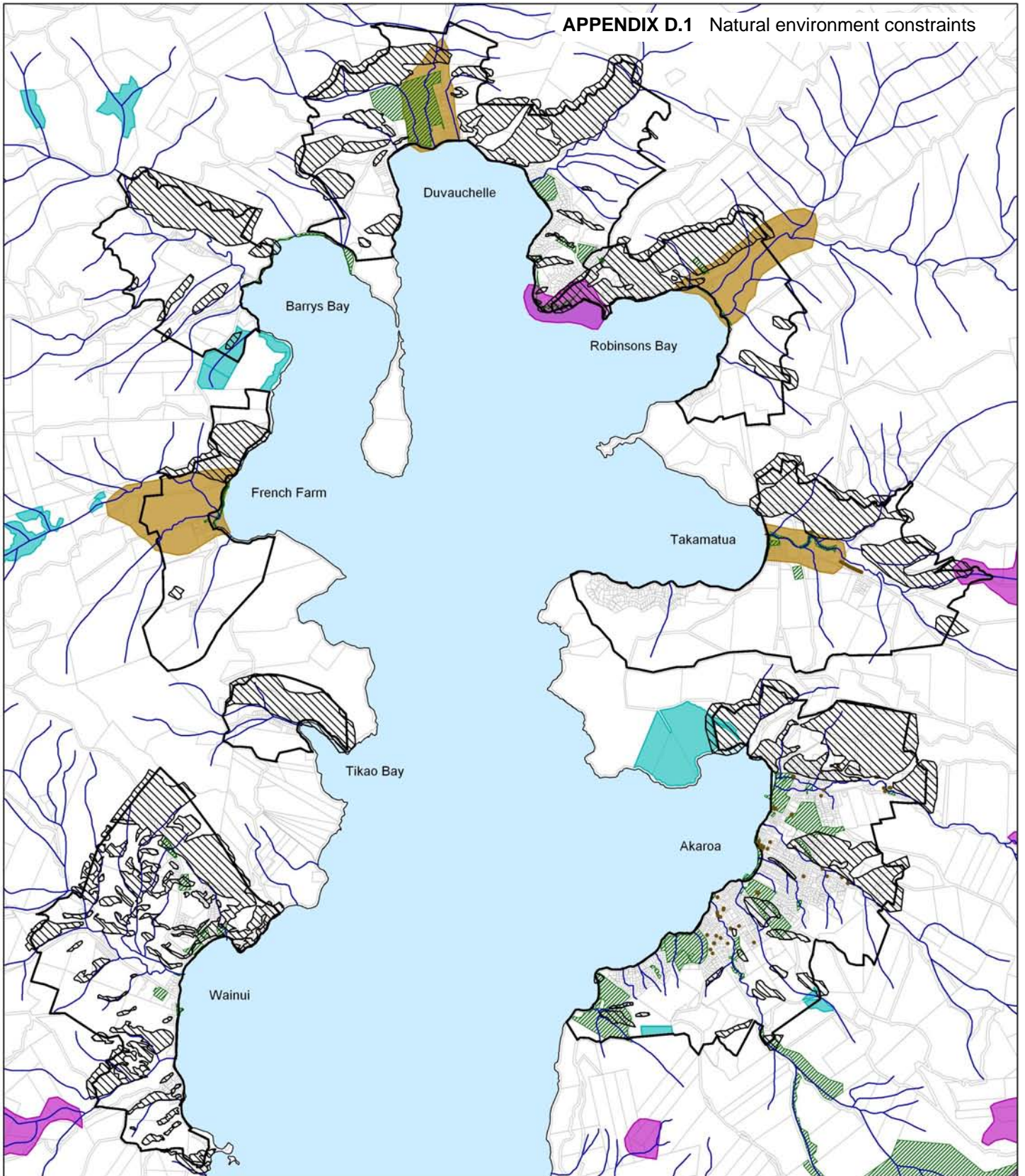
0.0 0.4 0.8 1.2 1.6 2.0

Kilometers









Scale : 1:32,000

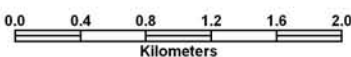
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**Akaroa Harbour Basin Settlements Study: natural environment constraints (1)**

Legend	
	Settlement study area
	Watercourse
	Slopes that get the least sun
	Land Use Capability 'class 3' soils (*3w1' soils - suitable for cultivated crops, pasture or forestry use. Wetness (w) is a major limitation.)
	Protected Tree
	QEII covenant
	Recommended Area for Protection (RAP)
	Park / reserve

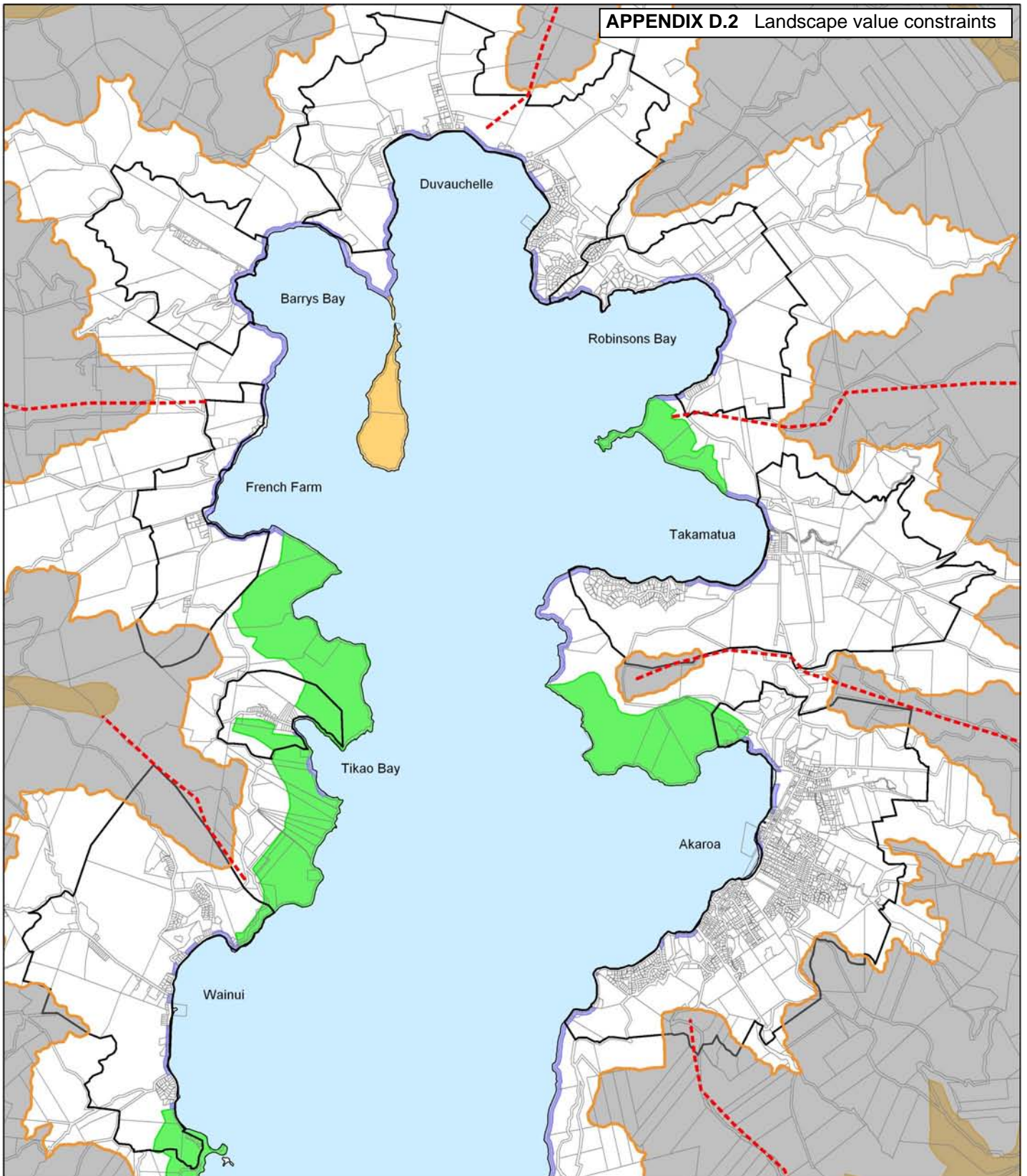


Scale : 1:32,000











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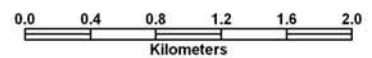
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**Legend**

-  Settlement study area
-  Prominent ridgeline
-  160m contour
-  Land above 160m contour
-  40m setback from MHWS (within Rural Amenity Landscape)
-  Coastal Natural Character Landscape (CNCL)
-  Outstanding Natural Landscape (ONL)

**Akaroa Harbour Basin Settlements Study:  
Natural environment (landscape constraints)**

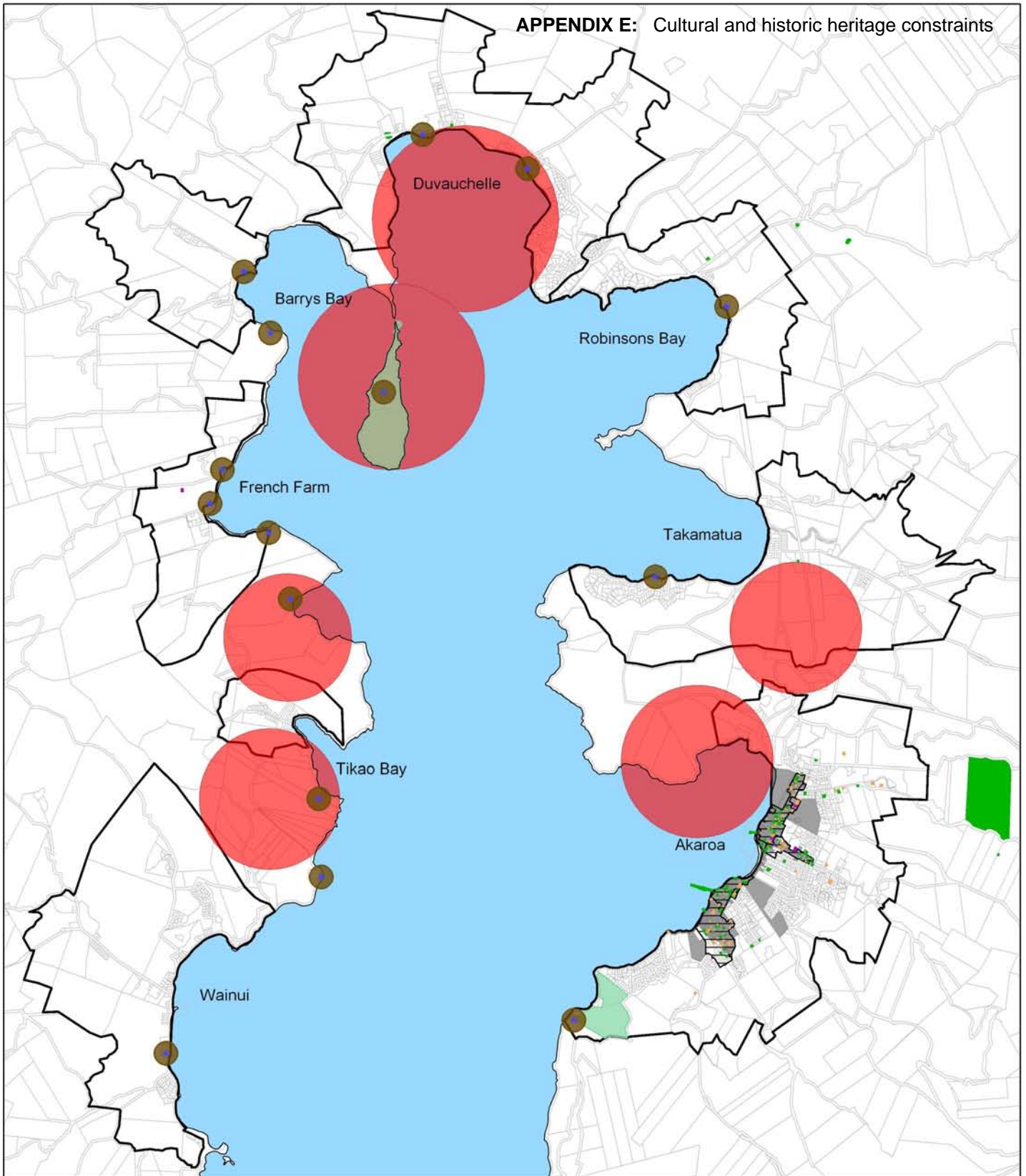


Scale : 1:32,000

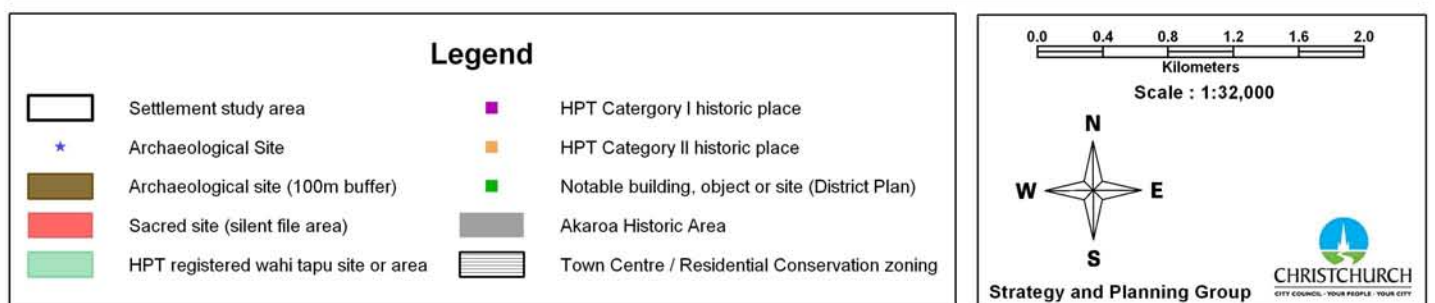
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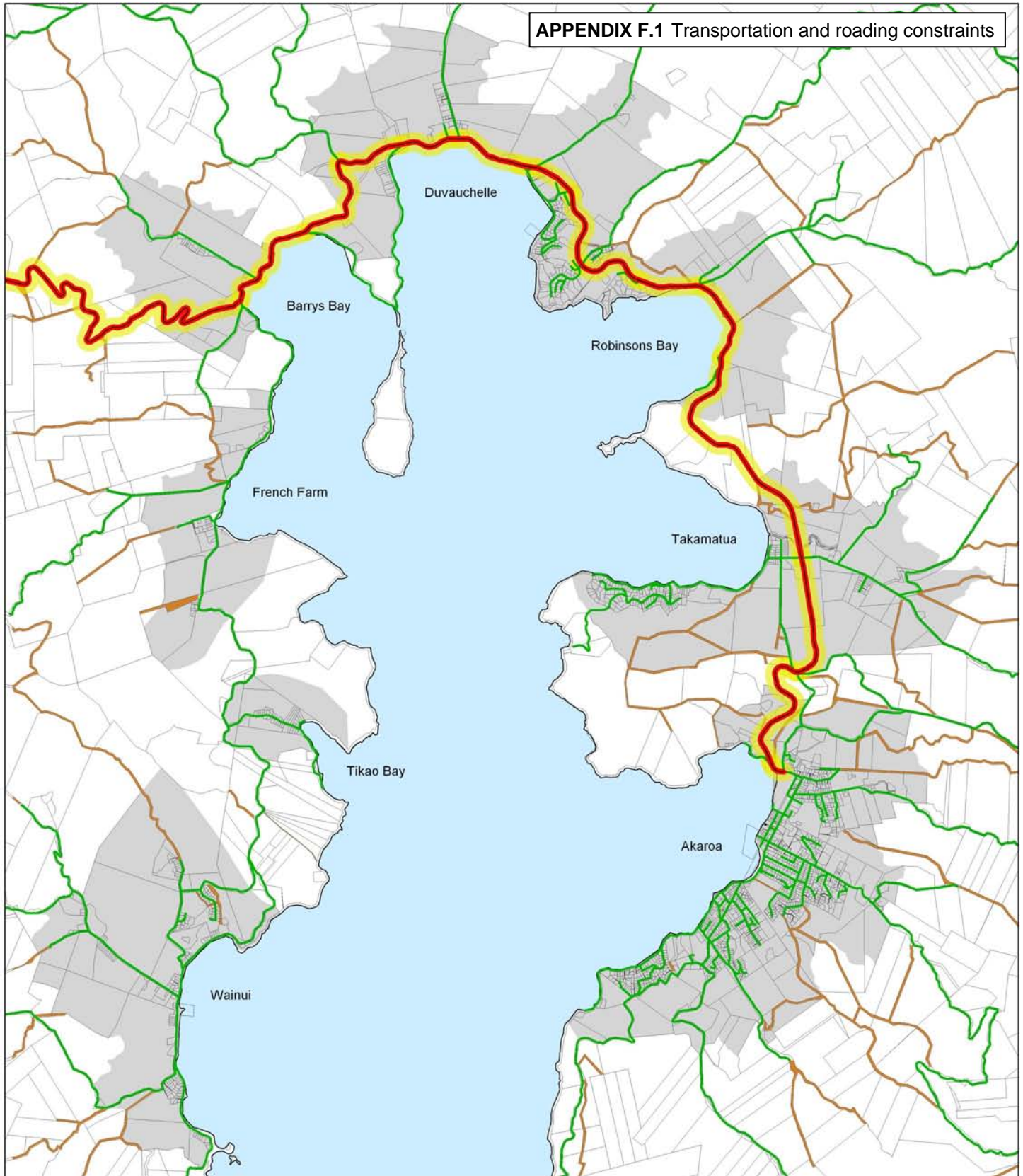












**Akaroa Harbour Basin Settlements Study - Cultural and Historic Heritage Constraints**

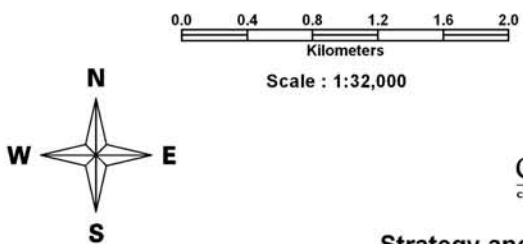




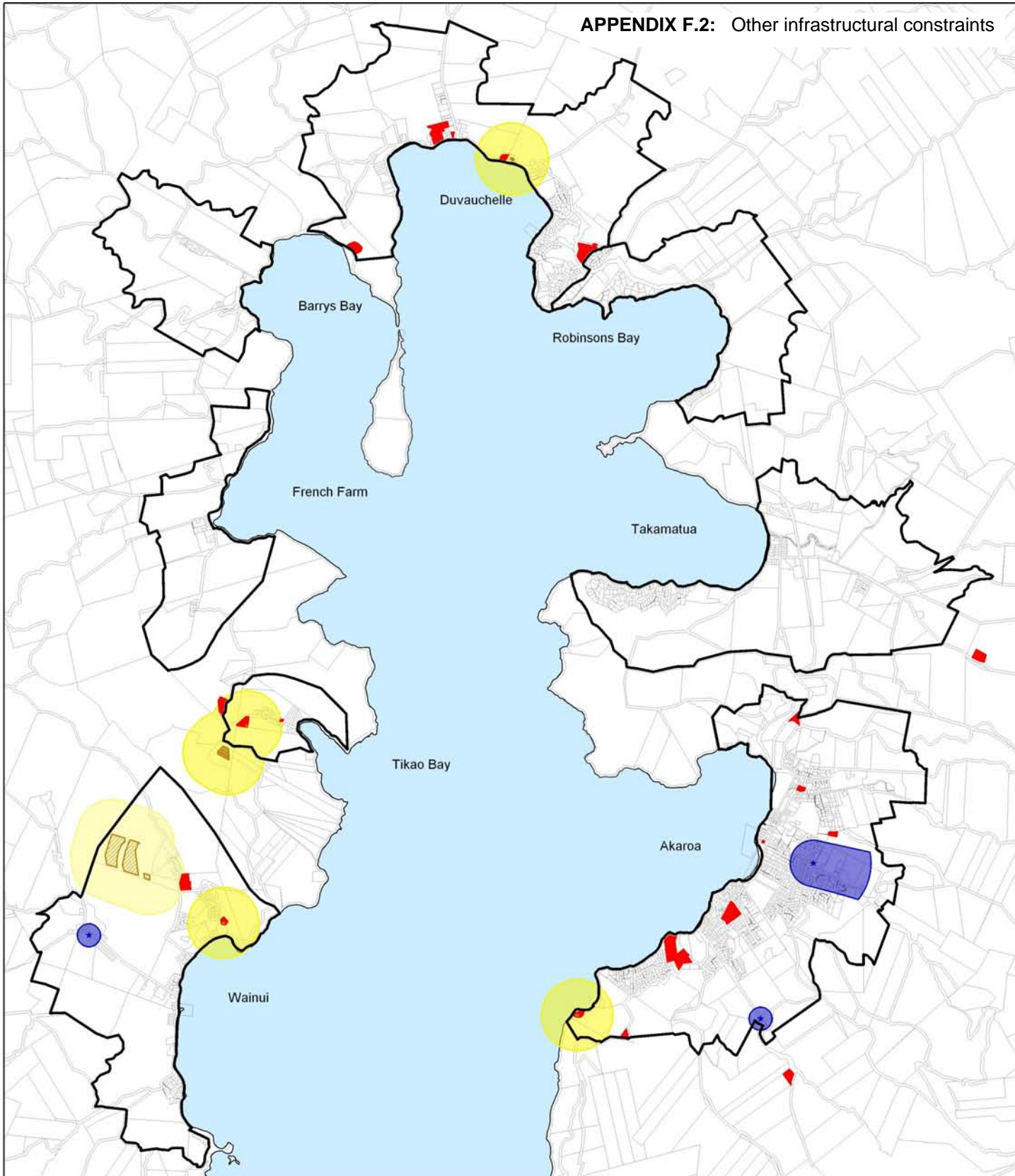
**Akaroa Harbour Basin Settlements Study: transportation constraints**

**Legend**

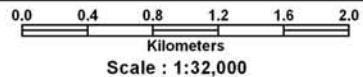
-  Settlement study area
-  State Highway 75 (SH 75)
-  SH 75 - Environmental Buffer Area (0-20m from road edge)
-  SH 75 - Road Noise Effects Area (20-80m from road edge)
-  Local roads
-  Unformed 'paper' roads (excl. coastal areas)











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**Akaroa Harbour Basin Settlements Study:  
Physical infrastructure constraints**



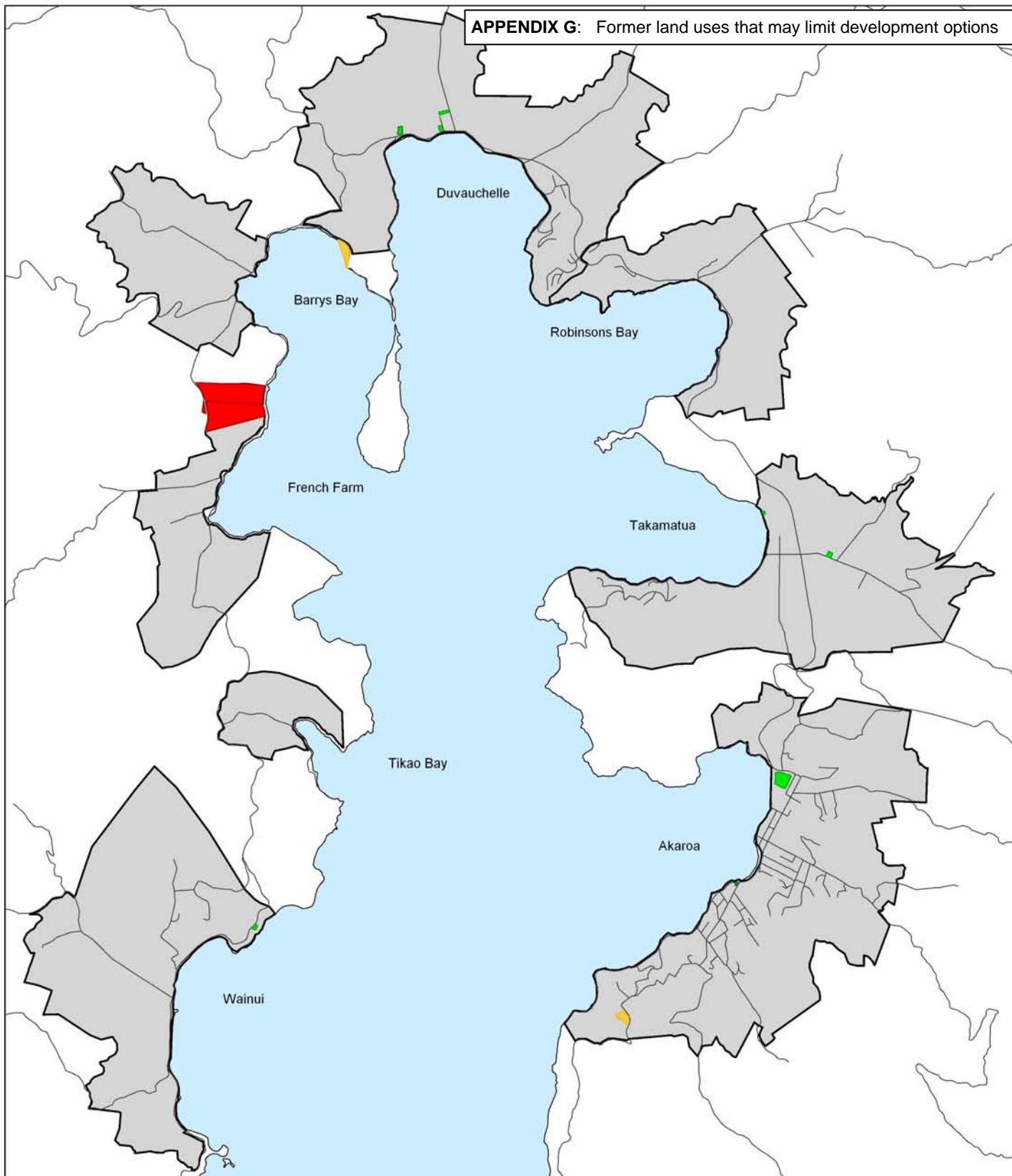
**Legend**

- |                                                                                     |                                        |                                                                                     |                                                        |
|-------------------------------------------------------------------------------------|----------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------|
|  | Settlement study area                  |  | Wastewater treatment plants (WWTPs) and disposal areas |
|  | Designation                            |  | 300m buffer of existing WWTPs and disposal areas       |
|  | Community water supply well            |  | Proposed Wainui WWTP and disposal areas                |
|  | Community water supply protection zone |  | 300m buffer of proposed Wainui WWTP and disposal area  |



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**APPENDIX G: Former land uses that may limit development options**

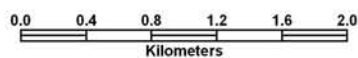


**Legend**

-  Closed (and monitored) landfill
-  Sites where contamination has been recorded (Barrys Bay Gun Club)
-  Location of potentially contaminated activity (past or present)\*
-  Road centreline
-  Settlement study area

\*Soil contamination at these sites has not been verified. There may be other potentially contaminated sites within the study areas that have not yet been identified.

**Akaroa Harbour Basin Settlements Study:  
Former land uses that may limit development options**

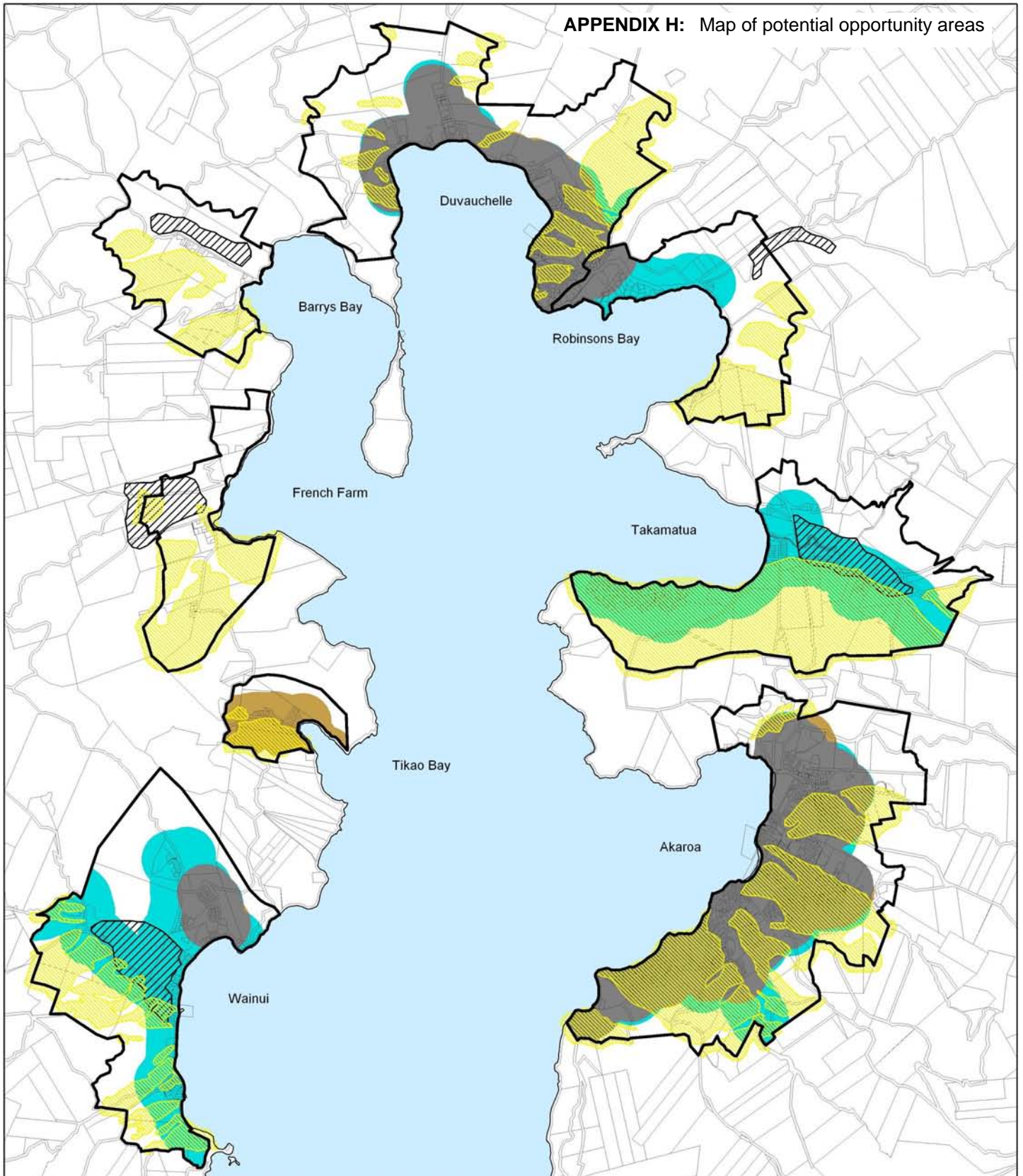


Scale : 1:32,000







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APPENDIX H: Map of potential opportunity areas



**Legend**

-  Settlement study area
-  Slopes that receive the most sun
-  Areas with potential to absorb growth (Boffa Miskell)
-  Areas within 250m of wastewater main\*
-  Areas within 250m of water supply main\*
-  Areas within 250m of both water supply and wastewater mains\*

\* The 250m buffer of wastewater and water supply mains is indicative only and should not be taken to imply that these areas are capable of being serviced. Other constraints (eg elevation and the capacity of water sources, pumping stations and treatments plants) limit the ability to service some of these areas.

**Akaroa Harbour Basin Settlements Study:  
Potential opportunity areas**



Scale : 1:32,000

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