Case Study C

6.1 SALINITY Turning our soil white

Introduction

Salinity is an urgent national environmental problem resulting from poor land management over the past two hundred years. Salinity is often described in broad national terms. Even so, this issue is of concern within the local environment of Maitland.

What is salinity?

Salt is a naturally occurring compound necessary for a variety of biological processes. Too much salt, however, can be lethal for most living things.

Salinity occurs as a result of poor land management and leads to the concentration of salt in the top soil and upper soil profile. There are two main forms of salinity affecting rural and suburban land - *dryland salinity* and *salinity caused by irrigation*.

Dryland salinity

Dryland salinity is the most common form of salinity affecting land across Maitland and broadly, across Australia. Also known as seepage salting, dryland salinity results from the large scale removal of deep-rooted native vegetation causing the water table (groundwater) to rise. This vegetation would otherwise have kept the water table lower and helped bind soil to prevent erosion.

The water table also rises because groundwater recharge (water added to the ground) exceeds the discharge (water lost/used). As the water table rises it carries dissolved salt from the bedrock and soil profile. This salt becomes more concentrated as the water moves towards the surface. At the upper surface the water evaporates leaving behind salt that is clearly visible on the ground as a white crust.

Irrigation salinity

Irrigation, the use of water from artificial channels, pipes or bores, is another cause of salinity in the Maitland area. Irrigation salinity occurs in places where large amounts of salty water from the Hunter River or groundwater are used to irrigate crops and land.

It is caused by excess water saturating the soil and raising the water table. The process described in 'dryland salinity' above then commences. Irrigation may also add salt directly to the soil, as salty water from the Hunter River, its tributaries, or groundwater is sprayed over crops and pasture for agriculture.

Why does salinity affect Maitland?

Approximately 9.5% of the Maitland local government area is affected by salinity, a combination of both dryland and irrigation salinity (refer to map of salinity 'hot spots'). Maitland is affected by salinity due to a combination of geological and human factors.

The geology factor

The Maitland area is underlain by sedimentary rock material formed during the Permian geological age over three hundred million years ago. At that time, the area was covered by brackish swamps with naturally high levels of salt.

This salty bedrock and associated groundwater now lies about 2 - 2.5 metres below the surface. Watertable levels such as this sound warning bells (NSW Dept. Land & Water Conservation 2000). Groundwater is close enough to the surface that evaporation and capillary action can combine to bring the salty water to the surface, concentrating salts in the soil as described in 'dryland salinity'.

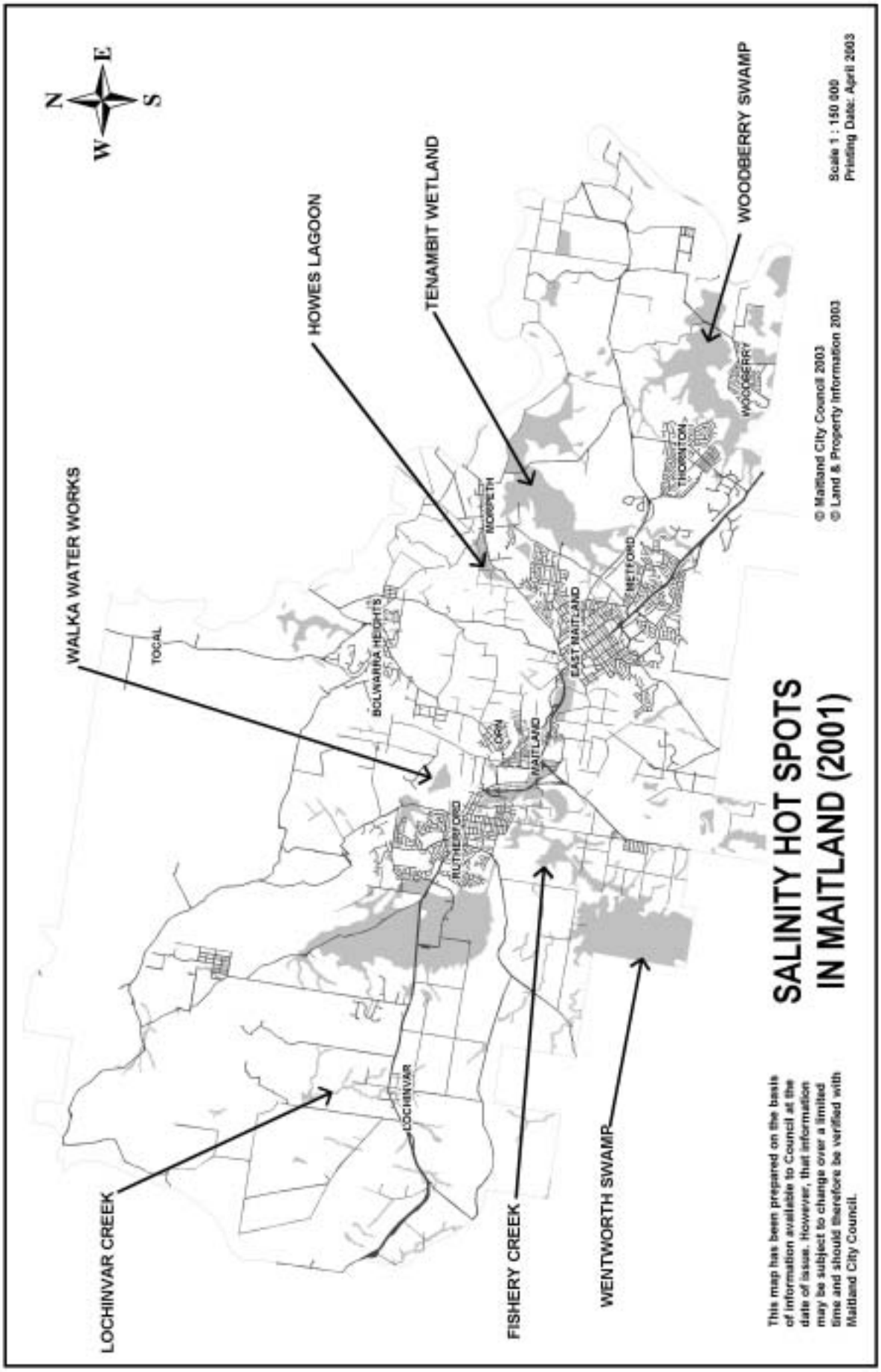
As well, erosion of the landscape may expose the salty rock material and groundwater and wash this down drainage lines to low points in the catchment such as wetlands.

The human factor

The Maitland area, being mainly floodplain and wetlands, was extensively cleared from the early 1800s as European settlers gathered valuable timber and established agriculture, mining and settlements. This trend continues today, despite Maitland having less than 6.8% of its native vegetation remaining.

The dryland salinity we see today is a function of such vegetation clearing practices. The natural balance between surface waters and the salty groundwater has been affected. This has occurred through replacement of deep-rooted native vegetation with shallow-rooted annual crops and pasture, and extensive sealed surfaces (e.g. roads and buildings).

Clearing, poor land management and increased stormwater runoff have also increased erosion across the Maitland landscape. Erosion of salt-bearing geology as described in the previous section, worsens the local salinity problem.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FISHERY CREEK
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TOCAL
BOLWARRA HEIGHTS
MORPETH
EAST MAITLAND
METFORD
THORNTON
WOODBERRY
LOCHINVAR
RUTHERFORD
LORN
MAITLAND
SALINITY HOT SPOTS
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Case Study C

SALINITY: Turning our soil white

The impact of salinity on the Hunter River

During 2001, the Healthy Rivers Commission conducted an independent public inquiry into the health of the Hunter River. The issue of salinity in surface water (e.g. rivers, creeks, lakes) and groundwater bodies was investigated through the inquiry.

The Healthy Rivers Commission report (refer to ***www.hrc.nsw.gov.au/site/river_frame.html***) stated:

The Main Issues

The salinity of surface and underground water at many locations in the Hunter Valley is a threat to the productivity of irrigated agriculture and quality of drinking water, and in some cases may be a threat to the ecology. Dryland salinity is also a problem for land managers.

Median salinity levels in the lower Hunter River are higher than in most western NSW streams, including the lower Murray. More than 1% of the Hunter catchment has water table depths of less than 2m (a higher percentage than any other NSW catchment), indicating high potential for dryland salinity.

The Commission's Conclusions

Many groundwater and surface water bodies in the Hunter Valley are naturally highly saline because of salt-bearing rocks in the underlying geology. However, human activities since European settlement, especially land clearing, irrigation and mining have led to an increase in the salinity of the water reaching streams.

The Commission believes that the contributions of the different sources to stream salinity can be summarised approximately as follows:

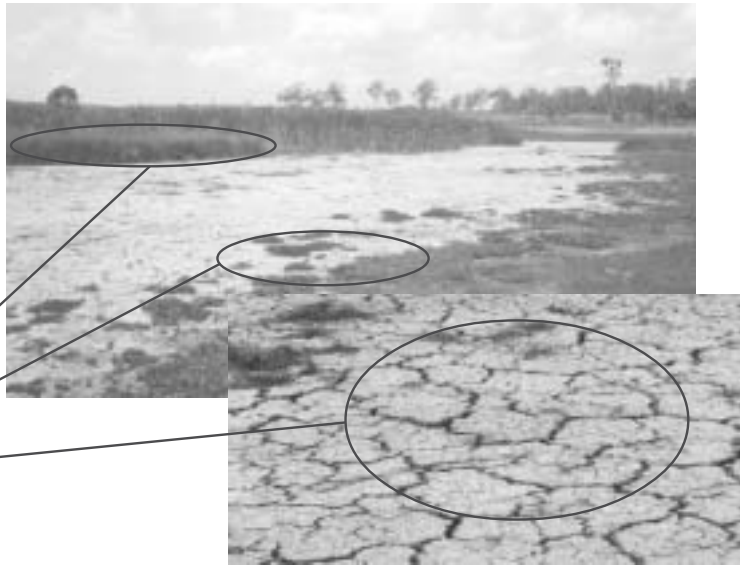
- *natural salinity (as would have occurred prior to European settlement) accounts for about 75% of current levels in the lower Hunter;*
- *increases in stream salinity due to land clearing and agricultural practices account for about 15%;*
- *mining and its after-effects account for about 10%.*

Salinity in groundwaters is continuing to rise, with land clearing, dryland salinity and rising water tables being the probable major causes. Further rises in some locations can be expected, as the longer term impacts of mining emerge. Comparable rises in river salinity could logically be expected, but are not yet evident, possibly because the Hunter Salinity Trading Scheme has masked this effect so far (for information on the Hunter Salinity Trading Scheme go to ***www.epa.nsw.gov.au/licensing/hrsts/***).

What does salinity look like?

The symptoms of salinity in the initial stages can be difficult to detect. Some of the typical features of a salinity-impacted area may include:

- Scattered areas of patchy growth in paddocks, especially around water seeps, at a break in slope or along minor drainage lines.
- Species thin out and die, being replaced by more salt-tolerant species like Common Rush (*Juncus usitatus*).
- Reduced vigour and stunting of pastures
- In severe cases, 'salt scalds' (localised areas of white salt crystals) can be seen on the land. There is little or no vegetation surrounding the scalds. Existing native trees and shrubs die due to the inability to cope with the high salt concentration.



Dryland salinity has emerged on Tenambit Wetland at the practice golf range.

Case Study

SALINITY: Turning our soil white

Local implications of salinity

Environmental

- Increasing salt damages soil structure and micro-organisms which leads to erosion. A decline in the diversity and health of native plants follows, affecting wildlife habitat and biodiversity.
- Agricultural crops are affected by salinity in soil and irrigation water leading to a decline in the quality and quantity of crops.
- Plant and animal species are placed under additional stresses as most do not have the adaptations to successfully cope and survive.
- Water quality declines within the Hunter River, its tributaries and local wetlands as saline groundwater and salt-laden sediments flow in.

Economic

- The economic costs of salinity in the Maitland area have been felt through impacts upon infrastructure. For instance, Tenambit Sports Oval required $15,000 in drainage works and equipment to remedy the problem of salt scalds on the oval.
- Local farmers have inherited the costs of salinity as the quality and quantity of produce supplied to the market has been affected by high levels of salt in irrigation water and the onset of dryland salinity.
- The economic impact on farmers also comes with the cost of remediation through revegetation, advanced irrigation techniques, or in the most extreme circumstances, the building of evaporation ponds to dispose of saline water.

Social

It is difficult to single out salinity in Maitland as having major social implications. It combines, however, with other issues such as vegetation clearance, loss of biodiversity and water quality decline to impact on our way of life. For example:

- our local community today does not enjoy the same level of freedom to drink from and swim in the Hunter River compared to many years ago;
- farmers and landholders are often unable to afford the costs to remedy salinity. This creates significant financial and personal stresses.

Managing salinity

Salinity is a complicated and difficult issue to address. There is no easy answer to solving the salinity problem. The management of local salinity issues should include:

Preservation - Greater value needs to be placed on protecting existing native vegetation combined with revegetation in the upper catchments (recharge areas).

Revegetation - Low-lying areas (discharge areas) should be revegetated. Deep-rooted vegetation has the important role of lowering localised water tables, thereby reducing salinity.

Improved farming practices - Irrigation practices need to become more efficient. Reducing the wastage of water and maximising crop uptake can assist in reducing the amount of irrigation water applied to the land.

Education - Informative, practical and relevant information should be made available to all members of the local community.

Resourcing - Ways of providing support to farmers and landholders are now being sought. Resources are coming from government and other sources recognising that salinity impacts are shared across the broader community.

Current action

- Local farmers have been progressively regenerating their land through native vegetation windbreaks and corridors.
- Maitland Council's Greening Plan has focused funding and labour into:
  - the Native Plant Distribution Scheme which has provided 30,000 native plants (2002-03) to rural landholders across the Maitland area;
  - hosting a Green Corps team to revegetate Tenambit Wetland.
- The Hunter Salinity Audit was undertaken by the Dept. Land & Water Conservation in 2001. This audit assessed the extent of the salinity problem across the Hunter Valley and predicted salinity trends in the Valley's major river systems over the next 100 years. A request can be made for the relevant brochure at: *www.hcmt.org.au/ep_publications.php3*

Acknowledgements & References

This case study has been prepared by Catherine Baird (Maitland Environmental Youth Council), with contribution by Kylie Yeend (Environmental Education & Project Management Consultant). Other information sources included:

Healthy Rivers Commission 2002, *Independent Inquiry into the Hunter River System (Final Report)*, Sydney: Healthy Rivers Commission; pp.16-17.

Maitland City Council 2000, *The Maitland Greening Plan, Stage 2 Part B*, Maitland, NSW: Maitland City Council.

NSW Department Land & Water Conservation 2000, *Hunter, Karuah & Manning Catchments: State of the Rivers and Estuaries Report*, Sydney: NSW Government; p.178.

Case Study C

6.2 EROSION
Losing our natural wealth

What is erosion?

Erosion is a natural process in the development of the landscape. Agents such as wind and water erode away rock to form the mountains, valleys, plains and rivers that are all around us. It is the increased rate of erosion, however, that has become a major concern as valuable soil is lost from the land.

Under natural conditions vegetation holds soil together and protects it from the effects of water runoff and wind. The broad clearing of vegetation since European settlement in the Hunter has accelerated the rate of erosion and made it an environmental issue of concern.

Erosion types across Maitland

In Maitland two main types of erosion affect the local environment: *streambank erosion* and *soil erosion*.

Streambank erosion

This form of erosion is concentrated in areas where past land uses have stripped the riverbank of native vegetation. It can change the length and shape of waterways and affect water quality through increasing the amount of sediment, nutrients and salt transported downstream.

An example of streambank erosion along the Hunter River. Extensive land clearing along streambanks has made this a common sight.

Soil erosion

Soil erosion in the Maitland area mainly affects cleared rural land and may be found in a number of forms:

Rill Erosion - Rills are small grooves that develop as water runs off the land and concentrates into channels. They are often the first sign of an erosion problem.

Sheet erosion - is the most common form of erosion across Maitland and also the hardest to identify. Sheet erosion involves the loss of soil material from across an entire slope without water concentrating into channels.

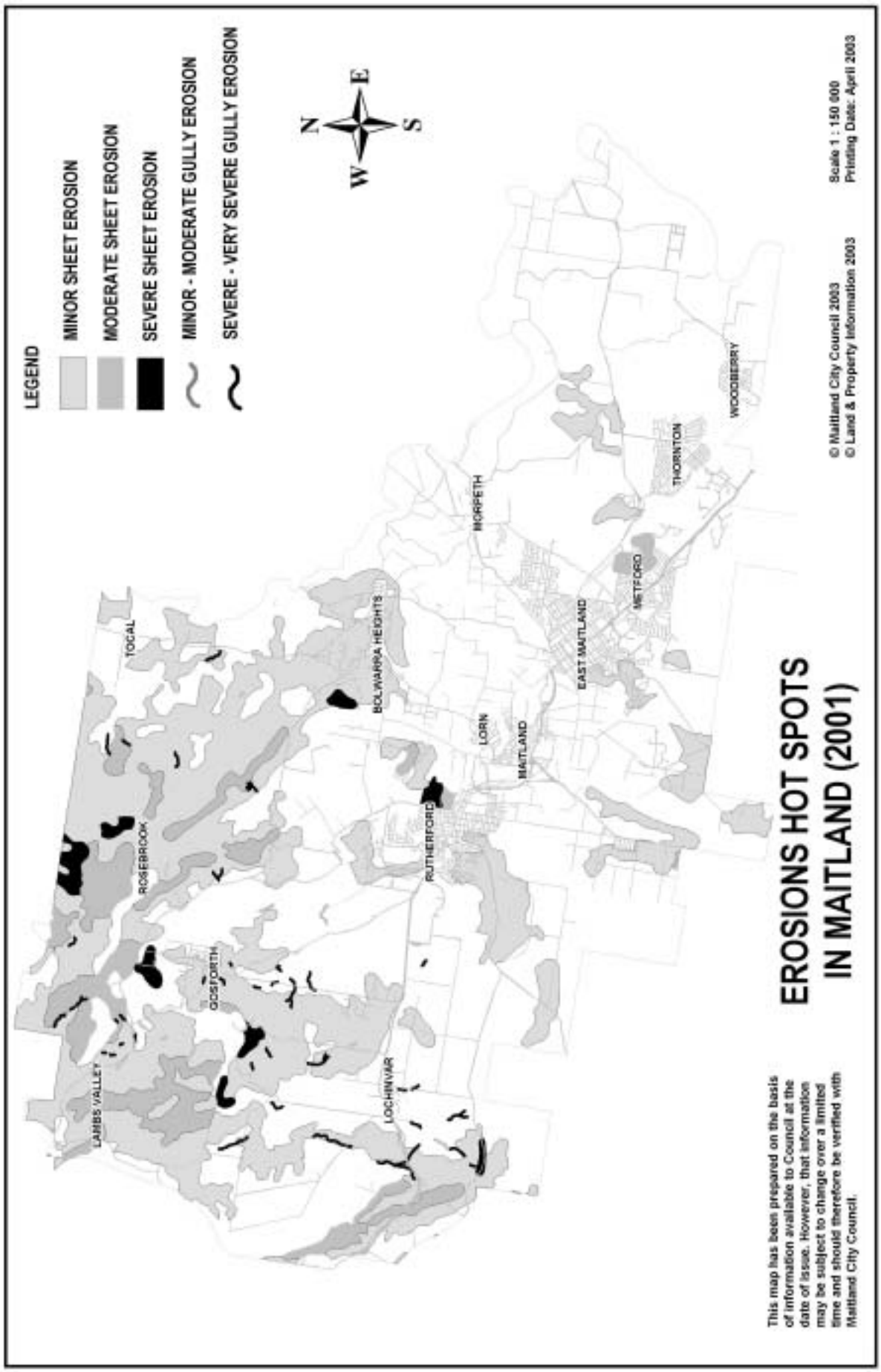
An example of sheet erosion in the local area, also illustrating the lack of vegetation characteristic of areas where erosion is most severe.

Gully Erosion - is the most obvious form of erosion where large areas of soil are washed away creating often deep and permanent scars on the landscape. It is very difficult to rehabilitate areas that have been affected by gully erosion. Prevention through maintaining native vegetation along drainage lines is a far better option.

An example of severe gully erosion. Once established this type of erosion is extremely difficult to restore.

Mass Movement - involves large losses of soil through sudden or gradual events such as landslides or soil creep, respectively. Mass movement is usually associated with the clearance of steep lands.

Mass movement in the form of soil creep is common in the Maitland area. It is recognised as a series of small terraces on steep land often mistaken for cattle tracks.


LEGEND
MINOR SHEET EROSION
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WITFORD
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WOODBERRY
EROSIONS HOT SPOTS
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Case Study C

EROSION: Losing our natural wealth

Locating erosion across Maitland

There are a number of erosion 'hot spots' in the local area. This legacy comes from the past and present mismanagement of land. The main offence has been the clearing of over 93% of Maitland's native vegetation since European settlement.

Erosion is widespread across Maitland. Local examples can be found by a brief walk or drive around new development areas, agricultural land, parkland, or even within your schoolyard. Fortunately, some of these areas also show attempts to manage erosion.

The map on the previous page offers a snap-shot of the areas affected by erosion across Maitland. A comparison of this erosion map with ones of similar scale showing geology, vegetation cover and topography may help to illustrate relationships between these elements.

Local implications of erosion

Environmental

- Erosion affects large areas of the Maitland district. It results in soil loss, permanent changes to the landscape, and leads to the sedimentation of waterways.
- Eroded material is constantly being washed into local waterways including the Hunter River, Wallis Creek and One Mile Creek (East Maitland) to name a few.
- Habitat for native wildlife can be affected through altering of the natural behaviour of local waterways by streambank erosion.

Economic

- The impact of erosion is felt through the loss of productive land. Valuable top soil is stripped away through erosion which reduces the viability of agricultural activities.
- Recent estimates undertaken for the Hunter Catchment Blueprint show costs ranging up to approximately $80,000 per kilometres for treating gully erosion.
- Sinder and Yapp (1992) estimate that if all land degradation in NSW were eliminated, the average value of agricultural output would rise by $7.3M per year per local government area, or $12/hectare.

Social

- The social effects of erosion are tied into the economic and environmental impacts.
- The loss of productive land affects the rural community through decreasing agricultural livelihood.
- Some forms of erosion are also highly obvious and are easily recognisable. This may ruin the visual appeal of an area and make some recreational activities unsafe (e.g. walking, riding, swimming).

Managing erosion

There are no simple methods to manage erosion. Like most degradation issues, the best way to address erosion is to avoid it in the first place.

Generally, erosion rehabilitation projects focus on activities that:

- reduce the effects of the two main erosion agents, water and wind:
  - for water this might include slowing the velocity through building mounds and swales or planting native vegetation;
  - for wind, this might involve planting windbreaks and shelter belts across farmland.
- stabilise the soil through planting native vegetation.

Current action

There are a number of local projects aiming to better control and manage the impacts of erosion. These include:

- establishment of native vegetation and rock revetment works along One Mile Creek in East Maitland;
- establishment of native vegetation around Tenambit Wetland;
- revegetation of the banks of the Hunter River;
- planting native vegetation for windbreaks by local farmers.

Erosion is a major issue identified in the Maitland Greening Plan. It will be the focus of future environmental projects coordinated by Maitland City Council. An example of such a project includes the Native Plant Distribution Scheme. Through this scheme local landholders can access revegetation materials to address streambank and soil erosion on their properties.

The Hunter Catchment Management Trust is also committed to managing erosion. Through the 'Land Management Scheme' it provides financial rebates to landholders who undertake erosion control works and revegetation on their property.

Acknowledgement & References

This case study has been prepared by Tim Crosdale (Environmental Officer, Maitland City Council). Other information sources included:

Hazelton, P. & Koppi, A. 1993, *Soil Technology: Applied Soil Science*, Sydney: NSW Governement Printing Service.

Hunter Catchment Management Trust 2002, *Integrated Catchment Management Plan for the Hunter Catchment 2002*.

Maitland City Council 2000, *The Maitland Greening Plan, Stage 2 Part B*, Maitland, NSW: Maitland City Council.

Sinden, J.A. & Yapp, T.P. 1992, "Estimation of the Opportunity Costs of Land Degradation in NSW: Preliminary findings", paper presented at the *36th Annual Conference of the Australian Agricultural Economics Society*, Canberra, Agricultural Industries, Outlook 99.

Case Study C

6.3 BLUE-GREEN ALGAE in local waterways

What is blue-green algae?

Blue-green algae or *Cyanobacteria* comprise several species of naturally occurring algae that affect local waterways.

Blue-green algae become a problem when their numbers multiply rapidly, forming a 'bloom'. They may cause toxic or allergic reactions in humans and other animals when contact is made and therefore pose both a health and environmental threat.

Fact File:
There are two known blue-green algae species in the lower Hunter region that produce toxins of risk to animals and human: *Anabaena* and *Microcystis*. These two species have contributed to blooms in Maitland's waterways.

Identifying blue-green algal blooms

When a 'bloom' forms the water can turn bright blue / green in colour and form a paint-like scum on the surface. Other characteristics of a blue-green algal bloom can include:

- unpleasant odours in and around the water body;
- unpleasant tastes to the water; and
- dried blue-green scum on the edges of the water body.

If any these factors are identified it is possible that the water contains blue-green algae. In public waterways laboratory analysis is often carried out at this point to confirm whether the algae is blue-green algae.

Blue-green algae bloom over surface of water. (Photo: Bruce Cooper; from NSW Dept. Land & Water Conservation 1997)

What factors contribute to the formation of blooms?

There are three main factors that promote the growth of blue-green algae. These are:

- high nutrient levels,
- high water temperatures, and
- relatively calm conditions.

Fact File:
During 2001-02 three blue-green algae blooms appeared in water bodies around Maitland. They were located at Telarah Lagoon, Rathluba Lagoon and sections of Wallis Creek The blooms lasted for about two to three months.

High nutrient levels are an important factor leading to the growth of blue-green algae. Increased levels of nutrients in waterways can come from a number of human sources including stormwater and agricultural runoff and soil and streambank erosion.

Why are blue-green algae a problem?

There are many types of algae present in water. Problems arise if they are present in large numbers, affecting the taste, odour and appearance of the water. Of all algae species, blue-green algae are the worst offenders.

If the toxins produced by blue-green algae come into contact with skin the following may occcur: skin irritations, rashes, swollen lips, eye irritation, ear ache and itchiness, sore throat, hay fever symptoms and asthma.

The use of affected water for drinking may cause nausea, vomiting, stomach pain, diarrhoea, liver problems, muscle weakness or paralysis. Blue-green algal blooms can pose a serious health risk to both humans and animals.

Native wildlife can also be affected by the bloom either through direct contact with the toxic algae or through the loss of oxygen within the water as the algae decomposes.

The formation of a bloom also indicates declining water quality. Blue-green algal blooms are symptomatic of a waterway under stress especially due to high nutrient levels.

Case Study C

BLUE-GREEN ALGAE in local waterways

Fact File:
The occurrence and intensity of blooms in the Maitland area have increased in recent years. Blooms have occurred in the same water bodies -Telarah and Rathluba Lagoons - for three consecutive years. Investigations of the blooms have revealed that high nutrient levels in catchment runoff contributed to the frequency and intensity of the blooms.

Impacts of blue-green algal blooms

Due to their toxicity, blue-green algal blooms can render waterways virtually useless for drinking water, agricultural and recreational purposes.

The economic impacts of a blue-green algal bloom can be widespread. The costs are largely related to the management of the bloom and reducing the risk to humans and animals. In some areas of NSW algal blooms have formed within town drinking supplies, forcing the introduction of water restrictions.

Recreational users are also affected by the formation of the bloom. In this sense, economic impacts may be felt through loss of tourism income and the social impacts of a decline in aesthetics of the waterbody and restrictions in use.

The recent algal blooms in Telarah Lagoon have meant that restrictions on fishing and swimming have had to be imposed. Even walking around the lagoon was affected due to the unpleasant odours of the bloom.

Preventing blue-green algal blooms

Very little can be done to address an algal bloom once it has formed. Whilst there are options to control the bloom, including algicides and water treatment methods, they are often very expensive and can cause considerable environmental harm if not used correctly.

The most effective way of addressing a bloom is to prevent it from occurring in the first place. This can be achieved through controlling the human factors that contribute to blooms.

Central to the prevention of algal blooms is the education of the community on ways to reduce the amount of nutrients in waterways.

Managing blue-green algae

The management of algal blooms in Maitland is guided by the 'Hunter Regional Algal Contingency Plan' which has been prepared on behalf of the Hunter Regional Algal Co-ordinating Committee. There are a number of main players including Maitland City Council and the NSW Department of Sustainable Natural Resources.

The Plan outlines the management of algal blooms. This includes alerting users of the water body to the presence of the bloom and continual monitoring of algae levels.

An example of signage used to alert users of water bodies of the presence of an algal bloom.

Also outlined in the plan are alert levels based on the number and type of algae present in the water body. This is to reduce the risk of humans and animals coming into contact with the contaminated water. High alert levels have been maintained for months at a time during blooms in Rathluba and Telarah Lagoons.

Fact File:
A high alert level is issued when the algae concentration is more than 15,000 cells (individual alga) per millilitre of water.

Education programs have also been designed and used in the areas where blooms are recurring. The educational material focuses on how to reduce the amount of nutrients in runoff from residential, agricultural and commercial areas. Maitland City Council has introduced these educational programs in the Wallis Creek, Telarah Lagoon, and Rathluba Lagoon catchments.

Acknowledgement & References

This case study has been prepared by Tim Crosdale (Environmental Officer, Maitland City Council). Other information sources included:

Hunter Regional Algal Coordinating Committee 2000, *Hunter Region Algal Contingency Plan.*

NSW Dept. Land & Water Conservation 1997, *What scum is that? Algal blooms and other similar prolific plant growth.*

Maitland City Council 2000, *The Maitland Greening Plan, Stage 2 Part B*, Maitland, NSW: Maitland City Council.

Program

6.1 Developing a Local RESEARCH ACTION PLAN

Links with Syllabus

Key Learning Area	Stage	Syllabus outcomes addressed
Geography	5	5A3 (Issues in Australian environments) - 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.9

Overview

This program involves students in an investigation of a current geographical issue, feature or process in their local community by developing a Research Action Plan. The program involves three main stages:

1. **Defining** a geographical issue, feature or process.
2. **Developing a plan** of how to investigate the issue, feature or process.
3. **Implementing the plan** by undertaking the investigation.

Materials Required

Provided

- Excursion Program 7.4 - *Investigating issues & ecosystems at Tenambit Wetland*
- Case Study 3.1 - *Native Vegetation in Maitland*
- Case Study 3.3 - *Investigating Woodberry Swamp*
- Case Study 4.4 - *Catchment Management of Wallis & Fishery Creeks*
- Case Study 5.1 - *Local Environmental Citizenship*
- Case Study 5.2 - *Maitland Environmental Youth Council*
- Case Study 5.3 - *Landcare: Making a Difference*
- Case Study 5.4 - *Regeneration at Earthcare Park*
- Case Study 6.1 - *Salinity*
- Case Study 6.2 - *Erosion*
- Case Study 6.3 - *Blue-Green Algae*
- Worksheet 6.1

To Obtain

- Newspaper clippings of local geographical issues
- Copies of case studies and worksheets

Acknowledgement

This program has been designed collaboratively by Social Science staff at Maitland High School and trialed with Year 10 geography students at Maitland High School and Maitland Grossmann High School.

Program

6.1 Developing a Local RESEARCH ACTION PLAN

Program Instructions

Content	Strategies	Resources
Issue identification	◆ Students identify a LOCAL geographical issue, feature or process to be investigated. Issues may be identified through: - review of case studies; - implementing an excursion program, e.g. *7.4 Investigating Issues & Ecosystems at Tenambit Wetland*; - review of local newspaper articles; - guest speakers and class discussion.	◆ Case Studies 3.1, 3.3, 4.4, 6.1, 6.2, 6.3 ◆ Excursion Program 7.4 ◆ Local newspaper clippings ◆ Guest speaker (refer to Section 8)
Developing a research action plan	◆ Students develop a PLAN of how they are going to investigate the issue. This should include both *primary* and *secondary* information sources. ◆ The plan should address questions such as: - When and how will information be collected? - How will research findings be presented (communicated)? - What actions (solutions) are proposed to manage the issue? - To whom shall the research findings and proposed actions be reported?	◆ Worksheet 6.1 (student guidelines)
Implementing the research action plan	◆ Students put their PLAN into action by: - conducting secondary research, e.g. review of case studies, reports, publications; and - conducting primary research, e.g. surveys, interviews, drawing maps, taking photos. ◆ Students keep an accurate log of what research they did and when. ◆ Students collate their research findings and present these using appropriate written, oral and graphic forms.	
Communicating research findings and active citizenship	◆ Students report their research findings in a report format: INTRODUCTION (max. 100 words) - Identification of the local issue. - Outline of why this issue was identified for investigation. METHOD OF INVESTIGATION (max. 150 words) - Explanation of how the issue was investigated. FINDINGS (max. 250 words + graphics) - Description of the findings (results) of the investigation. - A range of formats should be used to present findings (e.g. text, graphs, tables, maps, photos). ACTIONS (max. 100 words + letter) - Explanation of proposed actions/solutions to manage or rectify the issue. - Write a letter to an appropriate person and/or authority explaining the research, findings and suggested actions. ◆ Refer students to environmental citizenship case studies to broaden awareness of options for active citizenship.	◆ Case Studies 5.1, 5.2, 5.3, 5.4

Worksheet W

6.1 Developing a Local RESEARCH ACTION PLAN

Student Information Sheet

A requirement of the School Certificate Geography course is that students must investigate a current geographical issue in their local area by developing a RESEARCH ACTION PLAN. Through this Plan students are expected to:

- gather and process relevant data
- evaluate alternative solutions regarding the management of the issue
- communicate research findings
- propose individual or group actions to address the issue
- demonstrate active citizenship.

The steps to develop your LOCAL RESEARCH ACTION PLAN are outlined below along with the criteria that will be used to assess your work.

STEP 1 Identify a local geographical issue of interest or concern to you.

EXAMPLE:
Is the local community concerned about the loss of native vegetation in the Maitland area?

Assessment criteria:
The issue is geographical (i.e. place specific) AND it is clearly explained.

STEP 2 Develop a plan to research the issue.

This plan should include a time frame and address the following questions:

- What *primary* and *secondary* information is required?
- How will the information be collected? What are the information gathering instruments and how will these be used?
- When will the information be collected?
- How will research findings be presented (communicated)?
- To whom will the research findings and proposed actions be reported?

EXAMPLE:

Days 1&2:	Read case study *(3.1 Native Vegetation in Maitland)* and look through the Maitland Greening Plan.
Day 3:	Design questionnaire and tally sheet. Decide on locations and number of people to survey.
Days 5 - 9:	From 4.00-5.30pm, use local shopping mall to implement questionnaire. Ask 40 local residents to respond to questionnaire.
Day 10:	Collate results...

Assessment criteria:
Evidence is provided showing a structured and logical sequence in the research plan with an emphasis on primary information sources.

Worksheet W

6.1 Developing a Local RESEARCH ACTION PLAN

STEP 3 Put the research plan into action.

This step will include:

- conducting secondary research;
- conducting primary research (e.g. distribute surveys, conduct interviews, draw maps, take photos);
- collating the research findings (e.g. use tallies, tables and/or graphs for results from surveys and interviews; finalise maps; develop and annotate photos; select appropriate information to be included in the report).

EXAMPLE:

Date	Step	Activity

Assessment criteria:
Demonstrated ability to initiate and implement research using a range of methods and information sources. Provide a detailed and accurate log of research activities.

STEP 4 Communicate research findings.

Prepare a report on your research using the format below:

INTRODUCTION (max. 100 words)

- Identification of the local issue.
- Outline of reasons why this issue was identified for investigation.

METHOD OF INVESTIGATION (max. 150 words)

- Explanation of how the issue was investigated.

FINDINGS (max. 250 words + graphics)

- Description of the findings (results) of the investigation.
- A range of formats should be used to present findings (e.g. text, graphs, tables, maps, photos).
- Secondary information (i.e. other people's work) may be used to support your results, this information is to be acknowledged.

EXAMPLE:
Level of local residents' concern for loss of native vegetation across Maitland: 30% highly concerned; 50% concerned; 15% not very concerned; 5% not at all.
65% said they would be willing to pay a small annual environmental levy to help address the issue.

CONCLUSION (max. 100 words)

- State the conclusion to your research.
- Suggest and explain proposed actions/solutions to manage or rectify the issue.

EXAMPLE:
Most local residents are concerned about the loss of native vegetation in the Maitland Local Government Area. This concern could be addressed in a number of ways. Some solutions have been described in the Maitland Greening Plan. An option that some local residents might support is the introduction of an environmental levy. This money could be spent on...

Worksheet W

6.1 Developing a Local RESEARCH ACTION PLAN

STEP 4 Communicate research findings (cont.)

ACTIONS (letter)

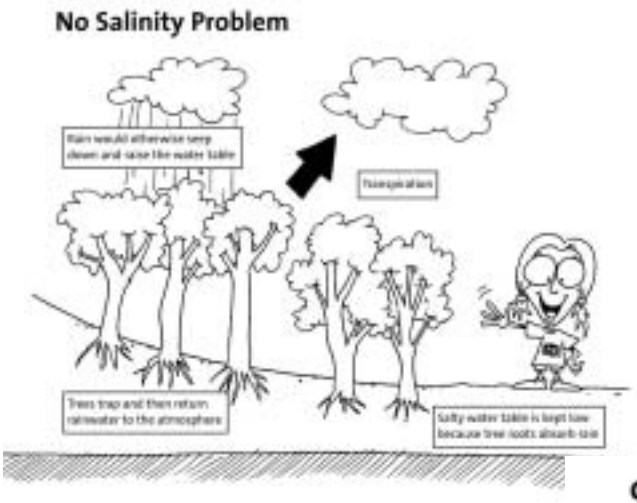
- You identified an issue, investigated it, proved it existed (or not), and suggested a possible solution or improvement. ***What would an active citizen do next?***
- Write a letter to an appropriate person and/or authority explaining the research, findings and suggested actions.

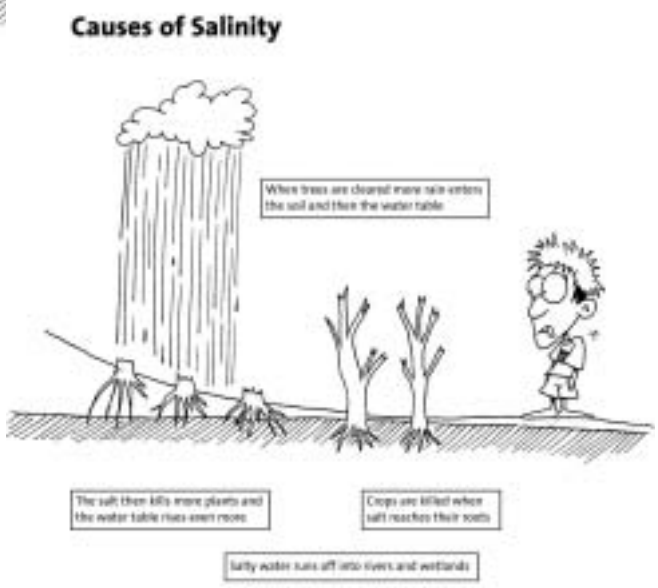
Assessment criteria:

- *Clear and detailed description and analysis of data and results.*
- *Range and depth of research findings.*
- *A logical conclusion, including possible management options deriving from the results.*
- *Degree of appropriateness, structure, and grammatical correctness of the letter.*

Worksheet W

6.2 Understanding & Managing DRYLAND SALINITY





(Images source: *http://www.streamwatch.org.au/pdf/StreamsAlive22-33.pdf*)

Use these diagrams to explain the link between vegetation clearing and the salinity problem.

Worksheet W

6.2 Understanding & Managing DRYLAND SALINITY

Prior to 1788 Aboriginal occupation was designed to live with the environment. How did this system change with European settlement?

Image source:
www.saltwatch.org.au/saltwatch/book/index.html

Use the following webpages to assist in determining a management plan for the salinity problem in Maitland. Use Case Study 6.1 from the *Sense of Place Resource Kit* to begin your thinking.

Submit your plan to the EPA outlining the issue and the best way of overcoming the problem. Communicate your findings using ICT media.

Image source: *www.saltwatch.org.au/saltwatch/book/index.html*

Useful links are:

- *www.salinity.com.au/*
- *www.dlwc.nsw.gov.au/care/salinity/index.html*
- *www.saltwatch.org.au/saltwatch/book/index.html*
- *www.ndsp.gov.au/*
- *www.mdbc.gov.au/naturalresources/env_issues/water_and_land_salinity.htm*