



Sea Lake Charrette

dancing under the stars





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Name: Sea Lake Charrette, dancing under the stars
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For the project: Design-led Decision Support for Regional Climate Adaptation

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preface



The 'design-led decision support for regional climate adaptation' project builds on the participating regional councils for their support and willingness to be part of the project. Climate change and its impacts are to a certain extent uncertain and this is valid for this project also. The approach to organise design charrettes represents this, because in the format of design charrettes there is room to experiment, adjust the process when circumstances change and apply new information whenever available. However, dealing with these uncertainties implies dealing with a certain risk that the outcomes will not be as expected. This requires courage of the council that hosts the design charrette. Therefore, Buloke Shire and the Advance Sea Lake group deserves all the credits for supporting enthusiastically the initiating, organisation and execution of the design charrette. In dealing with the impacts of climate change the solutions are diverse and may change over time. A well-engineered solution for the problem is therefore in many occasions not satisfying. The solutions are multi-dimensional and require a combinations of solutions for each of the parts. This requires agility in the mindset of the designers and participants of the design charrette. The use of several methods to design a desired future for a climate proof Sea Lake, whether the use of post-its, pencils and maps or plasticine was required, added to this ability.

We have been very lucky that all participants showed this agility during the design charrette. We look back at an intense and exciting design process, in which innovative solutions have been proposed and we look forward to continue the conversation in the future.

A special thank you is appropriate for Grant Alday as our main contact in Sea Lake, who, on behalf of the Advance Sea Lake Inc. group has supported this event to happen and helped us to put together the right group of participants, provided us with the right background material and gave us feedback on the process and program.

On behalf of all the members in the project team, I would like to thank all participants in the Design Charrette for their contributions!

Rob Roggema
Project Manager
Design-led Decision Support for Regional
Climate Adaptation
Centre for Design, RMIT University
4 July 2012

management summary



The town of Sea Lake, halfway Bendigo and Mildura and in the middle of the most important grain producing region in Victoria, faces a tough future. Already, the town suffers from droughts, hot summers and occasional failing harvests. The future only accelerates these weather impacts. A focus on producing grain only could well prove a wrong future pathway. Its dependency on a single form of income is fragile. Therefore, the people from Sea Lake discussed how a coherent future for their town might look like. The design charrette of Sea Lake resulted in a spatial long-term framework that deals with these future challenges. It came up with several, very clear priority policy areas:

- **Innovate current farming:** The newest technology allows farmers to organise their production process remotely and as managers of vertical integrated farms. A range of new products and services can thus be added as the output of the farm.
- **Lock in natural wonders:** The unique natural and cultural setting of Sea Lake allows for the development of special tourist attraction, such as star gazing above Lake Tyrrell or the development of Land-Art in and around town. A new arts precinct around the silos creates a vibrant town centre, where galleries, shops, cafes and restaurants open and space is found for a planetarium, a museum and artists residencies. The silos themselves are used to project movies and as a climbing wall.
- **Unlock the science of geology and history:** the area is full of geological and

historical wonders. The history of the sea lakes is extremely exciting and new scientific technologies can be discovered using this knowledge. The aboriginal heritage in the area is rich and needs to be studied in all its broadness.

- **Advance agricultural education:** The existing strengths at Tyrrell College can be extended into an international valued education. The connectedness, both virtual as in exchanging students with the rest of the world belongs to the core of the Agricultural centre of excellence in Sea Lake.

- **Facilitate with accommodations:** the development of Sea Lake as a vibrant city with a focus on tourism and education requires a range of quality accommodation. For visitors the accommodation ranges from simple RV-parks to farm stays and luxury lake edge lodges. Students, professionals and elderly need to be accommodated with accessible housing, which can range from yurts and teepees to semi attached care units and large modern villas.

No matter how serious the climatic impacts may become, one thing became clear: "Leaving is no option". The framework that has been developed during the charrette illustrates that a small community can decide to be prepared for the future through diversifying its functionalities, facilities and services. The choice to shift its focus from farming only towards education, tourism and science shows the power of the community: it enables them to

construct the right combination of activities at any desired moment. This will provide the income, the safety and the quality of living together. The sense of community in Sea Lake is very strong and made it possible to develop the framework, which provides the pathways forward. Sea Lake is a true example of a small town, which is able to develop, to improve quality of life and improve its livability.

The priority areas mentioned above offer the stronghold when in the future choices are required. It offers the contours within which the town, together with Buloke shire can jointly develop proposals to realise their ambitions. It offers the basis to claim a profound position in Federal and State level funding schemes for regional and sustainable development.

This design charrette is being organised parallel to the so-called 'small charrette'. In this small charrette primary school children have been working on the same issues and topics. They developed their visions for a future in Sea Lake under climatic and economic constraints. Mutual exchange of ideas has been proven very fertile. A sustainable and climate proof development of Sea Lake forms the communal theme.

charrette program



DAY 01// 15 JUNE 2012 / FRIDAY

EXPLORING THE PAST,
PRESENT AND FUTURE

0600 pm

WELCOME & INTRODUCTION

Welcome

Cr. David Pollard, Mayor
Buloke Shire Council

Sea Lake

Grant Alday

Advance Sea Lake Inc

Climate step changes and
what it means for Sea Lake

Prof Roger Jones

Victoria University

The Charrette process (what
are we going to do?)

Rob Roggema

Centre for Design, RMIT Uni
versity

0630 pm

DESIGN SESSION 01:
30 YEARS BACK

What was Sea Lake like in 1982? We will discuss the following topics: The economy, the People, the Climate and Technology. Based on these topics, how did Sea Lake look like (where did people live, where

was which land use types, such as forest, agriculture, residential, etc). We will put this information on a map and illustrate this with historical pictures.

0730 pm

DESIGN SESSION 02:
NOW

What is the current situation in Sea Lake? Several analytical maps will be prepared beforehand and will be presented (land-use, topography, planning zones, transport network, green, land cover, (absence of) water. These maps will be attributed by the group with specific qualities that are essential for a certain map/function. The maps are enriched with stories and facts.

0830 pm

DESIGN SESSION 03:
30 YEARS AHEAD

How do we expect Sea Lake to have developed in 2042. This session is to identify the expectations, NOT the desires for the future (so, no wishful thinking!). We will address the same topics again: economy, people, climate, technology and we will formulate and create a map how we expect Sea Lake to look like (new developments?; growth?; changing land-use?).

0930 pm

FINISH DAY ONE

DAY 02// 16 JUNE 2012/ SATURDAY

DESIGN THE FUTURE

The main question for day two will be: "How do we want the future to be?" In design session four the goals are set, in design session five the future is drawn and in design session six the plan will be modelled using plasticine. The designs are made in groups, of which a couple focus on the surroundings of Sea Lake and others on the town itself. Half-way the day these groups mingle and integrated town-surrounding groups are formed. The day ends with presentations of each group.

0930 am RE-CAPTURE DAY 01

DESIGN SESSION 04: Goal setting

Identification of the future goals that the groups want to achieve. Half of the groups will zoom in on Sea Lake, the town and the other half on its surroundings. Considering weather events, such as drought, extreme rainfall, heat or water provision the desired goals to be achieved over a period of 30 years are formulated for the topics residential living, town amenities and commercial functions, agriculture, nature and public green space and infrastructure. The goals are located on the map and must be represented as icons or symbols.

1030 am FLASH PRESENTATIONS

In short 5-min presentations each group shares their goals

1100 am MORNING TEA

1130 am DESIGN SESSION 05:
Sketching

In this session the groups will sketch a land use plan for their area (town or surroundings). In their sketches the most optimal land-use achieving the formerly defined goals must be designed

1230 pm LUNCH

0130 pm DESIGN SESSION 05:
Plasticine

In this session the town and the countryside will be integrated. The groups split up in two and mingle with their 'other half' (refer to figure 1). This results in connected groups, in which integrated solutions for Sea Lake are modelled, using plasticine. Each of the four groups will receive a specific assignment, which will have risen during the design process.

0300 pm FINAL PRESENTATIONS
Each group has 7 minutes to present their work.

0330 pm QUICK SCAN APPRAISAL:
WHAT IS GOOD ADAPTA -
TION?

The plasticine models are appraised by the participants and judged where good and bad adaptation is proposed.

0430 pm FINISH

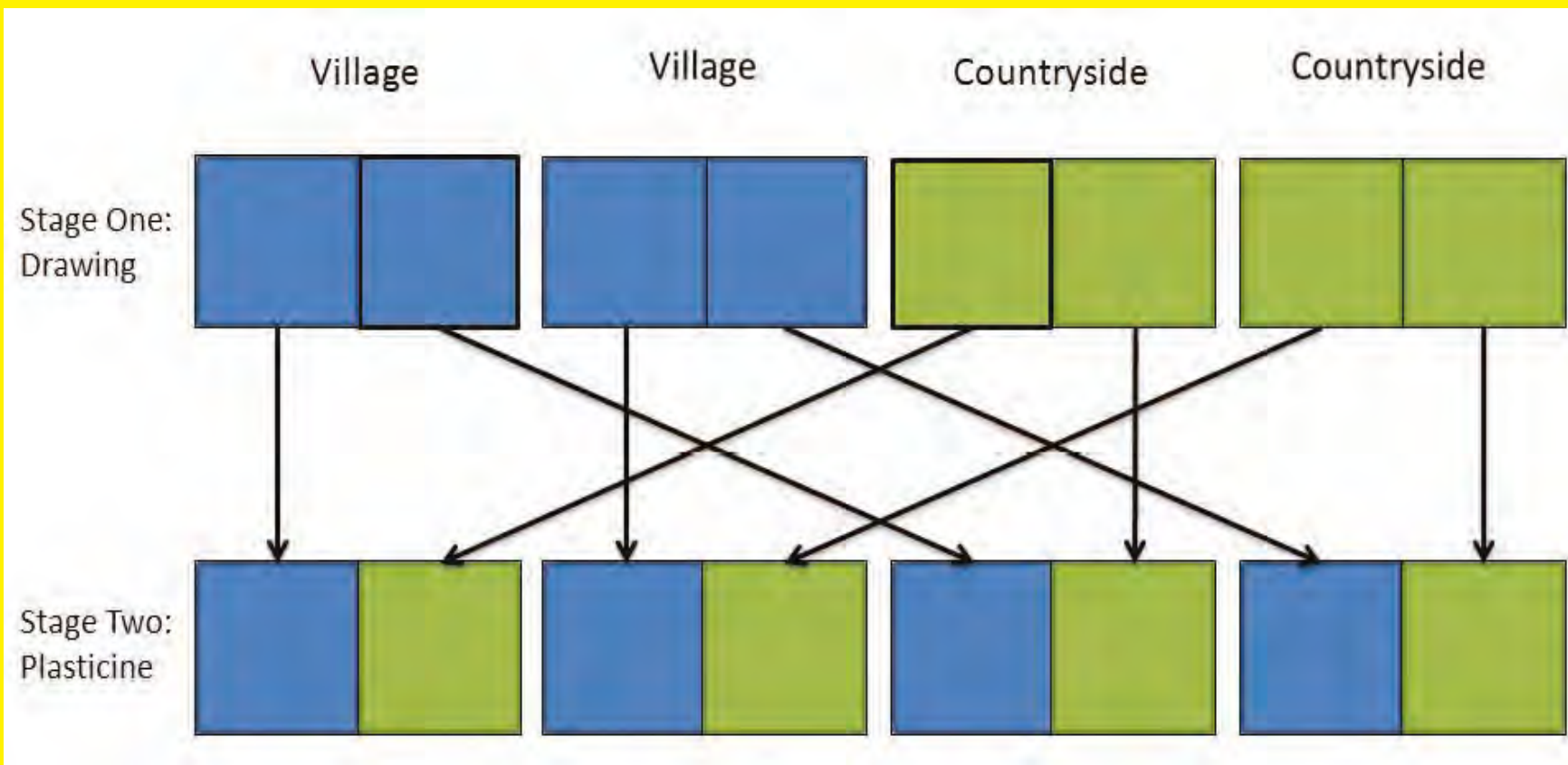


Figure 1

participants



Bron Alday	
Grant Alday	Advance Sea Lake
Pat Amos	
Kate Auty	CES
Charlie Brydon	farmer
Stephen Clune	RMIT
Miranda Conlan	Advance Sea Lake
Terry Cox	Sea Lake Nandaly Football Club
Patricia Fitzsimons	DPI
Pauline Ham	
Roger Jones	VU
Damien Kennedy	DPCD
Christine Kilmartin	DPCD
Danny Lindenbergh	RMIT
Jessie Lysaght	Buloke Shire
Cr. Read Mather	Councillor Buloke Shire
Kylie McClelland	
Laurice McClelland	Advance Sea Lake
Robert McClelland	
Kate Nunn	St, Mary's Primary School
Rachel Pierce	
Sandra Pierce	
Cr. David Pollard	Mayor Buloke Shire
Mark Remnant	Buloke Shire
Rob Roggema	RMIT
Clair Ryan	
Peter Shadwick	DSE
Lisa Vos	MBS
Cr. Ellen White	Councillor Buloke Shire

introduction



“dancing under the stars”

Global warming is a phenomenon that is occurring worldwide. The effect will impact on a local level. This does not mean that many places are deemed to disasters, but each and every area will have the opportunity to identify its future development, given that change is going to happen. Sea Lake will have to face increase in temperatures, leading to more and longer heat waves, possible long droughts and sudden heavy rainfall occasionally. This requires a long term strategy for the town and its surrounds that incorporates urgent attention and responses to these inevitable changes. The challenge for the Sea Lake design charrette is to identify those design and planning policies through the development of design principles that minimise the impact of climate change to the well-being of future generations. This challenge has been formulated in the design brief as follows: “To develop a range of future scenarios, which all sketch a future image of Sea Lake providing a community that is safe, sustainable and resilient”.

Parallel to this Sea Lake Charrette a ‘small’ charrette, especially focused to involve children at the age of primary school, is organised. This opened the opportunity to share ideas and exchange design principles between the adult population of Sea Lake and the ones that actually will experience the changes in Sea Lake the most.

sea lake charrette: the results



past-present-future

Sea Lake in 1982

Economy

The economic situation in 1982 is strongly influenced by the extreme drought in that year, which was the worst since the 1940's. This precluded the Mallee Crisis, which in 1985/1986 led to large numbers of unviable farms and farm exits. The people were unprepared as the extremely dry year of '82 was followed by a very productive year, which lulled producers into an invincible mindset. 1982 marked the near ending of a prosperous period.

Before 1983 the population was large, there were many farms, workers and shearers and more services and products were available. At the time the farms had a low debt ratio and sheep were worth good money. There were two doctor surgeries separate from the hospital, two viable hotels, clothes shops, butchers and slaughteryards and a TAB. Three or four banks existed in town, a bakery, three car-dealers and four mechanical farm machinery dealers and services. The new Carinya community centre opened in 1981, a new Shire office opened and a regional DPI office was located in town. The SEC and water commission held residence in Sea Lake. Green Lake was a popular campsite over summer and functioned as the primary campsite for all primary

schools. Finally, in 1982, a film society was active in the community.

After 1983 many things changed and the extreme drought is generally seen as the cause. Population was lost, interest rates increased to 15-18% and household debt developed. There was hardly any financial support from government, leaving financial support to families, the church and rural finance. Overdrafts were introduced and were pushed to extremes as banks were generally unsupportive. People were forced to shop locally and it was possible (and necessary) to put things on account ('over the counter banking'). In cafes there was only fruit and vegetable available. Many women were retrained to get back to work. The question is however whether this was voluntary or a plain necessity.

AWB cash payment when delivered and payments over years when the pool was reduced AWB little price fluctuations: high price due to the drought
SLD half its size – dark and clingy; very limited range of stock

The size of the population in 1982 is seen as a good thing. It allowed for a wider range of shops and services. Families and farmers had more in built financial resilience.

Downsides in 1982 were the high debt and interest rates and the fact that the population was about to decrease, especially the younger population, which is seen as a future economical loss.

Climate

Taking into account the wet years of 1981 and 1983 when big rains occurred late March and April, 1982 stood out as the exception. However, when the mid-80's are brought into the picture the drought is dominant and '81 and '83 can be seen as the wet exceptions. It was experienced as a shock to be confronted with several dry years in succession, which hadn't occurred since the 1940's. In 1982 many dams were without water. Only in January a little bit of rain fell, that was it for the rest of the year. It led to the greatest dust storm ever. It is said that people couldn't leave the pub ...! The drought and lower humidity changed garden practice and people became more stressful. Still, because of the wet years before and after 1982 Green Lake was full and functioned as a vibrant social place. It was a good year for mushroom picking. 1982 is also seen as a watershed year to change farming practices. Before there was no

In 1911 Sea Lake had-

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- 20. J. A. Campbell

TOWNSHIP OF SEA LAKE

SCALE 1:5000



In 1973 Sea Lake had-

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- 2. J. A. Campbell
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- 40. J. A. Campbell



old map of Sea lake (1973)

no-till farming, while afterwards no-till was introduced. At the time nobody was considering climate change. It was just a cycle the weather was in. The advantages of the occurring drought were mainly the search for innovations and new solutions. New research was initiated into farming practices, such as no-till and the genetics of crops, tree planting to mitigate erosion was considered good practice and salinity solutions to deal with salt in the environment were all developed as a result of stressing circumstances. However, 1982 is the announcing year of the biggest drought ever seen: there was no rain at all, a huge dust storm and the loss of soil. In winter, extreme frost killed many trees and crops. Probably the most serious problem is the domino effect of the climatic drought: it led to loss of people, young people leaving the town, businesses were lost and schools were forced to merge.

Technology

In 1982 the machinery for farming was much smaller and needed to do without GPS but using CB Radio, so the time needed for sowing and harvesting was much longer. The majority of machinery, such as 24/28 row combines, 10 tonne tray trucks and PTO headers and tractors was individually and locally owned. On the farm more (casual) labour was required, which was recruited from the region. It was the era of mechanical diesel motors, 2WD-utes, 2WD-tractors and basic fire trucks. Hydraulic presses were freshly introduced.

The price of fuel would have been under 40 cents. 120 horse power
The main transportation means for moving grain was the train. In 1982 all silo's were in use. Grain was delivered to bulk handling and less segregated. This led to grain handling facilities spread along the railway lines.

Crop varieties different in 1982. FAQ
Wheat, single desk. Wheat barley oats. 90% sold into the AWB pool – G/B. Fallow
“Acky” Bar – which contributed to the upheaval of soil in the drought. Clean; more fallowing

All the land was cultivated and paddocks were rested every four years. The soil-conservation was locally executed. Farmers began buying semi's In the production process less chemicals were used. There were no generic ones available and these were costly. The weather was predicted by looking at the sky. Local agricultural officers, based in the Department of AG and Walpeup Research Field Station, organised days for farming information.

There was no air-conditioner in machinery or in housing. Cooling was provided mostly through ceiling fans. The “brick” telephone was a landline, operated through manually exchanges. There were no computers in schools, and no photocopiers, digital photo-cameras or Eftpos around. Orders, often put in by telephone, needed to be paid cash or using cheques. Shops made use of adding machines, kept manual written customer, ‘shoe box’, accounts. Bank statements were typed, using type

writers. There were few radio (AM Radio, 3SH, with Harold Pratt) and TV (ABC, Bendigo, BCTV6, BTV8) channels. TV channels finished at 11 pm. Each family had (only) one family TV. Southern Cross 10. The first VCR's were introduced. The common mode of local transport was the bike: bike racks in school were full. Windmills and gravity fed energy systems were introduced.

The advantages in 1982 were environmentally friendly modes of transport, bikes for people and trains, using all silo's for grain, implying that less trucks and cars were on the road. Knowledgeable people were closer at hand for advice to improve farming practices and soil conservation. However, there were no technologies available for business (cash transfers, computers), the farming was dependant on looking at the weather and sowing when it rained without advanced predictions and all the land was cultivated (less regeneration or natural reserves).

People

The community in Sea Lake was in 1982 much more conservative and monocultural. Many women stayed at home and didn't work. It was the tail end of the '10 kid family', even if you were catholic. The farms were smaller, but could sustain more people and families were bigger still. This led to more family-oriented activities. More people were religious and supported a number of churches. Church

1034 lives — that means everyone

... In Sea Lake, the town that is a symbol

Photo: BOB TENNANT
Caption: BRYCE WALTON



BOB TENNANT PHOTOGRAPHED BY BOB TENNANT
BRYCE WALTON, OWNER OF THE SEA LAKE HOTEL



You have traveled 200 miles on the highway to Phoenix, and the sign here that says "Sea Lake" is the first sign you see. The sign is a long way behind you, and you are in a town called Sea Lake.

When you drive all around the town, you will see a sign that says "Sea Lake" in every direction. It is a sign that is a symbol of the town. It is a sign that is a symbol of the town. It is a sign that is a symbol of the town.

Sea Lake is a town of 1034 people. It is a town that is a symbol of the town. It is a town that is a symbol of the town. It is a town that is a symbol of the town.

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BOB TENNANT PHOTOGRAPHED BY BOB TENNANT
BOB TENNANT, OWNER OF THE SEA LAKE HOTEL

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leaders lived and worked in the town. People were still cashed up so nobody really 'hit' a wall in 1982. The population was greater (approx. 1200) and there were more young families living in Sea Lake and the surrounding areas. There were more schools in all towns in the surrounding (Colgoa, Berri, Nandaly and Sea Lake). There was a separate primary and high school in Sea Lake. The high school population in 1981 was 245. The larger population implied more social interaction within Sea Lake and the surrounding towns and a larger availability of people to be part of running committees for all organisations and sporting clubs. Each surrounding town had its own football club and there were cubs, scouts and guides. The Corinya complex was build and a weekly cabaret with a band travelled around the towns. There was a little theatrical group. Several service clubs were in operation, CWA, Apex, Young Lions, and a local hospital and small aged care unit was in operation. The three banks, four churches, three petrol stations came with more professionals, such as bank managers, church leaders and others to flow on to local committees. As a result, the socio-economic range (SEIFA) was higher. 1982 is a year this all tipped. Because of the drought kids went away from the farms to Melbourne and Bendigo, where they could earn comparable wages. The shrinking size of families was because of this further reduced, ultimately leading to a whole 'missing' generation. This reduction

in population numbers, especially youngsters, had consequences for the number of schools, footy-clubs and other sport clubs. Some disappeared, while others were forced to amalgamate, such as the cricket and netball clubs. In this period the first signals of council amalgamation became apparent through the pre-council amalgamation of Wicheproof. A sad witness of the sometimes hopeless forecasts were the higher suicide rates in this period. The positive side in this era was the number of people and the vibrant social interactions within town, such as represented in sport clubs, the caberet dances on weekends, more entertainment, and a high number of young families. Mid 80's this all changed with negative consequences such as higher suicide rates, mums forced to staying at home even if they wanted to enter the work force and children leaving the farm for higher wages in the city.



Sea Lake now

Sea Lake has a compact business district and the town has a walkable size. This is good for health and transport. The boundaries of the town are good and clear. However, there is little room for expansion as the town is bounded on all sides by private land (e.g. farms). There are only few problems related to the town centre. The old school site is seen as a waste of a prime real estate location and the quality of stock is getting old. There is a lack of qualitative housing for a professional population and the distance of the oval is too far from the town centre. The main (Calder) highway does not divide the town is not divided. This implies also that the Calder freeway bypasses the main commercial district, which leads to a loss of potential tourism and retail business. The main road is accessible for trucks and a bypass is desirable here. The quality of the pavement could be improved, particularly given heavy truck use. The town is well serviced by public transport (bus). The health precinct is good and could be emphasised, for instance through expand room for aged care units, as the aging population is not very well catered for through independent living space. The number of cycling and walking tracks as well as facilities for skaters and netballers could be improved. Generally, the number of bio-

links needs to be increased in order to support native vegetation. The area for nature reserves could also be increased. There are opportunities for biodiversity corridors around lake Tyrrell, along boundary fences (mechanised) and along the railway and creeks. The actual natural watercourses are broken and incomplete. The water has difficulties to flow, even in case of excessive rain. In order to maintain waterways and creeks, culverts need to be reinstated, for instance in the Dunmunkle creek between Birchip and Sea Lake. The unused salt extraction area is not yet given a reserved status, which could improve biodiversity. In other parts of the salt extraction area salt harvesting could continue as it is good for business. The potential of lake Tyrrell is underused. It could play a significant role in tourism development. When a cork is put in Green Lake tourism could be enhanced here as well. The crop type will change depending on (1) sub-soil moisture prior to the growing season, (2) grain prices and (3) previous years crops. To preserve good farming conditions salt incursion onto farmland must be minimised through planting salt tolerant plants and both salinity as rabbits must be controlled.



Sea Lake in 2042

Economy

The unique qualities and attractors for Sea Lake in 2042 is primarily found in the natural environment and its tourism potential. The unique star-filled skies above the salty lake Tyrrell offer touristic opportunities for astronomy, art and health (Tyrrell salt scrubs!), and mountain biking, farm and flora and fauna tours. This way tourism can be diversified and be developed in a thriving industry with an excellent supply of water. When Green Lake holds water it can function as a counter balance of the vast lake Tyrrell.

Secondly, Sea Lake has become the Australian heart and hub of the agricultural excellence in education. It includes an agricultural school program for residential students and international school exchanges. It is conditional to develop reliable connections with the broader region, metropolitan centres and the rest of the world. Fast Internet and train connections (fast trains, bullet trains) are amongst the essentials here.

Farming continues to be a key drawcard for Sea Lake and its surroundings. It has the potential to feed the world! Therefore it is required to develop a trusted food chain and also supply local markets, where local vegetables can be purchased. In this manner food miles can

be reduced. Meanwhile it is important to parallel develop an alternative to become less dependent on crop farming. Further exploitation whilst conserving the salt from Lake Tyrrell is an option. Innovative opportunities, such as the production of batteries for the new trains out of salt, need to be further explored.

The beauty of the natural environment can be used to create a very attractive residential area, where houses can be built on the water of Sea Lake and a retirement village could be developed. As older people are rich these developments can be capitalised. Besides these more exclusive houses more affordable and accessible housing for people of different age groups and situations attribute to the identity of Sea Lake as a preferred residential location. A good hospital and residential aged care, a diversity of housing stock, for instance smaller units with no backyard contribute to this idea.

Economic development requires all kinds of facilitative measures. The look of the town from the Calder is important, the initiation of a community bank as a foundation where business owners to contribute to in good years, a bakery opposite travellers rest and excellent technology for professionals to work in Sea Lake and link to anywhere else work-wise will boost online

industries. In 2042 the majority of people working in Sea Lake will enjoy a three day work week.

Through combining the touristic, educational and agricultural strongholds with new ways of living and health care and excellent high speed connections over land and blue tooth, by 2042 Sea Lake has become the central service centre and economic hub for the Mallee ward.

Climate

The climate for 2042 in Sea Lake is expected to show a greater variability containing more extreme events. Therefore it becomes very important to adapt to these future changes. There are many different ways Sea Lake can adapt in the future. First of all, the production of renewable energy allows the area to become self sufficient in power supply, whilst reducing pollution and contributing to economic development.

Extreme rain events will cause temporarily severe water problems. Lake Tyrrell might fill up rather quickly before the water evaporates slowly afterwards. A way to anticipate this and to create an innovative new environment is to build houses on the lakes: for instance as a floating villages in Culgaa.

Depending innovations in technology,

carbon capture and storage is a way to adapt in agriculture (Biochar) and create better soil conditions, which will raise productivity. It is also a way to mitigate climate change as it captures carbon permanently in the soil. Farmers will have become more adaptable to weather fluctuation in other ways as well, for instance through innovative new practices to store summer rains and adjustments in the diversity of crops, cropping cycles and methods. Introduction of drought tolerant varieties of wheat will be common and sowing of opportunity crops (e.g. corn, sorghum, sunflowers) will play a more important role. The impacts of more extreme weather events are used to change farming practices and what is grown to secure our own food supply and be able to contribute food to the region. The timing of crops becomes more significant and new practices and technologies will have been developed. Marginal land or land that is vulnerable to use as productive land is used for something other than farming, e.g. livestock, such as Kangaroo or emu. Because farms will have become bigger there is more room for flexibility and uncertainty. In 2042 farming practices will no longer impact the environment through burning or spreading fertiliser. The internationalisation of industries through online application will reduce the dependency. Vegetation stocks will increase with growing knowledge and there will be less dependence on monocultures.

Technology

As history has proven technological developments occur in breakthroughs and market take-ups that are difficult to predict. Imagine a world without mobile phone or a computer. These techniques were around for a while, but became available to the larger public only recently. Despite this unpredictable nature of technological developments, Sea Lake has several comparative advantages, which may prelude innovations of the future.

The first element that stands out is the opportunity to study the sky. To build on this, a telescope and observatory could be located at or near Lake Tyrrell. This could then be linked with astronomical research in Victoria and across the country and would enhance tourism.

The second opportunity lies in the chance to secure food and energy supply within the region of Sea Lake. The area has already excellent farming and food production facilities and its location in the sun-loaded landscape offers high potentials for developing a solar power plant that could provide the energy for the town and beyond. Also wind energy can be a serious option to explore and develop. The future will be supported by accessible modern technologies, such as virtual, wireless and fast broadband. This means that the model of education, but also the way we spend our recreational time, will change. Fewer people will work in the traditional 'brick and mortar' sectors and more will operate as internet businesses,

allowing them to broaden their scope worldwide. Learning doesn't stop after, or even before, year 12, but transforms in a lifelong experience, continuously supported by new and renewing technologies. Primary and secondary schools will have the opportunity to exchange with communities internationally enriching their curriculum. For farming changes might include that the farm is no longer a single 'fabric' located on a specific piece of land, delivering products to the local or regional market, but that it can be 'marketed' at the global level. The best visible farms on the net eventually end up being the most successful. For health care new technologies imply also change. For ordinary and simple health care virtual means make it possible to care remotely, while for specialist services people become more reliant on air services. In order to attract professionals in health care it is conditional to be able to offer high quality housing stock.

Technology allows farming to increase the size of farms. Many aspects of farming will be automated, such as machinery that is controlled remotely and climate information that is available publicly for efficient controlled farming. Research into more variety and drought tolerant crops will lead to higher yields. A variable rate technology for sowing will come in use. The upscaling of farming in big sheds is supported by improved rail/freight technology, which makes it possible to transport larger amounts of grain. The decrease of

hands-on labour allows the farmer to shift role towards a manager of technology, using integrated logistics. He becomes a land manager who employs professional expertise, whenever required. This leaves time for vertical integration of products. Instead of being the producer of a single product in the chain of grain, he may as well participate or own several parts of the chain: the marketing, the machinery, the seeds, the land and others.

New technology could be of help to solve the 'Green Lake leak' problem.

And finally, advanced technology may improve the Sea Lake website, on which a virtual tour, job opportunities or housing options can be advertised.

People

On the longer term the population of Sea Lake needs to be stabilised. Decline, as current trends are showing is found not desirable. The goal therefore must be to realise a balanced demographic profile of a multicultural society with more people in all age groups. Given the current gaps, priority is given to attract young people. In order to be successful in this, social infrastructure is required. Therefore, the development of new activities, organised events and entertainment for youngsters, other than sport is essential. Scouting facilities, apex, crabs, theatre, skate- and bike-park, gopher and bike tracks throughout town and in the surroundings are some of the suggested ideas. This will hopefully lead to a more active youth group. Other

social ambitions include the dismantling of the divide between town and farm, re-involve disengaged Sea Lakers and aiming for people to live in harmony and understanding.

The aim to create a more balanced population needs to be underpinned by an increased diversity of housing stock, which is more flexible, innovative and of higher quality. If combined with the right health-, jobs- and education infrastructure it will attract retirees and potentially professionals and keep them. The idea to create 'centres of excellence' in agricultural and aged care training, giving people the opportunity for lifelong learning will lead to top class aged care facilities (especially dementia) in town.

The connection between school, young people and farming can be strengthened through the development of agricultural programs to become a prime mover, leading to more employment and more accommodation. When young people are offered apprenticeships and local employment on farms, they can gain experience and insights into farming and young people are attracted to stay in the community. The Birchip Cropping Group model, which forms a network of farms sharing and developing knowledge and resources could be applied here. Additionally, succession planning could keep local farmers in the region.

Finally, a Masterplan enhancing a community hub around the recreation reserve, the old courthouse, pool and old croquet

club needs to be developed.

TECHNOLOGY & 2042

How will we
use technology
in 2042?

Changes made
in education by
using with global
technology will
more than what is
expected in schools

Education will
be more
personalized
and
adaptive

Education
will be
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personalized
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surroundings

The designs for surroundings and town were created in separated groups (two each) and the desired future for these areas is drawn and sketched on large maps. each group needed to come up with a spatial plan which responded to the question to develop a future vision for (surrounding, respectively town of) Sea Lake, that is safe, sustainable and resilient.



Development through diversity

Robert McClelland
Damien Kennedy
Charlie Brydon
Grant Alday
Patricia Fitzsimons



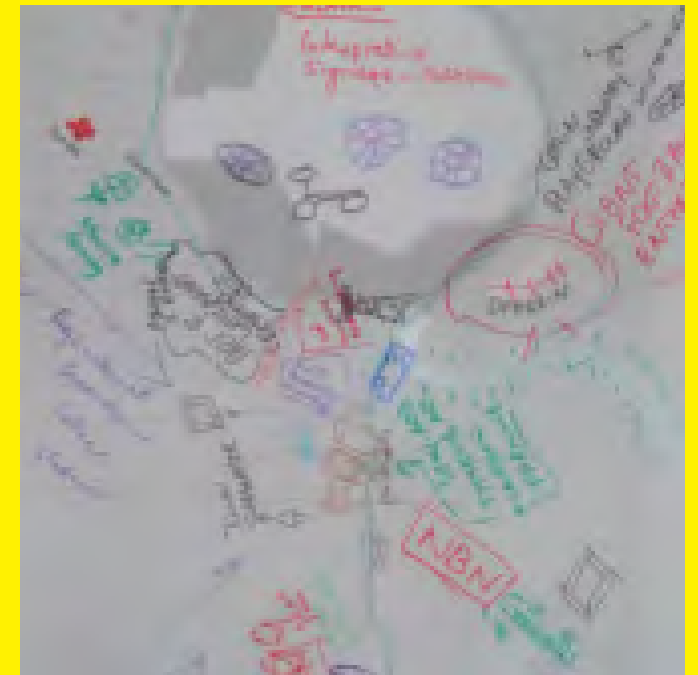
The design 'development through diversity' emphasises the range of investments and integration of fields of attention required to create a sustainable and climate proof future. The first focus area is Lake Tyrrell. This natural beauty is currently underdeveloped. The vast views over the salt lake in combination with nightly stargazing open up immense opportunities to capitalise on tourism. In this design it is proposed to create a firm environmental zone around the lake, which is seen as an ecological function with human co-use. This makes it possible to access the lake and create several attractions along the shorelines. One of these attractions is an observatory with telescope at the north-western shore, which is accessible by road, but also using a flat bottom boat that crosses the lake, even if there is a lack of water. There are several places around the lake foreseen as temporary stages to perform opera under the stars. This could develop in a summer festival of lounge-listen to the opera, while gazing at the stars. The bio-ecological zone around the lake offers improved ecological quality and will function as an ecological core in the wider landscape. Additional bio-links are proposed to connect with this zone along the Tyrrell and Dunkmunkle creeks. Additionally, there is an abundance of space in this environmental zone available to develop wind farms and a solar plant. Especially the eastern side of Lake Tyrrell is suitable. The existing salt extrac-

tion continues to function. In the region the balance between biodiversity goals and farming needs to be preserved. This means that both the efficiency of farms as well as the integration of farmland in biodiversity corridors is important. Regulations are required that support farm outcomes, not only ones that protect the environment. An increase is needed in integrated knowledge development as a response to extreme weather events, such as long droughts, sudden floods and locusts. A combination of local knowledge and leadership should be put in place for an immediate response. Farming becomes a more holistic activity. It twins the goals of plain efficient agricultural production with activities that go beyond the basic farming activities. This vertical integration of activities, in which a range of industries, such as poultry farming, intensive agriculture (pigs) as well as marketing, virtual selling, ownership over machinery and transport means, is involved, also requires a critical mass of engaged people. A strategic response is required to manage wood infestations. It is proposed to focus on research that approaches this issue from a regional perspective and deals with it immediately. Extensive research is needed to respond to the outcomes of no-till practice through local institutions such as BCG and the government. In order to support farmers in temporary difficult times an innovation centre is proposed that develops appropriate govern-

ance arrangements to provide labour and/or capital on ad-hoc basis. The (underestimated) potential of Green Lake is (re)developed. The water problem will be solved and a new, state of the art, campsite is projected. A cultural response to labour expertise from Asian countries is developed and stimulates the arrival of Asian families. It is seen as important to provide appropriate cultural support, such as language classes and education for children. A multicultural community, in which locals also learn Asian languages is developed and improves understanding and coherence amongst all inhabitants of Sea Lake. In order to connect all projects and ideas, to dedicate labour to project and to liaise between the local community and the (higher) governments and other funding bodies, the position for a town-manager is created. Symbolically, this 'host' of Sea Lake is offered the director's chair, a piece of art, overlooking the beauty of Lake Tyrrell.

Salt, Sky, Sun and Stars

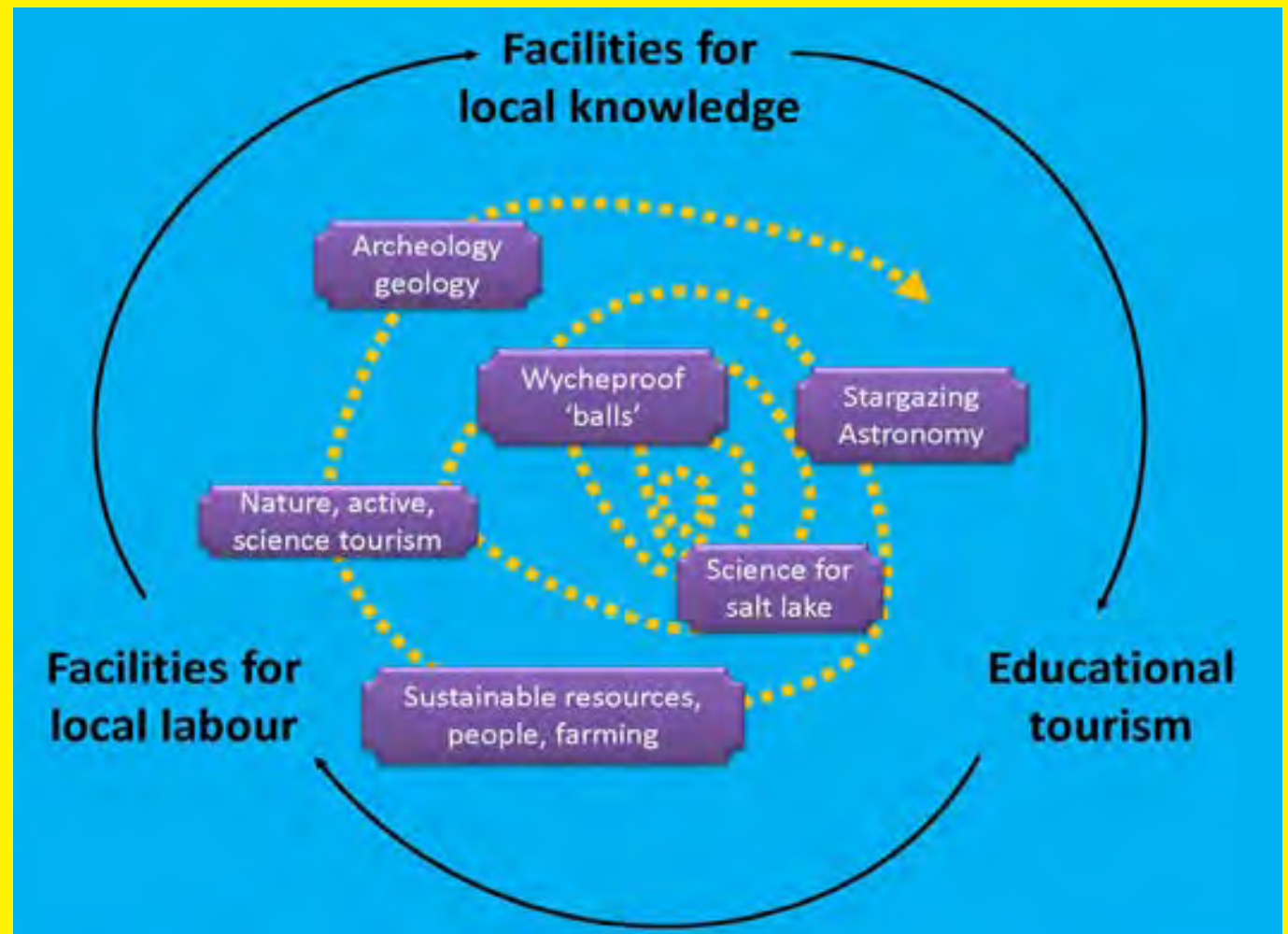
Kylie McClelland
Danny Lindenbergh
Lisa Vos
Kate Auty
Roger Jones



The 'Salt, Sky, Sun and Stars' design makes optimal use of the natural qualities of Sea Lake and around. The specific qualities of Lake Tyrrell are taken as the starting point for the proposal to develop the area for sustainable tourism. Apart from the general aim to make the area more sustainable, the focus lies on the crisp and clear skies, archaeology, indigenous heritage and art. The skies offer the opportunity to develop astronomical science and stargazing activities. The dunes and salt lakes, and facts such as the shoreline that used to be at Swan Hill, are used to develop interest in archaeological finds. In the area many cultural heritages of aboriginal origin can be discovered. Several ideas related to art are launched. The development of an artists and/or writers retreat near the lake is one of these. The other, more specific idea is to create an art exhibition in Lake Tyrrell. What if overnight the large balls, made by an artist in Wycheproof appear suddenly in the lake? They would have the same impact as the grain circles do in remote areas in the US. Further it is suggested to paint buildings with artwork, organise more exhibitions and create art in the landscape. These developments all require accommodation and facilities. This design proposes to realise those as part of the farm experience and in a sustainable way. Moreover, the idea is to link these proposals to educational tourism: (young) people come to Sea Lake to learn about culture, art and astronomy. This would generate a broader scientific interest for the salt lake

in general and Lake Tyrrell specifically. Students, academics and interested local people could jointly research and be brought together. When this can be subsequently linked with Tyrrel College educational programs, school camps and agricultural learning lines the connection between local assets and the wider world is established. A sustainable relationship then can be developed between nature,

science and activities, such as cycling (bike races) and hiking along or around the Lake. The long term sustainability is seen as an integrated approach in which the quality of the environment, care for natural resources such as water and energy is connected with demographic and economic prosperity, which provides work locally, increases facilities and the number





of people, visiting or living in Sea Lake. This way the critical mass is reached and sustainably maintained, because it is not solely dependent on farming. Specific points that enhance the sustainability is the attention for local flora and fauna, a sustainably filled Green Lake with a kitchen and other facilities and the need for more drought tolerant crops. The focus on the assets Lake Tyrrel brings to the region, and exploiting those, in combination with thorough sustainability gives Sea Lake a position as the HUB to other towns and regions in north-western Victoria, such as Little desert, Big desert and Sunset National Parks. Finally, a strong communication strategy is essential to create attention for the qualities that are already locally experienced and developed. It must be visible, real time and virtual.



town



Community hub

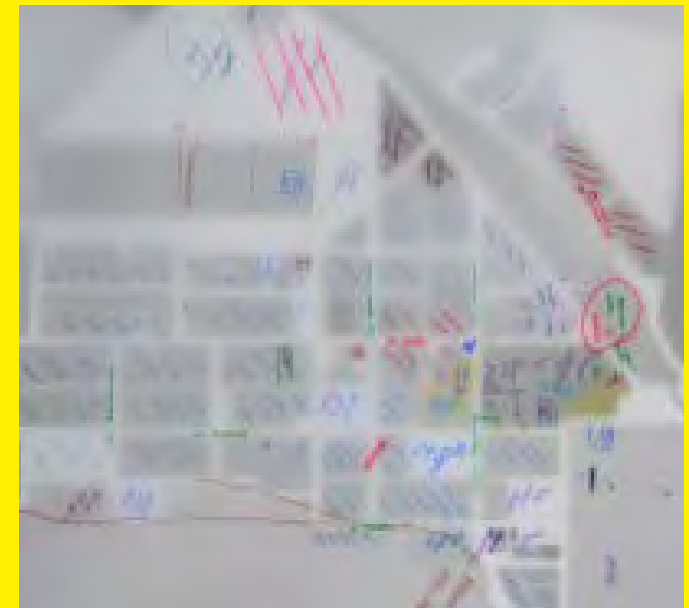
Laurice McClelland

Rachel Pearce

Pat Amos

Pauline Ham

Christine Kilmartin



In 'Community hub' it is proposed to integrate many goals of different kinds. Historical aims in the form of a museum are combined with aged care, education and arts and culture. The town then develops into a city hub through concentrating and building of these different facilities in each others vicinity. In order to facilitate these functions to be developed available land is proposed to be used. Land currently underused, such as the old primary school site and oval, the railway precincts and station and the recreation reserve are potential options. These centrally located areas are suitable for functions that fit in a town centre, such as hotels or motels, conference facilities, a memorial hall, a theatre or an outlet for online ordering. In order to create an attractive centre, where passing visitors, tourists or students stop by, the shop fronts along the Calder freeway need to be updated, for instance through add paintings on walls.

Another site that can be developed is the health services complex, in which the hospital, the ambulance function, police, pharmacy and doctor services are combined with office uses such as for DPI-landcare and where BCG can be united. Independent housing for aged can be attached to this cluster.

Current housing need to be renewed and developed as innovative and up-to-date housing in order to attract professionals, such as teachers, accountants, nursing health, bank and curators and artists to come living in Sea Lake. To make Sea Lake

more attractive to families, education is the key. When a multicultural centre for primary school children, TAFE and higher education is developed the basic conditions are provided.

Part of the community hub is also to arrange a sustainable town. Therefore it is proposed to provide solar energy for every building/house and realise a solar farm for the entire town. Rainwater is collected and preserved to water the city gardens and natural vegetation. The city garden and/or the old croquet club is seen as an ideal location to develop a planetarium. In order to provide future funds to realise these ideas 'community hub' proposes a city bank, which buys land to develop it and invest the revenues in the quality of Sea Lake. A town manager is seen as essential to consolidate all project ideas and stimulate realisation.

Centre of the Mallee

Sandra Pierce
 Bron Alday
 Peter Shadwick
 Claire Ryan



In 'Centre of the Mallee' Sea Lake is seen as the central hub of the region. The town has a function for the entire region as a housing centre, for amenities and facilities. Sea Lake has excellent aged care and the housing that is required for that. These up to date care is also attractive for the aged from out of town, which makes a frequent and high-quality taxi service necessary. The housing offerings are diverse. There are try before you buy houses, which you can occupy for a certain period in order to experience the quality; especially for retirees attractive. There are appropriate houses for families in the form of units and many other different typologies. Technology in Sea Lake is of high level, allowing education to keep up and allowing spending money wisely on medicine. There will be less farms in Sea Lake, but the ones that are left are large industrial agribusiness estates, also supported by the latest technology. In town there are a lot of activities for children, not only sports, but also technology, art and music. In order to create a safe and quiet town the main truck route, currently crossing town is bypassed away from Best St. Sea Lake will have frequent and good quality bus transport with surrounding towns as well as with Bendigo and Mildura. The school bus is double used and during the weekend the V-line is operational. The newly invented "Sea Lake drive" connects all facilities and attractions of Sea Lake. It is a well-designed beautiful drive full of surprises, which links many different

points of interest: First there is Horace St., which is beautified and operates as a high quality public open space with nicely painted walls. Then there is the Mallee centre, where facilities, such as health, education, shopping, meeting and government are concentrated and function as a regional hub. Thirdly the town as place to stay midway Bendigo and Mildura is advertised and Lake Tyrrell is promoted as the ultimate ex-

perience for quiet night skies and aboriginal art and history as well as the less quiet uniqueness of the Mallee Rally. Finally Sea Lake offers a range of accommodation, from farm stays, family hostels and luxury sleep-inns to a range of locally supplied eateries. Main St. is tarted up and thank to its historic buildings, shining and blinking again. All points of interest are well signed and easily connected.



plasticine scenarios

The final assignment in the charrette is to build a 3D model, using plasticine, which illustrates the long term future of Sea Lake the best. Working with plasticine has several advantages. Firstly, it allows people to work with their hands and modify the material according to their will. While doing so, the conversation amongst the group members is kuddling ahead and is harmless. Everything you want to mention is welcome and nothing sounds strange. Secondly, plasticine focuses on the collaboratively making of the future. This intrinsic creative process doesn't allow people to start arguing or take positions. Finally, plasticine delivers colourful and imaginable representations of the future and focus on the most highlighted, illuminated elements of the design or plan.



Peter Shadwick
Bron Alday
Roger Jones
Danny Lindenbergh



Sea Lake for the People

This model puts people at the heart of the community. Not only current inhabitants of Sea Lake are cherished but the aim is to attract many more people to the region. The ideas in this model vary from very concrete building proposals to more abstract and figurative.

The first priority is to make the town attractive, for instance through restructuring the entrance of Bond Street in order to showcase visitors the inner parts of the town. The centre is opened up to let people see the beauty of what's inside.

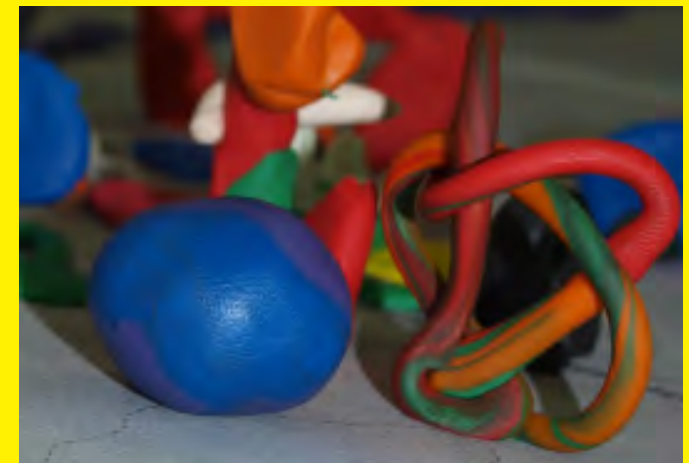
Several new buildings are proposed, such as a planetarium, a museum for the Mallee Rally, making Sea Lake the home of road racing, the transformation of the silo's into heritage monuments and development of an eco-village at the shores of the lake. Here, a view tower is added for stargazing.

The public space is enriched with a sculpture park and outdoor gardens. The sculpture park connects Sea Lakes with other sculpture parks near salt lakes in the rest of Victoria and beyond. In town and its surroundings new bike paths and tracks make sure visitors and inhabitants can do exercise and activities. The connection with Swan Hill is upgraded and a coach connection is developed between Sea Lake and Swan Hill airport.

Farming continues its focus on the production of high quality grain, but the productivity is enhanced with other profitable layers, such as solar farming, harvesting

energy and carbon farming, storing carbon in the soil.

Town and region will get improved signage to direct visitors to the diverse, new and rich variety of services.



Grant Alday
Lauris McClelland
Pat Amos
Christine Kilmartin
Stephen Clune

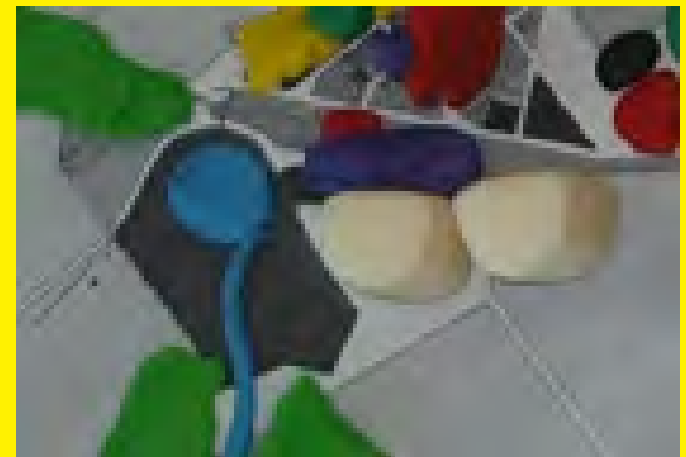


Vibrant and connected

In this model the Town of Sea Lake is transformed in a vibrant and connected country town. Outside the Town itself, Lake Tyrrell is difficult to access for ecological, licensing (salt lakes) and heritage (aboriginal) reasons. The only addition to view night skies and the salts is a look out, where except for the night skies sea gulls and Aboriginal heritage can be viewed. The infrequent running creeks are transformed in natural vegetation corridors. Sea Lake is made safer and cleaner through a bypass for trucks through town. The town is connected with the wider world in two ways, virtual and physical. A Virtual Centre for Education, the Centre of Excellence is connected through satellites with the rest of the world. More traditional ways of connecting, through roads, are used to attract students for higher agricultural education. The accompanying higher education staff is provided with different types of modern residential accommodation, but also hospital and care facilities.

The vibrant town is enriched with a restaurant with a view, the 100 mile restaurant high in one of the silos. High in this silo an interactive and highly technological weather station provides up-to-date weather information, which is immediately available (via laptop or app) to all residents in and around town. The area around the silos is transformed in an art precinct, with a café in the old station and old sheds that are used for artists residen-

cies. A planetarium, museum, a new swimming pool and the center for commerce complete the precinct, which transforms from a somewhat boring area into a livable and active environment. A little further out, the old recreation reserve and the old croquet club are used to develop an extended community garden with skate park and a relocated fire station. Elderly people can find a place in communal housing projects, which are semi-detached, easy accessible and close to health services. Farming is vertically integrated and includes pig farming. The area around Sea Lake can be explored by tourist plane and Green Lake is filled up with water and used for yachting. In order to coordinate and stimulate all developments a town manager has been appointed and offered a house in the new vibrant town center.



Claire Ryan
Kylie McClelland
Sandra Pierce
Lisa Vos
Ellen White



Eco, art and stars

This model proposes to focus on the unique assets of Sea Lake: its arts culture, the fantastic night skies and the ecological consciousness of the community. The main street doesn't change much, but the area between Calder and railway is transformed into an art precinct, where artists use vacant buildings as ateliers, restaurants are opened and a museum is developed. The silos are used to project movies on cinema walls and the buildings are used to host a planetarium. A community garden, including a skate park is located next to the silos. Around town art is promoted and statues are developed everywhere, but especially in and around Lake Tyrrell. Here an eco-lodge is proposed, where visitors can enjoy the tranquility of the lake and gaze at the stars at night. A sighting platform at the edge of the lake is specifically designed for stargazing. A giant buggy, housing the Mallee Rally Museum and a giant Footy restaurant are located next to it. Towards and around Lake Tyrrel, but also around Green Lake, bike tracks are developed, which can be used by visitors, but also as a track to host cyclo-cross races. In and around Lake Tyrrel salt and water is collected, solar power is stored in the salt. This technological process is new and leads to scientific knowledge development in Sea Lake. It is linked with the college, which doubles in size. Education is further developed and exchange students are attracted to the Town. This implies that the existing buildings

and facilities will be used differently. Vacant buildings, for example, are used for student accommodation.

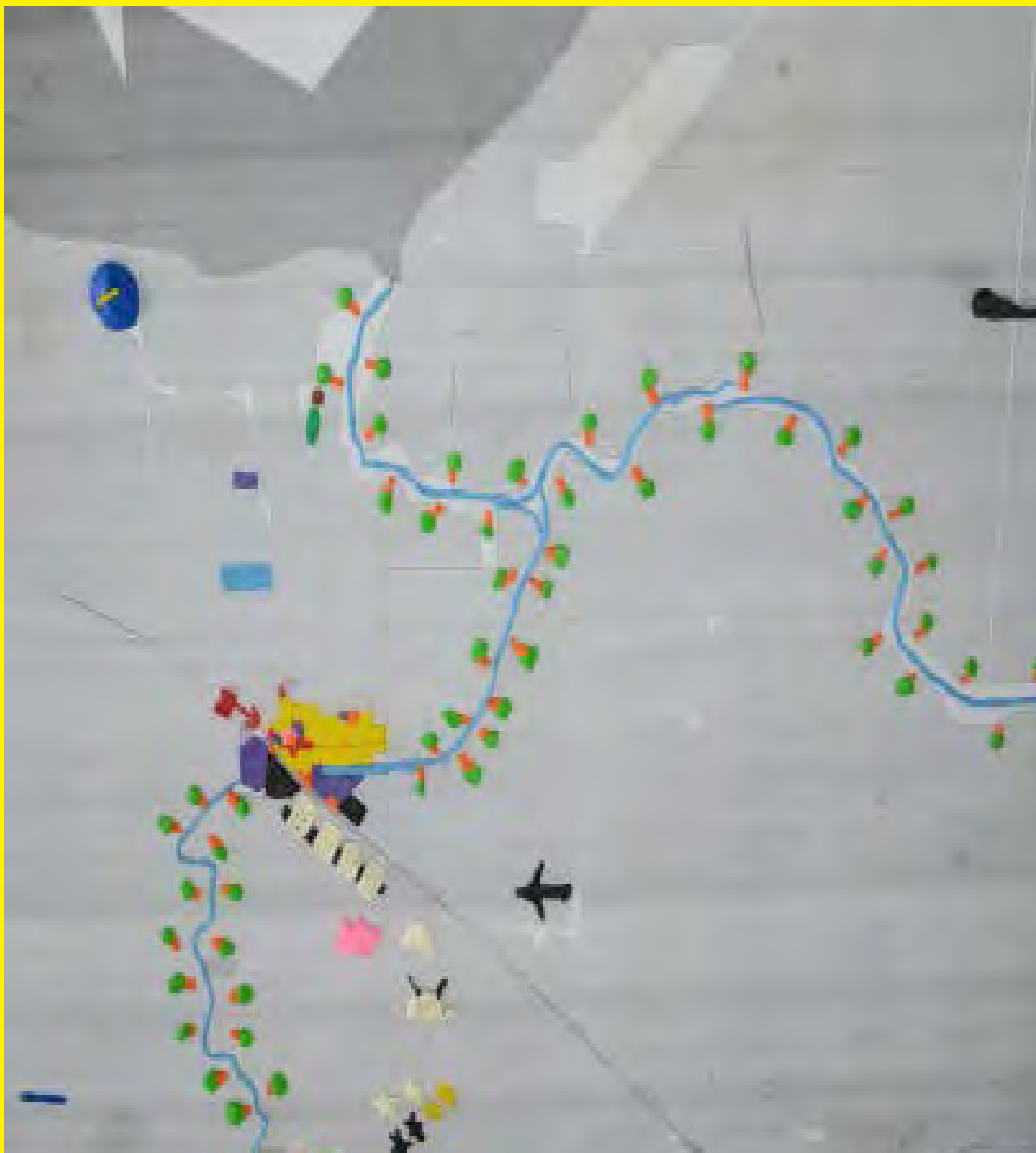
Green Lake will be further developed with canoes, additional accommodation and solar power with energy storage. The recreation shire CWA is downsized. The size of the industrial park is decreased, but in amount expanded. The industrial estates are all aligned with native vegetation. The health precinct doesn't change.

Farming undergoes slight changes and will be diversified. New intensive farming (pigs, kangaroos, emu and chooks) enriches the existing farming practice.

Sea Lake is efficiently connected by bus with Swan Hill Airport and taxi services and signage are increased. Entering the town from Bendigo the silos are framed in your view by a giant arch across the road.



Robert McClelland
Rachel Pierce
Pauline Ham
Damien Kennedy

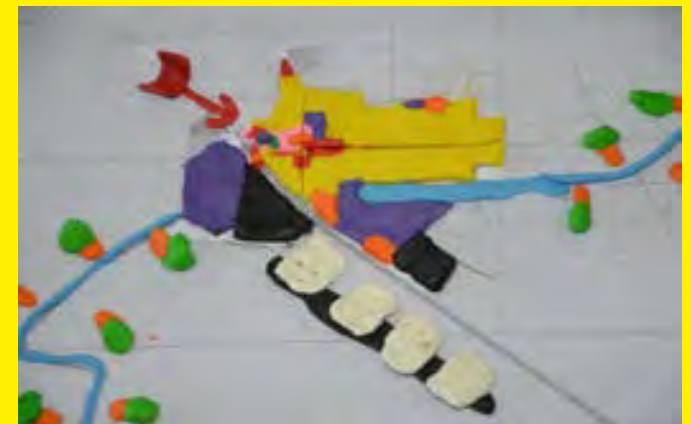


Backpackers, tee pees and yurts

In this model new space is created for alternative functions. Because of the town's strict zoning there is a lack of expansion space and existing underused and vacant spaces, such as the old primary school, the old recreation reserve, the community garden and the croquet club can be used better and use can be intensified in these places. The commercial functions are proposed to expand to the old recreation reserve and along the Calder Freeway. The main Town center is kept in its current place. The silos will be used as a planetarium and on the outside a climbing wall will be established. They form the heart of the new art precinct near the center of town. Further out, a petting zoo is proposed, which supposes to attract moa lookers to the 'pink' region, the color of the salt lakes.

The current agricultural program forms the basis to build on further. It requires additional development in the form of, for example, accommodation and attracting exchange students. Specific places need to be determined and developed for student living. This can be extravagant and take shape as tee pees or yurts. Basis of the program must be however, attractive and innovative agricultural education. The combination of available, cheap and extraordinary housing with top-class agricultural education will attract young people to the area. It is also proposed to develop more accommodation near Green Lake. More intense industries are proposed near

the town center and all buildings in town are provided with roof-top solar. Additionally, a solar farm south and a wind farm north of town are proposed. Along the Dunkmunkle creek extensive vegetation corridors are proposed that will need to protect existing vegetation and extend the bio-links.



appraisal

The solutions generated through the Charrette process differed considerably in focus points – due to the design briefs presented, and the approach of participants. The above combination led to some solutions focusing more thoroughly on different hazards and systems. The Common themes that arose from the appraisal of the four designs were:

1. land use and agriculture, continue best practice agriculture and enhance soil and biodiversity
2. Lake Tyrell and Tourism
3. Renewed Town Centre and Community Garden with no vacant buildings or land
4. Silo and Railway station redevelopment as a cultural and art precinct
5. Aged Care accommodation and services attracting retirees
6. Education development and accommodation

The appraisal method of 'concept scoring' identified the differences between the themes with regards to which elements of adaptation, maladaptation, or potential risks each theme addresses. Locating the concept scoring appraisal at this 'reflection in action' phase of the design process enables the potential synthesis (or merging) of multiple design elements into future designs. It should be noted that no one theme addresses every criteria; however the combination of themes could provide an adaptive strategy for Sea Lake with positive appraisal outcomes for each criteria achieved.

Population could be seen as the heart of Sea Lakes future, reversing the decline in population enables key services to be delivered, which may have a multiplier affect of attracting people to the area. A large number of the conceptual design scenarios have merit to be able to achieve an influx of tourists passing through the region, retiring in the region, and staying in the region to study.

The solutions identified for tourism, education and aged care all have a range of costs associated. These could be further classified as no cost, low cost or high costs by the community. For example air B&B farm stays require no capital aside from time and connection to the internet. The aboriginal night skies have existing educational material prepared via Museum Victoria (Southworth 2005) and journal papers publishing the findings (IPCC 2007), as well as the first recorded aboriginal constellation in *On the Astronomy and Mythology of the Aborigines of Victoria* published in 1857 (Fünfgeld and McEvoy 2011). The Box Gully archaeological site on Lake Tyrell has remains of a small hunting camp radiocarbon dates of between 26,600 and 32,000 years (Turner, Kasperson et al. 2003). Coordinating the existing educational material for promotion could assist in the promotion of Lake Tyrell at minimal expense. Cyclo-cross tracks around Lake Tyrell could utilise parts of the Mallee Rally track.

On the other extreme a planetarium or observatory would require higher invest

ment, and the conversation of existing building for different uses could be achieved for a more modest budget. What has been identified are a number of worthwhile ideas that would require further refinement matched against multiple business plans. Creating momentum towards realisation if Sea Lake desire.

This appraisal is the beginning of a method that will allow design solutions to be appraised for their adaptive capacity. However the appraisal has also identified gaps in the Charrette approach relating to what the conceptual designs did not include. That is what was missing or not overt such as

- Farming practices largely determining the environmental impact of the area, be that positive or negatives. What practices are continued should be in consideration of environmental metrics.

- Heat stress and Energy efficiency should be explicit in future developments, this may be achieved by both landscaping and building design. Energy supply was presented as renewable in various forms be that solar thermal and wind, as a diversification for farms, or roof top Photo Voltaic in town. This is seen as resilient. Energy generation and efficiency could be part of the one strategy.

Conclusion

This report has provided an overview of the development of the methodology and sustainability appraisal of the first Design Charrette held at Sea Lake as part of the broader Design-Led Decision Support

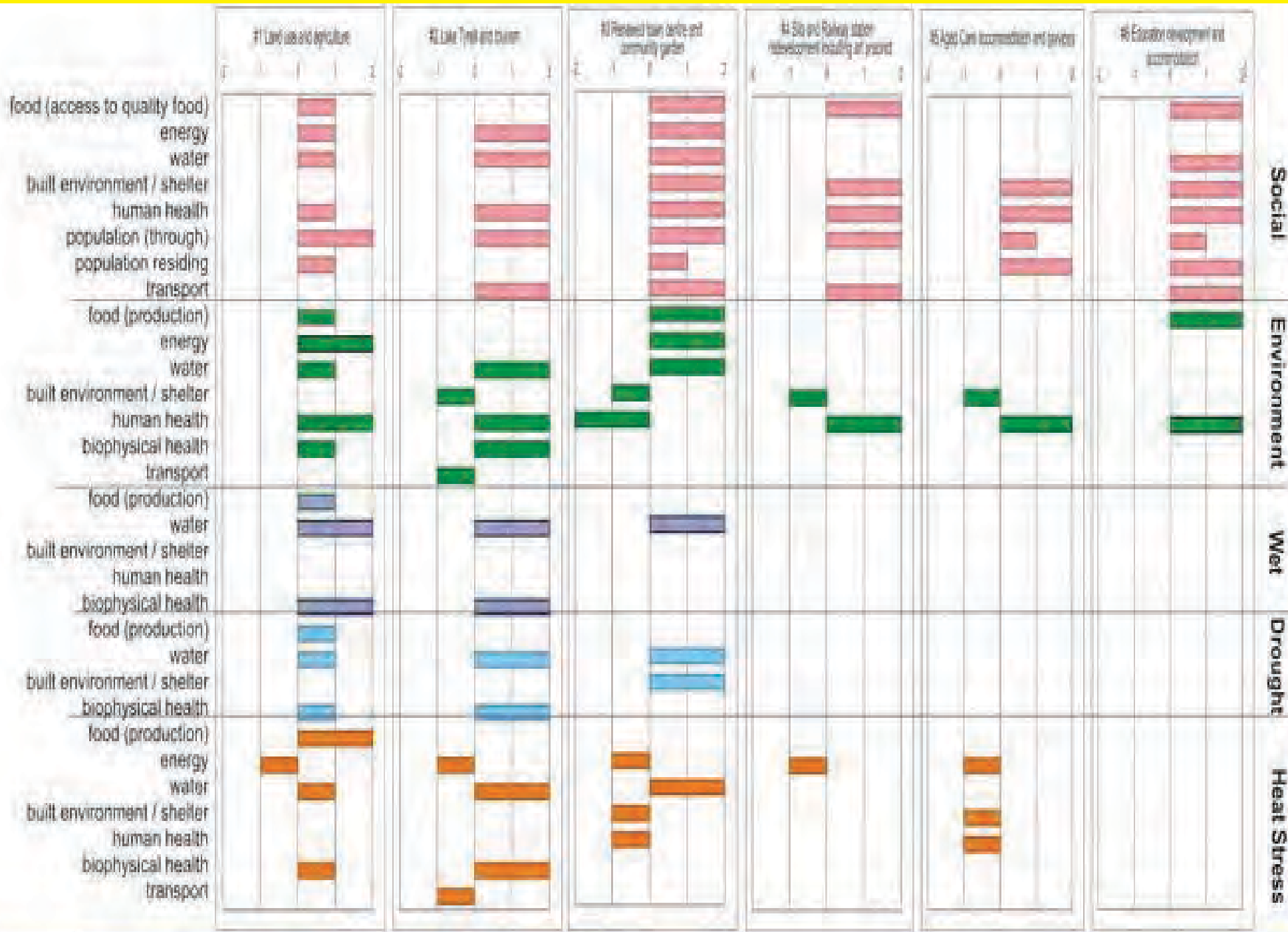
project supported by VCCCAR and managed by RMIT University. The report has identified solutions beneficial to the communities that the climate adaptive solutions across the above mentioned six themes.

Within each theme there is diversity of solutions that could be met via differing investment amounts. For example tourism could be increased through relatively low cost (or no cost) farm stays, to a development of a planetarium with significantly higher costs.

The appraisal also identified what was not addressed. These are framed as 'design challenges' that can be further developed from the design concepts, these include:

- Farming practices largely determine the environmental impact of the area, be that positive or negative – the design solutions included both adaptive and maladaptive suggestions.
- Heat stress and energy efficiency not explicitly addressed in any of the design solutions at present, and would be critical to an adaptive future.

Supports for the design solutions were overwhelmingly positive within the community appraisal.



reflections

Change is nothing new. However, the upcoming 40 years will change enormously, in economic, social and climatic sense. A dramatic shift will take place in economy, as in making use of broadband or transforming towards a knowledge economy. This is not only about inventing new knowledge, but the biggest changes are achieved through the invention of new technologies, consisting of putting intelligently the already existing techniques together. The iPhone, when it was firstly released, wasn't a completely new technique, but consisted solely of already existing parts.

In Sea Lake the legacy of decennia of farming encapsulates the *raison d'être* of Sea Lake and it also illuminates the tension between obduracy and change. The stronger the elements of obduracy are the more problematic change is experienced. And the next 40 years will appear as decades with huge change. What is needed in this situation is ideas, a vision with power and boldness, able to react to change and incorporate the strong historical and cultural 'statics' at the same time. Is it, in the light of the realisation of broadband, plausible to expect that car use decreases and people will cycle and walk more? We know we've never stayed the same, the question to be answered is more about how we want Sea Lake to change, also in relation to other regional towns and the way we want the change to happen. Besides elements currently existing in the landscape, such as the lunets,

Lake Tyrrel and Green Lake, the desired future will also introduce new elements in the landscape. Climate induced transitions, such as protection against sudden floods, heat waves or prolonged droughts need to be taken carefully and not in a way they exacerbate the problem. How convenient can we make the transition towards low carbon economies, landscapes and towns as Sea Lake, given the nature of each individual community. Some interventions may be easier realisable in certain towns and more difficult in others. The question is how do we let this collective, shared process of change to take place? We will have to let new developments to emerge and this will not happen without intervening in everyday life. It might get in the way of what people aspire. Therefore we need to involve people, the government needs to transform in a reflexive variant and needs to collaborate with its citizens in a true and even way. If the government sees its citizens as prosumers, people who contribute as much as they consume, both in terms of products, such as food, energy, water, but also in the form of ideas, designs and ways to create their environments, then several gaps, between politics and citizens, between climate aims and realisations, between greenfield development and retrofitting or between supply and demand can be solved. The design charrette allowed us to develop diverging views and visions. Participants made use of their creativity and set aside preconceptions, in order to

develop many different options on maps and by making use of plasticine, which allowed for the construction of physical structures in a very tactile way. This was needed to pull us of the pathway of existing policies and learn (again) to start creative thinking, in terms of opportunities instead of constraints. The next step is to use the developed framework to identify the projects that have largest chance to be uptaken and supported by governments and the market.

background material

“bringing knowledge to life”

Climate change is often seen as a threat, bringing risks to landscapes and people. This is one of the reasons why, in dealing with climate adaptation, the focus often lies on gaining more scientific knowledge and on conducting risk and vulnerability assessments. Does all this knowledge gathering lead to an increased adaptive capacity in regional Victoria? We suggest an approach that involves gaining and storing knowledge with a focus on optimal use of this knowledge. This approach bypasses discussions or questions about whether climate change is ‘real’ or caused by humans. We take the estimated trends and suggested developments for the Sea Lake area as a starting point. Our intention is to design a regional plan, which anticipates future weather events and climate change, for Sea Lake, given the facts and parameters of the region. In moving beyond a debate around science and knowledge we offer a design process that takes the available knowledge, both scientific and policy driven, and brings this knowledge to life to create and imagine a climate adaptive future for Sea Lake. A design charrette will allow us to develop these creative solutions. Charrettes are intensive and creative multi stakeholder design workshops that occur over multiple days. They allow for the development of

solutions that may occur outside of regular policy processes of recent date and give participants the opportunity to think outside the box to envision ‘unthinkable futures’. Such characteristics, common to charrettes, are ideal for problems that are unclear, complex and long-term. Climate adaptation is one of these problems. The year 2042 will be used as our planning horizon, to reflect the long time periods over which many effects of climate change will become manifest appear be realised. The Design-led Decision Support for Regional Climate Adaptation project will work with the following ambitions for Sea Lake:

1. The future of agriculture; ‘climate variability’ or ‘dry weather’ is nothing new to the area and the agricultural community has proven to be able to deal with varying seasons, such as reflected in the plants grown, the ‘manipulation’ of fertilizer applications on certain ‘zones’ and the conservation of moisture falling out of season. However, there is still a need to acknowledge the things that damage the environment and consider what role both individuals and the community could play.
2. Future proofing the town; besides dealing with hotter/drier (or wetter) weather, overall population, ageing population, ac-

cess to research and extension for farmers, valueadding of produce, access to labour and infrastructure that is not a burden are broader elements that determine the viability of the Town in the longer term. How could the peak and troughs be taken out of the areas that affect the sustainability of the community?

3. Qualities of the natural, ecological environment; the dominance in the landscape of the agricultural production leaves alone that ecological and natural values are apparent in the surroundings of Sea Lake. The question how to preserve these qualities, under pressure of climate variability and weather events and in relation with tourism, deserves a longer term vision.

4. A future for Lake Tyrrell; the Lake is probably the one very specific feature in the landscape that attracts people from far. It functions for the main period of time as natural reserve and (partly) as salt production unit. The famous Mallee Rally, around the lake is one of the few events that are linked to the Lake. The development of a future vision for further development of the Lake and its surrounding s could illuminate new perspectives.

design-led decision support for regional climate adaptation

The Victorian Centre for Climate Change Adaptation Research (VCCCAR), which was established in 2009 and is funded by Victorian Government, aims to improve government and community understanding about the potential impacts of climate change and adaptation options. It does this through the funding of interdisciplinary and multi-institutional research projects, which address priorities identified by the Victorian Government. Climate change adaptation has become an important consideration when discussing future development trajectories for cities and regions in Victoria. This connection between the required adaptation and the desired urban and regional spatial development has been the major driving force for the development of the research project "Design-led Decision Support for Regional Climate Adaptation" [Roggema et al 2010], which State Government departments, united in the VCCCAR Investment Panel, have agreed to fund. This project takes as a starting point the premise that knowing about possible hazards and assessing their risk is an important step in understanding and dealing with climate change, but it still doesn't give us answers yet how to design landscapes and societies for it. The aim of the project is to develop future visions in which the regions are more resilient to the impacts of climate change and are more capable of dealing with unforeseen (climate) events. The design of these future visions is undertaken in collaboration with a rich mix of participants including lo-

cal stakeholders, state government representatives, designers and researchers. The project takes a new approach to climate change adaptation at the (sub-) regional scale by organising and conducting design charrettes, addressing the positively and optimistic framed question "What might a 'climate-proof' future look like?" instead of "How do we become resistant and protect ourselves against the impacts of climate change". The design charrettes will be conducted in several pilot regions across Victoria, amongst which Buloke Shire (Sea Lake) and the City of Greater Bendigo. How we deal with change is often an underlying question that is not always addressed through policy and planning processes. If we, as a community and a landscape, are confronted with more complexity and more change, as societies under threat of climate change currently are, this leads to more variety in the way we experience our environment [Wierdsma, 1999]. One way of reacting in such circumstances is, instead of returning to well-known procedures' of the same' kind, to introduce more variety and cherish diversity as a collective competence. When people are encouraged to allow for diversity in values, opinions and visions, this collective competence will dynamically emerge. It is learning by working and working by learning at the same time. This co-creation of change [Wierdsma, 1999] can be experienced in optimal form in design charrettes. In the charrette context a variety of people are brought together,

maintaining their diversity in professional expertise as well as in their own values and visions. In a well-organised and directed process all individual competencies will emerge into a collective one, crystallised by the collective drive to design the desired future. The following principles for dealing with complexity and change can be distinguished (after Wierdsma):

1. Revaluation of context specific knowledge of experience (local storytelling);
2. Learn to act without disappearance of existing plurality and diversity;
3. Organise for transactions (opposite of organise for positions). Order activities, focus on the contributions (of participants) and facilitate dealing with variety: balancing between stability and dynamic enhancing activities;
4. Self-organisation of units or teams and respect for their autonomy;
5. Create platforms for interactive processes;
6. Value the unidentified character of interactive processes and meaning creation;
7. Allow participants to construct, in interaction with each other, meaning creation and give reality significance;

8. The place where the result of ordering (e.g. minimising variety) appears is called the place of effort [Kooistra, 1988]. Here, the entrance of participants to the process of creating meaning is blocked;

9. Processes of co -creation need to be accessible for all participants;

10. The process needs to be open and indeterminate, which can be organised through temporary workable arrangements. In the design charrette a variety of exercise types may provide this as 'specific conversation spaces'.

the design charrette

The term 'charrette' originates from France. At the end of the nineteenth century the Architectural Faculty of the Ecole des Beaux-Arts issued problems that were so difficult few students could successfully complete them in the time allowed. As the deadline approached, a pushcart (or charrette in French) was wheeled past students' work-spaces in order to collect their final drawings for jury critiques while students frantically put finishing touches on their work. To miss 'the charrette' meant an automatic grade of zero [Condon, 2008]. Charrettes are successfully used in the most controversial and complicated design and planning problems. Examples of these, as given by the NCI (National Charrette Institute) include [Lennartz and Lutzenhiser, 2006]:

- High stakes projects involving substantial public and private investment;
- Volatile yet workable political environments – situations that are 'hot' but manageable;
- Complex design problems;
- Real projects that include imminent development.

The NCI defines the charrette as: "a collaborative design and planning workshop that occurs over four to seven consecutive days, is held on-site and includes all affected stakeholders at critical decision-making points" [Lennertz and Lutzenhiser, 2006]. Building on this, Condon formulates it as: "a time-limited, multiparty design event organised to generate a collaborative produced plan for a sustain-

able community" [2008]. A typical charrette is seen as part of a dynamic planning process, which starts with the preparation phase, followed by the charrette and finishes with the implementation phase. The process, as derived from both Condon [2008] and Lennartz and Lutzenhiser [2006], consists of the following phases: The first phase we distinguish is the preparation phase. In this phase everything that is required to hold a successful design charrette is taken care of. Besides the obvious, required material, booking the venue etcetera, the main issues in the preparation phase are the design brief and the selection of participants. In the design brief the assignment is clearly defined. The goals and objectives, design principles, if possible the quantitative requirements and the performance targets are all described and collected. Selecting the right 'mix' of people to participate is essential. A combination of scientists, local experts and stakeholders, decision makers and knowledge brokers, designers and technical experts, all contribute to the dynamism of the event. The second phase consists of the visioning charrette. During this charrette the main goal is to envision the desired future. A typical visioning charrette includes the following parts: an opening event, a site tour, the design stages, during which iterative phases of conceptualisation, drawing alternatives and refinement of the vision take place (or in the words of Condon [2008]: "talk-doodle-draw"), the public meetings and finally the after-

party. In general, this type of charrette involves (mainly) designers for a full week. The purpose is to shift from attractive sounding prospects to real solutions, which, in this phase, are represented in designs. During the charrette a common language for solutions is developed and, because no implementation questions will be raised at this stage, the risk ideas will be rejected is minimal. However, it may be expected that, in the openness of the process several policy contradictions will be revealed. The third phase is the implementation charrette. This charrette typically lasts for four days and involves (mainly) design facilitators and stakeholders. Its aim is to develop a shared understanding of the desired future and what is needed to realise this future. This method also addresses some of the barriers to change that exist in many governmental organisations (the so-called 'window-of-no'). This prevents change from happening and is often well established through unwritten codes and invisible agreements. The implementation charrette is a powerful tool to go past this window of no. The fast and efficient charrette process involves stakeholders in a powerful integrative way. The connection of participants of the charrette, who in their regular work are probably not connected helps to embed the solutions brought up in the charrette process, which may help to outpace the approval processes, which can take years. The final phase we distinguish is the writing of the charrette report. In the report the re-

sults of the charrette are presented visually and with clarity. The report functions as the 'contract' for the participants and may be used in formal decision making processes. In conducting design charrettes Condon [2008] defines nine general rules for a good process. The four we acknowledge as the most significant are highlighted here:

1. Design with everyone: Despite the fact that becoming a designer requires thorough training and very specific skills, the design process as undertaken during charrettes is integrative and contains a variety of possible solutions. This is partly an intuitive and judging activity, which makes it accessible for many individuals. In this sense, everyone is a designer;

2. Start with a blank sheet: If the group of participants are standing around the table, on which a large map of the site is laid down, the simple action to overlay this map with a blank piece of transparent paper. The invitation and the challenge are then before all. Everyone is invited to fill in the future and a shared vision will, in the hours to follow, fill up the formerly empty paper;

3. Provide just enough information: Too much information causes decision paralysis and too little produces bad proposals. Just enough is mainly arranged through the expertise of the participants and will be provided during the charrette in

a concise and easy to grasp way (maps, schemes);

4. Drawing is a contract: All drawings produced during the charrette embody the consensus as experienced and achieved by the charrette team. They form a wellunderstood agreement, or contract, in images amongst the group. The drawings cannot be broken without consent of the group and function as such as a very strong commitment.

In this project we define design charrettes as: "two or more day intensive design workshops in which a mixed group of participants work collaboratively towards designing climate adaptation future scenarios." A design charrette:

1. Integrates intuitive, rational and emotional knowledge;

2. Is an inventive approach, includes idea generating forces and results in envisioning futures;

3. Is set up in a creative atmosphere to allow many different stakeholders to collaborate;

4. Alternates between plenary discussions and small mixed design teams to provide a creative environment to think about the future in unlimited ways;

5. Creates an environment in which outdated frameworks, often related to individual beliefs or 'silo-ed' policies, can be overcome;

6. Makes use of maps and other visual tools to allow people to collaborate and integrate topographical, ecological as well as social and economic aspects.

The way design charrettes are organised help to create an atmosphere that differs from regular and day-to-day working environments. This environment is created because it allows people to enter a different mind-set and use a broad variety of ideas, values and habits. The charrette process offers participants the following:

- Participate in a creative way to think about the future;
- Use risk assessment data in a creative way in order to develop ideas about responses to risks;
- Develop design ideas which are based on the uncertainty and unpredictability of climate change;
- Speculate about future change and ways of living;
- Open their minds and their conversations, which not necessarily take place within settled structures and habits in government or elsewhere;
- Work in a "bottom-up" way and take local knowledge and local climate perceptions into account in designing and decision making;

- Collaborate across disciplines, organisations and levels of government;
- Share responsibilities.

- To develop ideas and strategies to increase the resilience of Sea Lake in the face more extreme weather events.

Charrette objectives:

1. Bring together 'champions' in the field of adaptation planning, spatial planning and spatial design to explore possible futures for Sea Lake using a 2042 time-horizon. These futures aim to interlink pathways towards more adaptive systems with spatial planning and design processes in an optimal way;
2. Launching the design-led VCCCAR project at different spatial scales;
3. Presenting stimulating reports to be used in other case studies and beyond;
4. Offering a multidisciplinary arena to identify and explore new issues relevant for the main focus of the project;
5. Bringing together team members of the different 'Design-Led' case study areas.

More specific objectives for the Sea Lake case study include:

- Explore the specific weather issues Sea Lake area is facing;
- To discuss possibilities how the resilience of Sea Lake can be improved;
- To design ideas how Sea Lake, adapted to climate impacts, in the future might look like;

sea lake and buloke shire

Buloke Shire is a predominantly rural area located in north-eastern Victoria, on the eastern edge of the Wimmera plains and southern Mallee. It is approximately 300km from Melbourne, and covers an area of 8,003 square kilometres. There are ten key towns in the shire, five of the largest being Birchip, Charlton, Donald, Sea Lake and Wycheproof. [id, 2011]. At present, agriculture constitutes the largest economic and employment sector, with much of the land use taken up by grain (wheat, oats and barley) production and sheep grazing. Other significant economic sectors include education, retail, light industries and community services. The charrette process is a creative way of thinking about the causes of and possible spatial solutions for the adaptation to occurring and future weather events. However, the charrettes will not provide definite answers for the problem of climate change, they function as food for thought, enhancing exchange and thinking about the desired future of the community in a broader and integrated sense. The charrettes function as a platform to share expertise from different fields. In the Sea Lake charrette the most likely disciplines to involve in the charrette are agriculture, water-management, community planning and climate change. Because future weather events will have impact on a broad spectrum of functions and traditionally isolated expert fields, collaboration is essential and will serve as the basis for integrated solutions. The Buloke Shire has identified five strategic objec-

tives:

1. Community: Ensure support and access to services for all people to live healthy and fulfilling lives.
2. Local economy: Agriculture and business growth is actively supported and encouraged.
3. Built environment: Meeting the needs of agriculture while enhancing the natural environment, all public infrastructures should be well maintained and contribute to the community.
4. Natural environment: Reducing the carbon footprint and enhance the natural environment.
5. People and organisation: Responsible governance, good financial and risk management and responsive to the community.

Sea Lake is located in the Mallee Ward which is part of the Buloke Shire. Prior to European settlement, the Boorong people were the main inhabitants of this area. This region is characterised by a dry climate and dryland agriculture. The agriculture dominated by cereal farms are part of the wheat belt of Australia. Sea Lake is built close to Lake Tyrell which is a salt lake. Strategic directions foreseen by community plan are improving the community, local services local economy with special focus on tourism. Major problems in Sea

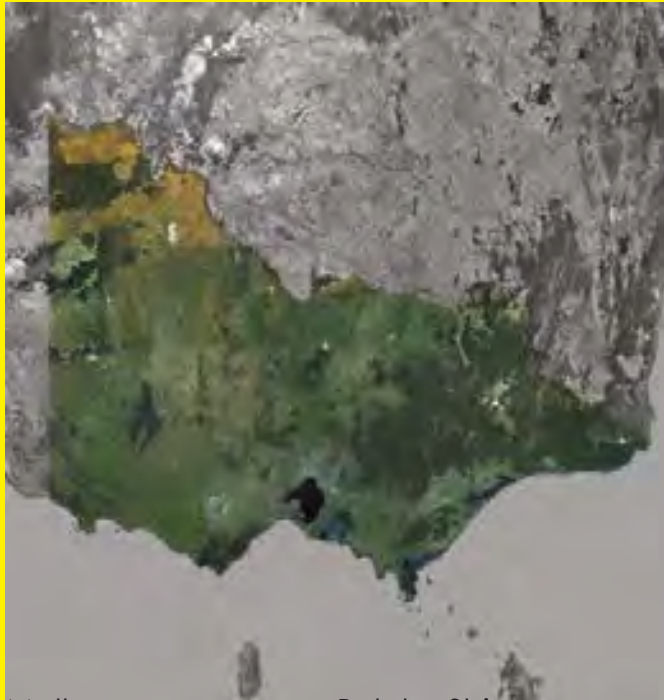
Lake are the following:

- Climate/weather related issues mainly drought, heat, heavy rainfall
- Capacity of the landscape, agriculture in dealing with excess rainfall and droughts and soil erosion
- Heat wave effects in the village will be affecting mainly elderly, sick and children. Heat exhaustion and heat stroke are just some of the effects of hot weather on the body.

The Sea Lake community plan identified five focus areas:

1. Maintaining and Growing Essential Services: All essential services should be available in the town; this will lead to a healthier community and makes it easier to attract new residence.
2. Stimulating our Local Economy: encourage new business and expansion of existing ones, to improve the local economy which will benefit the local community.
3. Tourism: further development of natural assets and festivals to increase number of tourist visiting Sea Lake.
4. Strengthening and Growing the Community: providing the residents with a sense of social connectedness.
5. Caring for Our Environment: to become more ecological sustainable and environmentally aware.

site data



Melbourne Metropolitan

Buloke Shire



Mallee Ward

Sea Lake



SEA LAKE

area
8,806 sq km

8,004 sq km

392.5 sq km

66 sq km

population
19,413,240 (2001)
20,697,880 (2006)
28,484,167 (2030)
44,565,965 (2100)

7,331 (2001)
6,852 (2006)
6,028 (2030)
3,819 (2100)

2,415 (2001)
2,297 (2006)
2,085 (2030)
1,472 (2100)

666 (2001)
634 (2006)
446 (2030)
244 (2100)

population density
540/sq km

0,9 /sq km

5.9/sq km

9.5/sq km

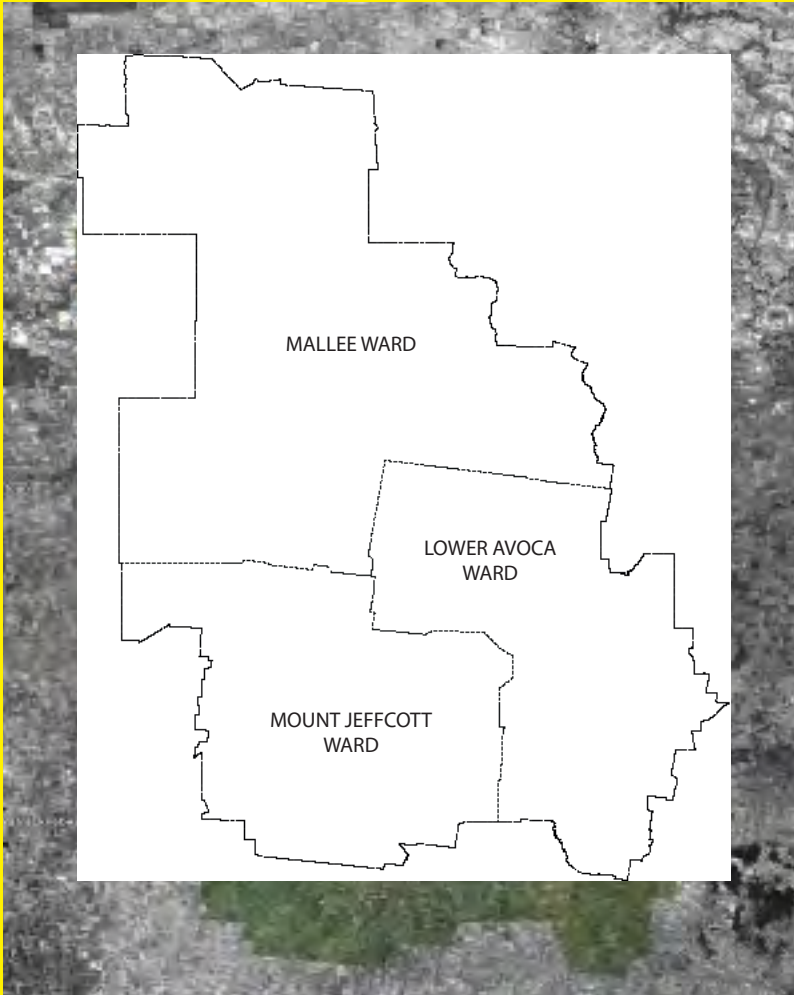
source: Australian Bureau of Statistics

temperature averages
summer monthly average temperature 31.3 °C
summer highest daily temperature 46.8 °C
summer lowest daily temperature 5.9 °C
winter monthly average temperature 15.9 °C
winter highest daily temperature 29.8 °C
winter lowest daily temperature -5.8 °C

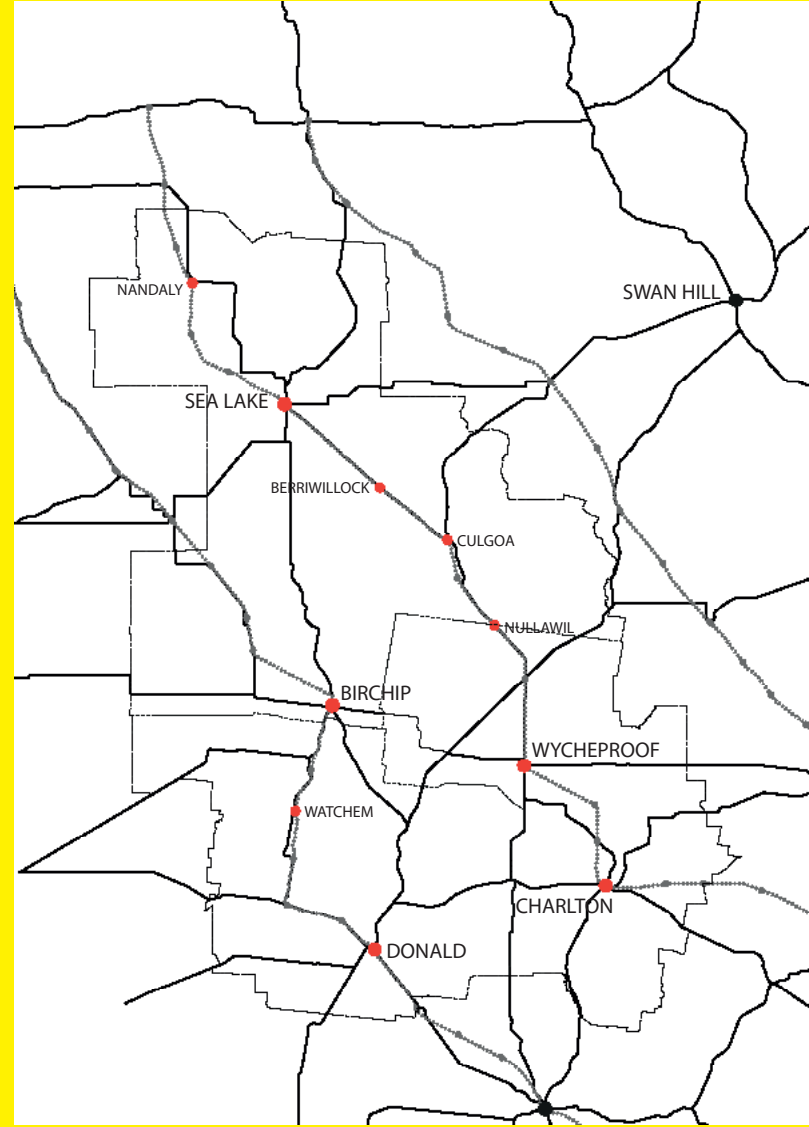
rainfall
annual rainfall 332

Source: Bureau of Meteorology




BULOKE SHIRE



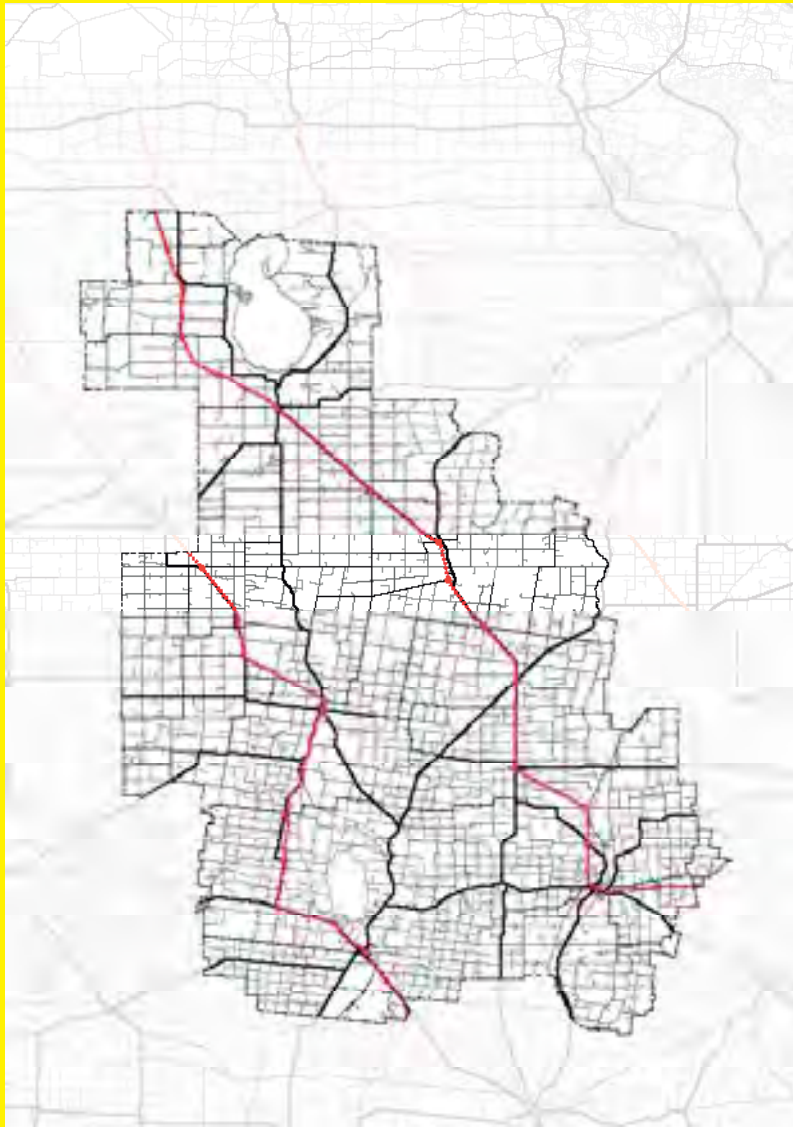
KEY TOWNS



LEGEND

-  Buloke Shire Council Boundary
-  Highways
-  Key Towns

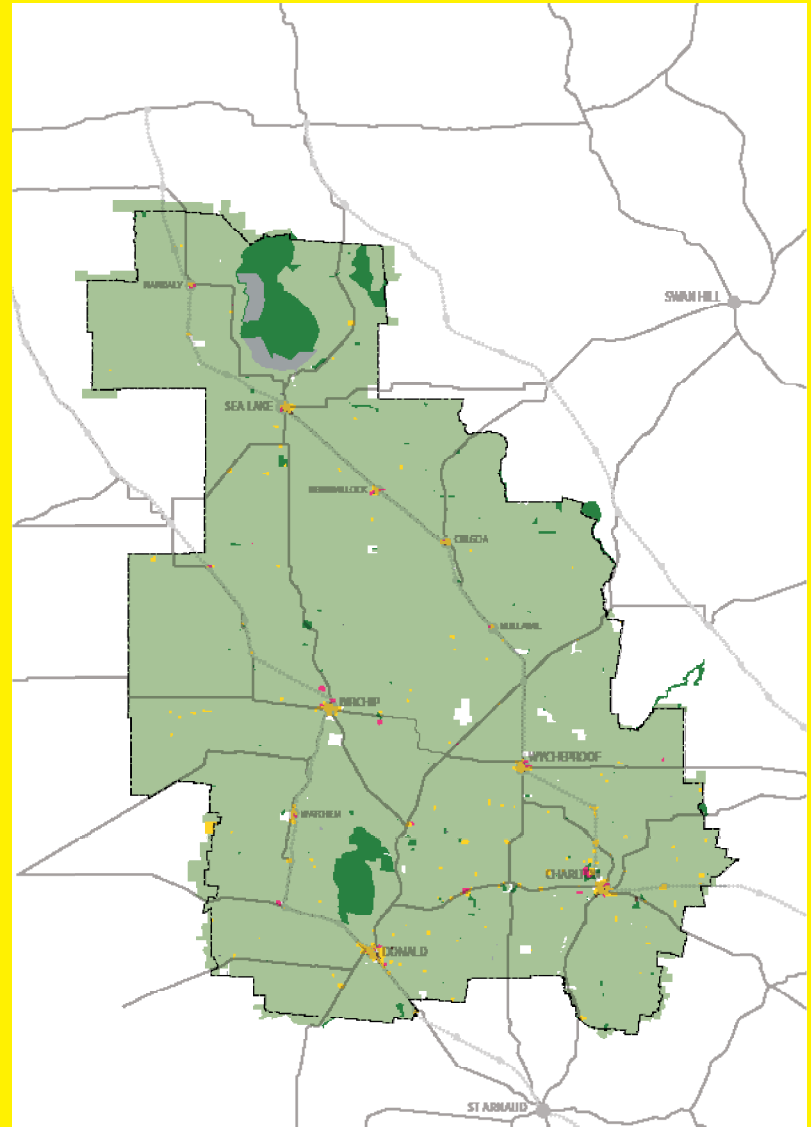
TRANSPORTATION NETWORK



LEGEND

- | | |
|------------------------|----------------------------|
| Railway Station | Arterial + Collector Roads |
| Railway (Freight Only) | Local Roads |
| Freeways | Tracks |

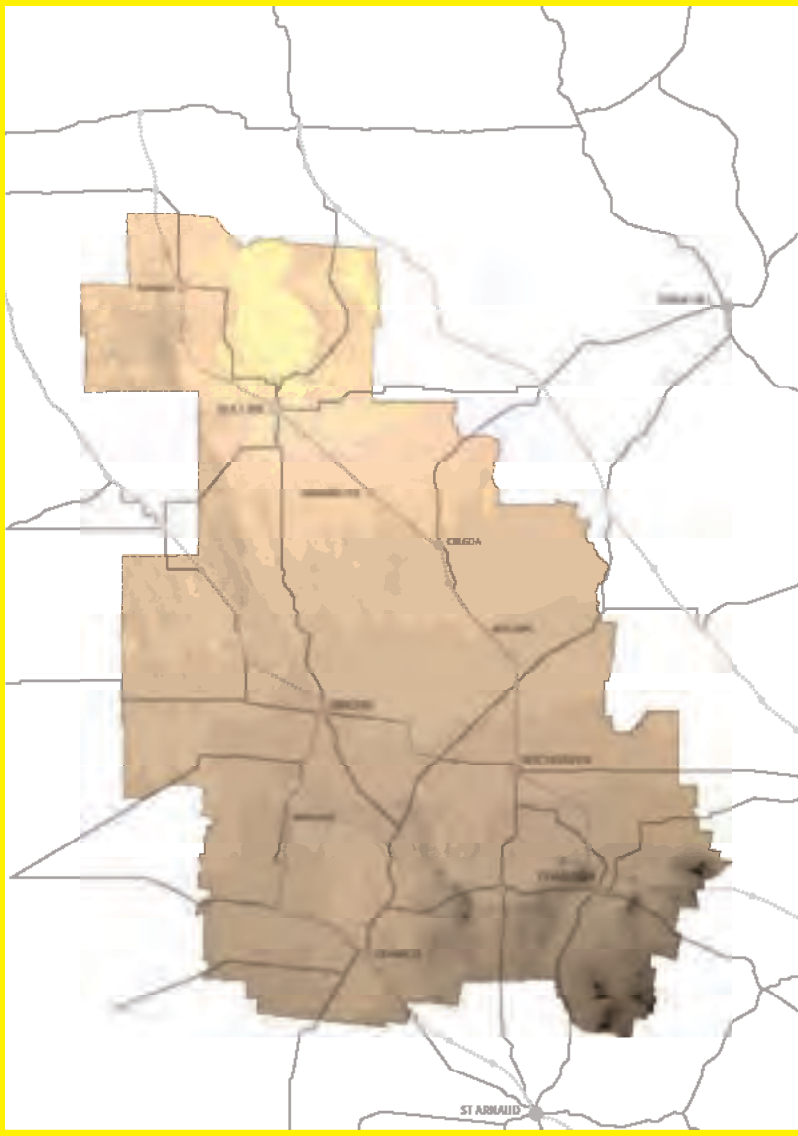
LAND USE PLAN



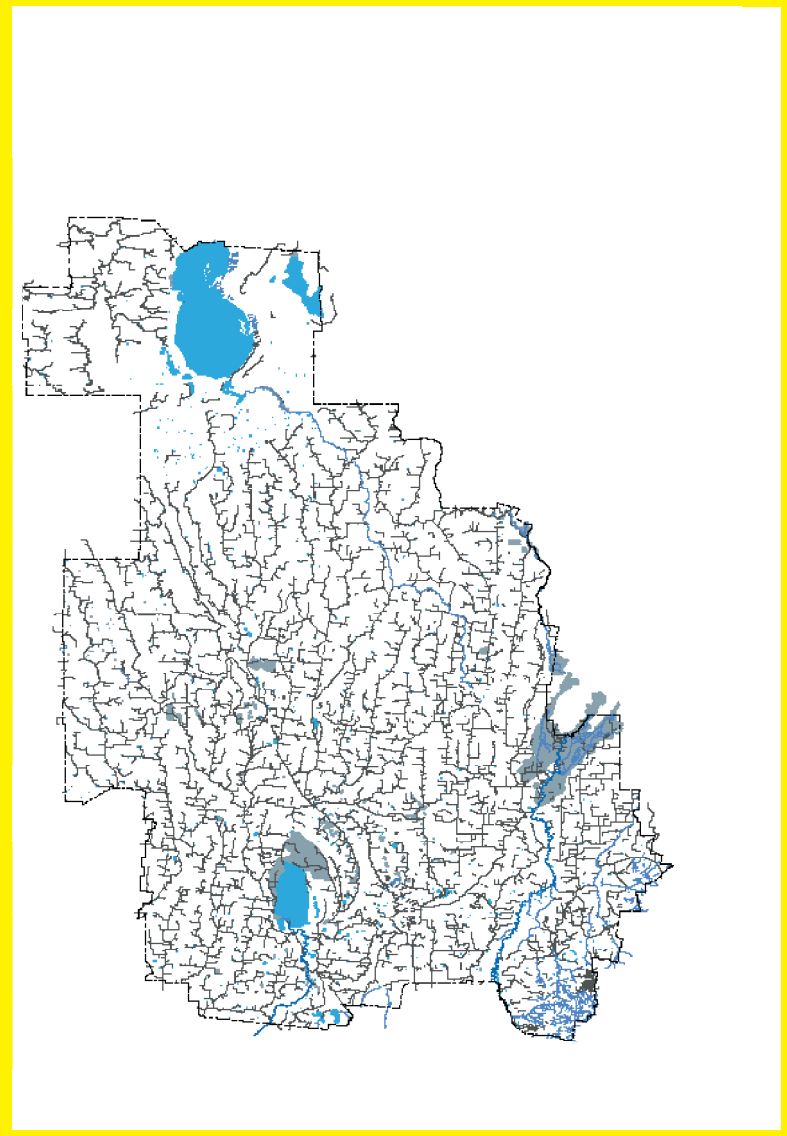
LEGEND

- | | |
|------------------------------|--------------------------|
| Residential | Industry |
| Commercial | Open Spaces + Recreation |
| Mixed Use | Reserves |
| Civic + Community Facilities | Services |
| | Others |

ELEVATION PLAN



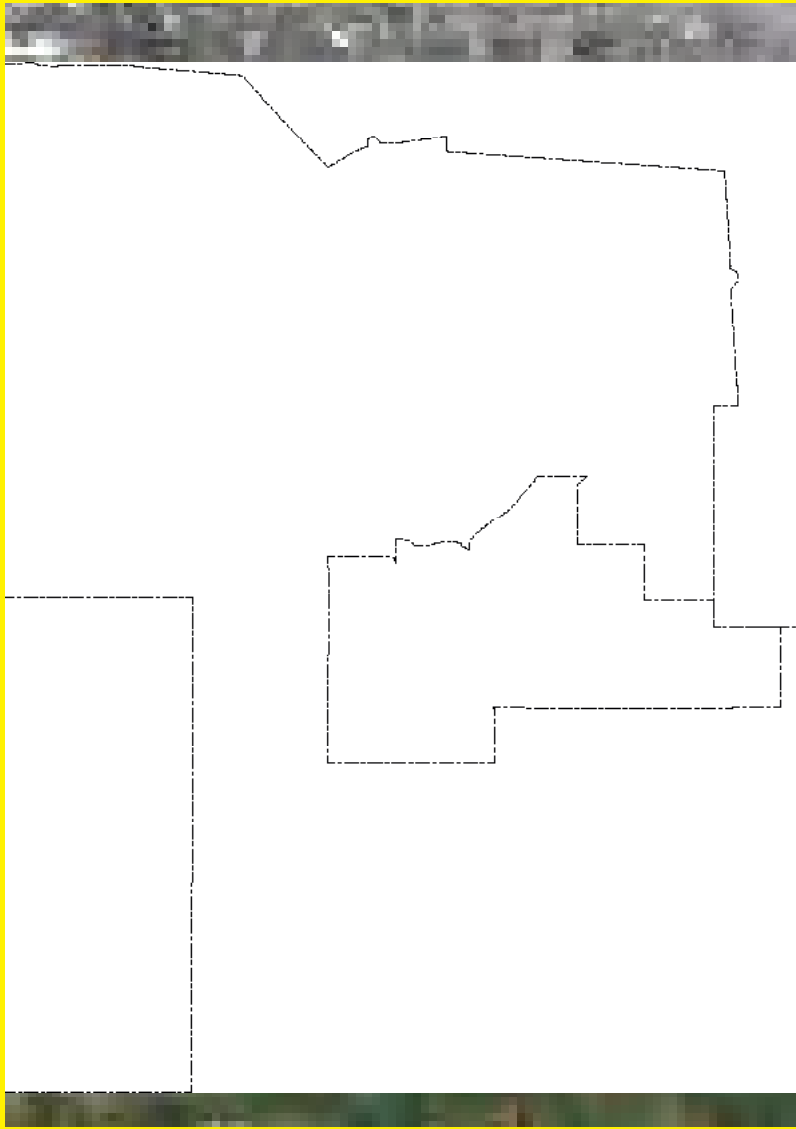
WATERWAYS PLAN



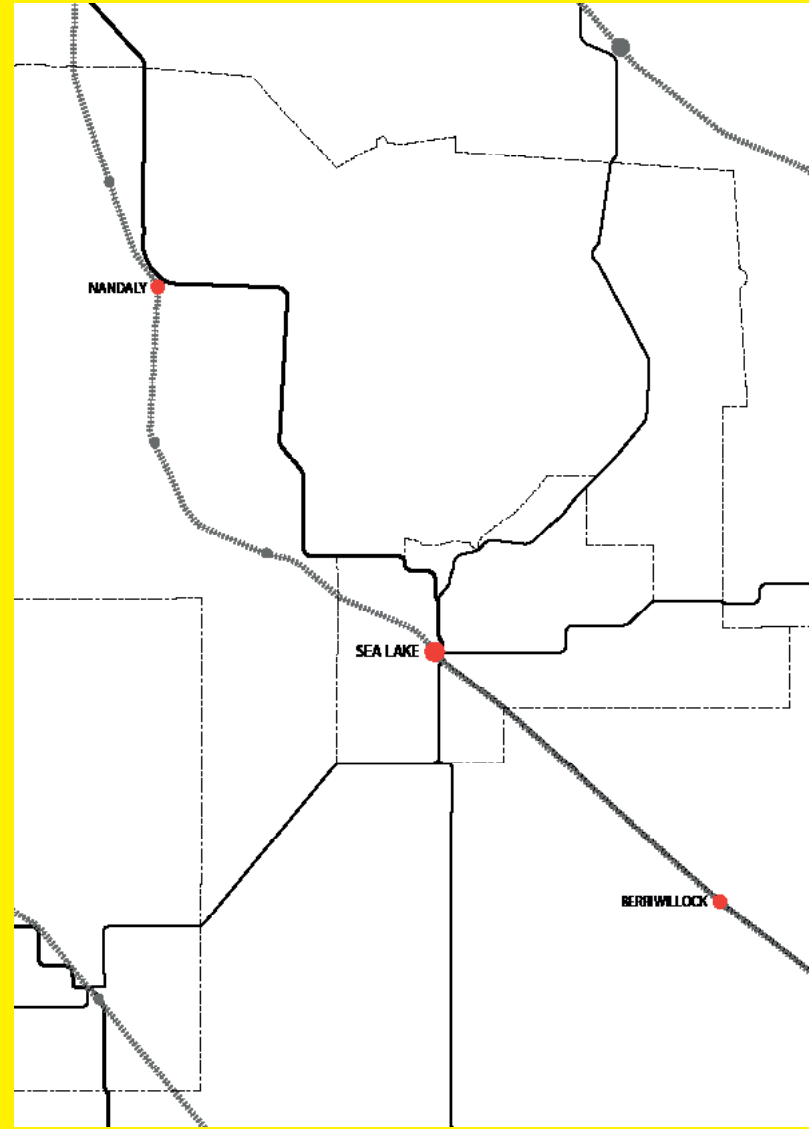
LEGEND

- Rivers
- Streams
- Channels/ Drains
- Lake
- Salt Lake




SEA LAKE + SURROUNDS



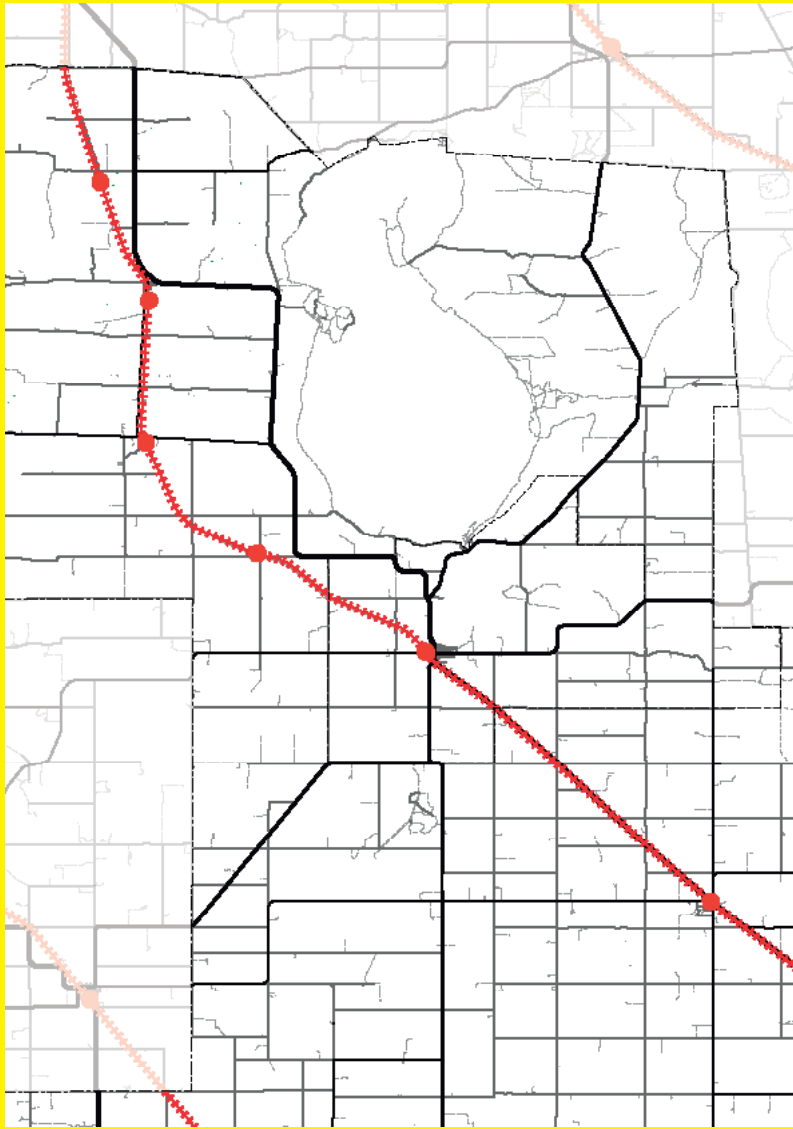
KEY TOWNS



LEGEND

-  Buloke Shire Council Boundary
-  Highways
-  Key Towns

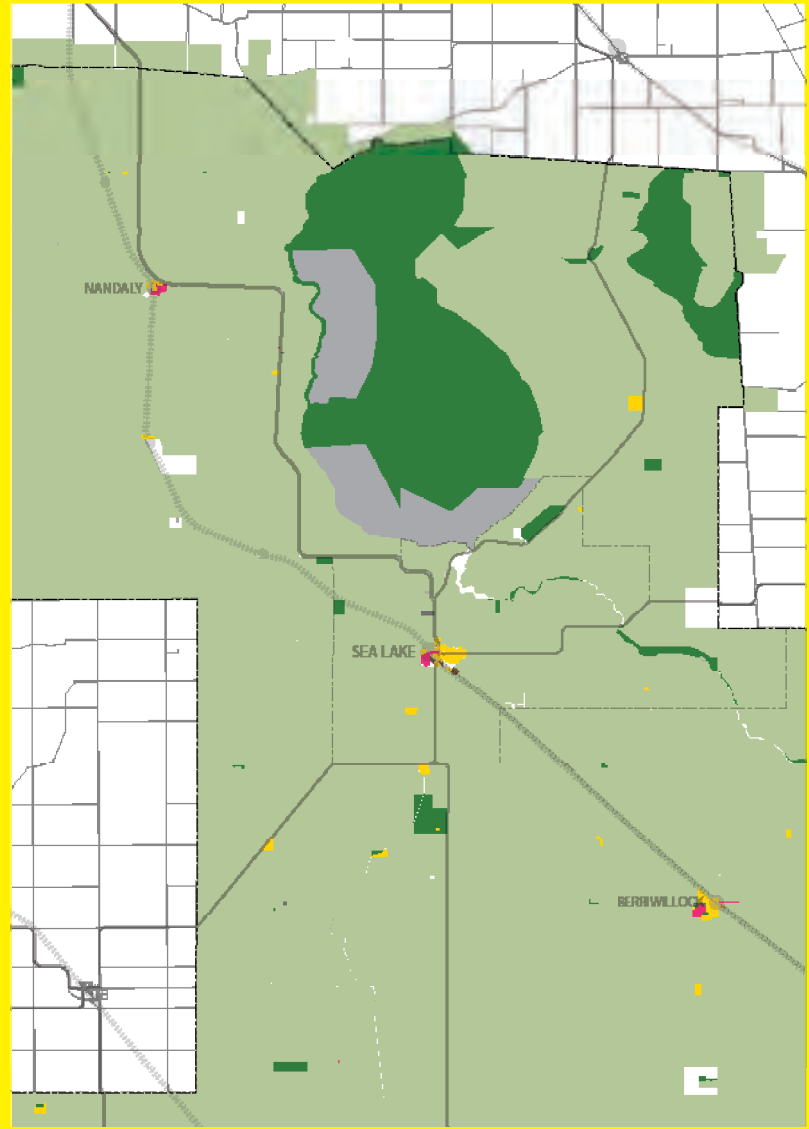
LAND USE PLAN












LEGEND

- | | |
|--|--|
|  Railway Station |  Arterial + Collector Roads |
|  Railway (Freight Only) |  Local Roads |
|  Freeways |  Tracks |

PLANNING ZONES



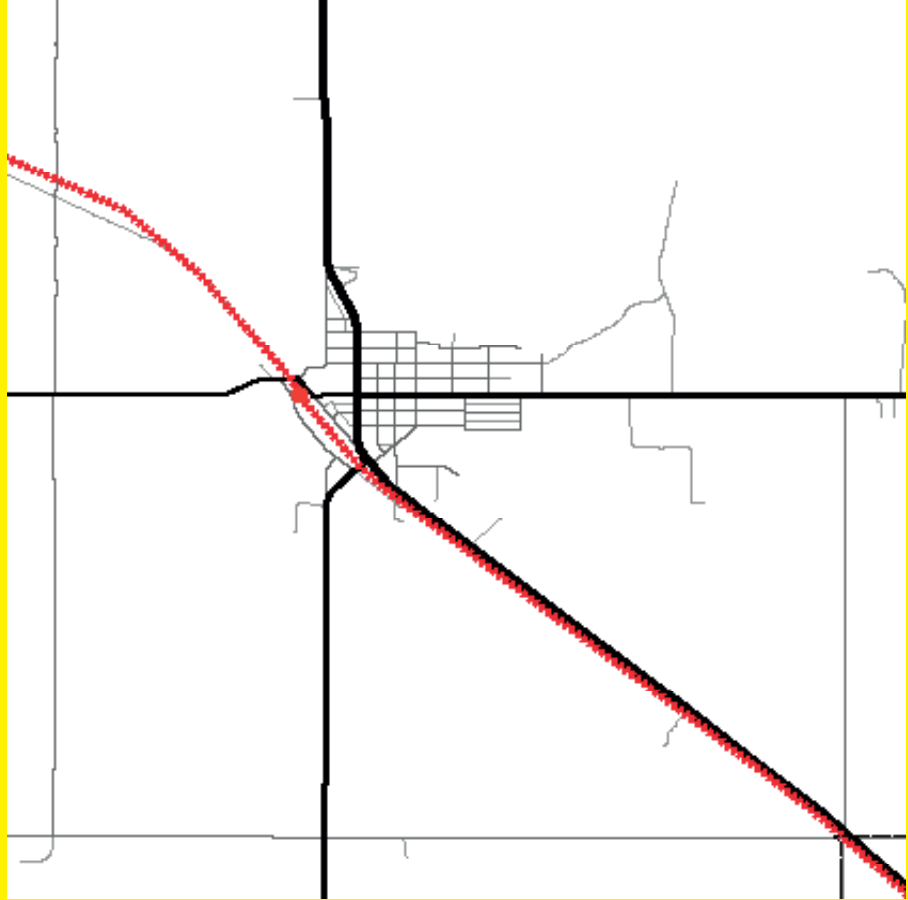
LEGEND

- | | |
|--|--|
|  Residential |  Industry |
|  Commercial |  Open Spaces + Recreation |
|  Mixed Use |  Reserves |
|  Civic + Community Facilities |  Services |
| |  Others |

SEA LAKE



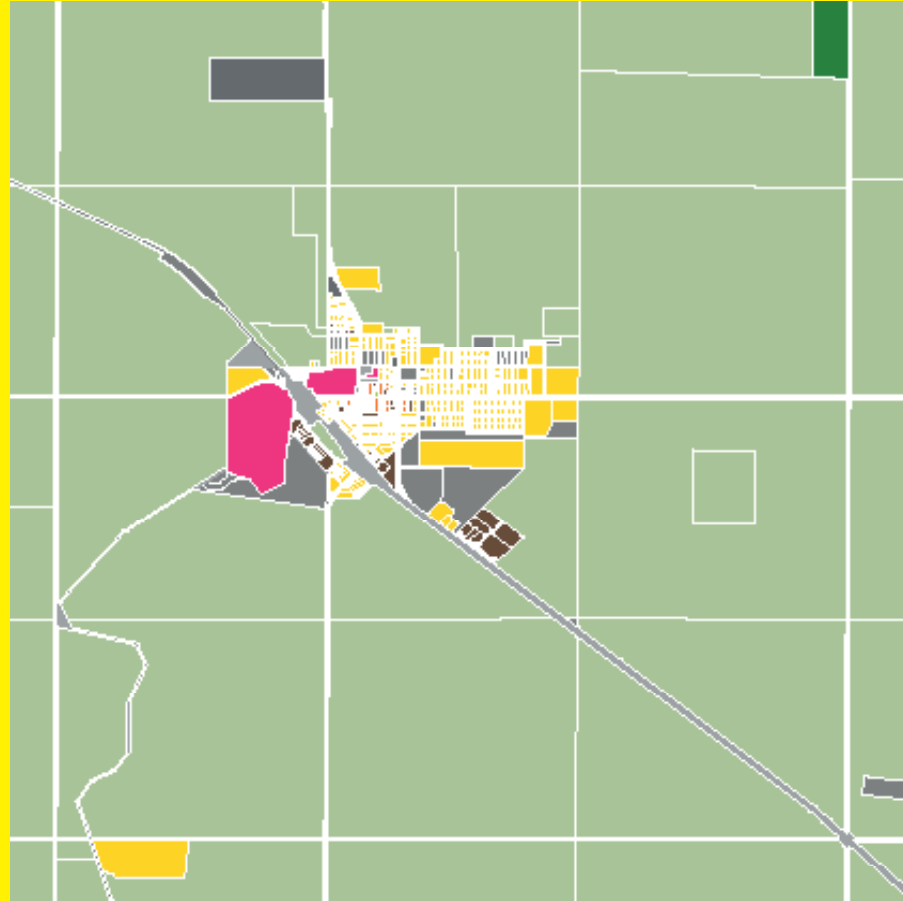
TRANSPORTATION NETWORK



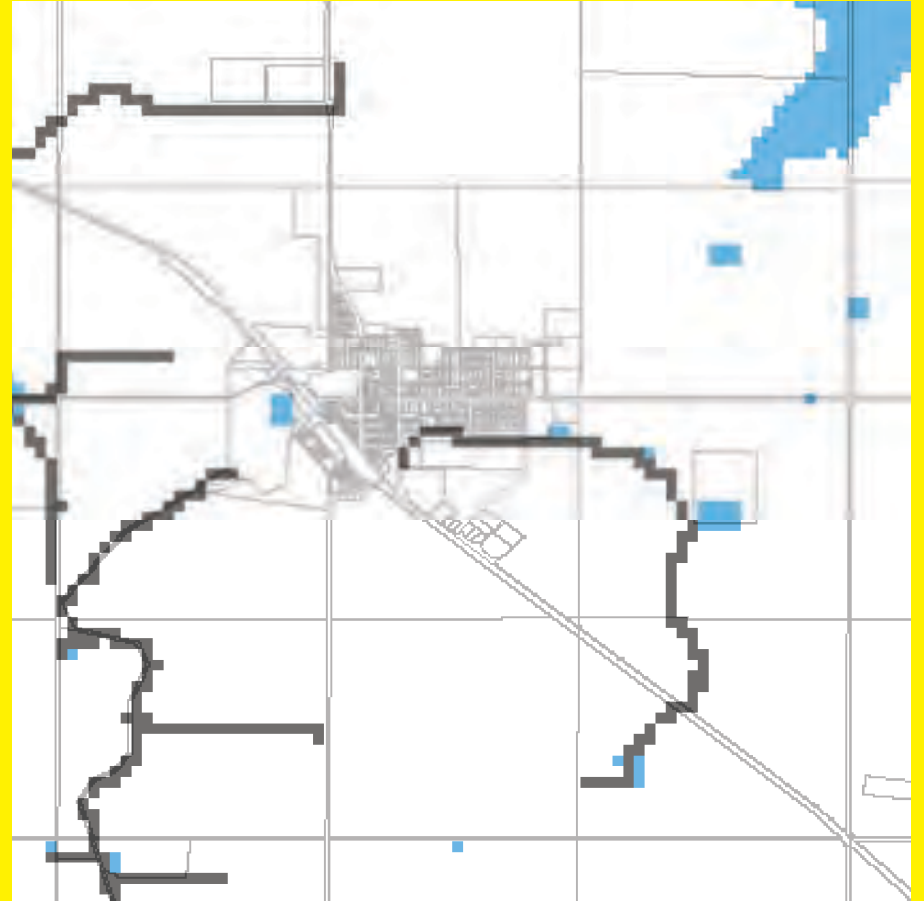
LEGEND

- Railway Station
- Railway (Freight Only)
- Freeways
- Arterial + Collector Roads
- Local Roads
- Tracks

LAND USE PLAN



ELEVATION + WATERWAYS



LEGEND

- | | |
|------------------------------|--------------------------|
| Residential | Industry |
| Commercial | Open Spaces + Recreation |
| Mixed Use | Reserves |
| Civic + Community Facilities | Services |
| | Others |

LEGEND

- | | |
|------------------|-----------|
| | |
| Rivers | Lake |
| Streams | Salt Lake |
| Channels/ Drains | |

demographic data

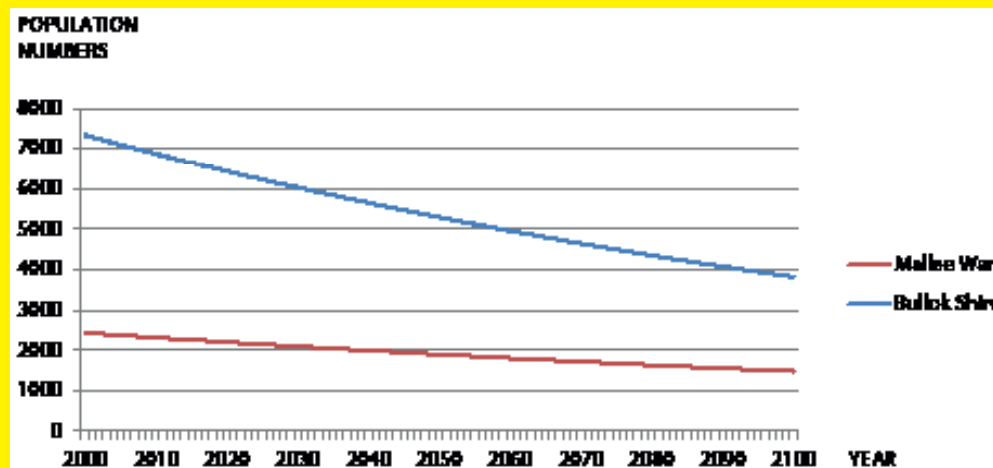


Figure 3. Population growth across Buloke Shire.

Below is a snapshot of demographic facts and figures for Sea Lake in the year 2006:

Population: 634

Median age: 44 (youngest of the five major towns)

7.3% of the population is aged 0-4 years of age

6.2 % of the population is aged 15-19 years of age

3.8% of the population is aged 20-24 years of age

55.7% of the population is aged 25-64 years of age

27% of the population is aged over 65 years of age

16% of people live alone

The median individual weekly income was \$315

The median household weekly income was \$568

0.8% of the population identified themselves as being of Aboriginal or Torres Strait descent

These demographic data are gathered from

the 2006 Census and are extrapolated for future developments. It shows that the population in the region declined for at least the last decade. Also the population density is very low, in the entire shire which has a comparable surface area as the greater Melbourne region only live 7.331 people. Two thirds of the population in the Buloke Shire live in urban areas (towns).

On the basis of this demographic profile two problems can be identified:

1. Ageing of the population. Only 17.3% of population is under 24 years old and 27% is above 65 years old. This will lead to greater social burdens to be carried by a smaller workforce and will lead to a lack of sufficient workers to fill up the position that becomes vacant when elderly workers retire.
2. Decline in total population. This may cause problems for local business and services. The amount of potential

customers goes down and it may become unprofitable to continue with the business. The potential lack of suitable employees can also drive up wages. Services are more expensive to maintain in areas with small population since cost is usually paid by rates and fees.

It should be noted that these predictions are rough calculations, assuming an unchanged policy environment without interventions and not a full demographic analysis.

Figure 3 shows a projection of the future population in the Mallee Ward and the Bullock Shire till the year 2100. For the Mallee Ward the decline is 0.5% per year and for the Bullock Shire the decline is 0.65% per year. This small difference has quite some impact in the long term future. If the decline is just a little bit higher lets 1% than in 100 years only one third of the population remains.

climate analysis

The scenarios in this charette use the idea that climate, its associated hazards and the people and places exposed to those hazards, can change very quickly.

When considering climate, we look at two sets of change. The first centres on the year 1997, when maximum temperature in south-eastern Australia rose by almost 1°C and rainfall decreased by more than 10%. The second is a reprise, a speculated further change in 2020, where temperature again rises. Rainfall patterns are less certain, although climate models and theories suggest that the long-term direction will be one of overall decrease with shorter-term fluctuations up and down.

Understanding historical shifts requires focus on the risks of fire, extreme heat, drought, flash flooding and widespread flooding. These data indicate changes in the region, but unfortunately climate data from Sea Lake are affected by quality issues before 1961 and during 1981, meaning that the observed changes can be estimated but not accurately quantified. In all cases they are broadly consistent with more accurate records elsewhere in the state.

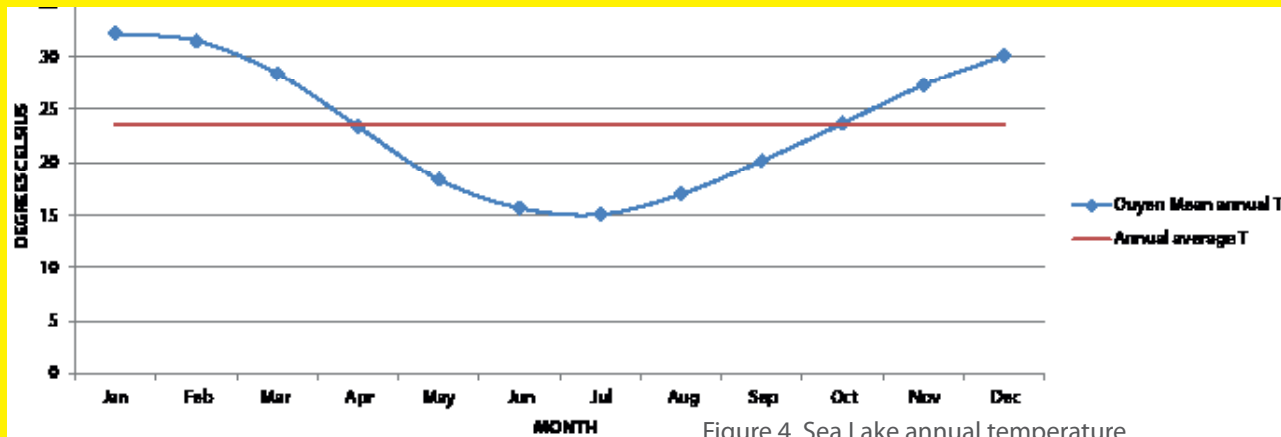


Figure 4. Sea Lake annual temperature.

TEMPERATURE

The annual average temperature in Sea Lake, taken from the closest station at Ouyen, is 23.6 degrees Celsius (refer to figure 4). The summer temperature is 31.3 degrees Celsius, autumn is around 23.4 degrees Celsius, winter is on average 15.9 degrees Celsius, and spring is 23.7 degrees Celsius.

The temperature data shown figure 5 is Kerang as this is the closest high quality data site. The average maximum temperature during the period 1962 - 2001 was 22.7 degrees Celsius. During the last decade the average maximum temperature was 23.6 degrees Celsius. The moving average shows an increasing temperature over the whole period. This last decade was 0.9 degrees warmer than the than the 30 year average beginning in 1960. From 1995 there has been a large increase in annual average temperatures. Although there have been hot periods before like from 1978 till 1982.

Hot weather has become more common and consistent since 1995.

Models predictions made by CSIRO shows temperatures increase for the whole of Victoria for a low and high scenario. The low impact scenario is a best case scenario and represents the lower boundary of future climate change. The high scenario is a worst case scenario and represents the upper limits of climate change as simulated by the models used.

The range that these models (refer to table 1) indicate is 1.1 degree Celsius as lower boundary and 4.7 degree Celsius for the upper boundary. The highest increase for the lower boundary will be the summers they will become 1.5 degrees warmer. Spring and summer have the largest increase in temperature. Currently the average summer temperature for Sea Lake is 31.3

degrees; the average summer temperature in 2100 in the high scenario will be 36 degrees.

It must be noted that these numbers are for the State of Victoria as a whole and there might be significant local or regional variations. Moreover, these numbers represent a limited range of models and scenario's. Therefore, these numbers represent a plausible scenario for the full range of possible future climate change.

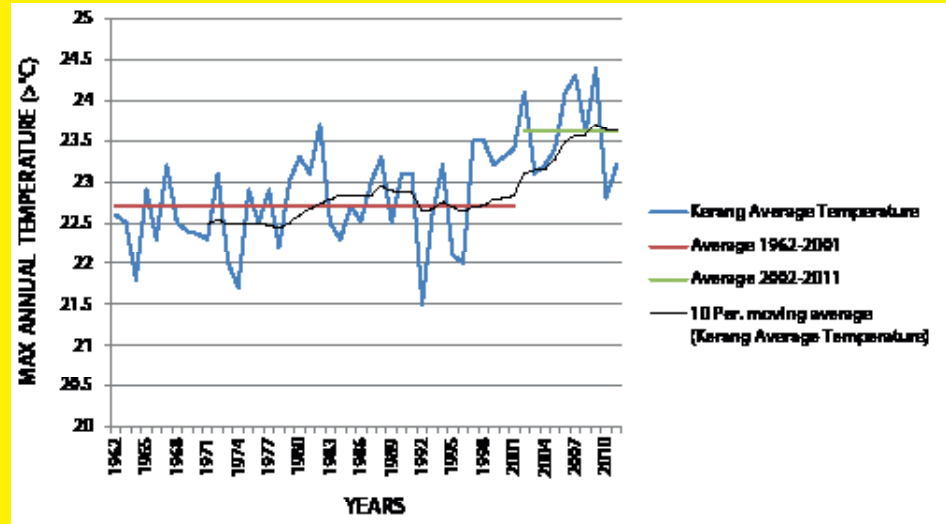


Figure 5. Maximum temperature in Kerang.

Table 1. Scenarios for temperature increase.

Increase in Temperature in year 2100		
	low scenario	high scenario
Temperature annual	1.1 °C	4.7 °C
Temperature spring	1.1 °C	6.6 °C
Temperature summer	1.5 °C	4.7 °C
Temperature autumn	1.2 °C	3.2 °C
Temperature winter	0.8 °C	4.3 °C

Model: CSIRO-Mk3.5.
 Emission Scenario: SRES marker scenario A1B
 Global Warming Rate: high

Model: CSIRO-Mk3.5.
 Emission Scenario: SRES marker scenario A1FI
 Global Warming Rate: low

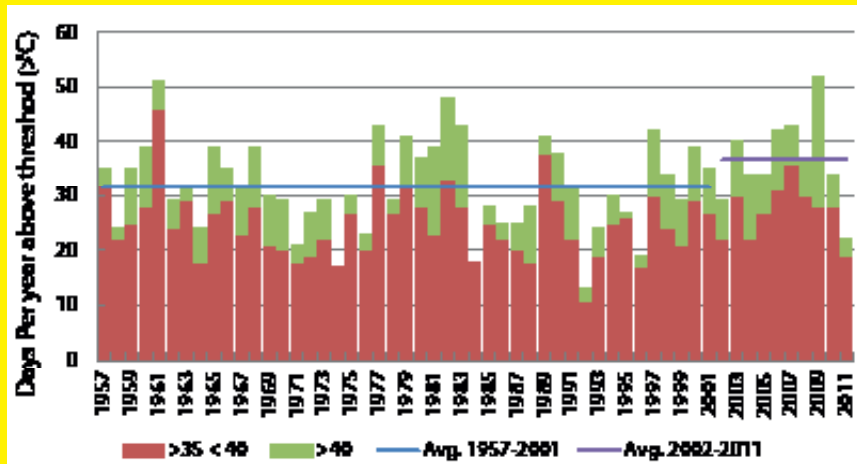


Figure 6. Number of hot days per year.

HEAT STRESS

Sea Lake has experienced periods with frequent hot weather in the past, such as in the eighties of the last century. But the frequency of hot days (above 35 °C) and very hot days (above 40 °C) have been more common in the last decade than ever before. When comparing the last decade to the climate average of the period between 1961 and 2001 than there is a there is a 16 pro cent increase in hot days. Of particular note, days of 40°C or above have increased from an average of 6.7 to 9.4. This is an increase of 40% and is more than the increase in days between 35 and 40 degrees.

Table 2. Percentage increase in number of hot days.

Days above temperature	>35 °C	35- 40°C	> 40 °C
1961-2001	31.6	25.0	6.7
2002-2011	36.7	27.3	9.4
Increase %	16.1%	9.4%	40.3%

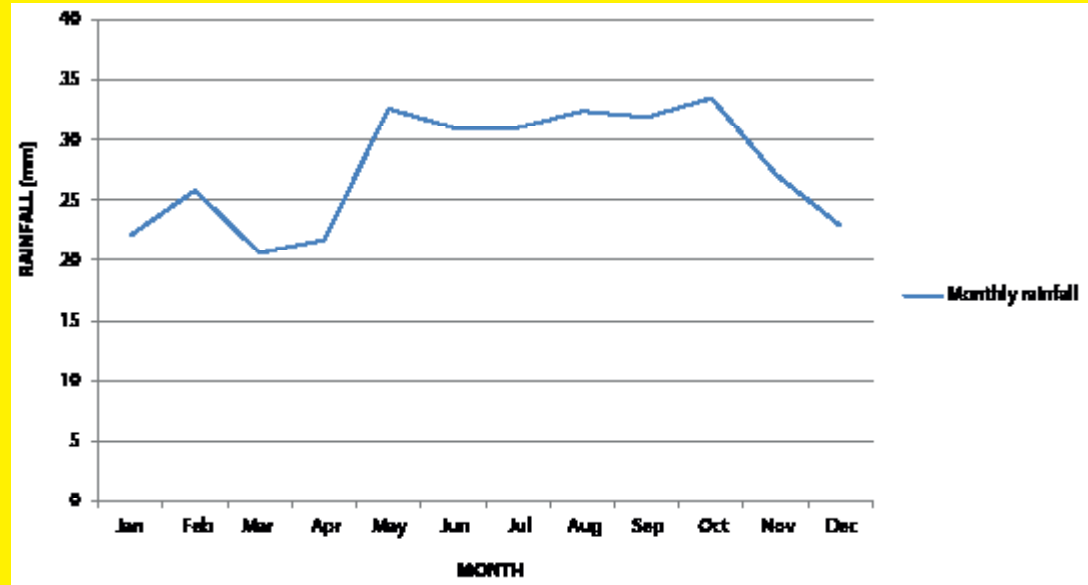


Figure 7. Monthly rainfall.

RAINFALL

The most rain in Sea Lake falls in the period May to October the growing season; during this period the average rainfall is 32 mm per month. For the season rain fall is as follows:

Season	mm
Summer	23.6
Autumn	24.9
Winter	31.4
Spring	30.8

Sea Lake is a dry place with an average of 330 mm of annual rainfall. In the last two decades the 30 year average has been more often than not been below this long

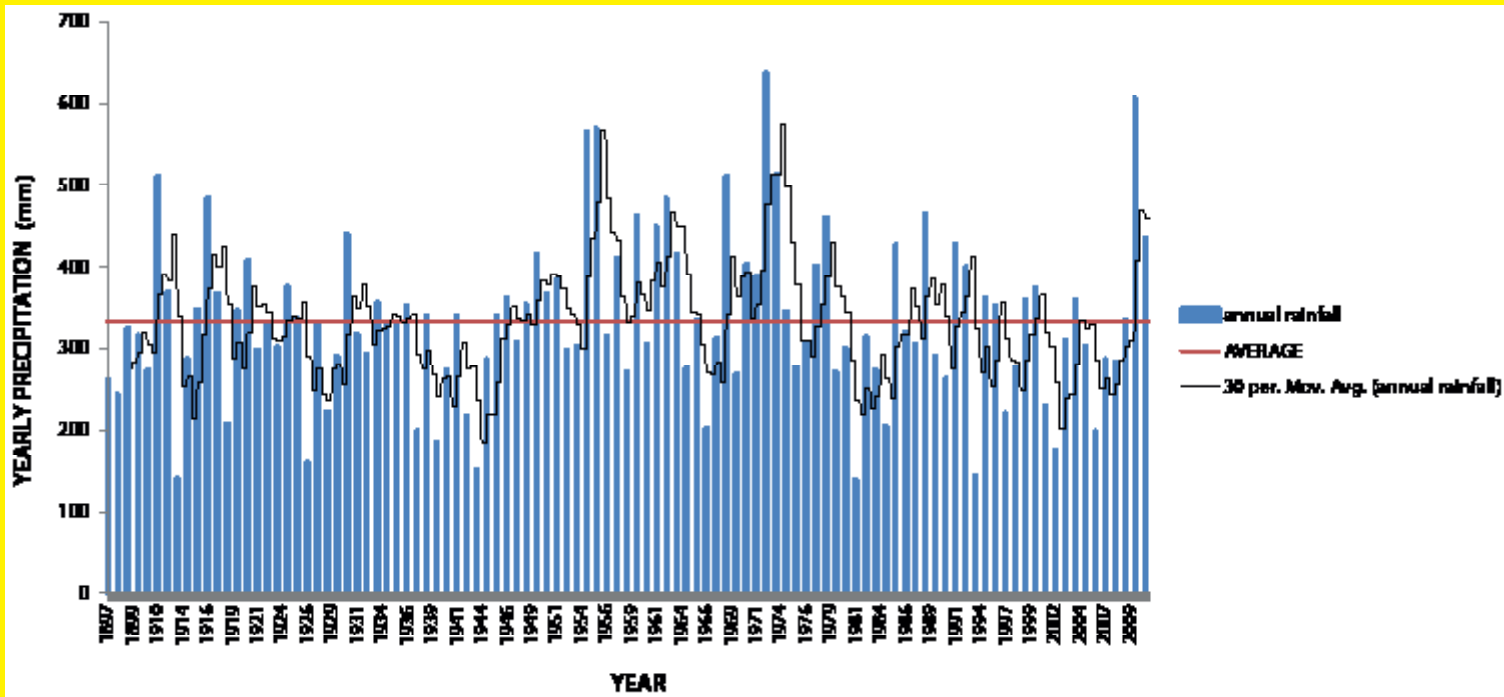


Figure 8. Yearly rainfall.

term average. The exception has been 2010 with 600 mm of rain. Predictions for the year 2100 indicate up to 195 mm or a 60% decrease in rain for the area of Sea Lake.

For the whole of Victoria the rainfall predictions show a decrease in annual rainfall in the year 2100. Under the best case scenario the decrease is less than 10 mm. But the worst case scenario shows an annual decrease of almost 250 mm. Most the decrease is during the winter and the spring while the summer shows a small increase in rainfall.

Climate models and theories suggest that rainfall patterns will more frequent high intensity rainfall. However, it should be noted that there is uncertainty associated with rainfall predictions. (Refer to Table 3.)

The same models as used for temperature are also used for the rainfall in the State of Victoria.

Table 3. Percentage increase in number of hot days.

	Year 2100	
	low scenario	high scenario
Rainfall Annual	-9.4 mm	-249.1mm
Rainfall Spring	-24.6 mm	-82.9mm
Rainfall Summer	13.2 mm	0.4 mm
Rainfall Autumn	-6.8 mm	0.4 mm
Rainfall Winter	-6.8 mm	-135.1mm

EVAPOTRANSPIRATION

Potential evapotranspiration is maximum evaporation that would occur if sufficient water would be available. The amount of actual evapotranspiration is the result atmospheric demand for moisture from a surface and the ability of the surface to supply moisture. The potential evaporation is affected by surface and air temperatures, insolation, and wind. Sea Lake is a dry land area because the potential annual evapotranspiration exceeds the annual rainfall.

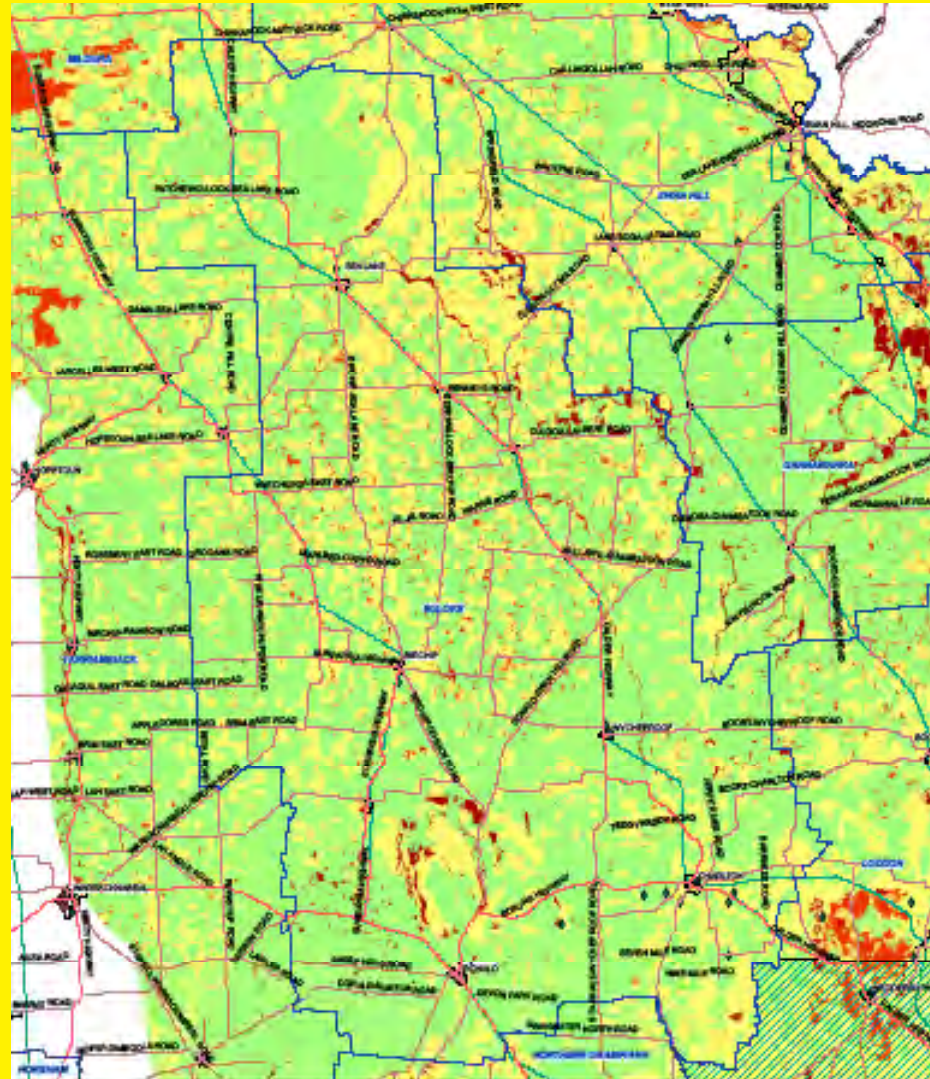
The potential evapotranspiration is going to increase, most likely because of higher temperatures. Since rainfall is going to decrease the moisture deficit will increase. This will lead to dryer soil conditions.

Table 4.

	Rainfall (mm)	potential evapotranspiration (mm)	moisture deficit (mm)
current	332.8	1558	-1225.2
Future (2100)	137.8	1788	-1650.2
change	-58.6%	14.8%	34.7%

DROUGHTS

Drought has also accompanied hotter and drier conditions. Research indicating less storm generation over southern Australia suggests dry conditions on average will continue. Drying has seen a decrease in heavy daily falls >25 mm since the 1970s. The wet conditions earlier this year were exceptional and were associated with a negative Indian Ocean Dipole and La Nina. Eleven such events in northern Victoria since 1900 have caused moderate to major flooding. A simple model based on IOD-ENSO indices suggests that this event was much wetter than would otherwise have been anticipated. Therefore drier conditions will lead to fewer very wet events but extreme events will be wetter.



FIRES

There is relatively low risk of bushfires across the Buloke Shire, but the Loddon Mallee Regional Strategic Fire Management Plan has identified the concentration of valuable “relict and fragmented landscapes” that may be at risk during fire events or fire management activities.

Figure 9. Map of Fuel load in the Bulok Shire.

FLOODS

There is a relatively low risk of flooding in the Buloke Shire except in the areas adjacent to Tyrell Creek. Figure 10 shows the extent of affected areas during the last flood in January 2011.

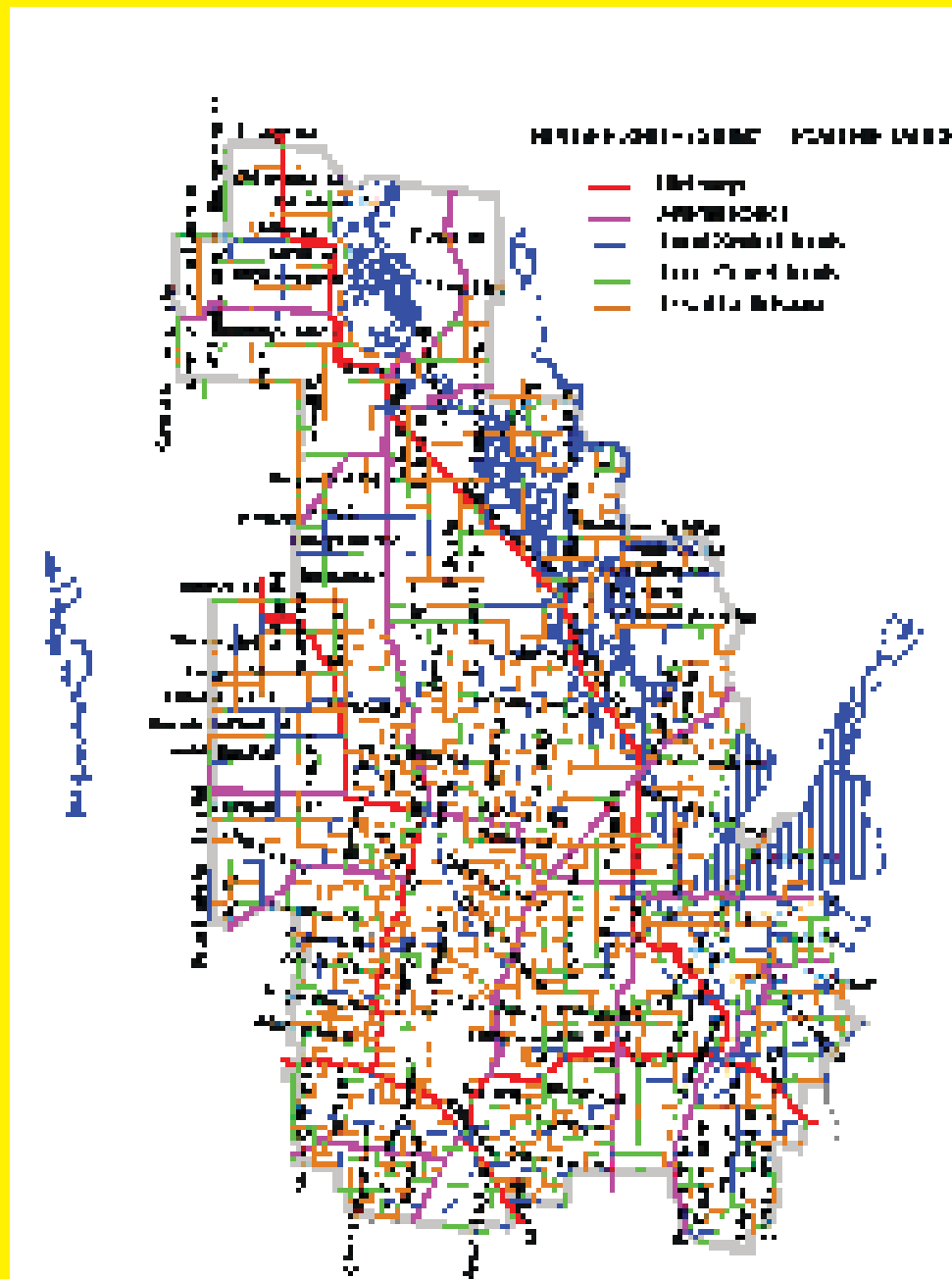


Figure 10. Map of flood extent (January 2011).

dryland farming

Dryland farming is an agricultural technique for non-irrigated cultivation of drylands. Sea Lake is a dry land area because the potential annual evapotranspiration exceeds the annual rainfall.

Dryland farming is a set of techniques and management practices used by farmers to continually adapt to the presence or lack of moisture in a given crop cycle. Seed planting depth and timing are carefully considered to place the seed at a depth at which sufficient moisture exists, or where it will exist when rain falls. In marginal regions, a farmer should be financially able to survive occasional crop failures, perhaps for several years in succession. Survival as a dryland farmer requires careful management of the moisture available for the crop and in poor years it is essential to keep the expenses and losses to a minimum.

Wheat is the typical crop grown in dryland areas. But the crop choice is influenced by the timing of the rainfall. For example winter wheat is better suited to regions with a high rainfall during the winter, while summer growing crops like sunflower or cotton are better suited for a region with wet summers. Dryland farming is possible with as little as 230 mm of precipitation a year; higher rainfall increases the variety of crops.

Dry land farming is dependent on natural rainfall. If there is a lack of rainfall it can leave the soil susceptible to erosion, especially wind erosion. This can lead to large dust storms especially if poor farming techniques are used. Erosion

control techniques such as windbreaks, reduced tillage or no-till, spreading straw strip farming and leaving standing stubble are used to minimize soil loss by erosion.

The following two examples illustrated the vulnerability of dry land farming.

In south Australia farming spread north from Adelaide into the Flinders Ranges, aided by several wetter than normal years. By the 1880s the rainfall was back to normal and farming collapsed. Even nowadays with all the new techniques farming has not returned to these regions.

A more dramatic example occurred in the United States during the 1930s, the Great Dust Bowl. The great plains were seen as unsuitable for agriculture when the early settlers arrived in America. Starting around 1900 the increased usage of mechanized ploughing opened up the Great Plains for agriculture. Also there was a period of unusually wet weather. Farmer on the Great Plains used farming practices common in wetter climates. These practices allowed erosion, the increased exposure was revealed when a severe drought struck the region during the 1930s. This drought caused the topsoil to become dry and be carried away by the wind. In some regions the topsoil loss was 75%.

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