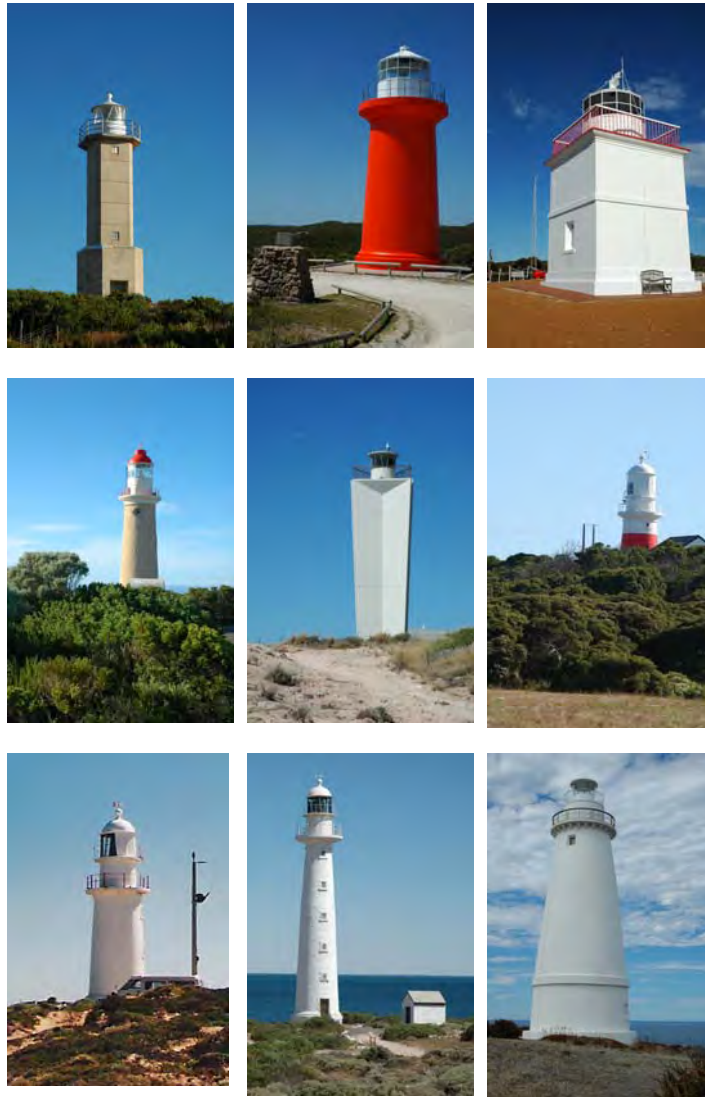


COASTAL VIEWSCAPES OF SOUTH AUSTRALIA

Report for the Coast Protection Branch
South Australian Department for Environment and Heritage



Dr Andrew Lothian

2005

Scenic Solutions, PO Box 385, Mitcham 5062

Cover photograph of lighthouses on the South Australian coast:

Beachport (SE)	Cape Banks (SE)	Cape Borda (KI)
Cape du Couedic (KI)	Robe (SE)	Cape Northumberland (SE)
Corny Point (YP)	Point Lowly (upper Spencer Gulf)	Cape Willoughby (KI)

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EXECUTIVE SUMMARY

Project Requirements

The Coastal Protection Branch of the Department for Environment and Heritage engaged Dr Andrew Lothian of Scenic Solutions to measure and map the scenic quality of the South Australian coastline.

The Branch recognised that increasing developmental pressures on the coast were threatening the very qualities that the community value. Development pressures included housing and land division, marinas, aquaculture, wind farms and access roads and trails.

The outcomes of the project were intended to assist in the development of planning policy and the assessment of development applications.

The project tasks were to:

- Develop and apply a methodology to measure the scenic value of the South Australia's coast;
- Provide recommendations for the incorporation of the methodology into the Policy, Planning and Development Assessment processes;
- Map scenic value at a scale sufficient for planning and policy development;
- Report on the findings of the project;

The project commenced in mid December 2004 and was completed by the end of June 2005 with the exception of the mapping of scenic quality. This was completed in October 2005.

Approach to the Task

In essence the approach involved classifying the coast into units of similar characteristics, sampling these by the use of photographs, selecting photographs for an Internet-based survey, arranging for the scenic quality of these scenes to be rated by participants, analysing and modelling the results, and using the results as the basis for mapping the scenic quality of the South Australian coastline.

Aesthetics and Coastal Landscapes

The project commenced with a review of previous studies of coastal scenic quality both

in Australia and overseas. Virtually all the studies examined applied various criteria to what was believed to constitute attractive landscapes and then analysed them accordingly. A typical methodology involved the classification of areas of similar landscape character and the application of criteria such as naturalness, pattern, form, line and texture to each area. The scores would then be added and its landscape quality thus derived. This method is heavily dependent on the selection of factors to be scored and this varied widely from study to study. The selection of factors tended to be those which were measurable and were treated as of equal importance. This reductionist approach in which the whole is the sum of the parts is contrary to the holistic way in which landscapes are viewed and judged. The alternative is community rating of scenes which is the method used in this project.

The nature of aesthetics as an affective quality was then reviewed. Aesthetic preferences do not derive from cognitive analysis but rather from affective preferences. The influence of culture and individual differences (e.g. age, gender) on preferences was examined; it being shown that the similarities in preferences across cultures and individuals were greater than the differences. Theories of landscape aesthetics have an evolutionary perspective which argues that people's landscape aesthetics reflect what is survival enhancing. Studies which have examined the influence of water on landscape preferences were summarised.

The use of photographs on which to assess landscape aesthetics was examined, it being shown from a range of studies that providing the photographs meet certain criteria (e.g. colour, common format, not-composed) the preferences would be similar to those derived from field-based studies.

Acquiring the Data

The principles and criteria which guided the taking of coastal photographs were described. The entire accessible coast was traveled, covering over 10,000 km during which nearly 1700 photographs were taken.

At the consultant's request, DEH Environment Information prepared a set of maps showing the land that can be seen from the sea. This

viewshed comprises land with a sea view which is likely to come under greater development pressure than land without this view. Such land with a sea view would also have a higher scenic quality rating. These maps were subsequently used in mapping of scenic quality.

The South Australian coast was classified into five main landscape units: high cliffs, low cliffs & beaches, headlands & bays, beaches & dunes, and the samphire-mangrove formation. Each was described and its length measured. Dunes & beaches comprised 45% of the coast, headlands & bays 28%, high cliffs 12%, low cliffs 3% and mangroves/samphires 10%. The proportion of each landscape unit per region provided the basis for the selection of photographs.

The survey instrument was assembled using 138 coastal scenes plus 28 scenes from wider South Australia to ensure the rating of the coastal scenes reflected a State-wide perspective. The survey instrument commenced with instructions, demographic data, and 10 introductory scenes of the coast and South Australia. The scenes were then shown in random order which was changed for each participant. Ratings were on a 1 – 10 scale (low-high). The ratings were automatically tallied in a data base. An opportunity for comments was provided upon completion of the survey.

The survey commenced on 7 April and *The Advertiser* carried a 2-column article with a photograph on that day with the web address included. By its termination on 30 April, 3324 had participated of whom 2258, 68%, completed all 166 scenes. A further 58 were found to rate most scenes as 10 – a clear case of strategic bias, and were deleted leaving 2200 for analysis. Of these participants, 679 offered comments, particularly about the importance and beauty of the coast. Their comments were included on the CD. A sample of 2200 provided a confidence interval of 2.09; i.e at 95% confidence level, the response will be +/- 2.09% of the true value. This is an exceptionally small figure.

The scenic quality of scenes varied reflecting the presence or absence of certain features. The presence of the following factors were scored on a 1 – 5 scale: indentation of the coast, area of water, awe/ tranquillity scale, diversity, naturalness, quality of beach, and

height of land forms. Each was scored by small groups of participants.

Analysis of Data

The data set comprising the ratings of the 166 scenes by 2200 participants was analysed. The distribution of responses was close to normal.

Compared with the South Australian community, the sample was better educated and more middle aged. However the ratings were similar across the range of participant characteristics (age, gender, education, birthplace), reinforcing the finding earlier that ratings are similar across cultures and groups of individuals. Participant familiarity with different regions of the South Australian coast was strongest nearest to Adelaide and declined with distance. Familiarity with an area increased ratings slightly.

Appendix 10.3 contains all scenes with their ratings. Average ratings of scenes ranged from a low of 3.38 (samphires near Whyalla) to a high of 8.65 (Admiralty Arch, Kangaroo Island). Scenes typical of ratings 3, 4, 5, 6, 7 and 8 were included in the report. The factor scores were also analysed to derive averages.

The highest rating region was Kangaroo Island (7.15) while the lowest were the northern parts of the two Gulfs, St Vincent (4.64) and upper Spencer Gulf (4.57). Averages for other regions were: South East 6.79, Fleurieu Peninsula 6.68, Adelaide coast 5.93, Yorke Peninsula 6.17, Eastern Eyre Peninsula 5.92, Western Eyre Peninsula/Nullarbor 7.02. The ratings by landscape unit were: high cliffs 7.84, low cliffs 6.32, headlands & bays 7.02, dunes & beaches 6.30, samphires & mangroves 4.75.

Content analysis of the scenes in each landscape unit searched for possible influences on the ratings and detected various factors, which contributed to the identification of factors to be scored.

Analysis of the ratings combined with the scores for the factors identified (e.g. naturalness, height) found that the strongest influences were diversity, tranquillity-awe, and naturalness. The presence of seaweed had a negative influence on ratings.

Multiple regression analysis was used to develop predictive models for the scenes. Its purpose was to identify the influence of the

various factors that had been scored on the scenic quality rating that had been obtained by the survey. Models were derived for all the scenes, and then for each of the landscape units. The results of each model were tested against the survey ratings to assess their accuracy.

Mapping Scenic Quality

The project required scenic quality to be mapped at a scale sufficient for planning and policy development. This was determined to be 1:40,000, the scale of the Development Plan maps used by Councils. However maps for mapping could only be produced at a scale of 1:50,000 which was considered satisfactory.

The following three zones were defined for mapping:

Zone 1: The water/land interface and land immediately facing the sea, including cliffs, dunes, headlands etc. This was generally a narrow band of land but for mapping purposes was defined as 100 m wide.

Zone 2: The land inland from Zone 1 from which the sea was visible. This may be quite narrow or stretch a considerable distance inland depending on the topography of the area. The extent was defined by the coastal viewshed maps.

Zone 3: Land where the sea was not visible and comprised agricultural land, parks and other uses. Often Zone 3 was inland of Zone 2, however in many areas, low land from where the sea cannot be seen occurred near the coast so in these areas, Zone 3 was located quite close to the sea.

A proforma was developed to guide the mapping of each section of the coast. This covered the following:

1. Defined the section
2. Defined the landscape units present and the length of coast in the section
3. Identified any scenes used in the survey present in the section, plus other photographs from the 1700 taken
4. Identified scenes similar to those found in the section of coast; this is based on the principle of equivalence, that a scene in one area can be applicable to another area with similar characteristics
5. Oblique aerial photographs available on-line from the Atlas of South Australia were inspected covering the entire coast
6. A brief description of the section covered
7. A table setting out the scenic quality ratings of scenes from 3 and 4, together with the ratings derived for them by the predictive models
8. The scenic quality rating for Zone 1 was given as a range of half a unit, e.g. 6.5 – 7.0. The mapping showed the median (6.75).
9. Ratings for Zones 2 and 3 were also provided. These differentiated ratings by location and land cover; land with 1 km considered of higher scenic quality than land more distant, and vegetated land slightly higher than non-vegetated land.

The overall Zone 1 ratings of the entire coast are summarised below.

Rating	Length km	%
na	38.8	0.8
3	31.4	0.7
4	402.8	8.4
5	813.5	17.0
6	1410.1	29.4
7	1987.9	41.5
8	107.5	2.2
Total	4792.1	100.0

A summary of these ratings by region and the detailed ratings of each section were included on the CD. The highest rated areas were, in order, Whalers Way – Shoal Point and Cape Catastrophe-Cape Tournefort areas south of Port Lincoln, Cape du Couedic-Kirkpatrick Point area on Kangaroo Island, and Cape Spencer at the toe of Yorke Peninsula. These areas rated 8 – 8.25. Other highly rated areas were in the South East (Cape Northumberland – Finger Point, McIntyre Beach – South End, and Beachport – Robe), the north-west and south-west coasts of Kangaroo Island, western Eyre Peninsula from Farm Beach through to Cape Bauer, and the Nullarbor cliffs. These all rated 7.75.

Coastal Development Survey

Following discussions with the Department a second Internet survey was conducted to ascertain the impact of development on scenic quality. The survey covered mainly housing-type developments of various forms and scales, plus several scenes of marinas and aquaculture. Scenes were prepared digitally with development included and the same scene without the development. The survey comprised 82 scenes. No demographic data was sought but an opportunity to provide comments was included. The comments

received were placed on the CD and provide valuable insights into the views of a broad cross-section of the community regarding coastal development.

The survey was placed on the Internet and ran during 11 – 31 May and attracted 2413 participants. Of these, 1659 (69%) completed all scenes and provided the basis for analysis. The data set was checked for strategic bias but little found. The scenes without development averaged 7.09 and with development 5.00, a significant difference of over two units. The reduction due to development ranged from 10% to 50% of the scenic quality with an average of 29%.

Interestingly analysis showed that the impact of development did not correlate with the level of scenic quality; rather the impact was independent of the particular level of scenic quality and applied uniformly across the range of scenic quality. The decrease in scenic value attributable to development was around two units regardless of whether the scenic quality was eight or six. It had been expected that the impact would be greater for higher scenic quality and vice versa.

Other findings from the analysis of the results were:

- The largest impact was from housing and marina development while aquaculture appeared to have a lesser impact
- The impact was similar whether the development was on headlands or dunes
- While the impact of development was lower for distant scenes, it was similar in the near and middle distance
- The impacts were similar for shack development and high rise development and both were greater than for housing development
- The impact was greater for less familiar scenes than for scenes of high familiarity.

The findings regarding the level of impact being independent of the scenic quality rating and also being greater for unfamiliar scenes were unexpected.

The findings from an earlier study of the impact of wind farms on coastal scenic quality were also summarised. The study used 21 coastal scenes with and without wind farms and had over 300 participants rate the scenic

quality. It found that in all cases, the wind farm diminished scenic quality by an average of 1.5, but a larger impact for scenes of higher scenic quality and lesser for scenes of lower scenic quality. The findings enabled the likely impact of wind farm on a coast of known scenic quality to be predicted.

Application of Findings to Policy, Planning and Development Assessment

The project required recommendations for the incorporation of the results in the planning policy and development assessment processes. Scenic quality would be considered along with other relevant considerations in these processes. The assessment of scenic quality that were derived from this project, and the resultant maps were considered sufficiently robust and accurate to provide a basis for the development of planning policy and for the assessment of development applications.

The findings from the Coastal Development Survey were summarised as they were relevant to this chapter.

The issue of access to high quality scenic areas was discussed, with spur roads favoured over coastal roads.

An extensive review was provided of coastal scenic area planning policies from South Australia, other states and overseas together with a synthesis.

Development options for high quality coasts were reviewed and the issue of a veto over development for high quality areas discussed. Options were presented ranging from complete exclusion to providing a high level of access. This is a policy issue which would require broad community input for its resolution.

The approach proposed to guide planning policy and development assessments classified coastal areas by their relationship to the sea (i.e. Zones 1, 2 or 3) and by the scenic quality rating – also in three zones, proposed as: SQ 1 rating more than 7.25, SQ 2 more than 5.0 and less than 7.25 and SQ 3 more than 3.0 and less than 5.0.

A matrix comprising SQ1, 2 and 3 across and Zones 1, 2, and 3 down was constructed. The strategic approach involved high levels of protection for Zone 1/SQ1 and lesser levels of protection for SQ2 and SQ3 and for Zones 2

and 3, allowing progressively greater levels of access, structures and developments consistent with maintaining the scenic values as well as other environmental values (e.g. wetlands in SQ3). Greater protection was provided within Zones 2 and 3 for areas within 1 km of the coast; it being recognised that there were many Zone 3 areas in proximity to the coast.

The matrix was then applied to the following areas of development: access, visitor facilities, structures & infrastructure, commercial developments, tourist developments and housing developments. Mining and extractive industries, wind farms, aquaculture, marinas and marine Infrastructure were also covered.

Conclusions

The requirements of the Project Brief were fulfilled by the Project.

The conclusions examined the issue of the use of surrogates (photographs and scales) in the Project and that although scenic quality is inherently subjective, the Project has demonstrated that it can be measured objectively.

A whole-of-government policy approach to coastal scenic quality is advocated. This would cover planning and development assessment, Government developments and marine management, National Parks policy, declaration of Landscapes of State Significance, working with the Commonwealth, assigning responsibility for coastal scenic quality, and promoting community appreciation and opportunities for involvement.

Coastal scenic quality is an important community resource of immense social and economic value. South Australia can lead the nation in its recognition of this through its efforts to identify, protect and manage coastal scenic quality.

References

A comprehensive set of references was included.

Appendixes

Appendixes covered the following:

- 10.1 Project Brief
- 10.2 Gantt Chart of Coastal Viewsapes Project Implementation

10.3 Scenes in survey by region

CD

The CD accompanying the report contained:

1. Powerpoint summary of Coastal Viewsapes project
2. Locations of all photographs
3. Scenes arranged by landscape unit
4. Coastal development scenes
5. Coastal rating assessments
6. Rating maps by regions
7. Rating maps by councils
8. Comments by participants from Coastal Scenic Quality Survey
9. Comments by participants from Coastal Development Survey

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1. INTRODUCTION

1.1 PROJECT BRIEF

The origins of the study derived from the recognition by the Coastal Protection Branch of the South Australian Department for Environment and Heritage that the scenic quality of South Australia's coast is a significant social, economic and environmental resource. The coast has played a major role in the development of the State and continues to be enjoyed by the community.

Increasing developmental pressures on the coast however are threatening the very qualities that the community value. Developments including housing and land division, marinas, aquaculture and wind farms, together with access roads and trails are imposing far greater pressure on the coast than in the past.

The Branch therefore identified the need to evaluate the scenic value of South Australia's coastal landscape as a basis for the development of policy and the assessment of development. The Project's aim was to measure and map the scenic value of the coastal zone of South Australia.

The outcomes of the project were intended to:

- Provide a basis for strategic planning and policy within the coastal zone;
- Provide information on community aspirations both on a local, regional and statewide basis, in respect to landscape qualities, in order to include appropriate development controls in Council Development plans;
- Provide a basis for the assessment of development, particularly within the coastal zone in development plans where development should be classified as non-complying or prohibited;
- Provide support for decisions made on policy, planning and development applications including in appeals;
- Inform and enhance knowledge and understanding of the value of the coastal landscape among professionals, regions and the community.

The tasks required of the project were to:

- Develop and apply a methodology to measure the scenic value of the South Australia's coast;
- Map scenic value at a scale sufficient for planning and policy development;
- Provide recommendations for the incorporation of the methodology into the Policy, Planning and Development Assessment processes;
- Report on the findings of the project;
- Complete the project by 30 June 2005.

The Study Brief defined the Project's scope and certain specifications to be observed. A Project Steering Committee was established to oversee and assist in the implementation of the Project. The Project Brief is included as Appendix 10.1.

1.2 PROJECT METHODOLOGY

The project brief required the development and application of a methodology to measure and map the scenic value of the South Australian coast. The approach to this task required the coast to be classified into units of similar characteristics, for these to be photographed and rated by participants, and for these ratings to be applied to coastlines of similar characteristics in order to map them.

Figure 1.1 summarises the overall design and methodology of the project. Appendix 10.2 provides a Gantt chart of the components for the term of the project. The approach to the project was guided by the following key considerations as defined in the Project Brief.

(1) Ensure the integrity of the resultant scenic quality ratings

The scenic quality of the coast must be derived in a manner that does not compromise or bias its results. It requires the results provide an objective, rigorous and accurate measure of coastal scenic quality as a basis for development policy and other applications.

The ratings should be derived without reference to their use so that participants can rate scenes disinterested in the use to which they may be put. The principle of disinterest is foundational to social surveys. Informing participants that the results will provide an input for development policy carries with it the

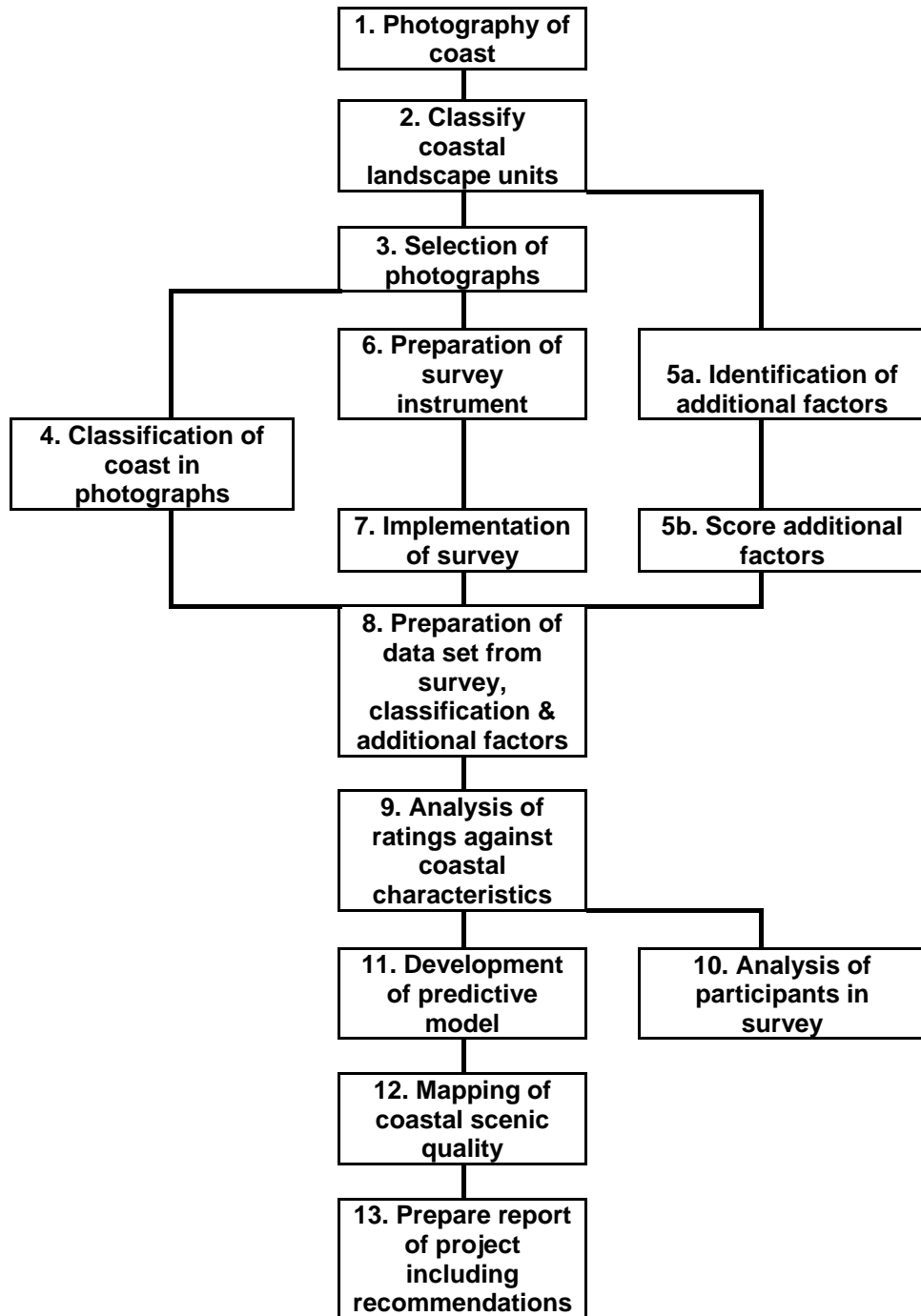


Figure 1.1 Project Methodology

risk of strategic bias; that participants will frame their responses in a way that may achieve their objectives and the survey may accordingly be biased.

The methodology proposed would involve participants from the regions, community and professional groups. The ratings derived from each group could be compared and any differences identified. However based on the literature of such studies and the consultant's previous experience, any differences were not expected to be significant. This means that the scenic quality ratings derived through community involvement could be taken to reflect the preferences of the whole community.

(2) Ensure adequate context for the ratings

Gaining scenic quality ratings which reflect as State-wide perspective and accurately reflect community preferences requires that they be adequately benchmarked. This required the inclusion of non-coastal scenes so that the ratings of the coastal scenes are based within a wider context. Otherwise the ratings would reflect solely the scenic quality range of scenes present at the coast may not necessarily be taken as representative of State-based ratings. The presence of water in the coastal scenes would automatically elevate ratings by at least 2 points (on a 1 – 10 scale), however these heightened ratings would not be apparent if all the scenes contained water and none were without it.

Benchmarking also required that the entire South Australian coast be included, not just sections of it. If say, only Eyre Peninsula and Kangaroo Island were subject of the ratings, then these could not be compared with later surveys of other coastal regions where the scenic quality may be substantially lower. The project needed to cover the entire coast for the results to be comparable from region to region.

(3) Reflect community preferences

As a qualitative attribute of the environment, the assessment of scenic quality must involve the participation of people to provide the ratings of scenic quality. While there are various theories about why people like the landscapes they like (see Section 2.5), these are insufficiently prescriptive to determine scenic quality ratings without involving people.

Alternative methods of assessing scenic quality are often termed *expert assessments* and are largely descriptive, focus on formalist qualities (e.g. line, shadow and texture) and involve analogy, classification of landscape sensitivity, and use of GIS generated maps of visibility and viewsheds. They tend to be driven by the technology that is available and do not test whether the results correspond with community-derived preferences. These are examined in sections 2.2 and 2.3.

1.3 TERMINOLOGY

Terms which are used in this report are defined as follow.

Scenic quality refers to the aesthetic quality of the landscape.

Quality refers to the aesthetic worth of a scene, generally on a high – low continuum.

Landscape comprises the physical characteristics that are present including land form, land use, land cover, the presence of water and other attributes.

Land form comprises the terrain of the landscape including sand dunes, hills, valleys.

Land use covers human use of the land including agriculture and forests, but also non-uses such as national parks and conservation reserves.

Land cover refers mainly to the presence of vegetative cover, trees, shrubs and grasses, but can refer also to crops.

– 25 were moderate, and 26 – 39 were high. Edwards commented: “generally the inland areas and low energy coastal areas scored a low value whereas a variety of coastal landscapes were accorded a high value”.

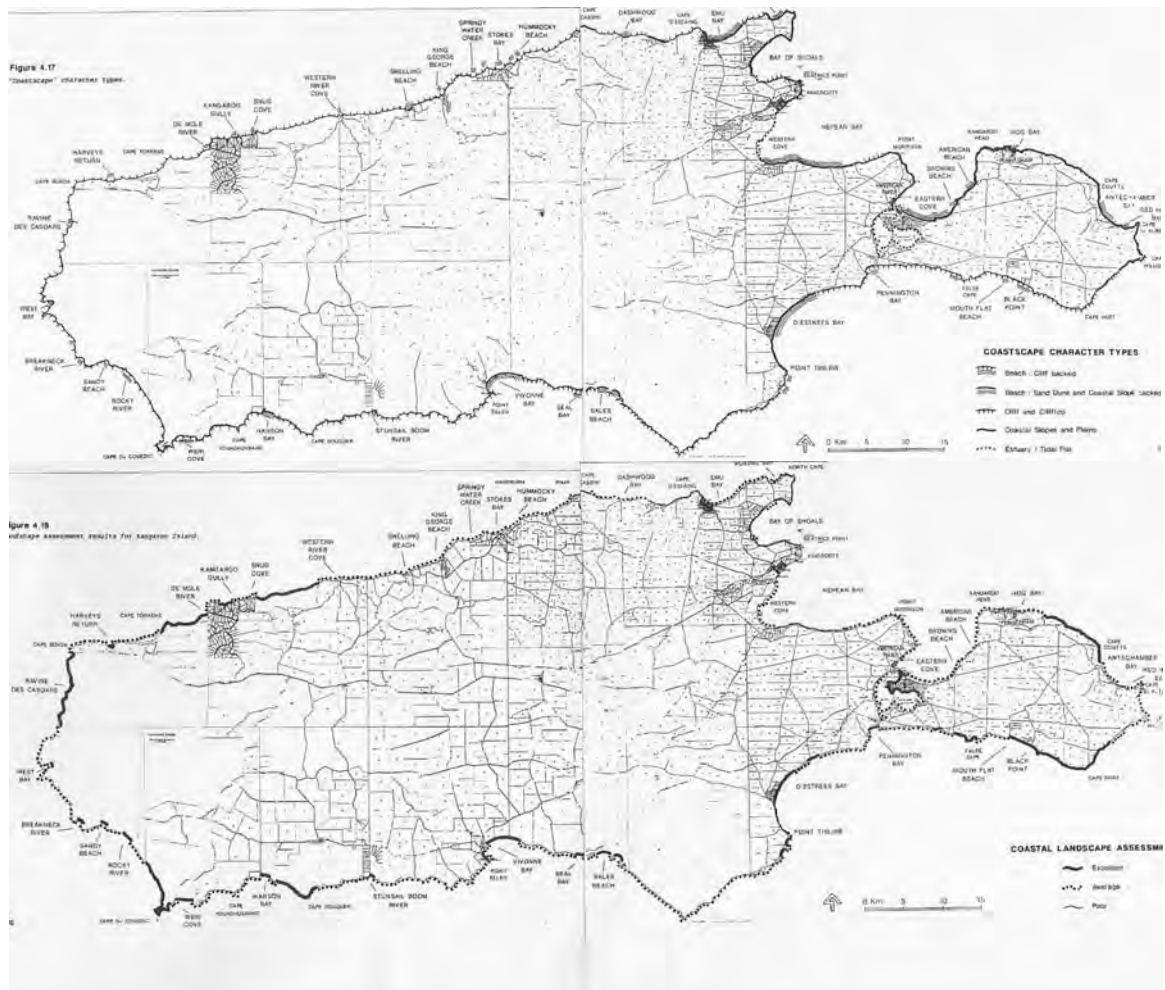
Edwards examined the model by Brown, Itami and King (1979) based on earlier work by Stephen Kaplan (1979) which indicated the “essential landscape components corresponding to the key human responses” (Table 2.1). This is derived from research of human landscape preferences.

Edwards identified and mapped five “coastscape” character types for Kangaroo Island (Figure 2.2):

- Beaches backed by cliffs
- Beaches backed by coastal slopes and sand dunes
- Cliffs and clifftop areas
- Coastal slopes and plains
- Estuary and tidal flat areas

Table 2.1 Model relating scenic resource values to landscape preference components

	Making sense	Involvement
Land form	Slope Relative relief	Spatial diversity Relief contrast
Land cover	Naturalism Compatibility	Height contrast Internal variety



Source: Edwards, G., 1987. *Kangaroo Island Coast Protection District Study Report*, Coastal Management Branch, Dept for Environment & Heritage, p 107-8.

Figure 2.2 Kangaroo Island Coastscape Character Types (upper) and Coastal Landscape Assessment (lower)

Edwards assessed landscape quality on the basis of land form and land cover using the following components:

Land form

Relative relief – the change in elevation within the landform unit; the higher the relief the higher the landscape value. Thus height of 0 – 50 m above sea level scored 1, 51 – 100 m scored 2 and 101 + m scored 3.

Slope – the steepness of the landform with landscape quality increasing with slope.

Relief contrast – the differences in relief (undulation) between adjacent (landward) landform units; the greater the contrast the higher the landscape value. Flat land scored 1, moderate undulation 2, hilly undulation 3.

Spatial diversity – the variety or complexity of spaces created by the landform; the greater the diversity the higher the landscape value.

This appeared to measure the horizontal undulation of the shoreline – the degree of indentation may be equivalent.

Land cover

Compatibility - the visual congruence, unity, harmony and balance of the landward land cover; the greater the compatibility the higher the landscape value. Land which had not been cleared, or comprised pasture scored 3.

Naturalism is the degree by which the land cover is affected by man; minimal impact, the higher the landscape value.

Height contrast – the difference in average height of adjacent vegetation; the greater the height contrast, the higher the landscape value. A pasture/sparse tree cover scored 3, ground cover/pasture 1.

Internal variety – the variability in the visual pattern and tone within land covers; the greater the variation the higher the landscape value. This was based primarily on the number

of major colours present; up to 2 colours scored 1, 3 – 5 colours 2, 5+ colours 3.

The scoring of each of these was added and a weighting applied to each factor, it being recognized by Brown *et al* that the components were not considered of equal value. Higher weightings were accorded relative relief, slope, compatibility and naturalism. Edwards produced a map of the scores derived for Kangaroo Island (Figure 2.2). This indicated only three categories, Excellent, Average, and Poor.

Using community rating of landscape photographs with over 300 participants, Lothian (2000) carried out a landscape quality assessment of South Australia including the coast.

This was at a broad state-wide level. Using a 1 (low) – 10 (high) rating scale, he found the '6' and '7' ratings together accounted for 89.2% of the total length of coastline. In contrast to the rest of the State, where the '7' rating covered only 0.5% of the State's area, on the coast it extended nearly 30%. The coast is thus one of South Australia's key regions in terms of landscape quality.

Table 2.2 Lengths of Landscape Quality Ratings Coast

Ratings	Length [Km]	%
3	72	1.94
4	18	0.50
5	17	0.45
6	2213	59.82
7	1088	29.41
8	292	7.88
Total	3700	100.00

Source: Lothian, 2000

Table 2.3 Lengths of Coastal Ratings by Region (km)

	Rating Scale								Total
	1	2	3	4	5	6	7	8	
West coast Nullarbor						155	210	225	590
W. Eyre Peninsula			5			255	410	100	770
E. Eyre Peninsula					10	510			520
Upper Spencer Gulf			30		20	140			190
Yorke Peninsula						430	105		535
Pt Wakefield - Sellicks			35			130			165
Fleurieu Peninsula						20	120		140
Coorong						20	160		180
South East						135	100		235
Kangaroo Island						180	210		390
Total			70		30	1975	1315	325	3715

Source: Lothian, 2000

Table 2.2 summarises the length of coastline for the different ratings. Table 2.3 details the ratings of coast by region. It indicates the high rating of the Nullarbor coast with its high cliffs, the west coast of Eyre Peninsula, the lower Yorke Peninsula, Fleurieu Peninsula, parts of Kangaroo Island, the Coorong and parts of the South East coast.

(2) Queensland

During the 1990s, Alan Chenoweth, a Queensland planning consultant, developed a methodology to assess the scenic resources of parts of the Queensland coast. His Coastal Landscape Assessment (CLA) Methodology was developed for the Coastal Management Branch of the Department of Environment and Heritage. CLA “assessed a range of scenic and cultural landscape values associated with coastal settings, and identified significant landscapes as an input to coastal land use planning”. The methodology was applied to four regions: South East Queensland, Wide Bay – Burnett, Mackay – Whitsundays, and the Wet Tropics.

CLA provided a comprehensive approach and involved the following components:

- Hierarchical assessment of (coastal) scenic resources, cultural themes and heritage values, followed by a regional analysis which provided the framework for smaller units;
- Cultural themes and associations were identified from coastal history, heritage registers, regional focus groups;
- Landscape setting units were defined comprising identifiable places bounded by viewsheds to provide basis for assessment, GIS, planning and management;
- Scenic quality indicators comprised naturalness, pattern, built form & activity, landform, vegetation & wildlife, and water & shoreline. These were based on the US Forest Service Scenic Management System. The indicators were assessed by landscape professionals for each landscape setting. The criteria had been validated by community focus groups but apparently not calibrated across assessment teams. Relative ratings (Very High to Low) were derived but not given arithmetic values;
- Landscape character and identify – the distinctiveness of the character and strength of identity;

- Land types at a local scale covering foreshore, island, foothills, plains etc. These were evaluated for landscape sensitivity, scenic integrity, positive and negative elements, and cultural heritage sites.

The products of the methodology were maps of landscape settings ranked according to their scenic significance – State, regional, local. Data were also provided of cultural significance and sensitivity and of landscape elements which contribute to scenic and regional identity.

The coast was divided into 58 individual coastal landscapes and classified into one of the following landscape character types: regional city, low intensity coastal plain, extensive coastal plain, coastal valley, steep coastal range, major peninsula and island groups, and major island groups.

Level 1 scenic quality landscapes (e.g. Whitsunday Islands, Port Douglas) were considered to be highly outstanding and distinctive. Criteria for their inclusion were:

- the landscape is recognised as having exception or unique statewide, national or international aesthetic values
- the landscape displays high visual quality indicators for landform, landcover and waterform

Chenoweth claimed the methodology was credible, repeatable and capable of yielding maps, data and recommendations for planning measures. Although it is comprehensive and used focus groups to review criteria, the derivation of scenic quality ratings was based on expert assessment, not community preferences. Fairly coarse categories of value (very high – low) were derived. The method does not provide ordinal quantification of scenic quality. Nevertheless it provided a comprehensive approach which relied on expert assessment and it attempted to go some way towards ensuring its replicability and validity.

EDAW (Aust) carried out an assessment of Queensland’s scenic resources for the Coastal Management Branch of the Queensland Department of Environment in 1996 (EDAW, 1996) (see also www.epa.qld.gov.au/register/p00607af.pdf accessed 20/3/05). The methodology built on Chenoweth’s work among others and involved three steps:

- Step 1 Identification of the coastal 'viewshed' and coastal landform types; this used physical criteria to identify viewsheds and the basic types of coastal landforms;
- Step 2 Identification of 'coastal landscapes'; this classified coastal landscapes of similar characteristics and carried out a field inventory of coastal landscapes;
- Step 3 Overall scenic amenity assessment and development of scenic quality criteria; this assessed scenic amenity by categories of visual quality and prepared scenic quality criteria for each landscape character type.

Step 1 mapped the coastal landscape into four landform types – coastal ranges, coastal lowlands, coastal plains, and coastal islands. These were mapped at 1:250,000 scale. The report noted that the coastal viewshed, which comprised all land seaward of the dominant coastal range, extended from two kilometers to several hundred kilometers on Cape York and the Gulf of Carpentaria.

Step 2 adopted Chenoweth's classification of the coastal landscapes: regional city, low intensity coastal plain, extensive coastal plain, coastal valley, steep coastal range, major peninsula and island groups, and major island groups. Step 2 also involved the videoing of the entire Queensland coast from the air using a low flying aircraft.

The scenic quality assessment of Step 3 indicated the relative distribution of scenic quality indicators in a number of categories. Chenoweth's four level classification of scenic qualities was used:

- Level 1 Highly outstanding and distinctive

- Level 2 Outstanding and distinctive
- Level 3 Somewhat distinctive or outstanding
- Level 4 Tend to be present in other parts of the coast

These grades of relative scenic quality were depicted on a map of the Queensland coast. These comprised blocks of the same level extending for a distance along the coast and inland for varying distances – to the nearest range. Based on this, a further map depicted relative scenic management priority – high, medium and low.

Tables containing the recommended scenic quality criteria for the eight landscape character types (i.e. regional cities, linear coastal strip etc) were defined. These comprised matrices of the level of scenic quality (high, moderate, low) across and landform, land cover and waterform down the matrix. Desirable scenic quality criteria were defined for the matrix. Part of one of these matrixes is provided by Table 2.4.

The resource inventory contained in the report provided detailed descriptions in the form of matrices of each of the 58 coastal landscapes.

This assessment required considerable resources to undertake and provided a detailed and comprehensive description of coastal landscapes. It used explicit criteria to classify and inventorise these landscapes. The derivation of scenic quality was based on an assessment of the data gathered. The classification provided of scenic quality into four grades was fairly coarse given the amount of information gathered. Mapping of scenic quality covered blocks of areas,

Table 2.4 Scenic Quality Criteria Matrix – Queensland Steep Coastal Ranges

	High scenic quality	Moderate scenic quality	Low scenic quality
Landform Type	Mountainous	Hilly – rolling	Undulating – plains
Landform features	Distinctive gorges & valleys	Minor valleys	Flat to gently sloping
	Strongly contrasting landforms such as localized mountains/ outcrops/ peaks/ headlands, particularly when adjacent to flatter areas or forming a backdrop to semi developed areas	Low rising hills with some contrast with adjoining areas	Minor rises with limited to no contrast with adjoining areas
Land cover	Strong/ dense patches of remnant vegetation particularly when contrasting with adjoining areas	Areas with significant vegetation such as open forest	Areas extensively cleared of vegetation
Water form	Major river systems, including wild & scenic rivers	Minor rivers and creeks	Absence of waterforms

Source: EDAW, 1996

thereby assuming the entire block to be of equivalent scenic quality from adjacent to the coast to inland – in some cases tens of kilometers from the coast. The descriptions of the 58 coastal landscapes provided a wealth of information but in a form which may be difficult to apply.

(3) New South Wales

Planning NSW carried out the Comprehensive Coastal Assessment (CCA) over 2001 – 04 at a cost of \$8.6 m. It aimed to identify, analyse and assess data and information on the physical, biological, social and economic values of the State's coastline. It included a visual assessment which mapped areas of high scenic quality that are important for preservation.

The Assessment described scenic quality as a resource:

Coastal visual resources not only make a major contribution to tourism and recreation but strongly influence the amenity of those who live, work and recreate within the coastal zone. Visual resources are particularly significant as most people are immediately responsive to them. (Visual Project Summary)

Its emphasis on scenic quality as a resource is significant as it underlies much tourism and recreational activities. The study's objective was:

to characterise, assess and document the visual resources of the NSW coast to assist in the protection and effective management of that resource through well-informed decisions on conservation, development and management.

The coastal visual assessment defined the extent and character of the coastal landscape, the extent of the visual catchment, identified management opportunities, and established a framework for local detailed visual assessment, planning and design.

Visual catchments enclosed landscapes which comprised the coastal viewing experience. They could extend up to 10 – 15 km inland to coastal ranges. *Viewing situations* defined locations from which the surrounding areas of landscape were viewed - e.g. roads, rivers, trails as well as from residential, commercial, industrial and agricultural areas. These were differentiated into primary and secondary viewing situations. *Seen*

areas were those portions of the landscape that were visible from Primary Coastal Viewing Situations.

The concept of a *visual catchment* is a useful innovation, preferable to viewsheds. However the terms *viewing situations* and *seen areas* are rather clumsy.

The Visual Resource Management System for the NSW Coastal Landscapes had the following components (Figure 2.3):

Landscape Management Structures described at state and local levels

Landscape Assessment to determine what parts of the coastal landscape contribute to coastal landscape settings and classification of landscape systems and units on the basis of land form and land cover (vegetation)

Landscape Analysis which examined their visual features and qualities and visibility of the coastal landscape from significant locations. It defined Viewing Situations and Landscape Features which included landform, land cover and water features as well as ephemeral features such as light and atmospheric conditions. Visual Elements were the formalist features of form, shape, pattern, line, colour and texture. Visual Values assessed the landscape in terms of visual integrity, diversity/contrast, balance/harmony, distinctiveness, adjacent scenery, rarity, ability to accept change and visual quality. The landscape analysis was thus based on explicit descriptive information and qualitative judgements.

Landscape Management defined the level at which the visual resource of the landscape should be managed based on considerations of uniqueness, integrity and the visibility from regionally significant locations. Four management levels were defined:

1. Preservation – High visual quality + visible from viewing situation + high ecological or natural values
2. Conservation – High visual quality + visible from viewing situation
3. Modification – Low visual quality and low visibility from viewing situation
4. Restoration – Very low visual quality.

High quality landscapes visible from regionally significant locations were ascribed a preservation or conservation status while more common landscapes were ascribed as suitable for various development potentials. Degraded

landscapes (e.g. quarries) were ascribed a restoration prescription. This layer was the most difficult to describe as it has overlapping themes with conservation, agriculture and forestry, and geological features. By these means the visual management system defined the management needs of the coastal landscape to maintain visual quality.

The NSW Visual Resource Management System for Coastal Landscapes provided a comprehensive and resource intensive, assessment of landscapes. Objective data were used to describe the landscape and qualitative judgements used to describe its landscape quality attributes. This information will be of value to planning and management. Although the landscapes were described in qualitative terms: high, low, and very low, the

derivation of these was not described. Like the Queensland study, the NSW approach provides a wealth of information about the landscape but was inadequate on the crucial element of establishing their quality. The Visual Resource Management System was applied to a 35 km section of the Tweed coast (northern NSW) as a pilot project.

The visual quality of a given unit was defined over five grades by a matrix of viewing situations and the four levels of visual management; thus the top grade comprised preservation and conservation areas in the foreground, middleground and background of primary coastal regional viewing situations.

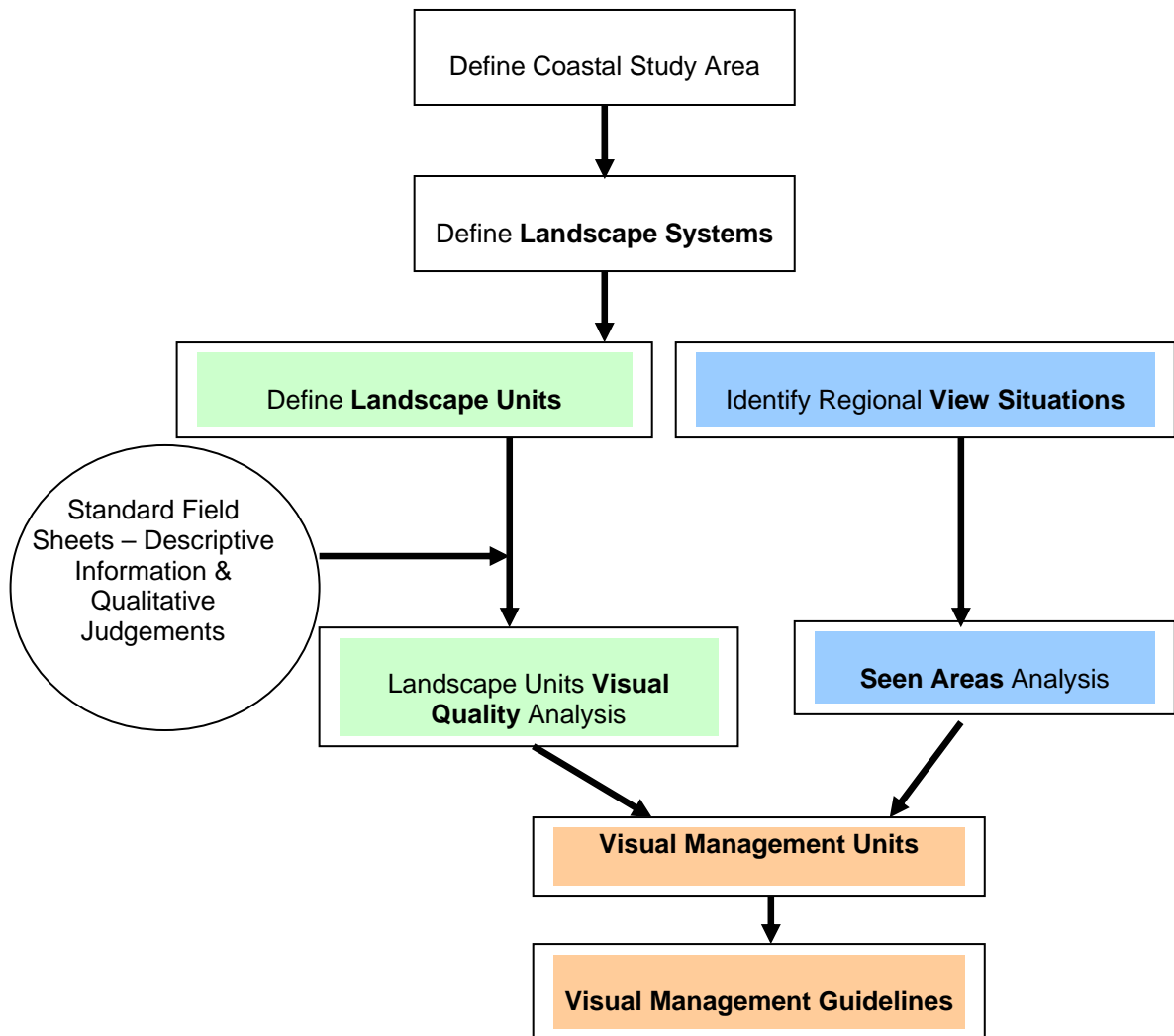


Figure 2.3 NSW Coastal Landscapes Visual Resource Management System

It identified and mapped 87 landscape units and classified their visual qualities by their visual integrity diversity/contrast, etc. Overlay maps of each were produced and combined into a single map of visual quality. The small scale and poor quality of the map made this difficult to interpret. Finally it defined a range of visual management strategies for application in this region.

(4) Victoria

In 1998, Tract Consultants and Chris Dance Land Design prepared a report: *Landscape Setting Types for the Victorian Coast* as an input to the Victorian Coastal Strategy. The identification of landscape setting types was based on site and aerial field work. The following criteria were used to determine the zones:

- The landscape as viewed from a number of points, including the sea
- Natural systems (landforms/geomorphology/land cover)
- Cultural systems (settlements/structures)
- Stability or energy level of the landscape – exposure to winds/sea
- Capacity of the landscape to absorb change without creating visual impacts from prominent viewpoints
- Cultural influences and impacts, both Aboriginal and European
- Landscape character - climatic, experiential, visual, spiritual aspects of the coastal environment

Based on these, 34 setting types were identified and defined. These provided a brief description of the physical characteristics, viewing points including a diagram, and considerations relating to planning (see www.vcc.vic.gov.au/landscape/type3.htm).

In 2003, the consultants, Planisphere carried out *The Great Ocean Road Region Landscape Assessment Study*. The study assessed the landscape character of the region and the way in which various types of development can be managed in different landscape types. The study included an assessment of “distinctive landscape elements, features, characteristics, character, quality and extent of the landscape within the region, and their value or importance.”

The study involved the confirmation of landscape character types defined in a preliminary assessment and the identification of additional landscape types, undertaking a “visual and

sensory analysis from a professional outsiders’ point of view”, and the definition and delineation of precincts within each landscape character type.

The National Trust in Victoria has been active over many years in identifying significant coastal landscapes. The methodology employed appears rather *ad hoc* and descriptive; it does not appear quantitative or based on an overall assessment of coastal landscape quality.

(5) Western Australia

A project is approaching finalisation to assist planners, local government, consultants and developers assess visual landscape character¹. A method for visual impact assessment is also being developed. Details of the Western Australia project are scant but it appears to be based on a landscape architect approach to assessing landscape quality on the basis of defined criteria.

2.3 INTERNATIONAL STUDIES

(1) New Zealand

In New Zealand, the Waikato Regional Council covers coastline in the northern part of the North Island including the attractive Coromandel Peninsula. The Council prepared a Regional Coastal Plan as required under the Resource Management Act 1991. Among its principles it stated:

Cultural, historical, spiritual, amenity and intrinsic values are the heritage of future generations and damage to these values is often irreversible.

The Resource Management Act defined amenity values as:

those natural and physical qualities and characteristics of an area that contribute to people’s appreciation of its pleasantness, aesthetic coherence, and cultural and recreational attributes

The Plan included a map delineating areas of national, regional and local significance. The criteria used in deriving these were described in *Revised Draft Conservation Management Strategy for the Waikato Conservancy* (1994).

1. *Pers. comm.* Tara Cherrie, WA Dept of Planning & Infrastructure.

It appeared that they had been derived on the basis of explicit criteria rather than by community preference surveys.

(2) United States

Californians acted in 1972 to "Save our Coast" and passed a voter initiative that:

It is the policy of the State to preserve, protect, and where possible, to restore the resources of the coastal zone for the enjoyment of the current and succeeding generations

In 1976 the California Coastal Act was passed and the California Coastal Commission (www.coastal.ca.gov) established to plan and regulate development and natural resource use along the coast in partnership with councils.

"The coast is the scene of never-ending struggle among natural and human forces" stated the Commission in a description of its role. Protection of scenic landscapes and views of the sea were among the Commission's policies. The major focus of the CCC has been Local Coastal Programs which established the planning ground rules for development in the coastal zone of 74 cities and counties. Among the standards used by the Commission was the protection of scenic landscapes and views of the sea. The Coastal Act provided that:

The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of the surrounding areas, and where feasible, to restore and enhance visual quality in visually degraded areas... (Sec 30251)

Although scenic quality was referred to in many hundreds of development decisions (see website), no survey of coastal scenic quality could be identified.

Interestingly, however, a report from the Commission's Executive Director in May 2004 addressed the protection of views from the ocean to the land. The paper recognised that with increasing numbers of boaters, fishers, kayakers, surfers and other ocean users, the

view from the ocean should be taken into account in development decisions. It referred to the State of Maine which in 2003 had amended its coastal management program to protect views from water toward land.

In Oregon, the Statewide Planning Goals and Guidelines covered coastal shorelands (Goal 17). The policy included aesthetics in conservation, protection and development. It required inventories of shorelands including aesthetics "in sufficient detail to establish a sound basis for land and water use management". Based on the inventory, the comprehensive plan for coastal areas should cover shorelands which were to include "areas of exceptional aesthetic or scenic quality, where the quality is primarily derived from or related to the association with coastal water areas."

The Statewide Planning Goals and Guidelines also covered natural resources, scenic and historic areas and open spaces (Goal 5). This required local governments to adopt programs to protect these resources. Inventories of scenic views and sites were required and presumably these were to be undertaken at the local level.

Oregon's Natural Heritage Plan covered ecosystems including fauna and flora, and geological formations, but did not cover scenic values associated with natural areas including the coast.

In Washington State, the Department of Ecology operates the Shorelands and Environmental Assistance Program funded under the Federal Coastal Zone Management Act 1972. It provides grants and carries out conservation activities. The website illustrates coastal scenic quality by photographs (10,000 oblique aerial photographs) but scenic quality does not appear to have been surveyed. As indicated by its name, the Department has a strong ecological focus. The Washington Department of Natural Resources is largely concerned with forestry management but has responsibility for State-owned aquatic resources including the "bedlands" of Puget Sound, rivers and lakes. Again, although the State legislature recognised state aquatic lands as "a finite natural resource of great value and irreplaceable public heritage" there appeared to be no program to assess its scenic resources.

On the eastern coast of the United States, Rhode Island carried out a landscape inventory (see <http://envstudies.brown.edu>). The inventory had its origins in the 1980s with a law to inventory areas worthy of special designation as "scenic". The inventory was

undertaken in 1990. Rhode Island included coastal resort towns and a coastal plain. The planners who surveyed scenic values differentiated three ratings:

- Distinctive landscape which had the highest visual appeal and variety of form, line, colour and texture – 15% of the total area
- Noteworthy landscape which were scenic but of a lesser visual quality – 11% of the total area
- Common landscape covered the remainder of the Island – 74% of the total area

The results were used in planning and development assessment. The method used to classify the landscape by the planners was not described.

Interest in Massachusetts' scenic resources began with the 1933 Massachusetts Landscape Survey (see www.mass.gov/dem/programs/Histland/landSurveys.htm). A set of categorical landscape types were chosen as "...kinds of Massachusetts scenery that are believed to have special character of outstanding value...". These included ocean beaches and dunes, moor and seashore uplands, and flooded lands in the coastal plain. Many of the areas identified were subsequently acquired as parks.

In 1980, the Department of Environmental Management initiated a further Statewide inventory of scenic landscapes. These were based on methodologies of the US Forest Service and Countryside Commission of Scotland. Physiographic regions were evaluated on the basis of a set of scenic feature guidelines. The inventory was published in 1982. More recently Massachusetts has embarked on a heritage landscape inventory program.

(3) Canada

Nova Scotia in Canada has mapped scenic quality based on land form, land cover, land use and water (see <http://museum.gov.ns.ca>). Scenic quality was assessed on 10 X 10 km square blocks (which is a large area), the components rated separately and added to produce composite scores of 0 - 15. The method was based on many untested assumptions – e.g. that scenic quality increased with increasing land relief but at a declining rate, variety was more valuable than monotony, and the positive scenic quality of water declined only marginally when more water is seen. The addition of these

components assumed that each component was of equal worth, which is unlikely (e.g. land use and water). The resultant map indicated the areas of highest landscape value are "where prominent hills meet the ocean or where farming areas abut an indented coastline".

(4) United Kingdom

The United Kingdom has a long tradition, extending back to after World War 2, of recognising and protecting its outstanding landscapes. Many of its Areas of Outstanding Natural Beauty (AONB) were defined by the 1949 National Parks Act and others have been designated in more recent years. More recently, the Countryside Agency has conducted landscape assessments of some 30 AONBs and other significant areas.

These landscape assessments covered the following:

- Description of physical and human influences that have shaped the landscape
- Review of the features contributed to special character of the area
- Classification of landscape into a number of distinct and recognizable landscape types including a description of the characteristics of each
- A review of the forces of change influencing the landscape now and in the future
- Information on the perception of the landscape over time
- A summary of the special character and quality of the area that makes it of national significance

These landscape assessments were largely descriptive as evidenced from their scope. Their purpose has been to raise awareness of the importance of the area and to guide planning policies. Their focus has been the characteristics of the landscape rather than its quality.

In an early study, Wallace (1974) described the character of 290 km of the Essex coast and extending up to 2.5 km inland. He based the evaluation of landscape quality on the following factors:

- Land form
- Land use
- Development present
- Special landscape features – hedgerows, eyesores

- Compositional effect – harmony, variety and interest
- Viewpoints
- Feeling of isolation and remoteness

Wallace sought to make a relative, rather than absolute, assessment of landscape quality and aimed to make a “subjective interpretation applied in a consistent and rational manner.” Four evaluators were involved and produced four rankings of landscape quality: uninteresting, modest, important, and dominant & attractive. He mapped the resultant evaluation.

2.4 CONCLUSIONS FROM STUDIES OF COASTAL LANDSCAPE QUALITY

The studies examined above focused almost exclusively on the measurable – particularly features which may be objectively measured. This is akin to measuring the enjoyment that one may derive from a piece of music by numbering the notes it contains, the types of instruments used, the pitch and rhythm used – anything but the very attribute that one is interested in knowing.

The focus on the measurable may derive from a belief that objective measurement is a pre-requisite for qualitative assessment – that the knowledge of what the landscape contains and its characteristics will somehow provide a sound basis for the judgement of its quality. Again, using the music analogy, knowledge of the workings of instruments and of music form, though these may contribute to one’s appreciation of the piece, definitely are not pre-requisites for the enjoyment of a piece.

Interestingly where judgements were made, the reports were almost apologetic for resorting to them. The judgements were made with little description of how they were derived. In a few cases where explicit criteria were used (e.g. EDAW’s study of Queensland’s coastal ranges) in which high, moderate and low scenic quality were defined, the results were not tested. Rather it was assumed that scenic quality increased with the height of land forms, the distinctiveness of land forms, the density of vegetation, and the extent and wildness of rivers present. Each of these attributes may contribute to scenic quality but not necessarily in the way or to the degree assumed. For example, from the author’s studies, it was not just the extent of water but the indentation of the water/land interface that was an important determinant of coastal scenic quality. The factors selected derived from those

features of the landscape which were measurable, regardless of whether they were really significant or not.

A related problem with these assessments is that they treated all factors on an equal footing – thus land forms and height might be rated along with vegetation, water, rocks and other features and the results added together as though they all have an equal influence on scenic ratings. In the author’s study of South Australian landscape quality, factors such as diversity, naturalness and the presence of water were found to be far more important than some other factors.

The choice of characteristics included in expert assessments varied from expert to expert. Thus replicability of the results by other persons is not possible.

Underlying the approach which used measurements was the belief that anything that was measured was objective and defensible while aspects which required judgements were inherently subjective and lacked credibility. Certainly this is so where the judgement was based by one person, however if it was based on a sample of the community, then while still subjective, it is defensible and credible.

A further criticism of these studies is that they were based on a reductionist approach to the landscape, segmenting it into its component parts which were measured and added together in some unique way to provide its overall quality rating. However when a scene is viewed, one’s appreciation of it is made holistically, based on its entirety, not by forensically dissecting it into its parts. It is a judgement that is reached instantly and without analysis.

The whole is not simply the sum of the parts; it is much more than this. The reductionist approach separates the components, rates these and adds the ratings but fails to consider whether the results reflect one’s preferences. These methods do not test their findings by evaluation by the community, rather a method is asserted and applied and gains its standing by repeated use. Its validity is rarely questioned, perhaps because the methods appear logical and no alternative presents itself.

The alternative to expert assessment is to use the community rate their preferences. This is based on the premise that as landscape quality is a subjective quality, it is the

community who derive satisfaction from it and they should be involved in its assessment. The community view and rate scenes holistically, not by reductionism, and issues of the relative importance of their characteristics do not enter into the assessment. Surveys which aggregate the opinions of the community in a structured way amenable to statistical analysis can provide the basis for an objective assessment of this subjective quality. It is this approach which is applied in this study.

2.5 LANDSCAPE AESTHETICS

(1) Affective Basis of Aesthetic Preferences

Following from the preceding review of studies of coastal scenic quality, the nature of aesthetics is described to assist in understanding why the approach proposed in this study was used, rather than the measurement system employed by many other studies.

At its core, aesthetics is not an attribute that can be measured in the way that physical characteristics of the landscape can be measured. This is because aesthetics is an affective quality. Dictionaries reinforce this in their definition of aesthetics: "things perceptible by the senses as opposed to things thinkable or immaterial (Shorter Oxford, 1973), and "pertaining to the sense of the beautiful or the science of aesthetics" (Macquarie, 1981).

Aesthetics derives from the affects or preferences of individuals. Affects do not derive from cognitive analysis. An individual's liking of a composer derives from their liking for their music, not from an analysis of the composer's competency as a composer, his or her use of instruments, his or her scoring for the orchestra etc. The individual knows immediately whether or not they like a piece of music, although sometimes a piece may grow on the individual and he or her comes to like it. But it still derives from the individual's preferences, not from cognitive analysis. Similarly a person's liking of another person derives from intuitive preferences, not from cognitive reasoning.

Preferences for landscape do change over time but are remarkably stable. The shift that occurred at the start of the 17th century transformed the Western view of mountainous landscapes, from features regarded as the haunts of devils, uncouth areas fit for the scrap

heap², to features in which we delight. In *Mountain Gloom and Mountain Glory*, Margaret Nicolson (1959) traced the revolutionary change that occurred in the space of a generation in Western attitudes to mountainous areas which lead to the contemporary love of mountainous landscapes.

More recently the wilderness movement has influenced landscape preferences by heightening an appreciation of natural areas compared with areas where human influence is evident. In my study of South Australian landscape preferences, naturalness was second only to diversity as a predictor of landscape preferences (Lothian, 2000).

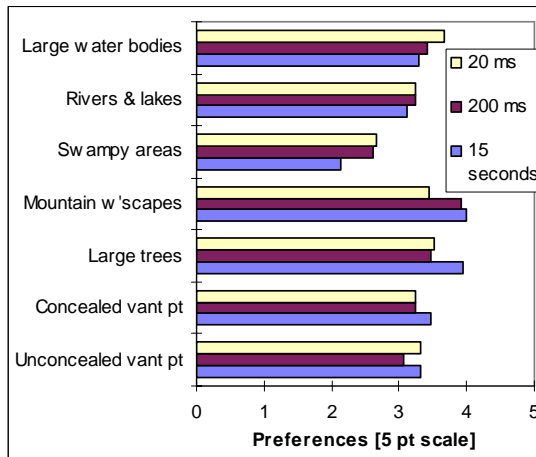
The affective model of preference is based on the premise that emotional (i.e. affective) responses to landscapes occurred before cognitive information processing. With the development of cognitive psychology in the 1960s, affects were regarded as products of cognition, i.e. they were post-cognitive.

In a widely quoted paper, *Feeling and thinking, preferences need no inferences*, R.B. Zajonc (1980) argued against affect being post-cognitive and provided experimental evidence that discriminations [like-dislike] could be made in the complete absence of recognition memory. He argued that preferences preceded cognition. He concluded that affect and cognition were:

"under the control of separate and partially independent systems that can influence each other in a variety of ways, and that both constitute independent sources of effects in information processing."

Preferences are registered extremely quickly which supports them being pre-cognitive. Herzog (1984, 1985) used scenes which respondents viewed for 20 milliseconds [i.e. 1/50 sec] or 200 milliseconds [i.e. 1/5 second] and compared the responses with 15 seconds. As Figure 2.4 indicates the ratings, though not identical, were very similar. The instantaneous rating of what we like and dislike is obviously a skill that everyone possesses.

2. A typical description of the European Alps, by John Evelyn who cross them in 1644: "which now rise as it were suddenly ... as if nature had here swept up the rubbish of the Earth in the Alps, to form and cleare the Plaines of Lombardy." (Nicolson, 1959)



Source: Herzog, 1984 & 1985

Figure 2.4 Effect of Viewing Times on Preferences

(2) Influence of Culture on Landscape Preferences

Cross-cultural studies of landscape have indicated that landscapes were rated similarly regardless of the cultural origins of the participants. Studies of the influence of culture on landscape preferences include the following.

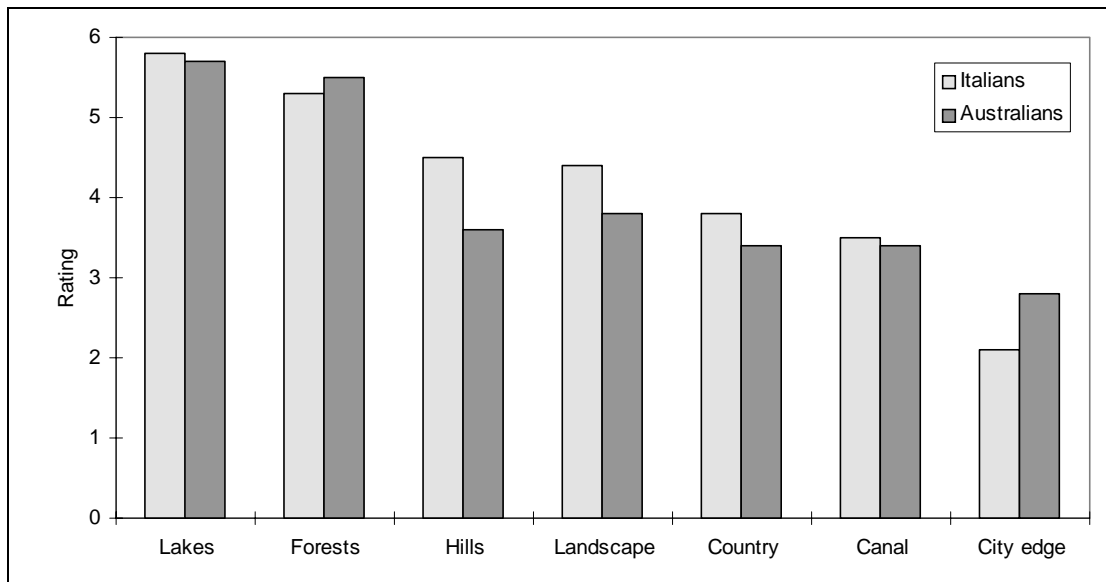
Hull and Revell (1989) found the level of agreement regarding the scenic beauty of Bali among the Western tourists was significantly higher (0.86) than among the Balinese (0.79)

which was surprising given that they came from many countries. They considered that the Balinese who had been exposed to Western culture for decades might have adopted western values. Overall they concluded that despite the “enormous differences which exist between the Balinese and western culture” that “the results suggest that there was perhaps more similarity than difference between the two groups in their scenic evaluations” of the Balinese landscape.

Purcell *et al* (1994) compared the responses by Italian and Australian students to photographs of landscapes from both countries. Preferences by the Italian participants were generally higher than by the Australian participants but the differences were only slight (Figure 2.5).

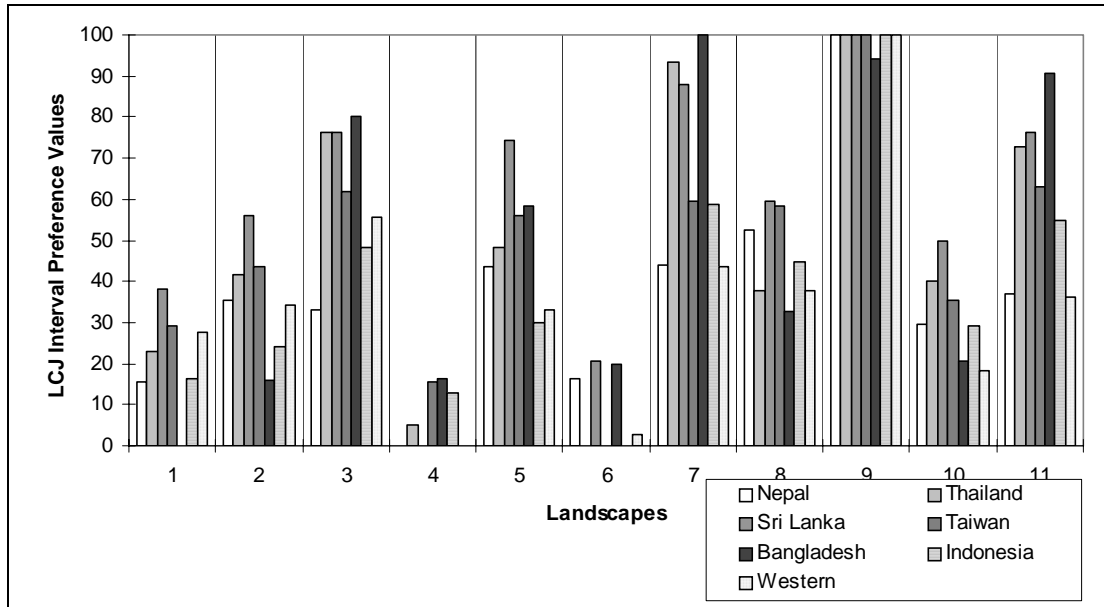
Figure 2.6 indicates the preference values obtained by Tips & Savasdisara (1986) from people from a range of national backgrounds. They found, with some exceptions, a reasonable degree of similarity across different nationalities.

These and similar studies suggest that human preferences for landscape are deep seated, deriving from past human development. While culture has some influence, the core of our aesthetic preferences is innate.



Source: Purcell *et al*, 1994.

Figure 2.5 Comparison of Italian and Australian Landscape Preferences



Source: Tips & Savasdisara, 1986

Figure 2.6 Preference Values for 11 Landscapes

(3) Theories of Landscape Aesthetics

Theories of landscape quality, which seek to explain *why* we like what we like rather than simply describing *what* we like, all derive from an evolutionary perspective. These theories essentially argue that landscape preferences are survival enhancing: human preferences are moulded by what enhances our capacity to survive as a species. These theories are summarised briefly below.

G.H. Orians, an evolutionary biologist, proposed the *habitat theory* with the biological imperative for humans to “explore and settle in environments likely to afford the necessities of life ...” (Orians & Heerwagen, 1992). He focused on the African savanna which contains scattered trees amongst extensive grassland and is believed to be the environment in which humans evolved. He argued that there would be a strong preference for this type of environment. Using the characteristic shape of the Acacia trees present he found strong human preferences for these trees. Similar environments are found in our public parks comprising extensive lawns and isolated trees and even own gardens and the ubiquity of this form reinforces Orians’ case.

Jay Appleton proposed the *prospect-refuge theory* in which he proposed that landscapes are preferred which enable one to see without being seen; they provided places (prospects) where one could spy out game, the enemy or other objects, while also providing places

(refuges) in which to hide. However when these ideas were tested empirically, the proof has not been compelling. While prospects tend to correspond with the appeal of mountains and trees, refuges (e.g. caves) tend to be regarded negatively.

Roger Ulrich proposed the *affective theory* in which natural settings and landscapes produce in their viewers, emotional states of well-being. Measured on a like-dislike dichotomy, it correlated closely with scales such as beautiful – ugly or scenic quality scales. A disciple of Zajonc’s view that preference is pre-cognitive, Ulrich provided supporting evidence from preference studies. He proposed that:

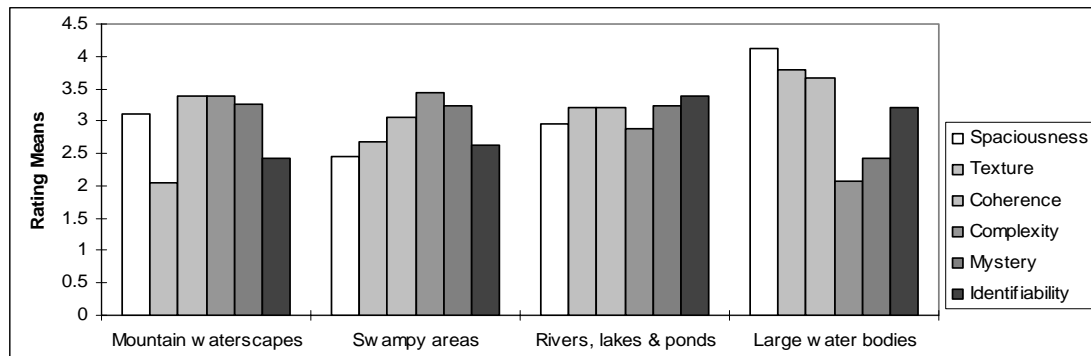
“immediate, unconsciously triggered and initiated emotional responses - not ‘controlled’ cognitive responses - play a central role in the initial level of responding to nature, and have major influences on attention, subsequent conscious processing, physiological responding and behavior” (Ulrich, *et al*, 1991)

Using various physiological measures of brain activity and of feelings, Ulrich has found that urban scenes without trees or natural objects produced negative feelings while scenes of nature provided positive feelings, and that these produced physiological benefits. In a study of hospital patients, for example, he found that those patients with a view of trees recovered more quickly and required fewer

	<u>Understanding</u> Making sense	<u>Exploration</u> Being involved
<u>Immediate</u> The visual array	Coherence Making sense now Orderly, "hangs together" Repeated elements, regions	Complexity Being involved immediately Richness, intricate Many different elements
<u>Inferred</u> Future, promised Three-dimensional space	Legibility Expectation of making sense in future Finding one's way there & back Distinctiveness	Mystery Expectation of future involvement Promise of new but related information

Source: Kaplan, Kaplan and Brown, 1989; Kaplan, 1979.

Figure 2.7 Kaplans' Predictor Variables



Source: Herzog, 1985

Figure 2.8 Rating of Waterscapes by Kaplans' Predictor Variables

analgesics than those without this view (Ulrich, 1984).

The overarching theory of environmental perception is information processing theory which has been applied in the field of landscape aesthetics by Stephen and Rachel Kaplan. They suggested that in extracting information from the environment, humans sought to *make sense* of the environment and to *be involved* in it. They have identified four predictor variables: *coherence* and *legibility* help one understand the environment, while *complexity* and *mystery* encourage its exploration (Figure 2.7).

Coherence and complexity involve minimal analysis and are registered immediately while legibility and mystery require more time and thought. Research of these has found that coherence is the strongest predictor and mystery, the most consistent.

Among the many studies of the Kaplan model, Thomas Herzog, a colleague, carried out several. In a study of waterscapes, he used Kaplans' predictor variables and found (Figure 2.8):

- spaciousness was, not unexpectedly, best shown in large water bodies; these also showed highest texture and coherence but lowest complexity and mystery - they are water bodies which lack interest and are easy to make sense of;
- by contrast the other water bodies are more interesting, being high in mystery and complexity yet being reasonably coherent; they thus reward immediate involvement yet hold out promise of more
- the distinguishing features of (1) mountain waterscapes are their low textures which suggest that they are difficult to navigate; (2) low spaciousness of swamy areas; (3) identifiability of rivers, lakes & ponds; (4) while large bodies of water have the most distinguishing features.

The studies of the Kaplans' information processing model that have been conducted provide support for its elements. There would appear however to be a fair degree of interpretation required of the application of these four predictor variables in the landscapes studied. The nebulousness of the concepts involved suggests that they are still evolving and this is likely to continue for some time.

Stephen Kaplan describes the theory as an evolutionary view based on habitat theory, with human preferences deriving from the adaptive value offered by particular settings (Kaplan, 1987). He regarded preferences as:

“An intuitive guide to behavior, an inclination to make choices that would lead the individual away from inappropriate environments and towards desirable ones”

An evolutionary perspective, in which preference aids the survival of the individual, led Stephen Kaplan to conclude:

“Aesthetic reactions reflect neither a casual nor a trivial aspect of the human makeup. Aesthetics is not the reflection of a whim that people exercise when they are not otherwise occupied. Rather, a guide to human behavior that has far-reaching consequences.” (Kaplan, S., 1987)

Brown & Itami (1982) proposed a model which related scenic resource values to landscape preference components as defined by the Kaplan model.

Kaplan model:

	Making sense	Involvement
Visual array	Coherence	Complexity
3-D space	Legibility	Mystery

Brown & Itami model:

	Making sense	Involvement
Visual array	Slope	Spatial diversity
3-D space	Relative relief	Relief contrast
	Naturalism	Height contrast
	Compatibility	Internal variety

The Brown & Itami framework comprised two inter-related systems - the natural (land form) & cultural (land use). These described the physical components. Landform reflected the permanent “immutable” components and the cultural system was reflected by the land use and land cover pattern. This model was used by Edwards (1987) in his assessment of the Kangaroo Island landscape (Section 2.2).

Clearly a robust theory of landscape which provides an all encompassing framework with which to understand and to predict landscape preferences does not currently exist. What we

have at present area a range of theories which offer explanations of aspects of landscape preferences but which fall well short of a definitive explanation.

(4) Individual Differences in Landscape Preferences

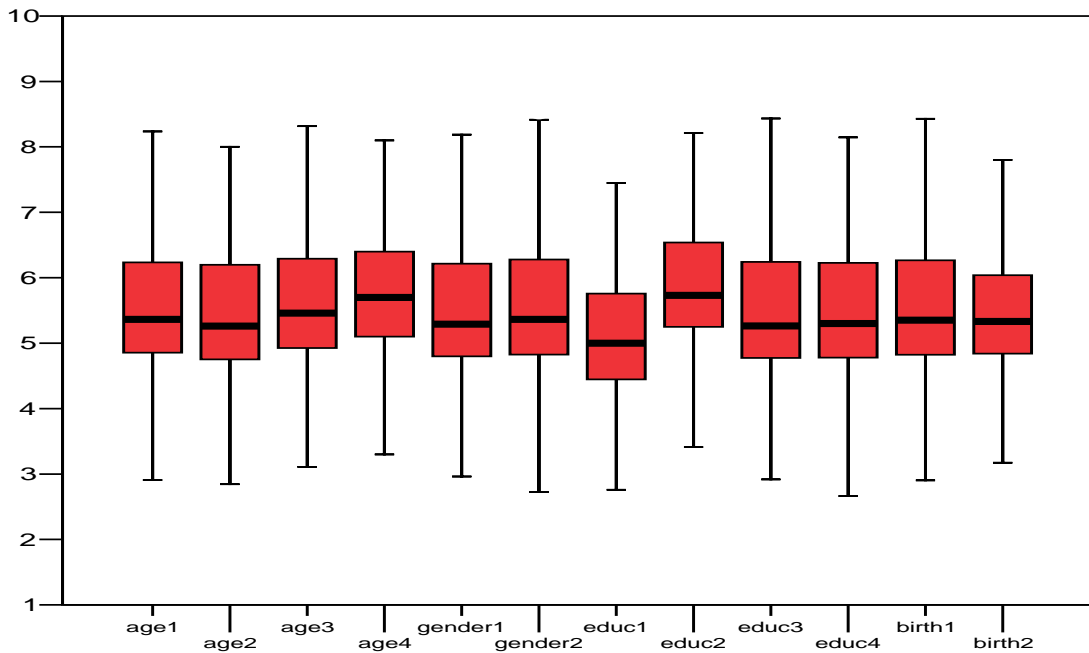
Many studies have examined the influence of respondent characteristics such as age and gender on their landscape preferences and have generally found there to be little difference.

Among the findings:

- Age generally had little effect, the exception being young children whose preferences differed markedly from adults
- There were slight differences between genders in the types of landscapes preferred
- Education, employment and socio-economic status appeared to have nil or negligible influence on preferences

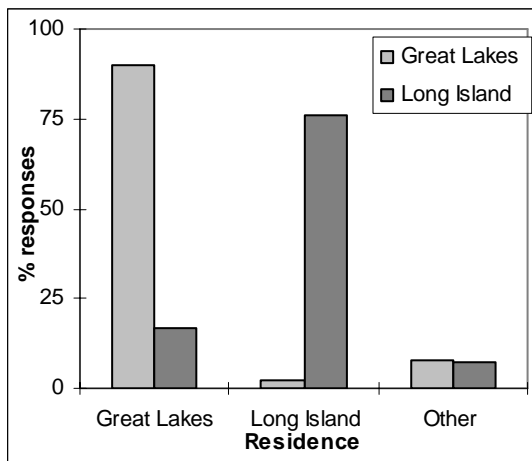
Three studies that the author has undertaken (Lothian, 2000; 2003; 2004) support these conclusions; overall the similarities in preferences across respondents were greater than the differences. This is illustrated by Figure 2.9 which indicates the similarity of average preferences across the differing age, gender, education and birthplace (i.e. inside or outside of Australia). Only in respect of education were the differences significant.

Familiarity is one component of observer characteristics which does appear to influence their preferences. Some studies have found a direct correlation between familiarity and preferences (e.g. Hammit, 1979). Nieman (1980) examined the landscape preferences of residents near the Long Island coast and the Great Lakes shore and found they strongly preferred the environment with which they were most familiar (Figure 2.10). Similar results were found when respondents were asked which coastal area they would most prefer to live - in both cases, 82% preferred to live where they were rather than in the other location.



Source: Lothian, 2004

Figure 2.9 Boxplot of Average Ratings by Participant Characteristics

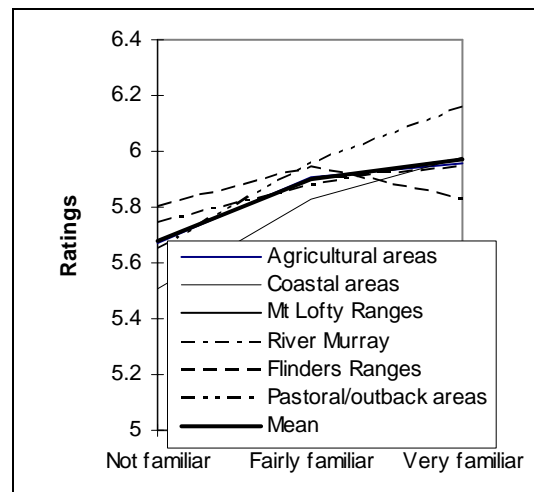


Source: Neiman, 1980

Figure 2.10 Preferences vs familiarity

I found in my study of South Australian landscape preferences that familiarity with the various regions had a small but marked positive influence on landscape ratings (Figure 2.11).

Generally if respondents do not normally respond positively to a scene, familiarity will not alter this, however where a scene elicits a positive response, this will be reinforced and even increased by familiarity.



Source: Lothian, 2000

Figure 2.11 Effect on Ratings of Familiarity with Regions

(5) Influence of Water on Landscape Preferences

Finally in this examination of landscape aesthetics, the findings relating to the influence of water on preferences are briefly reviewed. The defining characteristic of the coast is the close proximity of water, the sea. Many studies have shown that the presence of water has a significant and generally positive influence on scenic quality ratings.

The studies reported that scenic value increased with:

- Water edge (Anderson *et al*, 1976; Palmer, 1978; Whitmore *et al*, 1995)
- Water area (Anderson *et al*, 1976; Brush & Shafer, 1975)
- Moving water (Craik, 1972; Dearing, 1979; Hammitt *et al*, 1994; Whitmore *et al*, 1995)

In the Rockies, Jones *et al* (1976) found that water bodies were the third most important landscape component in defining preferences after the high mountains and forests. Mosley [1989] found water ranked the fifth factor in New Zealand after forests, view angle, relative relief and alpine components (e.g. snow and ice). Significantly he found the river environment to be more important than the river itself in determining preferences. In the less spectacular landscape of the Connecticut River valley, Palmer & Zube (1976) found that after landform, water was the second most important dimension.

Herzog (1985) assessed the preferences for different kinds of water bodies and found in order: mountain waterscapes; large water bodies; rivers, lakes & ponds; with swampy areas last (See Figure 2.4).

Factors which were found to decrease the scenic value of water included pollution and waterlogging (Choker & Mene, 1992), water colour (Gregory & Davis, 1993), and litter, erosion, water quality and structures (Nieman, 1978). Interestingly Hodgson & Thayer (1980) found that water bodies labelled as artificial rather than natural (e.g. reservoir instead of lake) scored lower than natural labels.

Serenity and tranquillity contrasting with awe and arousal were found to be psychological factors associated with water bodies (Gobster & Chenoweth, 1989; Herzog & Bosley, 1992; Schroeder, 1991). Water holds one's attention and has a stabilising effect on emotions (Ulrich, 1981).

Overall, water was found to be a major and positive factor by Calvin *et al* (1972); Choker & Mene (1992); Dearing (1979); Dunn (1976); Herzog & Bosley (1992); Hull & Stewart (1995); Orland (1988); Shafer *et al* (1969); Ulrich, (1981); Vining *et al* (1984); and Zube (1973).

2.6 USE OF PHOTOGRAPHS IN SURVEYS

Photographs of scenes are generally used in ascertaining the preferences of participants. These have obvious advantages over transporting large numbers of people into the field to visit widely dispersed locations. It would be clearly impractical to take 300+ people around the South Australian coast for the purposes of rating scenic quality. However the issue is whether photographs can be relied upon as substitutes for field assessments.

There have been many studies of this issue and their overall finding is that providing the photographs meet certain criteria then the ratings gained from them will not differ significantly from ratings gained in a field situation. Some of these studies are summarized below.

Zube, *et al* (1975) reported on a series of studies including the responses from field vs surrogate assessments. Using a range of techniques (semantic scales, rank order and Q-sort) and groups of field and non-field populations, they found high correlations between field and non-field assessments. Comparing the field and non-field evaluations for eight views, the average R^2 was 0.92.

Daniel and Boster (1976) used their Scenic Beauty Estimation (SBE) method to compare results produced by on-site vs slide judgements of forest landscapes. The SBEs derived from on-site judgements were generally slightly lower (i.e. based on the scale used, the scenes were judged to be of higher quality) than those derived from slide judgements. The correlation coefficients were highly significant statistically.

Table 2.5 Comparison of Field and Laboratory Assessments

Group	Mean value	Mean deviation	Range of variation
Basic group	56.9	6.8	44 - 63
- field			
- laboratory	56.1	7.8	42 - 65
Comparison group - lab	55.1	8.2	43 - 63
City dwellers - lab	55.9	10.2	40 - 66
City dwellers - lab	54.0	9.4	40 - 65

Source: Kellomaki and Savolainen, 1984

Kellomaki and Savolainen [1984] used a variation of the semantic differential method to assess the scenic values of selected tree stands in Finland. Three groups of participants evaluated the scenic values:

- a Basic Group of forestry students assessed the scenic values in the field and laboratory
- a Comparison Group, also students, assessed the values only in the laboratory
- 2 groups of City Dwellers only assessed the values in the laboratory

The results indicated very close assessments between the three groups ($p < .01$) (Table 2.5). While only one group rated the scenes in the field, the mean value of their assessment was only marginally higher than the laboratory assessments but their range of variation was slightly less.

A definitive study on the use of photographs as a surrogate of field observations was undertaken by Shuttleworth (1980). Being concerned that many of the studies that had examined this issue used different populations to assess the sites and the photographs, Shuttleworth used the same group in both situations.

His study used landscapes in rural areas and on the urban fringe (East Anglia, England). Colour and black and white prints were used as surrogates. Semantic differential (SD) and bipolar scaling techniques were used. The sample population of students ($n = 93$) was divided into two groups all of whom visited all the field sites and half viewed the colour and half the b/w photographs. Various techniques were used to ensure randomness (e.g. changing the sequence of field vs photograph assessments) and to enable within-group and between-group analysis.

Shuttleworth found no differences between groups in responses to landscapes in the field and found little difference in responses to the photographs. However he did detect distinctly more differences between responses to b/w photographs and field views than between colour photographs and field views. He found that with b/w photographs, participants tended to "make much more definite and differential responses by reinforcing likes and dislikes; responses to them thus tended far more to extremes of opinion than did responses to colour photographs".

Shuttleworth concluded that the results "indicated that there were very few differences of significance between the reactions to and perceptions of the landscapes either when viewed in the field or as photographs" with any differences being explainable by content. He proposed that photographs can be used providing they are in colour and that they are wide-angled to provide a lateral and foreground context.

In conclusion, with few exceptions, surveys have established that photographs can provide a viable surrogate of landscape, however there are slight differences in responses and certain rules should guide their use. Photographs tend to provide more objective, more dispassionate responses, while site assessments can yield a more subjective response influenced by a range of site factors unrelated to landscape quality. Black and white photographs can reinforce likes and dislikes and produce more extreme responses than colour photographs. Generally, photographs should be in colour and provide a wide view to provide sufficient context.

3. ACQUIRING THE DATA

The collection of the data on which this study is based is described in this section, commencing with the photography of the coast, the selection of scenes for the survey, and finally the development and implementation of the survey instrument.

3.1 PHOTOGRAPHY OF THE COAST

Principles

South Australia's coast is approximately 3,700 km in length and it would be clearly impractical to photograph every kilometre of it. Neither is it necessary. Rather a sampling of coastal landscapes was undertaken which aimed to ensure that each type of coastal landscape was represented.

Photography was based on certain principles:

- Principle of representativeness – the photographs needed to cover the diversity of coastal landscapes and the variations within each type;
- Principle of equivalence – two similar scenes of a given type of coastal landscape, e.g. sand dunes, should gain similar ratings; thus location is not critical, rather it is the characteristics that are present;
- Principle of complexity – the photographs should reflect the complexity of the coastal landscapes;
- Principle of typicality – scenes were selected which typified a particular landscape;
- Principle of simplicity – landscapes were photographed to contain the minimum of components, and complicating and distracting elements were avoided as far as possible.

The method used was that all accessible and navigable roads available in a region were traversed to the coast and photographs taken. Table 3.1 summarises the trips made to each region.

Photographs

Photographs were taken at 50 mm focal length which is equivalent to the human eye.

Composing each photograph sought to minimise extraneous factors such as people, sheep or cattle, wildlife and seagulls, fences, electricity poles and wires, dead trees, and

excavations or other eyesores. Any of these can influence preferences either positively or negatively and as many were of an ephemeral nature and not part of the scene they were excluded. Photographs were taken using the landscape view, not portrait view and extended to the horizon, not a close-up confined view. Photographs were taken in full daylight without strong side lighting or early morning or late evening which can dramatise scenes.

Table 3.1 Summary of Coastal Trips

Location	Distance (km)	Photographs
South East	1911	159
Fleurieu Peninsula	912	272
Kangaroo Island	964	196
Adelaide	235	30
St Vincents Gulf	297	268
Yorke Peninsula	1529	171
Upper Spencer Gulf	1186	62
Eyre Peninsula/Nullarbr	3099	578
Total	10133	1676

The photographs should be regarded as providing a benchmark for scenic ratings. The photographs deliberately did not include the transitory effects of special atmospheric lighting such as sunsets or particularly vivid side lighting. Nor did they reflect the influence that clouds can have on a scene – heavy cloud dampens colour saturation while spectacular cloud formations may enhance the scene. In some locations, seasonal colour such as autumn leaves or ripe cereals may also enhance the appearance of a scene.

In its effort to standardise scenes, the project sought sunny cloud-free conditions throughout to standardise scenes against a blue sky. This proved difficult as the 2005 summer was particularly cool and cloudy days persisted. As a result the photography took somewhat longer than intended. Photography was undertaken mainly in January and the first half of February 2005.

Photographs were taken so that the rating reflected the quality of the scene, not the quality of the photograph. Photographic composition of a scene to frame a view or to lead the viewer into a scene may enhance its appearance and was avoided as far as possible.

In the early trips (400 photographs), a Nikon F60 SLR camera was used and conventional photographs produced which were subsequently scanned. A Nikon D70 SLR digital camera was then acquired and used for the remainder of trips. Its advantage over lesser digital cameras was that it could be set at the correct focal length (50 mm). In digital cameras, the focal length needs to be multiplied by 1.5 to equate to conventional cameras. Thus a focal length of 35 mm in the Nikon D70 equated approximately to 50 mm in the Nikon F60. Digital photographs were recorded at the normal image quality and the medium image size, producing images of 2,240 X 1,488 pixels (3.3 megapixels) which were recorded by 8 – 900 kilobytes. Only a UV filter was used on both cameras.

Overall over 10,000 km was traveled and nearly 1700 photographs taken. This is an average of one photograph every six kilometres.

A Toyota HiAce campervan was used for all trips. This proved a reliable vehicle but as it lacked 4WD capability was limited to reasonable roads and tracks. Sandy areas were avoided and required walking some distances in many instances.

Photography at each of the thousand plus sites considered suitable involved the following five steps:

- 1 Stop the vehicle.
- 2 Switch on and place the GPS on front dash, collect camera. A Magellan 310 geographical positioning system (GPS) was used throughout.
- 3 Walk to suitable location for the photograph. At the least this required walking to the fenceline along the road but often it involved walking across dunes to the beach or along clifftops.
- 4 Compose and take the photograph(s) and walk back to the vehicle
- 5 Record the location and the latitude and longitude coordinates from the GPS. Note that these were generally of the vehicle's location so they could be some distance from the actual photograph located near the coast. The location of the photographs was also recorded on maps.

Later the details of each site were transferred to an Excel file to compile a permanent record of the photograph locations and for use in mapping the photograph locations. A file of their locations is included on the CD. Figure

3.1 indicates the location of the photographs around the South Australian coast. At the majority of sites shown more than one photograph was obtained.

Each stop took a minimum of five minutes to cover these steps but were often far longer where they involved walking a distance.

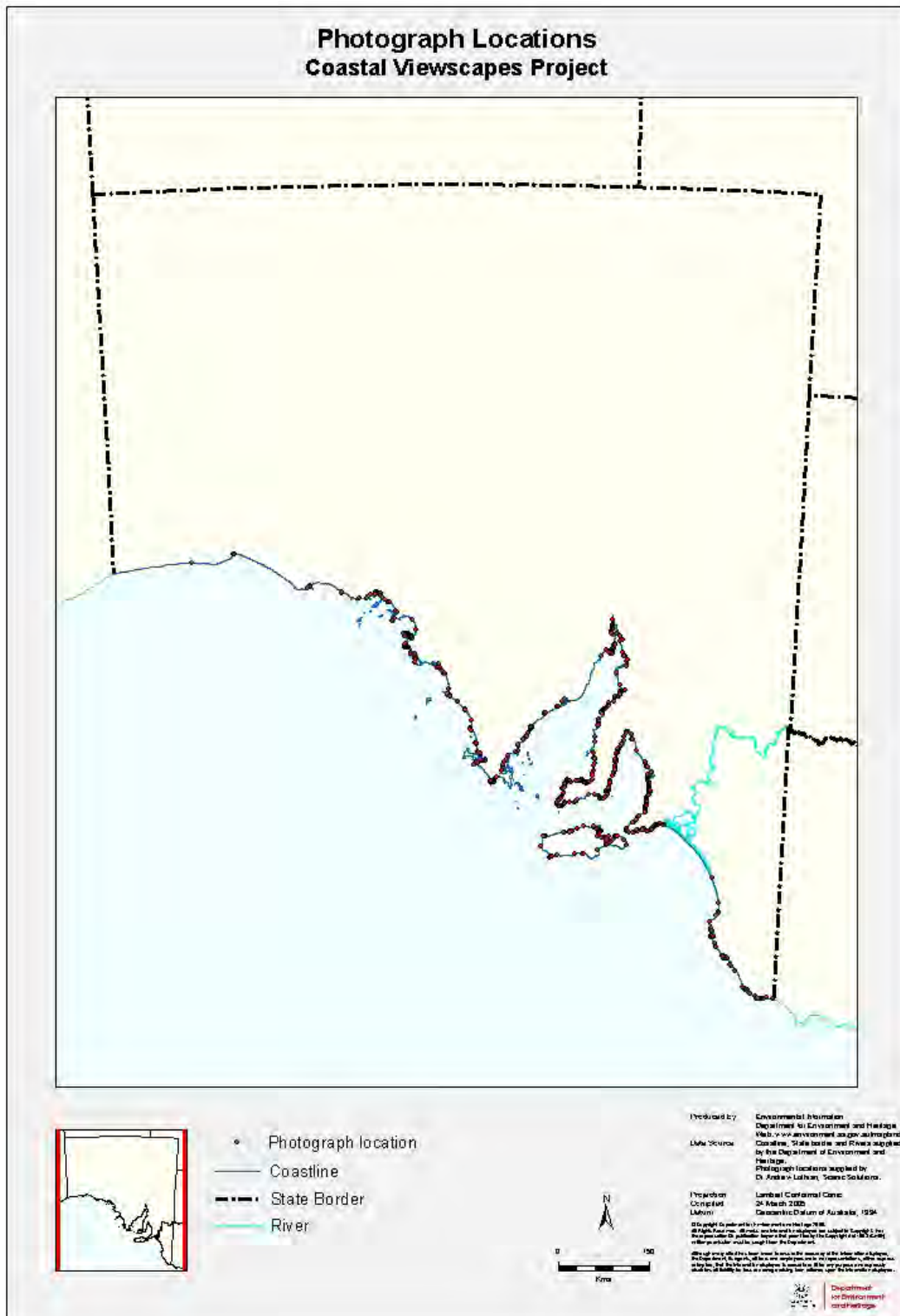
Maps of 1:50,000 scale were used for much of the coast, with the exception of Eyre Peninsula and the far west coast into the Nullarbor where such maps do not exist. For Eyre Peninsula, maps of 1:100,000 scale were used and for areas further west, the 1:250,000 maps were used.

Covering the coast (Figure 3.1)

There were sections of the coast which, due to the absence of access tracks, terrain, or prohibition of entry, were not possible to visit and photograph. The oblique aerial photographs of these areas in the Atlas of South Australia³ were examined in detail and assessments made from these of the categories of the coast. Examples of these inaccessible sections of the coast were:

- The extensive national parks and reserves on Kangaroo Island, some of which are designated Wilderness Protection Areas, in which tracks to the coast were non-existent. The Canunda National Park in the South East similarly limited access.
- The rugged terrain on Fleurieu Peninsula and the north coast of Kangaroo Island limited availability of access. On Fleurieu Peninsula the Heysen Trail which traverses part of the coast was closed for summer and access through private land was prohibited.
- The El Alamein Army Training Area, which includes approximately 18 km of the western coast of upper Spencer Gulf, is a prohibited area with signs warning of unexploded ordnance lying about.
- Areas of extensive mangroves and samphires, including upper St Vincent's Gulf and upper Spencer Gulf.
- An extensive inaccessible area south of Whyalla with mangroves in the northern part and coastal dunes towards Cowell

3. www.atlas.sa.gov.au



Note: in most locations, several photographs were taken.

Figure 3.1 Locations of All Photographs

- Much of the west coast, west of Ceduna, comprised high dunes rendering access impossible even for 4WD vehicles.

Many roads near the coast, marked on maps, were followed only to find them impassable. Many tracks were marked on maps but turned out to be private farm tracks and access was prevented generally by locked gates.



Source: Atlas of South Australia
Nullarbor cliffs (ep 023911)



Source: Atlas of South Australia
Youngusband Peninsula (se950609)

There were also sections of the coast which are so similar in their essential characteristics so detailed coverage was unnecessary. Two examples are the 160 km of dunes of Youngusband Peninsula between the Murray Mouth and Kingston, and the 200 km of high cliffs bordering the Nullarbor. The dunes are essentially similar in regards to their height, form and vegetation cover throughout their length. Similarly the Nullarbor cliffs are of a similar height and steepness throughout most of their extent. Sampling these sections would provide adequate coverage.

Observations

Based on the extensive travel in coastal regions, the following comments are offered.

1. Many rubbish dumps (waste depots) have been located near the coast. This is probably because it is Crown land and under the care and management of the local council. But it has resulted in dozens of rubbish dumps located within short distances of the coast, in often ecologically sensitive and environmentally significant land including dunes and wetlands. Efforts should be made to locate these out of the coastal zone inland to less sensitive environments.
2. Signs advertising coastal subdivisions were found in quite remote locations, particularly on Eyre Peninsula. These were generally of large allotments often with water frontage but sometimes lacking water and other services. Several large subdivisions were visited, including Fisherman's Paradise south of Streaky Bay and Perlubie beach north of Streaky Bay. Each had houses, caravans and various sheds scattered across extensive areas overlooking the coast.
3. A significant improvement to tourism in regional areas would be achieved by non-corrugated roads which currently do much to mar the enjoyment of an area. Tourism information of all areas failed to mention the condition of the roads that must be endured to reach the destinations sought. It was amusing to see speed limit signs of say 60 kph on the roadside when the condition of the road made it impossible to approach this speed. It was also apparent that while some councils had striven to provide good roads (e.g. Streaky Bay Council), in other areas, sections of the roads were atrocious. Kangaroo Island with its ironstone roads is an example, though efforts have been made to sheet some of these with limestone which appeared successful until potholes took over.



Sign near Lipson Cove, eastern Eyre Peninsula



Sign at Baird Bay, western Eyre Peninsula



Sign and developments at Fisherman's Paradise, south of Streaky Bay



Sign near Pt Neil, eastern Eyre Peninsula

3.2 VIEWSHED ANALYSIS

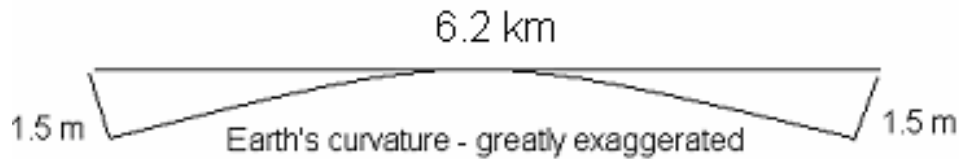


Figure 3.2 Sight Distance to Horizon (at sea)

At the consultant's request, DEH Environment Information carried out an analysis of the viewshed visible from the sea. The objective was to determine the boundary on the land at which the sea is visible.

It was known from the literature that the presence of water in a scene almost invariably enhances the scenic quality of the landscape (see Section 2.5 (5)). For South Australian scenes and using a 1 to 10 rating scale, I found that coastal scenes averaged 7.7 compared with inland scenes which lacked a view of any water of 5.3, a difference of 2.4 which is a very substantial difference (Lothian, 2000). It was considered therefore that land between the coast and this viewshed boundary could potentially be subject to development pressure. In crude real estate terms, a view of the sea adds thousands of dollars to the value of a property – particularly residential or holiday properties. The land lying beyond sight of the sea is likely to have a lower scenic quality rating. The viewshed boundary therefore provided the basis for demarking the coastal ratings where the sea is visible, and the land where the sea is not visible.

The viewshed boundary was derived by the Environmental Information Branch of DEH using a detailed topographic data set. Positions approximating the horizon at 6.2 km distance from the shore were selected at 5 km intervals around the coast. The figure of 6.2 km represents the distance visible at sea from eye level to a point 1.5 m above sea level⁴ (Figure 3.2).

From these positions, the land within a 20 km radius was plotted. This was plotted for

successive 5km positions parallel to the coast so that a location not visible from one position may be visible from one or more other positions.

The data did not consider the blocking effect of trees or buildings on the viewshed – these do not comprise permanent features on the landscape and could be removed. There are locations, e.g. western coast of Yorke Peninsula, where coastal dunes thickly vegetated by dense trees block the view of the sea from inland.

The viewshed maps provide a detailed assessment of the land visible from the sea. For the purposes of scenic quality ratings, it may be necessary to generalise the viewshed boundary to omit isolated hilltops and ridges so that a contiguous viewshed boundary can be derived.

The viewshed maps showing the detailed viewshed for the South Australian coast will be lodged with the Coast Protection Branch of DEH. These may be consulted for more detailed appraisal of the viewshed boundary, particularly in hilly coastal areas (e.g. Fleurieu Peninsula, northern Kangaroo Island) where isolated hills and ridges may be visible from the sea but are non-contiguous due to intervening vallies and gullies.

3.3 CLASSIFICATION OF SOUTH AUSTRALIA'S COASTAL LANDSCAPE

The landscape characteristics of the South Australia's coast are the product of its geology, climate, past and present sea levels, wave energy, and, more recently, human influence such as the removal of sand dunes on the Metropolitan coast.

Davies (1977) grouped the State's coastline in a "warm temperate arid coasts" classification of Australia's coasts. It included rock coasts, mainland beach coasts, and small barrier

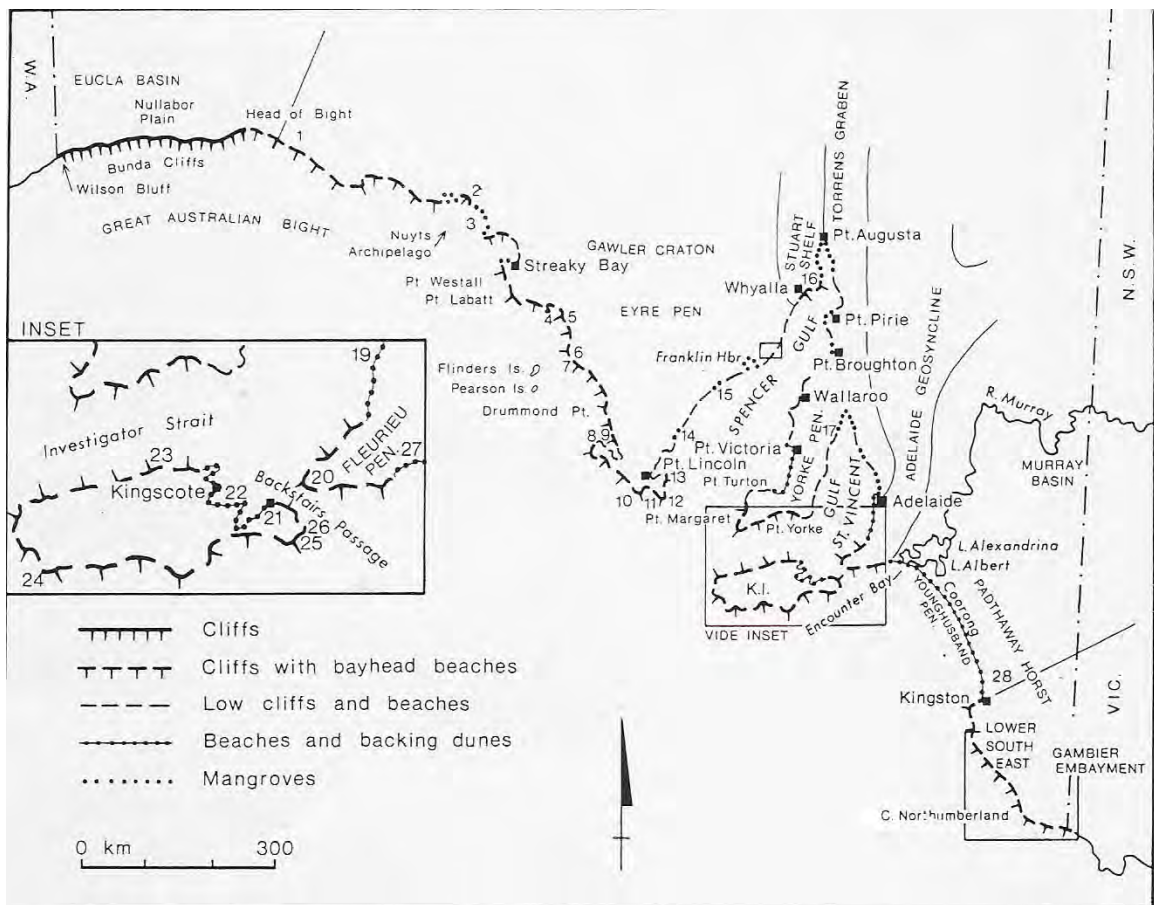
4. Based on the formula: Distance = $112.88 \cdot \sqrt{\text{height}}$ (in km) where 112.88 is the square root of the Earth's radius (6371 km). The distance visible from 1.5 m above the horizon (eye level) to another point 1.5 m above the horizon is 6.2 km.

Table 3.2 Areas of different coastal surface types (km²) – South Australia

Section	Total area	Bare mud flats	Mangrove mud flats	Holocene sand total area	Holocene sand bare	Holocene parabolic dunes
South East, Coorong, Fleurieu Peninsula	3903	150	0	666	225	180
Gulf St Vincent, Yorke Peninsula	1767	81	63	243	45	57
Upper Spencer Gulf, E. Eyre Peninsula	2022	108	99	132	21	0
W. Eyre Peninsula	1860	63	0	435	168	135
West coast	1887	84	42	384	183	78
Nullarbor	903	0	0	147	54	33
Total	12342	486	204	2007	696	483

Source: Galloway, *et al*, 1984. *Coastal Lands of Australia*. Summarised by Thom, 1984.

Note: the columns do not comprise the total area.



Source: Twidale, C.R. 1985. South Australia. In E.C.F. Bird, M.L. Schwartz (eds), *The World's Coastline*. Van Nostrand Reinhold Co, New York. p. 914.

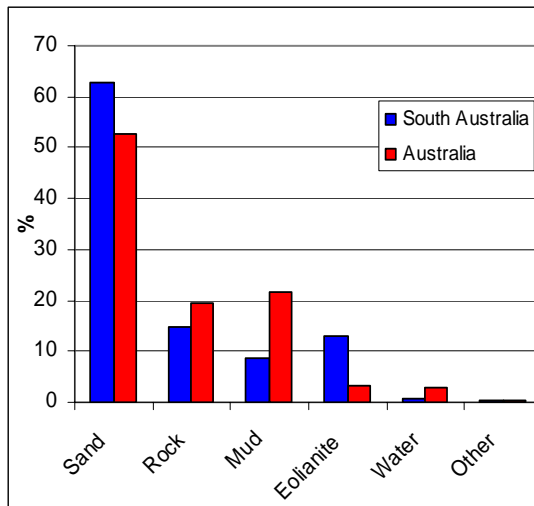
Figure 3.4 The South Australian coast showing structural base and major coastal types

coasts (i.e. the coastal dunes protecting the Coorong).

Gill (1982) classed the Nullarbor and far west coast as part of the Great Australian Bight Arid. Table 3.2 summarises the coastal surfaces of the South Australian coast. Holocene refers to the most recent geological period of 10,000 years. Riverless Coast, and

the remainder of the South Australian coast as part of the Aeolianite Coast which extends into western Victoria.

Galloway and colleagues of the CSIRO Division of Water and Land Resources classified the entire Australian coastline using LANDSAT satellite imagery, aerial photographs and maps. They classified a 3 km wide strip.



Source: Galloway, *et al*, 1984. *Coastal Lands of Australia*.

Figure 3.3 Comparison of South Australia and Australian Coastal Character

Compared with Australia, South Australia has a greater proportion of sandy coasts and eolianite coasts⁵ (Figure 3.3) and a much lower proportion of mud coasts which occur mainly in the tropics. Sand dominates the South Australian coast, covering over 60% of the coast. The sandy areas have formed following the return of sea levels around 6000 years ago.

Twidale, a prominent South Australian geomorphologist, classified South Australia's coast into five landscape units:

- Cliffs
- Cliffs with bayhead beaches
- Low cliffs and beaches
- Beaches and backing dunes
- Mangroves

Figure 3.4 indicates the distribution of these landscape units. This classification matches closely with a classification prepared by the consultant from traveling the South Australian coast. Based on Twidale's classification:

- The Nullarbor, west coast and Western Eyre Peninsula comprises mainly cliffs
- Eastern Eyre Peninsula comprises mainly low cliffs, interspersed with some mangroves

5. Eolianite (or aeolianite, also known as calcrete) comprises wind blown shell sand consolidated into limestone by solution and redeposition of calcium carbonate. It originated in the Pleistocene age as massive dunes (Galloway, 1984).

- Upper Spencer Gulf comprises extensive mangroves and low cliffs and beaches
- Yorke Peninsula comprises low cliffs and beaches except for the foot which has cliffs with bayhead beaches
- Upper and eastern Gulf St Vincent comprises extensive mangroves with some beaches
- Fleurieu Peninsula comprises cliffs with bayhead beaches
- Kangaroo Island comprises mainly cliffs with bayhead beaches and some mangrove areas
- Younghusband Peninsula, adjacent to the Coorong, comprises beaches with backing dunes
- The South East comprises cliffs with bayhead beaches

The following classification of South Australia's coast builds on the previous work, particular the five-part classification by Twidale. It comprises the following six landscape units:

1. High steep cliffs
2. Low cliffs and beaches
3. Headlands and bays
4. Beaches backed by dunes
5. Samphire – mangrove formation
6. Township foreshores

(1) HIGH STEEP CLIFFS

High land which terminates as sheer cliffs at the sea occurs in several localities. Cliffs are steep, generally sheer and inaccessible. Their height, steepness and sheer ruggedness differentiates them from other landscape units. These generally occur on high energy coasts which formed the cliffs through erosion.

The coast is defined by the larger morphological context extending well inland from the sea. High steep cliffs often present spectacular coasts with considerable diversity, indentation and unpredictability. They are of medium to high landscape quality. They are generally not developed except where valleys bottom out near the sea and settlements occur – e.g. Second Valley on Fleurieu Peninsula and Stokes Bay on Kangaroo Island.

These may be formed by high land and plateau extending to the coast via ridges and valleys or a high flat plain extending to the coast. High steep cliffs are found on the Nullarbor, western and southern Eyre Peninsula, the toe of Yorke Peninsula, north-western and south-western Kangaroo Island,

southern Fleurieu Peninsula and Newland Head.



Newland Head, Fleurieu Peninsula



South of Wellington Point, Eyre Peninsula



Cape Torrens, Kangaroo Island



Whalers Way, Eyre Peninsula

(2) LOW CLIFFS AND BEACHES

Low cliffs occur on several essentially straight sections of the coast and are generally on low energy coasts. Their low height is the main point of differentiation from the *high steep cliffs* landscape unit although they can be sheer and quite rugged. In some locations, beaches and dunes occur between the cliff and the sea and this is rare for the *high steep cliffs*. On the eastern coast of Yorke Peninsula these coasts are popular for shack development and holiday housing townships.

The main locations in which these coasts occur are the Redbanks – Pt Gibbon section of eastern Eyre Peninsula, much of the eastern coast of Yorke Peninsula, and a short section at Redbanks on north eastern Kangaroo Island. The name *Redbanks* indicates the ironstone character of these low cliffs.



Redbanks, north Kangaroo Island



North of Wool Bay, eastern Yorke Peninsula



Tiddy Widdy Beach, Ardrossan



Redbanks eastern Eyre Peninsula

(3) HEADLANDS AND BAYS

This group is similar to Twidale's *Cliffs with bayhead beaches*, and comprises headlands of resistant strata with beaches between them where the hard strata has been eroded and the softer rock underneath disappears through subsequent erosion.

The hard stratum is often of calcrete (aeolianite) but in some locations (e.g. western Eyre Peninsula) harder granite or other more resistant rock may underlie the cliffs at sea level. Although this base has been eroded it provides a firm base for the headlands. Headlands and bays generally occur on high energy coasts.

Many cliffs have wave cut platforms at their base and considerable rock debris strewn about. Some coasts comprise highly fractured headlands with rock debris and wave cut platforms (e.g. Cape Buffon area near South End).

The headlands may be low, medium or high in height, and the land may slope back into the bay. The bays may be backed by dunes or agricultural land. These are highly diverse landscapes, with considerable indentation of the coast and are unpredictable in their formations. These formations are generally of medium to high landscape quality. With plentiful limestone, South Australia's coast has many examples of this formation. They are found in the South East, southern and western Yorke Peninsula, and particularly the west coast of Eyre Peninsula.

In several localities of protected bays and inlets, the hills slide into the sea with virtually no erosion from the low energy sea. The lack of apparent erosion distinguishes these from areas in which the hills have been eroded into cliffs. In some locations the land slopes gently

or is nearly flat but because of the low energy coast erosion is minimal.

Examples include the upper Spencer Gulf between Pt Lowly and Port Augusta, Lincoln National Park, Port Lincoln, parts of Coffin Bay, Baird Bay and Smoky Bay at Streaky Bay. It also occurs on the protected side of some headlands – e.g. on the Encounter Bay side of the Bluff and in protected areas on Kangaroo Island.



Cape Northumberland area, South East



Pennington Bay, Kangaroo Island



Maslin Beach, Fleurieu Peninsula



Chinaman's Hat Bay (YP 123)



Near Pt Drummond, Eyre Peninsula



Edward Bay, West coast

(4) BEACHES BACKED BY DUNES

Beaches are backed by dunes which may be low, medium or high in height, vegetated or barren, and the beaches may be wide and extensive or narrow or intermittent. This type is found in both high and low energy coasts. The coast is usually fairly uniform, lacking indentation and other diversifying features. Landscape quality tends to be medium. These coasts are often used for shack development and holiday housing – e.g. in the South East and Yorke Peninsula.

Parts of the far west coast (e.g. near Fowlers Bay) comprise extensive stretches of coastal high dunes, some vegetated, others barren. On the western side of Yorke Peninsula the coast is lined by dunes of medium height,

generally vegetated. In the South East, the Coorong is separated from the sea by medium height dunes, mostly vegetated. Further south, there are low vegetated dunes.

Dunes occur backing large bays forming attractive curved arches of which there are many examples (e.g. Anxious Bay, Peake Bay, Berry Beach). In other localities, the coast is straight – Youngusband Peninsula is an example although it curves slightly over its very long length. Examples of very high dunes include the head of the Bight, Fowlers Bay, Talia Beach, and Formby Bay.

Parsons Beach and Waitpinga Beach on Fleurieu Peninsula are rare examples of dunes which have formed between high headlands not consisting of calcrete as is common on Yorke and Eyre Peninsulas.



Cape Banks Lighthouse Bay, South East



Youngusband Peninsula



Parsons Beach, Fleurieu Peninsula



Western Cove, north Kangaroo Island



Anxious Bay, western Eyre Peninsula



West Lakes Shore, Adelaide coast



Davenport Creek, west coast



Formby Bay, Yorke Peninsula



Head of Bight, Twin Rocks



Arno Bay, eastern Eyre Peninsula

(5) **SAMPHIRE – MANGROVE FORMATION**

Samphires and mangroves always occur on low energy coasts and often comprise extensive areas. While the other coastal landscape units refer to the land, mangroves exist in the sea. They can be considered as part of the seaward component of the coast. Mangroves require warm conditions in which to thrive so are not found in the South East, Fleurieu Peninsula or on Kangaroo Island.

There is little diversity and these formations have a high degree of predictability. Landscape quality tends to be low. Examples include south of Pt Pirie and Pt Augusta, eastern St Vincents Gulf, and inlets on Eyre Peninsula (e.g. Cowell, Tourville Bay, Murat

Bay). In some areas the mangroves are scattered (e.g. on the western side of upper Spencer Gulf and adjacent to the Port Wakefield Proof Range) and the samphire component may not exist or be highly dissected.

Development is rare in these formations although access tracks to boat launching facilities and crabbing localities often occur. An exception is the west coast of the upper Spencer Gulf where scattered littoral mangroves lie adjacent to extensive linear shack development.

In some localities, extensive sand flats occur with patches of mangroves or other coastal vegetation – Pelican Lagoon on Kangaroo Island is an example. These may comprise internal bays and lagoons. There may also be extensive flats with seagrasses and other marine vegetation – St Kilda, Fisherman’s Bay and Weerona Bay north of Port Pirie are examples.



American River *Chenopodia*, Kangaroo Island



Pt Wakefield mangroves, upper St Vincent’s Gulf



Mundorra Arm, Pt Broughton, Yorke Peninsula



Chinaman’s Creek, upper Spencer Gulf



NW Spencer Gulf



Laura Bay mangroves, west Eyre Peninsula



Murat Bay mangroves, Ceduna



Victor Harbor foreshore



Davenport Creek mangroves, west coast



Port Broughton, Yorke Peninsula

(6) TOWNSHIP FORESHORES

Often the foreshore of townships has been considerably modified from the original. Dunes, if they existed, have long disappeared, and the area is often grassed with non-indigenous trees planted. Norfolk Island pines are particularly popular.



Ceduna foreshore, Eyre Peninsula



Robe, South East

3.4 LENGTH OF COASTAL LANDSCAPE UNITS AND REGIONS

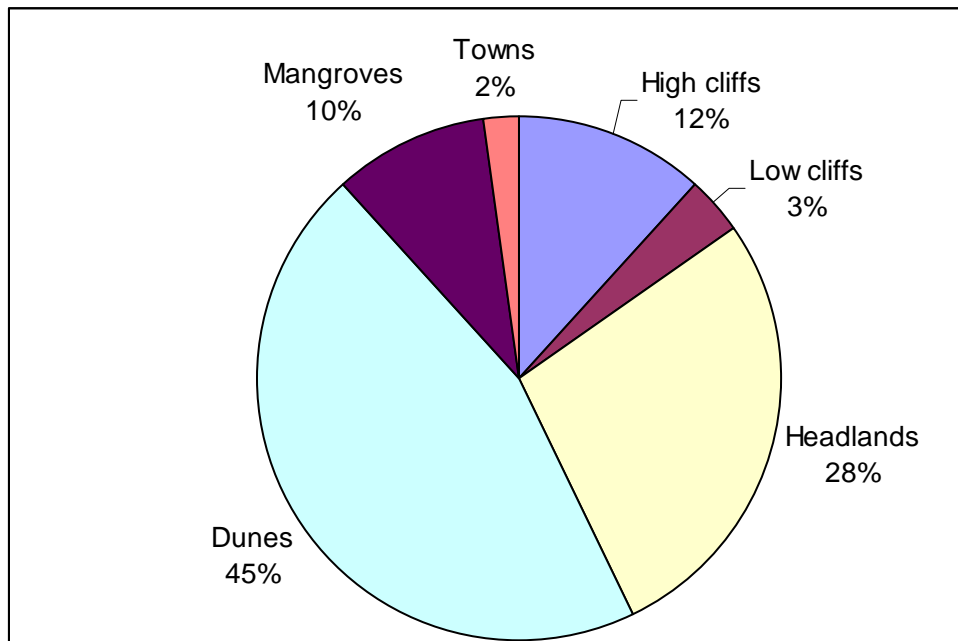


Figure 3.5 Relative Proportions of Coastal Landscape Units

The approximate length of the seven landscape units of coastal landscapes in South Australia was assessed by measuring each off maps of the State. Maps of 1:50,000 (1 cm = 0.5 km) and 1: 100,000 (1 cm = 1 km) scale were mainly used, the exception being the Nullarbor where 1: 250,000 (1 cm = 2.5 km) scale maps were used. Oblique photographs on the Atlas of South Australia were also viewed extensively.

Distances were scaled off the maps using a ruler. A measuring wheel was considered but decided against as it would offer little gain in accuracy. Reference was made to the photographs throughout the length of the coastline as well as to other sources of information.

The length measured from the maps totaled 3685 km, which compares well with the 3,700 km length of the South Australian coast – only 0.4% difference which is considered acceptable⁶. Table 3.3 summarises the length of the seven landscape units and these are illustrated by Figure 3.5.

These figures indicate that the South Australian coast is dominated by two

formations, dunes/ beaches and the headlands/bays formation. Together these account for 73% of the total length.

Table 3.3 Length of Coastal Landscape Units

	Total (km)	%
High cliffs	433	11.8
Low cliffs	126.5	3.4
Headlands	1015.5	27.6
Dunes	1676	45.5
Mangroves	353	9.6
Towns	81	2.2
Total	3685	100.0

Interestingly towns accounted for over 80 km or 2% of the total length, and this excluded Adelaide coast which was designated as dunes. This indicates the linear nature of much coastal development where the town stretches along the coast. Only the larger towns and settlements were recorded on the basis that these had produced major changes in the coastal formation and formed their own distinct formation.

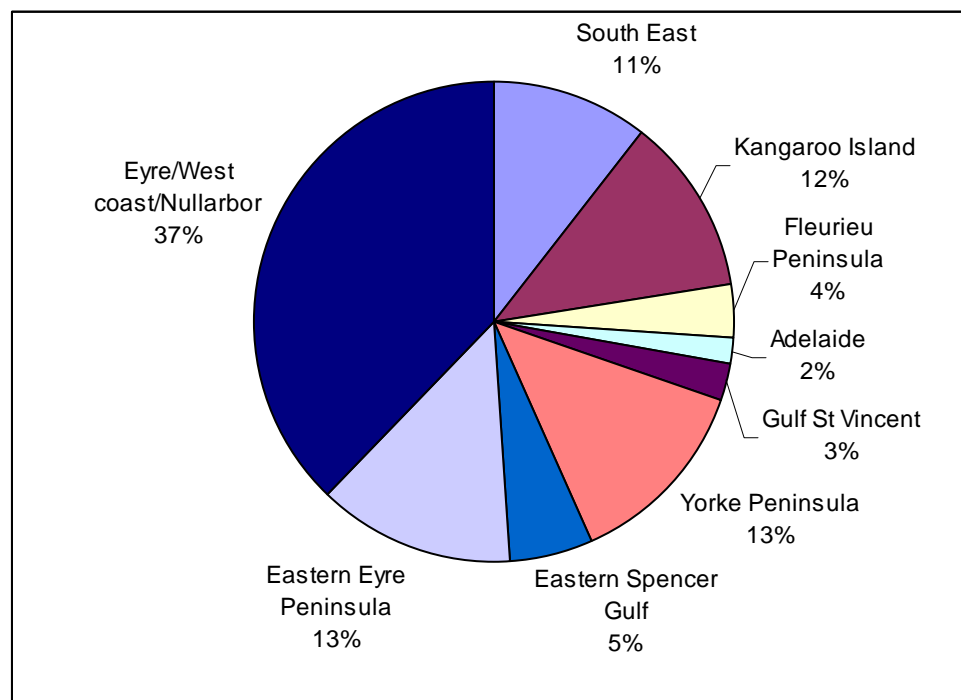
Figure 3.6 summarises the length of coast in each of the nine regions and indicates the dominance of the Eyre Peninsula and areas to the west. Together with eastern coast of Eyre Peninsula, these two sections total more than half the State.

6. The coast is a fractal entity as its degree of irregularity is the same at any scale. As the measuring scale becomes smaller the measured length of coast rises without limit. Thus any given length of the coast is an approximation.

Finally, Table 3.4 and Figure 3.7 summarise the length of each coastal landscape unit present in each of the regions. These indicate the region where the majority of a landscape unit is present:

- Most of the high cliffs are found on western Eyre Peninsula and particularly the Nullarbor, and on Kangaroo Island
- Headlands are found equally on Western Eyre Peninsula and Kangaroo Island
- Dunes are scattered across all regions but are best represented on western Eyre Peninsula, the South East (the Coorong), and western Yorke Peninsula

This analysis can inform the selection of scenes for the survey. Ideally it may be desirable that the numbers of scenes of each landscape unit reflect their prominence in the South Australian landscape. Thus the survey would show many scenes of dunes and headlands and fewer scenes of other landscape units. However other factors are important determinants, particularly the relative complexity of a landscape unit and how many scenes are required for it to be adequately represented. Also it is necessary to ensure adequate representation of a landscape unit for statistical analysis. Thus the analysis can inform but not determine the allocation of scenes for the survey.



Note: Gulf St Vincent covers St Kilda and Pt Wakefield. Eastern Spencer Gulf covers Tickera to Port Augusta. Adelaide covers Outer Harbor to Sellicks Beach

Figure 3.6 Length of Coast by Region

Table 3.4 Length of Coastal Landscape unit by Region

	High cliffs	Low cliffs	Headlands & bays	Dunes	Samphires & mangroves	Towns	Total
South East	0	0	51	332	0	5	388
Kangaroo Island	48	13	276	87	12	3	439
Fleurieu Peninsula	8	0	72	46	0	5	131
Adelaide	0	10	13	39	0	0	62
Gulf St Vincent	0	0	0	45	48	2	95
Yorke Peninsula	11	36	91	298	28	22	486
Eastern Spencer Gulf	0	0	5	88	90	14	197
Eastern Eyre Peninsula	0	24	135	216	103	22	500
Eyre/West coast/Nullarbor	366	43.5	372.5	525	72	8	1387
Total	433	126.5	1015.5	1676	353	81	3685
%	11.7	3.4	27.6	45.5	9.6	2.2	100.0

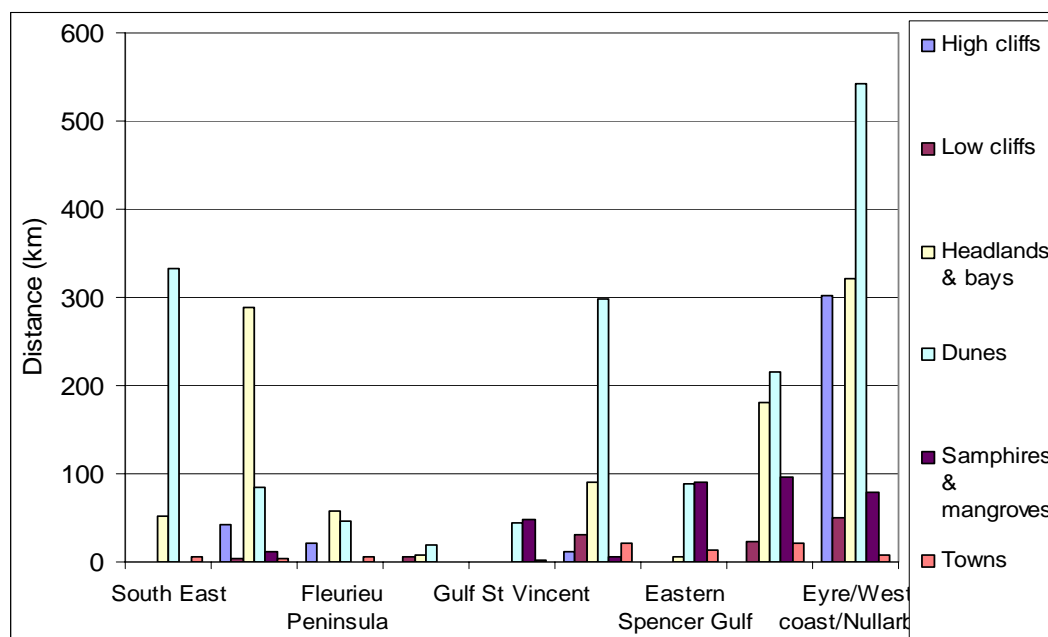


Figure 3.7 Length of Coastal Landscape unit by Region

Table 3.5 Number of Photographs by Landscape Unit and Region

	High cliffs	Low cliffs	Headlands & bays	Dunes	Samphires & mangroves	Towns	Other	Total
South East			55	82	0	5	17	159
Kangaroo Island	16	2	93	31	14	7	30	272
Fleurieu Peninsula	8		145	84		21	14	136
Adelaide				98		23	15	30
St Vincent's Gulf				5		25	0	268
Yorke Peninsula	2	35	94	79	6	3	49	171
Upper Spencer Gulf			31	31	44	6	59	62
East Eyre Peninsula		9	22	15	5	6	5	314
West Eyre Peninsula	49		175	54	14		22	38
West Coast			7	21	7	3	0	33
Nullarbor	21			6			6	193
Total	96	46	622	506	90	99	217	1676
%	6	3	37	30	5	6	13	100

Note: Other includes shacks (100), jetties, marinas, aquaculture and lighthouses

3.5 DISTRIBUTION OF PHOTOGRAPHS

The photographs were distributed by region and by landscape unit. These are summarised by Table 3.5 and Figures 3.8 and 3.9.

Photographs of headlands and bays, and dunes landscape units together account for two thirds of all photographs. The large proportion of *Other* landscape unit is due to the large number of photographs of shacks and other forms of development. These included jetties (23), marinas (15), aquaculture (11) and lighthouses (14).

The representation by region reflects their size and their accessibility, a small but highly accessible region such as Adelaide has many

photographs while a large region with extensive areas inaccessible such as eastern Eyre Peninsula has fewer photographs.

To gain a better appreciation of their representativeness, the linear distance of the coast contained in each landscape unit and each region is used as the basis for comparison (Table 3.6, Figure 3.10). Comparing the proportion of photographs taken in each landscape unit with the distance covered by each landscape unit (Table 3.6, Figure 3.10) indicates that the overall proportions are in similar levels of magnitude. Headlands and bays are slightly over-represented while dunes are somewhat under-represented. High cliffs and the mangroves &

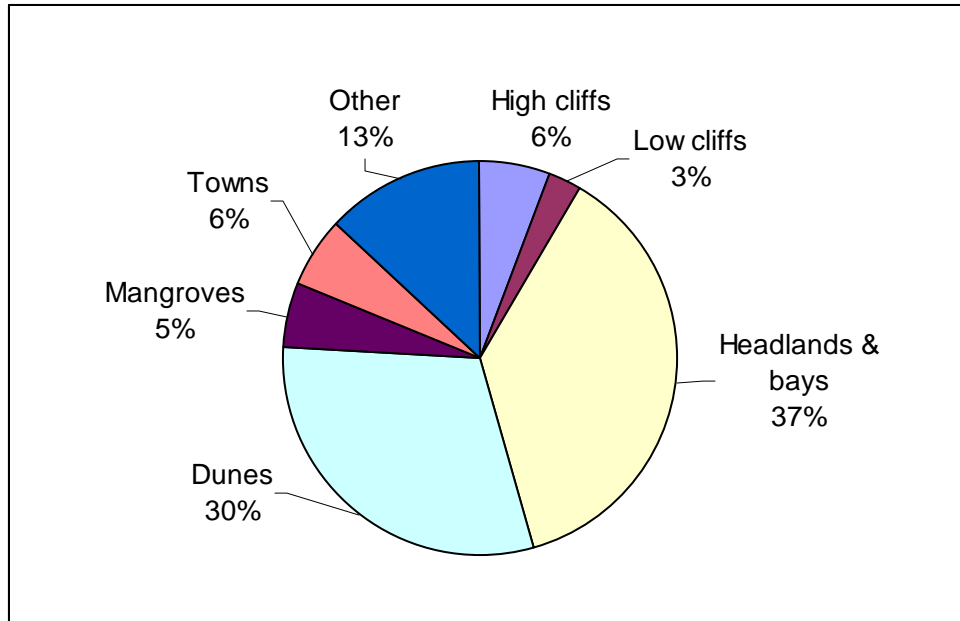


Figure 3.8 Proportions of Photographs by Landscape Unit

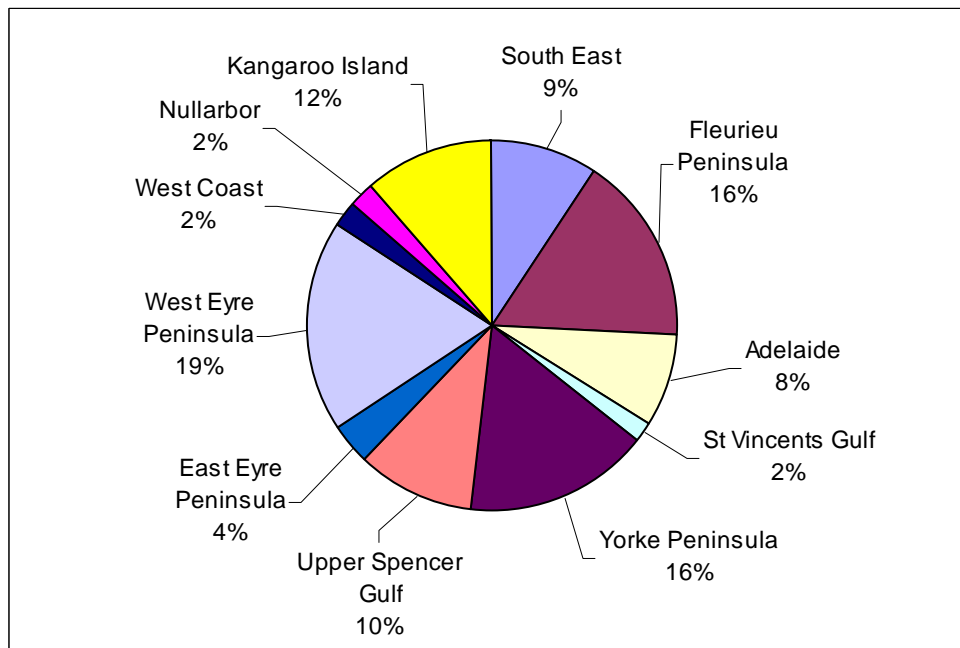


Figure 3.9 Proportions of Photographs by Region

Table 3.6 Comparison of Proportion of Photographs with Distance

	High cliffs	Low cliffs	Headlands & bays	Dunes	Samphires & mangroves	Towns	Total
Distance Km	433	126.5	1015.5	1676	353	81	3685
%	11.8	3.4	27.6	45.5	9.6	2.2	100.0
Photographs	96	46	622	506	90	99	1459*
%	6.6	3.2	42.6	34.7	6.2	6.8	100

* Total excludes 217 other scenes

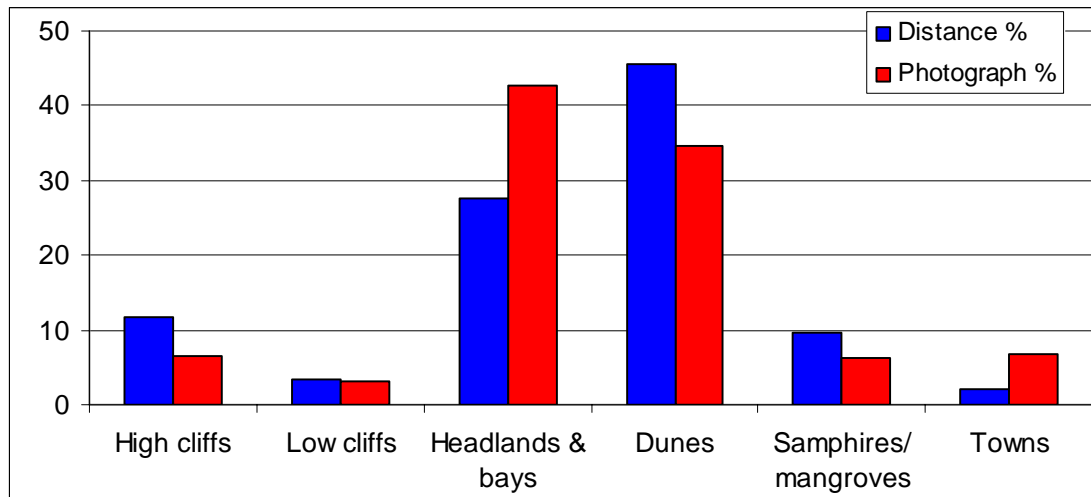


Figure 3.10 Comparison of Proportion of Photographs with Distance

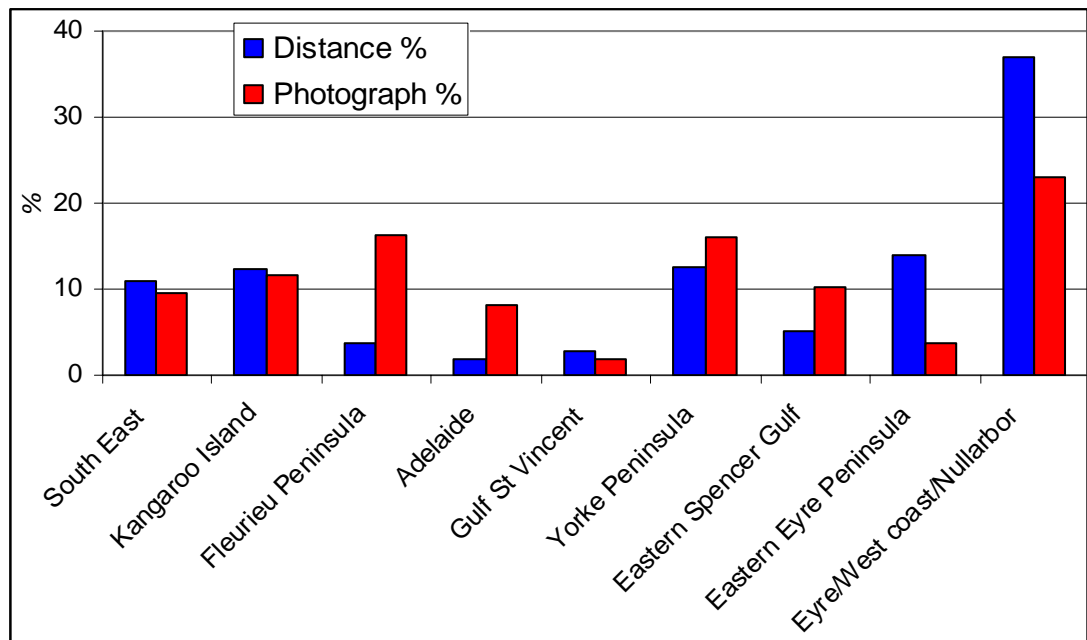


Figure 3.11 Comparison of Proportion of Photographs with Regions

samphires landscape unit could be better represented.

Figure 3.11 compares the proportion of photographs in each region with the distance represented by that region. As expected, the more accessible regions such as Adelaide, Yorke and Fleurieu Peninsulas are over-represented while the less accessible regions, particular the Eyre Peninsula and West Coast are less well represented.

These findings are presented to provide an objective assessment of the adequacy of the photography in terms of its representativeness. Using distance as the basis of comparison, it is apparent that some landscape units, particularly dunes, are under-

represented (while headlands & bays are over-represented), and some regions, particularly Eyre Peninsula are under-represented (while Fleurieu and Yorke Peninsulas are over-represented).

Overall these differences are not considered significant; all of the landscape units are adequately represented and the large number of photographs available should ensure that the diversity inherent in each landscape unit is able to be represented in the survey instrument.

3.6 SELECTION OF PHOTOGRAPHS

Overall the survey should comprise no more than 200 scenes as fatigue is likely to set in

with longer surveys and affect the concentration of participants. If 160 scenes were selected to represent the coastal landscapes, a further 20% (i.e. 32 scenes) of South Australia would be added making a total of 192 scenes. A lesser number would reduce the overall survey size.

Applying the coastline lengths of the seven landscape units to 160 coastal photographs yields the number of photographs per landscape unit as shown in Table 3.7.

Table 3.7 Number of Photographs based on Coastline Lengths per Landscape unit

Landscape unit	Distance %	Photos	Without towns
High cliffs	10.7	17	18
Low cliffs	3.2	5	5
Mangroves	9.3	15	15
Dunes	47.4	76	78
Headlands	27.1	39	44
Towns	2.3	4	
Total	100	160	160

These figures indicate the distribution to represent the landscape units by their abundance in the South Australian landscape. However for statistical analysis it is desirable that no landscape unit be represented by fewer than 12 scenes. It is also essential that the photographs in the survey adequately cover the diversity present in each landscape unit. This is likely to be the major determinant of the number of photographs in each landscape unit. If the landscape units were represented equally, then there would be around 27 scenes per landscape unit (excluding towns).

The diversity differs considerably across the landscape units. The most complex visually are the headlands and bays followed by the scenes with cliffs – particularly the high cliffs. Mangroves are less complex and can be represented by fewer scenes.

The 1676 photographs were distributed across the landscape units. The photographs in each were then examined critically and selection made on the basis of representing the variety present and also representing the different regions around the South Australian coast. Photographs which were too dark or too light, viewed into the sun or were too distant were rejected. Photographs without the imprint of people evident or present were sought although in the scenes of the Adelaide beaches this was not entirely possible.

In the landscape units with relatively few scenes – e.g. low cliffs, and mangroves and samphires, the selection was relatively straightforward. For the larger landscape units – dunes, and headlands and bays, where the number of photographs was 5 – 600, several sieves were needed. In the case of headlands and bays, this initially selected around 160 scenes from the 622 total, and from this the final selection of 45 was made.

The end result was the selection of 138 scenes for the survey. Their representativeness was reviewed by region and by landscape unit. Table 3.8 and Figure 3.12 indicate their representativeness by region and Table 3.9 and Figure 3.13 by landscape unit.

On a regional basis, the selection of photographs was very close for six of the nine regions, and in the remaining four regions ranged from 4.2% to 10.4%. The largest difference was eastern Eyre Peninsula where large areas south and north of Whyalla were inaccessible or where entry was prohibited (i.e. El Alamein). These coasts however were well represented elsewhere. For both Fleurieu Peninsula and Yorke Peninsula, there were somewhat more photographs than their distance would suggest. As both areas are close to Adelaide and under heavy pressure their higher representation was not considered undesirable.

The remaining region where the representation was 3.6% below the quota covers western Eyre Peninsula, the west coast and the Nullarbor which accounted for 37% of the State's coast. It was considered that the landscapes of this vast region were adequately represented by the selection made.

Table 3.8 Comparison of Survey Photographs with Regions

Region	Photos	Photo %	Region Dist. %	Diff. %
SE	15	10.9	11	-0.1
KI	15	10.9	12.3	-1.4
FP	15	10.9	3.7	7.2
Ad	5	3.6	1.8	1.8
St V G	7	5.1	2.7	2.4
YP	23	16.7	12.5	4.2
USG	7	5.1	5.1	0
EEP	5	3.6	14	-10.4
WEP/Null	46	33.3	36.9	-3.6
Total	138	100.0	100.0	

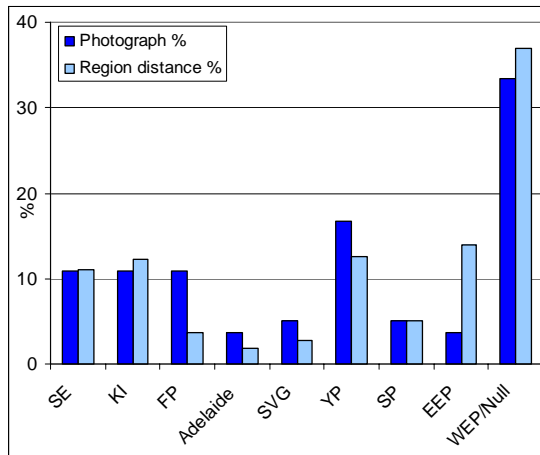


Figure 3.12 Comparison of Survey Photographs with Regions

On the basis of the landscape units, three were over-represented and two under-represented. Dunes were under-represented by 13.5%. It was considered unnecessary to increase the number of these scenes as dunes were relatively simple systems visually and were adequately represented by the scenes selected.

Table 3.9 Comparison of Survey Photographs with Landscape Units

Landscape unit	Photos	Photo %	Region Dist. %	Diff. %
High cliffs	15	10.1	12.1	-1.2
Low cliffs	14	10.1	3.2	6.9
Headlands	46	33.3	29.4	3.9
Dunes	45	32.6	46.1	-13.5
Mangroves	18	13.0	9.2	3.9
Total	138	100.0	100.0	

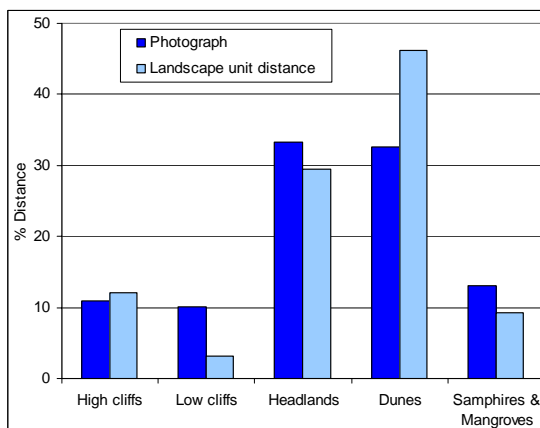


Figure 3.13 Comparison of Survey Photographs with Landscape Units

3.7 ASSEMBLY OF SURVEY INSTRUMENT

The survey instrument comprises the scenes of coastal landscapes together with additional scenes of the South Australian landscape. These were included to meet the requirements of the project specifications:

Ensure that the coastal scenic value is assessed within the wider context of the South Australian landscape

Scenes of the South Australian landscape would provide a context for the assessment of the specific target. Their inclusion better ensures that the ratings of the coastal scenes reflect a state-wide perspective and would be benchmarked at the State level. Scenes of known landscape quality rating would be used which can also provide a test of the adequacy of the sample of participants used to rate them.

With 138 coastal scenes and 28 South Australian landscape scenes, the total survey comprised 166 scenes. This is towards the upper limit for concentration for many participants but is considered acceptable as the Internet basis of the survey would enable the participants to take a break at any time.

The survey was preceded by a set of ten scenes, five being coastal scenes and five scenes of the South Australian landscape, to prepare participants for what will follow. These also help cue their minds to the rating scale.

3.8 CONDUCT OF THE SURVEY

An 18 page listing of regional and local groups had been compiled containing names, addresses and emails (where available) covering the following 284 groups:

- Regional groups – 145 groups
- Statewide organisations – 20 groups
- Councils – 26 local councils
- Economic Development Boards – 7 regional boards
- Regional Tourism Associations – 4
- Catchment Water management Boards – 5
- National Trust – 22 local branches
- TAFEs – 12
- National Parks Regional offices – 4
- Friends of Parks groups – 30 groups
- National Parks Consultative Committees

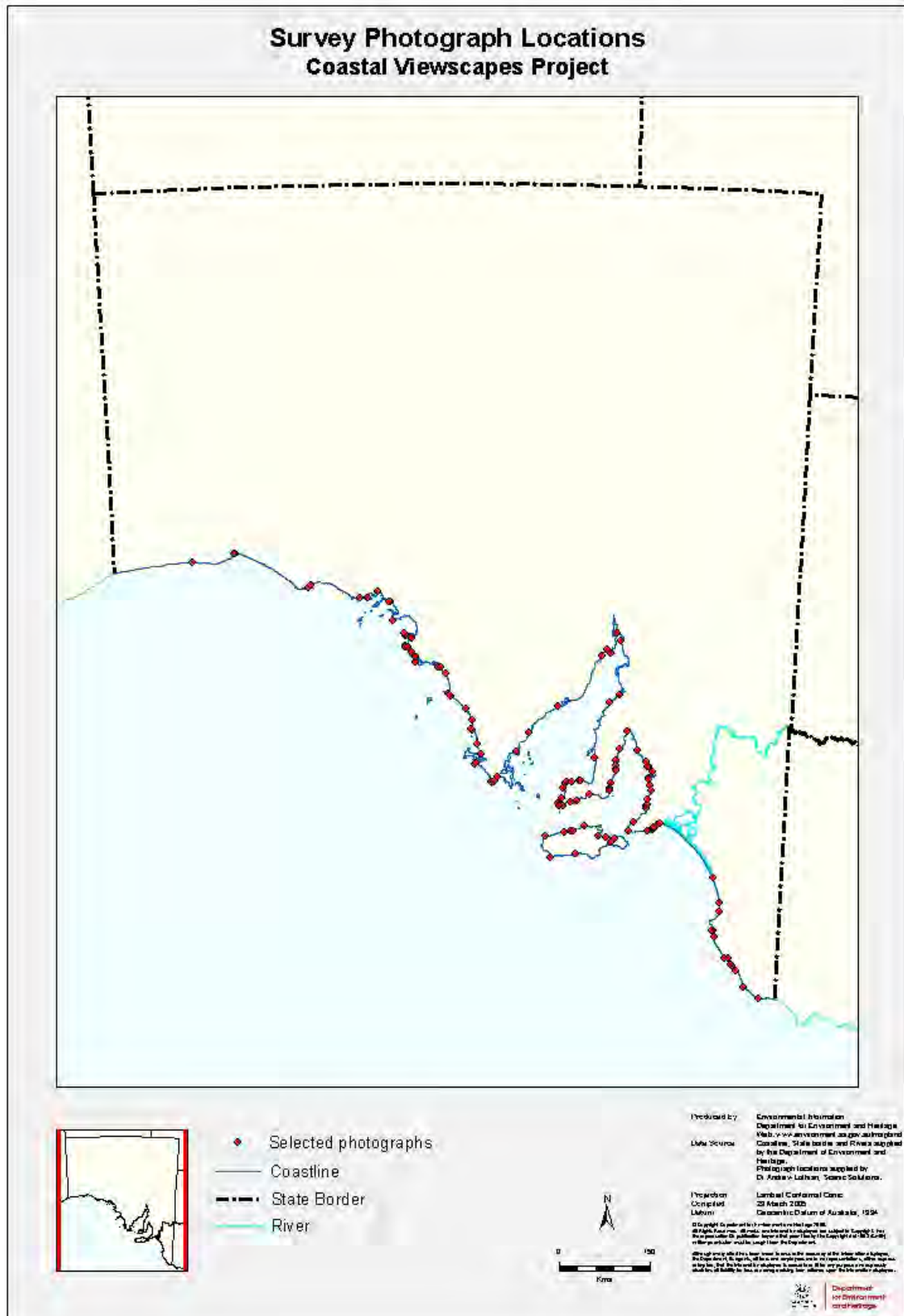


Figure 3.14 Locations of Survey Photographs

- Plus State departments

Invitations were forwarded to many of these groups via email.

The respondent characteristics used the categories of the Australian Bureau of Statistics and were included to compare the respondents with the community.

Design of the Internet survey

Previous experience had shown the efficiency of using the Internet to conduct surveys. To achieve rapid and cost effective results the Internet was relied upon solely for this survey. In 2003, 53% of Australian households had access to the Internet (up from 16% in 1998) & 58% of adults had access to Internet through work and libraries as well as home (ABS, 2005). By extrapolation, by 2005, around 70% of households were likely to have Internet access with a higher percentage having access through work and libraries. This suggests that reliance on the Internet should not strongly bias participation.

A sub-consultant, David Whiterod, prepared the survey instrument using the Internet. Mr Whiterod had undertaken similar work previously for Dr Lothian (Lothian, 2003; 2004).

The use of the Internet to deliver the survey introduced a number of challenges and required certain assumptions to be made about respondents, their web browsers, screen configurations and Internet connection speeds. The survey website was developed to cater for as large an audience as possible (slightly erring on the conservative side when making assumptions about respondents' Internet speed and screen size).

The site and survey application was developed using Macromedia's ColdFusion™ Application Server.

The landscape assessment survey was an image-intensive process; the cumulative file sizes of the scene images were quite large. This was not generally a problem for respondents with broadband (or faster) connections.

To cater for people with slower Internet connection speeds (such as those with dial-up Internet connections), two sets of scene images were created. Both sets of images

were identical in all respects except the level of JPEG compression used. A set (with a compression level of 80) was developed for use by broadband users while another set (compression level 60) was developed for dial-up users. The total file size of the dial-up images was around 60% of that of the broadband images.

The image compression settings were a trade-off between compression and image detail. As the level of JPEG compression increased the general quality of an image decreased. If images were compressed too much this would affect the ability for respondents to see fine details in an image and would result in "blockier" images. The trade-off was that high quality scenes were slower to download.

Each image set was resized to 585x390 pixels. This size fitted well into a screen size near 800 pixels by 600 pixels. The page layout also performed well at larger screen resolutions.

A Microsoft SQL Server was used to record both the demographic details as well as the ratings of each scene.

The survey website was designed to be as self-contained as possible. The front page included details of the survey process, background and contact information. If the respondent chose to proceed to the survey they were prompted to enter some general demographic information. This information was recorded in the database and a unique survey identifier generated for each respondent. This initiated the survey session. The respondent's session identifier was used to record scene ratings with the correct demographic details. As the participant rated each scene, their rating was automatically recorded in the database.

As part of the demographic collection stage, respondents were asked to indicate their Internet connection speed: either dial-up or broadband. This information was used to reduce the download requirements for dial-up users as they are shown a more compressed set of scene images during the survey.

Following the introductory ten sample scenes, the 166 scenes were then shown, each for as long as the respondent required. The order of these scenes changed for each participant, a new random order being generated automatically as the participant moved to the next scene. Each time a new scene was to be

shown the survey application chose a random scene from the list of scenes that the participant had yet to rate. Randomising the order of scenes overcame the issue of the order of the scenes affecting the results – with attention waning towards the end, or one scene being affected by the previous scene.

Following selection of the rating on the 1 to 10 scale at the top of the screen, the next scene automatically appeared. This allowed respondents to move through them at their own pace and not be anxious about completing their rating before it moved to the next scene, or alternatively, being frustrated for waiting the scene to change after they had completed their rating. The design of the rating instrument ensured that scenes loaded rapidly, even on dial up connections although delays can and did occur when many hundreds logged in concurrently.

Respondents could temporarily leave the session if interrupted and return to continue it. However there was a cut off time of 30 minutes at which point the survey terminated.

A respondent could exit the survey at any point. They could also leave comments, either at the end of the survey or, if they chose to leave the survey before completion, before rating all scenes.

On completion of the survey the participant was thanked and provided with an opportunity of commenting on the survey. They could then either exit or go back to the first page. The Internet survey is shown on the following pages.

The survey was launched publicly on Thursday 7 April, 2005 and *The Advertiser* covered it with a lengthy article. The Minister for Environment and Heritage was interviewed by the electronic media. By 2 pm on that day, 130 people had completed the survey. Over the following week, responses climbed steadily (Figure 3.16). Late on Wednesday 13 April a notice was posted on the State Government Intranet advising of the survey and inviting employees to participate (Figure 3.15).

The notice was posted at 4.28 pm and within an hour or so, nearly 700 had participated in the survey. Because so many logged onto the site concurrently, the scenes took far longer to download and this resulted in considerable frustration, premature terminations, and

comments on the surveys. The following 24 hours saw the number of responses climb from 500 to nearly 2500. The following day saw a further 320 participate. As the notice went out across the State Government it included many regional centres.

The survey was terminated late Friday 29 April by which time 3324 had participated in it. It is believed that this level of participation may be a record for a survey of this nature and vindicates the use of the Internet as the vehicle for the survey instrument.

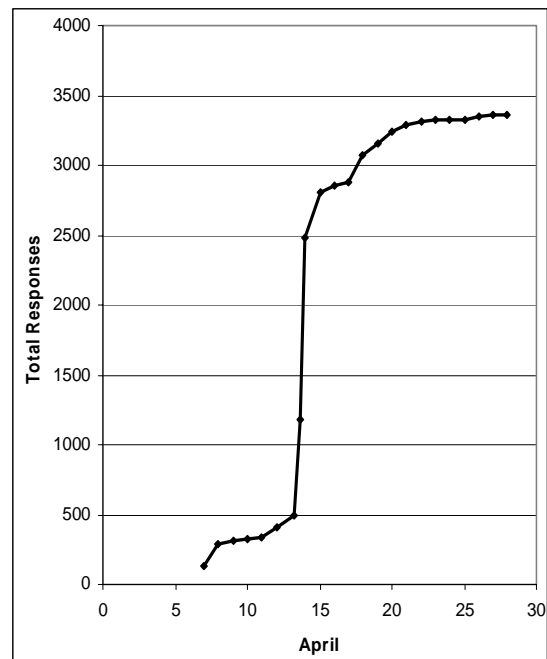


Figure 3.16 Total Responses to Survey during April, 2005

3.9 DATA MANAGEMENT

The survey results were transferred to Excel spreadsheet and the following steps taken:

- The ratings of South Australian scenes were removed to another file
- The comments of many participants were compiled and placed in a Word document. This was subsequently replaced by the verbatim record from the Internet survey which has been included on the CD.
- The data was re-arranged with participant data followed by ratings in numerical order
- Data from participants who rated less than the full 166 scenes were deleted. This reduced the total participants from 3324 to 2258, a 32.1% reduction. It was

Introductory Page

Coasts & Marine

Coastal Viewshed Survey

Purpose of this survey

South Australia has spectacular and diverse coastal scenery. The Department for Environment and Heritage (DEH) has commissioned a study to measure and map the scenic values of our coast. This survey is intended to help determine the scenic attractiveness of South Australia's coast. The outcome of this project will assist State and Local government in better planning and management of the coast. The Coastal Viewshed Survey closes on Saturday 30 April 2005.

How it works

You will be shown a photograph of a scene and asked to rate its scenic attractiveness. The ratings are on a scale of 1 to 10 - 1 being very low and 10 being very high. The rating scale is located at the top of each scene's page - just click the appropriate number to register your rating for each scene. Once a rating has been recorded you will be automatically shown the next scene.

How long will it take?

- The survey has a total of 166 scenes. How long it takes will depend on how much time you spend rating each scene: it can be completed in less than 15 minutes.
- There is no time limit to rate each scene, however, your rating session will end after 30 minutes of inactivity.
- Please rate all 166 scenes as this will provide a greater statistical weight to the survey.
- None of the scenes for rating are repeated.
- At the end of the survey, or if you leave before the end, you will be able to provide comments.

Hints

- Use the entire rating scale, don't just sit in the middle around 5.
- Judge each scene on its merits.
- Trust your initial instinct - don't try and analyse your response.
- Try to ensure you have no distractions (phone, callers etc) before you start the survey.
- If you feel tired or get interrupted during the survey, take a break, the survey will wait until you return (for a maximum of 30 minutes).

Contact

The project coordinator, [Damian Moroney](#), is available on (61 8) 8124 4896 if you have any questions about the project.

Page 2

Coastal Viewshed Survey

Before the survey starts please fill in the following form (please answer all questions)

	Please indicate your age	<input type="text"/>		
Gender	<input type="checkbox"/> Male <input type="checkbox"/> Female			
Birthplace	<input type="checkbox"/> Born in Australia <input type="checkbox"/> Not born in Australia			
Postcode	<input type="text"/> Postcode (if in Australia)			
Country	Australia	<input type="text"/>		
Education	Please indicate your highest level attained	<input type="text"/>		
Please indicate how familiar you are with different parts of the South Australian coast	Region	Very Familiar	Slightly	Not familiar
	Adelaide	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Fleurieu Peninsula	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	South East	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Yorke Peninsula	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Eastern Eyre Peninsula	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Western Eyre Peninsula	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Upper Spencer Gulf	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	West Coast and Nullarbor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Kangaroo Island	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Broadband (I have a fast Internet connection)

Internet Connection Speed

Dial-up (I have a slow Internet connection)

This will be used to reduce your download requirements



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Department for Environment
and Heritage

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Page 3

Coastal Viewshed Survey

You are about to start the survey

How do I rate each landscape?

- You will be shown a photograph of a landscape. Please rate the landscape's scenic attractiveness using the ratings scale on the top of the page.
- Rate the scenic attractiveness of each scene on a rating scale of 1 to 10 (1 being very low and 10 being very high).
- There are a total of **166** landscapes in this survey.
- There are some scenes of general South Australia to balance the coastal scenes.

Example Landscapes

- The survey will start with a series of **10** example landscapes. This will give you an example of the types of landscapes you will be asked to rate during the survey.
- During the example landscapes phase you can continue to the next landscape by either clicking the photograph or the rating buttons at the top of the page (these ratings are not recorded), otherwise the page will automatically progress to the next example landscape after a few seconds.
- If you get interrupted, the survey will wait until you return (for a maximum of 30 minutes).

[Continue ...](#)



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Example Landscape Page



Example Scene 9

Continue to the next example landscape by clicking the photograph or the rating buttons (above) otherwise this page will automatically progress to the next example landscape.



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Scene for Rating

Rating scale above scene: 1 2 3 4 5 6 7 8 9 10



22

Counter 1 Scene 22



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End of Survey

Coastal Viewshed Survey

Thank you for completing the survey

Please feel free to submit any comments you may have about the survey.

No Comments

[Back to front page...](#)



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Final page

Coastal Viewshed Survey

Thank you for completing the survey

Thank you for adding your comments.

If you want to find out more about the survey and its results please contact:

Dr Andrew Lothian

Scenic Solutions

Tel: 0439 872 226

Email: alothian@aapt.net.au

[Back to front page...](#)



Government of South Australia
Department for Environment
and Heritage

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Want to save our beautiful coast? Play your part



IN THE PICTURE: Courtney Romanowicz fills out her survey yesterday.
Main picture: BRENTON EDWARDS Coast pictures: ANDREW LOTHIAN

By JEMMA CHAPMAN

THE beauty of South Australia's coastline is being put under public scrutiny to determine how it should be protected from development.

The Department for Environment and Heritage will use people's views on the "scenic attractiveness" of the coast in creating a policy to protect it from housing and land divisions to windfarms and aquaculture.

People are being urged to take part in an Internet survey to comment on the looks of the state's diverse coastline - from the rugged cliffs of the Great Australian Bight to the South-East's sandy beaches.

"This is the first time in Australia that community preferences will be used to place a value on a landscape," Environment Minister John Hill said yesterday.

"The scenic quality of South Australia's coast is a significant social, economic and environmental resource so it is important that we protect it.

"The views will help the department in developing policy for protecting our coasts and for assessing developments such as windfarms and aquaculture."

Mr Hill said respondents would be asked to rate, on a scale from 1 to 10, the "scenic attractiveness" of 166 images which include white sandy beaches at Fowlers Bay on

the far West Coast, mangroves at Port Gawler, north of Adelaide, the cliffs of Whalers Way on Eyre Peninsula and the bay of South Port beach, south of Adelaide.

"The community's views will help state and local government in developing policy for protecting our coasts and for assessing new developments," Mr Hill said.

Conservation Council of SA spokeswoman Catherine Way said it was important visual attractiveness was not the only criteria used when determining a site's value.

"It is important to the Conservation Council that a sound policy is developed to assist state and local governments in assessing the biodiversity and environmental value of an area," she said.

Courtney Romanowicz, 21, of Valley View, took part in the survey yesterday. "I think it's a great way of finding out what the public think," she said.

"And what better way to do it than survey the people who know the areas. I think particular beaches should be better protected."

Responses will be anonymous and no qualifications or experience will be required to participate. Respondents must be aged 18 or more.

The survey can be taken until Saturday, April 30.



www.coastalsurvey.net

The Advertiser, Thursday 7 April 2005

From: Authorised Information
Sent: Wednesday, 13 April 2005 4:28 PM
To: DL:SAGEMS Serversall
Subject: COASTAL SURVEY

"This message has been authorised by

Allan Holmes, Chief Executive,

Department for Environment and Heritage"

COASTAL SURVEY

The Department for Environment and Heritage (DEH) has commissioned a study to measure and map the scenic values of our coast. The outcome of this project will assist State and Local government in better planning and management of the coast.

A selection of photographs, which are representative of the diversity of coastal sceneries, have been placed in a survey on the Internet. This will give the opportunity for as many South Australians as possible to rate their scenic values.

The Internet address www.coastalsurvey.net I am seeking your support for this project by completing the survey.

No qualifications or experience are required to participate and the responses will be anonymous. Participants need to be a minimum of 18 years of age.

The project co-ordinator, Damian Moroney (telephone number: 8124-4896 or <mailto:moroney.damian@saugov.sa.gov.au>) is available if you have any questions about the project.

Groups from across SA are being approached to participate in this significant project. It is important that people with an interest in South Australia's coast participate in assessing our coastal scenic resources.

Figure 3.15 Notice publicising Coastal Survey on State Government Intranet

- recognised that many participants spent considerable time viewing and rating the scenes, and it was with reluctance that their contribution was deleted. With the large number of completed surveys they were not required and their inclusion could distort the results.

Examination of the resulting data sheet revealed that some participants had rated all or virtually all scenes as 10. This is likely to comprise strategic bias, where the participant uses the survey to fulfil their own objectives, in this case, to achieve high ratings of all South Australian scenes. While the motive may be applauded, this actually diminishes the credibility of the data. Means of all participants' ratings were derived and those over 9.00 inspected. Mean ratings of 9.50 or

over were deleted along with those where mainly 10s were used. A total of 56 data items were deleted. In addition two participants entered mainly 1's and these were also deleted. The total participants were thus reduced to 2200.

A sample of this size provides a confidence interval of 2.09, in other words, at a 95% confidence level, the responses will be +/- 2.09% of the true value⁹. This is an exceptionally small confidence interval, for a sample of 300 the figure would be +/- 5.7%. Had the data from all 3324 participants been used, the confidence interval would have been 1.7%.

9. www.surveysystem.com/sscalc.htm

Analysis of postcodes indicated that 80.5% of the participants were from the Adelaide Metropolitan Area, 18.2% from elsewhere in South Australia, and 1.3% from elsewhere in Australia. Efforts to maximise participation in the survey from regional areas saw nearly 400 participate which was excellent. The high proportion of the survey from Adelaide reflected the high proportion of the State's population, 73%, who live in Adelaide.

3.10 IDENTIFICATION AND SCORING OF FACTORS

Analysis of the survey photographs identified a range of factors which could help to explain their scenic quality.

In the study of South Australian landscape quality, the following four factors were identified (Lothian, 2000):

- Significance of the area of the water
- Length of the water edge: short to long
- Movement of water: still to considerable movement
- Rating of the psychological impact of the scene: serene/placid to high level of arousing/awe

Each of these was scored on 5 grade scale. An additional factor, colour, was dropped as the sea was blue in all scenes. The significance of the area of water was based on the extent of the sea as a proportion of the non-sky portion of the scene. The length of water edge was based on the length of the interface of land and water in bays and beaches, cliffs and rocks - scenes with a heavily indented coast have longer edges than a uniform curving beach. The presence of waves and white foam were considered in scoring water movement.

The rating of psychological attributes was based on the entire scene - the land component and thus covered the perceived relationship between sea and land. High cliffs with rough sea and breakers for example may invoke a sense of high arousal and awe compared with a gently sloping beach and calm bay without any waves which may be rated as serene or placid. The selection of this scale was based on Gobster & Chenoweth, 1989; Herzog & Bosley, 1992; and Schroeder, 1991.

Analysis of the ratings of scenes against these factors indicated that water/land edge and the

area of water were the most important, followed by the scoring of awe-peaceful, and lastly water movement.

In addition to these factors, however, the study found that over the State as a whole, the factors of diversity and naturalness to provide the strongest causes of high scenic quality. Diversity may be defined simply as the busyness of the scene as generated by the combination of changes in land form, land cover, land use, the presence of water, textures, colour, forms and so on. Scoring of diversity is based on the whole scene, not one of its elements such as land form. It is thus an holistic quality which is the sum of all its elements. Diversity was based on a judgement of the busyness of the scene. A scene lacking diversity was monotonous; a highly diverse scene was full of interest. Scoring was again on a five grade scale. Coastal diversity varied across the scale with some beach scenes scoring low and scenes with cliffs, rock debris, wave action and other features scoring high.

Naturalness is how natural the scene appears to be, not necessarily the same as its ecological naturalness. An agricultural scene for example may be heavily grazed, lack understorey vegetation and hence be ecologically depauperate but the presence of scattered large trees may create a pleasing scene aesthetically and appear natural. Several studies have examined the influence of naturalness (or naturalism) on scenic quality including Anderson et al (1976), Kane (1981), Kaplan et al, 1989, Lamb and Purcell (1990) and Palmer and Zube (1976).

Scoring of naturalness required close inspection of scenes. The presence of tracts, fences, structures and even the footprints of humans or of stock diminish the appearance of naturalness. Coastal scenes tended to score high in naturalness so there is unlikely to be wide range of values – most will score 4 or 5.

Based on earlier work, the following factors were selected:

- Water land edge – or indentation
- Area of water
- Awe-tranquil scale
- Diversity
- Naturalness

Naturalness was included as although most scenes would score high, where development was present, it would be lower and this might

correlate with lower scenic value. Movement of water was omitted as it had less influence on scenic quality than the other factors.

In addition to these factors, the scenes were inspected to identify any additional factors which could be assessed. The following possible factors were identified:

- Quality of beach
- Height of land forms on a flat – high scale
- Familiarity with the location of the scene
- Pleasing forms – e.g. the curve of a beach

The quality of the beach is probably a function of its width, the characteristics of adjacent sea (e.g. smooth, surf), the presence of rocks, dunes and other features, and even of its accessibility (e.g. Adelaide's beaches). It would thus be an holistic gauge, based on a range of factors. Alternatively the quality may be judged by what the individual finds important at a beach – surfers will look for the quality of the surf, families with young children would look for the safety of the water, others might like the interest of rocks for beach combing. Clearly much additional information would be needed to understand why individuals judged its quality. However as an overall factor it would be worth exploring as the beach is such an important component of the coast.

Height will indicate the flatness or steepness of the land forms in the scene. In some locations such as cliffs, this factor may duplicate, or at least correspond with the awe-tranquil scale. However this would be a relatively simple factor to assess in the field and if it was found to correlate closely with scenic quality its inclusion could be useful.

Familiarity is known to influence ratings generally positively. Familiarity with the various coastal regions of South Australia will be assessed as part of the information gathered on participant characteristics. Therefore although data on the familiarity with a particular location may be interesting, it is repetitive. Also it is likely that while a few scenes will gain high levels of familiarity, e.g. the Bluff at Encounter Bay, and the Adelaide beaches, many other locations will be unfamiliar to most participants. The

information gathered will therefore be of doubtful value.

The main pleasing form is likely to be the curve of the beach, very common particularly in the headlands and bays landscape unit and the dunes and beaches landscape unit. It may occur in respect of cliffs, for example, the repetitive occurrence of high headlands as occurs on Whalers Way on Eyre Peninsula. However assessing the attractiveness of the form in the scene is likely to be influenced largely by the instructions. If an example of a curved beach is included then it is probable that all curved beaches will be scored accordingly. This factor would probably be the opposite of the degree of indentation of the coast which introduces irregularity and lack of pleasing forms. A long curved beach may correlate closely with the sense of tranquility. Overall it was considered that this factor would not be useful to include as it is likely to result in obviously curved beaches scoring high and other scenes scoring low – not a useful differentiation.

The final list of factors to be scored comprised:

- Water land edge – or indentation
- Area of water
- Awe-tranquil scale
- Diversity
- Naturalness
- Quality of beach
- Flat – height of landform

Sessions were held at the Department for Environment and Heritage and also with members of the Marine Life Society and volunteers at the Marine Discovery Centre to score the various factors. Participants were provided with scoring sheets and briefed about the factor they were asked to score. An opportunity was provided for any questions and clarification. The coastal scenes, without the South Australian scenes, were shown including the introductory scenes, at 6 or 7 second intervals. A Digital projector and Powerpoint™ presentation were used to project the scenes. The resulting scores were subsequently entered into the data set.

4. ANALYSIS OF DATA

4.1 PARTICIPANT NUMBER AND CHARACTERISTICS

The final data set comprised 2200 participants. The means of each participant's ratings plotted on a histogram indicate a close to normal distribution (Figure 4.1). The overall mean was 6.51 and standard deviation (SD) of 1.22. The QQ plot indicates close to a normal distribution (Figure 4.2).

Figure 4.3 shows the distribution of ratings arranged in ascending order. Overall the distribution has an 'S' curve, curving down at the lower ratings and arching upwards at the top ratings. This suggests a tendency to place a slightly more extreme value on scenes of very low or very high rating. This phenomenon is common in surveys of this kind (Prof. Terry Daniel, Dept of Psychology, Univ. of Arizona, pers. comm.).

South Australian Scenes

The means for the South Australian scenes were compared with means obtained during my thesis when the same scenes were used (Lothian, 2000).

In the current survey, the ratings were generally slightly lower (mean 5.57 compared with 5.82 for the thesis). In 24 of the 28 scenes, the means were lower.

The earlier survey had a smaller sample, 311 with about a third being university students whereas the current survey was much larger and drawn from a wider range. Based on a paired t test, the difference was statistically significant: $t = -4.68$, $df = 1, 27$, $p = 0.00$. However the differences were mostly less than 10% (Figure 4.4).

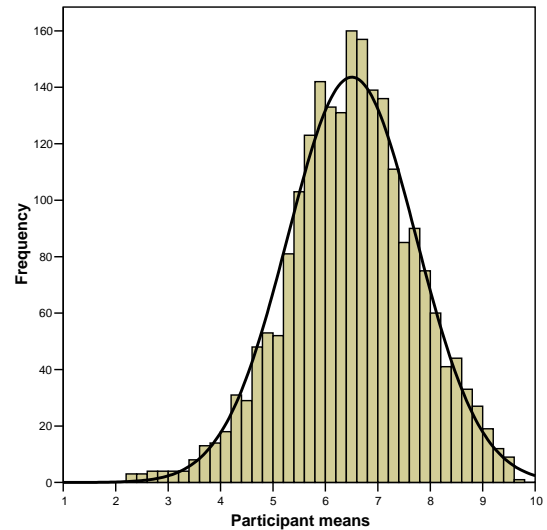


Figure 4.1 Histogram of Participant Means

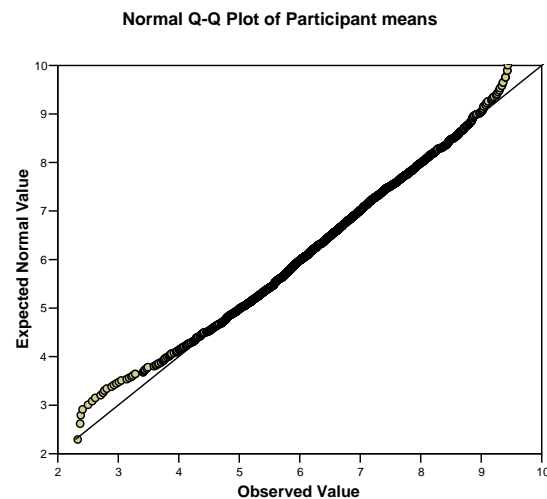


Figure 4.2 QQ Plot of Participant Means

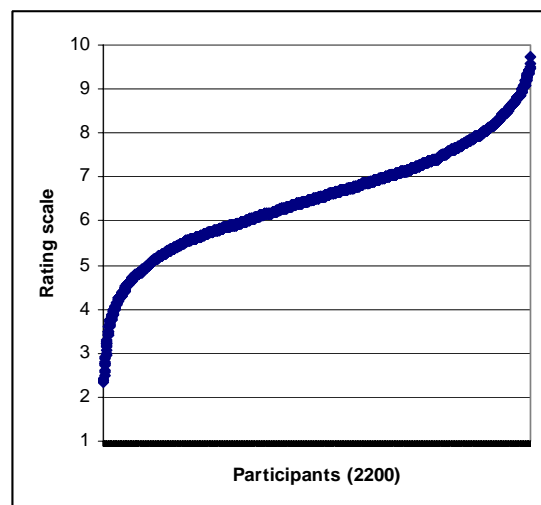


Figure 4.3 Ratings Arranged in Ascending Order

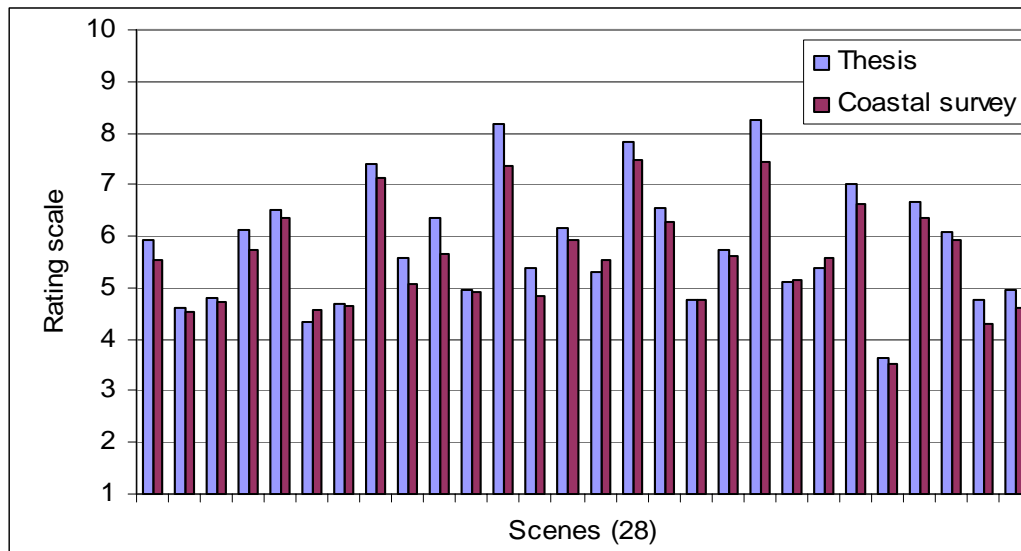


Figure 4.4 Comparison of Means of South Australian Scenes

4.2 COMPARISON OF PARTICIPANTS WITH SOUTH AUSTRALIAN COMMUNITY

Table 4.1 Age Distribution of Participants

Age cohorts	18 – 24	25 – 44	45 – 64	65+
South Australian %	16.4%	35.9%	29.7%	18.0%
Survey Frequency	148	934	1068	39
Survey %	6.7%	42.5%	48.5%	1.8%
Internet access 2002	84.0%	73.5%	50.0%	13.0%

Note: plus 11 (0.5%) not stated

Table 4.3 Educational Attainment of Participants

	No qualification	Diploma/Certificate	Degree	Higher degree
South Australian community	68.1%	21.2%	8.2%	2.5%
Survey frequency	314	675	714	489
Survey %	14.3%	30.7%	32.5%	22.2%
Internet users 2002 (ABS 2004)	48%	56%		88%

Note: Internet users were whole of Australia.

Note: plus 8 not stated

Age

The age distribution of participants indicated a greater proportion of middle age and substantially fewer older and younger participants (Table 4.1). This may be a consequence of using the Internet for the survey as older people have lower rates of participation (ABS, 2004). The differences between the participants and the South Australian community were significant: $\chi^2 = 739.6$, $df = 3$, $p = 0.000$.

Gender

The survey sample was within 1% of the population gender balance. The differences in gender between the participants and the South Australian community were not

significant: $\chi^2 = 1.05$, $df = 1$, $p = 0.29$ (Table 4.2).

Table 4.2 Gender of Participants

	Female	Male
South Australian	50.7%	49.2%
Survey frequency	1141	1058
Survey %	51.9%	48.1%

Plus 1 not stated

Birthplace

A slightly higher proportion (6%) of survey participants were born in Australia. The differences in birthplace between the participants and the South Australian

community were significant: $\chi^2 = 12.96$, $df = 1$, $p = 0.000$ (Table 4.4).

Table 4.4 Birthplace of Participants

	Born in Australia	Not born in Australia
South Australian 2001 Census	75.4%	20.3%
Survey frequency	1795	397
Survey	81.6%	18.0%

Note: ABS Census figure totals 95.7%, presumably because of participant failure to identify birthplace.

Note: plus 8 not stated

Education

The differences in education between the participants and the South Australian community were significant: $\chi^2 = 5974$, $df = 3$, $p = 0.000$ (Table 4.3).

The following tables provide cross tabulations between participant characteristics.

Table 4.5 Participants' Age vs Gender

	Female	Male
18 – 24	99	49
25 – 44	567	367
45 – 64	454	614
65+	17	22
No stated	4	6
Total	1141	1058

Plus one of unknown age and gender

Table 4.6 Participants' Education vs Gender

	Female	Male
No Qualification	170	144
Diploma or Certificate	309	366
Degree	388	326
Higher Degree	270	219
No stated	4	3
	1141	1058

Plus one of unknown age and gender

Table 4.7 Participants' Birthplace vs Gender

	Female	Male
Born in Australia	931	864
Not born in Australia	208	189
Not stated	2	5
	1141	1058

Plus one of unknown age and gender

Although the participants in the survey sample were better educated and more middle aged than the South Australian population, these differences do not affect the results. Figure 4.5a indicates the similarity of average ratings across the different participant characteristics. Figure 4.5b exaggerates the scale to highlight any differences. The range of differences was just over ± 0.1 . Thus the similarities were far greater than the differences. The differences in participant characteristics had no appreciable influence on the results.

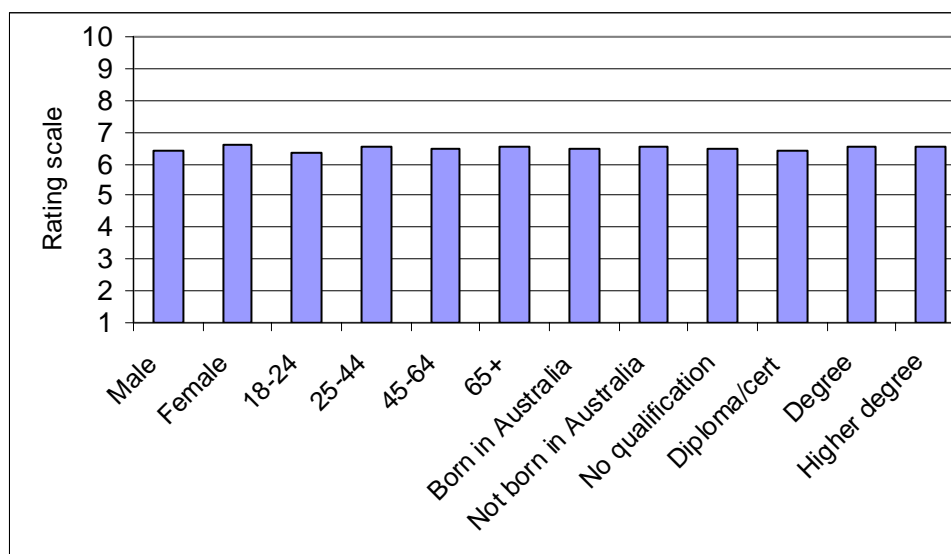


Figure 4.5a Mean Average Ratings by Participant Characteristics

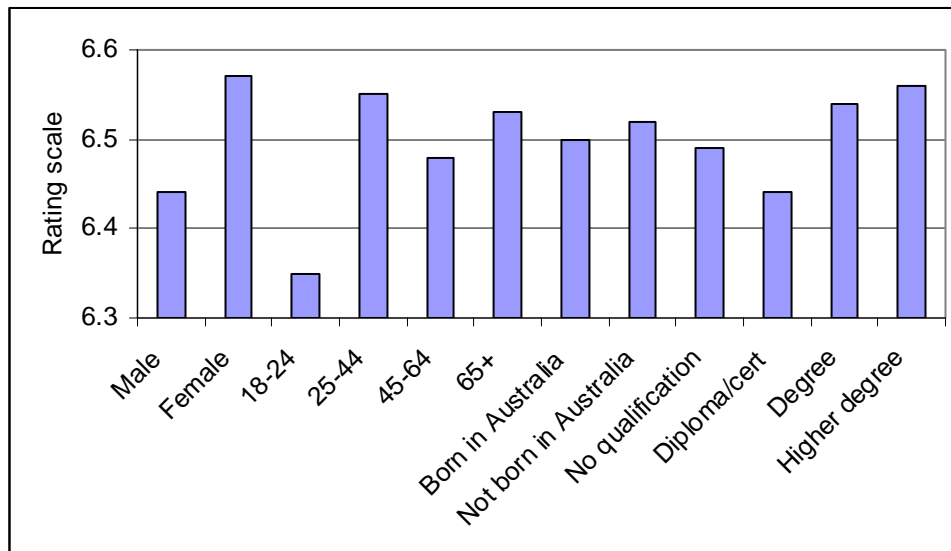


Figure 4.5b Mean Average Ratings by Participant Characteristics – Exaggerated Scale

4.3 ORIGINS OF PARTICIPANTS

Participants were asked their postcodes of residence. Of the 2200 participants, 96.6% were Australians and of the remaining 75, half were from the UK and the remaining 37 from 24 countries. Of the Australians, 95% were from South Australia.

4.4 PARTICIPANTS' FAMILIARITY WITH REGIONS

The familiarity of participants with the various regions was assessed by asking whether they were very familiar, familiar or not familiar with each of the nine regions specified. The regions were not defined further, e.g. by description or a map so it relied on the participant to recognise the region to which the reference was made. There were no adverse comments about the regional definitions so it would appear that participants understood the regional descriptions.

Overall, roughly a third each of participants were very familiar, familiar, or not familiar with the South Australian coast as a whole (Table 4.8)

Table 4.8 Familiarity with the South Australian Coast

Degree of Familiarity	%
Very familiar	29.9
Familiar	36.2
Not familiar	33.8

The regional figures indicated, as expected, that distance from Adelaide appeared to be the major determinant of familiarity (Table 4.9, Figure 4.6). No participant indicated that they were not familiar with the Adelaide coast and the largest proportion was very familiar with this area. Both Adelaide and Fleurieu Peninsula were the only regions in which majorities indicated they were very familiar. The next most familiar region was Yorke Peninsula followed by the South East and Kangaroo Island. In the remaining regions, the numbers who were unfamiliar were greater than the other categories. Although Kangaroo Island is relatively close to Adelaide, the need to take sea or air transport appeared to reduce its accessibility to below that of the South East.

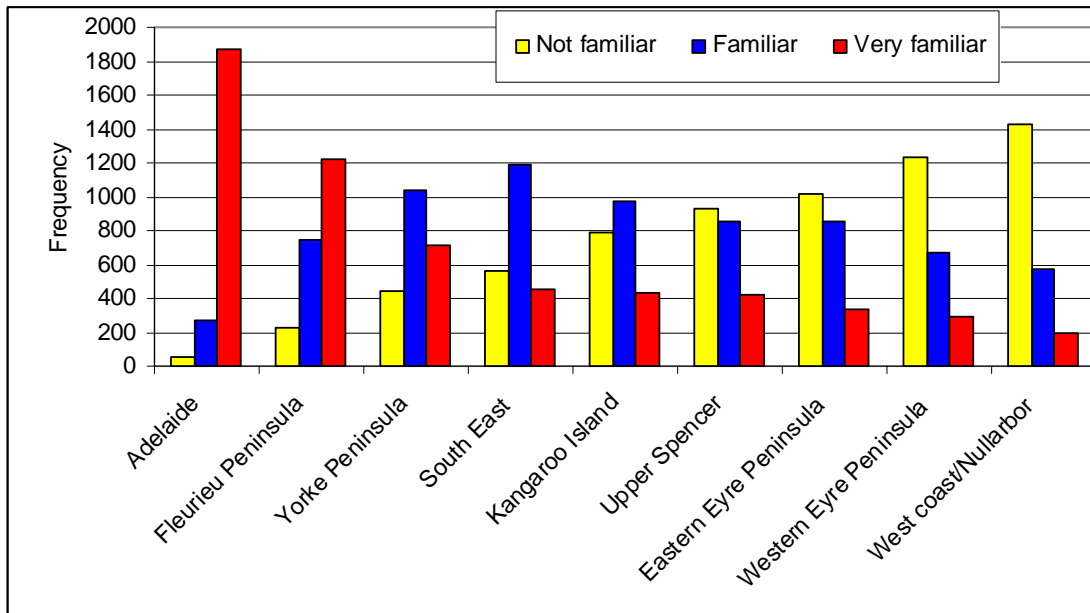


Figure 4.6 Familiarity of Participants with Regions

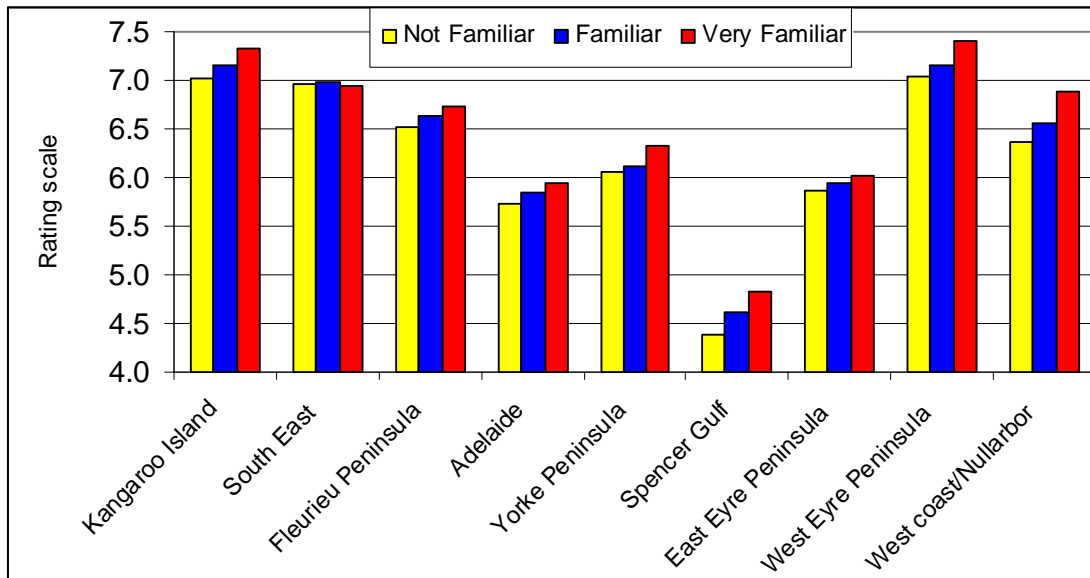


Figure 4.7 Influence of Familiarity on Regional Ratings

Table 4.9 Familiarity with Regional Coasts

	Not familiar	Familiar	Very familiar
Kangaroo Island	794	975	430
South East	558	1193	449
Fleurieu	232	748	1220
Adelaide	58	266	1868
Yorke Peninsula	446	1033	713
Upper Spencer	930	850	420
Eastern Eyre Peninsula	1013	857	330
Western Eyre Peninsula	1234	668	293
West coast/Nullarbor	1426	575	198

Note: There were also a few not stated in 5 regions

The effect of familiarity on the ratings of a region was examined by reviewing the mean ratings for each region by the familiarity of the participants (Table 4.10, Figure 4.6). In all but one region (South East), familiarity increased ratings. Being *familiar* with the region increased ratings by, on average, nearly 2% and being *very familiar* increased ratings by 4.4%. The largest increases were in Spencer Gulf (10%) and the west coast/Nullarbor (8%). However the number of participants who were very familiar with these regions was a minority (19% and 9% respectively).

Table 4.10 Influence of Familiarity on Regional Mean Ratings

	Not Familiar	Familiar	Very Familiar
Kangaroo Island	7.02	7.16	7.32
South East	6.96	6.99	6.94
Fleurieu	6.51	6.64	6.74
Adelaide	5.74	5.85	5.95
Yorke Peninsula	6.05	6.12	6.32
Upper Spencer	4.39	4.62	4.83
Eastern Eyre Peninsula	5.87	5.94	6.01
Western Eyre Peninsula	7.03	7.15	7.4
West coast/Nullarbor	6.36	6.55	6.88
Mean	6.21	6.34	6.49
% change	100	101.95	104.40

Although these figures indicate that ratings increase by the degree of familiarity with the region, the question remains whether this matters. Clearly when people observe scenic areas, their response derives in part from their past association and familiarity with the area. While the ratings could be adjusted to reflect the increase which results from familiarity, this would actually not be a true reflection of the community's appraisal of the scenes.

The significance of familiarity is a function of both the proportion who were familiar or very familiar with the region and of the change in rating which resulted. If 20% were familiar and 10% very familiar with the region this would obviously have a greater impact than if these figures were 10% and 5% respectively. Similarly a change of 10% in ratings is obviously of greater impact than 2 – 5%. Thus the overall impact can be expressed thus:

$$\text{Impact} = (a1, b1) + 2(a2, b2)$$

Where: a1 and a2 are the percentage familiar or very familiar
b1 and b2 are the percentage change in rating for the familiar and very familiar

The expression assumes that the very familiar results have twice the impact of familiar results. Applying this algorithm provided a gauge of the relative impact of familiarity (Table 4.11). The high figure for Adelaide reflected the fact that 85% of the participants were very familiar with this area. The result for the South East was somewhat anomalous as the ratings of those who were very familiar with this region were lower than those who were unfamiliar or just familiar.

Table 4.11 Relative impact of familiarity

	Relative impact
Kangaroo Island	2.56
South East	0.12
Fleurieu	4.60
Adelaide	6.47
Yorke Peninsula	3.45
Upper Spencer	5.85
Eastern Eyre Peninsula	1.18
Western Eyre Peninsula	1.92
West coast/Nullarbor	2.25

Table 4.11 suggests that the impact of familiarity was greatest in Adelaide, the Upper Spencer gulf and Fleurieu Peninsula and lowest for Eyre Peninsula.

4.5 TIME TO COMPLETE THE SURVEY

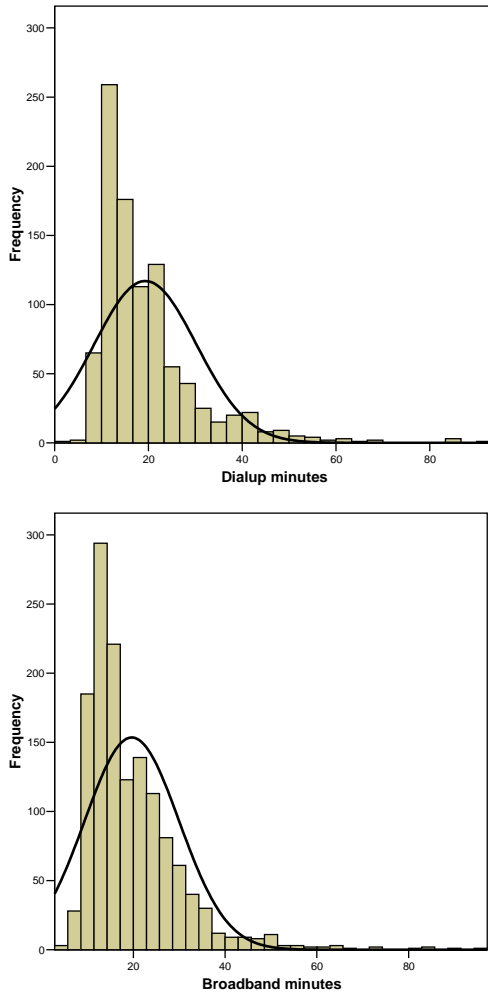
The two methods of carrying out the survey have differing speeds in terms of downloading files. However the survey had been designed to avoid delays due to computer speed. Dial up was used by 41% of participants and broadband by the remaining 59%.

The average time for the dial-up users was 19.71 minutes (SD 13.97) and for broadband was almost identical: 19.84 minutes (SD 11.18) – actually longer than the dial up (Figure 4.8). The differences in the time taken by broadband and dial-up were not significant ($t = 0.237$, $df 2353$, $p = 0.41$).

4.6 COMMENTS BY PARTICIPANTS

Of the 2200 participants who completed the survey, a total of 679 participants or nearly 30% offered comments. Only those who completed the survey could offer comments.

A file containing these is contained in the appended CD.



Note: Omitted 4 long duration participants: Dial up 164 & 248 minutes & Broadband 113 & 153 minutes

Figure 4.8 Duration of Surveys – Dial up and Broadband

4.7 OVERALL RATINGS BY PARTICIPANTS

Thumbnail photographs of each of the 138 coastal scenes together with their ratings are included in Appendix 10.3. These do not include the South Australian scenes.

The mean ratings of all 138 coastal scenes are shown by Figure 4.9 which indicates that they ranged from 3.38 to 8.65 with the majority in the 6 – 7 range. This corresponds with their overall mean of 6.51 and standard deviation of 1.88.

Figure 4.10 shows the mean ratings and standard deviations for all scenes. As the ratings fell, the standard deviation, a measure of the spread of ratings, increased. This suggests that for scenes rated high quality, there is a high degree of uniformity of opinion but as the perceived quality decreases, opinion widens, some participants rating a scene highly and others rating it much lower. In other words, everyone knows an excellent scene but opinion varies more widely as scenic quality falls.

Figure 4.11 indicates the normal distribution of ratings of coastal scenes, and this is reinforced by the QQ Plot (Figure 4.12) which indicates a close to normal distribution.

Of the 138 scenes, three scored 3, ten scored 4, twenty six scored 5, forty seven scored both 6, forty five scored 7, and seven scored 8 (Figure 4.13).

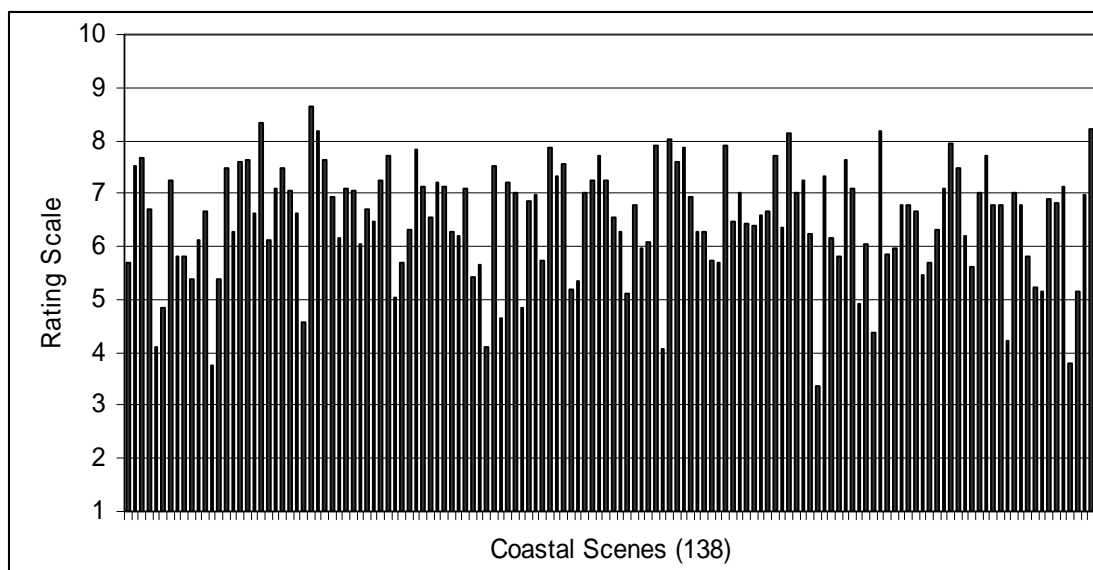


Figure 4.9 Mean Ratings of Coastal Scenes

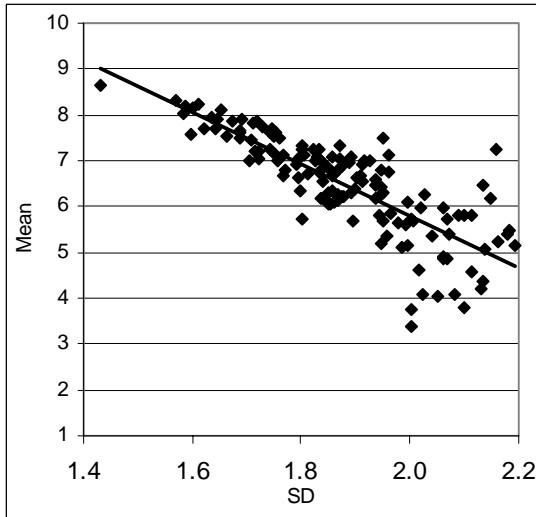


Figure 4.10 Ratings vs SD of Coastal Scenes

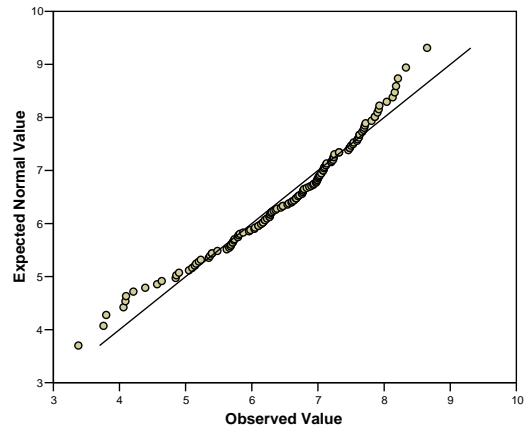


Figure 4.12 QQ Plot of Coast Means

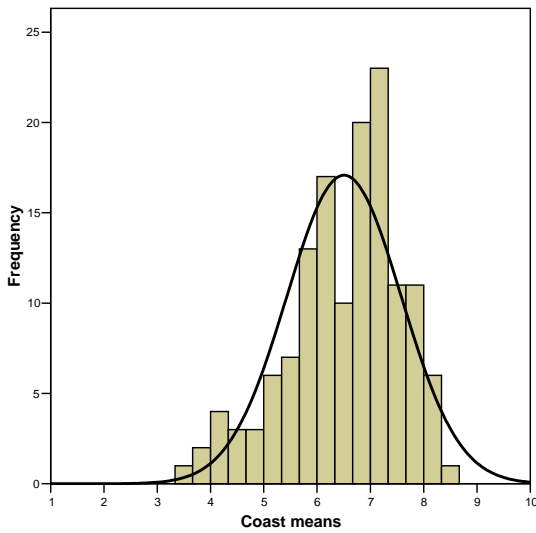


Figure 4.11 Histogram of Coastal Means

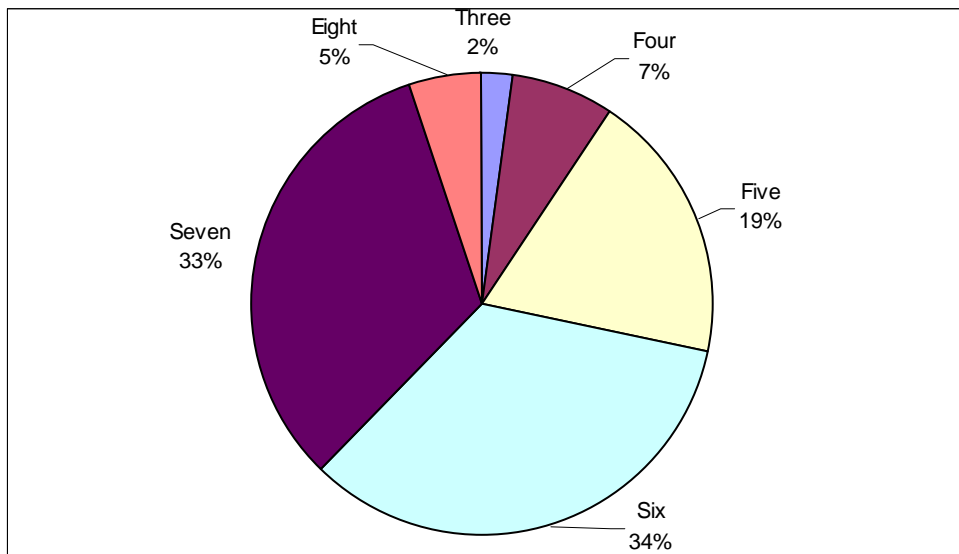


Figure 4.13 Summary of Mean Ratings

The highest and lowest ranking scenes are illustrated here. The high rating of the Admirals Arch at Cape du Couedic may derive in part from its familiarity as it is often used in publicity for South Australia and Kangaroo Island.



Scene 32 KI116 Cape du Coedic 8.65



Scene 122 SPG 117 Pt Bonython samphires 3.38

The following illustrates typical scenes in each of these ratings.

Rating 3



Scene 163 SPG71 Mt Gullett Beach Score 3.80

Rating 4



Scene 70 SPG20 Mundorra Arm, Pt Broughton Score 4.86

Rating 5



Scene 157 EP449 Pt Gibbon, eastern Eyre Peninsula Score 5.79

Rating 6



Scene 136 YP111 Formby Bay, Yorke Peninsula Score 6.67

Rating 7



Scene 44 EP179 Point Westall, Eyre Peninsula Score 7.71

Rating 8

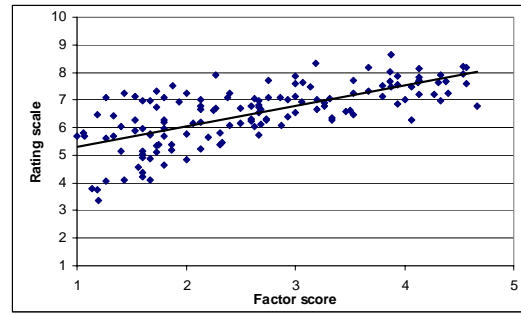


Scene 131 EP370 Whalers Way Score 8.16

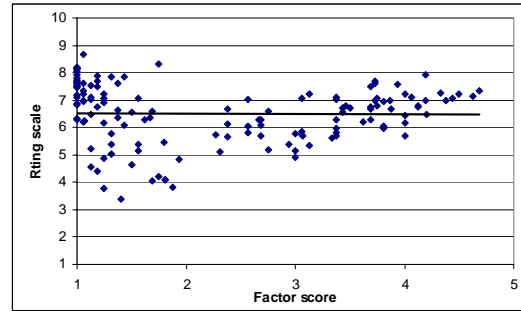
4.8 SCORING OF FACTORS

As described earlier (Section 3.10), seven factors were identified and scored. In addition to these, seaweed, wave action, and steepness of the land were also scored, these by six participants. Thus a total of ten factors were scored.

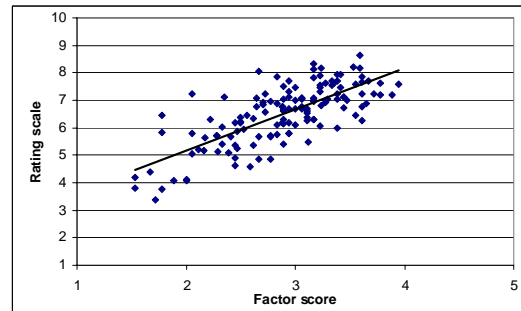
Figure 4.15 plots the factor scores as derived against the ratings of scenic quality. The graphs indicate the relationship between the ratings and these factors. The graphs include the trend lines derived by linear regression, the equations of which are included in Table 4.12).



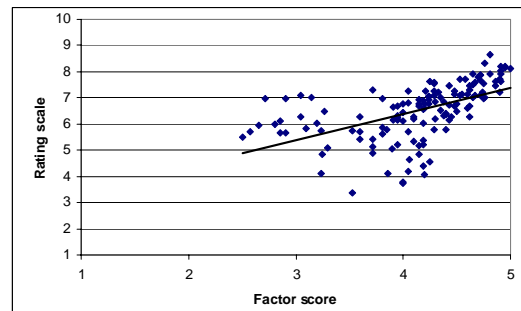
Indentation



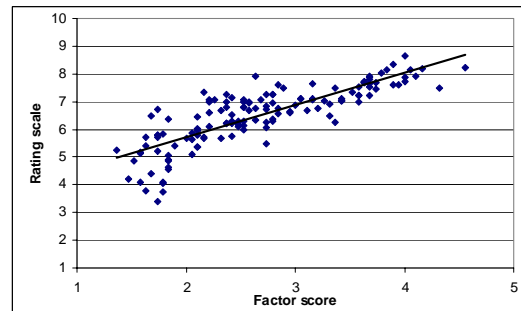
Quality of beach



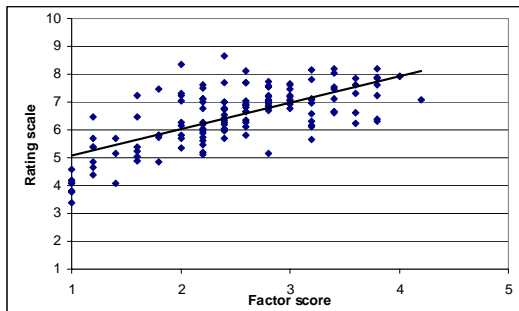
Diversity



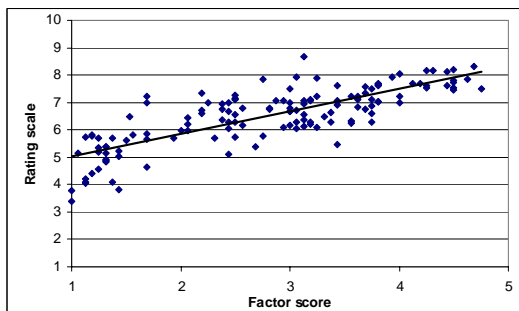
Naturalness



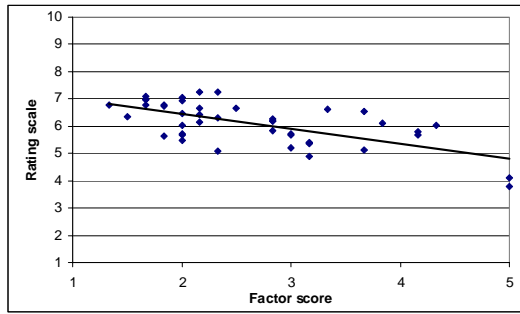
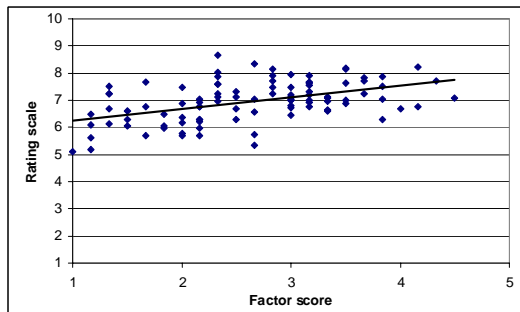
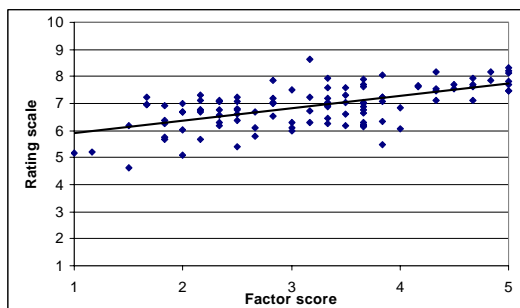
Tranquillity – Awe



Area of water



Height

**Seaweed*****Waves*****Steepness***

Note: * scenes which scored 1 (i.e factor non-existent) have been omitted as they form a vertical column

Figure 4.15 Factor Scores vs Scenic Quality Ratings for Factors

Table 4.12 Factor Equations

Factor	Trend line Equation	R ²
Area	$y = 0.9505x + 4.1181$	0.4749
Height	$y = 0.828x + 4.184$	0.6452
Indentation	$y = 0.7363x + 4.5703$	0.4807
Quality	$y = -0.0174x + 6.5459$	0.0004
Diversity	$y = 1.4982x + 2.1708$	0.549
Naturalness	$y = 0.9985x + 2.3758$	0.2941
Tranquillity	$y = 1.1685x + 3.3632$	0.6816
Seaweed*	$y = -0.5513x + 7.5501$	0.4288
Waves*	$y = 0.4259x + 5.8278$	0.2238
Steepness*	$y = 0.4605x + 5.4301$	0.367

Note: R² is correlation coefficient

For most factors the scenic quality ratings increased with the factor. However for two factors the ratings did not increase and even decreased. The quality of beach factor resulted in a horizontal trend line while that for

seaweed decreased. Thus increasing seaweed depressed scenic quality ratings.

Table 4.12 contains the equations derived from linear regression for each of these graphs.

The equations are in the form: $y = ax + b$ where:

y is the scenic quality rating for an x scoring of the factor

a is the slope of the line

x is the factor score

b is the trend line's point of intersection on the y axis at zero factor score

R², the correlation coefficient indicates how close the data lies along the trend line; if all the data were along the trend line it would be a perfect correlation of 1.0. A scattered distribution (e.g. quality of beach) has a low R².

The steepness of the slope (i.e. a) indicates the strength of the relationship, a high a indicates that as the factor score increased, the scenic quality rating also increased strongly. The steepest slope was for diversity (1.5) followed by tranquillity-awe (1.1), naturalness (1.0), the area of water (0.95), height of landforms (0.8) and the indentation of the coast (0.7).

Factors with low or negative influence were steepness of the landform (0.46), wave action (0.43), quality of the beach (-0.02) and the presence of seaweed (-0.55). The figure for the quality of beach, -0.02, is close to zero and this factor could be regarded as having neutral influence.

The insights provided by this comparison of ratings with factors will be valuable in the development of predictive models (Section 4.11).

4.9 ANALYSIS OF RATINGS BY REGION AND LANDSCAPE UNIT

Analysed on a regional basis (Table 4.13, Figure 4.16), the region with the highest average rating was Kangaroo Island (7.15) followed by western Eyre Peninsula and the Nullarbor (7.02). The lowest rated area was the upper Spencer Gulf (4.57) and upper St Vincents Gulf (4.64), both regions having extensive samphire-mangrove formations.

The highest rating landscape units were high cliffs, followed by headlands & bays, dunes & beaches, low cliffs, with samphires & mangroves a distant last (Table 4.14, Figure 4.17).

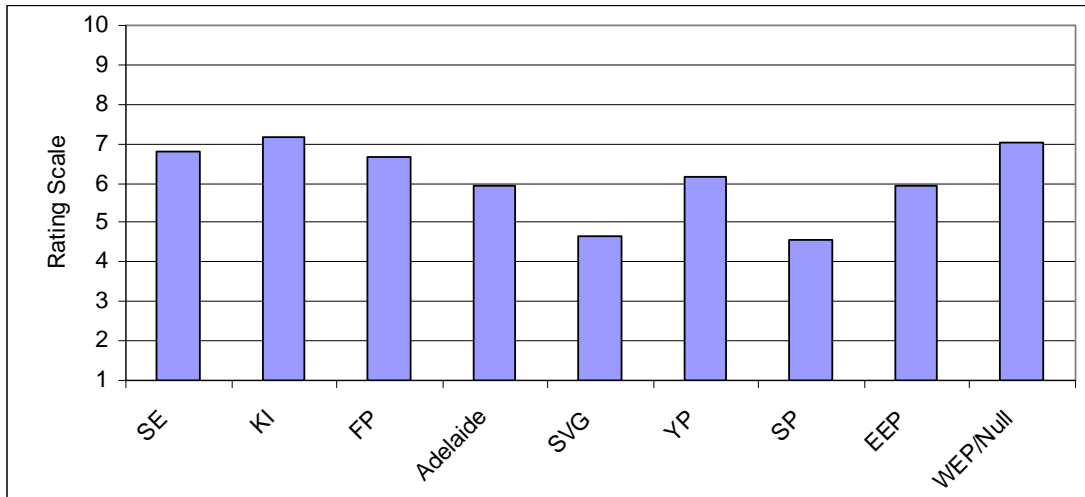


Figure 4.16 Regional Means

Table 4.13 Regional Means and SDs

Region	Mean	SD
South East	6.79	0.69
Kangaroo Island	7.15	0.89
Fleurieu Peninsula	6.68	0.65
Adelaide	5.93	0.32
St Vincents Gulf	4.64	0.79
Yorke Peninsula	6.17	0.65
Upper Spencer Gulf	4.57	0.71
Eastern Eyre Pen	5.92	0.94
Western Eyre Pen / Nullarbor	7.02	0.92

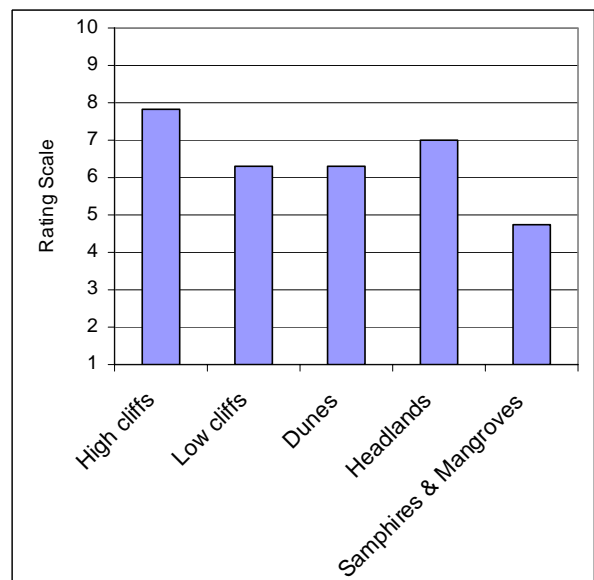


Figure 4.17 Landscape Unit Means

Table 4.14 Landscape Unit Statistics

Landscape Unit	Mean	SD
High cliffs	7.84	0.28
Low cliffs	6.32	0.47
Headlands & bays	7.02	0.67
Dunes & beaches	6.30	0.82
Samphires & mangroves	4.75	0.67

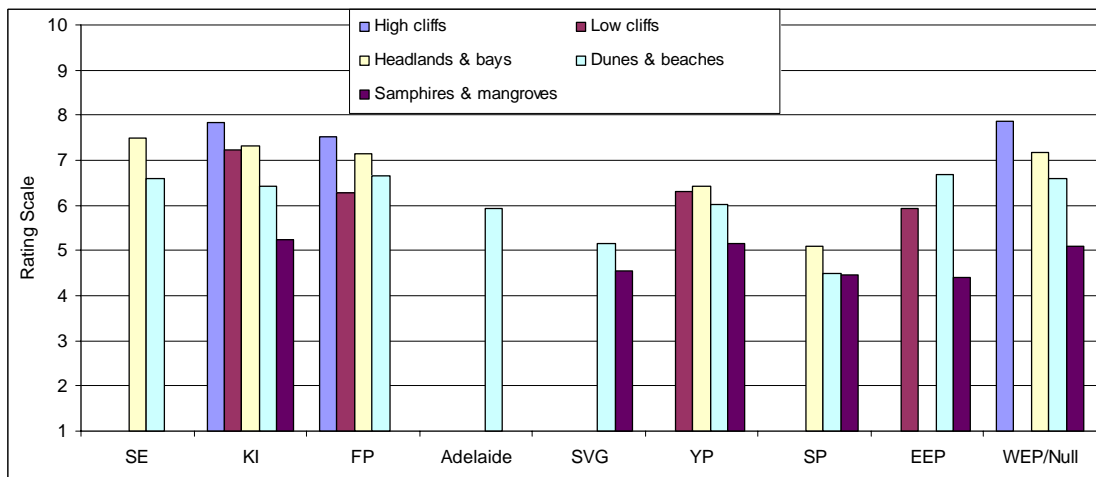


Figure 4.18 Landscape Unit Statistics by Region

Table 4.15 Landscape Unit Statistics by Region

	SE	KI	FP	Adelaide	SVG	YP	SP	EEP	WEP/Null
High cliffs		7.84	7.51						7.87
Low cliffs		7.24	6.29			6.30		5.92	
Headlands & bays	7.49	7.31	7.13			6.42	5.10		7.17
Dunes & beaches	6.60	6.41	6.70	5.93	5.14	6.01	4.50	6.69	6.61
Samphires & Mangroves		5.23			4.55	5.16	4.47	4.39	5.17

+

Breaking these figures down further, Figure 4.16 and Table 4.13 provide the means and SDs for each landscape unit by region. These figures provide insights into the likely ratings for mapping purposes. They indicate:

- High cliffs are located in three regions and their ratings were consistent across these regions, between 7.5 and 7.9;
- Low cliffs are located in four regions and their ratings ranged more widely, from around 5.9 to 7.2. In two regions they were nearly equal at around 6.3;
- Headlands and bays are located in five regions and their ratings ranged from 5.1 to 7.5. The low 5.1 was for a single scene of the flat headlands at Point Lowly in the upper Spencer Gulf and although common in that region, is atypical in other regions. In the remaining five regions, ratings of headlands and bays ranged less widely from 6.4 to 7.5;
- Dunes and beaches are located in all nine regions and their ratings ranged from 4.5 to 6.6. The Spencer Gulf region had a low score from two scenes, one of which included thick banks of seaweed across the beach which depressed the rating to 3.8. Another low score, 5.14 in St Vincents Gulf, was also for a beach with seaweed. In the remaining seven regions, the ratings ranged less widely from 5.94 to 6.7;
- Samphires and mangroves are located in six regions and their ratings ranged from around 4.4 to 5.2.

These brief analyses suggest that content analysis of the scenes may be important in differentiating the ratings.

4.10 CONTENT ANALYSIS OF RATINGS BY LANDSCAPE UNIT

The scenes arranged by their landscape unit in descending order of ratings are included on

the CD. This facilitated close inspection of the scenes to identify factors which might influence the ratings. A set of factors has been scored independently and these will be examined subsequently. The following summarises each landscape unit and searches for possible influences on the ratings derived. Influences may be detected by being present say in the top rated scenes but not in lower rated scenes, or vice versa. Where a factor was present across the range of scenes then its influence was general rather than specific. The following observations were made on each landscape unit.

High Cliffs

There were 15 scenes of high cliffs.

- In all scenes the photograph was from the top looking across or to the cliffs. There were no scenes looking up the cliffs.
- In some of the lower rated scenes, the cliffs were some distance away whereas the higher rated scenes tend to be slightly closer distance.
- In ten of the scenes, the cliffs were on the left facing the sea on the right, in the other five they were reversed. The topmost scene was on the left, the second on the right, and both sides occurred evenly throughout the set of scenes.
- Wave action was minor in all but a few scenes and was spread across the ratings.
- The cliffs in most scenes were vertical or nearly so.
- Vegetation on cliffs or clifftops was scant or non-existent.
- In scenes 24 and 131 the water colour was a distinctive aqua hue but a similar hue was present also in middle and lower rated scenes.
- A small inaccessible beach is present in the top rated scene and in one other scene, but there are no beaches in other scenes.

- Ratings of the scenes are confined within a fairly narrow band – 7.48 to 8.33, and several had identical or close ratings.

In summary, none of these factors appeared to have a noticeable influence the ratings.

Low Cliffs

There were 14 scenes of low cliffs.

- In all but one scene, the photograph was from the top looking across or to the cliffs. In one scene (39, Pt Gibbon) the view was from the foot of the cliff. This was the third to bottom rated scene.
- All scenes included cliffs in the near distance, in many cases stretching back to the far distance. This occurred throughout the set of scenes.
- In six of the scenes, the cliffs were on the left facing the sea on the right; in the other nine they were reversed. The first and second rated scenes were from opposite sides.
- In only two scenes was there any wave action (Scenes 52 and 84), in the remainder the sea was smooth.
- In half the scenes, the cliffs were sheer or nearly so. They were scattered throughout the set of scenes.
- Ten scenes had grass and low bush vegetation and these occurred throughout the set of scenes.
- Ten of the scenes were on Yorke Peninsula and as these had been photographed using a conventional camera and the print subsequently scanned, they tended to be somewhat yellow/orange through the scanning process. However these occurred throughout the set of scenes.
- The final scene (137) was of a cliff and beach with wheat silos at Ardrossan in the distance. This was rated appreciably lower than the others (5.48).
- In six of the scenes, beaches occurred at the base of the cliff. This was present in the topmost rated scene but then not until the fifth rated scene and then occurred throughout the set of scenes.
- There was a close similarity in the scenes, particularly many of those from Yorke Peninsula and their ratings were surprisingly close – seven in the range 6.17 – 6.33.

In summary, none of these factors appeared to have a noticeable influence the ratings.

Headlands and Bays

There were 46 scenes of headlands and bays.

- The top rated scene, Admirals Arch at Cape du Coedic, rated 8.65 and probably gained from the influence of familiarity as it was a scene frequently used in publicity about Kangaroo Island and many participants would have seen it in the media whether or not they had actually visited it. This was also the top rated scene out of the entire survey of 166 scenes.
- Headlands in the latter third of the set of scenes were generally lower and flatter than the higher rated scenes and suggest that the height of the landform may have had a positive influence on ratings.
- The scene of the Bluff at Encounter Bay, a popular holiday destination was among rated only 6.10. It may have been higher but for the presence of seaweed on the beach which depressed its rating. The scene of Petrel Cove from the Bluff, an iconic scene, was middle rating - 6.64. Although familiarity would be high with these scenes, this did not translate into high ratings.
- The low rating of scenes from Yorke Peninsula and Fleurieu Peninsula may have been influenced by the distinctive yellow colouring of scans used referred to above.
- The area of water varied from minor to extensive but both occurred throughout the set of scenes with no pattern apparent.
- Wave action occurred in many scenes scattered throughout the set of scenes although it was more prominent among the first third of scenes.
- Vegetation occurred in some scenes but most scenes were without any vegetation. It was more prominent in the lower rated scenes, this possibly a function of their generally flatter land forms.
- Many scenes had prominent rock outcrops as part of the headlands, associated cliffs, rocky foreshores and rocks strewn on the beach. These occurred throughout the set of scenes and no pattern was apparent.
- Some of the scenes included beaches but these were a minority - around ten out of the 46 scenes. These were scattered throughout the set of scenes.

In summary, the height of the headlands and wave action appeared to have a positive influence on ratings.

Dunes and Beaches

There were 45 scenes of dunes and beaches.

- In 27 scenes, the beach was on the left of the scene and the sea on the right, in the remaining 17 scenes, these were reversed. Both were evenly scattered throughout the set of scenes.
- The height of the dunes varied from almost non-existent to large and prominent. They were vegetated, partly vegetated or bare. Substantial high dunes occurred in four of the ten top rated scenes including the top two. However most of the dunes in the remaining scenes were lower and less substantial. There were only two scenes with substantial dunes in the 20 lowest rated scenes but both included seaweed on the beach. Thus the higher dunes appear to have had a positive influence.
- The extent of the beach varied across the set of scenes from minor to very extensive. Four of the ten top rated scenes had extensive sandy beaches but there were only five in the remaining 34 scenes. Thus the extent of the beach appeared to influence ratings positively.
- In higher rated scenes, the vegetation appeared generally higher and denser and more shrublike whereas in the lower rated scenes it generally comprised low scattered dune grasses and shrubs.
- Thick deposits of seaweed were present in six of the eight lowest rated scenes, including the four lowest rated scenes. This clearly depressed scenic values.
- In most scenes the sand was white or slightly off white colour, however in the top rated scene (2, Waitpinga) and the fourth rated scene (9, Canunda NP) it had a golden hue. Colour may have a slightly positive influence on preferences.
- The colour of the sea was striking in many scenes. The second rated scene had an intense aqua hued sea, however the same was apparent in several middle rating scenes (129, 87).
- The area of the sea varied widely from just a glimpse to extensive in the scene, however, no pattern across the set of scenes was apparent.
- Wave action was apparent in the topmost scenes, and in seven of the top ten scenes, however it was present in

only nine of the remaining 34 scenes. Thus the presence of waves appeared to have a positive influence on ratings.

In summary, the presence of substantial high dunes, the extent of the beach, the colour of the sand, and wave action appeared to positively influence ratings while the presence of seaweed on the beach in large quantities had a negative influence.

Samphires & Mangroves

There were 18 scenes of samphires and mangroves.

- In 11 scenes, water was present or was particularly visible in the scene (e.g. with strong blue colour) and these comprised the ten highest rated scenes. Thus the presence of water clearly enhanced ratings. The remaining scenes were mainly of samphires or mangroves with bare ground.
- In many of the scenes, the water present comprised creeks or internal lagoons, not the sea. The sea was present in four scenes, and these occurred throughout the set of scenes.
- Eleven scenes contain mangroves or other thick littoral vegetation and nine of these occurred in the topmost rated scenes. The remainder were mainly samphires. There was a preference for thick tall shrub-like vegetation over low ground vegetation.
- Bare ground was present throughout the set of scenes, however it was far more extensive and dominant in the lower rated scenes where it was associated with samphires.
- A beach was present in only two scenes, the topmost scene (10) where it was not particularly noticeable, and a middle rating scene (128) with seaweed strewn across it. Thus the presence of a beach did not appear to have significant influence.
- Being scenes of samphires and mangroves, land forms were generally flat with few vertical elements.
- The ratings were spread across the range, (3.38 – 5.80) without any appreciable bunching. Several consecutive scenes had similar ratings: 5.80 and 5.79, 5.40 and 5.37, 4.86 and 4.85. The reasons for this were not apparent.

In summary, the presence of water and thick tall shrub-like vegetation over low ground vegetation had a positive influence on ratings whereas extensive bare ground appeared to have a negative influence.

Summary

Overall, no influences could be detected for the high and low cliffs but the following factors were identified for the headlands & bays, dunes & beaches, and samphires & mangroves:

- Height of the headlands and wave action appeared to have a positive influence on ratings.
- The presence of substantial high dunes, the extent of the beach, the colour of the sand, and wave action appeared to positively influence ratings while the presence of seaweed on the beach in large quantities had a negative influence.
- The presence of water and thick tall shrub-like vegetation over low ground vegetation had a positive influence on ratings whereas extensive bare ground appeared to have a negative influence.

4.11 DEVELOPMENT OF PREDICTIVE MODELS

Multiple regression analysis was used to identify the characteristics and a formula by which the scenic quality of the coast could be quantified. The factors that were scored (e.g. area of water, tranquillity-awe inspiring) were the independent variables and the scenic quality rating of each scene was the dependent variable. Multiple regression analysis enabled the influence of these factors on scenic quality to be quantified.

Five methods of multiple regression analysis are available: enter, backward, stepwise, forward, and remove, each of which sequentially add or remove characteristics from the model. The amount by which each characteristic changes the multiple R^2 (i.e. correlation coefficient) determined whether or not to continue. Stepwise is the most commonly used method. All models were based on an entry probability for F of 0.05 and a removal probability of 0.10. The data was applied using all five models and each yielded the same result (Table 4.16).

The equation indicated that all seven factors contribute to scenic quality but, as would be

expected, by differing degrees. The tranquillity-awe factor had the strongest effect followed by the quality of the beach, the degree of naturalness, the area of water, the height of the landforms, the degree of diversity, and lastly the coastal indentation. The influence of all factors was positive. The correlation coefficient (R^2) indicated that the equation will explain nearly 85% of the variance. This model attempted to be all-encompassing, covering the very different scenes in the five landscape units.

Table 4.16 All Scenes Model 1

Method	Enter
Factors	Area, height, indentation, quality, diversity, naturalness, tranquillity
R^2	0.847
Equation	$Y = 1.017 + 0.486 \text{ Tranquillity} + 0.310 \text{ Quality} + 0.271 \text{ Naturalness} + 0.250 \text{ Area} + 0.227 \text{ Height} + 0.224 \text{ Diversity} + 0.163 \text{ Indentation}$
Significance	$F = 102.5, df 7, 130, p = 0.000$

Note: Area = area of beach
 Height = flat – high terrain
 Indentation = indentation of the water/land edge
 Naturalness = the appearance of naturalness in the scene
 Diversity = diversity (busyness) in the scene from its land form, land cover, land use etc
 Tranquillity = tranquil – awe inspiring
 Quality = quality of any beach in the scene

Testing the Model

The model was:

$$Y = 1.017 + 0.250 \text{ Area} + 0.227 \text{ Height} + 0.163 \text{ Indentation} + 0.310 \text{ Quality} + 0.224 \text{ Diversity} + 0.271 \text{ Naturalness} + 0.486 \text{ Tranquillity}$$

Testing this with two scenes yielded:

Scene 34 Rating 7.62

$$Y = 1.017 + 0.250 (3) + 0.227 (4.44) + 0.163 (4.13) + 0.310 (1) + 0.224 (3.35) + 0.271 (4.86) + 0.486 (3.95) = 7.70 \text{ i.e. } 0.08 \text{ or } +11\% \text{ difference}$$

Scene 12 Rating 5.40

$$Y = 1.017 + 0.250 (1.6) + 0.227 (1.31) + 0.163 (1.75) + 0.31 (1.31) + 0.224 (2.89) + 0.271 (3.6) + 0.486 (1.63) = 4.79 \text{ i.e. } 0.39 \text{ or } -11\% \text{ difference}$$

In scene 34, the model result was 11% different and in scene 12 it was 11% lower. To assess the accuracy of the model all 138 scenes were tested and model ratings derived. Figure 4.19 indicates the differences between the model ratings with the ratings derived from community preferences. Positive means the model results were higher than preferences, and negative means they were lower. Figure 4.20 provides a histogram of the differences between the model and preferences. It indicates that although the majority of scenes were within one rating unit of preferences, there were 33 scenes with greater than +/- 1 difference. The scenes in which the model results were markedly different from the preferences (i.e. +/- 1.0) were therefore examined to identify any contributing factors not covered by the model (Table 4.17).

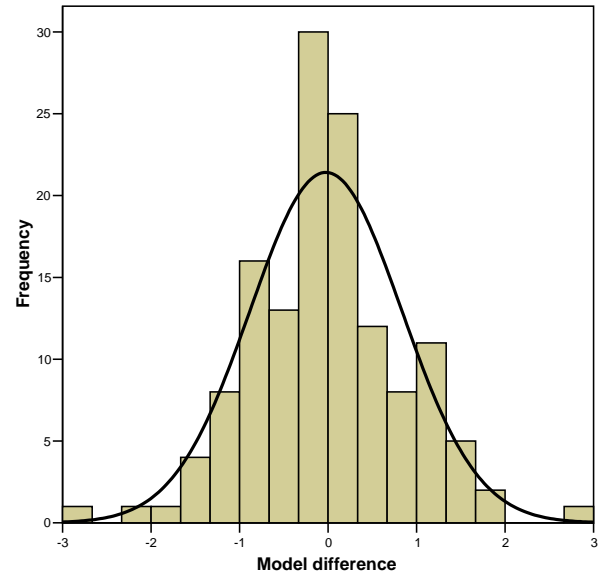


Figure 4.20 Histogram of Differences - Model 1

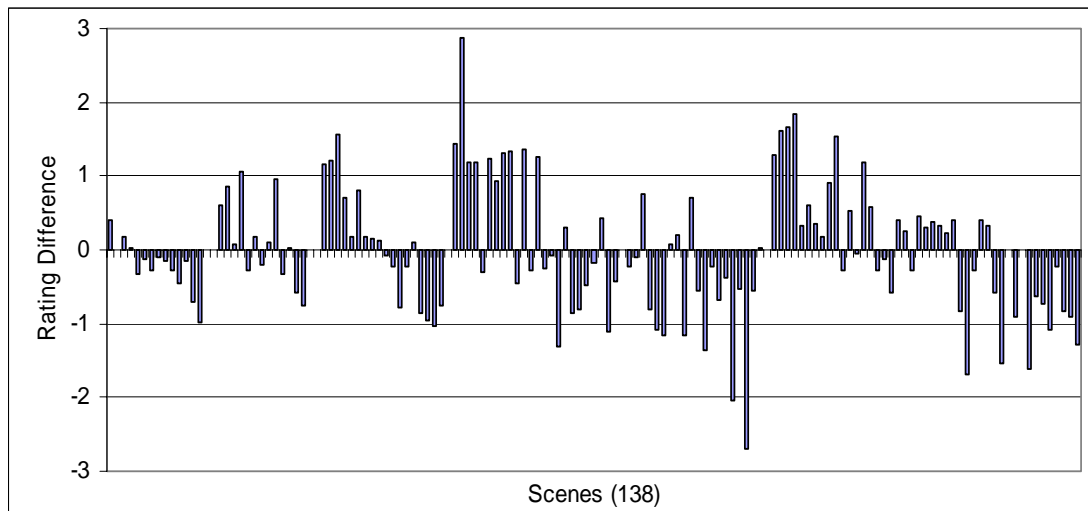


Figure 4.19 Model 1 Ratings Compared with Community Ratings

Table 4.17 Review of Scenes Where Model Results Differed Significantly from Preferences

Scene	Preferences	Model	Diff.	Comments
High Cliffs				
166	8.21	7.22	-0.99	Heavy wave action. Impressive high cliff scene
Low cliffs				
88	6.1	7.17	1.07	Steep low cliffs, smooth sea
Samphires & Mangroves				
16	3.76	4.97	1.21	Samphires, no water
90	4.06	5.62	1.56	Samphires, bare patches, no water
122	3.38	4.55	1.17	Samphires, heavily fragmented, no water
125	5.79	4.76	-1.03	Mangrove inlet, thick trees, smooth water
Dunes & Beaches				
1	5.71	7.07	1.36	Across grassed sand dunes to beach.
42	7.25	4.55	-2.7	Wave action. Wide sandy beach. Some seaweed.
53	6.56	5.46	-1.1	Browns Beach. Familiarity? Wave action.
61	5.4	6.64	1.24	Extensive scattering of seaweed on beach
62	5.66	6.98	1.32	Heavy seaweed banks on beach.
63	4.09	6.97	2.88	Heavy seaweed banks on beach.
73	5.73	6.98	1.25	Wide sandy beach, some seaweed. Thick fringing vegetation

77	5.2	6.4	1.2	Seaweed banks on beach.
100	5.68	7.01	1.33	Across grassed sand-dunes to beach. Some housing
116	7	5.63	-1.37	Boomer Beach. Familiarity? Wave action
133	5.96	4.66	-1.3	Wide sandy beach. Rip rack rock protection. Breakwater.
135	6.78	5.7	-1.08	Pondalow Beach. Familiarity? Wide sandy beach.
156	6.78	5.63	-1.15	Over vegetated dunes. Wide sandy beach. Wave action.
159	5.14	6.34	1.2	Seaweed banks on beach.
162	7.13	5.08	-2.05	Wide sandy beach. Close up of waves on beach.
163	3.8	5.23	1.43	Heavy seaweed banks on beach. Little water
165	6.97	5.8	-1.17	Wave action. Wide sandy beach

Headlands and Bays

13	6.1	7.77	1.67	Bluff. Seaweed strewn on beach. Housing development.
22	7.63	6.02	-1.61	Wave action. Rocky shore.
25	6.14	7.99	1.85	Low tide reef. Foreground weeds. Houses.
27	7.48	5.93	-1.55	Steep rocky cliffs. Some wave action.
32	8.65	7.3	-1.35	Iconic scene. Familiarity
33	8.18	6.9	-1.28	Wave action. Steep rocky headlands.
66	7.2	5.52	-1.68	Wave action. Island
81	7.69	6.6	-1.09	Steep vegetated headland. Sparkling sea.
85	5.1	6.37	1.27	Low headland. Rocky shore. Distant jetty.
99	5.74	7.34	1.60	Thick dune weeds. Rocky shore. Houses.
103	6.47	8.01	1.54	Very rocky shore.
110	6.67	7.87	1.20	Rocky ledges on shore. Some seaweed.

Common factors in the scenes which were negative (i.e. model lower than preferences) were:

- Wave action
- Familiarity with well known beaches
- Wide sandy beach
- Steep land form

Common factors in the scenes which were positive (i.e. model higher than preferences) were:

- Samphires with bare areas and no water
- Seaweed on the beach – often extensive and thick
- Housing developments
- Rocky shore

The scoring of wave action, the presence of seaweed, and the steepness of the landforms in the scenes was therefore undertaken. This was carried out with six participants.

Seaweed on a beach may be regarded as similar to dirt which mars a broad expanse of sand, analogous to cleaning up a property of all unwanted debris. Seaweed may carry with it a stigma of being a waste product and is therefore unwanted.

A revised model was then derived using the additional three factors (Table 4.18). In this model, the seaweed and wave factors were both negative but steepness of landforms was positive. Its correlation coefficient (0.86) was slightly higher than the original model (0.847)

indicating an improved goodness of fit to the data.

Table 4.18 Multiple Regression Model 2 – All Scenes

Method	Enter
Factors	Area, height, indentation, quality, diversity, naturalness, tranquillity, waves, seaweed, steepness
R ²	0.86
Equation	Y = 1.356 + 0.519 Tranquillity + 0.359 Quality + 0.255 Naturalness + 0.26 Area + 0.079 Height + 0.187 Diversity + 0.181 Indentation – 0.141 Seaweed – 0.056 Waves + 0.113 Steepness
Significance	F = 78.12, df 10, 1127, p = 0.000

Note: Seaweed = amount on beach
Waves = extent of wave action
Steepness = steepness of landform

The effect of the three additional factors was to produce ratings which were somewhat higher than the community ratings (Figures 4.21, 4.22). There were 55 scenes in which the difference was greater than 1 unit. This should not occur as the regression model aims to minimise the residuals; i.e. the difference should be balanced around zero as in the previous model. Thus in the model of all scenes, the inclusion of these extra factors appears to be inappropriate.

The Enter method of multiple regression was used in Model 2 as it was in Model 1.

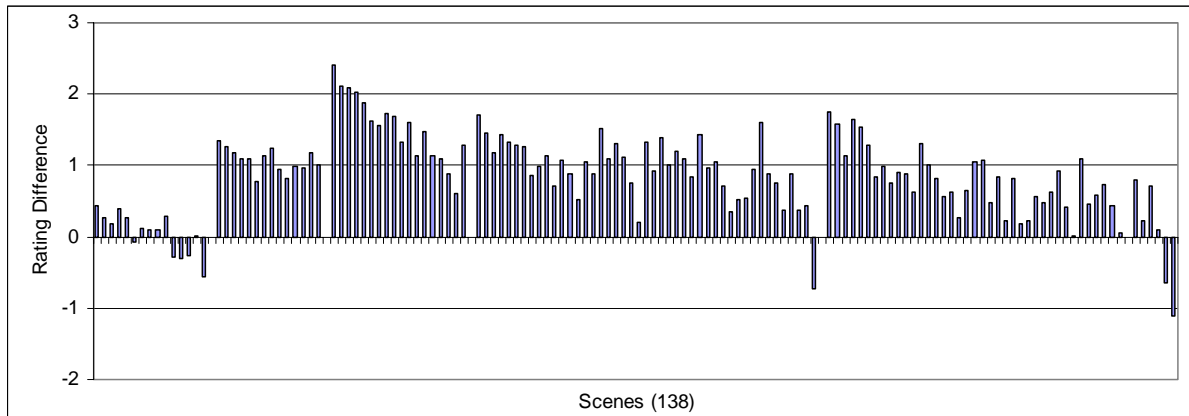


Figure 4.21 Model 2 Ratings Compared with Community Ratings

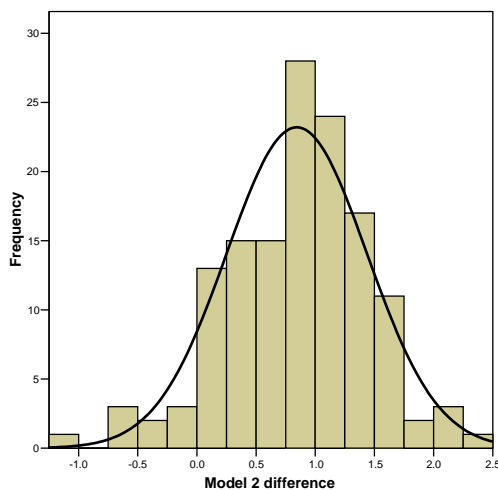


Figure 4.22 Histogram of Differences - Model 2

Table 4.19 All Scenes Stepwise Model 3 – Correlation Coefficients

Factors	R ²
Tranquillity	0.681
Tranquillity, Quality	0.762
Tranquillity, Quality, Area	0.803
Tranquillity, Quality, Area, Indentation	0.824
Tranquillity, Quality, Area, Indentation, Seaweed	0.838
Tranquillity, Quality, Area, Indentation, Seaweed, Steepness	0.848
Tranquillity, Quality, Area, Indentation, Seaweed, Steepness, Naturalness	0.856

Note: all models also include the constant

If the Stepwise method was used, a slightly lower R² resulted but it would still be possible to derive respectable results using fewer factors.

Table 4.19 indicates the R² for the third set of models derived, using the Stepwise method which progressively adds factors until all are included. The first model has

only one factor, tranquillity, and yet produces an R² of 0.681. The difference in R² between the first and last model was only 0.175.

The model with only tranquillity-awe as the factor was: $Y = 3.363 + 1.169 (\text{tranquillity})$. The model with seven factors (omits diversity) was:

$$Y = 1.77 + 0.489 \text{ Tranquillity} + 0.378 \text{ Quality} + 0.218 \text{ Naturalness} + 0.258 \text{ Area} + 0.273 \text{ Indentation} - 0.142 \text{ Seaweed} + 0.181 \text{ Steepness}.$$

It is obvious that a model with fewer factors would be easier to use providing its results were reasonable.

It is evident that these models which treated the entire coast equally were too coarse and it would therefore be appropriate to use the landscape units as the basis of separate models. Models were therefore derived for each of the five landscape units.

Landscape Unit - High Cliffs

The first model for the high cliffs landscape unit contained all factors with the exception of seaweed but was not statistically significant ($p = 0.2$) even though it derived a high R² of 0.797 (Table 4.20). The second model which was not significant included seven factors but omitted seaweed, waves and steepness. The third model used the backward method (opposite to the enter method, it started with all factors and withdrew them one at a time) and produced six models, the first being identical to the above model and the final model containing only two factors – quality of beach, and naturalness. Only this final model

of six models was statistically significant ($p = 0.03$).

Tested against the community ratings, the first model performed adequately with 13 of the 15 scenes within ± 0.4 (Figure 4.23) and the third model achieved even better results with all but three scenes within ± 0.3 (Figure 4.24).

Table 4.20 High Cliffs Models

Method	1. Enter
Factors	Area, height, indentation, quality, diversity, naturalness, tranquillity, steepness, waves
R ²	0.797
Equation	Y = 7.207 + 0.909 Tranquillity + 0.958 Quality + 0.086 Naturalness - 0.165 Area - 0.498 Height + 0.173 Diversity + 0.071 Indentation + 0.28 Waves - 0.702 Steepness
Significance	F = 2.176, df 9, 5, p = 0.203

Method	2. Enter
Factors	Area, height, indentation, quality, diversity, naturalness, tranquillity
R ²	0.539
Equation	Y = 5.947 + 0.306 Tranquillity + 0.779 Quality + 0.373 Naturalness - 0.065 Area - 0.453 Height + 0.002 Diversity - 0.068 Indentation
Significance	F = 1.168, df = 7, 14, p = 0.421

Method	3. Backward
Factors	Quality, naturalness (final model)
R ²	0.444
Equation	Y = 3.647 + 0.572 Quality + 0.748 Naturalness
Significance	F = 4.789, df 2, 12, p = 0.03

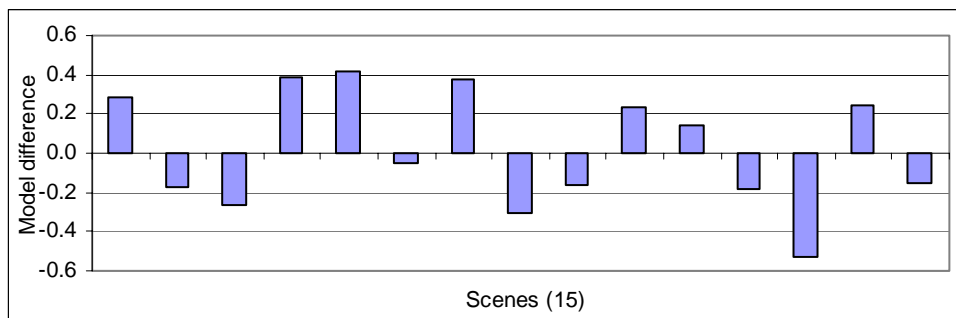


Figure 4.23 High Cliffs Model 1 Differences

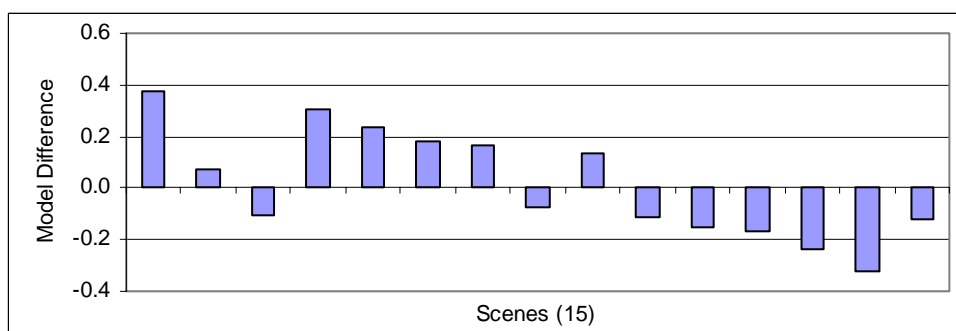


Figure 4.24 High Cliffs Model 3 Differences

In the first model it may seem surprising that the height of the cliffs was a negative quality as it was the height of the cliffs which identified this landscape unit. However as all of the scenes had this quality, the model searched for anomalies which explained the dependent variable, in this case, scenic quality rating. Similarly the inclusion of the quality of

the beach was unusual given that only two of the scenes contained pocket-handkerchief sized beaches.

Landscape Unit - Low Cliffs

The first model for the low cliffs landscape unit contained all factors (including seaweed), was

statistically significant, and had a high R² of 0.943 (Table 4.21). The strongest factors in the model were naturalness, steepness, and height. Tranquillity-awe had a negative effect. The second model which was also significant but had an R² of only 0.48, contained only one factor, indentation.

Tested against the community ratings, the first model achieved good results, with all but three scenes within 0.1 (Figure 4.23). The second model, with indentation as the sole factor, performed adequately though less spectacularly, with eleven scenes less than 0.4 of the ratings and only two greater than 0.4 (Figure 4.24).

Table 4.21 Low Cliffs Models

Method	1. Enter
Factors	Area, height, indentation,

	quality, diversity, naturalness, tranquillity, seaweed, waves, steepness
R ²	0.943
Equation	Y = 0.477 - 0.599 Tranquillity + 0.241 Quality + 0.517 Naturalness + 0.1 Area + 0.48 Height + 0.401 Diversity + 0.002 Indentation - 0.225 Seaweed + 0.295 Waves + 0.516 Steepness
Significance	F = 5.01, df 10, 3, p = 0.106

Method	2. Stepwise
Factors	Indentation
R ²	0.48
Equation	Y = 4.947 + 0.543 Indentation
Significance	F = 11.09, df 1, 12, p = 0.006

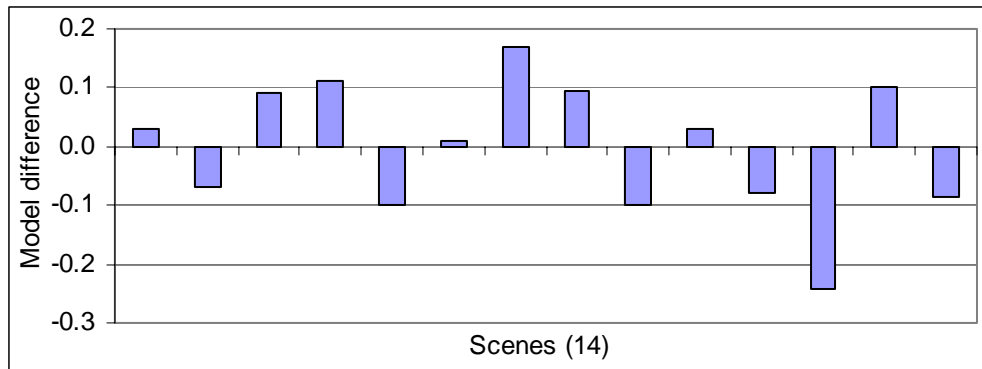


Figure 4.25 Low Cliffs Model 1 Differences

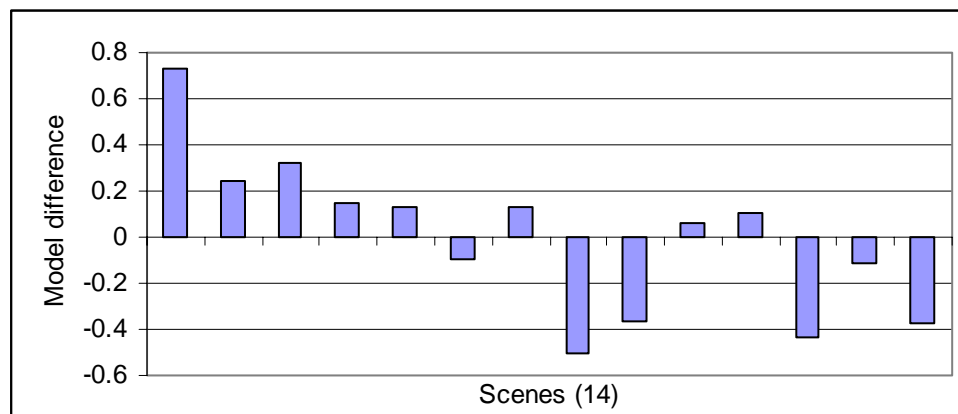


Figure 4.26 Low Cliffs Model 2 Differences

Landscape Unit - Samphires & Mangroves

The model for samphires & mangroves covered all factors except wave action and steepness of landforms, both of which were absent in these scenes (Table 4.22). The constant was negative and two factors, the

quality of beach and steepness of landform, were negative. The model was statistically significant and had a very high R². Tested against community ratings, the model yielded ratings which were substantially higher than the community ratings, most more than 0.4 greater (Figure 4.25).

The second model used only two factors, area of beach and coastal indentation, neither of which are particularly present in samphires and mangroves. However this model achieved a high R² and performed reasonably well with only four of the 18 scenes greater than 0.4 (Figure 4.26).

Neither of these models appeared to capture the essence of the samphires and mangroves landscape unit. It could be that the characteristics of this unit were so different from the other coastal landscape units that the factors used had little application.

Table 4.22 Samphires & Mangroves Models

Method	1. Enter
Factors	Area, height, indentation, quality, diversity,

	naturalness, tranquillity, seaweed, waves, steepness
R ²	0.905
Equation	Y = -0.218 + 0.336 Tranquillity – 0.177 Quality + 0.475 Naturalness + 0.681 Area + 1.211 Height + 0.239 Diversity + 0.59 Indentation + 0.14 Seaweed – 1.378 Steepness
Significance	F = 8.44, df 8, 9, p = 0.003

Method	2. Stepwise
Factors	Area, indentation
R ²	0.826
Equation	Y = 1.568 + 1.297 Indentation + 0.703 Area
Significance	F = 35.48, df 2, 15, p = 0.000

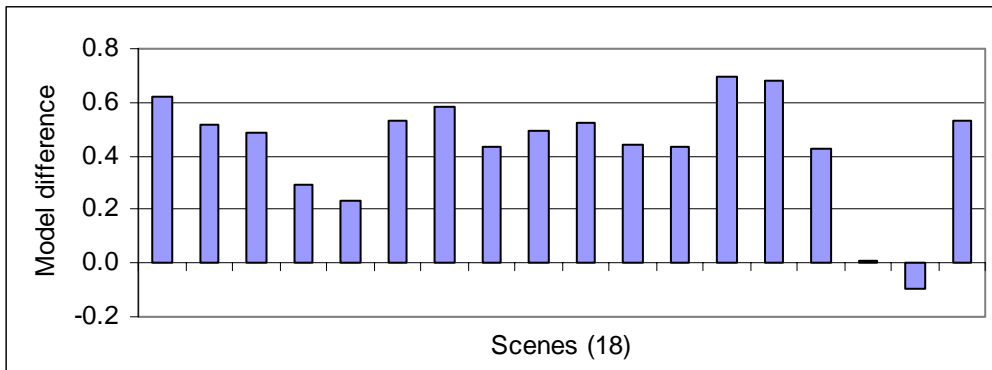


Figure 4.27 Samphires & Mangroves Model 1 Differences

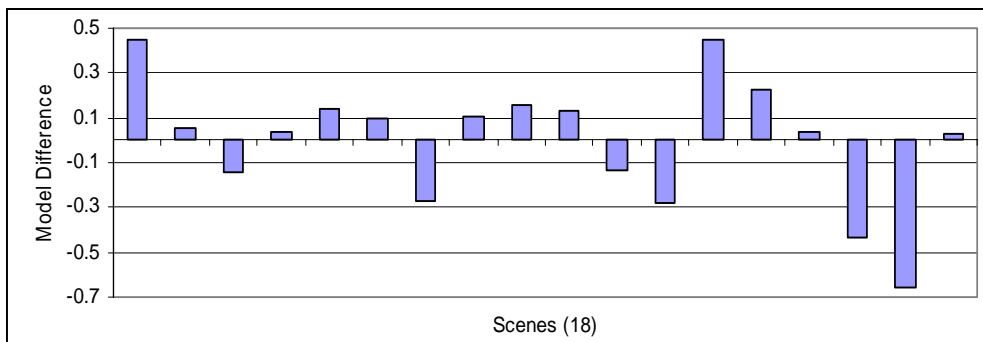


Figure 4.28 Samphires & Mangroves Model 2 Differences

Landscape Unit - Dunes & Beaches

Model 1 for dunes & beaches included all factors, was statistically significant and had a high R² (Table 4.23). Two factors, tranquillity-aw and seaweed, were negative. Quality of the beach was the strongest determinant. Tested against community ratings the model performed reasonably with all but nine of the

45 scenes within 0.4 of the ratings (Figure 4.29).

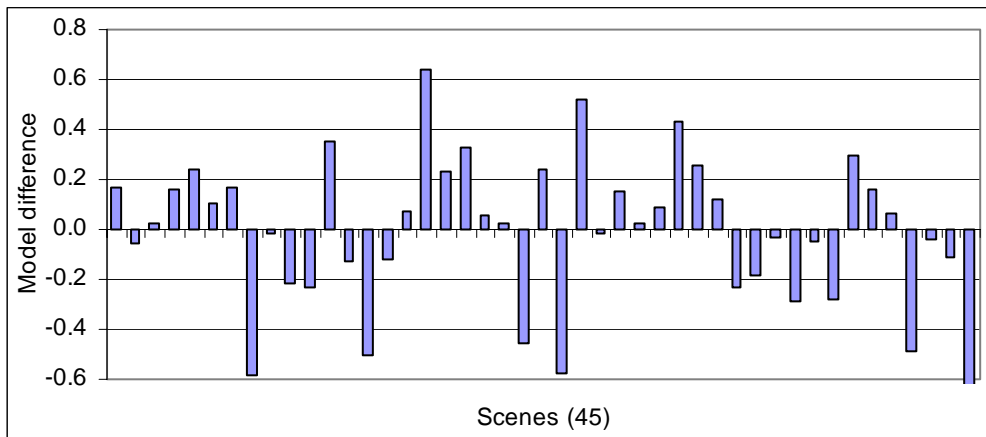
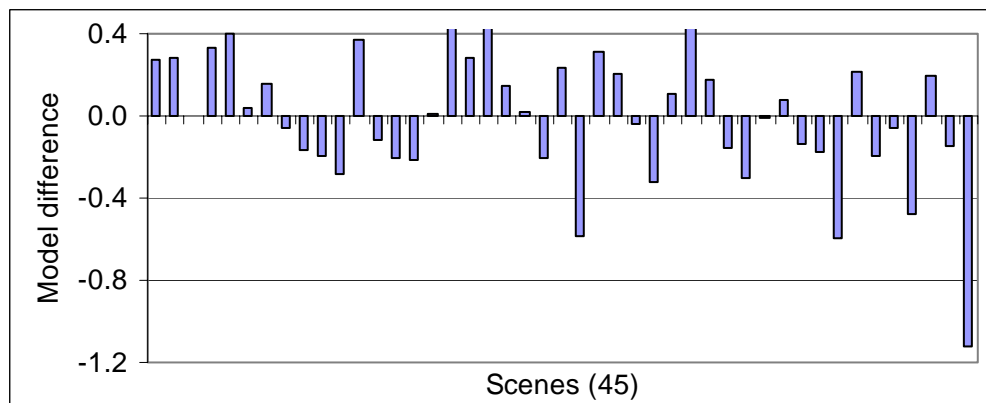
A second model was derived for the dunes & beaches using the stepwise method. This identified three models depending on how many factors were included. Table 4.24 shows the model with the highest R² (Figure 4.30).

Table 4.23 Dunes & Beaches Models

Method	1. Enter
Factors	Area, height, indentation, quality, diversity, naturalness, tranquillity, seaweed, waves, steepness
R ²	0.882
Equation	Y = 2.297 - 0.162 Tranquillity + 0.645 Quality + 0.154 Naturalness + 0.188 Area + 0.144 Height + 0.198 Diversity + 0.207 Indentation - 0.182 Seaweed + 0.043 Waves +

	0.048 Steepness
Significance	F = 24.46, df 10, 34, p = 0.000

Method	2. Stepwise
Factors	Area, indentation, quality
R ²	0.841
Equation	Y = 1.582 + 0.907 Quality + 0.258 Area + 0.474 Indentation
Significance	F = 72.22, df 3, 41, p = 0.00

**Figure 4.29 Dunes & Beaches Model 1 Differences****Figure 4.30 Dunes & Beaches Model 2 Differences****Landscape Unit - Headlands and Bays**

Model 1 for headlands & bays used all factors, was statistically significant and had a reasonably high R² (Table 4.24). Four factors were negative: landform height, coastal indentation, seaweed and wave action. Tranquillity-awe and naturalness factors were dominant. Tested against community ratings, seven of the 46 scenes differed by more than 0.4 (Figure 4.31).

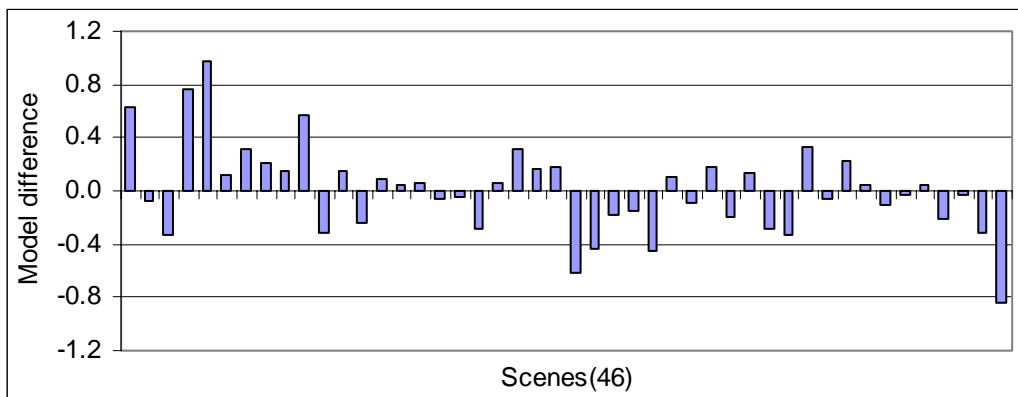
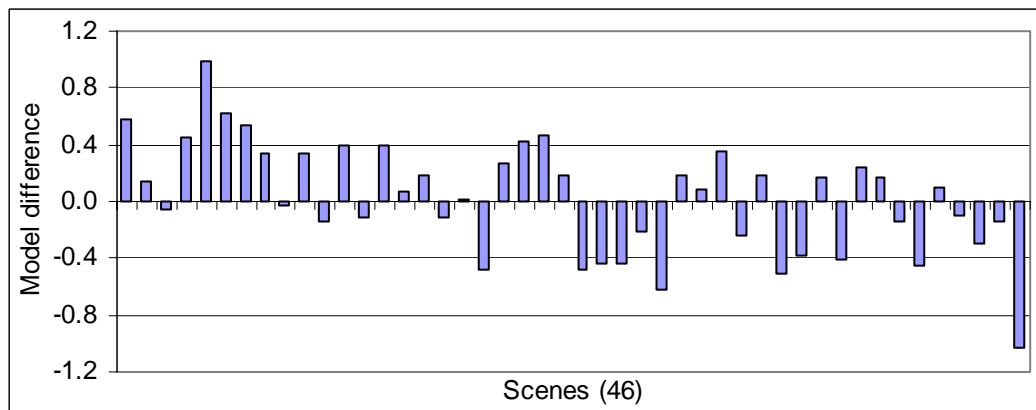
Model 2 used five factors: tranquillity-awe, quality of beach, naturalness, area of water, and steepness. It was statistically significant and had a reasonably high R². Tested against community ratings, fifteen of the scenes differed by more than 0.4 (Figure 4.32).

Table 4.24 Headlands & Bays Models

Method	1. Enter
Factors	Area, height, indentation, quality, diversity, naturalness, tranquillity, seaweed, waves, steepness
R ²	0.742
Equation	Y = 1.968 + 0.764 Tranquillity + 0.163 Quality + 0.574 Naturalness + 0.299 Area - 0.268 Height + 0.111 Diversity - 0.182 Indentation - 0.177 Seaweed - 0.21 Waves + 0.297 Steepness

Significance	F = 10.06, df 10, 35, p = 0.000
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Method	2. Stepwise
Factors	Area, quality, naturalness, tranquillity
R ²	0.656
Equation	Y = 1.507 + 0.671 Tranquillity + 0.193 Quality + 0.548 Naturalness + 0.24 Area
Significance	F = 19.5, df 4, 41, p = 0.000

**Figure 4.31 Headlands & Bays Model 1 Differences****Figure 4.32 Headlands & Bays Model 2 Differences**

Multiple Regression Analysis Models - Conclusion

The powerful tool of multiple regression analysis enabled the identification of factors on which scenic quality was based and the relative importance of these factors. Multiple regression analysis cuts through pre-conceptions and assumptions and quantified the important attributes.

The factors which were used in this analysis were reasonably sufficient, although it is

possible that some unknown factor(s) apply in the case of the high cliffs landscape unit as none of the models were statistically significant.

The models indicate what the rating of the scene should have been if the factors they included were applicable to a particular scene. Where the models indicated that the rating should be higher or lower than that derived by the survey, this suggests that either there were additional factors not covered by the models – eg presence of seaweed which

lowered ratings, or that the scene used in the survey had some deficiency which affected its rating. Scenes of Yorke Peninsula and some on Fleurieu Peninsula had been scanned from photographs and were somewhat browner than they should have been, thus slightly affecting these ratings. In other instances, the model results were lower than that derived

from the survey which in some cases might have been due to special lighting or other effects which enhanced the scene.

Table 4.25 summarises the models derived.

Table 4.25 Summary of Models

Equation	R ²	p	Test against ratings
All scenes			
Y = 1.017 + 0.486 Tranquillity + 0.310 Quality + 0.271 Naturalness + 0.250 Area + 0.227 Height + 0.224 Diversity + 0.163 Indentation	0.847	0.000	105/138 (76%) scenes < +/- 1
Y = 1.356 + 0.519 Tranquillity + 0.359 Quality + 0.255 Naturalness + 0.26 Area + 0.079 Height + 0.187 Diversity + 0.181 Indentation - 0.141 Seaweed - 0.056 Waves + 0.113 Steepness	0.86	0.000	89/138 (70%) scenes < +/- 1
High cliffs			
Y = 7.207 + 0.909 Tranquillity + 0.958 Quality + 0.086 Naturalness - 0.165 Area - 0.498 Height + 0.173 Diversity + 0.071 Indentation + 0.28 Waves - 0.702 Steepness	0.797	0.203	13/15 (87%) scenes < +/- 0.4
Low cliffs			
Y = 0.477 - 0.599 Tranquillity + 0.241 Quality + 0.517 Naturalness + 0.1 Area + 0.48 Height + 0.401 Diversity + 0.002 Indentation - 0.225 Seaweed + 0.295 Waves + 0.516 Steepness	0.943	0.106	11/14 (86%) scenes < +/- 0.1
Samphires & Mangroves			
Y = 1.568 + 1.297 Indentation + 0.703 Area	0.826	0.000	14/18 (78%) scenes < +/- 0.4
Dunes & Beaches			
Y = 2.297 - 0.162 Tranquillity + 0.645 Quality + 0.154 Naturalness + 0.188 Area + 0.144 Height + 0.198 Diversity + 0.207 Indentation - 0.182 Seaweed + 0.043 Waves + 0.048 Steepness	0.882	0.000	36/45 (80%) scenes < +/- 0.4
Headlands & Bays			
Y = 1.968 + 0.764 Tranquillity + 0.163 Quality + 0.574 Naturalness + 0.299 Area - 0.268 Height + 0.111 Diversity - 0.182 Indentation - 0.177 Seaweed - 0.21 Waves + 0.297 Steepness	0.742	0.000	39/46 (85%) scenes < +/- 0.4

5. MAPPING COASTAL SCENIC QUALITY

5.1 DERIVATION OF THE MAP

Requirements

The Project Brief specified that the scenic value of the coast was to be mapped at a scale sufficient for planning and policy development. It specified that it would not generally extend beyond one kilometre inland from the sea. It would also cover offshore areas to the extent that scenic amenity might be influenced by marina development. It covered areas subject to tidal influence to supra tidal levels, and also river estuaries. Information on the regions was to be provided in the following order of priority:

- Eyre Peninsula (border to Port Augusta)
- Kangaroo Island
- South East (border to Murray Mouth)
- Yorke Peninsula (Port Augusta to Port Wakefield)
- Fleurieu Peninsula (Murray Mouth to Port Wakefield)

Mapping Scale

The Development Plans were inspected to determine their scale. Generally these were 1:40,000 in rural coastal areas although some are at 1:100,000. As 1:40,000 maps were not available, maps at the 1:50,000 scale were produced by DEH Environment Information for the mapping of scenic quality.

Resources

The resources available for mapping comprised:

- The photographs of the individual 138 scenes of the South Australian coast together with their ratings (Appendix 10.3)
- The photographs of the scenes arranged in rating order by landscape unit (included on CD)
- The 1700 photographs taken throughout the coast in preparation for the survey
- The scoring of the factors for each of the 138 scenes (Section 4.8)
- The descriptive analysis of the ratings by landscape unit (Section 4.10)
- The quantitative analysis of the ratings by region and landscape unit (Section 4.12)

- The insights provided by the predictive models (Section 4.11)
- Oblique aerial photographs covering most of the South Australian coast available on-line from the Atlas of South Australia (www.atlas.sa.gov.au)
- Maps covering the entire coast at 1:100,000 scale showing the coastal viewshed. In addition, 1:50,000 scale viewshed maps were produced of the major bays on Eyre Peninsula – e.g. Venus Bay, Baird Bay.

Scenic Quality Rating

The scenic quality rating numbers such as a figure of 5 covered the range from 5.00 to 5.99. It could be a high 5 (e.g. 5.8), middle 5 (e.g. 5.5) or a low 5 (e.g. 5.2). The number did not differentiate within the integer and thus provided a reasonably robust figure capable of covering the variations within a scene and the concomitant changes in scenic quality. Mapping coastal scenic quality aimed to differentiate the coast within the range of half an integer, e.g. 6.5 – 7.0.

Viewshed Maps

The viewshed maps that defined the land could be seen from the sea and hence, vice versa, the areas from where the sea could be seen from the land. As explained in Section 3.2, the visible areas were those that could be viewed from a point at sea some 6.2 km from the coast. This represented the distance visible at sea at eye level. Land within a 20 km radius of this position was plotted for successive positions 5 km apart parallel to the coast.

Visibility was defined in three categories:

- Low visibility: visible from 1 – 6 viewing positions
- Moderate visibility: visible from 7 – 13 viewing positions
- High visibility: visible from 14 – 20 viewing positions

Because of the prevailing topography, in some locations, areas quite distant from the sea were included in the low visibility category. Thus Adelaide's Hills Face Zone was included up to the 20 km limit as were the low remnant sand dune ranges in the South East.

The areas shown to have sea views were mapped because these would have greater development potential, and generally higher

land values, than land without the sea view. However there would be a distance from the sea where this factor would be of little significance. A site nearly 20 km from the sea which may have a glimpse of the sea would be unlikely to have any of its value attributed to this and the sheer distance would make it only slightly noticeable unless it was from a high point such as Mt Lofty which is about 18 km from the sea. Twenty km is about the distance of Crater Lake at Mount Gambier to the sea. Even a distance of 10 km is considered too far – equivalent to the distance from Belair to the coast. Following consultation with the Steering Committee, a maximum of 5 km was adopted as representing the distance at which the sea view factor would be considered significant. This was the distance adopted for coastal scenic quality mapping. Five km is the distance from Flinders University to the sea at Brighton. High hills near the coast occur in only a few locations (e.g. Fleurieu Peninsula, northern coast of Kangaroo Island); generally the topography is far lower and the sea would not be as visible as it is from the top of these Ranges.

Coastal Zones

For the purposes of mapping scenic quality, the coast was defined to comprise three consecutive Zones:

Zone 1: The water/land interface and land immediately facing the sea, including cliffs, dunes, headlands etc.

This was generally a narrow band of land but for mapping purposes was defined as 100 m wide, the narrowest that could be mapped.

Zone 2: The land inland from Zone 1 from which the sea was visible. This may be quite narrow or stretch a considerable distance inland depending on the topography of the area. The extent was defined by the coastal viewshed maps and comprised agricultural land, parks and other uses.

Zone 3: Land where the sea was not visible and comprised agricultural land, parks and other uses. Often Zone 3 was inland of Zone 2, however in many areas, low land from where the sea cannot be seen occurred near the coast so in these areas, Zone 3 was located quite close to the sea.

The rating of coastal scenes applied to Zone 1. These ratings provided an accurate measure of the scenic quality rating of this Zone which in scenic quality terms usually has the highest scenic quality and is the most important. Zone 2 comprised land which would generally have a higher scenic quality rating than Zone 3 but usually a lower rating than Zone 1. Its higher rating compared with Zone 3 derived from the visibility of the sea. The lowest rating was usually Zone 3.

Generic Ratings

In mapping the scenic quality of South Australia the author used the ratings of scenes from his earlier State-wide survey to derive generic ratings (Table 5.1) for various landscape units including the coast, agricultural region, Murray Valley, Flinders Ranges and the arid region (Lothian, 2000).

Table 5.1 Generic Ratings of State-wide Landscape Units (Lothian, 2000)

COAST	Rating
High, sheer or very steep cliffs, frequently indented coast [maximum edge], reefs, islands, pronounced wave motion, beaches backed by steep cliffs or high land. Overall contains a high vertical element and strong awe inspiring effect	8
Headlands, long wide beaches, sloping cliffs, extensive dunes, wave motion, low rocky cliffs, reefs, some islands, smoother coastline - less indented. Overall a lower vertical element, sloping cliffs and low coastal indentation	7
Beaches, low hinterland, no cliffs, islands, mangrove flats, low dunes, little wave motion. Overall very little vertical element	6
Samphire flats	3
Coorong	6
AGRICULTURAL REGION	
Crops and pastures	4
Pastoral	5
Mixed uses – Hilly land	6
- Flat land	5
Hills and pastures (Mt Lofty Ranges)	5
- Steep land	6
NATURAL AREAS	
Mallee vegetation	5
Dense eucalypt woodlands	6
Salt bush/blue bush without trees	5
with trees	6
Vegetated dunes	5
Bare dunes	6

While the ratings of the coastal Zone were based on the survey scenes, ratings of Zones

2 and 3 were based on generic ratings derived from this survey and previous surveys of similar landscapes. These resources comprised the following.

- Ratings of the 28 scenes of South Australia included in the coastal survey. The scenes included flat featureless gibber plains, agricultural land, high mountainous areas in the Flinders Ranges, and the diverse landscapes of the Mt Lofty Ranges. The average of the agricultural scenes was 4.57.
- Ratings of a further 20 scenes of South Australia of relevance to the coast derived from the author's PhD thesis (Lothian, 2000). These included cereal growing, pasture lands, sand dunes, trees and other vegetation.
- Ratings of 19 near-coastal scenes and 19 inland scenes used in the author's study of the visual impact of wind farms in South Australia (Lothian, 2004).

Overall these provided 86 scenes from coastal and inland locations across South Australia which assisted in determining the scenic quality of Zones 2 and 3.

Table 5.2 Generic Ratings for Coastal Zones 2 and 3

AGRICULTURAL REGION	Rating
Crops and pastures	
- Flat & treeless	4
- Flat with trees	4.5
- Hilly & treeless	4.5
- Hilly with trees	5
Pastoral	
- Eyre Peninsula, Spencer Gulf	4
- Other areas	5
Mixed uses – Hilly land	6
- Flat land	5
Hills and pastures (Mt Lofty Ranges)	5
- Steep land	6
NATURAL AREAS	
Mallee vegetation	5
Dense eucalypt woodlands	6
Salt bush/blue bush without trees	5
with trees	6
Vegetated dunes	5
Bare dunes	5.5

Based on these resources and the above generic ratings (Table 5.1), generic ratings were derived for application to Zones 2 and 3 in the mapping of coastal scenic quality (Table 5.2).

The generic ratings were based on the sea not being visible. Where the sea was visible, these ratings were increased. In his thesis, the author found that coastal scenes averaged 7.67 while inland scenes without water averaged 5.31, a difference of 2.36. However these coastal scenes included the sea as a considerable portion of the view. If they were set back from the coast in Zone 2 their rating would be appreciably lower and the difference between scenes with and without water narrower. In the current coastal survey, the overall mean of non-coastal South Australian scenes was 5.57, slightly less than one unit lower than the overall mean for the coastal scenes of 6.51. However again the sea occupied a considerable proportion of the coastal scenes and the difference in Zone 2 would be lower.

Following consideration of this and analysis of many scenes, a 0.5 unit difference was adopted between Zones 2 and 3 throughout. However the Zone 2 figures were increased where the coastal rating was high. The difference between Zones 1 and 2 ranged from 0.5 to 2.0. The Zone 2 rating was thus benched on the Zone 3 rating but varied slightly by location.

Methodology

The methodology for assessing coastal scenic quality for any given area developed iteratively. A proforma was developed covering the information required (Figure 5.1). This contained the following components:

Location: Region number and section of coast covered.

Landscape Unit: Listed which of the five landscape units were present. Also the length of coast covered.

Scenes: Any scenes used in the survey taken in the area. Also the relevant photographs from the 1700 taken of the coast.

Similar Scenes: Based on the appearance of scenes in the area, identified similar scenes from among the survey photographs. This was based on the principle of equivalence which was a key to the mapping of scenic quality, that a scene in one region may be applicable to another region with similar characteristics. A wide flat surf beach backed by dunes may be found on Youngusband Peninsula, on western Eyre Peninsula and in other areas. The information and ratings applicable to one

Proforma					Example				
Location					EP 1 Port Augusta – Station Hill				
Unit	Data				Unit	Data			
Landscape unit					Landscape unit	Headlands and bays Samphires and mangroves 40 km			
Scenes					Scenes	SPG 82 - 116			
Similar scenes					Similar scenes	85 Pt Lowly shacks 18 Laura Bay mangroves 31 Chinamans Creek 128 Murat Bay mangroves 130 Murrupi wetlands 153 St Kilda mangroves 164 Pt Arthur mangroves			
Obliques					Obliques	sp020307 – 11			
Description					Description	The western coast south of Port Augusta comprises series of low headlands and bays with scattered mangroves offshore. Land rises slightly from shore. Shallow water. Low energy coast. Nearly continuous shack development from Curlew Point to Blanche Harbor. Scattered trees around shacks, otherwise mostly bare. Land is flatter than EP2 area. Area of mangroves at Blanche Harbor.			
SQ rating	Scene	Rating	All	LU	SQ rating	Scene	Rating	All	LU
						18	5.37	5.19	5.41
						31	4.57	4.75	4.30
						85	5.10	5.93	5.68
						128	4.90	5.33	5.35
						130	4.39	4.51	4.49
						153	4.21	4.45	4.35
Zone 1					Zone 1 Rating Port Augusta – Blanche Harbor 4.5 – 5.0				
Zone 2					Blanche Harbor mangroves 4.0 – 4.5				
Description					Zone 2				
					Description				
					Extends 3 – 5 km to Blanche Harbor and then narrows to 1 km with higher areas inland.				
Zone 2 Rating					< 1 km		> 1 km		
Non-Vegetated					4.5		4.0		
Vegetated					5.0		4.5		
Zone 3					Zone 3				
Description					Description				
					High land west of Cultana escarpment.				
Zone 3 Rating					< 1 km		> 1 km		
Non-Vegetated					4.0		3.5		
Vegetated					4.5		4.0		

Figure 5.1 Proforma for Assessing Coastal Scenic Quality

area may therefore be broadly transferable to the other area. However care needed to be exercised in applying the ratings from other locations.

Obliques: These refer to the oblique aerial photographs found on the on-line Atlas of South Australia. This was a valuable resource as it assisted in the identification of the landscape unit and the definition of their boundaries. They also enabled the viewing and assessment of areas which had not been visited due to access difficulties. The entire South Australian coast was thus viewed from the air during the assessment of scenic quality.

Description: This provided a brief overview of the area covered and a sequential description from one end to the other.

SQ (scenic quality) rating: This contained the ratings for each of the scenes in the area as well as the scenes identified as similar. Three columns of numbers were included. The first column contained the ratings derived from the survey. The second and third columns were the ratings derived from the two multiple regression models, the overall model and the specific model for the landscape unit. Their inclusion aided in assessing the ideal rating of a scene without any deficiencies it might possess, e.g. seaweed on the beach, or poor colouration.

Zone 1 rating: Based on consideration of the ratings of scenes in the area and of similar scenes, a rating for Zone 1 was defined. This was given as a range of half a unit. The mapping subsequently showed only the median of the range. Thus a rating of 6.5 to 7.0 was shown as 6.75.

Zone 2: A brief description of the extent of the Zone from which the sea could be seen was given. The ratings differentiated by location and land cover. Scenes within 1 km of the coast were determined to be slightly higher (0.5) than scenes further away. This recognized that a site which has a sea view and has proximity to the sea would generally rate higher than a more distant site. The scenes were also differentiated by the presence of vegetation which generally added slightly to the scenic quality.

For much of the coast, the following rating was adopted reflecting a range of one unit from a non-vegetated site more than 1 km from the

coast to a vegetated site within 1 km of the coast.

Zone 2 Rating	< 1 km	> 1 km
Non-Vegetated	5.0	4.5
Vegetated	5.5	5.0

In a few hilly locations such as parts of Kangaroo Island, southern Fleurieu Peninsula and southern Eyre Peninsula, these figures were increased slightly.

Zone 3: Again a brief description of the Zone was included and a similar differentiation by location and land cover applied. The ratings were 0.5 below those of Zone 2. These ratings are essentially those which apply to much of the agricultural and pastoral lands in South Australia.

Zone 2 Rating	< 1 km	> 1 km
Non-Vegetated	4.5	4.0
Vegetated	5.0	4.5

Applying this methodology to the entire 3700 km coast was a lengthy process but necessary in order to provide a sound basis for the ratings of each locality. The order in which the regions were tackled was as follows:

- South East
- Fleurieu Peninsula
- Kangaroo Island
- Eyre Peninsula
- Metropolitan Adelaide
- St Vincents Gulf
- Yorke Peninsula
- Upper Spencer Gulf

The methodology was developed iteratively during rating of the first three regions, and each was subsequently updated to reflect the defined approach.

Following consultation with DEH Environment Information, as Zones 2 and 3 were essentially similar, longer stretches of the coast were adopted for each unit and Zone 1 differentiated. The ratings were entered onto the set of 1:50,000 scale maps progressively.

The detailed 86 pages of coastal rating assessments are included in the CD.

Mapping

Following the delineation of ratings, the maps for each region were delivered to DEH Environment Information for digitizing. This

enabled the combinations in Zones 2 and 3 to be clearly seen. The mapping adopted the median point of each range, thus 6.75 for a range of 6.5 – 7.0. While this could suggest a greater level of precision than was necessarily warranted, in terms of the complexity of mapping it was the only practical solution. Even so, displaying the Zone 1 ratings which ranged from around 4.0 to over 8.0, proved challenging.

5.2 REGIONAL ASSESSMENTS

This section summarises the assessments on a regional basis.

High ratings exceed a rating of 7.0
Moderate ratings are 5.0 – 7.0
Low ratings are 3.0 – 5.0

The median rating (e.g. 6.75) was used which represented the mid-point of a 0.5 range (i.e. 6.5 – 7.0).

South East

The South East comprises a quite diverse coast which, apart from protected bays, is a high energy coast. South of the Coorong there are many off-shore reefs which produce considerable wave action. The region is characterised in the south by dunes and headlands with bays. Younghusband Peninsula on the seaward side of the Coorong stretches for many km from Kingston SE to the Murray Mouth.

The coastlines with high ratings were:

- Cape Northumberland – Finger Point 7.75
- Douglas Point (southern side) 7.25
- McIntyre Beach – South End 7.75
- Beachport – Robe 7.75

Much of the remaining coast was rated in the 6.5 – 7.0 range. Younghusband Peninsula rated 7.0.

Fleurieu Peninsula

This popular holiday and recreational region has a rugged coast along its southern extent and bare rounded headlands on the west. From the Murray Mouth to the Bluff at Encounter Bay it comprises dunes and beaches and then a series of headlands and intervening bays including the aptly named Horseshoe Bay at Pt Elliot. The Bluff marks

the boundary of the sheltered bays and the rugged south coast.

The coastlines with high ratings were:

- Kings Head – Newland Head 7.5
- Waitpinga and Parsons Beach 7.5
- Deep Creek area from Tunkalilla Beach to Fisheries Beach 7.5
- Cape Jervis – Rapid Bay – Lady Bay 7.25

The remaining areas were rated in the 6.0 – 7.0 range.

Kangaroo Island

South Australia's largest island has a spectacular and highly rated coastline, possibly a higher proportion of high ratings than any other region. Much of Dudley Peninsula on the Island's east comprises headlands and cliffs interspersed with bays and dunes. Pelican Lagoon, a large wetland separates the Peninsula from the rest of the Island. West of Pelican Lagoon comprises a plateau which rises towards the west, producing high cliffs and headlands particularly in the north-west and south-west.

The coastlines with high ratings were:

- North coast: Cape D Éstaing (near Emu Bay) to Cape Borda 7.25 – 7.75
- West coast: Cape Borda to Cape du Couedic 7.25 – 7.75
- Cape du Couedic to Kirkpatrick Point (Remarkable Rocks) 8.0
- South coast: Kirkpatrick Point to Point Tinline 7.25 – 7.75
- Cape Willoughby – Penneshaw 7.25 – 7.75

While Pelican Lagoon and some other wetland areas rated low, most of the remaining coast was in the 6.75 – 7.0 range, just below the high rating.

Metropolitan Adelaide

The Adelaide coastline comprises two distinct sections: from Sellicks Beach to Seacliff there are headlands and low cliffs, dunes and beaches, and from Seacliff to Outer Harbor it consists of beaches with, in some locations, low dunes.

Apart from Blanche Point at Maslin Beach which rated 7.0, the remainder of this coast had moderate ratings (6.0 – 6.25).

St Vincents Gulf

The coast between Outer Harbor and Pt Wakefield comprises low lying land with extensive mangrove-samphire formation and low dunes and beaches. The mangroves rated low (4.25) and the dunes were moderate ratings (5.25).

Yorke Peninsula

The Peninsula comprises a slightly elevated tilted plateau with low cliffs forming most of its east coast and dunes and bays on the west coast. A mixture of beaches/dunes and low cliffs are found along the southern coast. The toe of the Peninsula between Marion Bay and Corny Point comprises its most spectacular landscapes with some high cliffs, prominent headlands and long beaches with high dunes.

The high cliffs near Cape Spencer rated 8.0. Headlands and beaches with high dunes between Marion Bay and Corny Point rated 7.0. The remaining east, south and west coasts of the Peninsula rated moderate (6.0 – 6.75).

Upper Spencer Gulf

The coast from Point Riley (near Wallaroo) to Port Augusta includes much low lying land with extensive mangrove-samphire formations, low dunes and beaches, and, between Pt Riley and Tickera, low headlands and bays.

Only the southern headlands section (Pt Riley – Tickera) and the dunes and beaches north of Tickera rated moderate (6.0). The remaining coast rated low (5.0).

Eastern Eyre Peninsula

The northern part of eastern Eyre Peninsula between Pt Augusta and Franklin Harbor comprises low lying land with low dunes and beaches, low headlands and bays, and extensive mangroves and samphires. Franklin Harbor is a large enclosed bay with extensive mangroves and samphires. In the south, between Franklin Harbor and Port Lincoln are low cliffs and low headlands and bays.

None of this coast was high rated but ratings increased progressively towards the south. Port Augusta to Franklin Harbor, and including the Harbor, rated mainly low (4.25 – 4.75). Franklin Harbor rated 5. Franklin Harbor to Port Lincoln rated moderate (6.0 – 6.75).

Southern Eyre Peninsula

The southern tip of the Peninsula includes some of South Australia's most spectacular and highly rated coastline. South-east of Port Lincoln, the Lincoln National Park has high headlands and cliffs in the Cape Catastrophe - Cape Tournefort area. Whalers Way which extends from Fisheries Bay (west of Sleaford Bay) to Redbanks also has high cliffs and headlands and the high cliffs continue westward to Shoal Point. In the west, dunes and beaches and low headlands and cliffs line the protected waters of Coffin Bay.

This entire coastline with the exception of Coffin Bay had high ratings.

- Pt Lincoln Proper – Cape Donnington 6.5
- Cape Donnington–Cape Catastrophe 7.5
- Cape Catastrophe - Cape Tournefort 8.0
- Sleaford Bay 7.5
- Whalers Way 8.25
- Redbanks – Shoal Point 8.0
- Shoal Point – Pt Sir Isaac 7.0 – 7.5
- Coffin Bay 6.75

The 8.25 rating for the Whalers Way was the highest rating derived for South Australia's coast.

Western Eyre Peninsula

The west coast of Eyre Peninsula (Coffin Bay to Ceduna) comprises the longest section of spectacular landscapes in South Australia. It includes many high headlands and high sheer cliffs, long beaches with high dunes and several inlets with protected bays.

Dunes along the coast rated high (6.75 – 7.25) while the high cliffs between Cape Finniss and Cape Bauer rated very high (7.75). The largely land-locked Venus Bay and Baird Bay rated lower than the exposed coast.

The following localities were rated 7.5 – 8.0:

- High cliffs between Point Drummond – Cape Finniss
- Headlands and cliffs south of South Head, Venus Bay and north of Point Weyland
- Calca Peninsula: Cape Radstock – Point Labatt
- Slade Point – Cape Blanche
- High cliffs & headlands Yanerbie- Cape Bauer

West coast - Nullarbor

The coast west of Ceduna comprises a remote but often spectacular coast with extensive mangroves at Tourville Bay, headlands and bays extending beyond Fowlers Bay, a very long stretch of dunes extending to the Head of the Bight, and high sheer cliffs lining the Nullarbor nearly to the State border.

The entire coastline rated high. The beaches and dunes section rated 7.0, headlands 7.25, and the Nullarbor cliffs 7.75.

5.3 SUMMARY OF HIGH SCENIC QUALITY

Table 5.3 summarises the highest rating areas.

Table 5.3 Highest Rating Areas (in order)

Location	Region	Rating
Whalers Way	Eyre	8.25
Cape du Couedic-Kirkpatrick Pt	KI	8.00
Cape Catastrophe-Cape Tournefort	Eyre	8.00
Redbanks – Shoal Point	Eyre	8.00
Cape Spencer	Yorke	8.00
Cape Northumberland – Finger Point	SE	7.75
McIntyre Beach – South End	SE	7.75
Beachport – Robe	SE	7.75
Snelling Beach – Cape Borda – West Bay	KI	7.75
Mauperetiuis Bay – Cape du Couedic	KI	7.75
South West River – Pt Ellen	KI	7.75
Cape St Albans/Moncrieff Bay cliffs	KI	7.75
High cliffs between Point Drummond – Cape Finniss	Eyre	7.75
Headlands and cliffs south of South Head, Venus Bay and north of Point Weyland	Eyre	7.75
Calca Peninsula: Cape Radstock – Point Labatt	Eyre	7.75
Slade Point – Cape Blanche	Eyre	7.75
High cliffs & headlands between Yanerbie- Cape Bauer	Eyre	7.75
Nullarbor cliffs	Nullarbor	7.75
Kings Head – Newland Head	Fleurieu	7.50
Waitpinga & Parsons Beaches	Fleurieu	7.50
Deep Creek area	Fleurieu	7.50
Sleaford Bay – Fisheries Bay	Eyre	7.50
Shoal Pt to Pt Sir Isaac headlands	Eyre	7.50

The localities rated 8 and above are illustrated below, mainly with the oblique aerial photographs from the Atlas of South Australia.



Whalers Way, Southern Eyre Peninsula



Cape du Couedic-Kirkpatrick Point, Kangaroo Island



Redbanks – Shoal Point, Southern Eyre Peninsula



Cape Catastrophe-Cape Tournefort, Southern Eyre Peninsula



Cape Spencer, Yorke Peninsula

In the United Kingdom, high quality landscapes have been designated as Areas of Outstanding Natural Beauty (AONB) and certain management and development prescriptions apply. Similarly New Zealand has designated Nationally Significant Coastal Areas. The National Trust in Victoria has called for the identification of significant coastal landscapes. Queensland's State Coastal Management Plan has identified Level 1 Scenic Quality coasts to be "areas coastlines of State significance (scenic coastal landscapes)" (EPA, 2004).

The Australian Heritage Council and its predecessor, the Australian Heritage Commission, have concentrated more on the designation of heritage landscapes rather than aesthetic landscapes.

If a register of nationally significant landscapes were designated by the Australian Heritage Council, then the South Australian landscapes which have been rated at 7.5 or greater should be considered for inclusion. These comprised 946 km or nearly 20% of the coast, with over 660 km on western Eyre Peninsula and the West Coast/Nullarbor.

At the State level, these should be designated as Landscapes of State Significance and accorded status and protection from adverse impacts.

5.4 SUMMARY OF STATE-WIDE RATINGS

Following digitizing of the maps of scenic quality, DEH Environment Information calculated the lengths of the coast for the range of ratings. Figure 5.2 maps the distribution of the Zone 1 ratings for the South Australian coast.

Of the full distance of 4792 km, 43.7% rated 7 or 8, a surprisingly high proportion which serves to emphasise the high scenic quality of the South Australian coast (Table 5.4, Figure 5.3, 5.4).

Table 5.4 Summary of Ratings South Australian Coast

Rating	Length km	%
na	38.8	0.8
3	31.4	0.7
4	402.8	8.4
5	813.5	17.0
6	1410.1	29.4
7	1987.9	41.5
8	107.5	2.2
Total	4792.1	100.0

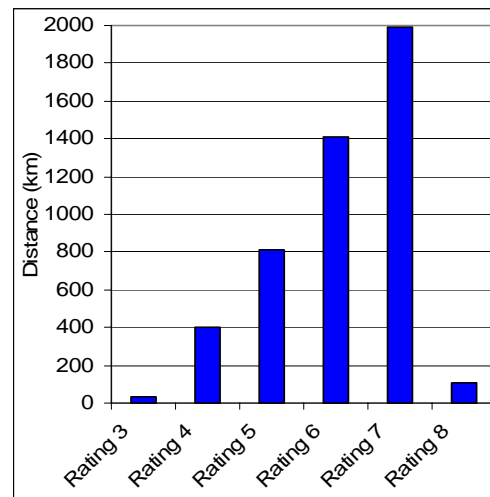


Figure 5.3 Distance of Ratings South Australian Coast

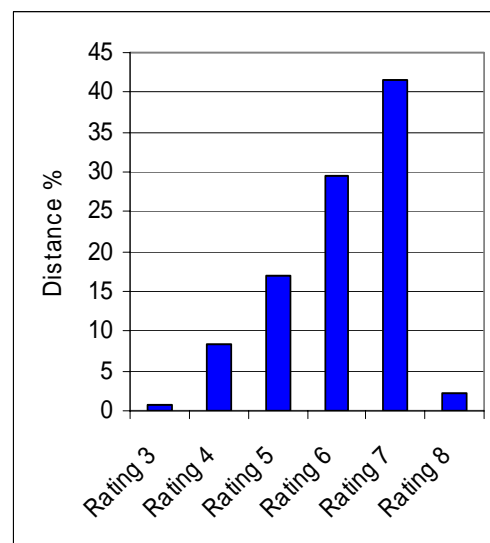


Figure 5.4 Proportions of Ratings South Australian Coast

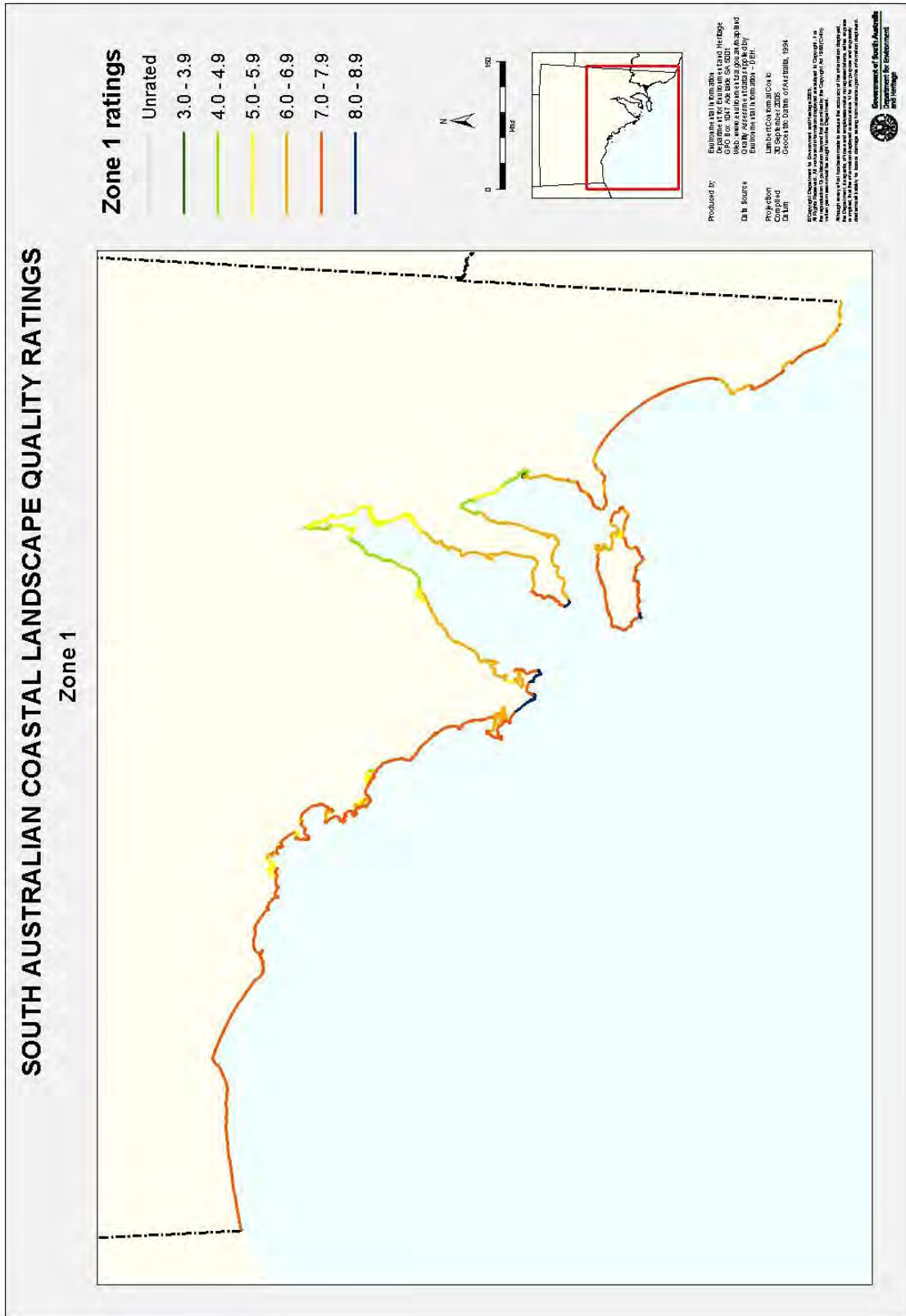


Figure 5.2 South Australian coastal landscape quality ratings Zone 1

5.5 REGIONAL RATINGS

The State figures are disaggregated in Table 5.5 and Figure 5.5 which summarise the regional ratings by distance and by Table 5.6 and Figure 5.6 which provide the detailed regional ratings at a 0.25 range.

At a regional level, the regions with the most extensive highest ratings (7 and 8) were the South East (290 km), Kangaroo Island (343 km), western Eyre Peninsula (1040 km) and the west coast/Nullarbor (488 km).

The following summarises the distribution of the ratings:

- Rating 3 extended over 26 km and entirely occurred in the upper St Vincents Gulf, south of Pt Wakefield.
- Rating 4 totaled 198 km, half of it occurring on eastern Eyre Peninsula and a quarter in the St Kilda - Torrens Island area north of Adelaide.
- Rating 5 totaled over 900 km, the largest length of 350 km occurring in
- Rating 6 totaled 1100 km and occurred in all regions, the largest extent, 371 km, being on Yorke Peninsula followed by western Eyre Peninsula.
- Rating 7 totaled nearly 2000 km and occurred in all regions except the head of the two Gulfs. The longest lengths were in western Eyre Peninsula (670 km), Kangaroo Island (336 km), the west coast/Nullarbor (307 km), and the South East (290 km).
- Rating 8 totaled 570 km, 65% of which was on western Eyre Peninsula (370 km). The top rating 8.5, 19 km, was located at the southern tip of Eyre Peninsula.

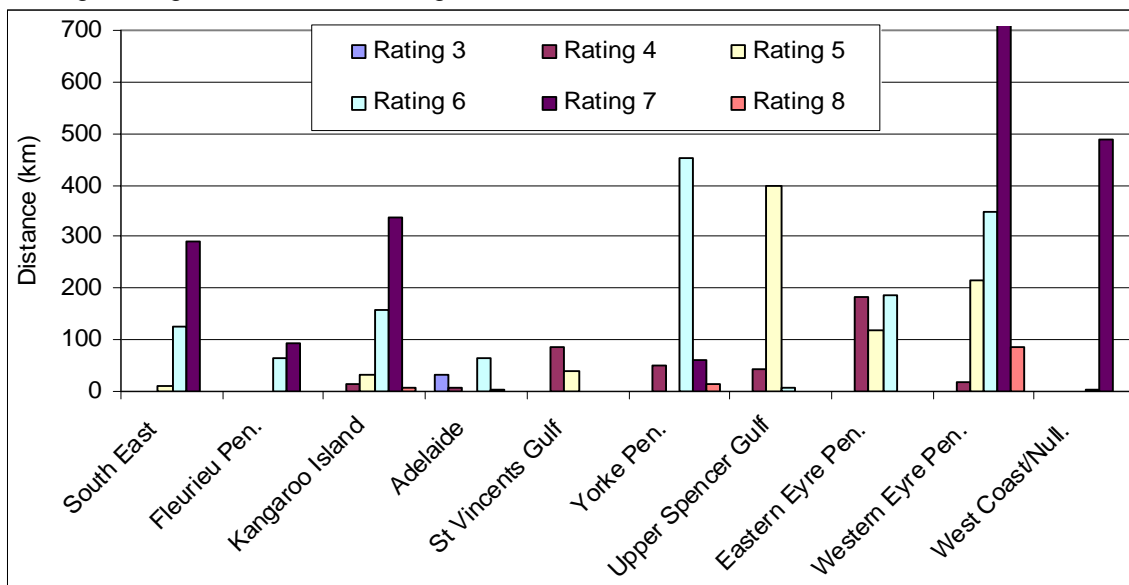


Figure 5.5 Regional Ratings by Length (km)

Table 5.5 Regional Ratings by Length (km)

Rating	SE	FP	KI	Ad	SVG	YP	USG	EEP	WEP	WC/Null	Total	%
na				12.6			26.2				38.8	0.8
3				31.4							31.4	0.7
4			14.9	6.7	85.8	49.3	44.8	181.8	19.4		402.8	8.4
5	9.9		32.5		38.8	0.0	397.3	118.8	216.3		813.5	17.0
6	124.8	63.5	157.6	64.6		453.9	7.2	187.3	348.0	3.3	1410.1	29.4
7	290.4	94.0	335.8	3.1		62.2			714.7	487.7	1987.9	41.5
8			7.4			14.5			85.6		107.5	2.2
Total	425.1	157.5	548.2	118.5	124.6	580.0	475.5	487.9	1384.0	491.0	4792.1	100.0

Table 5.6 Detailed Regional Ratings by Length (km)

Rating	SE	FP	KI	Ad	SVG	YP	USG	EEP	WEP	WC/Null	Total	%
na				12.6			26.2				38.8	0.8
3.75				31.4							31.4	0.7
4.00											0.0	0.0
4.25			14.9	6.7	85.8	8.7	21.7	109.0			246.8	5.1
4.50											0.0	0.0
4.75						40.7	23.1	72.8	19.4		156.1	3.3
5.00							329.3	68.8			398.0	8.3
5.25			32.5		38.8		0.1	50.0	165.4		286.8	6.0
5.50	2.4										2.4	0.1
5.75	7.5						67.9		50.8		126.2	2.6
6.00	3.0	11.8		33.7		18.7	7.2	40.1	7.6		122.1	2.5
6.25	17.6	11.3	27.7	30.9		329.9		14.4	58.7	3.3	493.8	10.3
6.50	15.0					22.1		20.1	42.4		99.6	2.1
6.75	89.3	40.4	129.8			83.3		112.7	239.2		694.7	14.5
7.00	214.3	21.7	18.1	3.1		62.2			242.0	245.2	806.5	16.8
7.25	1.9	28.9	172.4						78.3	61.6	343.1	7.2
7.50	3.8	43.4							110.1		157.2	3.3
7.75	70.5		145.3						284.4	180.9	681.1	14.2
8.00			7.4			14.5			66.2		88.1	1.8
8.25									19.4		19.4	0.4
8.50												0.0
Total	425.1	157.5	548.2	118.5	124.6	580.0	475.5	487.9	1384.0	491.0	4792.1	100.0

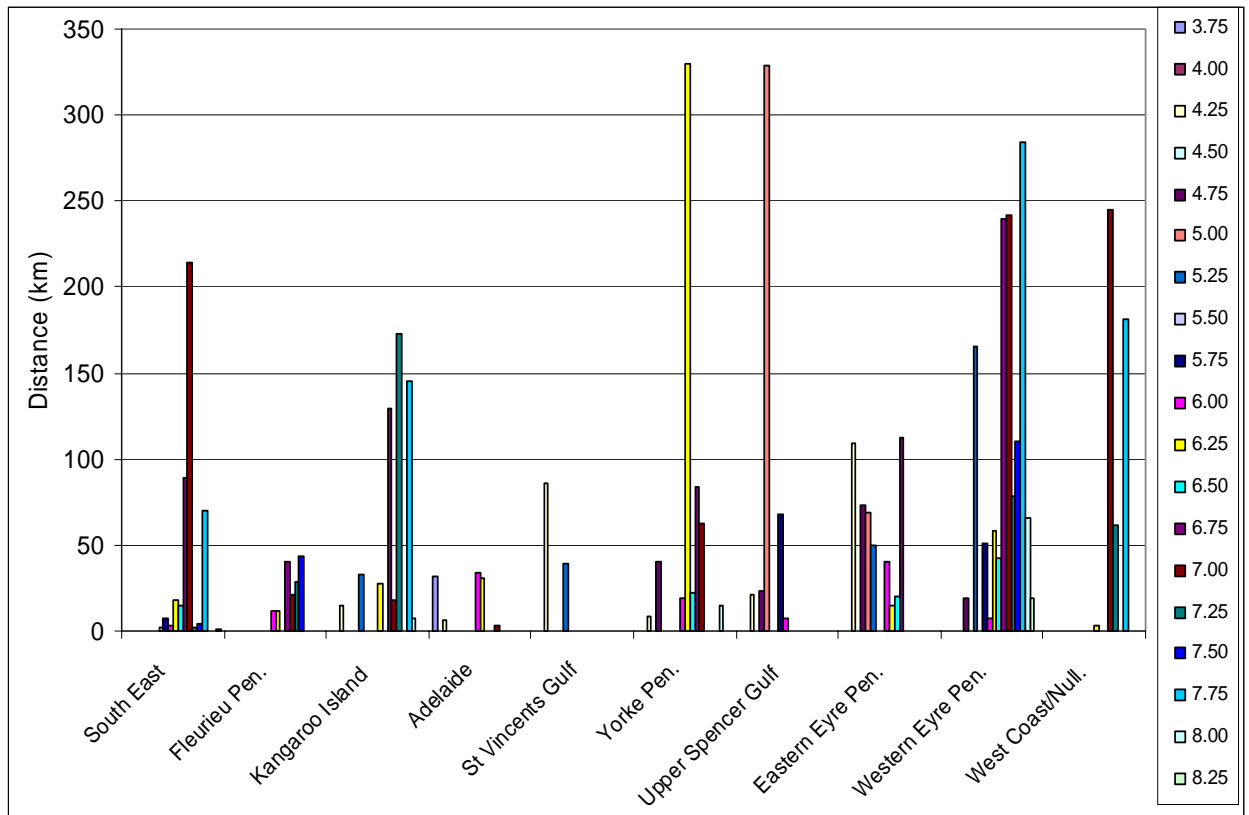


Figure 5.6 Detailed Regional Ratings by Length (km)

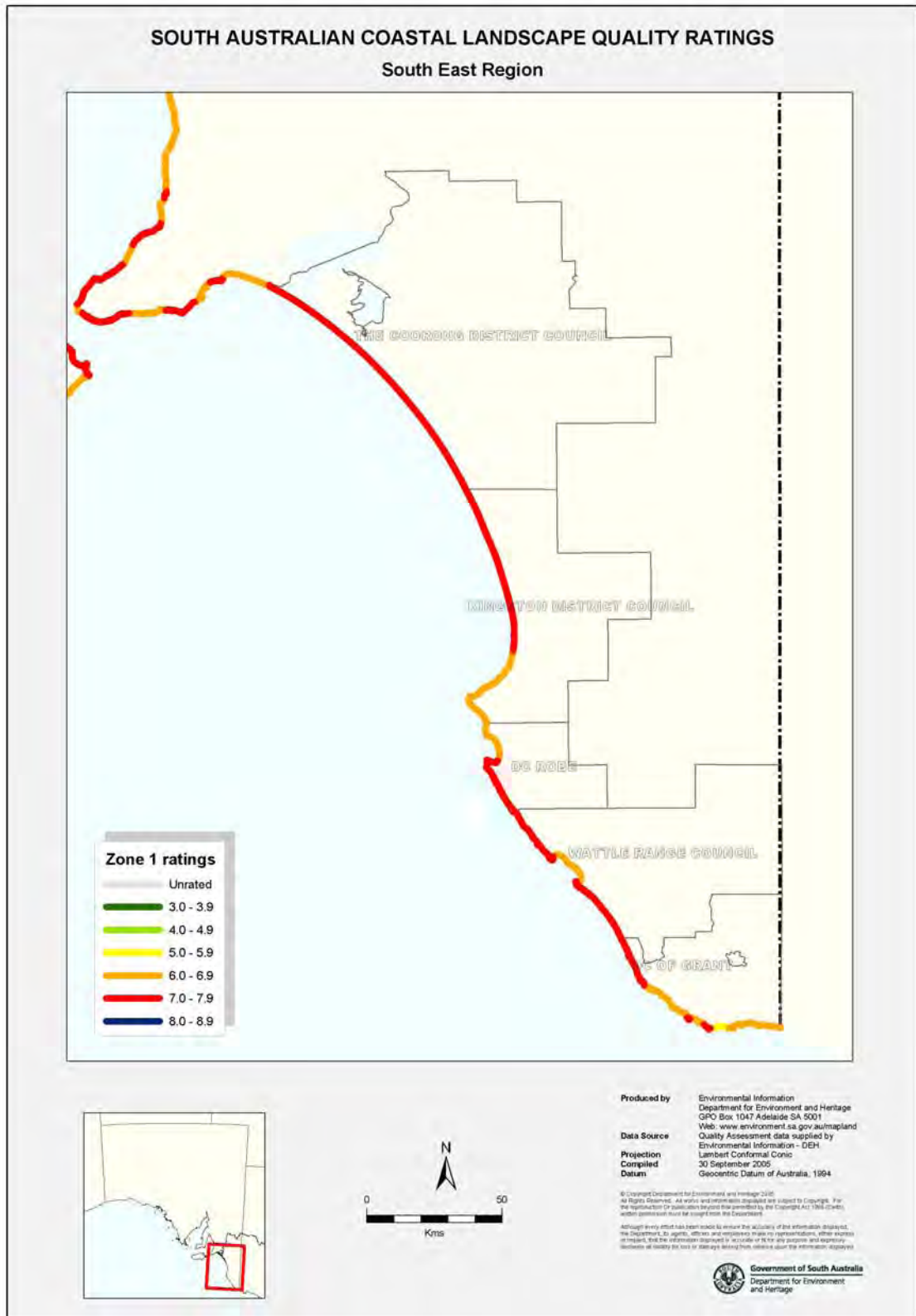


Figure 5.7 South East Regional Ratings – Zone 1

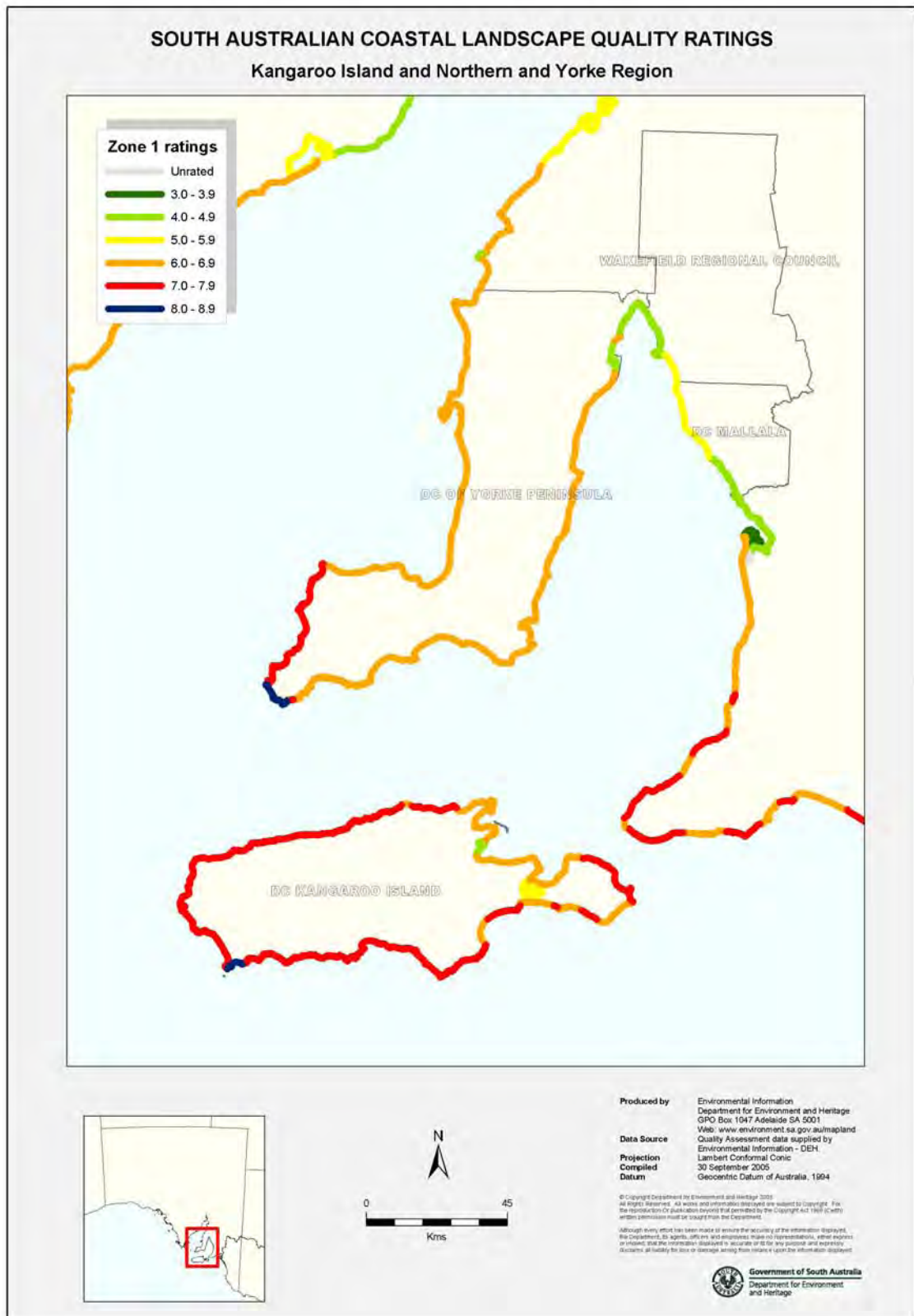


Figure 5.8 Kangaroo Island, Fleurieu Peninsula, Adelaide, St Vincents Gulf, and Yorke Peninsula Regional Ratings – Zone 1

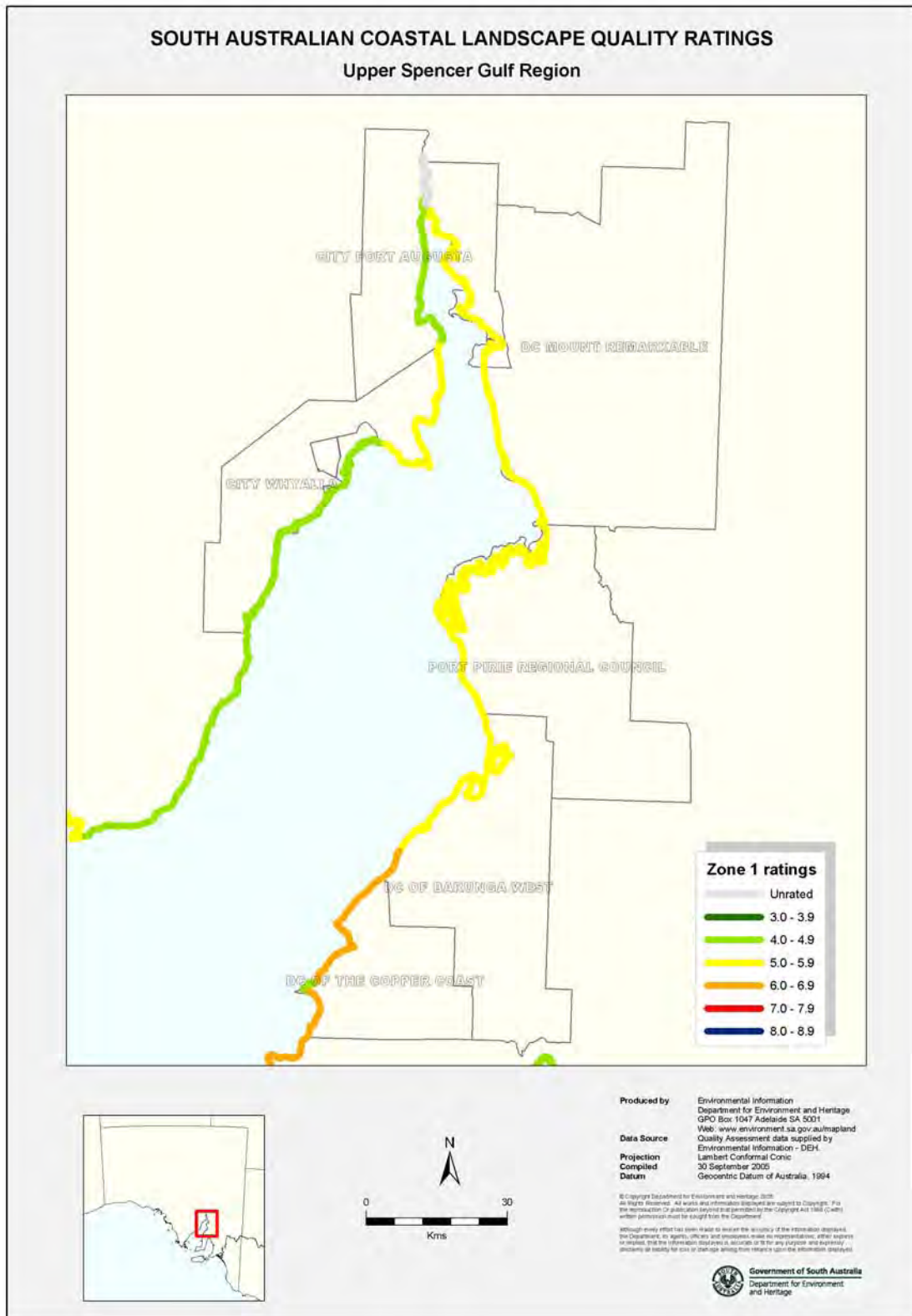


Figure 5.9 Upper Spencer Gulf Regional Ratings – Zone 1

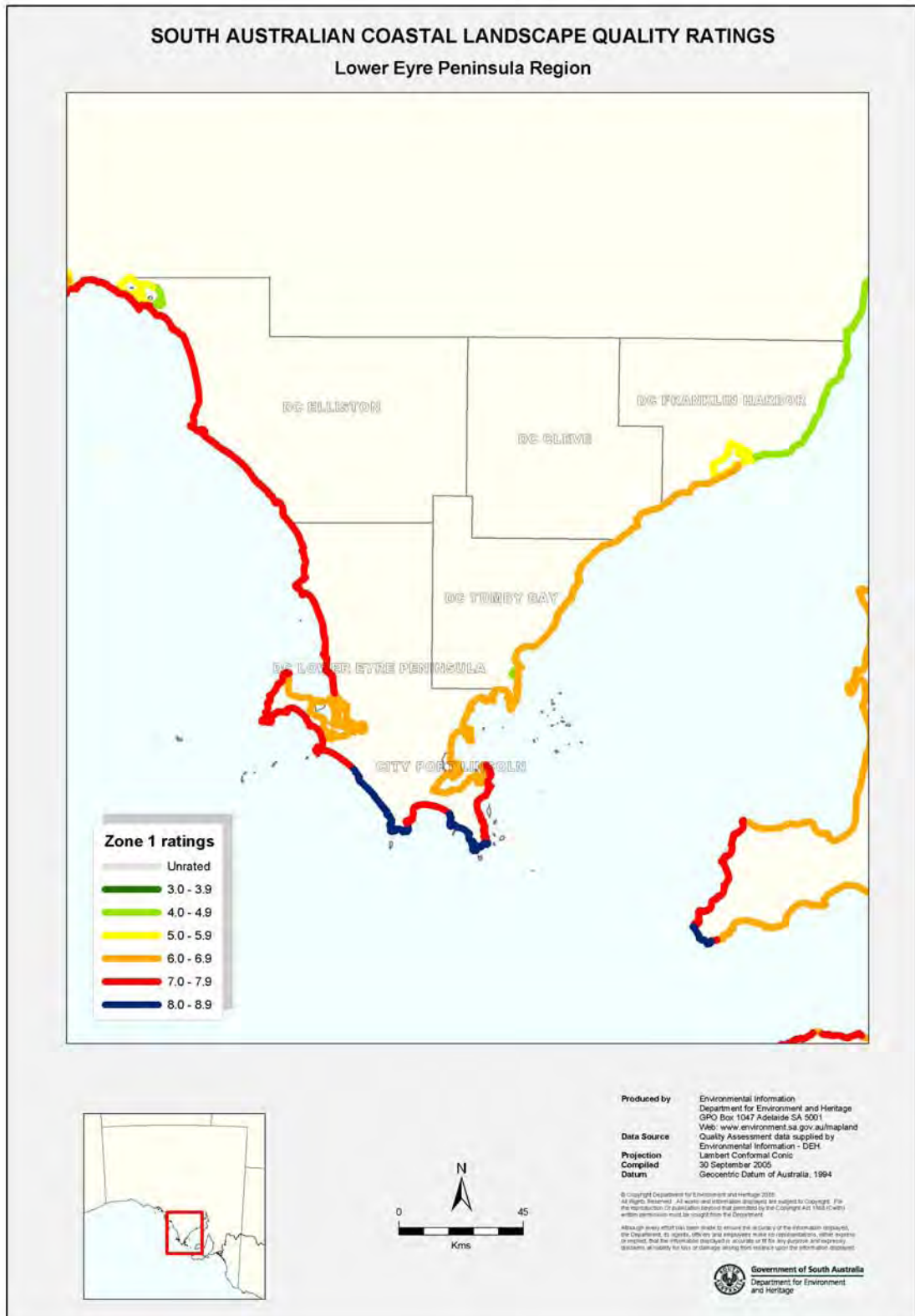


Figure 5.10 Lower Eyre Peninsula Regional Ratings – Zone 1

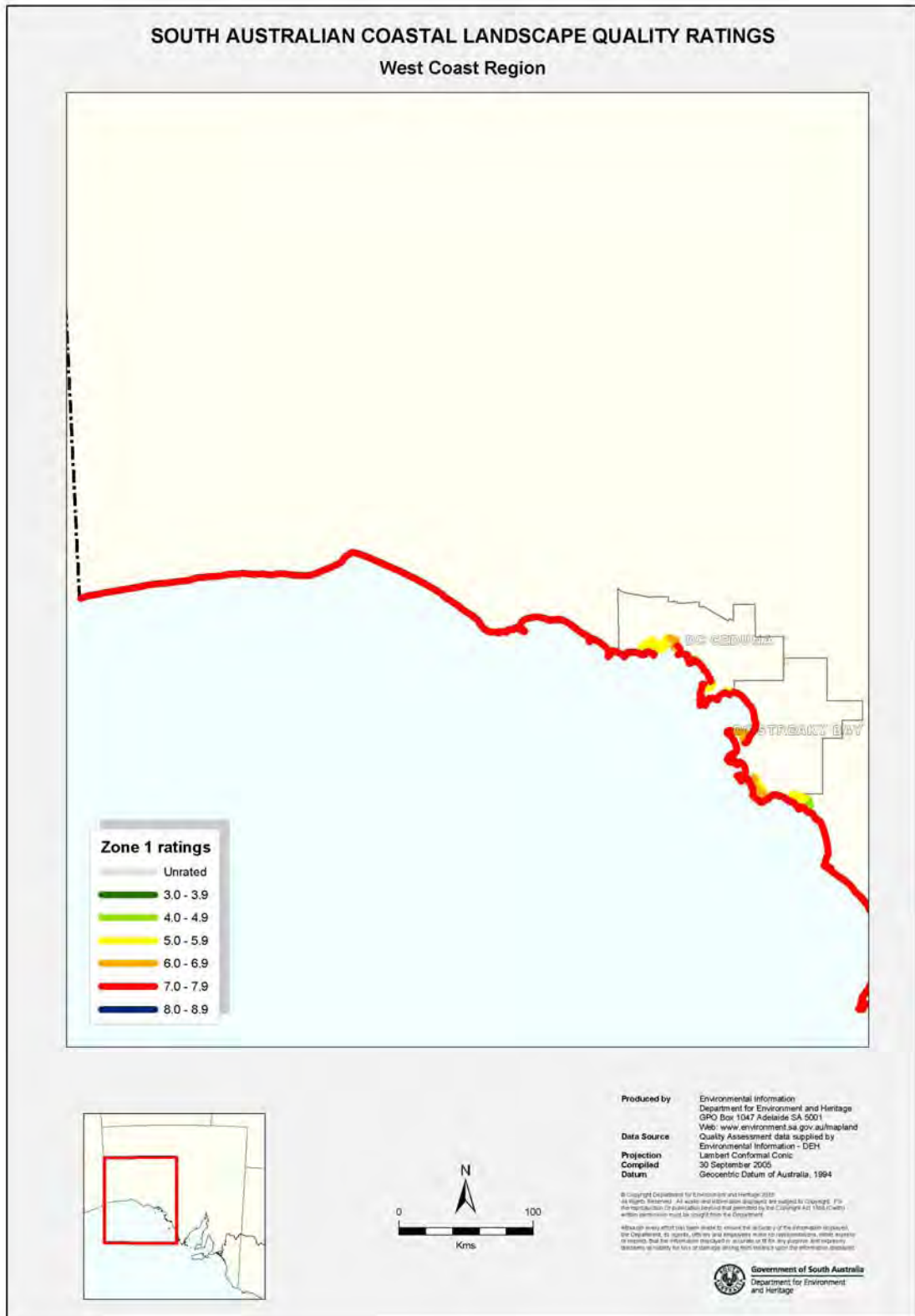


Figure 5.11 West Coast Regional Ratings – Zone 1

Figures 5.7 – 5.11 provides a regional summary of Zone 1 ratings for sections of the South Australian coast.

Peninsula/ West coast dominate. The Out of Councils column covers the west coast, west of Ceduna to the State border.

5.6 COUNCIL RATINGS

Figure 5.12 summarises the lengths of coasts of the highest landscape quality (≥ 7) per council. Kangaroo Island and western Eyre

Tables 5.7 A, B, C & D summarise the ratings by each of the 34 coastal councils plus the areas outside of councils. Maps for each council showing Zones 1, 2 and 3 are contained in the CD.

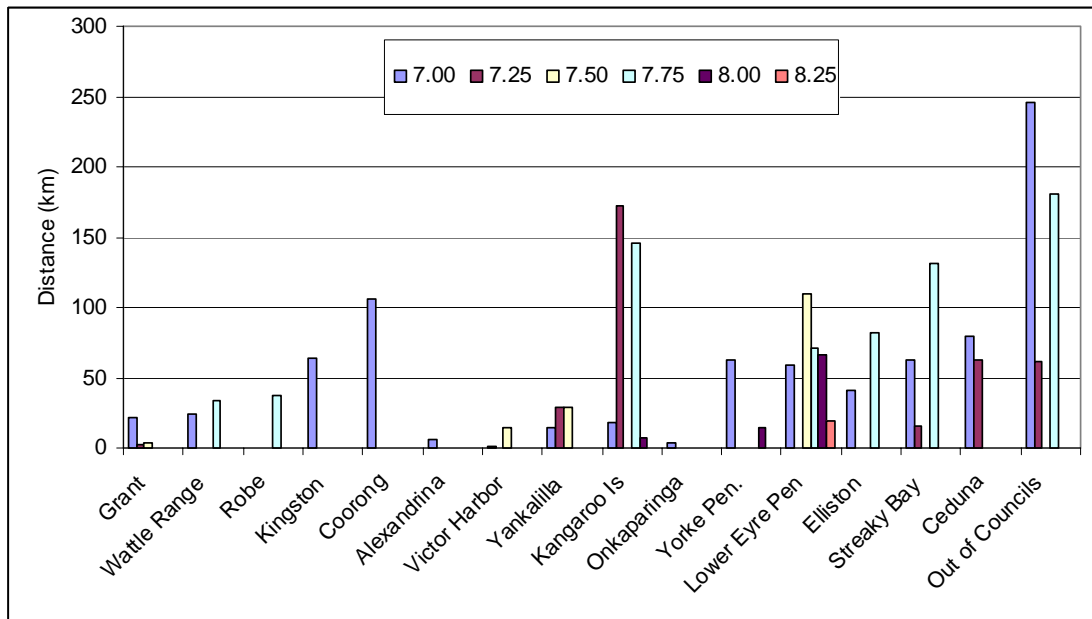


Figure 5.12 Councils with Coasts of High Landscape Quality (≥ 7)

Table 5.7 Ratings and Length (km) of Coast per Council

A. South East, Fleurieu Peninsula & Kangaroo Island

Rating	South East					Fleurieu Peninsula			K. Island
	Grant	Wattle Range	Robe	Kingston	Coorong	Alexandrina	Victor Harbor	Yankalilla	Kangaroo Is
4.25									14.9
4.50									
4.75									
5.00									
5.25									32.5
5.50				2.4					
5.75	7.5								
6.00				3.0		3.8	8.0		
6.25	8.4		6.2	3.0		5.9		5.3	27.7
6.50	15.0								
6.75	30.5	18.3	10.4	30.0		10.5	7.0	22.9	129.8
7.00	21.5	23.8		63.3	105.7	5.4	1.3	15.0	18.1
7.25	1.9							28.9	172.4
7.50	3.8						14.8	28.6	
7.75		33.7	36.8						145.3
8.00									7.4
8.25									
Total	88.5	75.8	53.5	101.7	105.7	25.7	31.1	100.7	548.2

B. Adelaide & St Vincents Gulf

Rating	Adelaide							St Vincents Gulf			
	Onkaparinga	Marion	Holdfast Bay	West Torrens	Charles Sturt	Pt Ad - Enfield	OOC	Salisbury	Playford	Mallala	Wakefield
na						12.6					
3.75						12.2	19.2				
4.00											
4.25						6.7		20.0	11.2	24.6	30.0
4.50											
4.75											
5.00											
5.25										28.5	10.3
5.50											
5.75											
6.00			9.1	1.8	11.5	11.4					
6.25	24.1	6.3	0.4								
6.50											
6.75											
7.00	3.1										
7.25											
7.50											
7.75											
Total	27.3	6.3	9.5	1.8	11.5	42.9	19.2	20.0	11.2	53.1	40.3

C. Yorke Peninsula & Upper Spencer Gulf

Rating	Yorke Peninsula		Upper Spencer Gulf			
	Yorke Peninsula	Copper Coast	Barunga West	Pt Pirie	Mt Remarkable	Pt Augusta
na						26.2
3.75						
4.00						
4.25	8.7					21.7
4.50						
4.75	31.9	8.8				23.1
5.00			50.4	150.1	46.9	81.8
5.25						0.1
5.50						
5.75			36.7	31.2		
6.00	3.7	14.9	7.2			
6.25	293.1	36.8				
6.50	22.1					
6.75	83.3					
7.00	62.2					
7.25						
7.50						
7.75						
8.00	14.5					
8.25						
Total	519.5	60.5	94.3	181.4	46.9	152.9

D. Eyre Peninsula & West Coast

Rating	Eastern Eyre Peninsula					Western Eyre Peninsula				West coast
	Whyalla	Franklin Harbor	Cleve	Tumby Bay	Pt Lincoln	Lower Eyre Pen	Elliston	Streaky Bay	Ceduna	OOC
4.25	101.3			7.7						
4.50										
4.75	1.2	71.7					19.4			
5.00		68.8								
5.25	50.0						9.6	40.3	115.6	
5.50										
5.75								24.8	26.1	
6.00		17.6	15.0	5.6	1.8	7.6				
6.25		14.4						35.7	23.0	3.3
6.50					20.1	42.4				
6.75		2.7	8.7	101.3		205.7		33.5		
7.00						58.5	41.5	62.8	79.2	245.2
7.25								15.8	62.5	61.6
7.50						110.1				
7.75						70.9	81.9	131.7		180.9
8.00						66.2				
8.25						19.4				
Total	152.5	175.2	23.7	114.5	22.0	580.9	152.3	344.5	306.3	491.0

Note: OCC is out of councils.

6.0 COASTAL DEVELOPMENT SURVEY

6.1 PURPOSE & FORM OF SURVEY

The purpose of the coastal development survey was to assess the influence of development on coastal scenic quality. Officers of the Department for Environment and Heritage indicated that they were particularly concerned about housing subdivisions and to a lesser extent, marinas and wind farms. A number of comments on the completed coastal viewscapes survey expressed concern about developments on the coast and included aquaculture development in the coastal area as well as driving on beaches and placing caravans on the beach (e.g. Farm Beach near Coffin Bay).

The form of development in the future is unlikely to be of low standard shack development, so any shack development used in the survey needed to be of a reasonable standard.

The form of survey was duplicate scenes; a scene which included the development and the identical scene without the development.

The survey covered the following categories:

- Urban type development such as is found on Adelaide's coast – Holdfast Shores, housing development
- Urban type development and subdivisions typical of the coast
- Holiday house/higher standard shack development
- Marina developments
- Aquaculture facilities

These were located in a variety of landscapes, ranging from currently developed through to undeveloped. Scenes were prepared in two ways:

- Scenes which already contain development had this removed, to provide with and without scenes
- Scenes without development had images of development inserted

In both cases, care was taken to ensure that the images were inserted to look realistic and appropriately oriented scaled according to the distance. Similarly where developments were removed from a scene, the land form and land cover were reinstated to appear as similar as possible to the surroundings. Scenes of

development from South Australia as well as from Sydney and the NSW coast were used.



Petrel Cove without development 7.99



Petrel Cove with development 4.72

The development should be obvious in the scene, not obscured, or camouflaged or so distant as to be difficult to identify. Over 70 scenes were prepared providing a total of 146 scenes from which 82 scenes were selected. The set of scenes included two scenes of aquaculture and three scenes of marinas. The scenes are included on the CD.

Table 6.1 indicates the number of scenes by landform and distance to the development.

In addition, this chapter reports on a previous survey conducted by the consultant on the impact of wind farms on scenic quality in coastal areas. This used a similar methodology.

6.2 CONDUCT OF SURVEY

The survey was placed on the Internet and commenced on 11 May 2005. By 23 May there had been only 125 participants and at that rate it would not have achieved the required number of 400 by the end of the month. The survey was therefore placed on the Government's Intranet and participation increased. By the termination of the survey on 31 May, 2413 had participated. A total of 1659 (68.7%) participants completed all 82 scenes and their ratings were used in the analysis of development impacts.

Table 6.1 Scenes for Coastal Development Survey

	Distance to Development		
	Near	Middle	Distant
Headlands			
Low headlands		2	2
Medium headland	2	2	2
High headland	3	1	1
Dunes			
Low dunes	3	2	
Medium dunes	4	1	
High dunes	2	1	1
Pt Augusta – Whyalla shacks	2	2	
Adelaide coast	1	1	1
Total	17	12	7

Coastal Development Survey

This survey is intended to contribute to a study of the scenic attractiveness of South Australia's coast. The outcome of this project will assist State and Local government in better planning and management of the coast.

In this survey you are asked to rate the scenic quality of a range of scenes in which various developments have been inserted. Developments include housing and apartments, marinas and aquaculture. Scenes with and without these developments are included in the survey and will be shown in random order.

Many participants provided comments on their attitudes about coastal development and these constitute a valuable resource from a cross-section of the community. The comments are included verbatim on the CD.

6.3 ANALYSIS OF DATA

Overall Results

The data set was examined for evidence of strategic bias. As scenes with and without development were included, clearly the participant means would not show strategic bias as they did in the coastal survey where mean ratings over 9.5 were rejected. Nor would a mean of say 5 be useful. The standard deviations were also assessed as a possible indicator. Finally the data set was examined for arrays of data 1, 10, 1, 10 ... where the 1 would be the rating for the site with development and the 10 for the same site without development. Only one such participant was found although a number of others came close but with a sufficient range of other ratings to be considered genuine. As

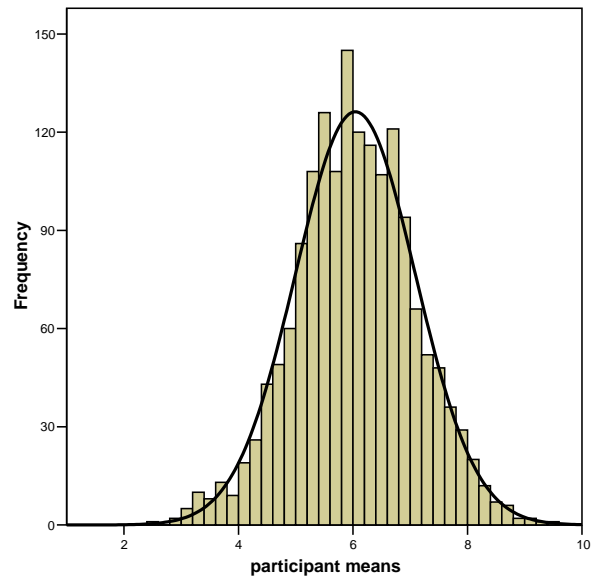


Figure 6.1 Histogram of Participant Means

Normal Q-Q Plot of participant means

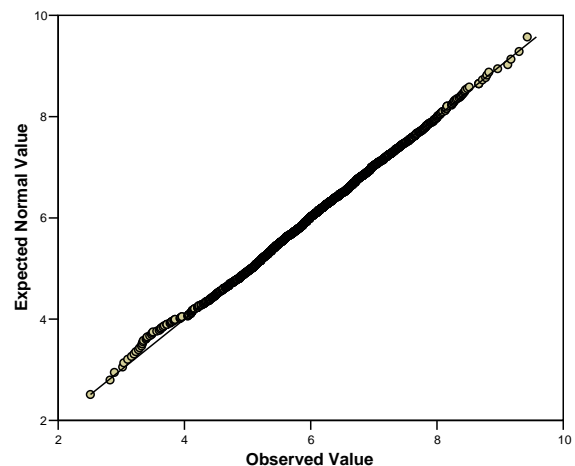


Figure 6.2 QQ Plot of Participant Means

only one participant clearly had strategic bias, it was ignored as its ratings would have negligible effect in a data set of 1659 participants.

Figure 6.1 is the histogram of the mean ratings by the 1659 participants and the QQ plot (Figure 6.2) indicates a very normal distribution. Figure 6.3 is the histogram of the mean ratings of the 82 scenes which suggests a not very normal distribution. However the QQ plot (Figure 6.4) indicates that it is reasonable.

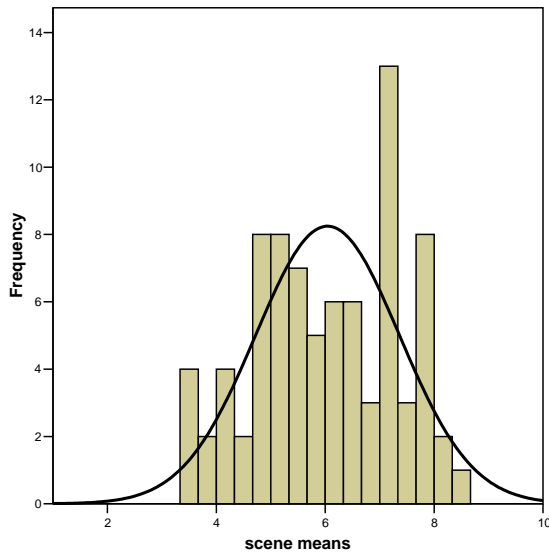


Figure 6.3 Histogram of Scene Means

The overall mean for all scenes without the developments was 7.09 and with development was 5.0, a clear difference of over 2.0. The difference was significant for the overall means: $t = 18.4$, $df = 40$, $p = 0.000$.

Table 6.2 summarises the means for each of the scenes. The Table includes the percentage change in scenic ratings and the highest is a halving of the rating from 7.23 to 3.55 for a scene of low cliffs at Pt Gibbon. The form of development included here was major high rise. The average reduction in scenic quality ratings was 29% but ranged from 10.5% to 50.9%. The differences for each scene were significant, using the paired t test.

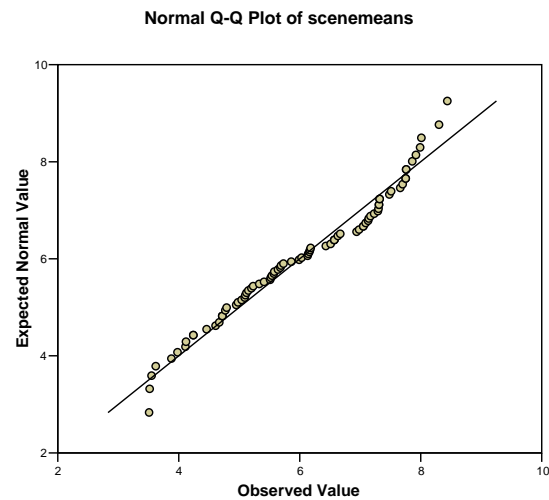


Figure 6.4 QQ Plot of Scene Means

Table 6.2 Ratings of Coastal Development Survey Scenes

Scene	Location	Without development	With development	Difference	% change	p*
SE39	Robe Hooper Beach	7.31	5.33	1.98	27.09	0.000
FP30	Commodore Point, Port Elliot	6.17	5.52	0.65	10.53	0.000
FP74	The Bluff	7.70	5.69	2.01	26.10	0.000
FP97	Petrel Cove & Newland Head	7.99	4.72	3.27	40.93	0.000
FP271	Blowhole Beach	7.66	4.61	3.05	39.82	0.000
FP197	Maslin Beach	7.30	5.54	1.76	24.11	0.000
FP190	Pt Noarlunga south	7.75	5.99	1.76	22.71	0.000
FP176	O'Sullivan's Beach 1	7.05	4.72	2.33	33.05	0.000
FP174	O'Sullivan's Beach 2	7.48	5.51	1.97	26.34	0.000
Ad49	Holdfast Shores 1	6.18	4.46	1.72	27.83	0.000
Ad52	Holdfast Shores 2	6.14	3.62	2.52	41.04	0.000
Ad71	Henley Beach	5.73	4.79	0.94	16.40	0.000
YP270	James Well	6.43	3.52	2.91	45.26	0.000
YP204	Black Point shacks	6.03	3.88	2.15	35.66	0.000
YP250	North Pt Vincent	7.32	5.41	1.91	26.09	0.000
YP222	Pt Vincent marina	5.58	3.98	1.60	28.67	0.000
SPG89	South Pt Augusta 1	6.51	4.95	1.56	23.96	0.000
SPG102	South Pt Augusta 2	6.13	4.24	1.89	30.83	0.000

Scene	Location	Without development	With development	Difference	% change	p*
SPG113	South Pt Augusta 3	6.94	5.23	1.71	24.64	0.000
SPG150	Pt Lowly fishpods	7.17	5.86	1.31	18.27	0.000
SPG166	Pt Lowly	6.16	3.51	2.65	43.02	0.000
EP448	Pt Gibbon South	7.23	3.55	3.68	50.90	0.000
EP440	Cove nth of Pt Neill	7.05	4.12	2.93	41.56	0.000
EP428	Cove nth of Lipson Cove	7.76	5.2	2.56	32.99	0.000
EP427	North of Lipson Cove	7.14	5.09	2.05	28.71	0.000
EP410	Peake Bay W	8.01	7.09	0.92	11.49	0.000
EP378	Groper Bay	8.44	5.15	3.29	38.98	0.000
EP323	Bay south of Coles Point	8.30	7.32	0.98	11.81	0.000
EP315	South Pt Drummond	7.92	5.10	2.82	35.61	0.000
EP293	Nth end of Sheringa Beach	6.98	4.98	2.00	28.65	0.000
EP270	Waterloo Bay - dunes	7.51	5.12	2.39	31.82	0.000
EP271	Cliff & bay at Elliston	7.75	5.04	2.71	34.97	0.000
EP268	Anxious Bay - beach	7.31	4.67	2.64	36.11	0.000
EP225	E end Venus Bay North	6.57	4.24	2.33	35.46	0.000
EP199	Baird Bay North	7.29	4.72	2.57	35.25	0.000
EP215	Baird Bay	7.13	4.77	2.36	33.10	0.000
EP161	Sceale Bay dunes	6.57	4.11	2.46	37.44	0.000
EP128	Smoky Bay aquaculture	6.67	5.68	0.99	14.84	0.000
EP93	Sandy cove – E. of Laura Bay	7.76	5.64	2.12	27.32	0.000
EP76	Cape Vivonne	6.57	5.57	1.00	15.22	0.000
EP30	Near Fowlers Bay	7.86	6.63	1.23	15.65	0.000
Mean		7.09	5.00	2.09	29.49	0.000

* Paired t test

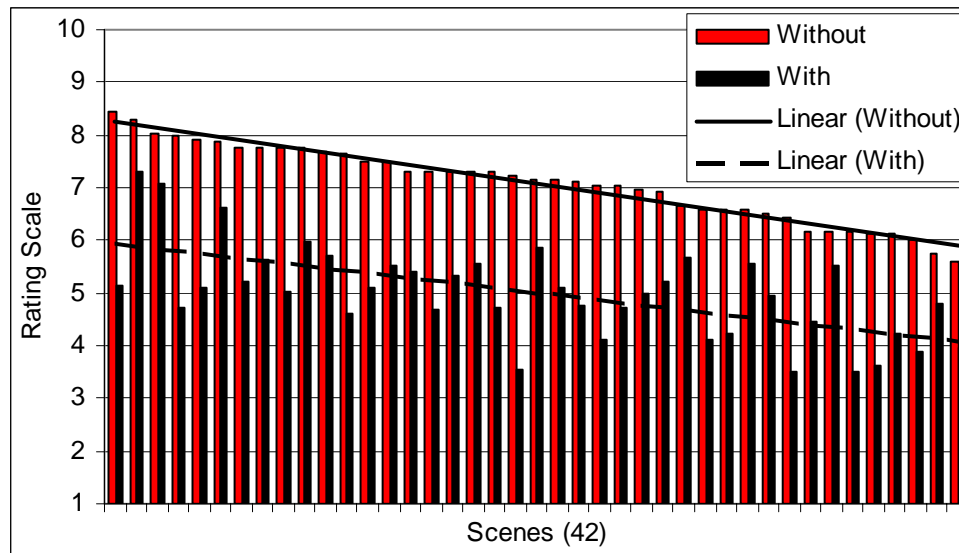


Figure 6.5 Ratings of Scenes Without and With Development
Arranged in descending order of means without development

Figure 6.5 illustrates the impact of development on scenic quality ratings. The data were arranged in descending order of scenic quality ratings to assess whether any relationship is discernible. The impact might be assumed to be greater for scenes of higher scenic quality rating and proportionally lower

for scenes of lesser scenic quality rating. However linear regression analysis indicated near parallel lines of best fit indicating that no such relationship was present. Removing the scenes with marinas and aquaculture from the data set did not change this result.

This finding indicated that the impact of development did not correlate with the level of scenic quality; rather the impact was independent of the particular level of scenic quality and applied uniformly across the range of scenic quality. The decrease in scenic value attributable to development was around two units regardless of whether the scenic quality was eight or four.

This finding is counter-intuitive as it would have been assumed that the impact would be proportionally greater the higher the scenic quality but these results suggest that this is not the case.

This result was based on 42 scenes and while a larger data set may vary it somewhat it is considered unlikely to change it markedly. The strength of the finding suggests that it would not be varied by the inclusion of many more scenes and development examples.

In eight of the scenes the same photograph was used as had been used in the survey of coastal scenic quality. The means of these scenes without development should be similar to those of the original survey. However they were not (Table 6.3). The difference between these averaged 0.88 or nearly 12% and in all scenes, the ratings of the development survey were higher than the original survey. The difference was significant: $t = -4.9$, $df = 7$, $p = 0.0009$.

Table 6.3 Comparison of Ratings of Scenes Common to both Surveys

Description	Original survey	Dev. survey	Diff.	%
Maslin Beach	7.1	7.3	0.2	2.7
Baird Bay	7.08	7.13	0.05	0.7
Sandy cove - E of Laura Bay	7.05	7.76	0.71	9.1
Peake Bay W Cove nth of	6.7	8.01	1.31	16.3
Lipson Cove	6.67	7.76	1.09	14.0
Petrel Cove & Newland Head	6.64	7.99	1.35	16.9
Pt Gibbon S	6.05	7.23	1.18	16.3
Sceale Bay dunes	5.4	6.57	1.17	17.8

Table 6.3 is arranged in descending order of the original survey ratings and interestingly the percentage difference with the development survey increased as the ratings decreased. This indicates close agreement regarding high quality scenes and lower agreement as the

scenic quality decreases – a finding which was noted in the analysis of the original ratings. The fundamental question however remains. Why was there a difference between in the ratings between the two surveys? There are several possible reasons.

Firstly the coastal development survey included no scenes of the wider South Australian landscape to provide a benchmark for the ratings so that they could be taken to represent State-wide ratings. The South Australian scenes contained a far wider range of scenic quality, from gibber plains to the Flinders Ranges whereas the scenes in the coastal development survey comprised a far narrower range. However without the constraint of viewing a wider range of scenic quality, the set of scenes comprised their own context resulting in a spread to higher ratings.

Secondly the coastal development survey contained no scenes of high cliffs, which rated highly, or samphires and mangroves which were at the other end of the scale. Their exclusion made the range of scenic quality even narrower.

Thirdly the coastal development survey contained scenes with and without development whereas the original survey contained no developments in scenes. The mixture may influence ratings of scenes without development – tending to exaggerate the differences, thereby increasing these ratings.

Whatever the reason might be, it is not important that the ratings differed as the results of the coastal development survey stand in their own right. The differences are interesting but do not affect the validity of the results. Although the ratings of the scenes without development should not be taken as necessarily being an accurate measure of scenic quality, they do provide a sound basis for comparing the impact of development on scenic quality.

6.4 DETAILED ANALYSIS

The following tables display the means for a range of options. In all tables, the probability between the two categories - without the development and with the development, was 0.000. In other words, there were significant differences between the two categories for each component. Given the size of the

difference in most cases, it is not surprising that the differences are statistically significant.

Table 6.4 summarises the means for the three forms of development in the survey. The smallest difference was for aquaculture while the differences for housing and marinas were similar. However with only a small number of cases for aquaculture and marinas, these results should not be taken as definitive.

Table 6.4 Means of Different Developments

Development	Without	With	Diff.	%
Housing (36)	7.13	4.98	2.15	30.2
Aquaculture (2)	6.92	5.77	1.15	16.6
Marina (3)	6.70	4.74	1.97	29.3

Using one-way ANOVA on the full data set of differences rather than the averages, the differences between the three forms of development were not significant: $F = 1.93$, $df = 2, 38$, $p = 0.16$.

Thus there was little appreciable difference, certainly none that was statistically significant, in the impact of different forms of development on scenic quality.



Headlands Sheringa Beach 4.98



Dunes Sceale Bay 4.11

Table 6.5 summarises the means for the two landscape units represented in the scenes, headlands and dunes. The average for

headlands was higher than for dunes but the size of the change was larger for dunes; nearly 34% reduction for development on dunes compared with 29% for development on headlands. Again this is partly due to the larger change occurring for scenes of lesser scenic quality. The differences between the two landscape units were not significant: $F = 0.29$, $df = 1, 37$, $p = 0.59$.

Table 6.5 Landscape Units

Landscape unit	Without	With	Diff.	%
Headlands (28)	7.27	5.17	2.1	28.8
Dunes (11)	6.64	4.41	2.2	33.6

Note: excludes aquaculture scenes

Table 6.6 compares the effect that distance to the development had on mean ratings. The difference for the distant scenes was smaller than for the near or middle distant scenes, but the differences were similar for these near or middle distances. The differences in the distances were significant: $F = 5.6$, $df = 2, 36$, $p = 0.008$; due particularly to the smaller difference for the more distant scenes.

Table 6.6 Varying Distance to Development

Distance	Without	With	Diff.	%
Near (3)	6.81	4.46	2.35	34.9
Middle (20)	6.93	4.49	2.43	34.9
Distant (16)	7.36	5.63	1.73	23.4

Note: excludes aquaculture scenes



Shacks, Black Point 3.88



Housing, Pt Lowly 3.51



High rise, Pt Gibbon 3.55

Table 6.7 compares the means for differing forms of development – shacks, housing, and high rise developments. The differences for shacks and high rise were nearly identical while that for housing was lower than for the other two. The differences across the three types of development were not significantly different: $F = 1.78$, $df = 2, 33$, $p = 0.18$.

Table 6.7 Differing Forms of Housing Development

Form	Without	With	Diff.	%
Shacks (3)	6.59	4.02	2.57	39.0
Housing (28)	7.25	5.22	2.03	27.9
High Rise (5)	6.75	4.17	2.58	38.0

Table 6.8 compares the means for scenes in which the development already exists versus those in which the development images have been inserted into the scene to create new developments. There is virtually no difference between the two sets. The differences between the new and existing development were not significant: $F = 0.08$, $df = 2, 34$, $p = 0.77$.

Table 6.8 Existing vs New Development

	Without	With	Diff.	%
Existing development (16)	7.35	5.22	2.13	29.15
New development (20)	7.37	5.18	2.18	29.68

Table 6.9 compares the means for scenes on the basis of how well known the location is to the community. A judgement was made of familiarity for each scene. All the well-known scenes were on the south coast, Noarlunga area and Adelaide beaches. Participants regarded these areas as familiar in the coastal

scenic quality survey. The difference was greater for scenes not well known which is counter-intuitive. It was considered more likely that there would be a greater impact of development perceived for well-known scenes. The differences however on the basis of familiarity were not significant: $F = 2.06$, $df = 2, 34$, $p = 0.16$.

Table 6.9 Familiarity with Scene

	Without	With	Diff.	%
Well known (8)	6.87	5.04	1.83	26.21
Not well known (27)	7.20	4.96	2.24	31.41

6.5 SUMMARY OF COASTAL DEVELOPMENT SURVEY FINDINGS

From this analysis the following conclusions may be derived:

- The differences between scenes with and without development were statistically significant for all groups analysed below.
- The impact of development did not correspond with the level of scenic quality; rather the impact was independent of the particular level of scenic quality and applied uniformly across the range of scenic quality. Thus it cannot be assumed that the higher the level of scenic quality, the greater the impact.
- The largest impact was from housing and marina development while aquaculture appeared to have a lesser impact, however this was based on relatively few aquaculture scenes.
- The impact was similar whether the development was on headlands or dunes.
- While the impact of development was less for the distant scenes, the impact was large for scenes in the near and middle distance.
- The impacts were similar for shack development and high rise development and both were greater than for housing development.
- It made no difference to the impact whether the development was new or existing development had been removed.

- The impact was greater for less well known scenes than for scenes of high familiarity.

The findings regarding the level of impact being independent of the scenic quality rating and also being greater for unfamiliar scenes were surprising as they were contrary to expectations.

6.6 WINDFARM SURVEY

In 2003, the consultant conducted research on the impact of wind farms in both coastal and inland areas of South Australia. The survey included 21 scenes on the coast. The scenes had images of wind farms inserted digitally and scaled in proportion to their distance from the viewer. A total of 311 participants completed the survey.

Overall the presence of wind farms reduced scenic quality rating by 1.52, from 7.61 to 6.09, a significant difference; $t = 14.06$, $df\ 310$, $p < 0.000$.

More interestingly however the study found that the greatest impact was for scenes of high scenic quality and the impact diminished as scenic quality fell (Figure 6.6).

For inland scenes, which are of a lower scenic quality than that found on the coast, the trend lines actually converged at a

rating of 5.1. In scenes below 5.1, the presence of a wind farm could enhance scenic quality.



Mt. Westall with wind farm. Rating 6.63

However on the coast, in all scenes the presence of the wind farm diminished scenic quality. The two trend lines can be used to predict the likely impact of a wind farm on scenic quality of a given rating (Table 6.10).

Table 6.10 Predicted Effect of Wind farm on Coastal Scenic Quality

Rating without wind farm	Rating with wind farm	Difference
8.5	6.51	-1.99
8.0	6.24	-1.76
7.5	5.97	-1.53
7.0	5.71	-1.29
6.5	5.44	-1.06
6.0	5.17	-0.83

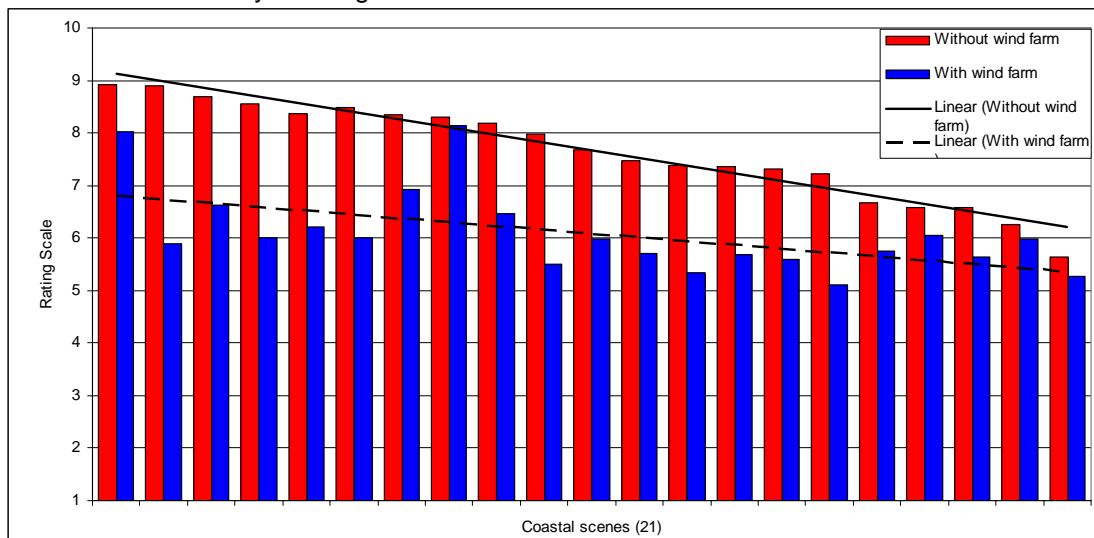


Figure 6.6 Impact of Wind Farms on Coastal Scenic Quality

7. APPLICATION TO POLICY, PLANNING AND DEVELOPMENT ASSESSMENT

7.1 PLANNING AND POLICY REQUIREMENTS

The Project Brief required recommendations for the incorporation of the methodology into the Policy, Planning and Development Assessment processes. This is taken to refer to the application of the *results* of the methodology in these processes rather than the incorporation of the methodology *per se*. It is unlikely that this extensive methodology would be carried out to assist in the assessment of a particular development proposal or in the development of planning policy. Rather the requirement is how the results may be applied in policy, planning and development assessment.

7.2 ROLE OF SCENIC QUALITY ASSESSMENT IN PLANNING

The results of the scenic quality assessment need to be seen in perspective. They provide one input into relevant decision making processes, whether for the development of planning policy or in the assessment of a specific development proposal. It is unlikely that the decision would rest solely on the scenic quality attributes of a given area. However this input may have a significant influence on the outcomes in certain areas, for example, in respect of areas of high scenic quality.

The results also provide one layer in the Geographical Information System, to complement and add to other data on biophysical, social, environmental and economic attributes.

The assessment of scenic quality that has been derived from this project, and the resultant maps are considered sufficiently robust and accurate to provide a basis for the development of planning policy and for the assessment of development applications. While it has been undertaken at a State-wide level, covering all 4,800 km of the State's coastline, nevertheless it has identified the scenic quality of any given section of the coast. Certainly within a small area, some variation would be expected but a rating of, say 6.5, was defined to cover the range of half a unit, from 6.25 to 6.75 which would, in many

cases, cover the range present in a given scene.

Naturalness is a key attribute of high scenic quality and anything that is perceived to diminish this will tend to be regarded negatively. This applies not only to buildings but also to other structures such as boardwalks, steps, fences, paths, roads, car parks, toilets, lighting, powerlines, signs and the many other manifestations of human presence and management of a site. The challenge in scenic quality terms is to maintain the essential naturalness of these coastal landscapes for in so doing the scenic quality will be maintained.

7.3 COASTAL DEVELOPMENT SURVEY

The insights provided by the coastal development survey indicate the scale of change that might result from certain developments. Relevant findings from the Coastal Development Survey are:

- The differences between scenes with and without development were statistically significant for all groups analysed below.
- The impact of development did not correspond with the level of scenic quality; rather the impact was independent of the particular level of scenic quality and applied uniformly (~2.0 units) across the range of scenic quality. Thus it cannot be assumed that the higher the level of scenic quality, the greater the impact.
- The largest impact was from housing and marina development while aquaculture appeared to have a lesser impact, however this was based on relatively few aquaculture scenes.
- The impact was similar whether the development was on headlands or dunes.
- While the impact of development was less for the distant scenes, the impact was large for scenes in the near and middle distance.
- The impacts were similar for shack development and high rise development and both were greater than for housing development.
- It made no difference to the impact whether the development was new

or existing development had been removed.

It was surprising to find that the impact of development on scenic quality was the same across the range of scenic quality, uniformly around 2.0. This suggests that it would be as important to protect the scenic quality of moderate and even low quality scenes as it is to protect high quality scenes. Indeed it could be argued that the impact of a reduction of 2 on a scene rated as 5 is greater than for a scene rated 8; the former reducing to 3 (a 40% reduction), the latter to 6 (a 25% reduction).

Despite this finding, it does not necessarily follow that it is more important to protect areas of moderate and low quality scenic quality than areas of high scenic quality. Comments from participants indicated how important they considered it to be protect high quality landscapes. Moreover, in terms of relative abundance, there were extensive areas of moderate and low scenic quality but relatively few areas of high scenic quality. On the grounds of community value and rarity therefore, protection should be afforded to areas of high scenic value over areas of moderate and low scenic quality. This does not argue for the sacrifice of areas of moderate and low scenic quality; these also should be well managed and maintained, but in terms of priority, the emphasis should be on protection of the areas of high quality.

Although the Coastal Development Survey used scenes on headlands and dunes it is probable that physical factors such as instability of the ground and risk of landslip would limit development in such locations, apart from consideration of any environmental factors and scenic quality. However past waterfront shack developments in South Australia were largely on coastal dunes, and the south coast of New South Wales has many examples of developments on headlands, so development on these areas should not be dismissed as impossible to occur. The risk is that these mistakes could be repeated.

Scenes in the Coastal Development Survey included extensive high-rise development, for example on low cliffs. Such developments are common in areas such as the Gold Coast and Sunshine Coast in Queensland and around Sydney Harbor. While the form of development in South Australia is generally of a lower height and a lower density than in these areas, nevertheless the Holdfast Shores

development at Glenelg may be a sign of what could occur in future. It is significant that the scene of the Holdfast Shores development from the Glenelg beach scored one of the largest impacts – 41% reduction in scenic quality from 6.14 to 3.62, a reduction of 2.52 which is very substantial.

7.4 ACCESS TO AREAS OF HIGH SCENIC VALUE

It could be argued on tourism grounds that access needed to be provided to all areas of high scenic value. Access here refers to vehicular access along made roads, not by 4WD along a bush track. The risk is that the provision of such access will damage or at least diminish the scenic quality it is meant to serve. This argues for very great care to be taken in the design, routing and construction of any such access.

A very popular means of enabling people to experience high quality landscapes is by the construction of linear access roads along the coast, similar to the Great Ocean Road in Victoria. However such coastal roads can be very damaging of the coastal environment, of creeks flowing to the sea, and can also form barriers to wildlife. There are localities in which a road along the coast can work without these impacts, for example a cliff top road such as at Cape Finniss near Elliston where a ring route provides excellent access and views over a high quality landscape.

Generally however a series of spur roads to coastal lookouts from roads set well back from the coast is preferable as these have minimal impact on the coastal environment yet provide visitors with access to the view. An example is the series of roads to the coast from the Robe – Nora Creina Road. The highway across the Nullarbor similarly has spur roads that overlook the impressive cliffs facing the Great Australian Bight. Another good example is the loop road that services Innes National Park at the foot of Yorke Peninsula from which spur roads reach the bays and lookout areas.

Whalers Way is a private road south of Port Lincoln that provides access to the highest quality coastal landscapes in South Australia. This is a mixture of a loop road and spurs, however the loop road is considered too close to the cliffs and considerable erosion has occurred, either from the road or heavy visitation. The area requires considerable restoration.

It is not proposed to suggest that high-grade vehicular access be provided to all of the high quality coastal seascapes where it does not already exist. An example is the Cape Catastrophe to Cape Tournefort coast in Lincoln National Park. Parts of this coast are accessible by a 4WD track. Access in natural areas such as this is appropriate by 4WD or by walking, it is inappropriate to provide a graded road.

7.5 COASTAL POLICY AND DEVELOPMENT ASSESSMENT IN AUSTRALIA AND OVERSEAS

Provisions describing policies relating to scenic quality in the coastal zone and also to the consideration of development within that zone are contained in the Appendix to this Chapter. They cover all Australian states and some overseas examples.

7.6 SYNTHESIS OF SCENIC POLICIES

From this review of policies related to the identification, protection and management of scenic policies, the following provides a synthesis.

Vision

Celebrate and appreciate the beauty of our coast and its contribution to our quality of life and economic well being.

Objectives.

- Identify the scenic quality of the coast.
- Protect and manage the scenic quality of the coast with priority to areas of high scenic quality.
- Development should be compatible with the protection and enhancement of coastal scenic quality through design of developments to be in harmony with coastal landscapes.
- Prohibit certain developments in areas of high scenic quality.
- Protect areas which form an attractive background to urban and tourist developments.

- Protect vistas, scenic outlooks, the skyline and the view from scenic routes including roads and trails.

Principles

- Development should not be undertaken that may adversely affect coastal features or significant views.
- Parts of the coast should remain largely inaccessible to protect high quality landscapes.
- Developments which are proposed to be located outside urban and tourist zones should be sited and designed to not adversely affect:
 - Areas of high scenic quality;
 - Views from the coast, near-shore waters, public reserves, tourist routes & walking trails

Classification

Identify and protect Landscapes of State Significance being landscapes which are recognised as having exceptional or unique statewide, national or international aesthetic values

Definition of coastal zone

- State waters to 3 nautical miles, including islands
- Land subject to tidal influence including dunes, wetlands, mangroves, estuaries, coastal river and coastal lagoons
- One kilometre landward of the open coast high water mark
- A distance of one kilometre around all bays, estuaries, coastal lakes, lagoons and islands

7.7 DEVELOPMENT ACT

The Planning Strategy and Development Plan which are instruments under the Development Act were referred to in Sec. 7.5.

The Development Act defines what constitutes development and it is significant for coastal scenic quality that several important development types are excluded (see Schedule 3). This means that they are not subject to the normal development approval processes.

Potentially significant coastal developments which do not require development approval include:

- Certain forms of advertising displays
- Council works including roads, effluent drainage schemes, recreation areas or recreation building (< 30 m²), playground equipment, works depot building (< 200 m² area or < 10 m ht).
- Outbuildings which would be regarded as complying development (< 10 m² area or < 2.5 m ht)
- Swimming pool
- Water tank
- Aerials and towers (< 10 m outside Adelaide)
- Rail infrastructure

There are many examples of scenes, particularly on headlands in NSW, where an outstanding coastal view has been irreparably marred by the construction of a toilet block by a well meaning local council.

In areas of high quality it does not take much to degrade the view. If landscapes of State Significance are declared on the coast, then it will be vital that amendments are made regarding these Development Act exclusions.

7.8 DEVELOPMENT OPTIONS FOR HIGH QUALITY COASTS

A fundamental issue regarding those coasts identified as of high scenic quality, should they be afforded some form of protection, even a veto over development? The foregoing section of policies suggests that governments are willing to curb development to protect important environmental assets including scenic quality.

With the quantification of scenic quality that has been produced by this project, it could be suggested that development be prohibited from any coast where the scenic quality was rated at, say, 7.5 or higher. This would include areas in lower Eyre and Yorke Peninsulas, a considerable part of the Kangaroo Island coast, parts of the South East coast, and areas along the south coast of Fleurieu Peninsula.

The designation of the Hills Face Zone overlooking Adelaide with strict planning controls provides a precedent for similar designations of Significant Coastal Zones.

A related issue is whether the control of development in high quality scenic areas should remain with local government or be considered as a matter of State significance?

A relevant question would be whether such a prohibition covered developments such as lighthouses which are to be found in such localities. Should it cover other communication facilities such as towers? Should it extend to roads, visitor facilities, interpretation centres, tourism accommodation and shopping facilities?

A range of developmental and access options are possible:

- A complete exclusion of all development including access with the area remaining essentially in its original state and access only by foot.
- Basic access and facilities which could include 4WD tracks and possibly basic toilet facilities.
- More comprehensive access with made roads and full visitor facilities but no accommodation or retail facilities.
- Comprehensive access with made roads, full visitor facilities, and accommodation and retail facilities.

Each of these options has implications regarding their development costs, environmental impacts and potential economic benefits to the local and regional economy.

It is considered that the level of access and development in relation to scenic quality, particularly in areas of high scenic quality, is an important policy issue that should not be resolved without adequate opportunity being provided for public input and discussion.

Should development be permitted, there would need to be explicit rules covering issues such as location, form, materials, plantings, management of the area and so on. In areas designated as significant landscapes, consideration should be given to calling up development proposals as State significant developments for a decision at the State Government level. This may require amendment of Sec 34(1)(vi) of the Development Act. The following section provides proposals covering these issues.

7.9 PROPOSED SCENIC QUALITY PLANNING POLICY AND DEVELOPMENT MANAGEMENT GUIDELINES

The following proposals are intended to fulfil the requirement in the Project Brief for recommendations covering the Policy, Planning and Development Assessment processes.

It is emphasised that these proposals solely cover scenic quality but it is not expected that planning policy or development management would be confined only to this aspect but rather consider it alongside other environmental and planning considerations.

The structure of the approach is described followed by the strategy and then detailed recommendations are provided covering a range of developments.

Structure

The following structure is proposed:

- Zones 1, 2 and 3 covering the land from the coast to 5 km inland
- Scenic quality levels 1, 2, and 3

Zones 1, 2, 3

It is proposed that the land along the coast be zoned in respect of its relationship to the sea and its scenic quality by the following three zones:

- **Zone 1** The coast being the land immediately facing the sea including cliffs, beaches, dunes, headlands etc
- **Zone 2** Land from which the sea is visible up to a distance of 5 km
- **Zone 3** Land within 5 km of the sea from which a view of the sea is obscured by topography

The sea includes the ocean, inlets, bays and estuaries.

These zones correspond closely with the Zones 1, 2 and 3 in this project. Zone 1 comprises the 100 m strip above HWM. Zone 2 comprises the land inland of Zone 1 and defined as visible from the sea in the Coastal Viewshed maps. Zone 3 is the land on the Viewshed maps which is shown to be out of sight from the sea.

It needs to be appreciated that many areas of Zone 3 land do not have a sea view but are very close to the sea. Such areas require safeguards to ensure that developments do not degrade the scenic quality of the coast.



Figure 7.1 South East coast showing Zone 3 (without toning) near coast

The choice of 100 m for Zone 1 was predicated on the need for a uniform width sufficient to encompass most of the key attributes of the sea/land interface. In some localities, 100 m would be insufficient to reach the top of the first set of dunes while in other areas such as the top of cliffs, it may be too wide.

The principle of a continuous coastal strip of uniform width was enshrined in the early surveys of South Australia when the Colonial Commissioners instructed the Surveyor General to provide a one chain road along the entire coastline. This became a public reserve and much of it remains to this day. One chain is 66 feet (~20 m). The principle is of a continuous strip of uniform width which the 100 m strip emulates.

It also accords with the definition of the coast under the Coast Protection Act as including land above and within 100 m of HWM.

Scenic Quality 1, 2, 3

- **Scenic Quality 1** comprises land of high scenic quality.
- **Scenic Quality 2** comprises land of moderate scenic quality
- **Scenic Quality 3** comprises land of low scenic quality

Table 7.1 Strategic Hierarchy of Coastal Scenic Quality Planning Policy

	SQ 1	SQ 2	SQ 3
Zone 1	Ensuring high levels of protection, management & enhancement while providing for public access and viewing where appropriate. No structures or made vehicular access routes. Maintain natural character & scenic quality. Essentially no modification.	Protecting the key characteristics of the Zone while providing for public access, facilities and limited development where appropriate and which complements the scenic character & scale. Maintain natural character & scenic quality. Limited structures and modification.	Ensuring the protection of environmental values while providing for access, facilities and developments where appropriate. Maintain natural character & scenic quality. Limited structures and modification.
Zone 2	Ensuring the protection of the quality of Zone 1 while providing for access, facilities and developments where appropriate and which complement the scenic character & scale. Within 1 km ensuring development and access has negligible impact on scenic quality.	Ensuring the protection of the quality of Zone 2 while providing for access, facilities and developments Within 1 km ensuring development and access has minimal impact on scenic quality.	Ensuring the protection of environmental values while providing for access, facilities and developments.
Zone 3	Ensuring the protection of the quality of Zone 1 while providing for access, facilities and developments where appropriate. Within 1 km ensuring development and access has negligible impact on scenic quality.	Ensuring the protection of the quality of Zone 2 while providing for access, facilities and developments Within 1 km ensuring development and access has minimal impact on scenic quality.	Ensuring the protection of environmental values while providing for access, facilities and developments.

Note: Planning policies will also need to take account of other environmental & planning aspects.

The location of these scenic quality levels would be defined by reference to the findings of this project. The suggested levels are:

- SQ1 ≥ 7.25**
- SQ 2 ≥ 5.0 < 7.25**
- SQ 3 ≥ 3.0 < 5.0**

The choice of the level is a policy issue and will require wide consultation and discussion.

Strategy

The strategy is summarised by Figure 7.2 and Table 7.1 and comprises high levels of protection for Zone 1/SQ1 which diminishes for SQ2 and SQ3 and for Zones 2 and 3, allowing progressively greater levels of access, structures and developments consistent with maintaining the scenic values

as well as other environmental values (e.g. wetlands in SQ3).

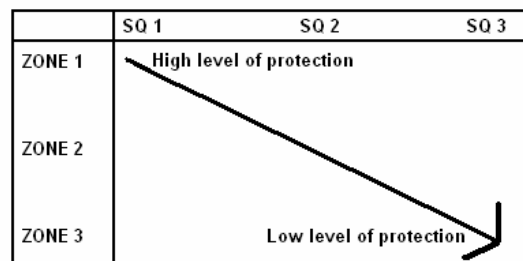


Figure 7.2 Policy Framework

The reference to developments in Table 7.1 or elsewhere in this section does not necessarily imply their support as this would depend on the consideration of all relevant environmental and planning factors which is beyond the scope of this report.

Provisions

Tables 7.2 – 7.6 summarise the planning policy as proposed for specified areas. These cover:

- Access
- Visitor facilities
- Structures and infrastructure
- Commercial developments
- Tourist resort developments
- Housing developments
- Mining and extractive industries
- Wind Farms
- Aquaculture
- Marinas
- Marine Infrastructure

Table 7.2 Access

	SQ 1	SQ 2	SQ 3
Zone 1	No made vehicular access. Walking paths.	Sensitively designed & constructed vehicular access. Preferably spur access, no coastal roads. Walking paths	Sensitively designed & constructed vehicular access. Walking paths
Zone 2	Sensitively designed & constructed vehicular access. Preferably spur access, no coastal roads. Car parks. Walking paths	Vehicular access. Car parks. Walking paths	Vehicular access. Car parks. Walking paths
Zone 3	Vehicular access. Car parks. Walking paths	Vehicular access. Car parks. Walking paths	Vehicular access. Car parks. Walking paths

Table 7.3 Visitor Facilities

	SQ 1	SQ 2	SQ 3
Zone 1	Seats, guard rails, boardwalks, steps, low interpretation signage	Seats, guard rails, boardwalks, interpretation signage, shelters, fences. Minimise height of facilities.	Seats, guard rails, boardwalks, interpretation signage, shelters, fences
Zone 2	Seats, guard rails, boardwalks, interpretation signage, shelters, fences. Interpretation and visitor facilities. Minimise height of facilities.	Seats, guard rails, boardwalks, interpretation signage, shelters, fences. Interpretation and visitor facilities	Seats, guard rails, boardwalks, interpretation signage, shelters, fences. Interpretation and visitor facilities
Zone 3	Seats, guard rails, boardwalks, interpretation signage, shelters, fences. Interpretation and visitor facilities. Ensure facilities are not visible from sea.	Seats, guard rails, boardwalks, interpretation signage, shelters, fences. Interpretation and visitor facilities	Seats, guard rails, boardwalks, interpretation signage, shelters, fences. Interpretation and visitor facilities

Table 7.4 Structures & Infrastructure

	SQ 1	SQ 2	SQ 3
Zone 1	No permanent structures of infrastructure except marine related. No overhead cables.	Sensitively designed and located permanent structures for visitors. Minimise height of structures & infrastructure. Vegetative screening.	Sensitively designed and located permanent structures for visitors. Vegetative screening.

Zone 2	Sensitively designed and located permanent structures & infrastructure. No multistorey buildings. Minimise height of structures & infrastructure. Vegetative screening.	Sensitively designed and located permanent structures & infrastructure. Vegetative screening.	Sensitively designed and located permanent structures & infrastructure. Vegetative screening.
Zone 3	Carefully designed and located permanent structures & infrastructure. Ensure structures & infrastructure are not visible from sea.	Carefully designed and located permanent structures & infrastructure	Carefully designed and located permanent structures & infrastructure

Table 7.5 Commercial Developments

	SQ 1	SQ 2	SQ 3
Zone 1	No commercial developments	Sensitively designed and located commercial developments. Low scale. Vegetative screening.	Sensitively designed and located commercial developments. Vegetative screening.
Zone 2	No commercial developments within 1 km. Beyond 1 km, sensitively designed and located commercial developments. No multistorey buildings. Vegetative screening.	Sensitively designed and located commercial developments. Vegetative screening.	Sensitively designed and located commercial developments. Vegetative screening.
Zone 3	Carefully designed and located commercial developments. Ensure buildings & associated structures are not visible from sea.	Carefully designed and located commercial developments. Vegetative screening.	Carefully designed and located commercial developments

Table 7.6 Tourist Resort Developments

	SQ 1	SQ 2	SQ 3
Zone 1	No tourist resort developments	Sensitively designed and located tourist resort developments. Low scale. Vegetative screening.	Sensitively designed and located tourist resort developments. Vegetative screening.
Zone 2	No tourist resort developments within 1 km. Beyond 1 km, sensitively designed and located tourist resort developments. No multistorey buildings. Vegetative screening.	Sensitively designed and located tourist resort developments. Vegetative screening.	Sensitively designed and located tourist resort developments. Vegetative screening.
Zone 3	No tourist resort developments within 1 km. Beyond 1 km, carefully designed and located tourist resort developments. Ensure buildings & associated structures are not visible from the sea.	Carefully designed and located tourist resort developments. Vegetative screening.	Carefully designed and located tourist resort developments

Table 7.7 Housing Developments

	SQ 1	SQ 2	SQ 3
Zone 1	No housing developments	No housing developments	No housing developments
Zone 2	No housing developments within 1 km. Beyond 1 km, sensitively designed and located compact housing developments. No multistorey buildings	Sensitively designed and located compact housing developments. Vegetative screening.	Sensitively designed and located compact housing developments
Zone 3	No housing developments within 1 km. Beyond 1 km carefully designed and located compact housing developments. No multistorey buildings. Ensure buildings & associated structures are not visible from sea.	Carefully designed and located compact housing developments	Carefully designed and located compact housing developments

Mining and extractive industries

Mining and extractive industries should not be located within 1 km of SQ1 coast. Mining and extractive industries in SQ2 coasts should minimise their visual impact on scenic quality and have stringent post-operational restoration requirements.

Wind Farms

Wind farms should not be located within 1 km of Zone 1 on a SQ1 coast. Offshore wind farms should not be located within 5 km radius of a SQ 1 coast.

Aquaculture

Aquaculture facilities at sea (e.g. fish pods, oyster racks) should not be placed near a SQ1 coast. They should be a minimum of 1 km distance from the coast (LWM).

Marina

Marina facilities should not be located adjacent to SQ1 coasts.

Marine Infrastructure

Jetties, loading or transfer facilities, permanent buoys and other permanent marine infrastructure should not be located within 1 km of SQ1 coast, except to fulfil safety requirements.

7.10 RECOMMENDATIONS

It is recommended that the following be adopted as defined in Section 7.7:

1. Zones 1, 2 and 3
2. SQ 1, 2, and 3
3. A distance of 100 m for Zone 1
4. A distance of 1 km within Zones 2 & 3
5. The Strategic Hierarchy of Coastal Scenic Quality Planning Policy (Table 7.1)
6. The proposed policy measures applying to:
 - Access (Table 7.2)
 - Visitor facilities (Table 7.3)
 - Structures and infrastructure (Table 7.4)
 - Commercial developments (Table 7.5)
 - Tourist resort developments (Table 7.6)
 - Housing developments (Table 7.7)
 - Mining and extractive industries
 - Wind Farms
 - Aquaculture
 - Marinas
 - Marine Infrastructure

APPENDIX COASTAL POLICY AND DEVELOPMENT ASSESSMENT IN AUSTRALIA AND OVERSEAS

QUEENSLAND

State coastal management plan, (no date)

Designated Landscape Area

Areas of State significance (Cultural heritage) are places declared as Designated Landscape Area. A Designated Landscape Area is declared under the Cultural Record (Landscapes Queensland and Queensland Estate) Act 1987 (Cultural Record Act) to prevent or regulate the entry of persons so as to protect areas of landscape value. The policy is that decisions regarding uses and activities adjacent to “areas of State significance (cultural heritage)” are to be compatible with the protection of the area’s values.

The context of the Act however makes it clear that these are landscapes of indigenous significance, not aesthetic landscapes.

State Coastal Management Plan, 2001(?)

Section 2.7 Coastal landscapes

Coastal management outcomes

The scenic and cultural values associated with coastal landscapes are protected.

Principles

- 7A** The values of coastal landscapes are conserved and recognised for their importance to the quality of life of both residents and visitors, as well as to the economic development and growth of Queensland.
- 7B** The dominance of the natural character of the coast (excluding developed urban areas) is retained, including elements of landscape and vegetation.
- 7C** The cultural and spiritual values of coastal landscapes are recognised and conserved through the involvement of the relevant Indigenous Traditional Owner communities.

Policies

2.7.1 Areas of state significance (scenic coastal landscapes)

This policy seeks to achieve the following ‘Coastal landscapes’ principles: 7A, 7B

Policy context

‘Areas of state significance (scenic coastal landscapes)’ are areas of outstanding and distinctive scenic quality and are high priority areas for scenic landscape management within Queensland (refer to Schedule 2). The richness of the Queensland coast is partly due to the diversity of coastal landscapes. If all landscapes were the same, resources and opportunities and their associated economic and social values would be greatly reduced. In particular, Queensland’s tourism industry is reliant upon this richness and diversity. Natural coastal landscapes also serve to separate and balance more intensively developed coastal landscapes.

Policy

In preparing regional coastal plans, ‘areas of state significance (scenic coastal landscapes)’ are to be identified and their diversity, quality and extent of scenic landscape values are to be recognised and protected. Schedule 2 provides the preferred criteria for determining ‘areas of state significance (scenic coastal landscapes)’, however the identification process should use other relevant and current information including landscape studies for the region.

The preparation of regional planning strategies and local government planning schemes for areas that include ‘areas of state significance (scenic coastal landscapes)’ as identified by regional coastal plans, are to include measures that protect areas with coastal landscape values from incompatible land uses.

Where ‘areas of state significance (scenic coastal landscapes)’ have not been identified by a regional coastal plan, regional planning strategies and planning schemes are encouraged to protect scenic landscape values from incompatible land uses.

2.7.2 Other coastal landscape values

This policy seeks to achieve the following ‘Coastal landscapes’ principles: 7A, 7B, 7C.

Policy context

Coastal landscapes form an important resource of the coastal zone. Some are of national significance while others are highly valued by local communities and visitors. Coastal landscapes embrace both visual amenity.

*State Coastal Management Plan—
Queensland's Coastal Policy 41*

How Queensland's coastal zone is to be managed and cultural values and include residential, industrial, rural and natural areas. Landscape values encompass a number of concepts:

- something perceived and appreciated by human senses, primarily sight;
- close relationships with a place or places;
- embracing a number of different yet integrated elements; and
- perceptions that depend on the personal and cultural values of individuals and communities.

Policy

When assessing landscape values, the importance of coastal landscapes to the state and regional community is to be addressed. In particular, the relevant Indigenous Traditional Owner communities are to be involved in the assessment of landscape values (policy 2.5.2). In addition to policy 2.7.1 which focuses on scenic values of coastal landscapes of state significance, regional coastal plans will assess the following:

- (a) for areas identified as 'areas of state significance (scenic coastal landscapes)' — other coastal landscape values such as cultural and spiritual values that are of state or regional importance;
- (b) for areas not identified as 'areas of state significance (scenic coastal landscapes)' — the importance of coastal landscape character and associated values; and
- (c) the coastal landscapes' sensitivity to development and change.

Investigations into landscape values will be undertaken as part of the preparation of regional coastal plans to identify the values identified in this policy. Other relevant and current landscape studies for the region will be identified and used in these investigations.

Regional planning strategies and local government planning schemes for coastal areas should protect areas with state and regionally important coastal landscape values, identified by regional coastal plans, from incompatible land uses.

Where state and regionally significant coastal landscape values have not been identified by a regional coastal plan, regional planning

strategies and planning schemes are encouraged to protect coastal landscape values that are consistent with this policy.

*State Coastal Management Plan —
Queensland's Coastal Policy 87*

**Schedule 2: Scenic coastal landscapes
Areas of state significance (scenic coastal landscapes)**

Coastal landscapes with either 'Level 1 Scenic Quality' and/or 'High Scenic Management Priority' are determined to be 'areas of state significance (scenic coastal landscapes)' for the purposes of coastal management (refer to policy 2.7.1).

Levels of scenic quality and management priority were investigated by the 1996 report *A View of the Coast: An Overview of the Scenic Resources of the Queensland Coast*. The intention of this report was to:

- (a) formulate a sound and repeatable methodology for compiling a continuous scenic resource inventory for the entire Queensland coast, including an appropriate set of criteria for assessing scenic quality;
- (b) assess the relative values of such resources; and
- (c) develop recommendations regarding the relative urgency of conservation measures of scenic landscape values for particular locations.

Further investigation and use of other relevant regional landscape studies are encouraged.

The Queensland coastline was divided into 58 individual coastal landscapes and classified into one of the following coastal landscape character types:

- regional city;
- linear coastal strip;
- low intensity coastal plain;
- extensive coastal plain;
- coastal valley;
- steep coastal range;
- major peninsula and island groups;
- major island groups.

The report investigated the scenic quality as well as priority areas for management of scenic landscape values for each of the 58 individual coastal landscapes.

Areas of **'Level 1 Scenic Quality'** are those areas that are highly outstanding and distinctive. Criteria for inclusion as a Level 1 Scenic Quality area are as follows:

- landscape is recognised as having exceptional or unique statewide, national or international aesthetic values; and
- landscape displays high visual quality indicators for all three criteria of landform, landcover and waterform.

Examples of these areas include Moreton Bay, Great Sandy Region, Keppel Islands, Shoalwater Bay, Whitsunday Islands, Palm Islands, Hinchinbrook, Mossman/ Port Douglas and Cape Tribulation.

'High Scenic Management Priority' areas were assessed against the following criteria:

- the distribution and relative abundance of each of the different landscape character types to determine any areas of scarcity;
- correlation of the scenic quality rating to the scarcer landscape types to determine areas in low relative abundance; and
- application of an overall rating based upon observed or known threats to an area such as likely land development or urban growth.

Examples of these areas include Gold Coast hinterland, Brisbane basin, Moreton Bay, Sunshine Coast, Blackall Range, Town of 1770, Keppel Bay/Yeppoon, Corio Bay, Port Curtis/Gladstone, St Helens, Whitsunday Islands, Townsville, Hinchin-brook, Mulgrave River, Malbon Thompson Range, Cairns, Cape Tribulation and Endeavour River/ Cooktown.

Scenic management issues

The report also identified relevant scenic management issues for each of these coastal landscape types.

A description of the coastal landscape type and relevant scenic management issues, as included in the *View of the Coast* report are outlined below. These issues are to be considered when undertaking regional and local planning within the relevant 'areas of state significance (scenic coastal landscapes)'.

*State Coastal Management Plan—
Queensland's 88 s Coastal Policy*

Regional cities

This coastal landscape character type focuses on the state's major coastal urban centres. Typically, they are based on a major river system and comprise mostly established or developing areas. Examples include the Brisbane basin, Cairns and Townsville. The following scenic management issues are relevant:

- (a) maintaining the integrity of major river corridors and estuaries;
- (b) protecting scenic/mountainous backdrops to cities and urban areas;
- (c) avoiding development unsympathetic to the landscape and built form;
- (d) minimising development of prominent foothills;
- (e) maintaining urban scenic character;
- (f) maintaining major areas of remnant vegetation, particularly on prominent hills and ridges;
- (g) protecting headlands;
- (h) sensitive design and location of major city infrastructure such as roads, power stations and transmission lines;
- (i) scenic management of harbour and port areas;
- (j) preventing merging of coastal villages and townships into continuous urban form; and
- (k) scenic management of quarries and extractive industries.

Linear coastal strips

These coastal landscape character types are coastal landscapes that comprise major urban centres, however they are distinguished by the concentration of built development towards the land/water edge, with more scattered development located inland. An example is the Sunshine Coast. The following scenic management issues are relevant:

- (a) avoiding development in close proximity to the land/sea edge;
- (b) controlling the scale and height of development;
- (c) protecting headlands subject to development pressure;
- (d) maintaining the integrity of river corridors and estuaries;
- (e) avoiding inappropriate development of foothills and rolling landscape;
- (f) maintaining rural landscapes as a scenic feature;
- (g) protecting coastal wetlands and lakes;
- (h) avoiding the modification of rivers and low lying areas into canals; and
- (i) avoiding uncontrolled continuation of linear development.

Low intensity coastal plains

This coastal landscape character type, the predominant for the Queensland coast, is characterised mostly by gently undulating lowlands and plains with a range from rural to low intensity townships and urban areas to semi-natural and natural areas. The major difference between this category and 'Extensive coastal plain' is that the distance from the shoreline to the dominant coastal range is far less, usually in the vicinity of 10km.

Examples include Keppel Bay/Yeppoon, Mossman/Port Douglas and St Helens. The following scenic management issues are relevant:

- (a) avoiding the merging of coastal villages and townships;
- (b) protecting the setting of landscape features such as prominent mountains and hills from inappropriate development;
- (c) protecting 'passage' landscapes;
- (d) maintaining areas of natural character;
- (e) avoiding extensive land clearing close to the land/sea edge;
- (f) inappropriate development of river mouths and estuaries;
- (g) growth of villages along rivers and creeks;
- (h) protecting backdrop to growing cities and townships;
- (i) protecting natural settings of headlands and bay settings;
- (j) maintaining the integrity of river corridors;
- (k) protecting prominent peninsulas;
- (l) protecting natural character of smaller islands, close to shore;
- (m) enhancing foreshore areas in developed areas;
- (n) scenic management of harbours and port areas;
- (o) visual integration of large scale industrial and processing facilities;
- (p) maintaining natural character of wetland areas;
- (q) protecting rural character; and
- (r) sensitive design and location of utility infrastructure such as roads, power stations and transmission lines.

Extensive coastal plains

This coastal landscape character type is typified by more northern areas of the state with very limited relief and an extensive coastal plain, sometimes beyond an applied 'limit' for the study of 100km. Land uses comprise mostly natural and semi-natural areas with an extremely limited degree of settlement.

Coastal valleys

This classification applies to both:

- inland coastal valleys based on major river systems which run either parallel or perpendicular to the coast; and
- inland coastal 'hinterland' areas of sufficient size and contrast to the adjoining landscape.

Examples include the Blackall Range, Endeavour River, Gold Coast Hinterland and Mulgrave River.

The following scenic management issues are relevant:

- (a) avoiding inappropriate development of foothills and backdrops;
- (b) appropriate management of scenic routes;
- (c) avoiding the merging of villages and townships;
- (d) protecting the estuaries from inappropriate development;
- (e) maintaining field/rural pattern; and
- (f) maintaining the natural character of prominent ridge and ranges.

Steep coastal ranges

This coastal landscape type applies to limited sections of the coastline where, for an extended area, the region is dominated by a continuous mountain range formation. Examples include Malbon Thompson Range and Cape Tribulation. The following scenic management issues were identified:

- (a) maintaining natural character of ranges;
- (b) managing major infrastructure such as roads, power stations and transmissions lines;
- (c) avoiding the merging of coastal townships and villages;
- (d) protecting river estuaries;
- (e) protecting the surrounds and settings of prominent hills and mountains;
- (f) maintaining integrity of river and creek corridors; and
- (g) protecting open exposed headlands.

Major peninsula and island groups

This coastal landscape type applies to island groups that have in their formation a segmented link to the mainland coast. In particular, they are not generally known as 'off-shore' islands.

Examples include Moreton Bay, Great Sandy Region, Shoalwater Bay, Whitsunday Islands, and Hinchinbrook.

The following scenic management issues are relevant:

- (a) protecting 'passage' landscapes;
- (b) managing the impacts of sand mining and recreational use;
- (c) managing the growth of island villages and townships;
- (d) integration for tourism development;
- (e) avoiding extensive clearing of hills and ranges;
- (f) managing roads and scenic routes;
- (g) maintaining areas of natural character;
- (h) appropriate siting and management of major infrastructure such as roads, power stations and
 - (a) transmission lines;
 - (i) avoiding development along ridgelines;
 - (j) protecting and enhancing foreshore areas;
 - (k) rehabilitating degraded areas;
 - (l) maintaining backdrop to townships and villages; and
- (m) improved appearance of island 'arrival points'.

Major island groups (Omitted here)

NEW SOUTH WALES

NSW Coastal Policy, 1997

The 1997 NSW Coastal Policy responds to the fundamental challenge to provide for population growth and economic development without placing the natural, cultural, spiritual and heritage values of the coastal environment at risk.

It specified nine goals of equal importance including:

- Protecting and enhancing the aesthetic qualities of the coastal zone.

Its objectives included:

- Protection of areas of high aesthetic quality.
- Cultural heritage items and landscapes managed & conserved

Key actions included:

- The aesthetic qualities of both the natural and built environments will be identified, protected and promoted through the continued acquisition of coastal lands under the Coastal Lands

Protection Scheme and the implementation of design guidelines, planning instruments, management plans, programs and regulations.

The coastal zone was defined to include:

- three nautical miles seaward of the mainland and offshore islands;
- one kilometre landward of the open coast high water mark;
- a distance of one kilometre around: all bays, estuaries, coastal lakes, lagoons and islands;
- tidal waters of coastal rivers to the limit of mangroves, as defined by NSW Fisheries' (1985) maps or the tidal limit whichever is closer to the sea;

Visual Management System for NSW Coast & Tweed Coast Pilot Project, 2004

This report, prepared by the NSW Department of Infrastructure, Planning and Natural Resources (2004), proposed visual management strategies to conserve the regional landscape visual values of the coast.

The report proposed four levels:

- Level 1: Preservation
- Level 2: Conservation
- Level 3: Modification
- Level 4: Restoration

It provided guidelines covering eight landscape units including beaches, and headlands. The guidelines describe the visual character of each unit and then provide guidelines under the four levels. The following are extracts from the guidelines for beaches and headlands

Beaches

Level 1 Preservation

- No structures with the exception of breakwaters adjacent to creeks and river, subject to EIA
- No structures including drainage pipes are to cross the beach or be visible from the beach
- No structures adjacent to the beach dune shall intrude into or above the dominant height of the vegetation

Level 2 Conservation

As for Level 1 plus:

- All structures are to be designed sympathetically to this visual setting and

should not be taller than the coastal dune vegetation which will form a backdrop.

Level 3 Modification

As for Level 2 plus:

- Buildings such as houses may be visible from the beach but are to be well integrated into dune vegetation by virtue of scale, colour and texture.
- (Sub-level 2): Buildings such as houses and commercial elements will dominate the front dune and become part of the beach visual setting.

Level 4 Restoration

- Dune vegetation is to be restored
- Structures on the fore dunes are removed or integrated depending on VML level (Visual Management Level) desired.

Headlands

Level 1 Preservation

- Headland areas to be free of structures with the exception of lighthouse facilities
- Recreation structures are to be limited to at grade walking trails.
- Any vertical elements such as seating must be within adjoining vegetation that can provide screening.
- Headland vegetation is to be restored.

Level 2 Conservation

- Recreation structures are to be limited to at grade walking trails which may include boardwalks with guardrails and other protective fencing.
- Adjoining vegetation should screen any vertical elements such as seating or fencing.
- Headland vegetation is to be restored to achieve screening of structures.

Level 3 Modification

- Recreation structures including boardwalks, viewing platforms and picnic facilities and car parks occur on headlands and create skyline conditions.
- Screening or integrating vegetation is generally absent
- Vegetation which may include exotic species is planted to achieve visual integration
- (Sub-level 2) Development structures occur on the headlands, including houses, commercial buildings, telecommunication elements, etc

Level 4 Restoration

- Headland vegetation is planted according to the VML level that is prescribed
- Structures on the headlands are removed or integrated depending on the VML level desired.

Lake Macquarie City Council Scenic Quality Guidelines, 2004

In New South Wales, the Lake Macquarie City Council adopted Scenic Quality Guidelines in 2004. This differentiates the landscape into three zones, A, B and C with A referring to areas of the highest Scenic quality and Visual Accessibility, B being highly valued areas and C being areas of moderate to low Scenic Quality. They are areas "of critical value to the scenic image of the City and are the most sensitive to development change."

Zone A

In respect of the foreshore and coastline, the Objective for Zone A was to "protect the natural character dominance of the coastline and foreshore by minimising the visual impacts of development." The Strategies it identified under this Objective were as follows:

Development within the 7(4) Environmental (Coastline) zone:

- Is in accordance with the Lake Macquarie Coastline Management Plan
- Development and landscape treatments comply with requirements, such as height, scale, species (sic) to ensure they are not visible from the beach or significant viewpoints and do not impact on the natural processes associated with this area.
- Development on the foreshore is:
 - Designed to complement the character and scale of surrounding development
 - Restricted to ensure protection of the scenic quality by:
 - No vegetation removal within 20 m of HWM
 - Vegetation removal with 20 – 50 m of HWM does not exceed 10% of the existing canopy
 - The number and size of jetties and boat moorings maintains the naturalness of the foreshore
 - Ensuring recreational facilities, including jetties, camping grounds, toilets and car parks have minimal impact on the landscape character and naturalness of the foreshore.

Zone B

The objective was to maintain the dominant natural character in foreshore and coastline areas while allowing some modification and rehabilitation of areas with diminished scenic quality. Strategies included:

Development within the 7(4) Environmental (Coastline) zone:

- Development is restricted in the beach processes zones
- Height of development within 100 m of the beach processes zone is restricted to minimise overshadowing of the beach
- The scale, form and extent of development within 100 m of the beach processes protects views inland from beach
- Development on the foreshore:
 - In open or semi-open grassland areas of the foreshore, development is limited in location, size and scale to minimise visual impact
 - Screening of buildings and structures and rehabilitation planting is implemented along the foreshore to achieve a 50% screening coverage, within 5 years
 - Where predominately treed, development is sited and designed to minimise the need for vegetation clearance and to maintain a natural appearance for the foreshore, within 20 m of HWM
 - Development beyond the 20 m buffer zone is restricted in scale, height and extent to maintain a dominant natural character and only partial visibility of buildings or structures when viewed from the water
 - Height of structures does not extend above the tree canopy

VICTORIA

Victorian Coastal Strategy, 2002

The Strategy aimed to encourage:

- recognising the established and valued community uses of the coast

The Vision was introduced by:

It is a vision that preserves the diversity of our coast, its flora and fauna, its natural beauty, and the diversity of activities you'll find there.

The hierarchy of principles for planning and management of the coast included the protection and management of significant environmental features. This included:

- Coastal and marine features of ecological, geological, geomorphological, cultural, landscape, scientific and historical significance will be protected.
- Parts of the coast will remain largely inaccessible to protect and retain areas with a sense of remoteness and exploration.

A further principle was Suitable Development for the coast. Under this, the following actions were defined:

- There are relatively pristine areas and important vistas along the coast where no development will be appropriate.
- Appropriate coastal development is development that (*inter alia*):
 - is sensitively sited and designed, having regard to the 'Siting and Design Guidelines for Structures on the Victorian Coast' and 'Landscape Setting Types for the Victorian Coast';

Objectives and actions for the coast were set out under six themes yet they and the actions scarcely covered scenic quality. It did include the promotion and protection of the values of scenic coastal roads (presumably the values of people who use these roads!).

The Built Environment and Coastal Infrastructure theme provided for the protection of the scenic landscape. This was solely through:

“the application of planning scheme overlays to manage development in visually sensitive and prominent areas as determined in the 'Landscape Setting Types for the Victorian Coast' will be encouraged.”

The same theme provided to:

- Ensure sensitive sites are identified to protect against inappropriate development and use.

An action under this was that:

- Information on sensitive sites (vegetation, fauna, cultural, geomorphological, coastal forms and processes, landscape units) will be identified and made available to coastal managers.

The Victorian coast was defined to include State waters and land and inland waters within the coastal catchment.

TASMANIA

Tasmanian State Coastal Policy 1996 (Revised 2003)

The policy's principles included the protection of natural and cultural values. The principle recognised that:

- the natural character of the coastal zone is of special cultural value to Tasmanians and to visitors from elsewhere.

The policy required:

- Places and items of cultural heritage will be identified, legally protected, managed and conserved where appropriate

The policy did not specifically cover scenic resources. However it did require in relation to development:

- The design and siting of buildings, engineering works and other infrastructure, including access routes in the coastal zone, will be subject to planning controls to ensure compatibility with natural landscapes.

The coastal zone covered state waters and extended 1 km inland of HWM.

SOUTH AUSTRALIA

Planning Strategy for Regional South Australia

The Strategy included under the heading of Environment & Resources:

Landscapes

South Australia has a diversity of landscapes and scenic areas ranging from arid lands, rivers, lakes, coasts, remote islands and areas of native vegetation. There is an increasing appreciation and valuing of natural landscapes for recreation and tourism. The quality of South Australia's landscape resources should be assessed and managed.

Development Plan

Development Plans have been prepared for all councils and included many common themes and measures. The following samples relevant coastal provisions from a selection of coastal councils. It does not attempt to be exhaustive.

Coastal Development Objectives included:

Development liable to detract from the appearance of the land should not be undertaken in areas of landscape significance.

Preserve areas of high landscape amenity value including stands of vegetation, exposed cliffs, headlands, islands and hilltops, and areas which form an attractive background to urban and tourist developments.

Maintain and protect the spectacular coastal scenery, vistas and scenic outlooks

Protection or management of areas or places of heritage and cultural significance including places of aesthetic, historic, scientific or social value for past, present or future generations.

The amenity of localities not impaired by the appearance of land, buildings and objects.

Coastal Development Principles included:

Development which is proposed to be located outside urban and tourist zones should be sited and designed to not adversely affect:

- The natural, rural or heritage character of the area;
- Areas of high visual or scenic value;
- Views from the coast, near-shore waters, public reserves, tourist routes & walking trails
- The amenity of public beaches by intruding into undeveloped areas
- Development should not prejudice the (coastal) zone's landscape qualities

Coastal Zone Objectives included:

The retention of the coast primarily in its natural state, with scenic beauty and natural features of coastal land preserved.

The conservation, preservation or enhancement of scenically attractive areas, including land adjoining water or scenic routes.

Preservation of landscapes of aesthetic merit, and sites and localities of natural beauty.

Protection of the natural skyline from artificial intrusion.

Protection of the visual qualities for the scenic coastal landscape, including rocky cliffs, sandy beaches, dunes and estuaries and native vegetation.

Coastal Zone Principles included:

Development that may adversely affect coastal features ...or significant views should not be undertaken.

Development of land should not prejudice the landscape qualities of the zone.

Tourist developments should not be located within areas of high landscape quality or significant scenic beauty.

Development should be compatible with conservation and enhancement of the coastal environment and scenic beauty of the zone.

Coast Protection Board Policy Document, 2003

Vision Statement:

The Coast Protection Board recognises that the South Australian coast is one of the State's most valuable assets. The coastal zone includes many diverse marine, estuarine and terrestrial ecosystems, which are subject to great natural change and variability. The diversity of coastal and marine plants and animals is rich and includes many unique species. Many special areas need identification and protection.

The document stated:

The coast is a place of great natural beauty, that is a source of inspiration for many South Australians, and a space for reflection and relaxation.

The Coast Protection Act defined the coast as including land above and within 100 m of HWM as well as 3 nautical miles to sea. It

included land within an inlet, estuary, river, creek, bay, or lake subject to the tide.

Regulations under the Development Act 1993 (Schedule 8) determine that "coastal land" in rural areas, in the absence of a coastal zone or similar between the subject land and the coast, includes land within 500 m of MHWM.

Under its Development Policy, the Board sought to protect scenic amenity.

Heritage and Landscape was one of the Board's six policy areas. It recognised the importance of heritage and landscape values, that while some areas were protected in reserves, others were less secure.

The intrinsic attractions of coastal areas include aesthetic qualities, which are significant both to tourism and recreation, as well as providing a sense of identity and well being for local people. The economic opportunities and the social values of South Australian coastal landscapes in part depend on its diversity of natural and semi-natural landscapes. Maintaining this richness of diversity poses a challenge in setting priorities for the development of the State's terrestrial, estuarine and marine coastal areas. For this reason the Coast Protection Board seeks to establish a state wide assessment of coastal landscape quality.

Policy 5.2 stated that the Board opposed development that would have a significant visual impact on coastlines with significant landscape value. The policy referred to the visual impact from both the land and the sea.

Living Coast Strategy, 2004

The principles included:

- Coastal, estuarine and marine environments are a valuable and common resource
- Ecologically Sustainable Development is fundamental to the long-term conservation and productivity of coastal, estuarine and marine environments

The objectives included:

- To conserve and safeguard the natural and cultural heritage of our coastal, estuarine and marine environments
- To protect our coastal, estuarine and marine environmental assets

In describing the significance of South Australia's coastal and marine environment, it stated:

The South Australian coastline includes high quality landscapes with high amenity and scenic value. The significance or quality of landscapes is derived from a combination of landform, land cover, land use, water, diversity, naturalism and colour. Features that have particular visual significance include undeveloped prominent landforms (such as cliffs / rocky headlands), undeveloped areas, unique features (such as lighthouses) and specific elements of vegetation cover.

Under the objective to protect coastal assets, it includes the need for a strategic vision of the coast. It stated:

The State Government needs to be more specific in regard to what areas will be kept development free, where development should be focussed, what coastal use is appropriate and where resources should be concentrated. As a priority, there is a need to identify high-quality landscapes at risk from development on the coast. The vision, ... would provide policy directions and principles addressing a range of coastal land management aspects including viewscapes, significant ecosystems, coastal hazards, ... and linkages with the marine environment.

The coastline has high amenity value and includes high-quality landscapes that need to be protected.

Actions under this objective included:

- Identify quality landscapes on the coast at risk of development
- Protect landscape qualities and amenity values through appropriate policies in Development Plans ...

WESTERN AUSTRALIA

Coastal Zone Management Policy for Western Australia, 2001

The Policy's vision was based on a ESD approach and whole-of-government management of the coastal zone.

Its principles, derived from the 1997 State Planning strategy included:

Environmental principle:

To protect and enhance the key natural and cultural assets of the State and deliver to all Western Australians a high quality of life which is based on environmentally sustainable principles.

Its environmental objective included:

Protection and conservation of areas of environmental and cultural significance through appropriate means...

Its Community objective included:

Protection and improvement of the visual amenity of the coast.

Government policies for planning and management of the coast included:

12. Scenic values are an important aspect of community enjoyment of the coast. In order to protect the visual amenity of the coast, the design of coastal developments should be in harmony with coastal landscapes.

The coastal zone comprised:

- State waters,
- the mobile beach zone and modern(Holocene) dune systems, mangroves, and wetlands and flats subject to tidal influence;
- areas potentially subject to shoreline movements; and
- estuaries and coastal lagoons.

NORTHERN TERRITORY

Coastal Management Policy, 2001

In 2001, the NT Government published the *Coastal Management Policy Implementation Strategy*. It recognised that it has value for aesthetic experiences. Its goals included the identification and protection of areas of cultural importance.

Although NT legislation protects of places of aesthetic values the strategy did not specifically cover it other than in a broad measure to help conserve coastal cultural values.

CALIFORNIA

A 1972 citizen's initiative, Proposition 20, saw the establishment of the Coastal Zone Conservation Act 1972. In 1976 this was replaced by the Coastal Act 1976 and the Californian Coastal Commission established.

In respect to the protection of scenic values, the Act provided:

“The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and

designed to protect views to and along the ocean and scenic coastal areas to minimise the alteration of natural land forms, to be visually compatible with the character of the surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas.” (Sec 30251).

In 2004 the Coastal Commission considered the protection of views from the ocean under the Coastal Act 1976. This recognised the growing importance of scenic vista from the water including lakes, rivers, estuaries and the ocean.

8. CONCLUSIONS

8.1 PROJECT BRIEF AND OUTCOMES

The Project Brief for the Coastal Viewsapes Project required the development and application of a methodology to measure and map scenic values of the South Australian coast. Specifically the project was required to:

- Develop and apply a methodology to measure the scenic value of the South Australia's coast;
- Map scenic value at a scale sufficient for planning and policy development;
- Provide recommendations for the incorporation of the methodology into the Policy, Planning and Development Assessment processes;
- Report on the findings of the project;

The Brief has been fulfilled by this report and the maps that accompany it.

Recommendations covering planning policy and development assessment have been developed in Section 7.

The outcomes of the project were intended to:

- Provide a basis for strategic planning and policy within the coastal zone;
- Provide information on community aspirations both on a local, regional and statewide basis, in respect to landscape qualities, in order to include appropriate development controls in Council Development plans;
- Provide a basis for the assessment of development, particularly within the coastal zone in development plans where development should be classified as non-complying or prohibited;
- Provide support for decisions made on policy, planning and development applications including in appeals;
- Inform and enhance knowledge and understanding of the value of the coastal landscape among professionals, regions and the community.

It is considered that the findings of the project together with this report and maps will assist in the achievement of these outcomes.

The project has been extremely demanding and has taken over six months of continuous work to complete to specifications. Nevertheless it has been a very rewarding and challenging project to be awarded and complete.

8.2 SUBJECTIVITY AND SURROGATES

The view is often expressed that scenic quality is a subjective quality that cannot be measured and on which no two persons can agree. However the results of this project should help to dispel these misconceptions; scenic quality *is* subjective but it can be measured objectively, and there is strong agreement across a range of people about what constitutes high scenic quality.

The outcomes of the project proved that while there was variation among individuals in the scenic quality of a given scene, nevertheless the similarities were far greater than the differences. It was shown for example that the average ratings across all scenes varied only marginally when examined by reference to the age, gender, education and birthplace of participants. *"Beauty is in the eyes of the beholder"*, but actually everyone's eyes are similar and result in close agreement about what is beautiful.

As shown in the study, it was actually those areas which were less beautiful where a wider range of opinion became evident. People can agree on what they like, there is less agreement on what they do not like.

The scenic quality ratings provide surrogates or indicators of scenic quality; they do not comprise scenic quality. When viewing a scene, few individuals would rate a scene out of ten, rather they would express their opinion about the beauty of the scene. The rating scale forces them to compare the scene with a standard of beauty that is held in their mind. Every individual has this standard built up through their lifetime of experience. In carrying out the rating, this standard is further informed by the range of scenes presented, including scenes that the individual possibly had not previously encountered, such as scenes from northern South Australia and from the west coast of Eyre Peninsula and the Nullarbor.

The rating instrument applied the surrogate of a number to a given scene and the individual translated their opinion of its relative scenic quality into a number which most closely

matches their opinion. It is recognised that the number cannot fully capture the subtleties involved in framing an opinion of the scenic quality of a scene in which the individual may compare it with other scenes in their mind's eye and note variations and differences.

While the ten point scale thus provides only a relatively coarse measure of scenic quality, nonetheless it is one which is readily comprehended and which is easy to apply. A scale of say 1 to 100 would be far more difficult to apply as it would present a ten-fold increase in possible choices, while a smaller scale of say 1 – 5 would present a too coarse differentiation across the range of scenic quality.

The photographs are surrogates also of the actual scene. Clearly it would have been impractical to take hundreds of participants around the coast to rate the scenes. As documented in the report (Sec 2.6), there is ample evidence from studies that providing the photographs meet certain criteria, that their ratings will be similar to field-based ratings.

As described in Sec. 3.1, care was taken in photographing scenes to avoid the transitory effects of lighting, clouds, seasonal differences, or photographic composition, all of which may enhance ratings. A conservative approach to measuring scenic quality is considered more appropriate than one which could inflate its level. However it is recognised that the scenic quality of scenes may seem higher at certain times than that which has been identified by this project because of the presence of these transitory effects.

8.3 SCENIC QUALITY AND THE COMMUNITY

It is hoped that this report will provide strong support and encouragement for the greater recognition of scenic quality as a key community resource. This may reinforce the importance of scenic quality as an environmental and community resource that should not be ignored as it has been up to now.

For too long, little more than lip service has been paid to scenic quality, acknowledging its importance for example in tourism literature and in regional and local planning but failing to do anything significantly to objectively identify, measure and map it.

Given that the tourism industry is dependent on attractive landscapes for much of its economic viability, scenic quality comprises an important economic resource and should be managed and protected accordingly. A century ago it was estimated that Switzerland gained between US\$10,000 - 40,000 per square mile from its scenery per year (Runte, 1979). South Australia's coast may similarly be valued in terms of its linear km and its contribution to the economy, particularly regional areas, through tourism.

It is also hoped that the methodology employed in the study, and the insights it has provided into the underlying factors which generate scenic quality, will inform and educate planning, environmental and land management professionals and the community generally. It has been shown possible to both measure and map scenic quality objectively and rigorously through a methodology that has produced replicable results.

8.4 SCENIC QUALITY POLICY

If the community and Government is serious about recognising the value of scenic quality and implementing a set of integrated measures that will ensure its protection, a whole-of-government policy approach will be required.

Such an approach will need to recognise:

- That scenic quality occurs regardless of land tenure and ownership, e.g. it is present on both public and private land; it is also present on land subject to mining legislation.
- That it is location specific to the boundary of the sea and the land, an area which marks the boundary of many Acts and policies. Scenic quality crosses over this boundary. Use and development of the sea immediately adjacent the land (e.g. marinas, aquaculture, infrastructure such as jetties) cannot be ignored.
- That it includes national parks and other State reserves, Council land and reserves, as well as Crown land.
- That much development of the coast has already occurred and that in many areas, degradation and loss of scenic quality has

resulted. The challenge is to minimise such losses in the future.

- That protection of scenic quality may limit individual freedom over one may do or develop in the coastal zone.

A whole of government policy approach could cover the following aspects:

1. Establish as policy the Government's commitment to recognise, protect and manage coastal scenic quality of significant landscapes.
2. Establish planning policy and development assessment requirements covering coastal scenic quality.
3. Establish as Government policy the protection of coastal scenic quality in all Government developments, as well as in land and marine management.
4. Ensure that National Parks legislation and management plans recognise, protect and manage coastal scenic quality.
5. Legislate to recognise and protect Landscapes of State Significance and declare those > 7 .5 from this project as such Landscapes.
6. Based on advice of the Crown Solicitor that the Coast Protection Board is well within its authority to comment on how development may or may not affect the conservation of the coast, including its biodiversity and landscape, assign clear statutory responsibility for the protection and management of coastal scenic quality to the Coast Protection Board.
7. Require that in areas designated as significant landscapes, development proposals be called up under Sec 34 of the Development Act for a decision by the Development Assessment Commission.
8. Advocate to the Commonwealth Government the establishment of Landscapes of National Significance under Heritage legislation.
9. Seek the cooperation of the Commonwealth Government in the exercise of their responsibilities, particularly in the marine environment, to protect and manage coastal scenic quality.

10. Allocate adequate resources to the management, protection and access issues associated with areas of coastal scenic quality, including assistance to councils for appropriate management and development.

11. Promote community appreciation of coastal scenic quality and provide opportunities for their participation in its protection, restoration and management, e.g. through Friends of the Coast groups.

Finally, coastal scenic quality is an important community resource of immense social and economic value. South Australia can lead the nation in its recognition of this through its efforts to identify, protect and manage coastal scenic quality.

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APPENDIX 10.1 PROJECT BRIEF

The following brief was the basis for the calling of tenders to undertake the project.

Background

The scenic quality of South Australia's coast is a significant social, economic and environmental resource. The coast has played a major role in the development of the State and continues to be enjoyed by the community.

Increasing developmental pressures on the coast are threatening the very qualities that the community value. Developments including housing and land division, marinas, aquaculture and wind farms, together with associated infrastructure and vegetation clearance, are imposing far greater pressure on the coast than in the past.

The Department for Environment and Heritage, through its Coastal Protection Branch, together with Planning S.A. and Local Government has responsibility for management of the coast. The Branch plays a key role in managing the coast and in providing expert input into the development of policy and the evaluation of development applications.

The Branch has identified the need to evaluate the scenic value of South Australia's coastal landscape as a basis for the development of policy and the assessment of development.

Project Aim

The purpose of the project is to measure and map the scenic value of the coastal zone of South Australia.

The Project Outcomes and Tasks required are described in the report

Scope

The project is to cover the South Australian coast, including Kangaroo Island but excluding the coasts of the remaining ~100 islands.

It is to include:

- The water/land interface and the immediate hinterland within view of the sea or under its immediate influence. It is not expected that

this will generally extend beyond one kilometer of the sea.

- Areas subject to tidal influence
- River estuaries but only covering the area where they enter the sea.

Project specifications

The methodology for the project shall:

- Be capable of being replicated using the same methodology
- Involve sufficient sampling of participants to achieve a sampling error of approximately 5%
- Include standard statistical tests of significance to ensure the statistical validity of the findings
- Ensure the scenic value of the coastal landscape is assessed within the wider context of the South Australian landscape
- Be capable of discriminating the scenic value of coastal landscapes to a level of approximately 0.5 on a 1 – 10 scale of scenic value, or its equivalent for other scales
- Be capable of being applied to the entire South Australian coast
- If the methodology involves participation of the community, ensure the representation of professional, broad community and regional representatives
- Be capable of being understood without specialist training or education

Project management

The client will establish a steering committee to oversee the progress of the project, to liaise with the consultant, and to assist on an 'as needs' basis.

The client will provide the consultant with 1:50,000 and 1:250,000 maps of the South Australian coast.

The client will provide web hosting for any internet surveys required.

2. SCOPE OF SERVICES

The project is to cover the South Australian coast, including Kangaroo Island but excluding the coasts of the remaining ~100 islands.

It is to include:

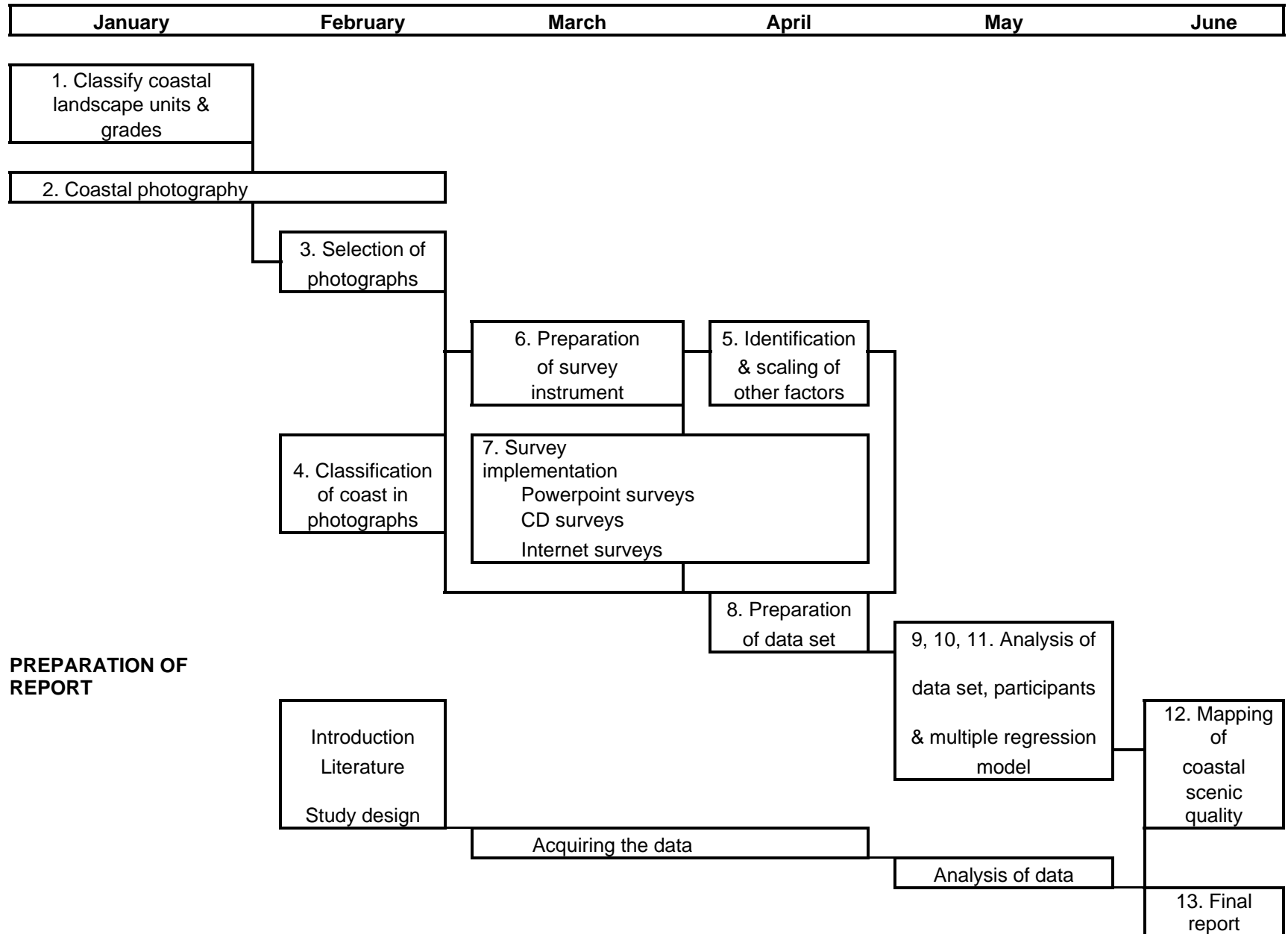
- The water/land interface and the immediate hinterland within view of the sea or under its immediate influence. It is not expected that this will generally extend beyond one kilometre inland from the sea, and offshore to the extent that the scenic amenity might be influenced by marina development.

- Areas subject to tidal influence, to supra tidal levels.
- River estuaries.

Information on the regions is to be provided in the following order of priority:

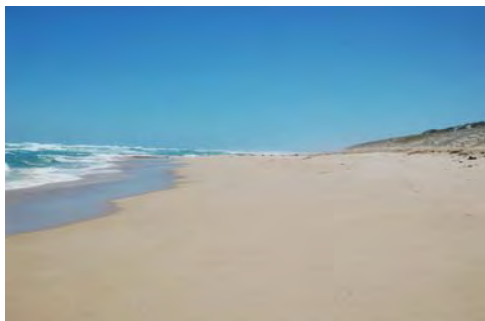
1. Eyre Peninsula (WA / South Australia border to Port Augusta)
2. Kangaroo Island
3. South East (Victoria /South Australia border to Murray Mouth)
4. Yorke Peninsula (Port Augusta to Port Wakefield)
5. Fleurieu Peninsula (Murray Mouth to Port Wakefield)

APPENDIX 10.2 GANNT CHART OF COASTAL VIEWSCAPES PROJECT IMPLEMENTATION



APPENDIX 10.3**Scenes in survey by regions**

Order of Regions	Page
South East	143
Fleurieu Peninsula	145
Adelaide Metropolitan Area	145
Kangaroo Island	147
St Vincents Gulf	149
Yorke Peninsula	149
Upper Spencer Gulf	153
Eastern Eyre Peninsula	153
Western Eyre Peninsula	155
West Coast (west of Ceduna)	159
Nullarbor	161

SOUTH EAST**SE123 Cape Northumberland 7.92****SE82 Sth Cape Buffon, South End 7.60****SE29 Guichen Bay 6.61****SE98 Lighthouse Bay 7.28****SE74 Rivoli Bay 6.97****SE32 Guichen Bay 5.34****SE93 Canunda NP 7.24****SE62 Beachport 6.79****SE13 Long Beach, Kingston 5.71****SE91 Canunda NP 6.72****SE67 Long Beach, Robe 7.02****SE2 142 Mile crossing 7.13****SE88 Boozy Gully (Sth South End) 7.16****SE87 Long Beach, Robe 6.00****SE11 The Granites 6.42**

FLEURIEU PENINSULA



FP23 Middleton 5.74



FP103 The Bluff from west 6.89



FP48 Boomer Beach 7.01



144 Newland Head 7.51



FP62 Encounter Bay 5.63



FP121 Waitpinga Beach 7.49



FP71 The Bluff 6.10



FP247 East Fishery Bay 7.02



FP212 Aldinga Beach 6.01



FP251 Pt Willunga 6.11



FP197 Maslin Beach 7.13



FP193 Seaford 6.30



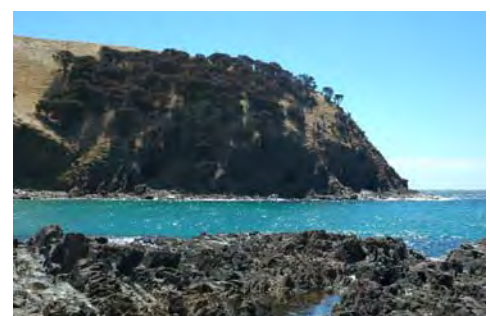
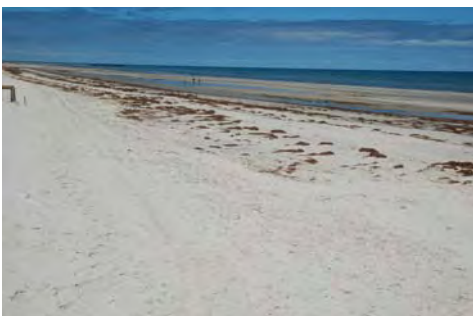
FP97 Petrel Cove 6.67



FP234 Second Valley 7.63



FP188 River Onkaparinga 7.02

KANGAROO ISLAND**Ad14 Brighton 5.73****KI11 Penneshaw 6.94****KI60 Cape Cassini 6.46****A58 West Beach marina 5.96****KI15 Eastern Cove 6.49****KI70 King George Bay 7.48****Ad83 West Lakes Shore 5.67****KI13 Pelican Lagoon 5.22****KI75 Snelling Beach 7.59****Ad90 Semaphore 6.49****KI36 Redbanks 7.24****KI86 Western River 7.74****Ad102 Semaphore 5.83****KI46 Western Cove 5.72****KI92 Cape Torrens 7.56**

ST VINCENTS GULF



KI105 Weir Cove 7.89



SVG3 St Kilda 4.18



SVG22 Pt Parham 3.73



KI116 Cape du Couedic 8.66



SVG4 St Kilda 4.12



SVG25 Webb Beach 5.14



KI122 Fm Cape du Couedic 8.12



SVG10 Pt Gawler 5.78



YP165 Pt Arthur 5.11



KI152 From Vivonne Bay head 7.11



SVG13 Pt Gawler 5.36



YP179 Tiddy Widdy Beach 5.46



KI154 Vivonne Bay 7.06



SVG20 Middle Beach 4.03



YP260 Nth Black Point



YP257 Sth Pt Julia 6.17



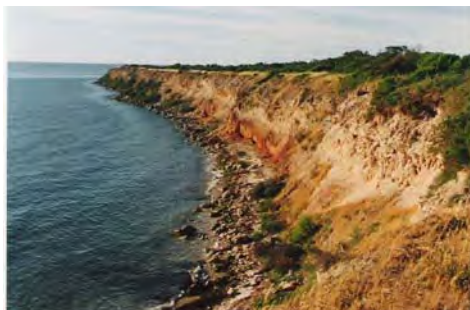
YP241 Pt Giles 6.08



YP123 Chinamans Hat Bay 6.78



YP252 Nth Pt Vincent 6.23



YP 242 Sth Port Giles 6.18



YP132 Ponalowie Bay 6.76



YP253 Nth Pt Vincent 6.80



YP149 Sturt Bay 5.64



YP141 Browns Beach 6.55



YP245 North Kleins Pt 6.32



YP146 Foul Bay 6.19



YP111 Formby Bay 6.64



YP243 Nth Port Giles 6.29



YP143 Meechan Point 7.14



YP101 Point Annie 6.35

UPPER SPENCER GULF



YP104 Nth Pt Annie 6.79



SPG20 Mundorra Arm 4.83



SPG171 Pt Lowly 5.08



YP 84 Dunn Point 4.08



SPG11 Tickera Bay 5.19



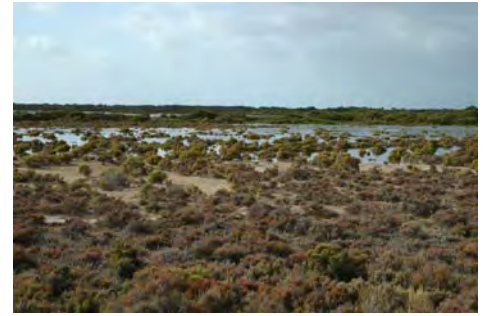
SPG117 Pt Bonython Road 3.37



YP82 Leven Bay 5.61



SPG71 Mt Gullet beach 3.80



EP458 Murripi wetlands, S Whyalla 4.33



YP81 Burners Beach 5.83



SPG77 Chinamans Creek 4.54



EP449 Pt Gibbon 5.77



YP40 Rifle Butts beach 6.26



SPG79 Chinamans Creek 5.05



EP448 Pt Gibbon 6.01



EP428 Nth Lipson Cove 6.68



EP370 Whalers Way 8.16



EP322 Sth Coles Point 7.25



EP410 Peake Bay 6.71



EP381 East of Cape Carnot 7.57



EP307 Near Pt Drummond 6.74



EP359 Sleaford Bay 7.87



EP354 Sth Pt Avoid 7.18



EP301 Cove Pt Drummond 7.02

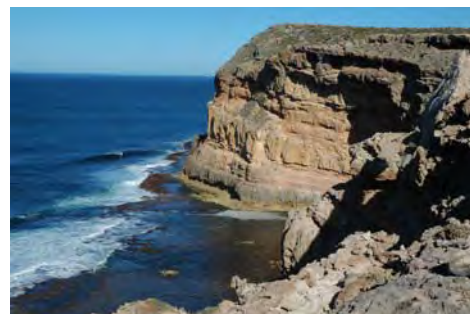
WESTERN EYRE PENINSULA



EP364 Whalers Way 8.06



EP349 Avoid Bay 4.03



EP295 Monument 7.71



EP369 Whalers Way 8.32



EP327 Mt Dutton Bay 6.10



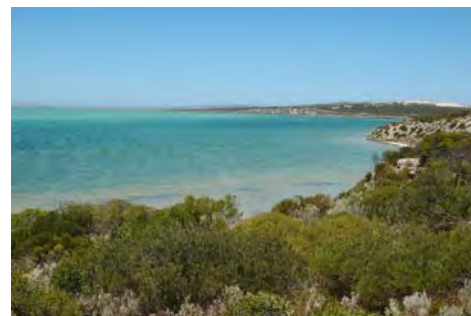
EP294 Monument 7.94



EP287 Sheringa Bay 6.25



EP235 Sth Venus Bay 6.99



EP201 Baird Bay 7.13



EP274 Sth Wellington Pt 7.82



EP231 Venus Bay sth head 7.69



EP192 Sceale Bay 7.36



EP258 Sth of Cape Finniss 8.20



EP 224 Venus Bay 4.63



EP179 Pt Westall 7.75



EP252 Salmon Point 7.04



EP210 Sth Cape Labatt 7.65



EP170 Pt Westall 7.61



EP242 Talia Beach 7.09



EP208 Pt Labatt 6.59



EP163 Sceale Bay 6.66



EP161 Sceale Bay 5.38



EP138 Cape Bauer 6.85



EP9 Murat Bay 4.92



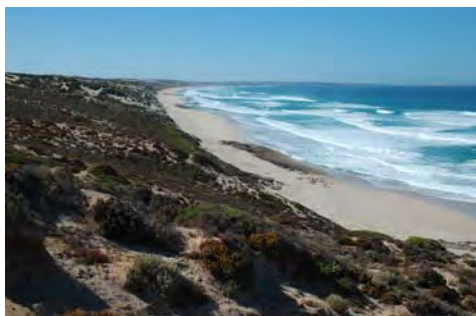
EP153 Corvisart Bay 7.02



EP123 Smoky Bay 4.81



EP23 Davenport Ck 5.80



EP151 Corvisart Bay 7.09



EP108 Edward Bay 7.25



EP28 Davenport Ck coast 6.94



EP149 Sth Cape Bauer 8.20



EP93 East of Laura Bay 7.06



EP29 Nr Rocky Point (w Ceduna) 6.70



EP146 Sth Cape Bauer 7.32



EP84 Laura Bay 5.38



EP31 Fowlers Bay 6.18



Scott Point, Fowlers Bay 6.19

NULLARBOR



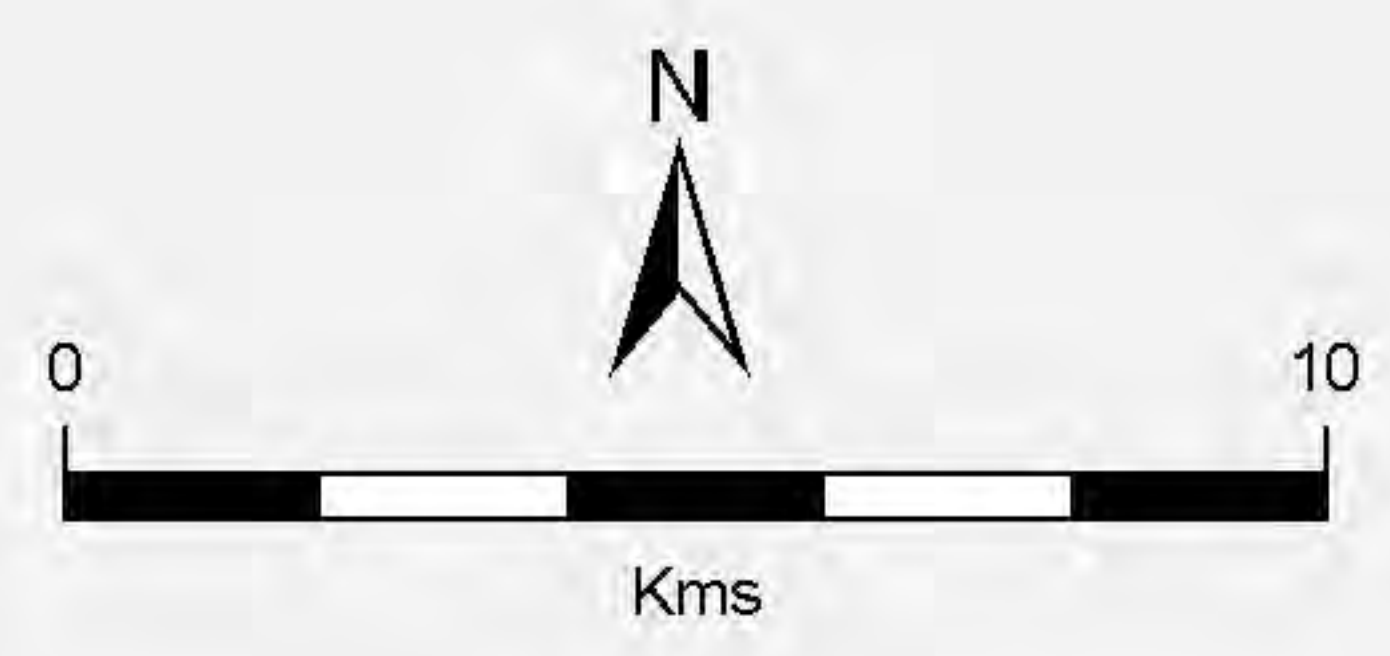
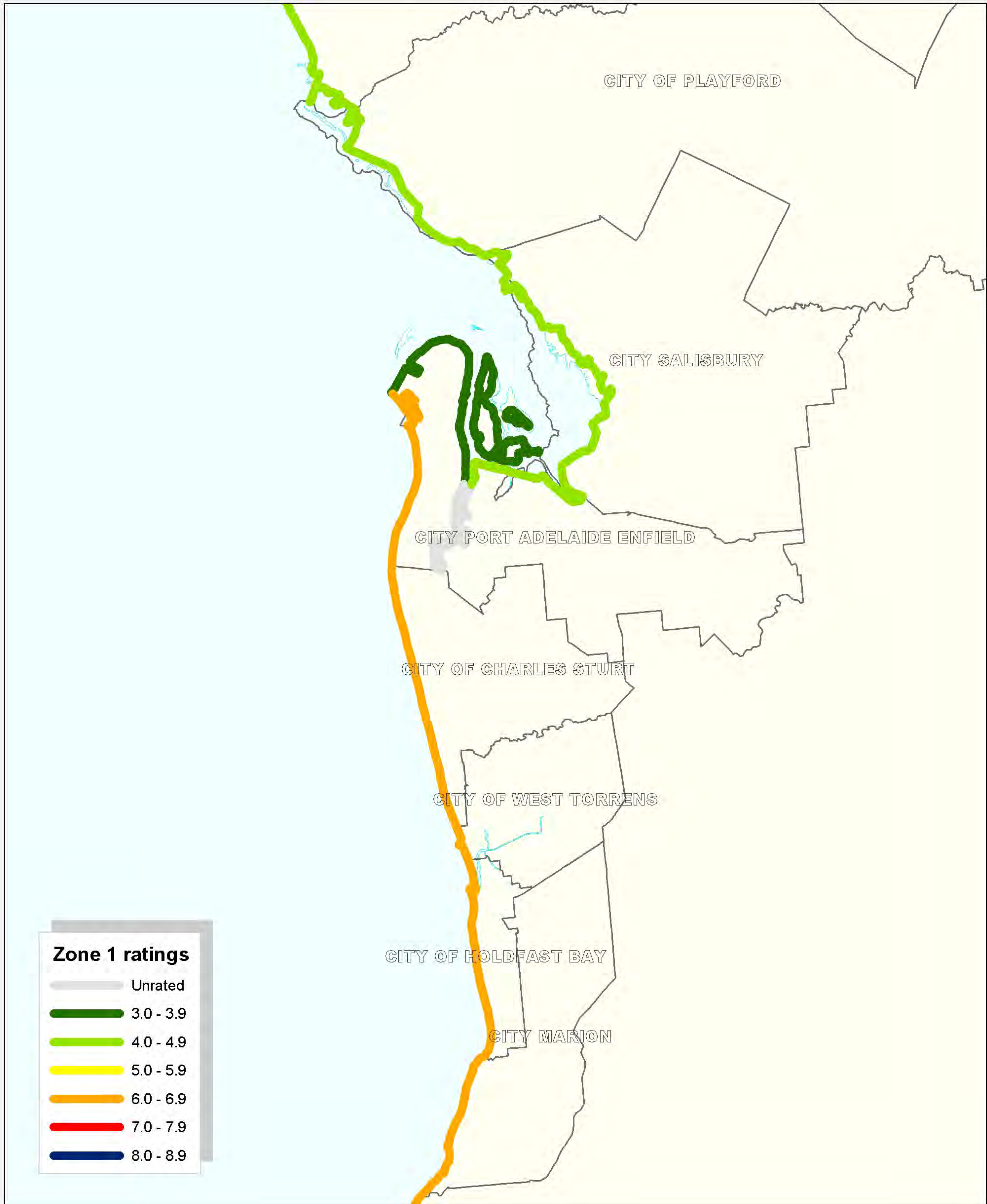
EP61 Head of Bight 7.69



Nullarbor cliffs 7.51

SOUTH AUSTRALIAN COASTAL LANDSCAPE QUALITY RATINGS

Adelaide Region



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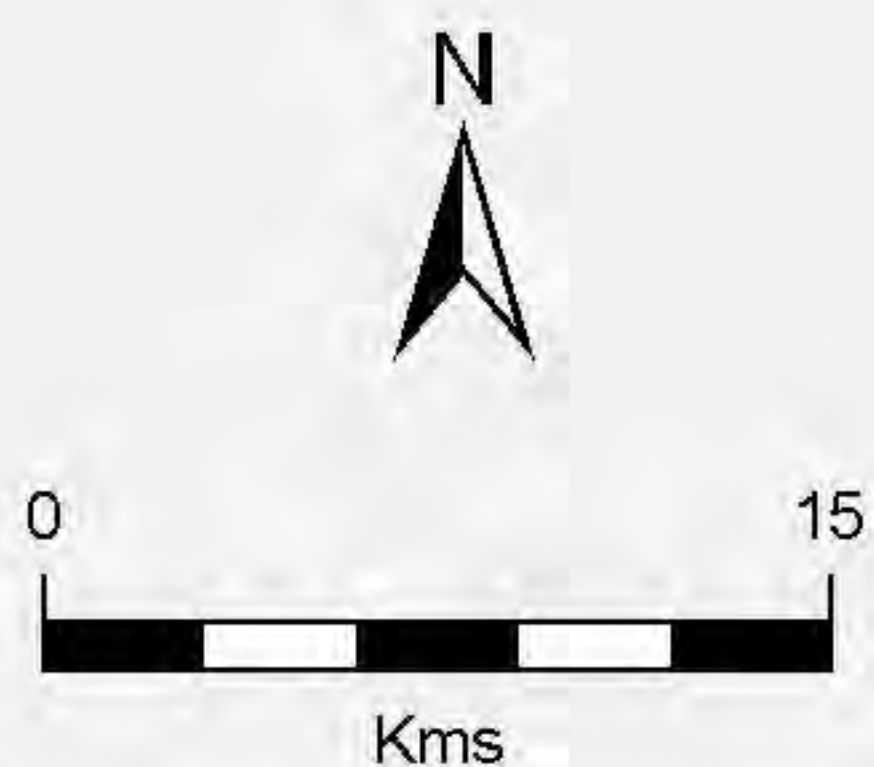
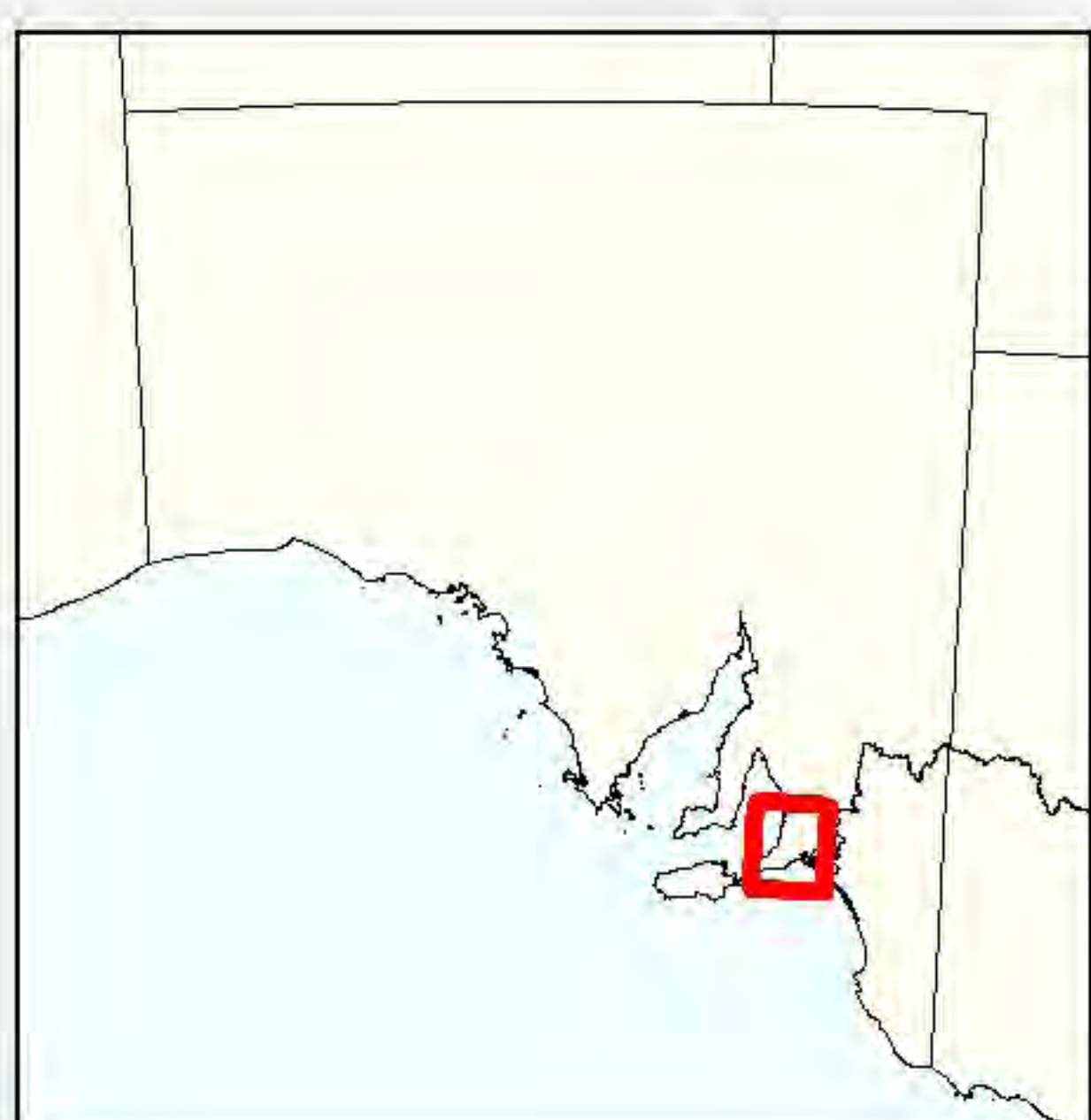
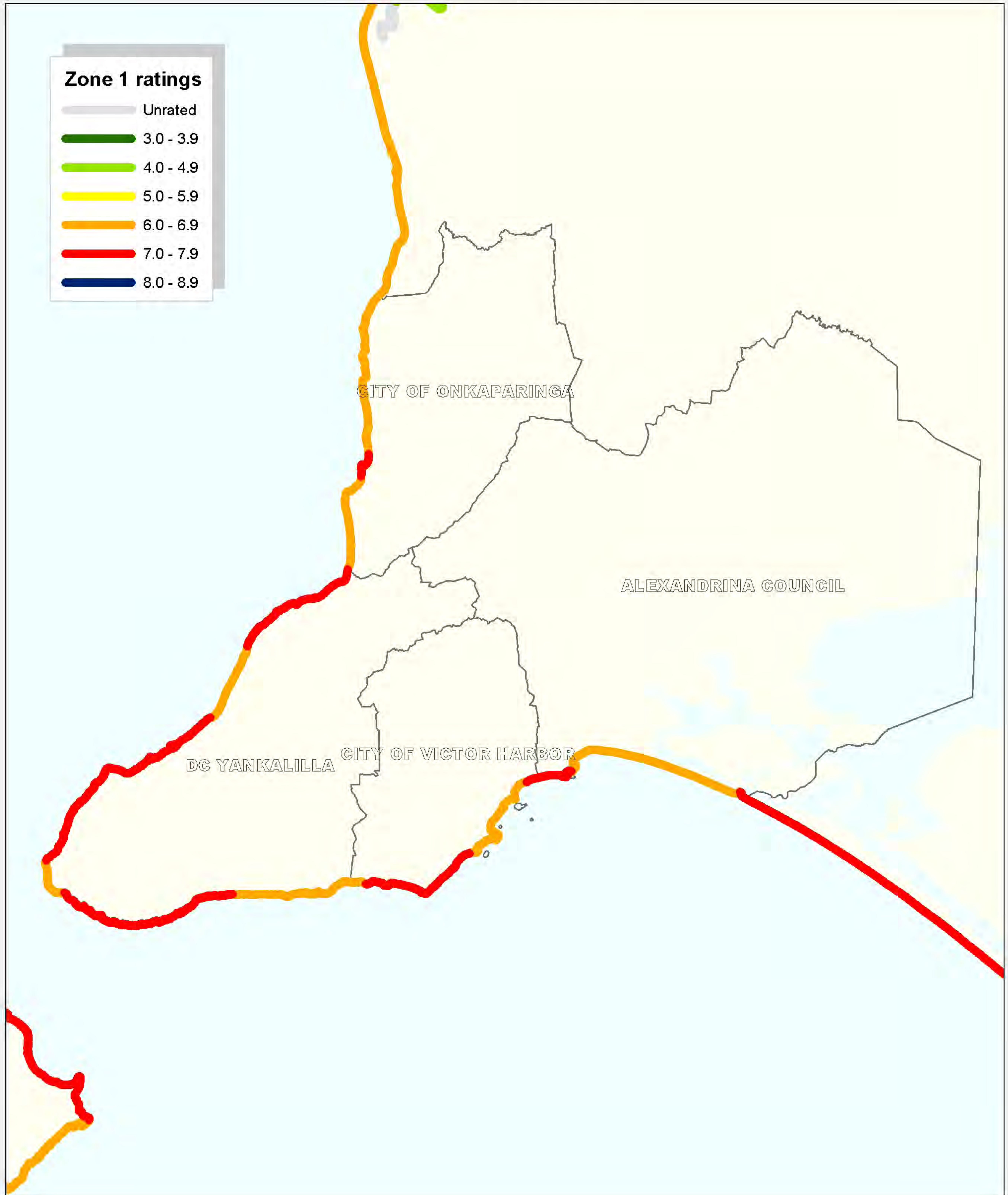
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Fleurieu Peninsula Region



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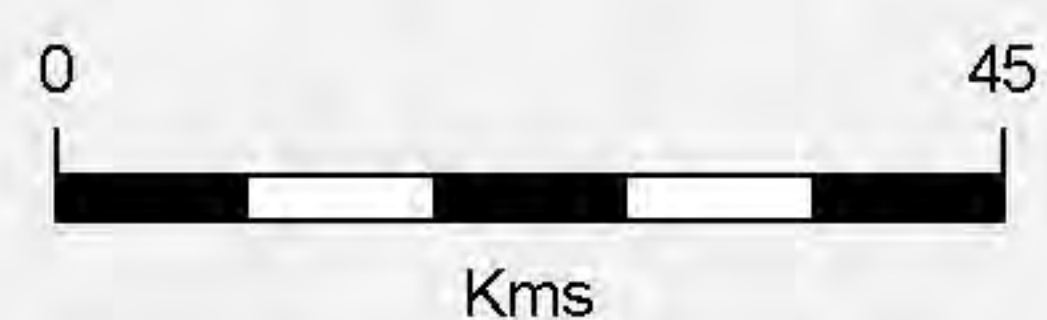
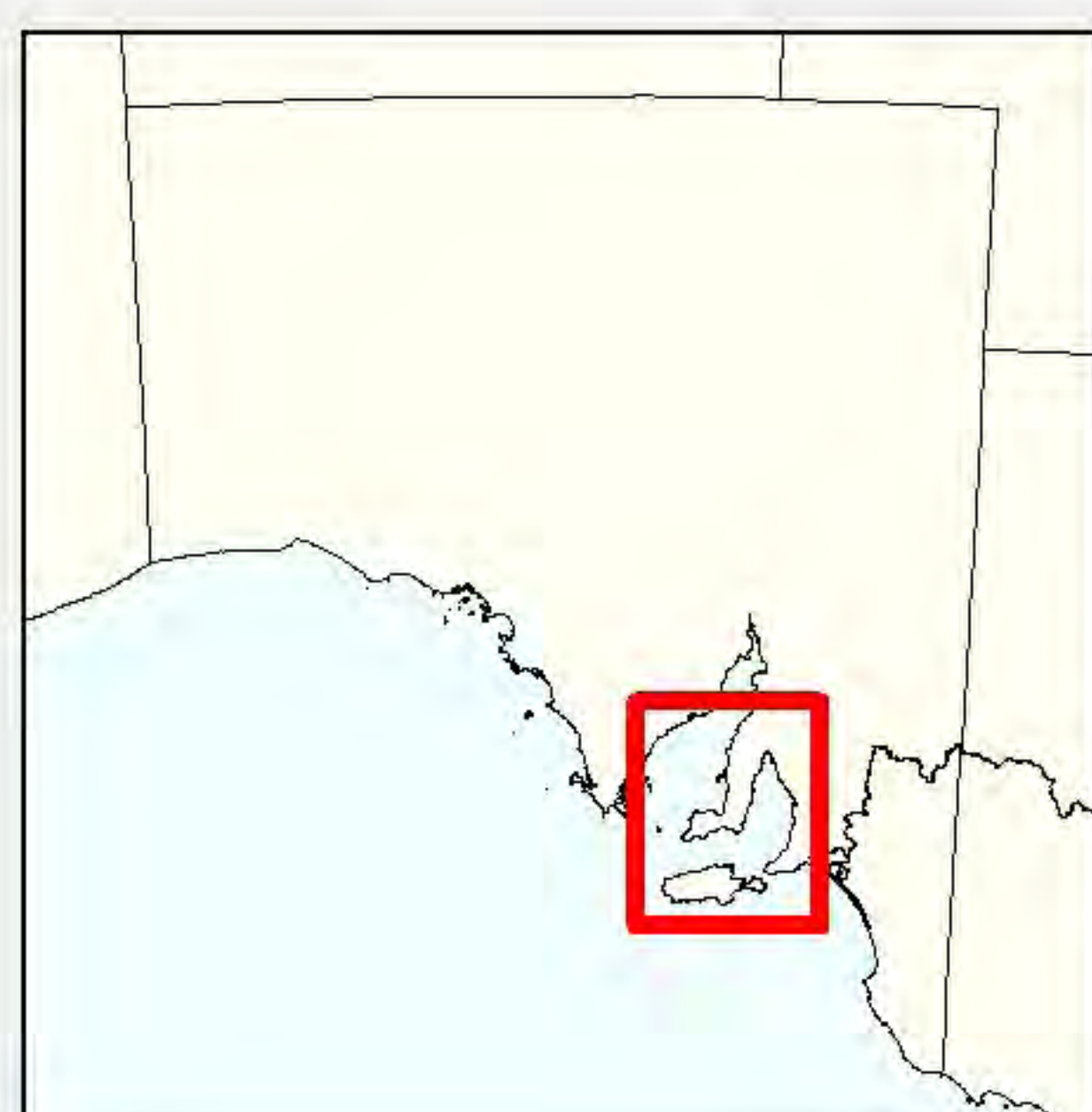
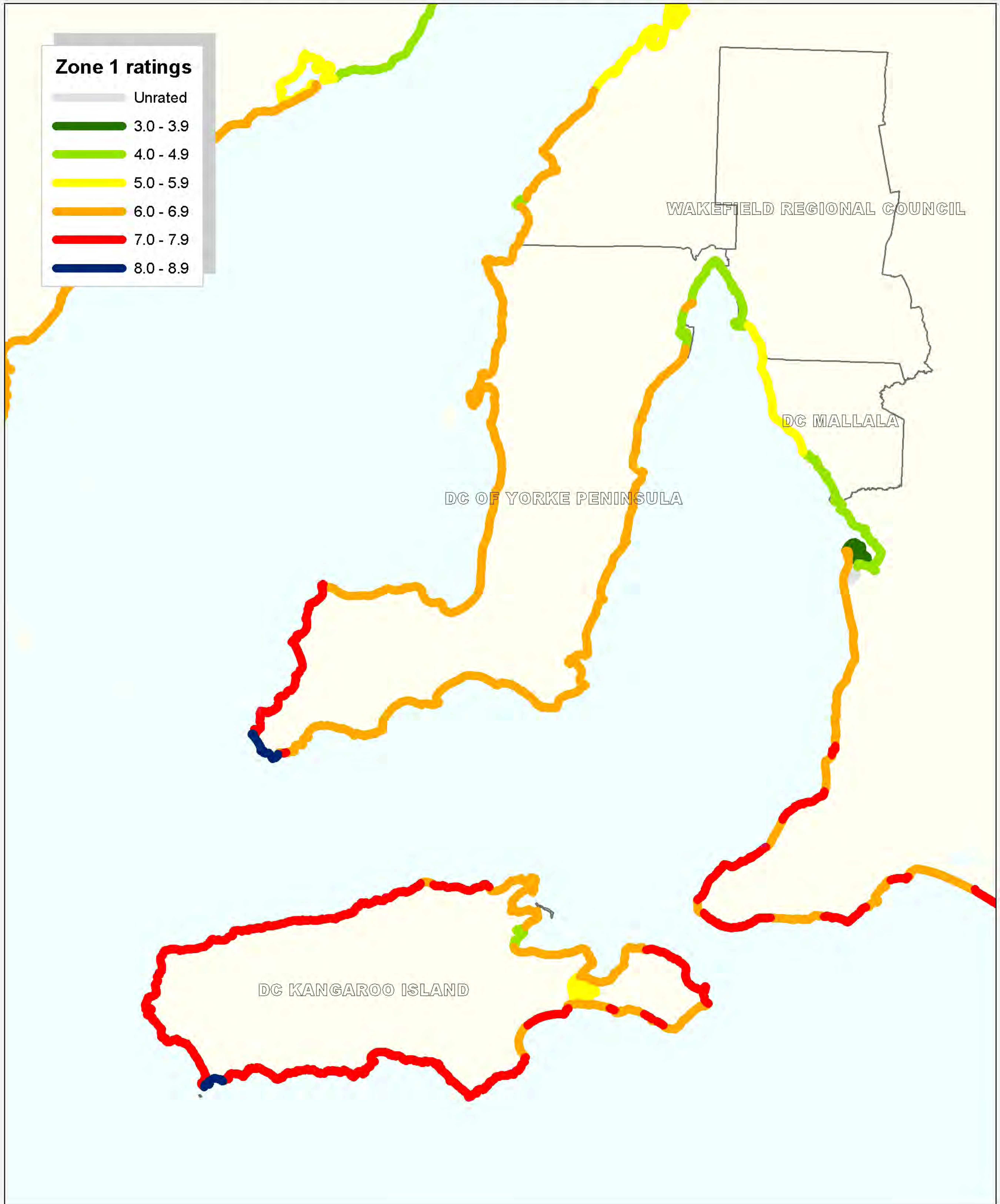
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SOUTH AUSTRALIAN COASTAL LANDSCAPE QUALITY RATINGS

Kangaroo Island and Northern and Yorke Region



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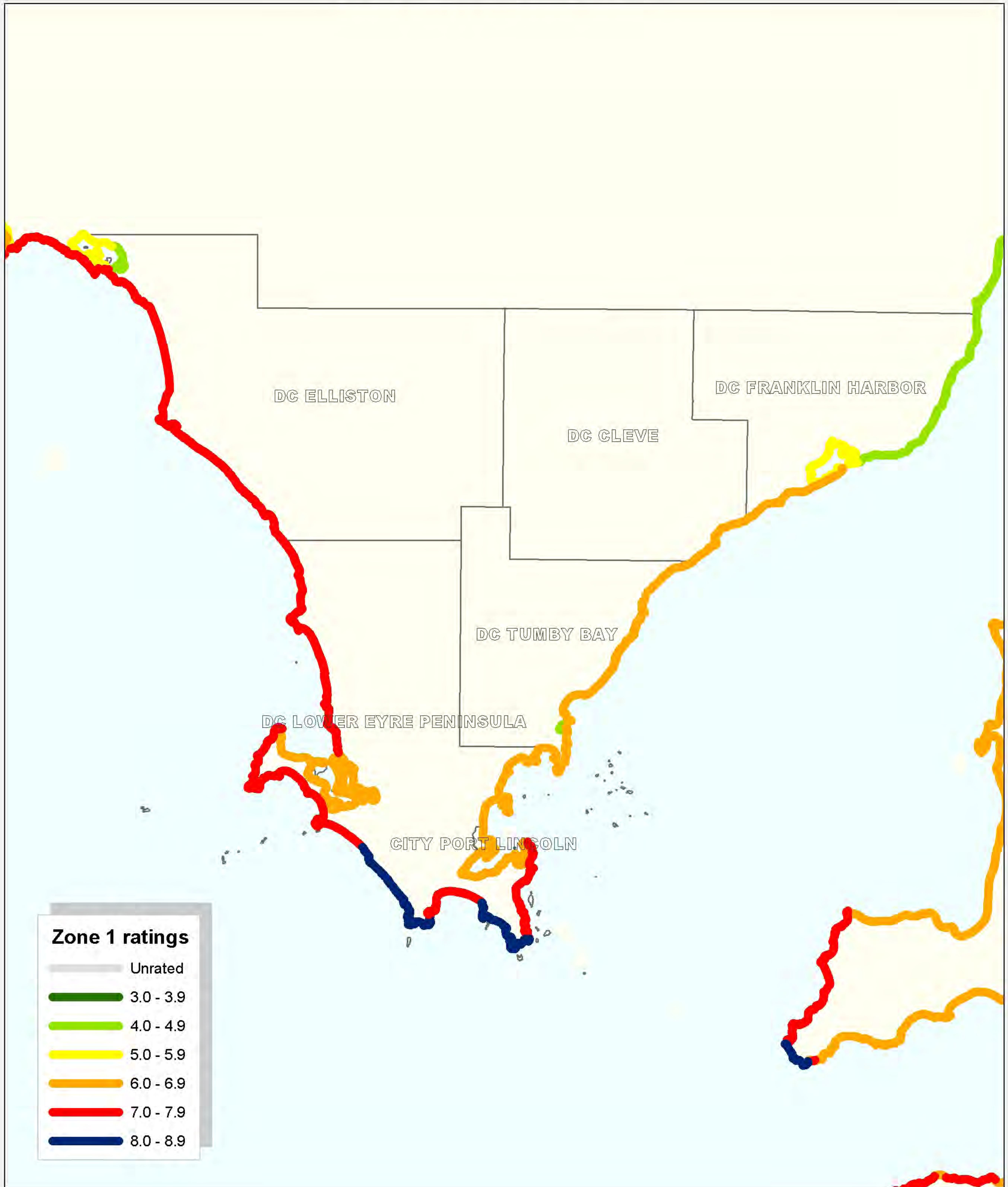
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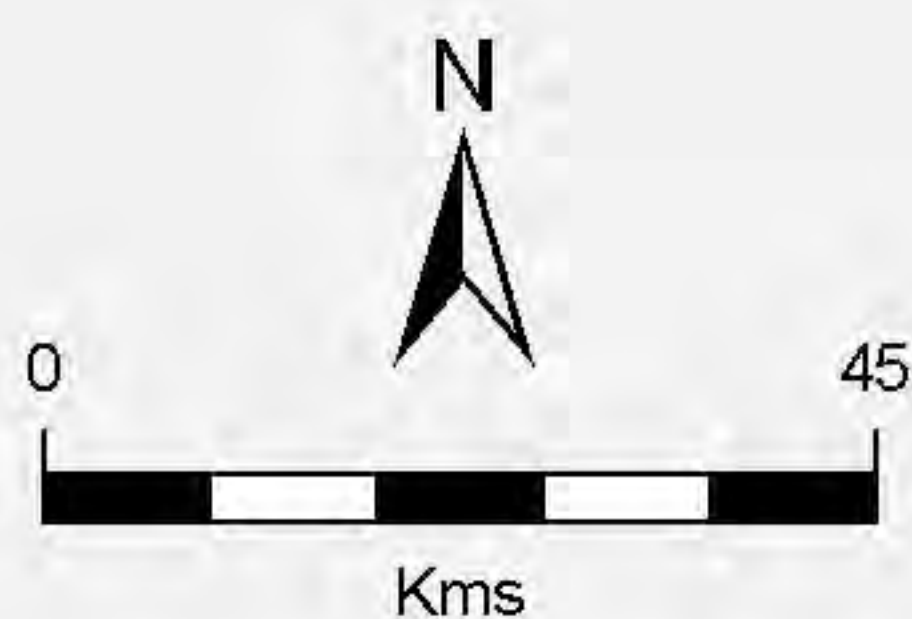
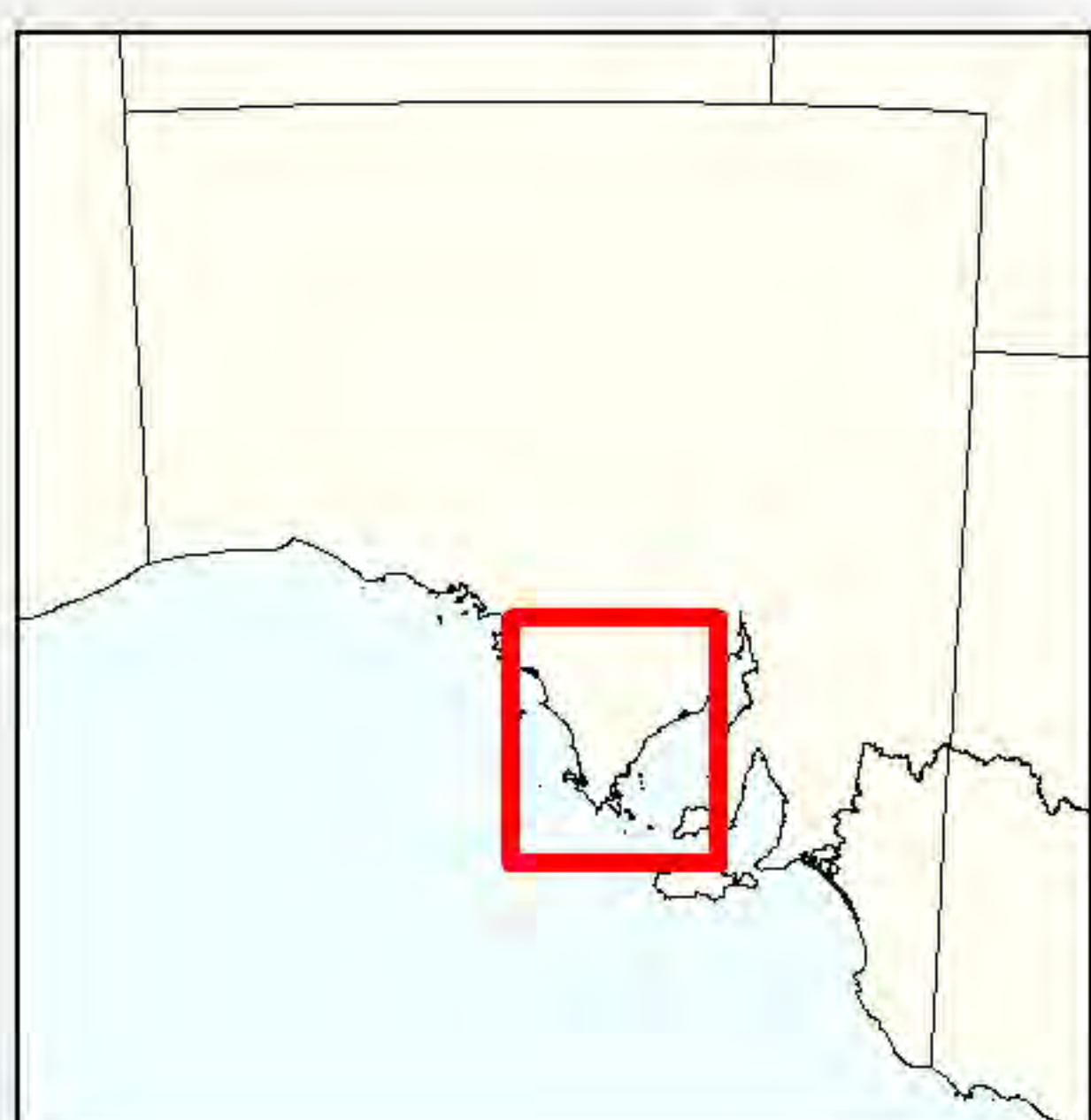
SOUTH AUSTRALIAN COASTAL LANDSCAPE QUALITY RATINGS

Lower Eyre Peninsula Region



Zone 1 ratings

- Unrated
- 3.0 - 3.9
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9
- 8.0 - 8.9



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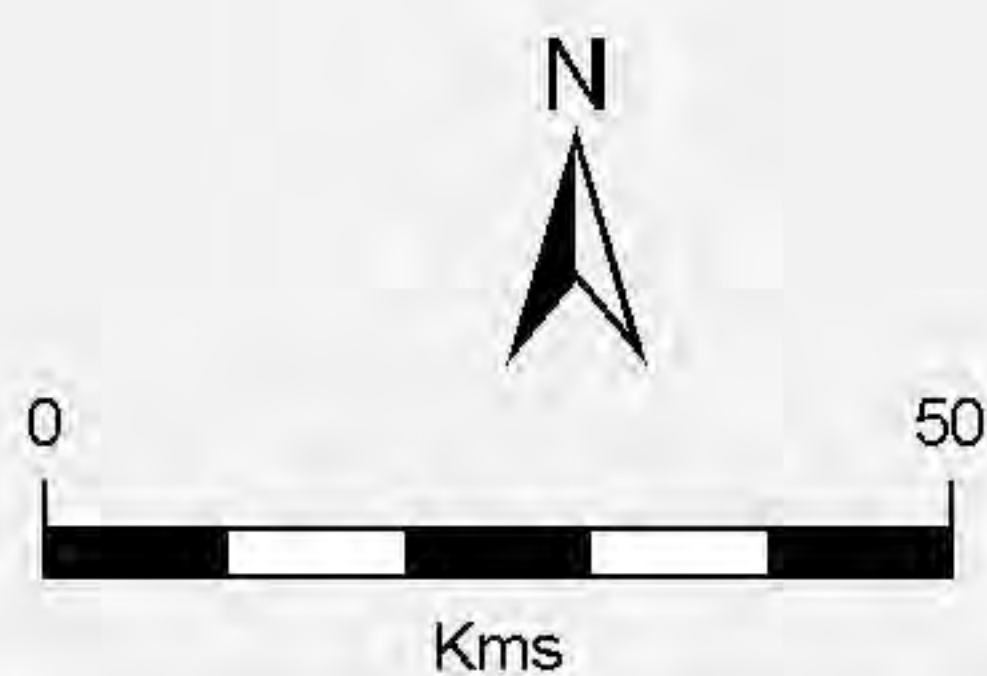
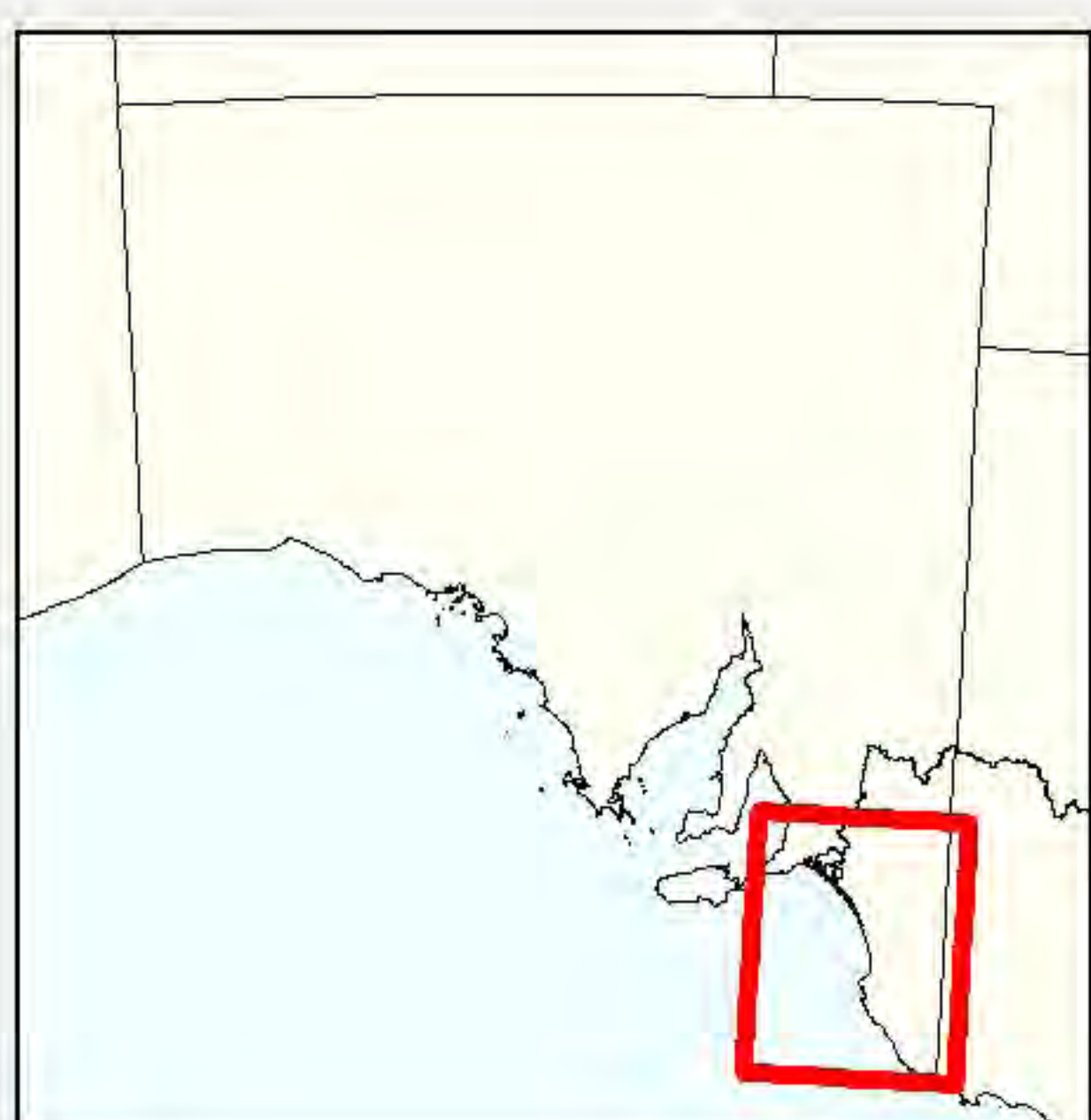
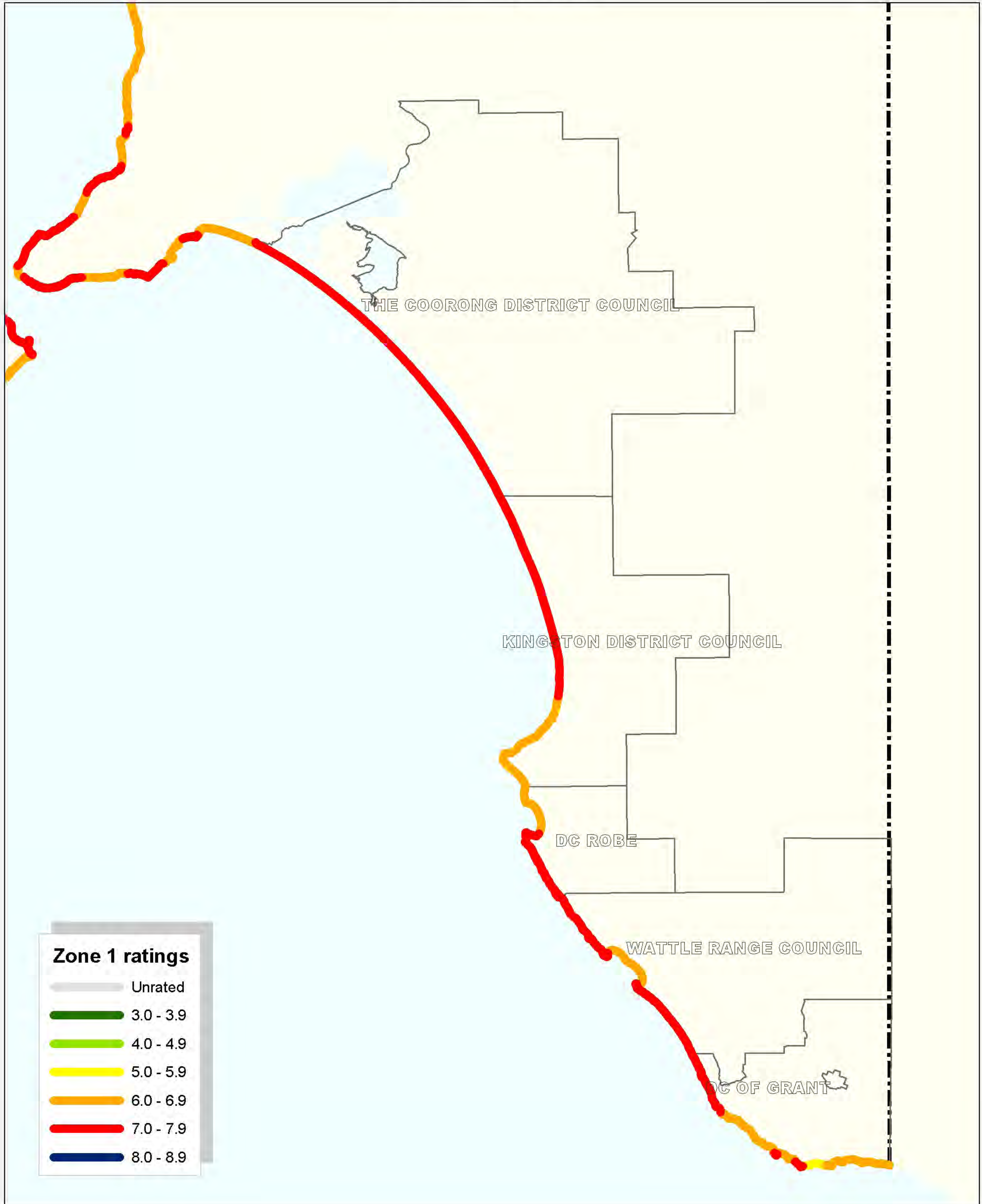
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South East Region



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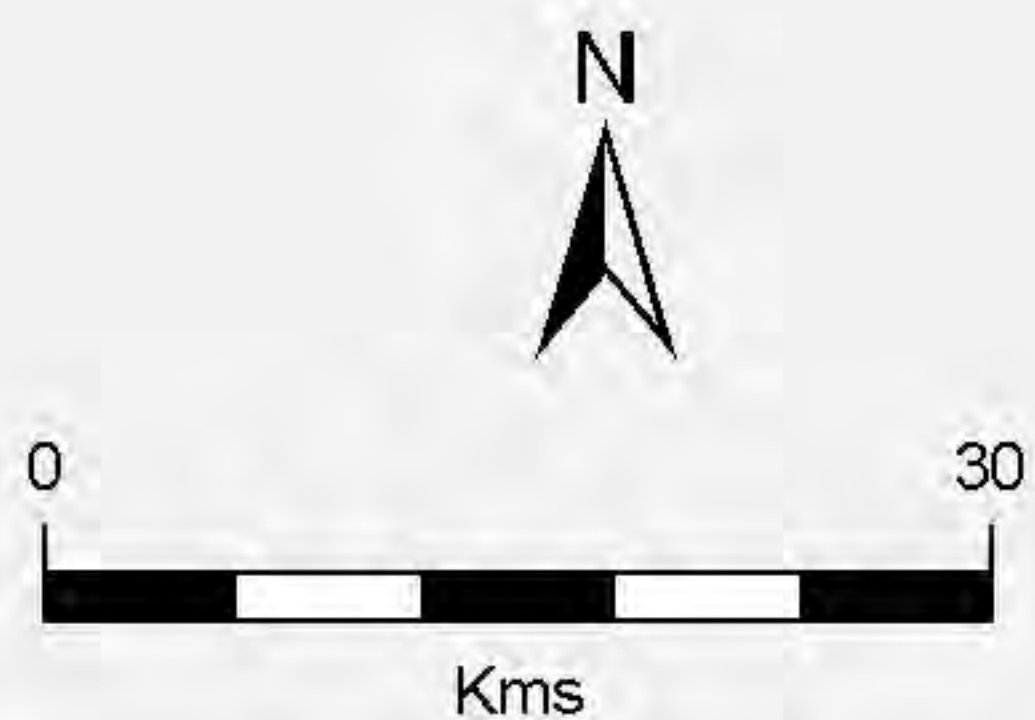
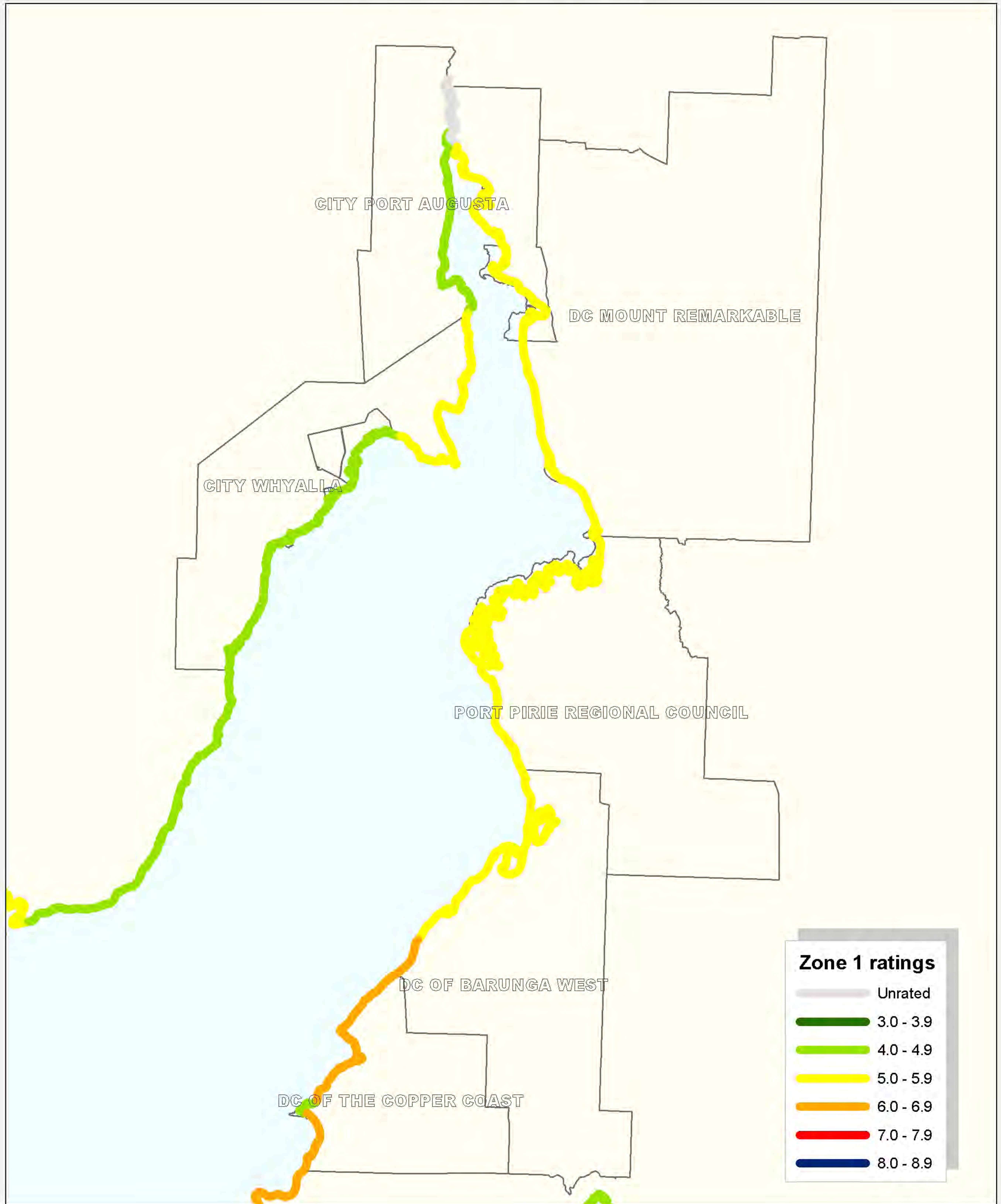
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Upper Spencer Gulf Region



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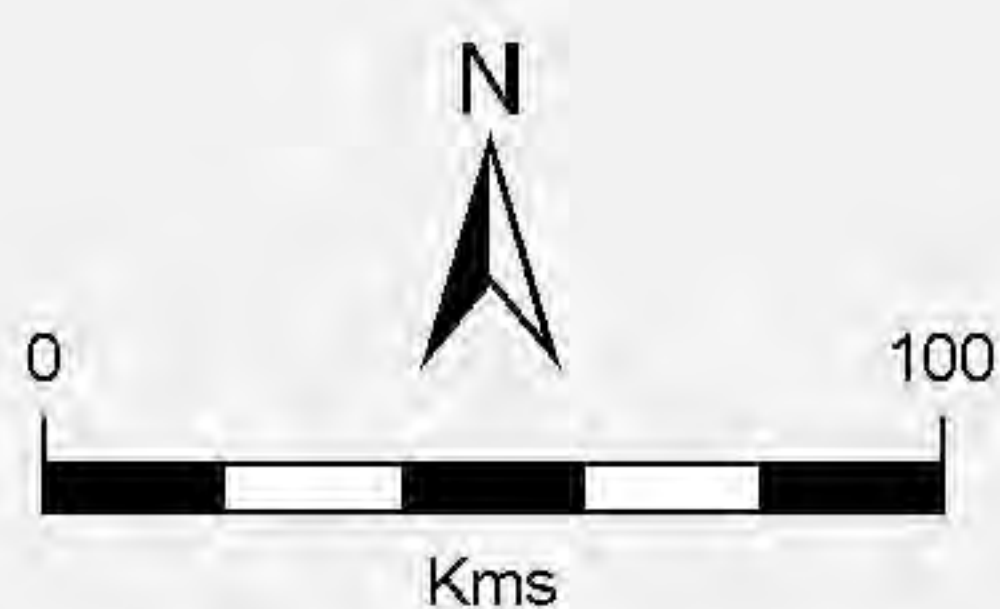
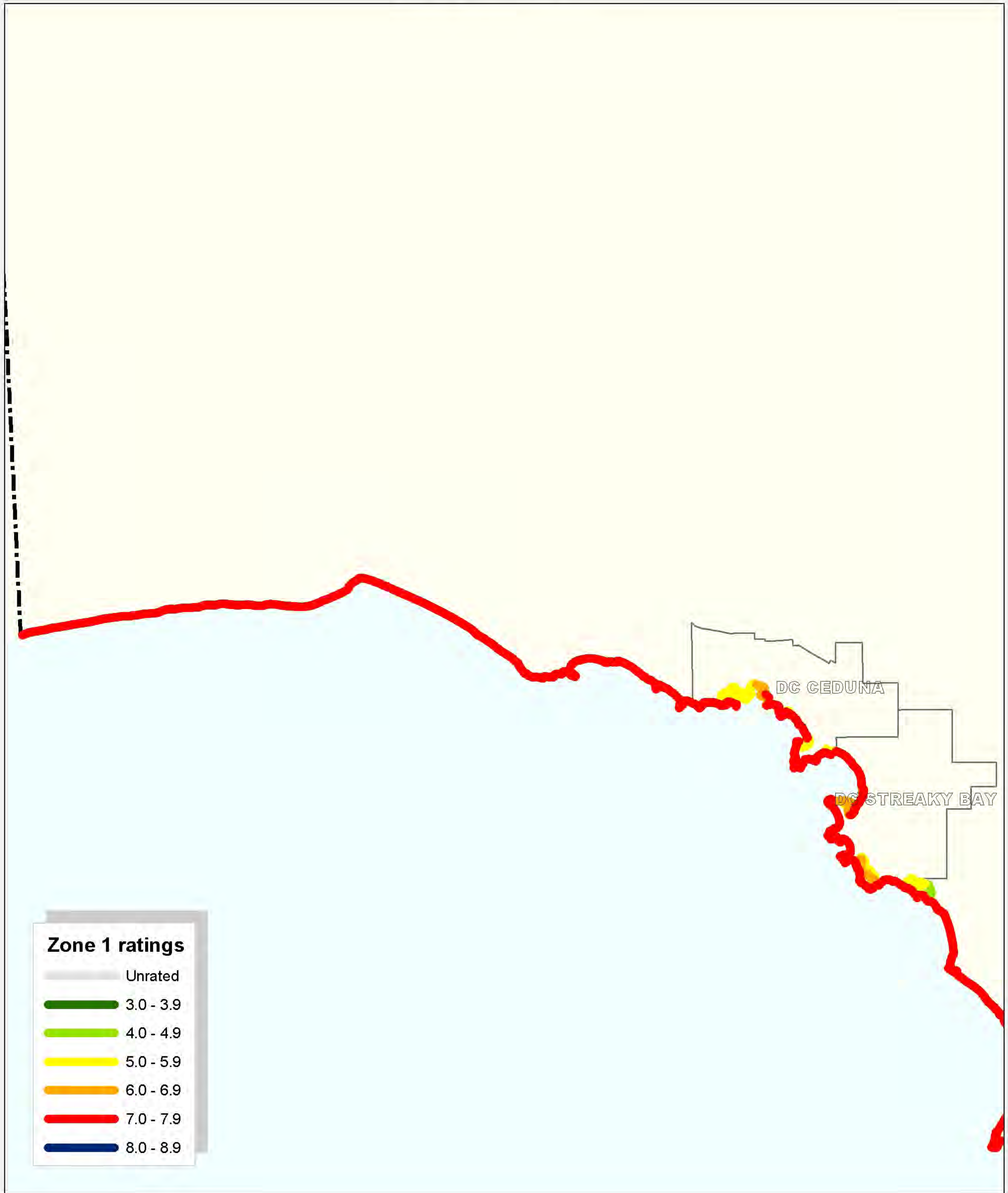
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SOUTH AUSTRALIAN COASTAL LANDSCAPE QUALITY RATINGS

West Coast Region



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