Welcome to Kepwari

- Place of moving water -

Artwork: Tjaltjraak Mooraak, Walkabout at Kepa Kurl by Donna Beach (Ninnon)

LAKE WARDEN WETLANDS CURRICULUM PACKAGE

For Upper Primary/Lower Secondary Students

Learn about wetland systems

(their features, plant and animal life, international importance and the threats they face)

by focusing on a unique local example – the Lake Warden Wetlands System

DEPARTMENT OF
Conservation
AND LAND MANAGEMENT
Conserving the nature of WA

"Kepwari"

- Place of moving water -

Seemingly still within the basin of a wetland,
water is in fact on a constant journey through the landscape.

Artwork: Baingilerup Merring by Donna Beach (Ninnon)

Welcome to Kepwari
Lake Warden Wetlands Curriculum Package

Printed by:
Fineline Print and Copy Service on 100% recycled paper.

Published by:
Department of Conservation and Land Management with funding assistance from the Department's Nature Conservation Division and the State Salinity Program.

CONTENTS

Helpful hint: Read this section first!

Welcome to Kepwari

Conservation through education

The Department of Conservation and Land Management is part of a greater conservation community and has distinct State Government responsibilities within that community. The Department has the lead responsibility for conserving the State's rich diversity of native plants, animals and natural ecosystems, and many of its unique landscapes on behalf of the people of Western Australia.

The Lake Warden Wetland System

The northern perimeter of the Esperance townsite is encompassed by the Lake Warden Wetland System. The Lake Warden Catchment is classified as a Natural Diversity Recovery Catchment (NDRC) under the State Salinity Strategy and contains a Ramsar-listed Wetland of International Significance, being the Lake Warden Wetland system. The Department is the coordinating State Government Agency for NDRCs and is responsible for the recovery of important natural assets from the threat of salinity processes.

The Lake Warden Wetland System is under threat from salinity, waterlogging, eutrophication (nutrient loads causing toxic algae blooms), plant disease (dieback), introduced pests and incompatible recreation use. Land use changes in the catchment and around the Esperance townsite are impacting upon the conservation values of the Lake Warden Wetlands.

(Continued . . .)

Project Team:

Tilo Massenbauer - Recovery Catchment Officer
Department of Conservation and Land Management

Peta White - Environmental Education Officer
Agriculture Western Australia

Michael Spragg - Recovery Catchment Curriculum Writer
Department of Conservation and Land Management

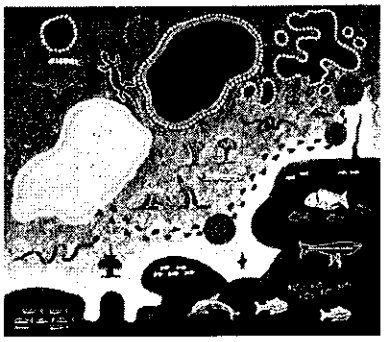
The Curriculum Package

At a local community level there is a major lack of awareness of the importance of the Lake Warden system and the conservation threats they face. As part of a broader communication plan the Department has developed a curriculum package with the support of local educational expertise. The Welcome To Kepwari Curriculum Package is a tool to help upcoming generations learn about the challenges facing the community to conserve our fragile wetland systems, with specific reference to the Lake Warden Wetland System.

The package takes a big picture approach to issues affecting the wetlands system and presents these issues in a diverse array of classroom activities and outdoor interaction with wetland environments. The outdoor interaction takes place on the Kepwari Wetland Walk Trail.

The Kepwari Wetland Walk Trail

The 3.6km trail (one way) winds through fringing sedgelands, heathlands, under banksia canopies and over dune ridges with views of the wetland system and catchment. Along the trail you can discover how these internationally significant wetlands are affected by activities that have dramatically altered the surrounding landscape through a series of interpretative panels. The interpretive trail contains themes over varying sections of the trail so that you can learn at your own pace.



The wetland trail infrastructure is comprised of jarrah boardwalks (1.5km), scalped trails (2.1km), two pine bridges, two bird hides, 13 interpretation panels, three bench seats and two sheltered information bays. Access can be made to the trail via Windabout Way, or Lakes Road, both adjacent to Fisheries Road.

Thanks

The Department wishes to thank the Esperance District Education Office and local community groups and schools for their support in the development of this package. We look forward to teachers utilising this resource in the development of young minds that are our future.

Acknowledgements:

Steve Brown, former Curriculum Improvement Officer, Esperance District Office, Education Department of WA, for his knowledgeable and unconditional help with the Curriculum Framework aspects of the package.

Lorna Charlton, Interpretation Officer, Department of Conservation and Land Management Esperance, for the excellent signs she produced for the Kepwari Walk Trail, on which this package is based and for allowing the use of her wonderful artwork.

Donna Beach (Ninnon), artist and direct descendant of the Bullenbuk people of Esperance, for her original artworks which feature both in this package and on the walk trail.

Using this package

The Lake Warden Wetlands Curriculum Package is designed to encourage the exploration of wetland systems (their features, plant and animal life, importance and the threats they face) by focusing on a unique example – the Lake Warden Wetlands System.

Many of the activities included are designed to complement an excursion to the Kepwari Wetland Walk Trail that passes from Wheatfield Lake to Woody Lake near Esperance, Western Australia (see map page 11).

Who is it for?

Activities in the package are suitable for upper primary/lower secondary students and support outcomes in a range of learning areas:

- ✎ Science
- ✎ Mathematics
- ✎ The Arts
- ✎ English
- ✎ Society and Environment
- ✎ Technology and Enterprise

What will we learn?

The package aims to increase student and teacher awareness of the inherent conservation values in wetland systems. The package is specifically designed to:

- ✎ Increase knowledge of wetland systems, especially the Lake Warden Wetlands System.
- ✎ Improve understanding of wetland management issues.
- ✎ Enhance personal commitment to wetland systems.
- ✎ Encourage positive community action to protect and enhance Esperance's wetland systems.

Why use it?

The learning activities suggested in this package are:

- ✎ Student-focused.
- ✎ Designed to cater for a range of abilities and interests.
- ✎ Involving examining wetland issues.
- ✎ Aimed at enhancing the experience of visiting the Kepwari Wetland Walk Trail.

Using this package

Structure

The information and activities in this package are divided into three sections:

1. **Before your visit**
   Information and activities designed to give an overview of wetlands and their importance.

2. **Your visit to the wetlands**
   Activities designed to be undertaken during a class excursion to the Kepwari Wetland Walk Trail.
   A range of issues are explored in greater detail:

   - ✎ Wetland bird life
   - ✎ Dieback
   - ✎ Salinity
   - ✎ Vegetation and weeds
   - ✎ Drowning wetlands
   - ✎ Land use conflict
   - ✎ Introduced animals
   - ✎ Eutrophication

3. **After your visit**
   Follow-up and extension activities that can be completed in the classroom. These activities are designed to examine issues raised on the excursion in more depth.

Teacher's notes are included at the start of each section.

Planning for outcomes using this package

This package is designed to facilitate outcomes-based planning. Teachers can use the package as a complete program or select activities to suit their learning areas and student levels.

The following pages provide an index of all activities (including a guide to their curriculum links.)

To assist your planning, tables showing links to:

- The overarching learning outcomes;
- Learning areas; and
- Relevant strands

are also included in this introductory section.

Student-directed learning: The package is presented in a way that will enable students to decide and plan their own study program on a particular theme if required.

ACTIVITIES INDEX

Activity	Heading	Page No.	Curriculum Links (Learning area & outcomes) S = Science M = Mathematics E = English A = The Arts S&E = Society & Environment T&E = Technology & Enterprise
Before your visit			
1	Local water cycle	30	**S:** L & L, E & B **S&E:** N & SS
2	Story of a water droplet	30	**E:** S&L,V,R,W
3	Global warming research	30	**E:** S&L,V,R,W **S:** IS, E&B **S&E:** ICP,P&P
4	How much water per tonne of grain?	31	**M:** WM, N
5	Photograph identification	33	**E:** S&L
6	Wetlands mind map	33	**E:** S&L
7	Identifying wetlands	34	**S:** IS
8	Categorizing wetlands	34	**E:** S&L **S:** IS, E&B
9	Wetlands sketch & brainstorm	37	**E:** S&L
10	Wetlands activity mime	37	**A:** I **E:** S&L
11	Wetlands conflict role-play	37	**A:** I **E:** S&L **S&E:** R
12	Ramsar Convention research	39	**E:** S&L,V,R,W **S&E:** ICP,R
13	Ramsar Convention talk	39	**E:** S&L
14	Esperance wetlands mapping	43	**S&E:** P&S
15	Names of lakes story	43	**E:** R,W **S&E:** ICP
16	Esperance flooded problem solving	44	**E:** S&L **T&E:** TP, S
17	Macroinvertebrate letter design	47	**E:** S&L
18	Match the macro	48	**E:** R
19	Macroinvertebrate data sheet	50	**E:** S&L **M:** WM, N **S:** IS, E&B **S&E:** ICP
Your visit to the wetlands			
20	Kepwari Wetland Walk Trail activity sheet	60	**E:** S&L **S&E:** ICP, P&S, R, N&SS
Issues to Explore			
Wetland bird life			
21	Bird life observation chart	66	**E:** S&L
22	Bird call recognition	66	**E:** S&L,V,R,W
23	Migratory bird story	66	**E:** S&L,R, W
24	Bird habitat hypothesis testing	67	**E:** S&L **S:** IS, L&L **S&E:** ICP
25	Waterbird protection leaflet	67	**E:** S&L ,W
Dieback			
26	Identifying dieback effects sketch	69	**A:** I **S:** IS, L&L **S&E:** P&S
27	Dieback brainstorm	70	**E:** S&L **S&E:** P&S
28	Dieback threat cartoon or roleplay	70	**A:** I, S&P **E:** S&L, W **S&E:** P&S
Salinity			
29	Salinity observation questions	72	**S:** IS, L&L
30	Salinity testing	72	**E:** S&L **M:** WM, M, N, A **S&E:** P&S, R
31	Dissolved salt experiment	73	**E:** S&L **S:** IS **S&E:** ICP
32	Travelling with salt experiment	74	**E:** S&L **S:** IS **S&E:** ICP
33	Salinity research news report	75	**E:** S&L,R,W **S&E:** ICP
Vegetation/Weeds			
34	Plantscape picture & analysis	76	**A:** I
35	Weeds wanted poster	78	**A:** I **E:** S&L, W
Drowning wetlands			
36	Flooded wetlands power point presentation	79	**E:** S&L, W **S&E:** ICP **T&E:** I

ACTIVITIES INDEX

The excursion

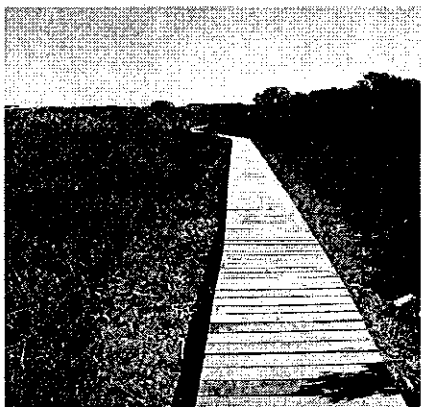
Although some of the activities, especially the 'Before your visit' section, can be used in isolation the package is designed to complement a visit to the lakes system.

Whilst on the excursion there are three types of activities included:

1. Whole class activities set in one location. These are designed to raise awareness of the surroundings and examine the 'health' of the wetland.
2. Overview activity focusing on the walk and signage. This is an activity sheet that students can complete whilst walking the Kepwari trail.
3. Group activities focused on individual wetland issues. The activities are based on information on the signage and exploring the surrounding area. These can be completed as separate small groups or a class may choose to focus on one of the issues:
    - Wetland bird life
    - Dieback
    - Salinity
    - Vegetation and weeds
    - Drowning wetlands
    - Land use conflict
    - Introduced animals
    - Eutrophication

The package includes post-excursion follow-up activities for each of these issues.

It is anticipated teachers will select the format and activities that best meets their students' needs.
A number of visits to the various locations at different times of the year is highly recommended.



Kepwari Wetland Walk Trail

The Lake Warden Wetland System is located on the northern outskirts of Esperance townsite. The Kepwari Wetland Walk Trail can be accessed from Windabout Way.

The trail can take between one and a half hours to a full day to complete, depending on the number of activities your class undertakes.

The lake site is an ideal spot for a pleasant lunch or morning tea.

To assist your teaching, a copy of all signs found on the walk trail are included at the end of this package.

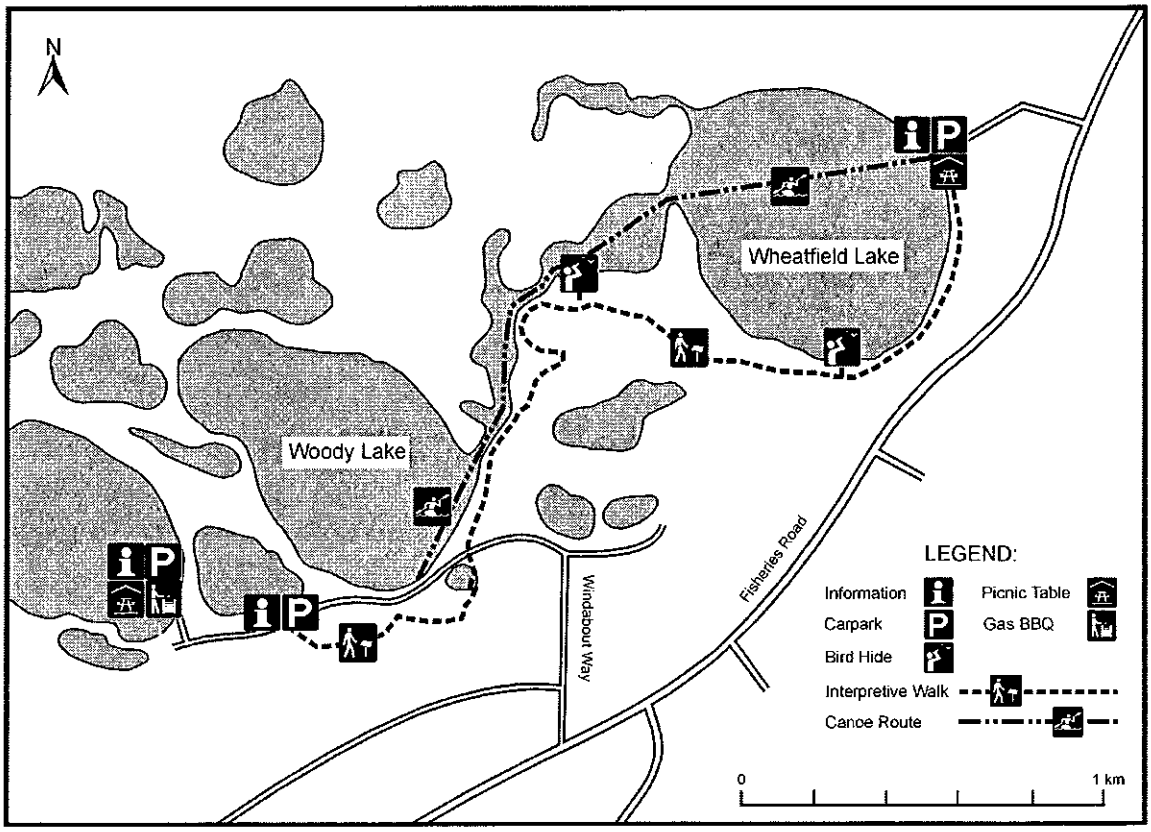


Table 1

LAKE WARDEN WETLANDS CURRICULUM PACKAGE

CURRICULUM LINKS

ACTIVITIES	CURRICULUM FRAMEWORK OVERARCHING LEARNING OUTCOMES							
	1 Students use language to understand, develop and communicate ideas and information and interact with others.	2 Students select, integrate and apply numerical and spacial concepts and techniques.	3 Students recognise when and what information is needed, locate and obtain it from a range of sources and evaluate, use and share it with others.	4 Students select use and adapt technologies.	6 Students visualise consequences, think laterally, recognise opportunity and potential and are prepared to test options.	7 Students understand and appreciate the physical, biological and technological world and have the knowledge and skills to make decisions in relation to it.	10 Students participate in creative activity of their own and understand and engage with the artistic, cultural and intellectual work of others.	12 Students are self-motivated and confident in their approach to learning and are able to work individually and collaboratively.
1. Local water cycle					X	X		
2. Story of a water droplet	X		X			X	X	
3. Global warming research	X		X	X		X		X
4. How much water per tonne of grain?		X						
5. Photograph identification						X		
6. Wetlands mind map	X							X
7. Identifying wetlands						X		X
8. Categorizing wetlands						X		X
9. Wetlands sketch & brainstorm						X	X	
10. Wetlands activity mime					X		X	X
11. Wetlands conflict role-play					X		X	X
12. Ramsar Convention research	X		X	X		X		
13. Ramsar Convention talk	X							
14. Esperance wetlands mapping		X						
15. Names of lakes story	X		X				X	
16. Esperance flooded	X		X		X	X		X
17. Macroinvertebrate letters							X	
18. Match the macro	X					X		
19. Macroinvertebrate data sheet	X	X			X	X		X

Table 1 continued

CURRICULUM FRAMEWORK - OVERARCHING LEARNING OUTCOMES								
ACTIVITIES	**1**	**2**	**3**	**4**	**6**	**7**	**10**	**12**
20. Kepwari Walk Trail – activity sheet	X		X		X	X	X	X
21. Bird life observation chart						X		
22. Bird call recognition	X					X		
23. Migratory bird story	X		X			X	X	
24. Bird habitats hypothesis testing	X		X		X	X		
25. Waterbird protection leaflet	X		X			X		X
26. Identifying dieback effects sketch						X	X	
27. Dieback brainstorm	X							X
28. Dieback threat cartoon	X					X	X	
29. Salinity observation	X		X		X	X		X
30. Salinity testing					X	X		X
31. Dissolved salt experiment					X	X		X
32. Travelling with salt experiment					X	X		X
33. Salinity research news report	X		X			X		X
34. Plantscape picture & analysis						X	X	
35. Weeds wanted poster	X		X			X	X	X
36. Flooded wetlands power point presentation	X		X	X		X	X	X
37. Pollutants and wetlands mind map	X					X		
38. Evaluating catchment activity	X					X		
39. Wetlands activity PMI chart	X					X		
40. Wetlands conflict resolution	X		X		X	X		X
41. Introduced animal hunt						X		
42. Introduced animals model	X		X		X	X	X	X
43. Your task as a news reporter	X		X		X	X	X	X

Table 1 continued

CURRICULUM FRAMEWORK - OVERARCHING LEARNING OUTCOMES								
ACTIVITIES	**1**	**2**	**3**	**4**	**6**	**7**	**10**	**12**
44. Phosphate & nitrate testing		X	X	X		X		X
45. Water quality experiment					X	X		
46. School grounds problem solving	X		X		X	X		X
47. Biologist for a day						X		
48. Looking at a lake						X		
49. Wetlands health check	X	X	X			X		X
50. How healthy are our wetlands?	X	X				X		X
51. Alien botanists	X					X		
52. Namus botanicus	X					X		
53. Discovering a plant	X					X		X
54. Evidence of animals chart						X		
55. Lake Warden wetlands web page	X		X	X	X	X	X	X
56. Kepwari Wetland Trail promotional leaflet	X		X			X	X	X
57. Designing student learning material	X		X		X	X	X	X
58. Wetlands display	X		X		X	X	X	X
59. Formation of 'Friends of the Lakes' group	X			X	X	X		X
60. Ongoing wetlands monitoring	X	X		X		X		X
61. Storm Boy comparison	X						X	
62. Conserving the wetlands – Lifestyle audit	X		X		X	X		X
63. Creative thinking/writing...	X		X		X	X	X	X
64. Aquifer model	X	X		X	X	X		X
65. The past	X		X		X	X	X	
66. Moving water experiment		X	X	X	X	X		
67. Moving water calculations								
68. Making a pump		X	X	X	X	X		
69. Home chemicals	X		X		X	X		X

Table 2

LAKE WARDEN WETLANDS CURRICULUM PACKAGE
CURRICULUM LINKS

ACTIVITIES	LEARNING AREAS					
	THE ARTS	ENGLISH	MATHEMATICS	SCIENCE	SOCIETY & ENVIRONMENT	TECHNOLOGY & ENTERPRISE
1. Local water cycle				X	X	
2. Story of a water droplet		X				
3. Global warming research		X		X	X	
4. How much water per tonne of grain?			X			
5. Photograph identification				X		
6. Wetlands mind map		X				
7. Identifying wetlands				X		
8. Categorizing wetlands		X				
9. Wetlands sketch & brainstorm		X				
10. Wetlands activity mime	X	X				
11. Wetlands conflict role-play	X	X			X	
12. Ramsar Convention research		X			X	
13. Ramsar Convention talk		X				
14. Esperance wetlands mapping					X	
15. Names of lakes story		X			X	
16. Esperance flooded		X			X	X
17. Macroinvertebrate letters	X	X				
18. Match the macro		X				
19. Macroinvertebrate data sheet		X	X	X	X	
20. Kepwari Walk Trail – activity sheet		X		X	X	
21. Bird life observation chart		X		X	X	
22. Bird call recognition		X				
23. Migratory bird story		X				
24. Bird habitats hypothesis testing		X		X	X	
25. Waterbird protection leaflet		X		X		
26. Identifying dieback effects sketch	X			X	X	

Table 2 continued

ACTIVITIES	LEARNING AREAS					
	THE ARTS	ENGLISH	MATHEMATICS	SCIENCE	S&E	T&E
27. Dieback brainstorm		X			X	
28. Dieback threat cartoon	X	X			X	
29. Salinity observation		X		X	X	
30. Salinity testing		X	X	X	X	
31. Dissolved salt experiment		X		X	X	
32. Travelling with salt experiment		X		X	X	
33. Salinity research news report		X		X	X	
34. Plantscape picture & analysis	X					
35. Weeds wanted poster	X	X				
36. Flooded wetlands power point presentation		X			X	X
37. Pollutants and wetlands mind map		X				
38. Evaluating catchment activity				X	X	
39. Wetlands activity PMI chart		X		X	X	
40. Wetlands conflict resolution		X		X	X	
41. Introduced animal hunt					X	
42. Introduced animals model	X	X			X	X
43. Your task as a news reporter	X	X		X	X	
44. Phosphate & nitrate testing		X	X	X	X	
45. Water quality experiment		X		X	X	
46. School grounds problem solving		X			X	X
47. Biologist for a day				X	X	
48. Looking at a lake				X	X	
49. Wetlands health check		X	X	X	X	
50. How healthy are our wetlands?		X	X	X		
51. Alien botanists		X		X		
52. Namus botanicus		X		X		
53. Discovering a plant		X		X	X	
54. Evidence of animals chart		X		X	X	
55. Lake Warden wetlands web page		X			X	X

Table 2 continued

ACTIVITIES	LEARNING AREAS					
	THE ARTS	ENGLISH	MATHEMATICS	SCIENCE	S&E	T&E
56. Kepwari Wetland Trail promotional leaflet		X			X	
57. Designing student learning material		X			X	
58. Wetlands display	X	X			X	X
59. Formation of 'Friends of the Lakes' group		X			X	
60. Ongoing wetlands monitoring		X	X	X	X	
61. Storm Boy comparison		X				
62. Conserving the wetlands – Lifestyle audit					X	
63. Creative thinking/writing...		X			X	
64. Aquifer model			X	X	X	X
65. The past		X			X	
66. Moving water experiment			X	X	X	X
67. Moving water calculations			X			
68. Making a pump				X	X	X
69. Home chemicals		X			X	

Table 3

LAKE WARDEN WETLANDS CURRICULUM PACKAGE
CURRICULUM LINKS

ENGLISH – LEARNING AREA

ACTIVITIES	RELEVANT STRANDS			
	Speaking & Listening	Viewing	Reading	Writing
2. Story of a water droplet	X		X	X
3. Global Warming' research	X	X	X	X
6. Wetland mind map	X			
8. Categorizing wetlands	X			
9. Wetlands sketch & brainstorm	X			
10. Wetlands activity mime	X			
11. Wetlands conflict role-play	X			
12. Ramsar Convention research	X	X	X	X
13. Ramsar Convention talk	X			
15. Names of lakes story			X	X
16. Esperance flooded problem solving	X			
17. Macroinvertebrate letter design	X			
18. Match the macro			X	
19. Macroinvertebrate data sheet	X			
20. Kepwari Walk Trail – activity sheet	X			
21. Bird life observation chart	X			
22. Bird call recognition	X			
23. Migratory bird story			X	X
24. Bird habitats hypothesis testing	X			
25. Waterbird protection leaflet	X			X
27. Dieback brainstorm	X			
28. Dieback threat cartoon or roleplay	X			X
30. Salinity testing	X			
31. Dissolved salt experiment	X			
32. Travelling with salt experiment	X			
33. Salinity research news report	X		X	X
35. Weeds wanted poster	X			X
36. Flooded wetlands power point presentation	X			X
37. Pollutants and wetlands mind mapping	X			
39. Wetland activity PMI chart	X			
40. Wetland activity conflict resolution	X			
42. Introduced animal model	X		X	
44. Phosphate & nitrate testing	X			
45. Water quality experiment	X			
46. School grounds problem solving	X			X
49. Wetlands health check				
50. How healthy are our wetlands?				
51. Alien botanists				
52. Namus botanicus				
53. Discovering a plant				
54. Evidence or animals chart				
55. Lake Warden wetlands web page	X		X	X
56. Kepwari Wetland Trail promotional material	X		X	X
57. Designing student learning material	X		X	X
58. Wetlands display	X		X	X
59. Formation of 'Friends of the Lakes' group	X			
60. Ongoing wetlands monitoring	X			
61. 'Storm Boy' wetland comparison	X	X	X	X

LAKE WARDEN WETLANDS CURRICULUM PACKAGE
CURRICULUM LINKS

MATHEMATICS – LEARNING AREA

ACTIVITIES	RELEVANT STRANDS			
	Working Mathematically	Measurement	Number	Algebra
4. How much water per tonne of grain?	X		X	
19. Macroinvertebrate data sheet	X		X	
30. Salinity testing	X	X	X	X
44. Phosphate & nitrate testing	X	X	X	X
49. Wetlands health check	X		X	
50. How healthy are our wetlands?	X		X	
60. Ongoing wetlands monitoring	X	X	X	X

TECHNOLOGY & ENTERPRISE – LEARNING AREA

ACTIVITIES	RELEVANT STRANDS		
	Technology Process	Information	Systems
16. Esperance flooded problem solving	X		X
36. Flooded wetlands power point presentation		X	
42. Introduced animal model		X	X
46. School grounds problem solving		X	X
55. Lake Warden wetlands web page	X	X	
58. Wetlands display		X	

THE ARTS – LEARNING AREA

ACTIVITIES	RELEVANT STRANDS	
	Arts ideas	Arts skills and processes
10. Wetlands activity mime	X	
11. Wetlands conflict role-play	X	
26. Identifying dieback affects sketch	X	
28. Dieback threat cartoon or roleplay	X	X
34. Plantscape picture & analysis	X	
35. Weeds wanted poster	X	
42. Introduced animal model	X	X
55. Lake Warden wetlands web page	X	X
58. Wetlands display	X	

LAKE WARDEN WETLANDS CURRICULUM PACKAGE
CURRICULUM LINKS

SCIENCE – LEARNING AREA

ACTIVITIES	RELEVANT STRANDS		
	Investigating scientifically	Life and living	Earth and beyond
1. Local water cycle		X	X
3. Global warming research	X		X
5. Photo identification	X	X	
7. Identifying wetlands	X		
8. Categorizing wetlands	X		X
19. Macroinvertebrate data sheet	X		X
20. Kepwari Walk Trail – activity sheet	X		
21. Bird life observation chart	X		
24. Bird habitats hypothesis testing	X	X	
25. Waterbird protection leaflet	X		X
26. Identifying dieback affects sketch	X	X	
30.Salinity testing	X		
31. Dissolved salt experiment	X		
32. Travelling with salt experiment	X		
33. Salinity research news report			X
38. Evaluating catchment activity	X		X
39. Wetland activity PMI chart	X		X
40. Wetland conflict resolution	X		X
44. Phosphate & nitrate testing	X		
45. Water quality experiment	X		
47. Biologist for a day	X		X
48. Looking at a lake	X		X
49. Wetlands health check	X	X	
50. How healthy are our wetlands?	X	X	
51. Alien botanists	X		
52. Namus botanicus	X		
53. Discovering a plant	X		
54. Evidence of animals chart	X	X	
60. Ongoing wetlands monitoring	X		

Table 3 continued

LAKE WARDEN WETLANDS CURRICULUM PACKAGE
CURRICULUM LINKS

SOCIETY & ENVIRONMENT – LEARNING AREA

ACTIVITIES	RELEVANT STRANDS			
	Investigation, Communication, Participation	Place & Space	Resources	Natural & Social Systems
1. Local water cycle				X
3. Global warming research	X	X		
11. Wetlands conflict role-play			X	
12. Ramsar Convention research	X		X	
14. Esperance wetlands mapping		X		
15. Names of lakes story	X			
16. Esperance flooded problem solving				X
19. Macroinvertebrate data sheet	X			
20. "Kepwari Walk Trail' – activity sheet	X	X	X	X
21. Bird life observation chart	X			
24. Bird habitats hypothesis testing	X			
26. Identifying dieback affects sketch		X		
27. Dieback brainstorm		X		
28. Dieback threat cartoon or roleplay		X		
30. Salinity testing	X	X	X	
31. Dissolved salt experiment	X			
32. Travelling with salt experiment	X			
33. Salinity research news report	X			
36. Flooded wetlands power point presentation	X			
38. Evaluating catchment activity	X		X	X
39. Wetland activity PMI chart	X		X	X
40. Wetland conflict resolution	X		X	X
42. Introduced animal model	X			X
44. Phosphate & nitrate testing	X			
45. Water quality experiment	X			
46. School grounds problem solving	X			
47. Biologist for a day	X	X		
48. Looking at a lake	X	X		
49. Wetlands health check	X	X	X	
53. Discovering a plant	X			
54. Evidence of animals chart	X			
55. Lake Warden wetlands web page	X			
56. 'Kepwari Wetland Trail' promotional leaflet	X		X	
57. Designing student learning material	X			
58. Wetlands display	X	X	X	X
59. Formation of 'Friends of the Lakes' group		X		
60. Ongoing wetlands monitoring	X			
62. Conserving the wetland – Lifestyle audit		X		

LAKE WARDEN WETLANDS CURRICULUM PACKAGE
CURRICULUM LINKS

Table 4

VALUES

ACTIVITIES	A pursuit of knowledge and a commitment to achievement of potential		Self acceptance and respect of self		Social & civic responsibility				Environmental responsibility		
	Empowerment	Values systems	Personal Meaning	Initiative & Enterprise	Participation & Citizenship	Contribution	Authority	Responsibility & Freedom	Conservation Of the Environment	Sustainable development	Diversity of species
2. Story of water droplet	X									X	
3. Global warming research									X	X	X
10. Wetlands activity mime	X		X								
11. Wetlands conflict role-play	X	X							X		X
12. Ramsar Convention research							X		X		X
49. Wetlands health check											X
50. How healthy are our wetlands?											X
25. Waterbird protection leaflet									X		X
33. Salinity research news report									X		X
40. Wetland conflict resolution	X	X					X	X	X	X	X
46. School grounds problem solving									X		
59. Formation of 'Friends of the Lakes' group		X		X	X	X			X	X	X
62. Conserving the wetlands lifestyle audit								X	X		X

Welcome to Kepwari

- Place of moving water -

BEFORE YOUR VISIT

Pre-excursion information and activities

BEFORE YOUR VISIT

TEACHER'S NOTES

Introductory section:

Information and activities before an excursion to the wetlands

The activities in this section have a 'wetlands' theme and are designed to provide a focus for the Kepwari Wetland Trail excursion. This section provides an overview of what wetlands are and why they are important.

Where does water come from? **Page 28**

Before commencing a study of the Lake Warden Wetlands and catchment area, a basic introduction (revision) of the 'water cycle' (hydrological cycle) may prove useful.

The diagram demonstrates the cycle of water through the catchment to the wetlands. For a droplet of water falling as rain to eventually form part of the wetlands can take decades. It is this process that explains why some of the major problems the wetlands are experiencing now have their origins in land practices 30 years ago. It also helps explain why effective environmental solutions to these problems have to be viewed in the long term.

Students should be able to understand that actions in the catchments will eventually manifest themselves in the wetlands. They should also comprehend that many of the problems in the wetlands have their origins in the catchment. (See Water Facts 7 in the additional resources section)

What is a wetland? **Page 32**

"Wetlands can be broadly defined as areas featuring permanent or temporary shallow open water. This includes billabongs, marshes, swamps, lakes, mud flats and mangrove forests, virtually any land which is regularly or intermittently inundated with water that is static, including areas of marine water which does not exceed a depth of six metres at low tide."

(Wetlands Unit, Australian Nature Conservation Agency)

Photograph identification **Page 33**

Activity 5 answers:

Photo 1 – Pink Lake

Photo 2 – Bandy Creek (above the weir at the boat harbour)

Photo 3 – Coppin Street

Photo 4 – Woody Lake

Identifying wetlands **Page 34**

The following would be considered wetlands:

- Dalyup River
- Stokes Inlet
- Pink Lake
- A dam on the farm
- Paperbark swamp in a farmer's paddock
- A salt lake
- Lake Warden

The other features are marine environments, not 'land that is wet'.

What is a wetland of international importance? **Page 38**

The Lake Warden Wetland System is internationally recognized under the Ramsar Convention. The research into the Convention is designed to highlight the importance of wetlands and the fact the Lake Warden system is internationally significant.

For information contact:

International: Ramsar Convention Bureau Slimbridge Gloucester GL2 7BX UK	The Ramsar Convention Bureau Rue Mauverney 28 CH-1196 Gland Switzerland

National: Wetlands Unit Environment Australia GPO Box 787 CANBERRA ACT 2601 Email: wetlandsmail@ea.gov.au	**State:** Local Department of Conservation and Land Management office Dempster St, Esperance 9071 3733

Some starting addresses for research are:

http://www.ramsar.org/

http://www.nht.gov.au/programs/ntlwetlands.html

http://www.biodiversity.environment.gov.au/environm/wetlands/ramsar/ramindex.htm

http://www.ea.gov.au/water/wetlands

http://www.anca.gov.au/environm/wetlands/policy.htm

A useful Australian search engine on environmental matters is:

http://www.earthlink.com.au/

Earthlink also has a calendar of environmental events so specific dates can be entered on the 'Environmental Days' list.

http://www.earthlink.com.au/cgi-bin.earthlink/cgis/webcal/webcal.pl

What are some other things we need to know before our visit? Page 45

The information and activities in this section are designed to familiarise students with an activity that is suggested on the excursion. When at the wetlands students can find and identify macroinvertebrates. This introductory information and activities will assist in acquainting students with the process.

ADDITIONAL RESOURCES

The following additional material is available at the end of this package:

- WATER FACTS 1 – **Water Words** – Coverage of commonly used geographic and water resources terms. (Waters and Rivers Commission)
- WATER FACTS 4 – **Living Streams** – Useful coverage of a streams ecosystem. (Waters and Rivers Commission)
- WATER FACTS 7 – **The Water Cycle** – Description of the water cycle and human impact on it. (Waters and Rivers Commission)
- **LANDCARE FOR WETLANDS** – Range of activities aimed at increasing awareness of wetlands. (Waters and Rivers Commission).

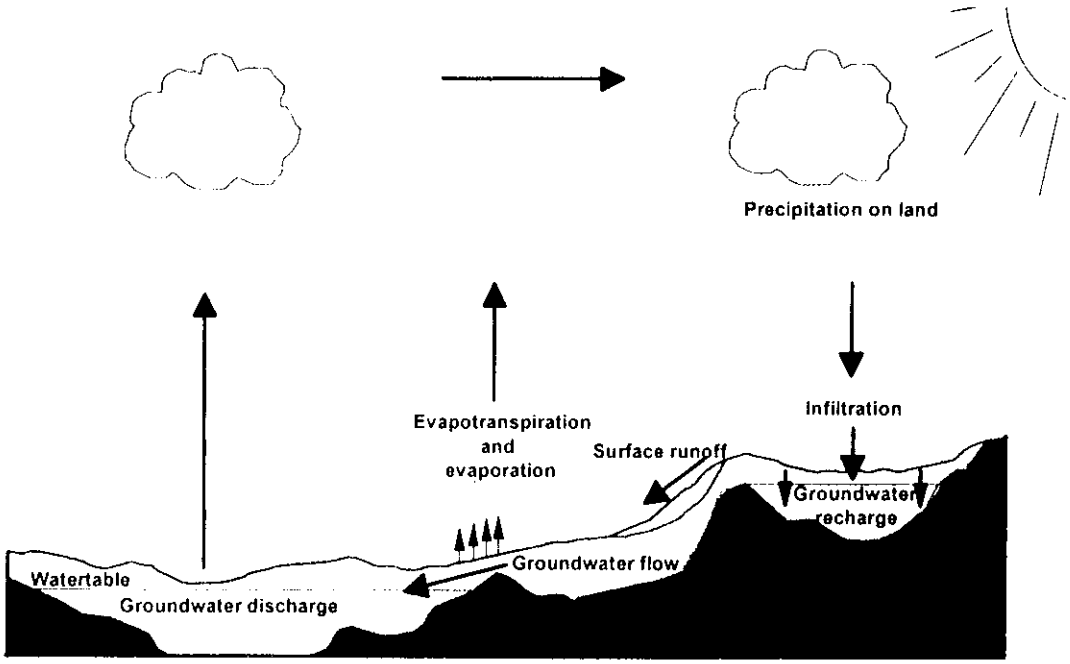
Welcome to Kepwari

- Place of moving water -

BEFORE YOUR VISIT

Student activities

WHERE DOES WATER COME FROM?



HYDROLOGIC CYCLE

(Source: T. Massenbauer, ed., "Lake Warden recovery farm kit", Department of Conservation and Land Management, 2000.)

The water cycle is a continuous movement of water between the land, water bodies (lakes, rivers, oceans) and the atmosphere (sky). The 'water cycle' - like a circle - has no beginning or end.

The diagram above shows . . .

Water evaporates (sucked up in to the sky) ☞

It is carried and temporarily stored in the atmosphere (clouds)☞

It may eventually fall on the land as precipitation (rainfall) ☞

and evaporate from the land ☞

Alternatively, it very, very slowly finds its way to water bodies where it evaporates ☞

and the process continues ☞

WHAT HAPPENS WHEN WATER FALLS ON LAND?

When water falls on the land a number of things can happen to it:

- It may be used up by plants and eventually evaporated through the leaves.
- It may 'run-off" the land surface into storm drains, rivers, lakes, the ocean where it will eventually be evaporated again.
- It may be temporarily stored in the soil as moisture. Plants (through their roots) may use the water where it will eventually 'transpire' in to the atmosphere. If the plants do not use it, it may be evaporated from the soil.
- The water may seep (soak) deeper into the ground, eventually reaching the water table (water under the soil). Very, very slowly, this water will move as 'groundwater flow' and eventually seep into water bodies or lay on the land surface where it is evaporated into the atmosphere.

WHERE DOES WATER COME FROM?

LOCAL WATER CYCLE ✎✎ Activity 1

Draw an example of the water cycle using local features to explain the process.

Features you may wish to include:

Ocean	Water Bodies	Higher ground
Southern Ocean	Lake Warden Lake Gore Pink Lake	Cape Le Grand Frenchman's Peak

Remember to use the following words in your explanation:

Evaporation
Precipitation (Rainfall)
Transpiration
Water Table
Ground Water

STORY OF A WATER DROPLET ✎✎ Activity 2

Write a story imagining you are a water droplet.
You could start in the ocean, be evaporated to form a cloud, fall to the ground, seep into the ground.
Then what happens to you?

GLOBAL WARMING RESEARCH ✎✎ Activity 3

'Global Warming' is an increasing problem facing our planet.

- If the average temperature is warmer - what happens to the evaporation rate?
- How will this affect the water cycle?
- What long-term effect will this have on your local area?
- Research what scientists predict will happen to the South Coast of Western Australia due to global warming.

HOW MUCH WATER PER TONNE OF GRAIN? ✎✎ Activity 4

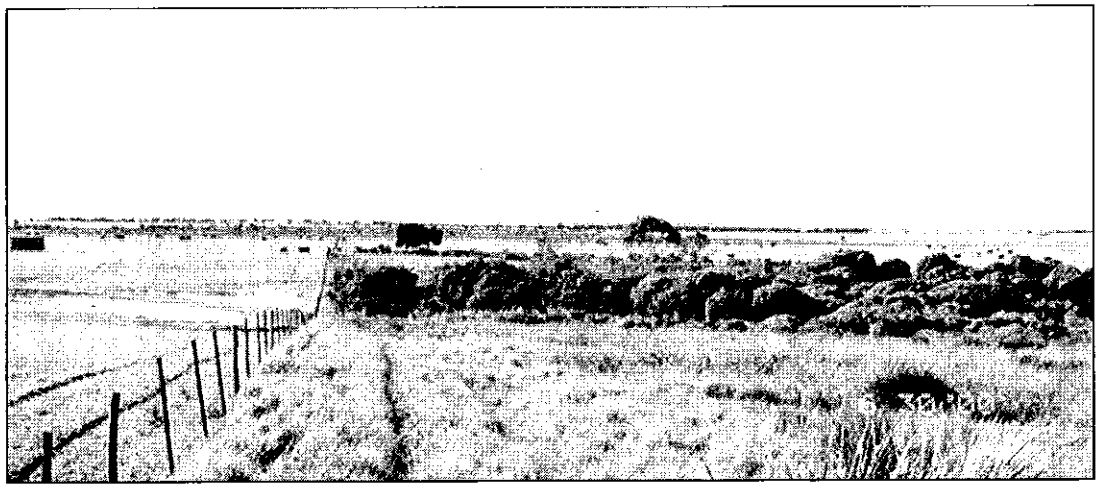
The quantities of water that fall in a small area are very large. A millimetre of rain falling over a hectare of land equals 10,000 litres and weighs 10 tonnes.

Find out how much rain falls in your area. (Try an atlas or the Bureau of Meteorology).

How many tonnes of water per hectare fall in one year?

Measure your school 'oval' - Work out how many tonnes of water fall on your oval in an average year.

A good wheat yield in the Esperance region is about 4 tonnes per hectare (Is this the same in your area? You may need to ask a local farmer or Agriculture WA).
Based on your previous calculations and assuming 4 tonnes per hectare . . .
How many tonnes of water are required in the production of each tonne of grain?



WHAT IS A WETLAND?

Photo 1

Photo 2

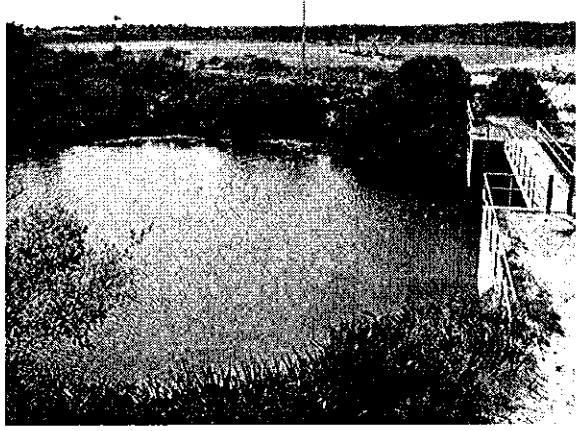
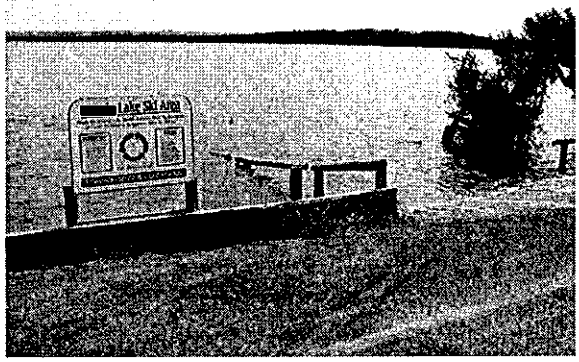


Photo 3

Photo 4



WETLANDS are 'wet' lands - Land that is covered by water.

Some wetlands are wet all the time; others are only wet part of the time, and some 'wetlands' never look wet at all.

Water in a wetland can be:

- flowing or still
- fresh, brackish or salty (saline)
- permanent or temporary

WHAT IS A WETLAND?

PHOTOGRAPH IDENTIFICATION ✎✎ Activity 5

Do you recognize any of the places in the photos?

Photo 1 _____

Photo 2 _____

Photo 3 _____

Photo 4 _____

WETLANDS MIND MAP ✎✎ Activity 6

In groups, or as a class, construct a 'mind map' of wetlands.
Use the photos and areas that you know for detail.
Here is the start of an example.

Activities

Insects

WETLANDS

Birds

Mammals

Vegetation

IDENTIFYING WETLANDS ✎✎ Activity 7

Below are ten places - tick the ones you think are wetlands.
Be prepared to explain your choices.

Bandy Creek Boat Harbour	
A dam on a farm	
Dalyup River	
The Southern Ocean	
Stokes Inlet	
Pink Lake	
Paperbark swamp in a farmer's paddock	
A salt lake	
Esperance Bay	
Lake Warden	

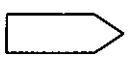
Explain to a partner why each place is or is not a wetland.
See if you can both agree on each place.
Does the whole class agree on each place?

CATEGORIZING WETLANDS ✎✎ Activity 8

In groups list as many 'Wetlands' in your local area as you can.
(A map of the local area may help).

- Compare your list with others.
- Compile a class list.
- Compile a key for each wetland.
- Mark whether the water is:

 Flowing or  Still

 Fresh or  Brackish or  Salty (Saline)

 Permanent or  Temporary

Wetlands are extremely important places -
Why do you think this is so?

WHY ARE WETLANDS IMPORTANT?

- Wetlands are home to many tiny invertebrates (an animal that doesn't have a back bone) insects, frogs, fish, reptiles, birds and small mammals. Some of our precious animals and wildflowers are only found in wetland environments. In fact, many species depend totally on wetlands for their survival.
- Wetlands are breeding grounds for many animals especially fish and waterbirds.
- Wetlands help to purify water by acting like 'kidneys' along waterways. Vegetation on the fringes of wetlands trap sediment and nutrients.
- Wetlands also slow destructive floodwaters and act as natural firebreaks.
- Wetlands are important drought refuges for wildlife.
- Wetlands support wildlife that control insect pests.
- Wetlands are popular recreational sites.

The following activities are popular in and around wetlands

CANOEING

FISHING

SWIMMING

BIRD-WATCHING

PICNICKING

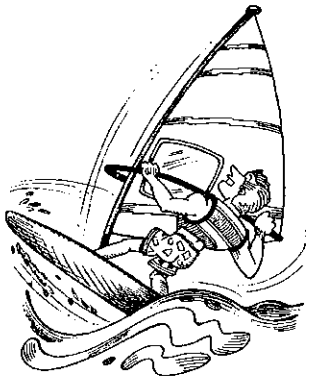
WIND-SURFING

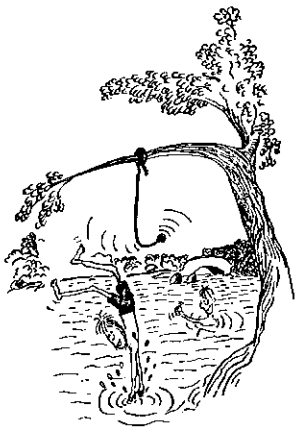
SAILING

CAMPING

PHOTOGRAPHY

SIMPLY ENJOYING THE SCENIC BEAUTY



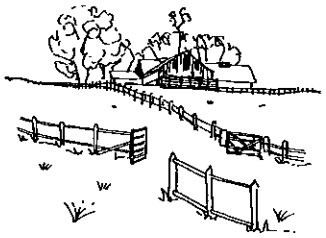


WHY ARE WETLANDS IMPORTANT?

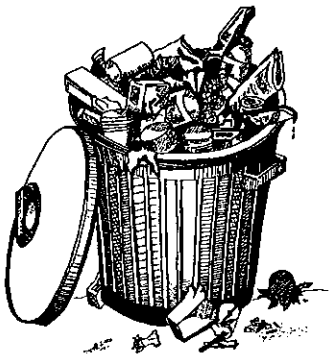
(Continued)

Unfortunately, many human activities can cause problems in a wetland area.
Degradation (ruin) and loss of wetlands is caused by . . .

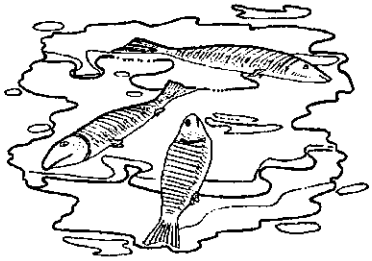
Clearing land of native vegetation



Dumping rubbish



Polluting the water



Filling in wetlands to create areas to build on

In fact since the 1780s more than half of Australia's wetlands have been lost due to building cities and towns and agriculture.

WHY ARE WETLANDS IMPORTANT?

WETLANDS SKETCH & BRAINSTORM ✎✎ Activity 9

On a sheet of A4 paper draw a square 10cm x 10cm approximately in the middle of the paper. In the square draw a sketch of a wetland. It could be based on one in your local area, on a photo you have seen or an imaginary wetland.

In the space around round your picture write down as many animals as possible that you think might live in or visit the wetland. Remember animals live in the water, some birds may fly in from all over the world to visit your area.

TIP: Think about food webs

Compare your picture and list with others.

WETLANDS ACTIVITY MIME ✎✎ Activity 10

In small groups discuss your favourite wetland area and the types of activities that you do there.
Make up a mime of a visit to the wetland.

Other members of the class have to guess where you are and what you are doing.

WETLANDS CONFLICT ROLE-PLAY ✎✎ Activity 11

In your group develop a short play to highlight the group's reaction when one of the following situations happens to your favourite wetland:

(i) The wetland is to be 'filled-in' to allow houses to be built in the area.

(ii) Rubbish has been dumped in your favourite spot and the area looks a complete mess.

(iii) The water has 'algal bloom' (like a green slime) and you can no longer swim or go into the water.

WHAT IS A WETLAND OF INTERNATIONAL IMPORTANCE?

Wetlands are recognized as being so important that an 'International Agreement' has been established to:

". . . halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain."

More than 80 countries, including Australia, have signed this agreement or 'convention'.
As part of the agreement countries list wetland areas that are very special (that is they may be unique, have value for biodiversity and value as waterbird habitat).
The countries agree to manage the listed sites to ensure they remain 'special' places (i.e. they maintain the ecological characteristics for which they were nominated).
So far, several hundred sites have been listed covering more than 30 million hectares.

This 'Convention on Wetlands of International Importance' is usually known as

THE RAMSAR CONVENTION

The Ramsar Convention was agreed to in 1971 in the small Iranian town of Ramsar.

WHAT IS A WETLAND OF INTERNATIONAL IMPORTANCE?

RAMSAR CONVENTION RESEARCH ✎✎ Activity 12

As a class, prepare a large poster on the Ramsar Convention. This can be used for display or to illustrate a talk on important environment days (see list on page 40).

Your poster could contain information that would answer the following questions:

1. What is the Ramsar Convention?
2. What areas are covered by the convention?
3. Why conserve wetlands?
4. How does the Ramsar Convention operate?
5. What obligations do countries have when they become a partner in the convention?
6. How can countries join the convention?
7. How are Ramsar sites chosen?
8. How effective do you think the Ramsar Convention is?
9. Why is the convention so important?
10. What is the future of the convention?
11. Where are Ramsar sites in your local area? In WA? In Australia? In the rest of the world?

RAMSAR CONVENTION TALK ✎✎ Activity 13

Once you have undertaken your research and answered the above questions you could prepare a talk (individually, as a group, as a class) to be presented to another class or school assembly. Your P & C may be interested in hearing about the Ramsar Convention, as might the local council.

Page 40 lists some important dates on which you could present your talk and display your poster.

ENVIRONMENTAL DAYS
TO FOCUS ON WETLANDS

FEBRUARY:
- "World Wetlands Week"

MARCH:
- "World Day for Water"
- "Clean Up Australia Day"
- "Action for Rivers Day"

APRIL:
- "Earth Day"

MAY:
- "World Environment Month"
- "Geography Action Week"

JUNE:
- "Arbor Day"
- "World Environment Day"
- "World Day to combat desertification and drought"

JULY:
- "National Tree Day"

AUGUST:
- "Landcare Week"
- "National Science Week"

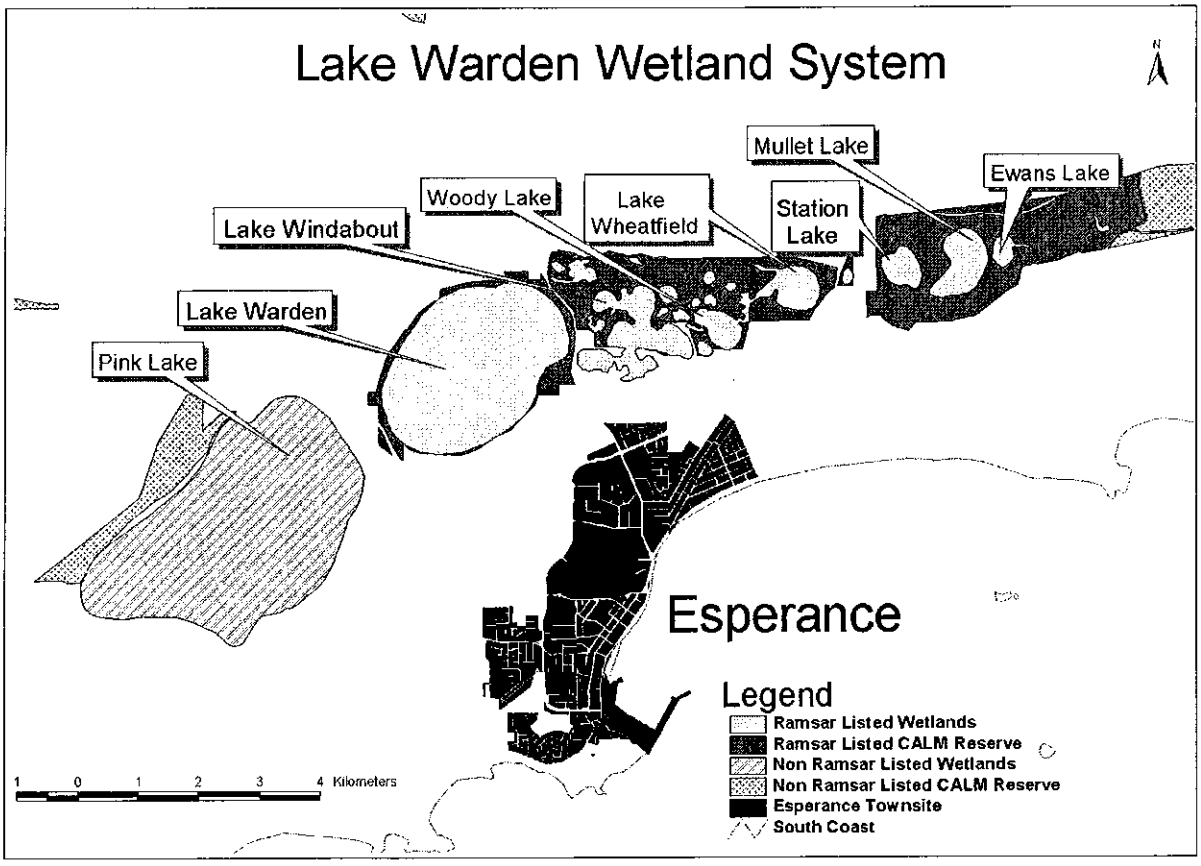
SEPTEMBER:
- "Biodiversity Month"
- "Threatened Species Day"
- "National Keep Australia Beautiful Week"
- "National Parks Week"

OCTOBER:
- "World Habitat Day"
- "World Animal Day"
- "Weedbuster Week"
- "National Water Week"
- "World Bird Week"

NOVEMBER:
- "Frog Week"
- "Festival of the Wind" (Biennial)

DECEMBER:
- "International Biological Day"
- "Coastcare Week"

WHERE ARE SOME IMPORTANT WETLANDS IN THE ESPERANCE AREA?



WHERE ARE SOME IMPORTANT WETLANDS IN THE ESPERANCE AREA?

The picture below shows a chain of wetlands that circle Esperance. Lake Warden, Woody Lake, Mullet Lake and Pink Lake make up what is called

"The Esperance Lakes Nature Reserve"

These reserves are an extremely important habitat (home) for a wide variety of waterbirds and other animals.

This area is so important that Lake Warden, most of Lake Windabout, Woody Lake, Lake Wheatfield, Station Lake, Mullet Lake and Ewans Lake are recognized as "*Wetlands of International Importance*" under the Ramsar Convention.

ESPERANCE WETLANDS

WHERE ARE SOME IMPORTANT WETLANDS IN THE ESPERANCE AREA?

ESPERANCE WETLANDS MAPPING ✎✎ Activity 14

On your map of Esperance shade:

- The wetlands - light blue
  (You may wish to try different types of shading for the Ramsar-listed wetlands)
- The Southern Ocean - dark blue
- The major roads into Esperance – black
- The shopping centre - red

Is your home on the map? If so, mark it in.
Is your school on the map? If so, mark it in.

If they are not on the map draw arrows coming from the direction you would travel into Esperance from your home, and your school.

NAMES OF LAKES STORY ✎✎ Activity 15

Look at the names of the lakes.
In groups discuss how they came to have their names.

Draw the shape of the lake on an A3 piece of paper. Write the name of the lake at the top. Write YOUR explanation of how it got its name in the lake.

You may like to write to the Esperance Shire requesting information on how the lakes were named.

ESPERANCE FLOODED (PROBLEM SOLVING) ✎✎ Activity 16

Imagine Esperance has a year of very high rainfall. The lakes flood and join to form one 'super lake' from Pink Lake to Mullet Lake.

- How do people get in and out of Esperance? (Do you know where the airport is?)
- Has this ever happened?
- Pretend the 'super lake' remains all year. What do the people of Esperance do to overcome this access problem?
- If you were the Shire Engineer, what would you recommend as the solution to getting in and out of Esperance?
  - Why have you chosen this solution?
  - What other ideas did you have?
  - Why were those not suitable?

(You may wish to works in groups and have each group present their solution to the class.)

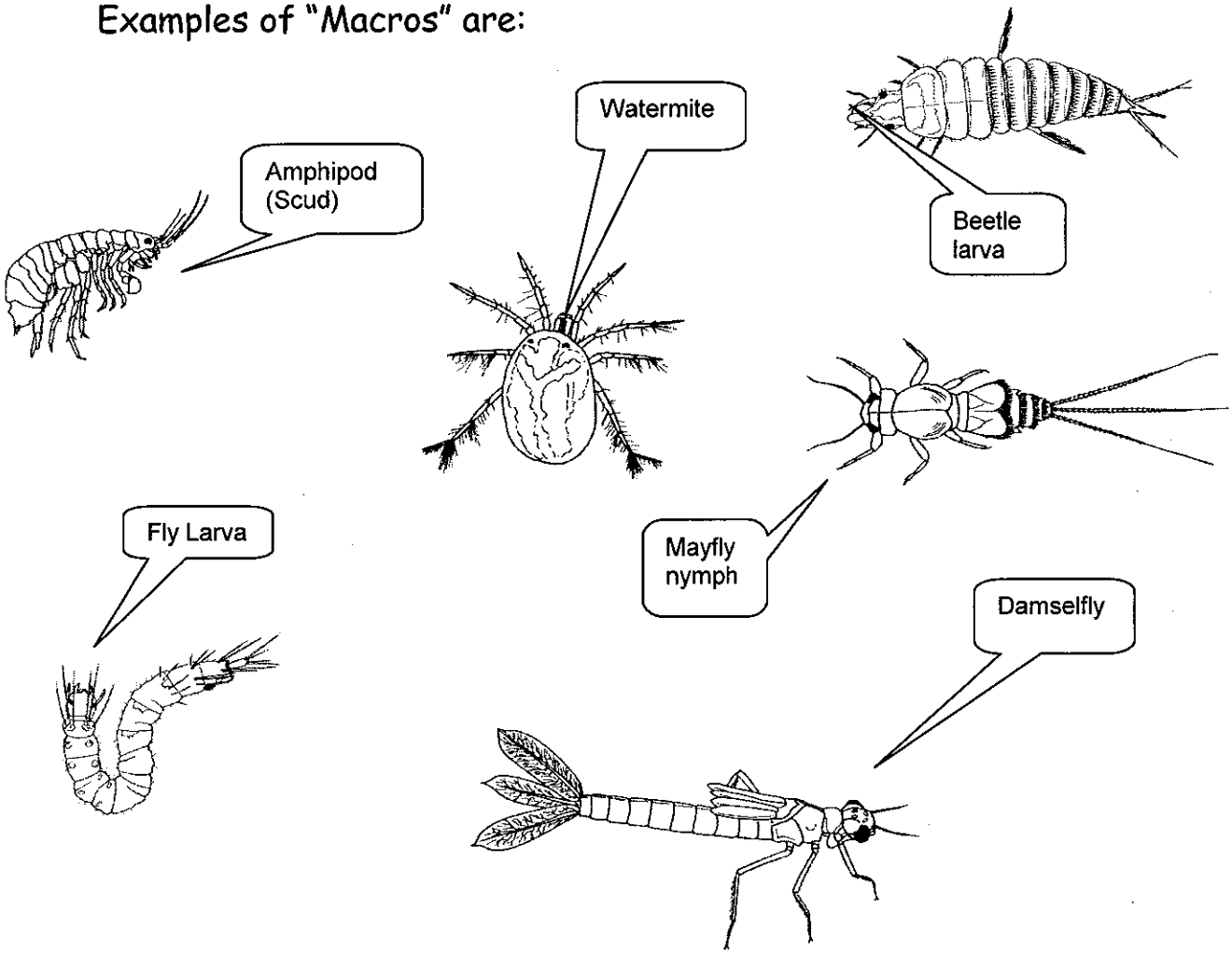
WHAT ARE SOME OTHER THINGS WE NEED TO KNOW BEFORE OUR VISIT?

If we are going to examine the 'health' of the wetlands, we need to know about:

MACROINVERTEBRATES

Big word for little creatures.

"Macroinvertebrates" or "Macros" are very small animals that do not have a backbone. They spend all or part of their life in waterways like rivers, ponds, lakes, dams.
Examples of "Macros" are:



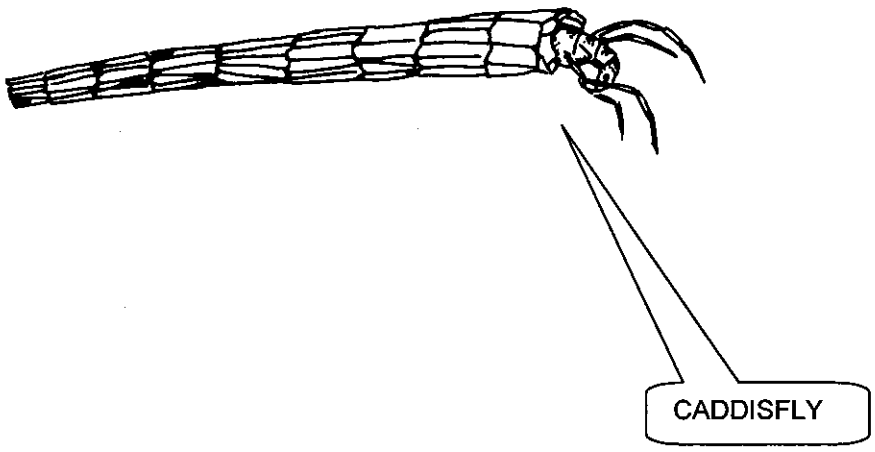
WHY ARE MACROINVERTEBRATES IMPORTANT?

Streams, rivers, wetlands and lakes are homes for many small animals called 'Macroinvertebrates', mainly insects, crustaceans and molluscs. These animals live in the water for all or most of their lives so their survival is closely linked to the water quality. In turn, the survival of larger animals, like fish, is dependent on macroinvertebrates as a source of food.

Macroinvertebrates are sensitive to different chemical conditions. If there is a change in water quality, perhaps because of a pollutant entering the water, then the macroinvertebrates community will also change.

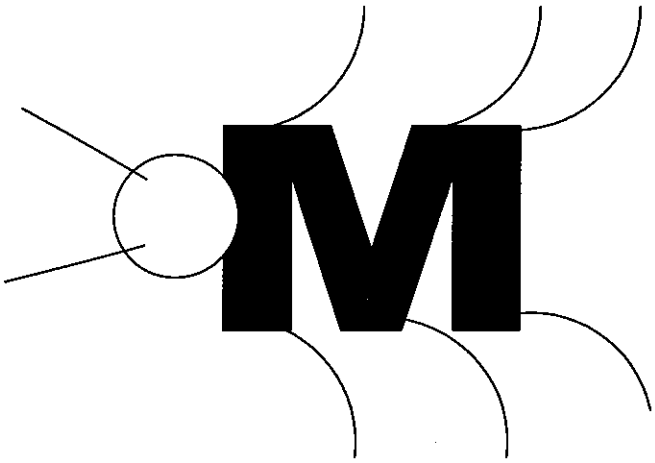
Macroinvertebrates' response to pollutants can vary enormously. Some animals may be quite tolerant of salinity (eg. scuds and the larvae of some damselfly) but other pollutants (eg. excess nutrients) may harm them.

When assessing the health of a wetland it is not the total number of macroinvertebrates in the water but the number of different animals that is important.



MACROINVERTEBRATE LETTER DESIGN ✎✎ Activity 17

Make each letter in the word MACROINVERTEBRATES into an imaginary macroinvertebrate.



If class members working in pairs complete one letter of the word you have a large interesting banner to highlight your work in this area.

Have a little practice with the letters below

A C R O I N E T B V

MATCH THE MACRO

Activity 18

Use the descriptions to name the macroinvertebrates pictured below.

STONEFLY LARVAE
Stonefly larvae have two long tails, tubes of thread-like gills on their undersides, wing pads, antennae, and two claws on each foot. They are found among stones or plants in clear, cool, well oxygenated streams.

CADDISFLY LARVAE
These are worm-like larvae with three pairs of legs on the first three body segments. They are usually found in cases made from rolled leaves or hollow twigs, with only their head and legs protruding when they move.

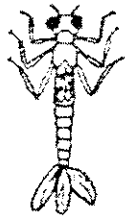
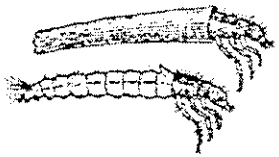
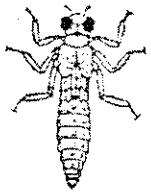
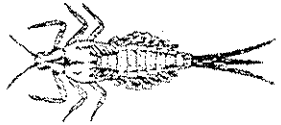
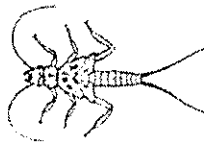
MAYFLY LARVAE
Mayfly larvae have three long filaments at the end of their abdomen.
They have short antennae, and a single claw on each foot. They are found under stones in fast flowing water or among plants in slow flowing water.

DRAGONFLY LARVAE
Dragonfly larvae are short, chunky predators with wing pads and internal gills.
They are found on plants, among stones and in leaf litter.

WATER MITE
Water mites are only just visible. They are often brightly coloured (red, orange, blue). They have a flat disc-like body, swim in open-water, among plants, or on the bottom in slowly flowing water.

DAMSELFLY LARVAE
Damselfly larvae are more slender than dragonfly larvae, have a distinct head section and three gills on the tail tip. They are also found on plants, among stones and in leaf litter.

A_____ B_____ C_____ D_____ E_____ F_____


MACROINVERTEBRATE DATA SHEET

One method of determining the water quality of a wetland is by sampling the number and variety of macroinvertebrates in the wetland. The larger the variety of macroinvertebrates the better the water conditions – especially if there are 'sensitive' invertebrates present. The table below indicates the 'sensitivity rating' of various macroinvertebrates.

INVERTEBRATE	NUMBER FOUND	SENSITIVITY RATING
Sensitive		
Stonefly larvae		8
Mayfly larvae		7
Caddisfly larvae		6
Dragonfly larvae		6
Damselfly larvae		6
Water mites		5
Tolerant		
Gilgies or marron		4
Freshwater mussels		4
Beetle larvae		4
Beetles (Coleoptera)		3
Bugs (Hemiptera)		3
Water fleas		3
Freshwater shrimp		3
Amphipods (Scuds)		3
Snails		3
Flatworms		3
Leeches		3
Very Tolerant		
Fly Larvae		2
Midge Larvae		1
Aquatice earthworms		1
MACROINVERTEBRATE WATER CONDITION INDEX:		

* Count the number of each different type of macroinvertebrate found.

* If a macroinvertebrate is present, circle its sensitivity rating.

* At the end of your collecting session, add up the circled numbers to get the macroinvertebrate water condition index.

* Use the index to work out your stream quality rating from the table below.

* To make the results comparable you must use the same collecting technique on all occasions.

Water Condition Index	Stream Quality Rating
19 or less	Poor
20-34	Fair
35-49	Good
50 or more	Excellent

MACROINVERTEBRATE DATA SHEET ✎✎ Activity 19

A class investigated 3 wetlands and researched the following data:

INVERTEBRATE	Number found at wetlands 1	Number found at wetlands 2	Number found at wetlands 3
Aquatic earthworms	10	3	6
Midge larvae	6	1	13
Leeches	0	0	1
Stonefly larvae	0	0	0
Marron	2	0	0
Flatworms	1	3	1
Fly larvae	5	7	17
Caddisfly larvae	3	0	0
Freshwater mussels	0	0	0
Bugs (Hemiptera)	7	1	0
Amphipods	4	5	3
Mayfly larvae	2	0	0
Water mites	3	1	0
Beetle larvae	2	1	0
Water fleas	1	3	0
Snails	8	2	0
Freshwater shrimp	3	6	0
Dragonfly larvae	5	1	0
Beetles (Coleoptera)	1	0	0
Damselfly larvae	3	1	0

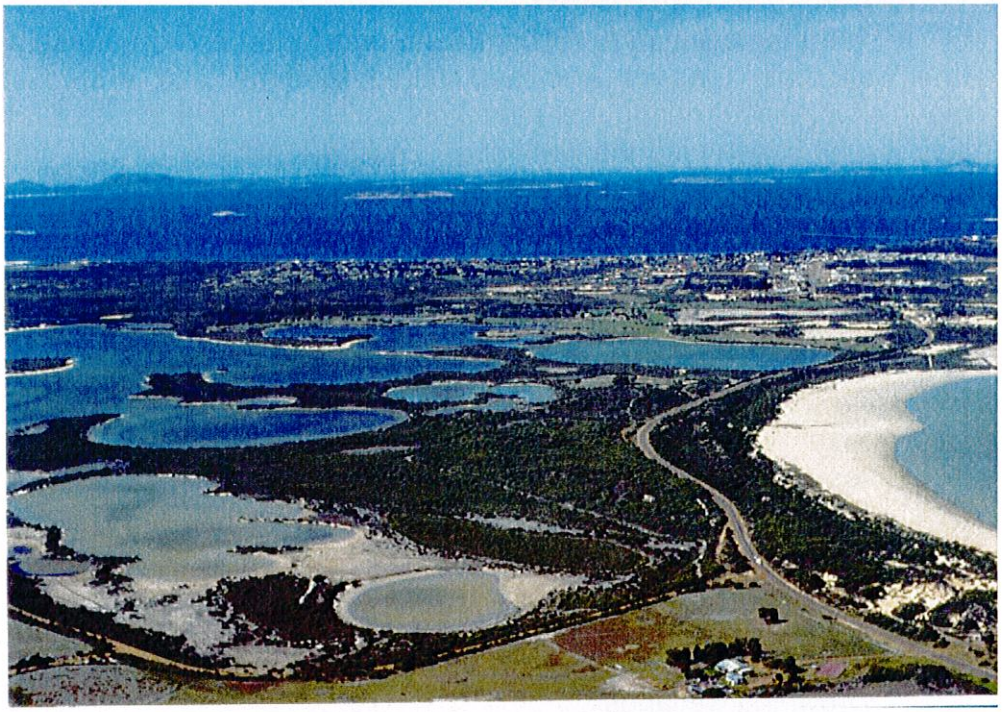
Using the "Macroinvertebrates Data Sheet" calculate the water quality (poor, fair, good, excellent) of each of the wetlands. Check your results with other groups.

WATER QUALITY RATINGS

WETLAND	1	2	3
RESULT			

Welcome to Kepwari

- Place of moving water -



YOUR VISIT TO THE WETLANDS

Excursion information and activities

This section contains:

TEACHER'S NOTES

Excursion section:
Information and activities to use while visiting the wetlands

Kepwari Wetland Trail activity sheet **Pages 60 - 64**

This activity sheet is designed to focus the students' attention on the signage along the walk trail. Classes who are limited for time may wish just to complete this worksheet during the walk. This activity will help focus on some of the key issues concerning the wetlands. Teachers will have to individually assess how long the walk will take. A copy of all walk trail signs are included at the end of this package.

Issues to explore **Pages 65 - 98**

Teachers may wish to examine wetland issues in more detail. This section offers a range of activities which focus on the following issues:

These activities are designed for smaller groups. It is suggested the class be divided into smaller groups (there are 8 issues examined) with adult supervision for each.

Each activity is focused on a particular sign along the walk trail (the relevant sign is indicated in italics at the top of the first page relating to each issue).

Each group could complete the walk but when they reach their focus (sign) they can complete the activities.

All the issues have follow-up classroom activities. Thus each group can present their findings to the whole class.

Alternatively, the whole class may focus on one issue with all students completing similar activities related to the theme.

Water testing

Testing for salinity levels and nutrient levels are suggested in these activities. However these should be undertaken under strict adult supervision.
For assistance with the methodology and equipment for scientific testing of the waters in the lakes contact the Ribbons of Blue coordinator for the region:

Mr Denis Smith
C/- Esperance Senior High School
Pink Lake Road
ESPERANCE WA 6450
Phone: (08) 9071 9555 Fax: (08) 9071 9556

General wetland activities — Pages 99 - 120

The last eight general activities in this section (activities 47 – 45) may be used as a class. Students may wish to work with partners or in small groups. These activities are not specific to the Kepwari Wetlands Trail. Any of the information sites near Woody Lake, Windabout Lake or Wheatfield Lake are suitable locations (see map page 57).

Biologist for a day & Looking at a lake — Pages 100 & 101

These activities are designed as an introduction to the surroundings. Some students may not have visited the lakes and these activities provide an opportunity to become acquainted with the environment. (10 mins approx)

Wetlands Health Check — Pages 102 - 105

This activity is a simple monitoring task to raise students' awareness that some wetlands are under threat. A small container would be useful to examine the smell and clarity of the water. Students should compare and discuss their ratings. The sheets should be kept and could be used to compare other sites or the same site over time. (30 mins approx)

How healthy are our wetlands? — Page 106

This is another monitoring activity. Each group of students (up to 8) will need a scoop net, tray, tweezers or dropper and if possible magnifying glass. Waders would also be useful but not essential.
Adult supervision is strongly recommended – an adult should do step 1.
Students need to be a little patient when searching for macroinvertebrates in the tray as they are sometimes hard to locate. Identifying the 'macros' may also be challenging so a magnifying glass would be useful. The data sheets should be kept for comparison and discussion. (45 mins approx)

Alien botanists **Page 113**

This activity can be used with the whole class or as a specific group activity based around a sign ("*Keeping our wetlands clean*") on the walk trail. It is a useful awareness exercise having students examine the variety and diversity of vegetation in and around wetlands. (30 mins approx)

Namus botanicus **Page 115**

This is an activity that can be used as extension to the 'Alien Botanists' exercise. Although detailed, it introduces students to the complexity of scientifically naming flora (and fauna). This activity has many applications beyond the excursion. (45 mins approx)

Evidence of animals **Page 120**

This chart raises awareness of the animals that may be present around the wetlands. Students may wish to complete the sheet as they walk around the lakes. (20 mins approx)

ADDITIONAL RESOURCES

The following additional material is available at the end of this package:

- **DIEBACK**: A Preventable Plant Disease – Summary leaflet on preventing 'Phytophthora'. (The Tree Society)
- WATER FACTS 15 – **Salinity** – Introduction to the causes and strategies for management of salinity. (Waters & Rivers Commission)
- FARMNOTE 08/2000 – **Salinity at a glance** – Technical coverage of causes and management of salinity. (Agriculture Western Australia)
- WHEATBELT WONDERS UNDER THREAT – Colourful brochure on the threat of salinity to the natural environment, from Landscope. (Department of Conservation and Land Management)
- FURTHER INFORMATION ABOUT SALINITY - **Useful websites**, (State Salinity Council)
- SALINTY – **Flow chart**, (Midlands Education District)
- EXAMPLES OF WATER SALINTY LEVELS, from rainwater to the Dead Sea measurement of salinity levels. (Agriculture Western Australia)
- WEEDNOTE, No. 1/99 – Coloured brochure on aquatic weeds. **(Agriculture Western Australia).**
- WATER FACTS 6 – **Algal Blooms**–Descriptions of algae and problems created by them. (Waters & Rivers Commission)
- WATER FACTS 10 – **Groundwater Pollution**– Explanation of how groundwater is managed to ensure our water supplies are clean. (Waters & Rivers Commission)
- WATER FACTS 2 – **Macroinvertebrates & Water Quality** –Outline of aquatic invertebrates and their importance in water monitoring. (Waters & Rivers Commission)
- WATER ADVICE No. 1 – **Caring for our waterways** – Leaflet for people living near rivers, estuaries and harbours. (Waters & Rivers Commission)
- **A WETLAND/WATERS HEALTH CHECK** – Colourful brochure on checking wetlands. (Waterwatch)

EXCURSION CHECKLIST

Teachers should visit the lake site and walk trial before the school visit. The teacher can then estimate the length of time required for the excursion. (Depending on the number of activities the excursion could take between one and a half hours to a full day).
The lake site is an ideal spot for a pleasant lunch or morning tea.

Preparation before the visit:

- ❑ Contact the Department of Conservation and Land Management to advise of visit (9071 3733)
- ❑ Photocopy worksheets
- ❑ Complete any pre-visit activities if required
- ❑ Organise bus
- ❑ Arrange for parent helpers
- ❑ Send out parent permission notes
- ❑ Inform school administration of excursion
- ❑ Book school mobile phone

On the day:

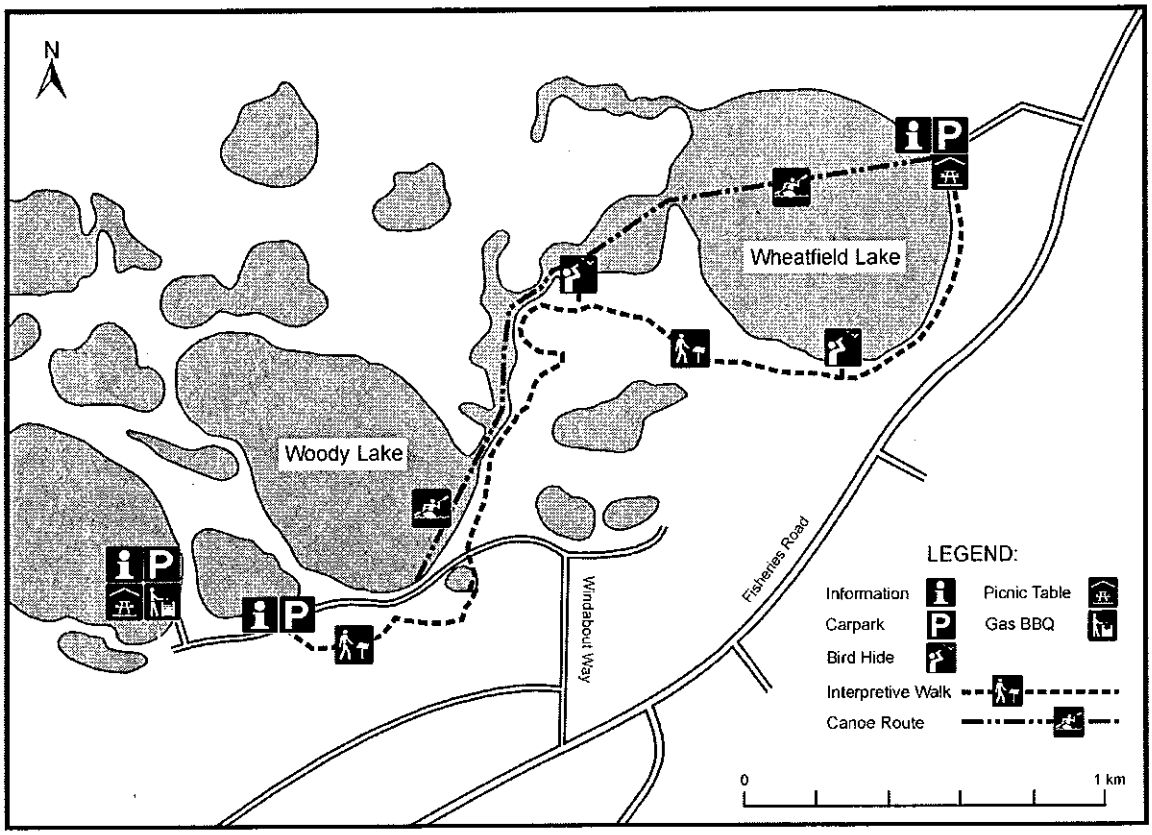
- ❑ Food, drinks, spare water
- ❑ Insect repellent, sunscreen
- ❑ First aid-kit
- ❑ Special equipment required for water testing etc.
- ❑ Student worksheets
- ❑ Remind school administration of excursion details
- ❑ School mobile phone

KEPWARI WETLANDS TRAIL MAP

The Lake Warden Wetland System is located on the northern outskirts of Esperance townsite. The Kepwari Wetland Walk Trail can be accessed from Windabout Way.

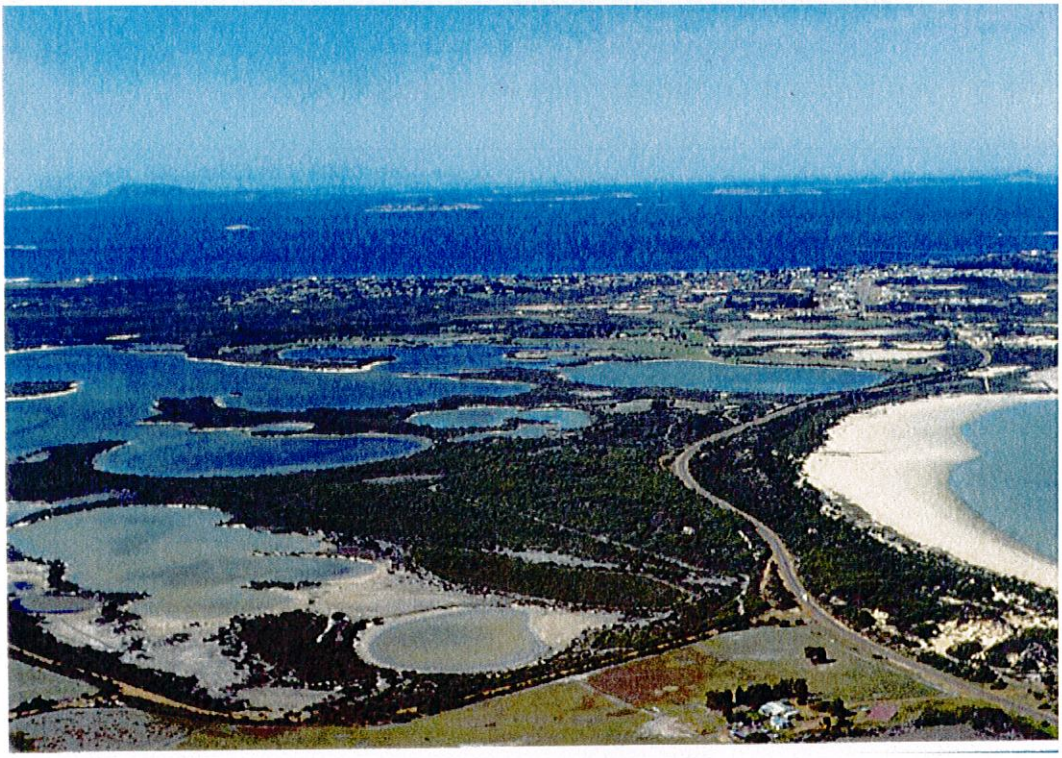
The trail can take between one and a half hours to a full day to complete, depending on the number of activities your class undertakes.

The lake site is an ideal spot for a pleasant lunch or morning tea.



Welcome to Kepwari

- Place of moving water -



YOUR VISIT TO THE WETLANDS

Student activities

This section contains:

- Kepwari Wetlands Trail activity sheet
- Issues to explore:
  - Wetland bird life
  - Dieback
  - Salinity
  - Vegetation/Weeds
  - Drowning wetlands
  - Land use conflict
  - Introduced animals
  - Eutrophication
- General wetland activities

KEPWARI WETLANDS TRAIL ✎✎ Activity 20

Name:

_____Date:_____

As you walk through the wetlands you will come across a number of information panels. Read the panels and complete this sheet:

"Welcome to the Kepwari Wetlands Trail"

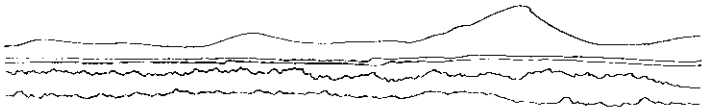
What will you find out on the Kepwari Wetlands Trail?

_____

_____

_____

_____



"Between plain and sea"

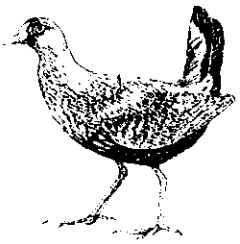
List three things that threaten the health of the Lake Warden wetlands.

1. _____

2. _____

3. _____

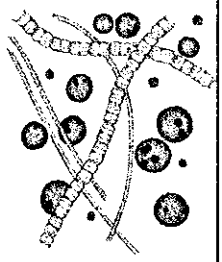
"Wetland network"



Esperance wetlands are very important to migratory waterbirds - give two reasons why.

1. _____

2. _____



"From tranquil blue to fiery gold"

What causes the build up of 'green algal blooms' and why is this a problem?

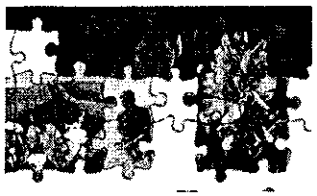
Causes:

_____

Consequences:

_____

_____



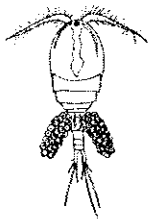
"You ... a vital part of the solution"

Write down two things **you** can do to help preserve wetlands.

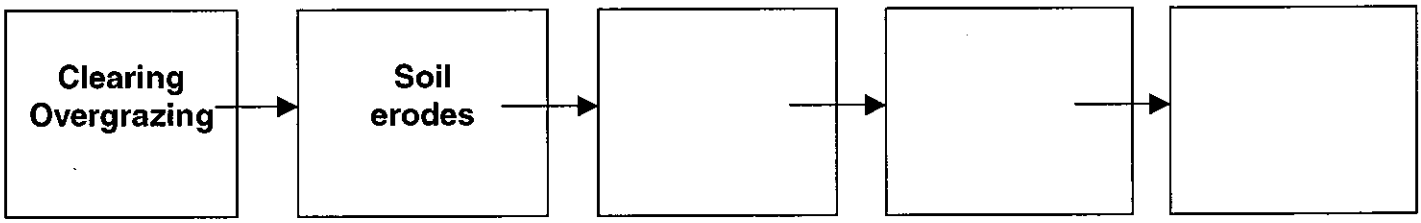
1. _____

2. _____

"Muddy waters"



Complete the following flow diagram.



"Keeping our wetlands clean"

In box (1) draw and label an example of the type of vegetation found in the buffer zone. In box (2) explain why this vegetation is important.

Box (1)

Diagram

Box (2)

Explanation

"An ancient history"

Why is the "Norrun" important to the local Aboriginal people?

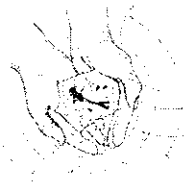
"The killer beneath your feet"

What do you think will happen to vegetation around the Lake Warden wetland system if dieback is allowed to spread?

"A tell tale sign"

Explain whether you think the following comment by a student is correct. Give reasons for your answer.

"There were millions of midges around the lake
so there was nothing wrong with the wetlands."

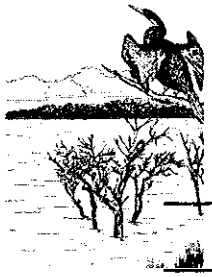


My response:

_____

_____

_____



"Drowning our wetlands"

List one thing that could be done to prevent wetland trees 'drowning'.

_____

_____

"Everybody lives in a catchment"

How do you think scientists can tell if a wetland is being 'contaminated' by pollutants?

_____

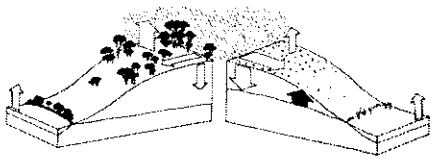
_____

"The rising tide"

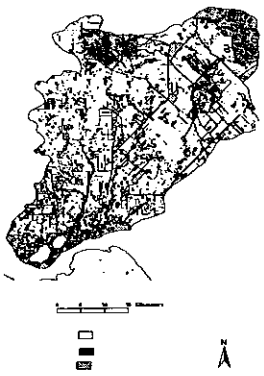
Why does it matter that the wetlands are becoming more saline (salty)?

_____

_____



"The changing face of the land"



Estimate the percentage of the catchment area that is

Cleared land _____%

Remnant vegetation _____%

"Welcome to the Kepwari Wetland Trail"

Imagine this sign is to contain a comment from a person who has completed the trail – What would you say about the trail?

WETLAND BIRD LIFE

The Lake Warden System provides important habitat that regularly supports 20,000 waterbirds and nearly 30 different species. Some of the waterbirds that visit these wetlands are rare, vulnerable or endangered.

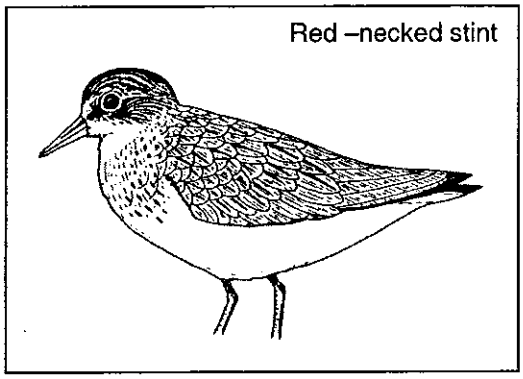
Waterbirds may come from halfway around the world to visit the Esperance wetlands.

Examples: - Greenshank

- Red –necked stint

- Sharptailed sandpiper

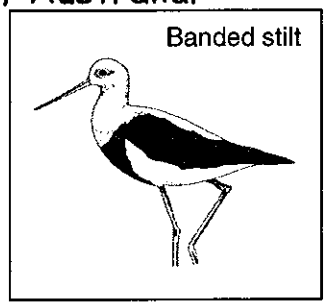
- Curlew sandpiper



Some birds may come from other parts of Australia.

Examples: - Banded stilt

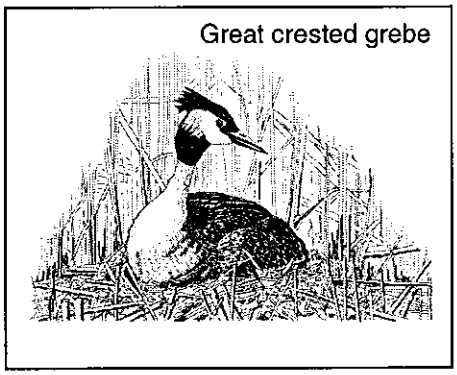
- Black-tailed native hen



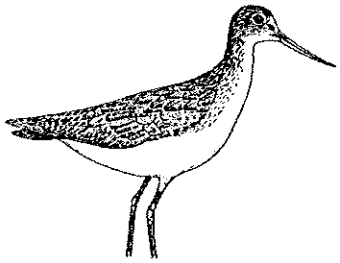
Other birds are permanent residents of the wetlands.

Example:

- Great crested grebe



WETLAND BIRD LIFE



BIRD LIFE OBSERVATION CHART ✎✎ Activity 21

Construct a recording sheet for your observations of the bird life on the Lake Warden wetlands. Include:

Date	Time of Day	Location	Number of birds sighted	Species of birds sighted	Activity of the birds

You can use your recording sheet on different visits to note any difference in the time of day and/or seasons. Report to the class your findings from your recording sheet.

BIRD CALL RECOGNITION ✎✎ Activity 22

Sit quietly in the bird observation hut for at least 5 minutes. Listen to the various bird calls. Try writing a description of the calls.

How many different ones are there? _____

When you report back to the class try and repeat the calls.

MIGRATORY BIRD STORY ✎✎ Activity 23

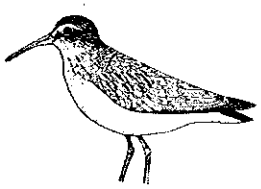
Imagine you are one of the migratory birds on the lake.

Write a story, poem, song, cartoon strip, about your adventures. Try and include why you visit the Esperance wetlands and what your feelings are towards the 'great trip'.

You may need to complete some research about migration patterns of the migratory birds before starting your story.

BIRD HABITAT HYPOTHESIS TESTING ✎✎ Activity 24

Whilst on your field trip 'hypothesize' (make an educated guess) about breeding and feeding habitats of the various birds you see. Write down:



- Where do you think the best resting places are and why?
- What do you think the various birds feed on?
- Look at the differences in the birds' feet. Write down whether you think they are 'waders' or 'paddlers' and why.
- Look at the bill shapes. Why do you think they are so different?

On your return to class check your guess with reference books or contact Esperance Bird Observers Group (contact through Department of Conservation and Land Management) and see if you can organise a speaker from the Esperance Bird Observers Group to come and talk to your class.

WATERBIRD PROTECTION LEAFLET ✎✎ Activity 25

As a conclusion to your research on the birds of the wetlands, construct a leaflet or sign on "Do and Don't" in the wetlands to help protect the habitat of waterbirds. Illustrate it and make it interesting.

Here's an example to help you get started:

WATERBIRDS OF THE ESPERANCE WETLANDS

Help protect the waterbirds and the habitat in the Esperance wetlands by following these few simple steps:

DO	DON'T
* Walk quietly & enjoy the calls of the many birds.	* Walk off the formed track as you may disturb nesting birds.

"The killer beneath your feet"

DIEBACK

Dieback is a fungal disease that affects and often kills many plant species. It was introduced in Australia at least 80 years ago.

The fungus is microscopic and infects the roots of plants. The roots rot and stop taking up water so the plant appears to be dying of drought. Dieback spores can remain in the soil for a long time and become active in warm and moist favourable conditions. Unfortunately there is no simple way of knowing if dieback is in an area.

The movement of infected soil spreads dieback. This occurs when it rains and soil is washed downhill, when gravel is transported from infected sites, or when soil is attached to vehicles or walking shoes. Even kangaroos can spread dieback on their feet. (On some walk trails a brush and container is provided to remove potentially infected soil from shoes to help prevent the spread of dieback).

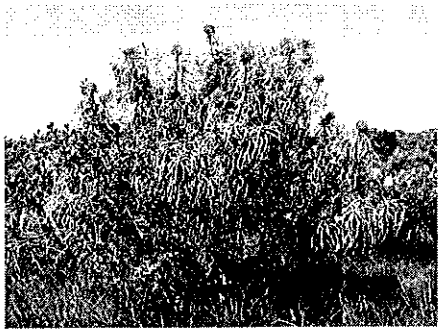
Not all plants around the lakes system are susceptible to dieback, unfortunately many are. Banksias, Hakeas and grass trees will all be affected by dieback. This is not only a threat to the native plants but some birds and animals (such as the honey possum) feed on the nectar produced by native flowers.

DIEBACK

IDENTIFYING DIEBACK EFFECTS (SKETCH) ✎✎ Activity 26

Look around (360°) at the vegetation in the area where you are *(at "The killer beneath your feet" sign).* Draw a sketch of the plants that look healthy and unaffected by dieback (a). Draw another sketch of the group of plants that appear to be affected by dieback (b). Use the signage to help.

(a) Healthy plants:	(b) Dieback-affected plants:



DIEBACK BRAINSTORM ✎✎ Activity 27

As a group, brainstorm what would happen if dieback spread throughout the wetlands. Mention the affect on plants and animals.

Describe what methods appear to have been used to stop the spread of dieback. (Hint: Dieback spores cannot survive in limestone).

DIEBACK THREAT (CARTOON or ROLE PLAY) ✎✎ Activity 28

Using the information you have gathered on dieback prepare, as a group, a brief role play or cartoon strip that outlines the threat of dieback and prevention methods for its spread. Remember to focus on what YOU can do to prevent the spread of dieback.

In your presentation (or cartoon strip) you could have an evil character representing the dieback spores - demonstrating how they affect some plants. A 'superhero' could be introduced who helps stop the spread of the 'evil' dieback by various means.

The rising tide"

SALINITY

"Salinity" refers to the presence of soluble salt in soil and water. Broad ranges of salts occur naturally in soil and water. Most of this salt originates from the ocean and is deposited in the soil and water through wind and rain. Unfortunately, too much salt can cause serious problems.

'Salinity is considered to be the greatest environmental threat facing Western Australia - 1.8 million hectares in the South-West agriculture region are already affected by salinity to some extent.
The area of salt-affected land has already had a serious impact on biodiversity, current and future water supplies, agriculture and regional infrastructure, including roads, rail, public and private buildings, water and waste water facilities.'

(Alex Campbell, Chairman, State Salinity Council)

Australia's present salinity problems have resulted largely from human activities, which in the past 200 years have changed the natural distribution of water and salt in the landscape. The reason for most salinity problems has been the rise in the level of the water table, bringing salt into the soil and waterways.

Currently a range of measures is being undertaken to reduce the impact of salinity (e.g. State Salinity Strategy). Farmers, with the support of government agencies such as Agriculture Western Australia are changing or modifying their practices to manage salinity thereby reducing the serious impacts of salinity.

"The rising tide"

SALINITY

SALINITY OBSERVATION QUESTIONS ✎✎ Activity 29

In your group answer the following questions by looking at the sign:

1) What do you think the water table is?

2) What happens to the water table when the trees are cleared?

3) What happens to salt during this time?

SALINITY TESTING ✎✎ Activity 30

Your teacher will show you how to measure for salinity.
You will use a 'Conductivity Meter'. The measurement is made in 'milliSiemens' or 'microSiemens' (1 milliSiemen/m = 10 microSiemens/cm).
The higher the milli/microSiemen reading the more salt is present in the water.
Freshwater usually has a reading between 0-500 milliSiemens/m (or 5000 microSiemens/cm).

(Contact: Agriculture Western Australia on 9083 1111, and/or the Department of Conservation and Land Management on 9071 3733 for more assistance).

DISSOLVED SALT EXPERIMENT ✎✎ Activity 31

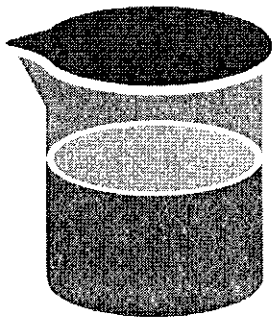
Back in the classroom try this little experiment:

* Dissolve $\frac{1}{4}$ cup of table salt with 1 litre of tap water in a dark coloured 2 litre ice cream container (or similar).

What do you observe the next day?

What do you notice after 3 days?

How can this observation be linked to 'Soil Salinity'?



TRAVELLING WITH SALT ✎✎ Activity 32

You will need:

A clear plastic cup
A strip of paper towelling
Water
Salt

What to do:

1. At the top of the cup write the word 'surface' and at the bottom the words 'ground water'.
2. Cut a strip of paper towel that is taller than the glass and write the word 'soil' at the top of the strip.
3. Fill one third of the cup with water and stir in two teaspoons of salt until it has dissolved.
4. Place one end of the paper towel strip in the salty water and observe what happens.
5. When the water reaches the other end of the strip, tear off a small piece of the wet towel and touch it to your tongue.

   What do you taste?

Now try this:

Take the paper strip out of the salty water and dry it in the sun. When it has dried, look closely at the surface of the paper. What do you see?

SALINITY RESEARCH - NEWS REPORT ✎✎ Activity 33

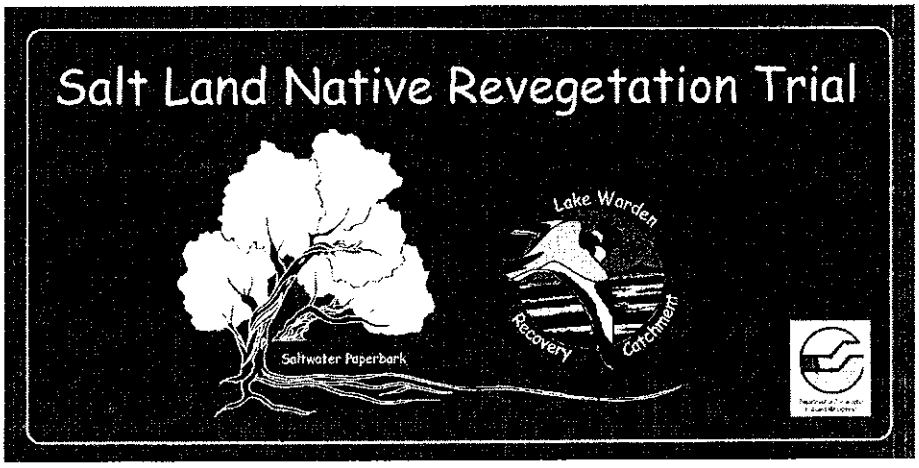
Imagine you are a GWN, WIN, ABC or SBS news reporting team.

Find out what you can about measures that are being taken to manage the problems of salinity in soils and water bodies in the Esperance region.

You may decide to contact Agriculture Western Australia, the Department of Conservation and Land Management and some local farmers for help.

Include a section on what community members (you) can do to assist with managing the impact of salinity.

Present your news report to the rest of the class in the form of a role-play.



VEGETATION

Plants are very important in wetland areas. They give shelter, provide food for many animals and protect the banks from erosion. They can also make the area look attractive.

PLANTSCAPE PICTURE ✎✎ Activity 34

You are going to draw a picture of the plants around the wetlands.

You will need a partner, an A4 piece of paper and a clipboard (or something to lean on).

Find a suitable place where you have a good view of the wetlands. You or your partner make a frame with your hands.

> Hands out in front, thumbs horizontal, fingers vertical – turn right hand palm facing you – join right thumb to left hand forefinger – then left-hand thumb to right hand forefinger – you should now have a rectangle, frame, to look through.

Look through your partner's frame and draw a picture of the scene. Draw any trees, bushes, rushes and sedges you can see. When you have finished place a border around your picture, label it:

"Lake Warden Wetlands Scene"

Name and date your artistic work.

Find another suitable spot and swap roles.

(Activity continues next page . . .)

What do you think?

On the back of your sketch answer the following questions:

1) How many different types of plants did you sketch?

2) What were some of the different sizes and shapes of the plants?

3) How do the plants change as you move further from the water? Why?

4) What threats exist for the plants in and around the wetlands?

5) What would happen if all the plants were removed?

6) What would happen if certain types of plants were removed?

"Keeping our wetlands clean"

WEEDS

Weeds are unwanted plants or species growing in an area. They can have a significant impact on the environment around the wetlands by displacing native plants, altering animal habitats and possibly spreading pests and diseases.

The nature reserves around the Lake Warden wetlands have several areas where weeds have established. Some of the more problem weeds include:

- Victorian Tea-tree
- Bridal Creeper (pictured left)
- African Love Grass
- South African Boxthorn

WANTED POSTER

Activity 35

Contact the Esperance Weed Action Group through the Department of Conservation and Land Management, they will help you identify the weeds listed above.
Find out from the Esperance Weed Action Group what YOU can do to help.
Obtain some examples and prepare a **WANTED POSTER** with either the example or a drawing.

- WANTED -

BRIDAL CREEPER

As well as an example or drawing include details on:

- Why is the weed wanted?
- What should be done if seen?
- Where was it last seen?
- What is the reward?
- Who should be contacted if sighted?

"Drowning our wetlands"

DROWNING WETLANDS

FLOODED WETLANDS (Power Point presentation) ✎✎ **Activity 36**

Near the sign "Drowning our wetlands" are the skeletons of dead paperbarks

1. Why do you think they have died?

2. Why are the fringing sedges and rushes able to survive?

3. Why do you think 'flooding' of the wetlands is a problem?

Back at school, contact the Department of Conservation and Land Management (Dempster St, 9071 3733) to obtain a copy of

"Esperance Lakes Nature Reserves - Management Plan, 1999 - 2009. Management Plan No. 39"

Pages 10 and 11 deal with:

- Why increased water flows have occurred;
- Why it is a problem; and
- What should be and is being done about it.

Prepare for the rest of the class a power point presentation or illustrated talk on:

"The drowning of our wetlands"

Organise your presentation so it includes information on:

- What the problem is
- Why it is a problem
- Why the problem is occurring
- What is being done about it
- What should happen in the future
- Your group's opinions, conclusion on the problem

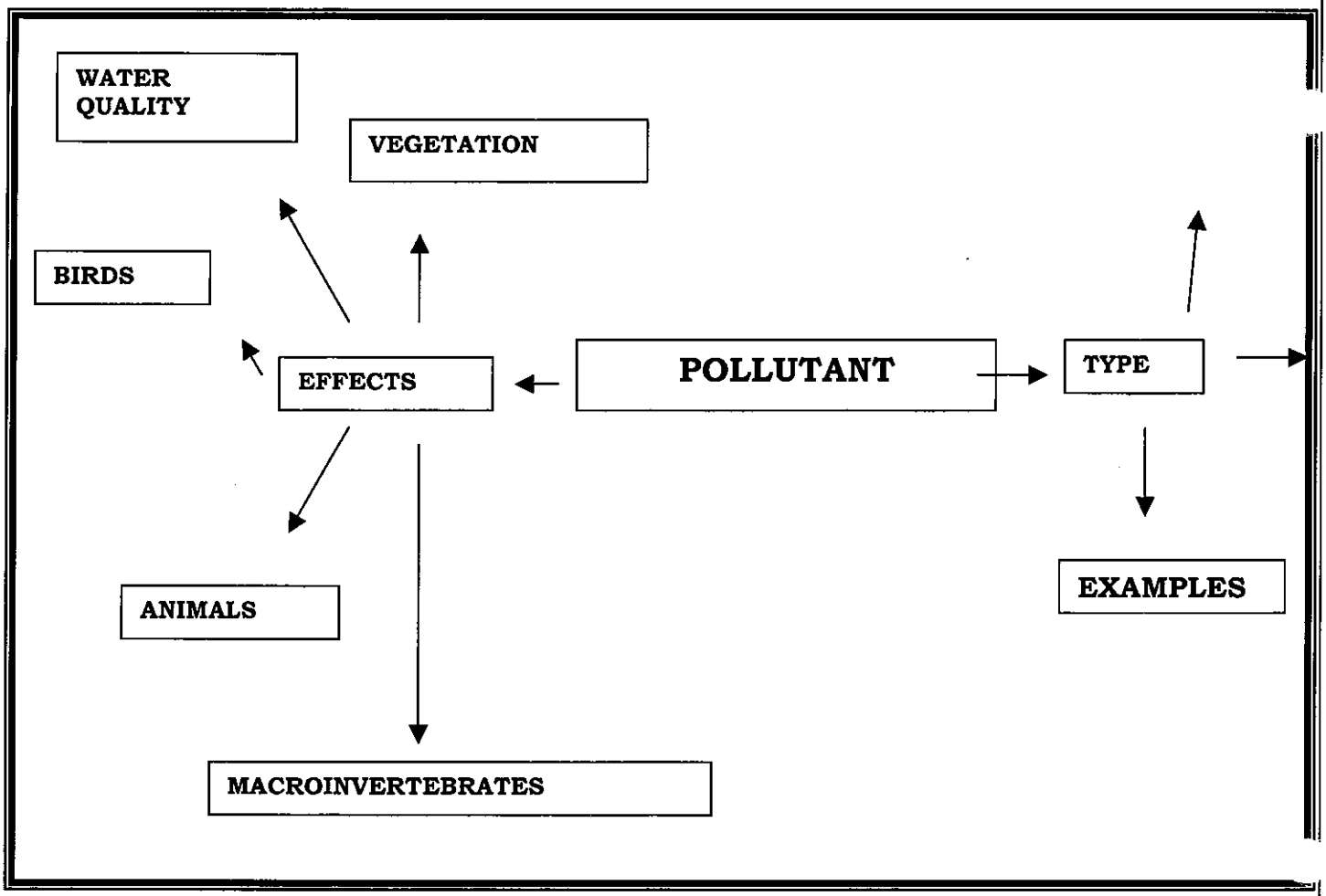
"Everybody lives in a catchment"

Conflict of Land Use

It does not matter where you live, your activities will have an impact on the ocean or wetlands.

POLLUTANTS AND WETLANDS MIND MAP ✎✎ Activity 37

In small groups produce a mind map of the impact that pollutants have on the wetlands.
Include the pollutants that will find their way into the wetlands and the likely impact it will have on the life in the wetlands.
Compare and expand your diagram so you have information from all the groups.



"Everybody lives in a catchment"

Conflict of Land Use

EVALUATING CATCHMENT ACTIVITY ✎✎ Activity 38

Below is a list of 10 activities that may be carried out in catchment areas. Tick (✓) the activities that you think will be 'helpful' to the environment. Place a cross (✗) beside the activity that you think will be harmful. In point form explain why you have made that judgement. Discuss your list with others - if you disagree have the whole group think about the activity.

CATCHMENT ACTIVITY

Activity	Helpful ✓ Harmful ✗	Reason
1) Digging for worms on the shore of the lake.		
2) Cleaning up rubbish on roadside verges.		
3) Taking shorter showers so as not to waste water.		
4) Washing paint brushes near storm water drains.		
5) Connecting to the town septic system.		
6) Feeding ducks in the lake.		
7) Choosing low-phosphate washing products.		
8) Fertilizing the lawn every month so it grows quickly.		
9) Composting waste material.		
10) Washing the car on the lawn rather than the driveway.		

WETLANDS ACTIVITY - PMI CHART ✎✎ Activity 39

Have a good look around where you are ("Everybody lives in a catchment" sign). It is a beautiful spot.

Would you like to live here? YES NO

Why/Why not?

As you can see some people like to live near the wetlands. They enjoy the peace and quiet and general 'ambience' of the area. Unfortunately some activities that occur near the lakes can have negative effects on the environment:

- Clearing of remnant vegetation to build houses may reduce habitats for native animals.
- Other activities such as horse riding, motorbike and four-wheel bike riding, and water-skiing are enjoyable but they too may impact on the wetlands.

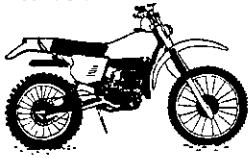
As a group think of the **P**luses and the **M**inuses and any other **I**nteresting comments of each activity carried out near the wetlands. Whilst compiling the list have a good look around to stimulate ideas.

The PMI wetland activity chart (next page) will help for structure.

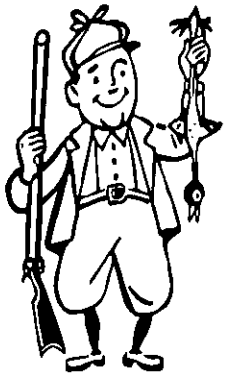
NAMES:

Date:

PMI
WETLANDS ACTIVITY

Activity	Pluses	Minuses	Interesting
Motorbike/four-wheel bike riding 	Example: Variety of areas to ride.	Noise may scare wildlife.	250cc are the best.
Horse riding 			
Water-skiing 			
Urban development (Building houses near the lakes) 			

WETLANDS CONFLICT RESOLUTION ✎✎ Activity 40



Some activities are not allowed in Nature Reserves. Contact the Department of Conservation and Land Management (9071 3733) to find out what is and what is not allowed.
Unfortunately, despite not being permitted these pursuits still occur near the lakes. A few people think they should be allowed to enjoy their activities where they like.

As a group develop a strategy that enables people to have fun on their motorbike, four-wheel bike or horse but not impact on the wetlands. Your strategy needs to include how you are going to stop the 'illegal' activities and minimize the impact of the permitted activities.

Prepare a letter, on behalf of "Save the Wetlands Committee", to be sent to the "Off Road Bike Club" and/or "Horseback Trail Riding Group". The letter should outline your group's strategy to ensure the wetlands are protected but people can still undertake the activities they enjoy. You may wish to send a similar letter to the "Esperance Express" to outline your concerns and solutions.

Alternatively your group can role-play a meeting between the various groups - each group could outline their point of view and from the discussion a solution/strategy is reached.

For help with this activity:
Check pages 28 to 32 of "Esperance Lakes Nature Reserves - Management Plan, 1999 - 2009. Management Plan No. 39"
(Available from the Department of Conservation and Land Management - Dempster Street, 9071 3733)

"Everybody lives in a catchment"

INTRODUCED ANIMALS

Another problem created by the spread of residential areas to the borders of the nature reserve is that of introduced and domestic animals.

Foxes,
Rabbits,
House mice,
Domestic and feral cats,
Dogs,
Horses,

can all create problems in wetland areas by disturbing native wildlife. These animals also have the potential to introduce or spread diseases and 'fouling' recreation sites (check the bottom of your shoes!).
Feral and domestic cats are a particular threat to waterbirds.

INTRODUCED ANIMAL HUNT ✎✎ Activity 41

Whilst on your walk see if you can find any evidence of these introduced animals. Remember not to leave the formed walk trail or disturb the vegetation and wildlife.
Discuss with a partner what evidence you will be looking for.
The 'Evidence of introduced animals' chart (next page) will help you record the details.
If you find any evidence point it out to another group and have one of them sign your chart.

NAMES:

EVIDENCE OF INTRODUCED ANIMALS CHART

DATE	TIME	LOCATION Near which lake? Near which sign?	EVIDENCE Footprint, waste, rabbit hole, diggings, etc.	ANIMAL(S) Suggested by evidence.	SIGNED Verified by other group members.

INTRODUCED ANIMALS MODEL ✎✎ Activity 42

To highlight the problem of introduced and domestic animals in and around the wetlands your group can make a model demonstrating the problem and your solution.

On a large baking tray cut out blue paper to represent the lakes - around the lakes place either green card or grass to represent the vegetation. Make some clay models (or you could obtain plastic ones) of the introduced animals (horses, rabbits, dogs, cats, foxes, rabbits, house mice). Place the models around the lakes.

Use labels near the animals to explain what they are and why they are a problem around the wetlands.

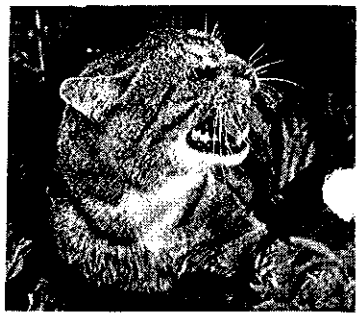
Place lined paper near your model and have other students list possible action to help solve the problems.

You can then incorporate these suggestions to complete your model by including them in your explanation of the model that could be attached to the baking tray.

Your completed model could be used as part of a display showing all the work you have completed on the wetlands. The display could be in the school foyer, part of an open day, at the Esperance Show or at the Boulevard.

For the above activity you will need:

- Baking tray
- Blue paper
- Green card or grass clippings
- Modelling clay
- Lined paper



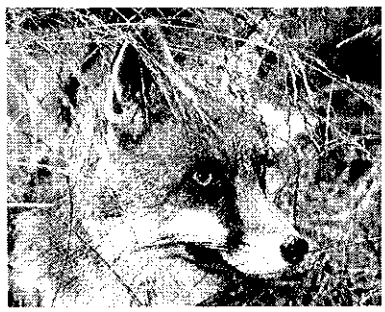
Feral Animals—Do They Have Rights?

Feral means wild, untamed. It is a word most used to describe domestic animals that have established breeding populations in the wild. Individual stray animals aren't necessarily feral. However, if stray animals breed and their descendants live and breed in the wild, then those descendants are called feral animals.

Feral animals are closely associated with the first European settlers who came to Australia. Some of their animals were abandoned or lost and established breeding populations in the wild. These include camels, pigs, horses, goats, cats, dogs, donkeys, honeybees, doves and water buffaloes. Others such as rabbits, foxes, deer, hares and starlings were deliberately released into the countryside. Yet others, like mice and rats, stowed away on ships and invaded the continent.

The following information sheets describe those feral animals which are causing greatest concern in our wetlands — foxes, cats and rabbits.

Note that controlling foxes and cats could lead to an increase in rabbits, while controlling rabbits alone could lead foxes to hunt more native animals or domestic stock. Therefore it is advisable to control foxes, cats and rabbits at the same time.



(Text: Chadwick, I. et al, *Exploring Wheatbelt Woodlands*, Department of Conservation and Land Management, 1994)

CATS

Cats turn feral when owners move on and leave them behind, or when unwanted cats are dumped in the bush. Some people prefer to abandon animals rather than have them destroyed. Domestic cats may destroy about 25 native animals every year. This accounts for most of the young birds bred in suburban areas each year. Feral cats eat many more native animals.

What do they look like?

Scientists have discovered that most feral cats are either tabby or ginger coloured. It has been suggested that predators, such as wedge-tailed eagles, more readily see other colours and therefore cats with these colours are more likely to be killed and eaten.

Feral cats are generally larger and heavier than domestic cats, They are also extremely cunning and difficult to shoot or trap.

Breeding

Females can breed in their first year and thereafter have two litters a year, averaging 3-5 kittens per litter.
For example, a female having four female kittens a year for ten years could be responsible for nearly 2 million female descendants!

Effects on Native Fauna

Feral cats eat birds, frogs, reptiles, fish, insects, crustaceans, molluscs, mammals and plant material.

An average feral cat needs 300 grams of flesh each day to survive. This means 10 small animals per day, 70 per week or 3650 per year! Cats also affect native animals by competing with them for food.

Diseases

Feral cats can spread disease into wildlife populations. Diseases include notoedric mange (a skin disease caused by parasitic mites) and toxoplasmosis (an infection throughout the body caused by microscopic animals).

Control

Actions which will minimise the effect of cats on fauna include:

- de-sexing cats;
- attaching bells to cats' collars (although this will make hunting more difficult, it will not prevent them taking wildlife):
- keeping cats in at night;
- ensuring that pet cats are adequately fed.

The public should also be persuaded not to dump cats or take them on holidays where they may get lost. Most dumped cats suffer a lingering death from starvation.

Trapping and shooting cats will work, but attempts at poisoning have been less successful.

YOUR TASK AS A NEWS REPORTER ✎✎ Activity 43A

1. Read the article on the cat.
2. Prepare ten interview questions based on the article.
3. Interview another person who has also studied the same article as yourself and record their answers.
4. Write a news report based on your interview and information that you have read.
5. Include a colour or black and white drawing with your report.

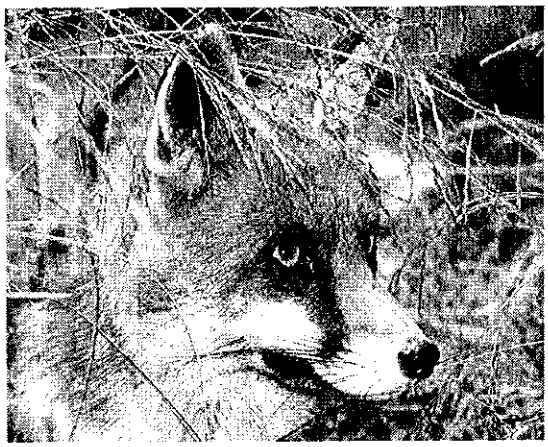
(Text: Chadwick, I. et al, *Exploring Wheatbelt Woodlands*, Department of Conservation and Land Management, 1994)

FOXES

The fox was introduced to eastern Australia in the 1860s. It was introduced for sport hunting and by 1917 had spread to Kalgoorlie.

What They Look Like

The fox is an attractive creature about the size of a small dog. It is actually a member of the dog family. A white chest and throat and a white or black tip on its bushy tail highlight its pale red or deep reddish brown fur.



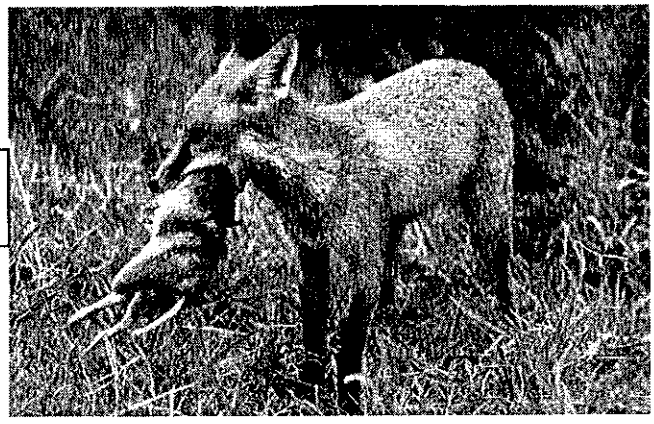
Foxes have an acute sense of hearing and smell.

Breeding

Both males and females breed in their first year. A litter of 4-5 cubs are born each year. At about 10 weeks of age the cubs are out of the den hunting for prey,

Effects on Native Fauna

The red fox kills native animals, feral rabbits, domestic fowl and lambs. Studies have shown that 75% of a fox's diet is carrion (dead) sheep and fresh rabbits. The remainder of its diet consists of insects (especially grasshoppers), domestic fowl, lizards, frogs, small mammals, fish, baby emus, small bats, berries and fruit.



Medium-sized mammals like the Eastern Barred Bandicoot are killed by foxes.

Diseases

Foxes are subject to diseases such as mange and distemper and would be carriers of rabies should it ever reach Australia,

Control

The main methods of control are shooting and poisoning with meat baits. In Western Australia the poison 1080 is used. Because 1080 is natural poison found in some Western Australian plants, native animals are little affected by the concentrations used in specially prepared dried meat baits.

YOUR TASK AS A NEWS REPORTER ✎✎ Activity 43B

1. Read the article on the fox.
2. Prepare ten interview questions based on the article.
3. Interview another person who has also studied the same article as yourself and record their answers.
4. Write a news report based on your interview and information that you have read.
5. Include a colour or black and white drawing with your report.

(Text: Chadwick, I. et al, *Exploring Wheatbelt Woodlands,* Department of Conservation and Land Management, 1994
Pictures: Daniel Hughes, *The Rabbit and Fox Resource Book*, Department of Agriculture, Fisheries and Forestry – Australia, Canberra, 1999)

RABBITS

Rabbits live in burrows called warrens. They eat grasses and other plants that grow around the burrows leaving inedible plants. Loss of plant cover contributes to soil erosion, and in some environments with very high rabbit numbers the land is denuded of plants.

What They Look Like

Rabbits are usually a grey-brown colour with pale belly. Black or ginger forms are also seen. They have long hind legs, short front legs, long ears and large eyes.

Rabbits blend easily into the Australian landscape.
How many rabbits can you count in this picture?

Breeding

Rabbits are able to breed at the age of 3-4 months. They can have up to six litters per year. Each litter averages 3-5 kittens. This gives an average of 20 kittens per rabbit per year!

Destruction

Rabbits may breed so quickly that their numbers outstrip their food supply. They not only eat grass, they sometimes also dig up and eat roots and climb trees to strip the leaves and eat the bark. This ultimately leads to the death of trees.

Apart from their voracious eating habits they sometimes take over the burrows of native animals leaving them nowhere to breed.

Control

Myxomatosis, a disease spread by mosquitoes and fleas, was introduced to control rabbits. At first this killed nine out of ten rabbits, but today with more rabbits showing resistance to the disease, the number has been reduced to five out of ten.

Rabbit Calicivirus Disease (RCD) is a viral disease that affects only European rabbits. Rabbits are infected with the virus and released into the wild. RCD can then be transmitted through contact with the infected rabbits. This is a fairly recent control method introduced in October 1996. It has proved relatively successful eliminating over 90% of the rabbit population in some areas, with an average success rate of about 65%.

Poisoning with 1080 oats and fumigating warrens are the most successful methods of control. Ripping of rabbit warrens has also proved effective in some cases.

YOUR TASK AS A NEWS REPORTER ✎✎ Activity 43C

1. Read the article on the rabbit.
2. Prepare 10 interview questions based on your article.
3. Interview another person who has also studied the same article as yourself and record their answers.
4. Write a news report based on your interview and the information that you have read.
5. Include a colour or black and white drawing with your report.

(Text: Chadwick, I. et al, *Exploring Wheatbelt Woodlands,* Department of Conservation and Land Management, 1994
Pictures: Daniel Hughes, *The Rabbit and Fox Resource Book,*
Department of Agriculture, Fisheries and Forestry – Australia. Canberra. 1999)

"From tranquil blue to fiery gold"

EUTROPHICATION

"Eutrophication" (algal bloom) is caused by excess nutrients in the water allowing algae to grow very quickly. The build-up of large amounts of algae can have several effects.

1) It reduces or cuts out light for other water plants.
2) At night it reduces the oxygen content of the water.
3) As it is decayed by bacteria, it greatly reduces the oxygen content of the water and gives off noxious (smelly) by-products.

PHOSPHATE AND NITRATE TESTING ✎✎ Activity 44

You can assist your teacher or helper in testing for excessive levels of nutrients in the water. Test for phosphate or nitrate. Try a number of locations and compare the results with tap and rainwater.

WATER QUALITY EXPERIMENT ✎✎ Activity 45

For this activity you will need:
- 3 glass jars, with lids and labels

In the classroom you will need:
- Hay infusion
- Teaspoon of superphosphate
- Distilled water
- 3 more glass jars, lids and labels

Continued
next page . . .

WATER QUALITY EXPERIMENT (Continued) ✎✎ Activity 45

You can also make some observations about water quality.
You will need a few glass jars with lids and some labels for the jars.
Carefully obtain some water samples from a few locations along the walk - each sample should be in a separate jar.
Before attaching the lids make some observations about the quality of the water - smell, clarity of the water, description of the colour, what is floating in it. Write this information along with the location and date on the label. Attach it to the jar.
Once back at school leave the jars in front of a window where they will receive plenty of light.
Obtain 3 other jars. In each place the same amount of distilled water and hay infusion, label the jars 1, 2, & 3 and include the date and your names.
In jar 1 - add half a teaspoon of superphosphate (fertilizer).
In jar 2 - add a quarter teaspoon of superphosphate.
In jar 3 - leave with just the hay and distilled water.

Design a chart to record the details of how the quality of the water in all the jars changes over the next few weeks.

Check the jars twice a week for about 4 weeks. Fill in the chart after each observation.

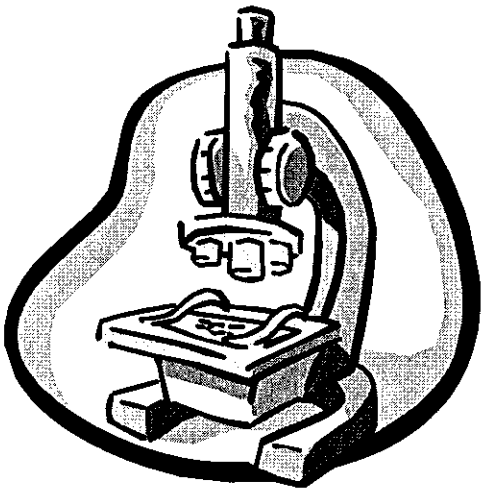
You can now compare each of the jars from the lakes; each of the jars with the fertilizers in them and you can also compare the lakes and fertilizer jars.

After 4 weeks report to the class about your experiment and any conclusions your group came up with. Use the following discussion questions to help with your report.

DISCUSSION:

1. In which 'fertilizer' jar did the water change the most?
2. In which 'lakes' jar did the water change the most?
3. Why do you think this was so?
4. Did the jars with 'fertilizer' in them change more than the 'lakes water' jars?
5. Why do you think this was so?
6. Why was distilled water used in the 'fertilizer' jar?
7. Why was one distilled water jar kept free of fertilizer?
8. What can you conclude about the effect of superphosphate on the growth of algae?
9. What can you conclude about the quality of the water in the lakes?
10. If you wanted to find out if fertilizer from the catchment was effecting the lakes what experiment(s) or observations would you need to undertake?

Contact Agriculture WA, the Waters and Rivers Commission, the Department of Conservation and Land Management to find out how they monitor water quality.



"From tranquil blue to fiery gold"

Eutrophication

SCHOOL GROUNDS PROBLEM ✎✎ Activity 46

Can your school help reduce eutrophication?

Walk around the school grounds and look at the plants. Discuss with the gardener(s) and your group whether your school could be contributing to a eutrophication problem in the lakes.

Consider factors such as:

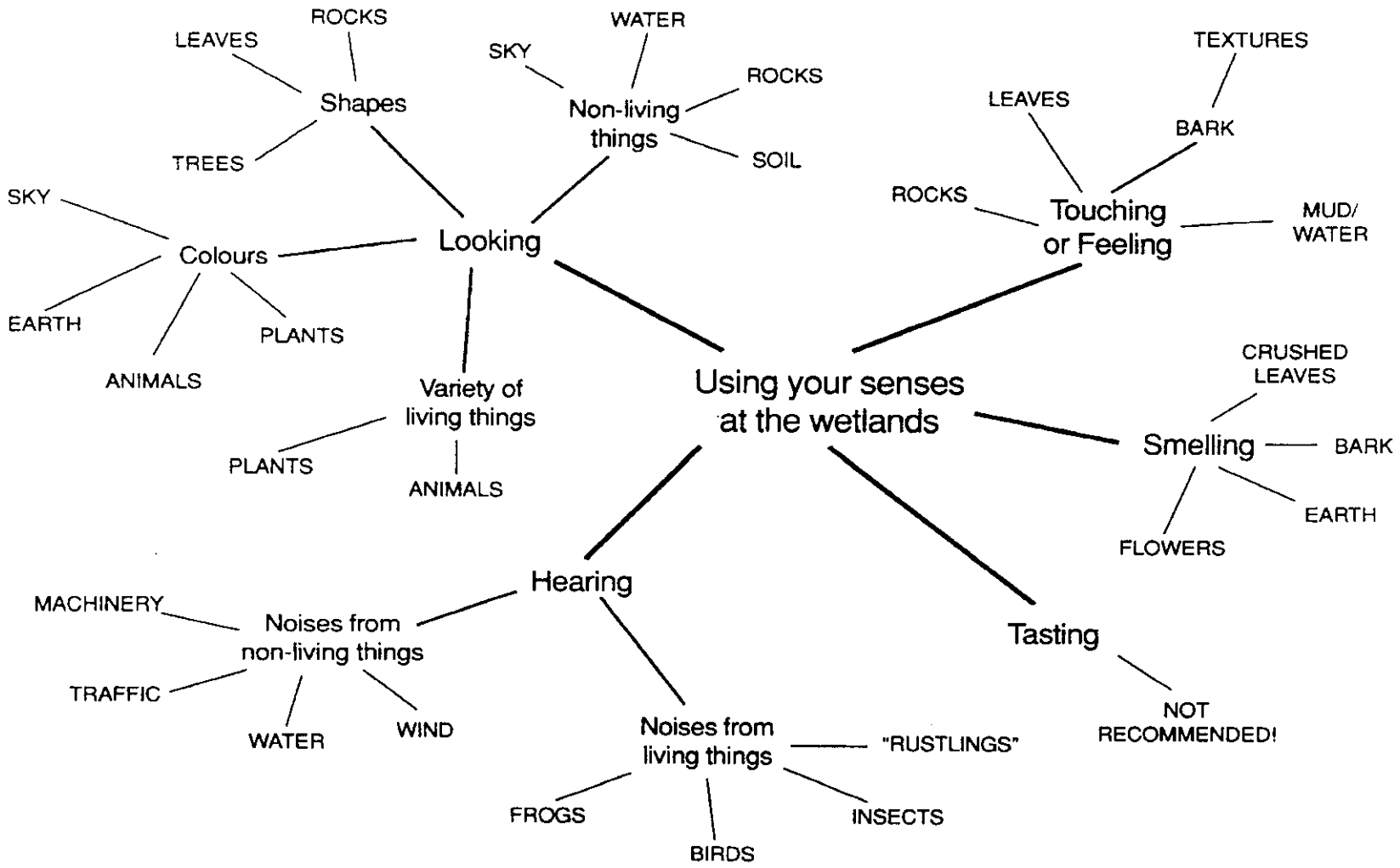
1) What kind of plants make up most of the gardens around your school?
2) Are they native or exotic (come from somewhere else)?
3) What type and how much fertilizer is used on the grounds?
4) Do these fertilizers get into any local waterways?

As a group design a garden which is both practical for the school needs and likely to use less fertilizer and water. Discuss your ideas with the gardeners. Present your ideas to the school for consideration as a school environmental project.

You can apply the same idea to your own garden at home.

(Acknowledgement: *Sowing the Seeds for Change*, Greening Australia)

DISCOVERING THE WETLANDS: USE YOUR SENSES



Acknowledgement: Donnelly, R., *From Sand to Ducks*, RGC Wetlands Centre, 1995

BIOLOGIST FOR A DAY

Activity 47

Biologists must use all of their senses to make observations about the things around them.

See how many observations you can make.

Name of lake		
What can you see? What colours? What shapes?		
Now look for living things. What animals can you see? What sorts of plants can you see?		
Find a quiet place. What can you hear?		
Touch some things around you. What can you feel?		

Acknowledgement: Donnelly, R., *From Sand to Ducks*, RGC Wetlands Centre, 1995

LOOKING AT A LAKE

Activity 48

You are now going to use most of your senses (no tasting please!) to make some interesting observations.

What is the name of this lake? _____

Why do you think it has this name? _____

Look around you.
What can you see?
What can you feel?

Colours	blue/grey sky				
Shapes	round stone				
Textures	smooth leaf				

Have a listen.
What can you hear?

Sounds from living things			
Sounds from non-living things			

Now have a closer look at the living things.
Choose two animals and plants to draw.
Find out their names

Animals Name:	Name:
Plants Name:	Name:

Acknowledgement: Donnelly, R., *From Sand to Ducks*, RGC Wetlands Centre, 1995

Name(s):

WETLANDS HEALTH CHECK

Activity 49

This activity will help you rate the health of the Lake Warden Wetlands. There are seven areas or categories to consider. Each category is rated out of 10. The lower the mark the poorer the condition of the wetlands in that category. You can use this rating to compare different wetlands or the same area over a number of different visits.

SITE INFORMATION:

Name of wetland: _____

Location: _____

_____

_____

(Provide sufficient detail so that you or someone else using these directions can return to exactly the same spot to repeat your rating.)

Date: _____

Weather: _____

_____

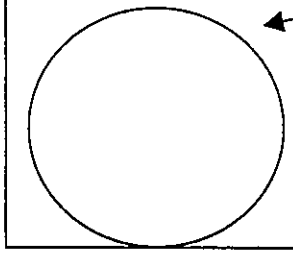
Has it rained in the past 24 hours? YES / NO

If yes, was it heavy? _____

Category 1 : LAND USE

Look around the area surrounding your wetland.
Record land uses that you see or land uses that you are aware of in the local area.

Your rating



RATING:

0	Lots of industry nearby, most of the land cleared, soil bare, environment disturbed.
1	
2	
3	Some industry, some land cleared.
4	
5	Some commercial, recreational and residential land use.
6	
7	
8	
9	No human use at all, in its natural state.
10	

Continued . . .

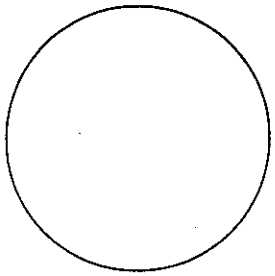
WETLANDS HEALTH CHECK (Continued)

Activity 49

Category 2: LITTER

Look around at the amount and type of litter floating on or in the water or on the surrounding land.

Your rating



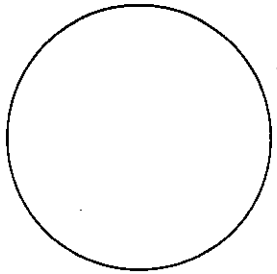
RATING:

0	Lots of human litter such as car bodies, plastics and cans, newspaper and containers.
1	
2	
3	A fair amount of human litter including cans and plastics.
4	
5	Some human litter such as garden rubbish and plastics..
6	
7	One or two pieces of human litter
8	
9	No human litter at all.
10	

Category 3: SMELL

Sit by the wetlands and record any smells. Take a sample of water in a jar and record its smell (don't taste it). A strong 'natural' smell in wetlands should be recorded as 6 or more.

Your rating



RATING:

0	Very strong unnatural chemical smell.
1	
2	
3	Strong unnatural smell
4	
5	Stronger decaying smell or slight unnatural smell
6	
7	
8	Very slight smell, perhaps natural decay.
9	
10	No smell/natural smell

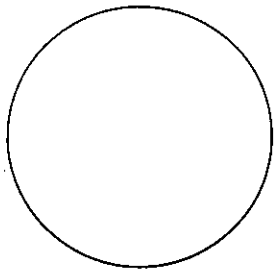
WETLANDS HEALTH CHECK (Continued)

Activity 49

Category 4: WATER CLARITY

Collect a water sample in a glass jar or clear container. Hold it up to the light. Record how clear the sample is.

Your rating

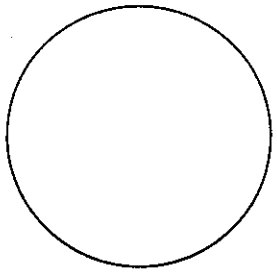


RATING:

0	Milky brown or green colour with particles and scum. You can hardly see through it.
1	
2	Cloudiness and/or greenish colour. Some particles or film..
3	
4	
5	Some colour and particles
6	
7	
8	
9	
10	Colourless and clear as tap water.

Category 5 : VEGETATION

Look at the shoreline and land extending away from the lakes. Note if the vegetation is natural or introduced. See if the soil close to the waters edge is eroded or stable.



Your rating

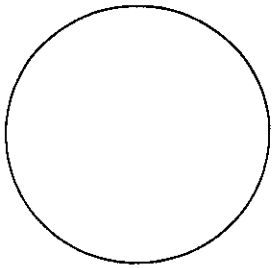
RATING:

0	Lots of introduced plants, much clearing, bare ground, pasture,
1	
2	Mixed plants, much clearing, large eroded areas.
3	
4	Mixed native and introduced plants. Some clearing. Small corridor of vegetation. Some minor erosion.
5	
6	
7	Mainly native plants, minor clearing. Natural vegetation extends to 30m from water, no erosion.
8	
9	
10	Mainly undisturbed native plants. No erosion.

Category 6: INVERTEBRATES

Sit close to the water and look for invertebrate animal activity. If possible run a scoop net through the water and see if you can catch insects or other invertebrates.

Your rating

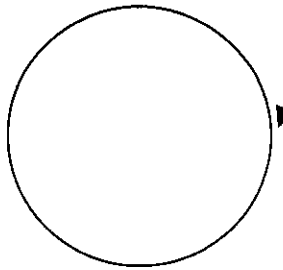


RATING:	
0	No invertebrate animal life visible at all.
1	
2	Only one or two types of animal life visible, snails, leaches or worms.
3	
4	
5	Fewer than five types of animals found.
6	
7	At least 7 types of animals found.
8	
9	Many types of animals found including insect larvae and nymphs
10	

Category 7: VERTEBRATES

Sit close to the lake and look for vertebrate animal activity. Note both the variety and number of birds. Look for fish, listen for frogs and note any animal tracks.

Your rating



RATING:	
0	No vertebrate animal life visible at all.
1	
2	One type of animal life (birds).
3	
4	
5	Two types of animals found.
6	
7	
8	
9	Many types of vertebrate animals found.
10	

Acknowledgement: *A Wetlands/Waterways Health Check*, Ribbons of Blue

TOTAL SCORE:


Amphipod

HOW HEALTHY ARE OUR WETLANDS? Activity 50

Testing water quality by studying macroinvertebrates

Wetlands are home to many small animals called macroinvertebrates. These animals live in the water for all or most of their lives, so their survival is closely linked to the water quality. In turn the survival of larger animals like fish is dependent on macroinvertebrates as a source of food.

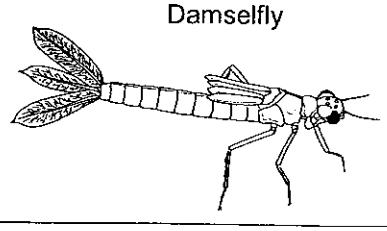
Macroinvertebrates are sensitive to different chemical and physical conditions. If there is a change in water quality then the macroinvertebrate community will also change. Because they are monitoring the water all their lives, the diversity and abundance of macroinvertebrates can be used an indication of the water's health.

How to sample for macroinvertebrates

Macroinvertebrates live in many different places in the water. Some live on the water's surface, some in the water itself, others in sediment on the bottom or on submerged logs and rocks. Emergent vegetation at the water's edge is an important habitat zone. The idea is to sample as many of these different microhabitats as possible.

To sample you will need:

- A long-handled 'dip net' (you can make one using a coat hanger and a stocking)
- A white tray, a student's desk draw would be ideal
- Tweezers, a dropper, a paintbrush or very fine sieve
- White ice-block tray or petri-dish
- Magnifying glass
- Macroinvertebrates Data Sheet & pen or pencil
- If available waterproof boots or waders
- A sense of investigation and discovery


Damselfly

How to sample for macroinvertebrates

(Continued)

Step 1:
If you have waders carefully walk a little way into the lake, otherwise get as close to the water's edge as possible. Bounce the net backwards over the bottom to stir up sediment, then swoop it forward. Repeat, swirling the debris back into the net. Scrape the net against emergent vegetation and submerged rocks and logs. Carefully rinse the net several times to let excess sediment pass through.

Remember that you will be disturbing animals and their homes when you look for invertebrates. Try to keep your impact to the minimum needed to study them.
It is suggested that a teacher does Step 1.

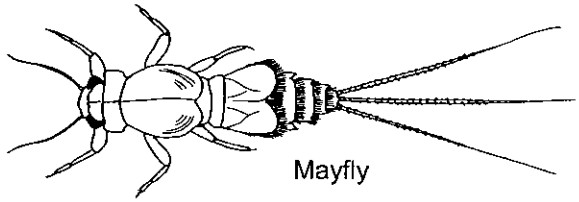
Step 2:
Empty the contents of the net into a white tray with about 2cm of water. Keep the tray very still and carefully watch for movement.

Step 3:
Use tweezers, a dropper, paintbrush or fine sieve collect the animals you see and transfer them to the ice-block tray or petri-dish. Keep animals that look the same in the same compartment.

Step 4:
Observe them with a magnifying glass if available. Try and identify each animal. Record each type of organism you see on the data sheet. This will help you get an idea of diversity and abundance.

Step 5:
When you are satisfied that you have observed and identified all the animals in the tray carefully **return your invertebrates to the water.** Any tadpoles or fish should be quickly returned to the lakes as they do not tolerate this study very well.

Step 6:
Use the "Macroinvertebrate Data Sheet" to determine the water quality in the lake. Sample different parts of the lakes system. You can also sample at different times of the year. Keep a record of your findings. If you notice any changes in the water quality you could contact the Department of Conservation and Land Management and outline your findings.



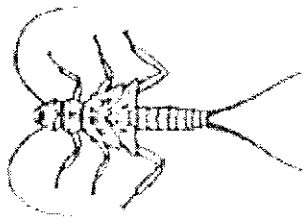
Mayfly

Identifying macroinvertebrates

SENSITIVE MACROINVERTEBRATES

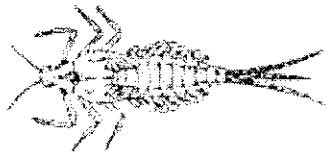
STONEFLY LARVAE [8]

Stonefly larvae have two long tails, tubes of thread-like gills on their undersides, wing pads, antennae and two claws on each foot. They are found among stones or plants in clear, cool well oxygenated streams.



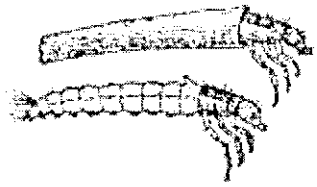
MAYFLY LARVAE [7]

Mayfly larvae have three long filaments at the end of their abdomen, with wing pads and lateral gills along the abdomen. They have short antennae and a single claw one each foot. They are found under stones in fast flowing water or among plants in slow flowing water.



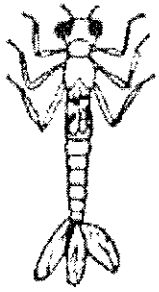
CADDISFLY LARVAE [6]

These are worm-like insect larvae with three pairs of legs on the first three body segments. They are usually found in cases made from rolled leaves or hollow twigs, with only their head and legs protruding when they move.



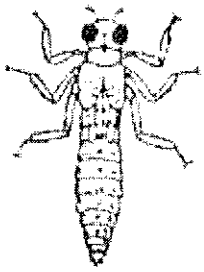
DRAGONFLY LARVAE [6]

Dragonfly larvae are short, chunky predators with wing pads and internal gills. They are found on plants among stones and leaf litter, or on the bottom.



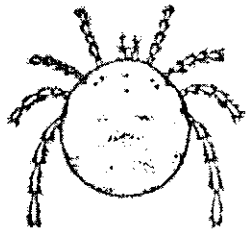
DAMSELFLY LARVAE [6]

Damselfly larvae are more slender than dragonflies, have a distinct head section and three gills on the tail tip. They are also found on plants, among stones and leaf litter or on the bottom.



WATER MITE [5]

Water mites are only just visible. They have a flat disc-like body and swim in open water, among plants or on the bottom in slowly flowing water.

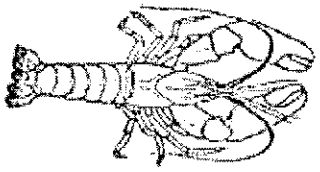


Identifying macroinvertebrates

TOLERANT MACROINVERTEBRATES

GILGIES AND MARRON (4)

Have strong grasping claw-like forelegs. Marron grow up to 40cm. They are both found in burrows, among rocks on stream banks and in holes on the bottom.



WATER FLEA (DAPHNIA) [3]

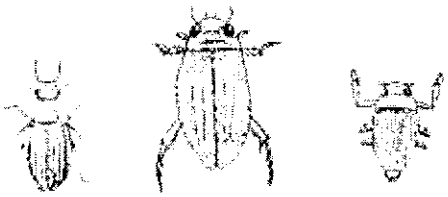
Water fleas are only just visible and can be very numerous. They are free swimming organisms.

BEETLE LARVAE [4]

Beetle larvae may be confused with other animals. They are segmented, have three distinct pairs of legs, are never found in cases, but have a wide variety of forms. They are very active, aggressive predators with large mouth parts and are found in all habitats.

BEETLES (COLEOPTERA) [3]

Beetles have hard front wings folded side by side along the centre of the back. From above, they have a more oval shape than bugs. Beetles have biting mouthparts. They are found on plants, or swimming on or on the water at all levels.

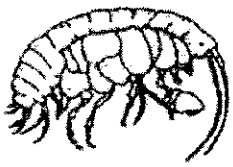


FRESHWATER MUSSEL [4]

Mussels are soft-bodied animals enclosed in two hard hinged shells. They can be found on stable sandy or muddy bottoms.

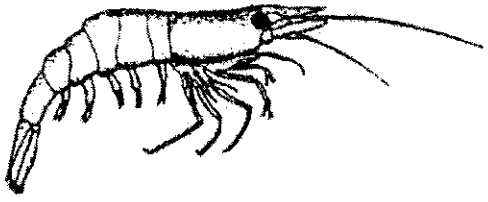
AMPHIPOD [3]

Amphipods are small, narrow, free-swimming crustaceans found in a range of conditions.



FRESHWATER SHRIMP [3]

Shrimp are familiar small crustaceans with slender legs and claws - found among aquatic plants and loose stones.



BUGS (HEMIPTERA) [3]

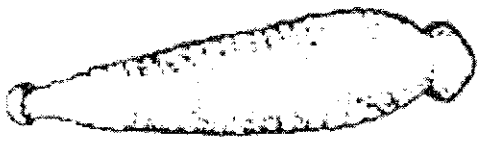
Bugs tend to be shield shaped when viewed from above. Their soft front wings are folded and overlap to leave a small triangle on the back, and they have sucking mouthparts. They are found among the aquatic plants on the water's surface, or swimming freely at all levels of slowly flowing water. Water boatmen and backstriders are bugs.

Identifying macroinvertebrates

MORE TOLERANT MACROINVERTEBRATES

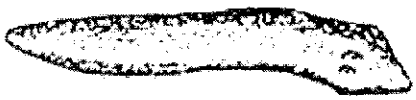
LEECHES [2]

Leeches are segmented worms with a sucker on one or both ends. They are found free swimming on the water, as well as on plants in water or on land, or on the bottom. They move in a looping manner. (Leeches are sensitive to salinity).



FLATWORMS (PLANARIA) [3]

Planaria are small flattened worm-like creatures with two distinctive eye spots. They move in a gliding fashion.



WATER SNAILS [3]

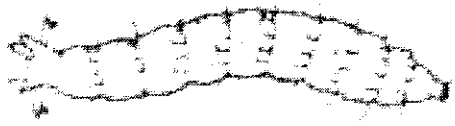
Aquatic snails are similar in form to land snails, but smaller. They are found on plants and on rocks.

Identifying macroinvertebrates

VERY TOLERANT MACROINVERTEBRATES

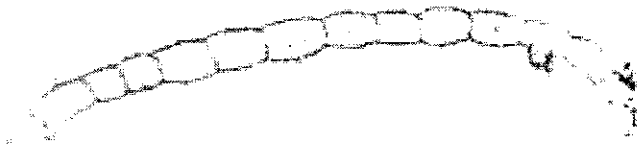
FLY LARVAE [2]

There are many types of fly larvae. They are worm-like creatures with no legs., or stumpy, unjointed legs and may have a sucker on the abdomen and a brush on the head. They occur in all sorts of aquatic habitats; swimming, on rocks or on the bottom.



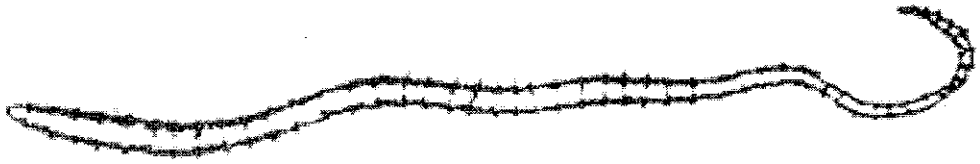
MIDGE LARVAE [2]

Midge larvae are slender worm-like creatures, sometimes red or green with no legs, or stumpy unjointed legs and bristles. They are found in all sorts of aquatic habitats; swimming, on rocks or on the bottom.



AQUATIC EARTHWORM [1]

These are segmented worms with rounded ends and no suckers. They can be opaque or flesh coloured and many are red and called bloodworms. They often live in tubes in the sediment.



MACROINVERTEBRATE DATA SHEET

One method of determining the water quality of a wetland is by sampling the number and variety of macroinvertebrates in the wetland. The larger the variety of macroinvertebrate the better the water conditions - especially if there are 'sensitive' invertebrates present. The table below indicates the 'sensitivity rating' of various macroinvertebrates.

INVERTEBRATE	NUMBER FOUND	SENSITIVITY RATING
Sensitive		
Stonefly larvae		8
Mayfly larvae		7
Caddisfly larvae		6
Dragonfly larvae		6
Damselfly larvae		6
Water mites		5
Tolerant		
Gilgies or marron		4
Freshwater mussels		4
Beetle larvae		4
Beetles (Coleoptera)		3
Bugs (Hemiptera)		3
Water fleas		3
Freshwater shrimp		3
Amphipods (Scuds)		3
Snails		3
Flatworms		3
Leeches		3
Very Tolerant		
Fly Larvae		2
Midge Larvae		1
Aquatice earthworms		1
MACROINVERTEBRATE WATER CONDITION		

* Count the number of each different type of macroinvertebrate found.

* If a macroinvertebrate is present, circle its sensitivity rating.

* At the end of your collecting session, add up the circled numbers to get the macroinvertebrate water condition index.

* Use the index to work out you stream quality rating from the table below.

* To make the results comparable you must use the same collecting technique on all occasions.

Water Condition Index	Stream Quality Rating
19 or less	Poor
20-34	Fair
35-49	Good
50 or more	Excellent

Sampling for Macroinvertebrates activity from:
Water Facts 2, Waters & Rivers Commission 1996

ALIEN BOTANISTS ✎✎ Activity 51

You and a partner will be examining a plant in detail -

Remember to keep to formed walkways.

Pretend you are botanists (people who study plants) who have arrived on Earth from another planet. Your spaceship has landed near the Lake Warden wetlands.
You have been sent by your leader to find out as much as you can about plant life on Earth.

Choose one or two plants from the ones around you. Using the special sheet give each plant a name (you can check the real name later). Make a detailed description of each plant; include a clear, coloured and labeled sketch. Work with your fellow botanists (partner) to share ideas.

You may like to swap sheets with other pairs and see if you can locate and identify their plants.

When you are back in the classroom you may wish to display your pictures. You can research the actual plants' names and information about them.

Contact Esperance Wildflower Society (through the Department of Conservation and Land Management) to give a talk to the class about the vegetation around the wetlands.

Acknowledgement: Donnelly, R., *From Sand to Ducks*, AGC Wetlands Centre, 1995.

NAME:

ALIEN BOTANISTS

Plant Name: ----------

Location: ----------

Other relevant information:

.....

.....

Detailed sketch (with labels)

Acknowledgement: Donnelly, R., *From Sand to Ducks,* AGC Wetlands Centre, 1995.

NAMUS BOTANICUS — Activity 52

(Botanincal Naming)

Background Information

All living things have scientific names. Latin or Greek words are usually used and that is why they seem hard to understand. These names usually consist of two words. We are now going to concentrate on the naming of plants.

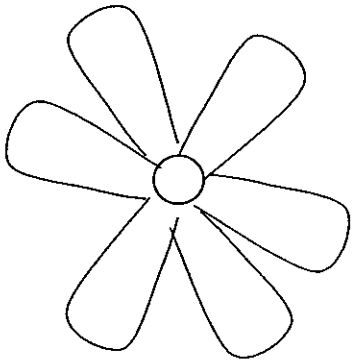
The first word (which starts with an uppercase letter) may be a name which commemorates a famous person (eg. Banksia—after Joseph Banks, the botanist) or it may refer to their plant family (eg, Melaleuca—paperbark, Eucalyptus—gum, or Acacia—wattle). This first word refers to the Genus.

The second word (which starts with a lower case letter) is usually a descriptive word which picks out a special feature such as its flower colour or leaf texture and shape. This second word refers to the species.

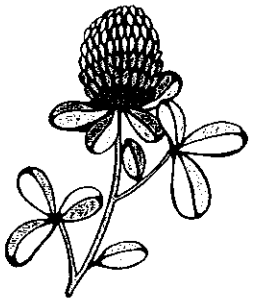
Here are some of the Latin and Greek words which are commonly used when naming plants.

General Structures:

leaf = folia



petal = petalus
flower = flora or anthos



plant = phyton

Acknowledgement: Donnelly, R., *From Sand to Ducks*, AGC Wetlands Centre, 1995.

Numbers

one	=	mono
two	=	di
few	=	pauci
many	=	poly

Size / Shape

small	=	micro or parva
large	=	mega or macro
long	=	long
broad	=	lati
round	=	totuna

Colours

black	=	melos or niger
blue	=	cyanos
brown	=	phalos
gold	=	chrysos
green	=	chloros or virens
purple	=	viola
red	=	rhodos or rubri
white	=	leucos or alba
yellow	=	xanthus or luteus

Texture

smooth	=	glabrous
hairy	=	hirsutus
wrinkled	=	rugosus
sticky	=	viscosus
dry	=	xeros
rough	=	scaber
woody	=	xylo
scaly	=	lepido

Other Descriptive Words

scent	=	odora
sharp smell	=	pungens
heavy	=	grave
good	=	bon
bad	=	mal
sweet	=	suave
honey	=	melio
citrus	=	citri

What could you say about plants which had the following second names?

- latifolia
- longifolia
- leucoflora
- citriofolia

Think of a plant that you might find in you garden—how about a pink one with lots of petals.
What second name would you suggest?

Acknowledgement: Donnelly, R., *From Sand to Ducks*, AGC Wetlands Centre, 1995.

NAMUS BOTANICUS (Continued) — Activity 52

After reading about how plants are scientifically named you are can try your hand at 'Botanical Naming'.
Select a plant that looks particularly interesting. Note its key features, perhaps colour, long leaves, it may have thorns.
Complete the details below and then swap your sheet with someone who has been looking in another area.
See if they appreciate your botanical naming skills.

Name: .....

Plant name:

(First word - *Genus*)	(Second word - species)

Reason for name:

Partner located plant - YES / NO

Acknowledgement: Donnelly, R., *From Sand to Ducks*, AGC Wetlands Centre, 1995.

DISCOVERING A PLANT — Activity 53

Imagine you are Joseph Banks'* apprentice or trainee. The Endeavour has just anchored in Esperance Bay. It will remain there for a number of days while you study the flora and fauna (plants and animals) of the region. Today you are going to study the plants found around the wetlands.

Choose a plant that you find attractive or interesting and make as many scientific observations about it as you can so that when you return to England you will be able to include it in the publication "Unique Plants of the South West of New Holland". You will need to give it a scientific and common name.

INSTRUCTIONS:
Fill in the explosion chart on the next page with all your observations. It is best to do it in steps.

1. Look at each box and see what information is required.
2. Draw an accurate sketch of the part of the plant mentioned and then fill in the information around the picture.
3. Leave the scientific and common name until last (after you have all the information!).
4. Note: there may not be some of the structures, for example fruit, on your plant. If this is the case then leave it out.

When everyone has finished, a swap of information could be arranged to test the accuracy of your observations. Make sure that you swap with someone who was not working near you.

* (A botanist who sailed with Captain Cook, that is where the name 'Banksia' comes from)

Acknowledgement: Donnelly, R., *From Sand to Ducks*, AGC Wetlands Centre, 1995.

Name of Collector: _____

Date collected: _____

Size

Type

Entire plant

Arrangement of leaves along stem

Bark

Colours

Texture

Scientific name:

Common name:

Colours

Texture

Smell of crushed leaf

Size range

Leaf

Shape

Edges

Fruit

Size range

Shape

Texture

Flower

Colours

Shape

Size

Number of petals

Acknowledgement: Donnelly, R., *From Sand to Ducks*, AGC Wetlands Centre, 1995.

NAMES:

EVIDENCE OF ANIMALS CHART

Activity 54

DATE	TIME	LOCATION Near which lake? Near which sign?	EVIDENCE Footprint, scats/waste/faeces, diggings, nibbled leaves, etc.	ANIMAL(S) Suggested by evidence.	SIGNED Verified by other group members.

Welcome to Kepwari

- Place of moving water -

AFTER YOUR VISIT

Post-excursion information and activities

This section contains:

TEACHER'S NOTES

POST-EXCURSION ACTIVITIES

Most of the "Issues to Explore" activities for the Kepwari Walk Trail have classroom-based follow-up activities. These include:

Theme	Page	Activity
Wetland bird life	66	23 - Migratory bird story
	67	24 - Guest speaker(s)
	67	25 - Waterbird protection leaflet
Dieback	70	28 - Dieback threat cartoon or roleplay
Salinity	73	31 - Dissolved salt experiment
	74	32 - Travelling with salt experiment
	75	33 - Salinity research news report
Weeds	78	35 - Weeds wanted poster
Drowning wetlands	79	36 - Flooded wetlands power point presentation
Land use conflict	84	40 - Wetlands conflict resolution
Introduced animals	87	42 - Introduced animals model
	90,92,94	43 - Your task as a news reporter
Eutrophication	95	45 - Water quality experiment
	98	46 - School grounds problem solving

The expectation for many of these activities is that students take the responsibility for contacting agencies, organizations or individuals mentioned.

ADDITIONAL POST-EXCURSION ACTIVITIES

The following is a brief list of alternative activities that are not focused on a specific theme but examine the wetlands in totality:

Lake Warden wetlands web page ✎✎ Activity 55

Students could design a web page based on the lakes. This could include photos from the excursion and results/findings of the various activities.
The site could be linked to the various other 'Wetland' sites.

Kepwari Wetland Trail promotional leaflet ✎✎ Activity 56

Students could design a promotional leaflet for the Kepwari Wetland Trail. The material could be constructed in conjunction with the Department of Conservation and Land Management. It could be made available on site and at the Tourist Bureau.

Designing student learning material ✎✎ Activity 57

Classes could design their own learning material for the trail or additional wetlands excursions. Student-initiated activities could be trialled then sent to other schools in the district for inclusion in their Lake Warden Wetlands Package.

Wetlands display ✎✎ Activity 58

Students could collate the information they have gathered into a display on the Lake Warden wetlands. This could be displayed in the school or town library, your school reception area, the Boulevard Shopping Centre, the Esperance Show or possibly the reception areas at the Esperance Shire or Department of Conservation and Land Management offices.

Formation of 'Friends of the Lakes' group ✎✎ Activity 59

Students may wish to form their own 'Friends of the Lakes' group. Students could determine the purpose, structure and organization of the group. Students from other schools, parents and community members could be invited to join. Contact the local Department of Conservation and Land Management office for initial ideas.

ADDITIONAL POST-EXCURSION ACTIVITIES

Ongoing wetlands monitoring ✎✎ Activity 60

In conjunction with the Waters and Rivers Commission, Agriculture Western Australia and the Department of Conservation and Land Management, students could regularly monitor various sites around the lakes. Data collected could be used by the various agencies.

Esperance Senior High School already has considerable data and the additional monitoring could supplement this. Contact Denis Smith at Esperance Senior High School (08) 9071 9555 for details.

'Storm Boy' wetlands comparison ✎✎ Activity 61

Read *Storm Boy* by Colin Thiele (Rigby Australia, 1963). The wetlands in South Australia could be compared to our wetlands. His feelings and actions around wetlands can be examined in the light of the Esperance students' experience with our wetlands.

Conserving the wetlands – Lifestyle audit ✎✎ Activity 62

Have students prepare a 'lifestyle audit'. Students examine their everyday activities and the impact on the environment. In light of their experiences in the wetlands and of their knowledge about the threats to the wetlands - what actions can the students do to help preserve the wetlands? Discussion of individual plans could lead to 'what can the class can do?' and perhaps 'what can the school and/or community do?' This activity helps the realization that we can all make a difference or have an impact in helping our environment.

Creative thinking/writing/doing ✎✎ Activity 63

Use the following questions as stimulus for critical thinking, creative writing and/or practical activities:

- What would the lakes have been like 100 years ago?
- What will the lakes be like in 100 years time?
- What would a bird that lives or visits the lakes see in a year of its travels?
- How do the wetlands fit into the 'Water Cycle'?
- From catchment to coast how do the wetlands fit into the total picture?
- What is the 'best' management strategy for the lakes system?
- What would a model of a well-managed lakes system look like?
- Does your model value the environment?

ADDITIONAL RESOURCES

The following additional material is available at the end of this package:

- WATER ADVICE No. 14 – **Caring for Esperance groundwater** – Leaflet containing information and advice for people who have an interest in Esperance groundwater. (Waters and Rivers Commission)
- FARMNOTE, No. 102/2000 – **Monitoring groundwater levels** – Technical detail on monitoring groundwater levels. (Agriculture Western Australia)
- WATER FACTS No. 8 – **What is groundwater?** – Outlines importance of groundwater. (Waters and Rivers Commission)
- WATER FACTS No. 9 – **Western Australia's groundwater resources** – Fact sheet explaining important groundwater resources and caring for them. (Waters and Rivers Commission)

CATCHMENT ACTIVITIES

The following pages contain activities that assist in the explanation of the concept of a 'Catchment'.

> ***Catchment:*** *The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetland) or groundwater.*
>
> *(Water Facts 1, Waters and Rivers Commission)*

Ultimately actions in the catchment have an effect on the lakes system. These effects however may take up to 30 years to manifest themselves.

For more information on the Lake Warden catchment system contact the Catchment Recovery Officer at the Department of Conservation and Land Management (9071 3733).

These activities are sourced from:
Working for the right balance **(from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001**

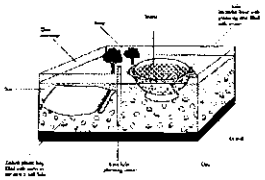
GROUNDWATER

AQUIFER MODEL (A) ✎✎ Activity 64A

The following model will help demonstrate the action of water on and through the ground.

To construct the model you will need:

- Clear plastic container (as big as a cake tin)
- 2 litre ice cream container of clay
- 2 litre ice cream container of gravel
- Zip lock sandwich bag
- 2 litre ice cream container of local soil
- Small plastic colander or sieve
- Plastic shopping bag
- Tuffs of grass
- Drinking straw



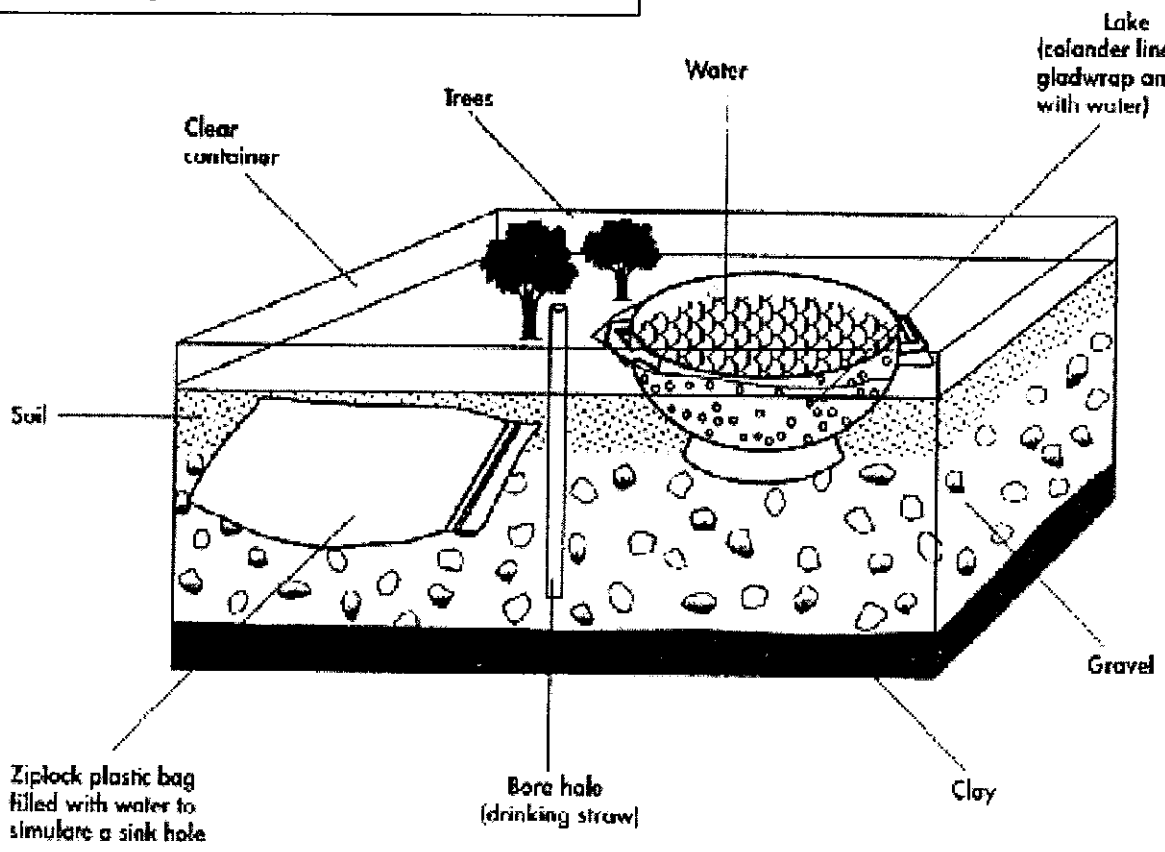
Using the clear container such as a plastic tray, create 'the ground' area. From the bottom up, place the following materials in layers:

1. Clay
2. Gravel
3. A plastic ziplock sandwich bag filled with water
4. A layer of soil
5. A small plastic colander sealed with plastic on its inside, filled with water to be sunk into the soil so that the top is at surface level to simulate a lake.
6. Grass, 'trees'
7. Add a straw sinking it almost into the bottom of the gravel layer to represent a bore hole.

(Turn to the next page to see what your model should look like . . .)

Acknowledgement: *Working for the right balance* (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001

Aquifer Model



Pour a small amount of water onto the soil part of the model.

Where do you think the water might have gone?

Acknowledgement: *Working for the right balance* (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001

AQUIFER MODEL (B) ✎✎ Activity 64B

Use the model you made in Aquifer Model (A). Using a sponge, place a straw into its centre. Wet the sponge thoroughly to show the idea of groundwater.

Using a plastic cup and drinking straw, demonstrate a model aquifer by filling the cup with ice chips, which represent rock and soil-like materials underground. Simulate groundwater by adding lemonade or juice to the cup.

The cup and drink represent an aquifer and groundwater, where:

- The bottom of the cup is the layer of rock or soil that keeps the water from seeping down any further
- The top of the water is the watertable or top of the underground water layer.

Simulate a well by adding the straw to 'pump' the liquid from the aquifer. What might happen to the water table?

.....

.....

.....

.....

.....

.....

What would have to be done to bring the water level back to its original level? Check your ideas by adding water as rain, which replenishes or 'recharges' the groundwater.

.....

.....

.....

.....

.....

AQUIFER MODEL (C) ✎✎ Activity 64C

Create an aquifer model using a glass bowl. The bottom of the glass bowl can act as an 'impermeable layer'.

- Simulate an aquifer which can hold water by adding a layer of sand to the glass bowl.
- Using blue-tinted water, saturate the sand and simulate groundwater.
- Create the impermeable layer by adding a layer of modeling clay over the sand aquifer. As the clay is impermeable, so the aquifer is confined between two impermeable layers – the glass bottom and the clay.
- To represent the aquifer, add a layer of aquarium gravel on top of the clay. Pour an extra amount of blue tinted water and show a watertable.

Draw, label and explain your model below:

Acknowledgement: *Working for the right balance* (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001

AQUIFER MODEL (D) ✎✎ Activity 64D

Using a pump from a liquid soap or pump action container, place the pump into the model's unconfined aquifer

In groups, make predictions about what might happen once the pump is worked. Record these.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Test and check your predictions. Record the results.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Illustrate the changes caused by settlement, such as clearing of land and cereal crops replacing bushland.

Use drawings to show the differences, eg environments before settlement and environments after settlement.

Acknowledgement: *Working for the right balance* (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001

MOVING WATER EXPERIMENT (A) ✎✎ Activity 66A

AIM: To test the length of time it takes for water to pass through clay, sand, gravel and topsoil.

Form a group of four and give out

- Four cups,
- Four lengths of plastic tubing,
- Four pieces of gauze, four rubber bands,
- A quarter of a cup of sand, soil, clay and gravel and
- A jug of water.

Each group should design a test to show:

1. The length of time it takes for the water to pass through each material; and
2. The volume of water that can be collected after the water has passed through.

Did the water flow through all the materials at the same rate?

.....

Did similar amounts of water pass through all the materials? If not, what happened to it?

.....

.....

.....

.....

.....

Make bar graphs using the information gained from the tests.

Discuss the results.

Acknowledgement: *Working for the right balance* (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001

MOVING WATER CALCULATIONS ✎✎ Activity 67

1. If groundwater is moving at a rate of 15cm per year how many years might it be until it reaches a location of 1.5km away?

   .....

2. If groundwater is moving at a rate of 0.9m per month, will it reach a location 55.8 m away in:

   Exactly one year? ☐

   Less than one year? ☐

   Between one and two years? ☐

   After two years? ☐

Write below other moving water calculations. Ensure you have worked out the answer first then give them to a partner to calculate.

MOVING WATER EXPERIMENT (B) ✎✎ Activity 66B

AIM: To test whether the composition of soil determines its ability to absorb water and to allow water to move through it.

In a small group collect *three* cups: one filled with sand, one with clay* and one with topsoil, leaving 2.5cm of space at the top of the cups.

Using a thumbtack, punch the same number of holes in the bottom of each cup. Holding the soil-filled cups over a beaker, pour a quarter of a cup of water into the first sample.

Have a recorder in the group to record (1) the time when the water was poured and (2) the time when water drips from each cup.

Repeat the procedure for the other soil samples, always continuing to allow water to filter through the samples.

*NOTE: When using the clay sample, a 'spacer' of 6mm of sand is needed at the bottom of the cup, so that water does not have to be restricted by moving to the holes. To overcome this, the bottom of the paper or plastic cup can be cut out when using the clay sample.

Compare each time and rank the times in order from fastest to slowest. For example:

Soil Type	Water poured in at	Water dripped out at	Time (secs)
Sand			
Topsoil			
Clay			

MOVING WATER EXPERIMENT (C) ✎✎ Activity 66C

AIM: To test whether the porosity of soil varies with the composition of the soil.

Build on the previous activity by allowing the water to drip for another 10 minutes. This simulates **porosity.** Soil and rock have differing abilities to hold water, depending on how much empty space exists between the particles and how large the spaces are. Simulate the idea by pouring water onto sponges of varying coarseness, and how much each type of sponge can hold.

Measure and record the amount of water in each beaker. Then subtract the amount from the starting amount to determine the total amount of water held by each soil type.

Using the total amount of water held, rank or order the porosity of the soil types. For example:

Soil type	Amount retained
Sand	Cup (63mL) poured in, minus ..... that passed through the sample, equals ..... that in held in the soil
Topsoil	Cup (63mL) poured in, minus ..... that passed through the sample, equals ..... that is held in the soil
Clay	Cup (63mL) poured in, minus ..... that passed through the sample, equals ..... that is held in the soil

Acknowledgement: *Working for the right balance* (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001

MAKING A PUMP ✎✎ Activity 68

Use a pump from a soap dispenser and a beaker filled with a 10cm layer of gravel and sand.

In a group demonstrate how a well or bore works. Add 7.5cm of water to the gravel/sand layer and pump 'groundwater'.

Sketch your 'pump'.

Discuss what happens to the simulated 'watertable'. In your group talk about what happens when water is taken out of the ground. How does water get back into groundwater supply? Show the action of rainfall and how it affects the groundwater by adding more water, and simulating recharge.

Summarise your findings in sketches. Label each part.

Acknowledgement: *Working for the right balance* (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001

HOME CHEMICALS ✎✎ Activity 69

Complete a survey of household chemicals found at home or school. For example:

Dear Parent/Caregiver,

Please take a few moments to assist your child complete this survey of home chemicals. Many products have the potential to be hazardous and improper use and disposal may endanger our groundwater resources. This will be discussed in class and details shared with you.

We are trying to find out how many of these types of products we unknowingly might have in our homes and school. Please identify the products found in your home on the survey form. All information is only to be used for class investigation.

Cleaners	Used at home	Toiletries	Used at home	Garden Products	Used at home
Bleach		Nail polish		Fertilizer	
Ammonia		Nail polish Remover		Insecticide	
Floor polish		Hair spray		Rat poison	
Furniture polish		Hair colour		Weed killer	
Silver polish				Flea powder	
Window cleaner					
Oven cleaner					
Bathroom cleaner					

Acknowledgement: *Working for the right balance* (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001

ADDITIONAL INFORMATION

The following organizations may provide additional information about waterways and wetlands:

Water and Rivers Commission, Level 2 Hyatt Centre, 3 Plain St., East Perth, WA 6004. Telephone: (08) 9278 0300, Fax: (08) 9278 0301. www.wrc.wa.gov.au.
Ask the Waters and Rivers Commission who the local Rivercare Officers are and who the local coordinator for "Ribbons of Blue" is. At the time of printing it is **Denis Smith**, Esperance Senior High School.

LOCAL CONTACTS:

Agriculture Western Australia, Melijinup Road, Esperance, 9083 1111.
Talk to the local hydrologist.

Department of Conservation and Land Management, Dempster Street, Esperance, 9071 3733. Talk to the Recovery Catchment Officer.

Contact the Esperance Shire Library, 9071 0680, for details of the contacts for the following voluntary organizations:

Bird Observers Group

Esperance Coastcare group

Esperance Regional Forum

Esperance Wetland Group

Esperance Wildflower Society

Local Environmental Action Forum (LEAF)

Weed Action Group

USEFUL WEBSITES:

http://www.wrc.wa.gov.au/waterinf/telem/table.htm
- Waters and Rivers Commission site showing Lake Warden Catchment gauge statistics.

http://www.erin.gov.au
- Federal Environmental Resource Information network, useful for accessing a broad range of information.

http://www.landmonitor.wa.gov.au/
- Site showing salinity satellite mapping

http://www.salinity.org.au/
- State Salinity Council website

ADDITIONAL RESOURCES

Attached to this package are a number of additional resources that have been referred to in the Teacher's Notes:

- WATER FACTS Nos. 1, 2, 4, 6, 7, 8, 9, 10 & 15 (Waters & Rivers Commission)
- WEEDNOTE, No. 1/99 (Agriculture Western Australia)
- FARMNOTE, Nos. 08/2000 & 102/2000 (Agriculture Western Australia)
- DIEBACK – A preventable Plant Disease (The Tree Society)
- WATER ADVICE Nos. 1, 14 (Waters & Rivers Commission)
- WHEATBELT WONDERS UNDER THREAT (Department Conservation and Land Management)
- A WATERS HEALTH CHECK (Waterwatch)
- LANDCARE FOR WETLANDS (Waters & Rivers Commission)
- SALINTY – Flow chart (Midlands Education District)
- EXAMPLES OF WATER SALINTY LEVELS, (Agriculture Western Australia)
- FURTHER INFORMATION ABOUT SALINITY - Useful websites, (State Salinity Council)

The following packages/files* contain extremely useful additional material on issues covered in this package:

Kalgan and Beyond – Available through Agriculture Western Australia. A comprehensive package concentrating around the Kalgan River, but with useful sections on the South Coast and Sand Plain areas. Accessible to upper primary and lower secondary.

Resource File – Available through Water Corporation. Very useful range of activities and information relating to waterways and wetlands. Accessible to upper primary and lower secondary.

Ribbons of Blue – Available through Waters and Rivers Commission. Scientific approach to studying waterways and wetlands. Range of activities and information. Aimed at secondary students.

* Contact **Esperance Resource Centre**, Windich Street, Esperance (phone 9071 1474) to check the availability of the above resources.

REFERENCES

The following sources of information were used in the compilation of this package:

Anderton, J., *Ribbons of Blue,* Waterways Commission

Assessing the causes, impacts, costs and management of dryland salinity, occasional paper No. 20/98, revision number one, National Dryland Salinity Program

Chadwick, I. et al, *Exploring Wheatbelt Woodlands,* Department of Conservation and Land Management, 1994

Curriculum Framework, Curriculum Council, 1998

Donnelly, R., *From Sand to Ducks,* RGC Wetlands Centre, 1995

Farrelly, S., *Critter Catalogue"* Department of Environment & Natural Resources, South Australia

Hughes, D., *The Rabbit and Fox Resource Book*, Department of Agriculture, Fisheries and Forestry – Australia, Canberra, 1999

Massenbauer, T., *Lake Warden Recovery Farm Kit,* Department of Conservation and Land Management, Jan. 2000-11-21

Oates, N., *Managing Your Wetland: A practical guide for landholders,* Victorian Wetlands Trust inc., Department of Conservation & Natural Resources, March 1994

Pettigrew, C., Laing, P., *Wetlands Teacher's Kit,* National Parks & Wildlife Service of NSW, 1984

Rabbit Control and Rabbit Calicivirus Disease, Rabbit Calicivirus Program, 1997

Salinity, Natural Resource Management in WA, March 2000, State Salinity Council

Student Outcome Statements, Overview, Education Department of WA, 1998

The Ramsar Convention, Australian Nature Conservation Agency, Canberra

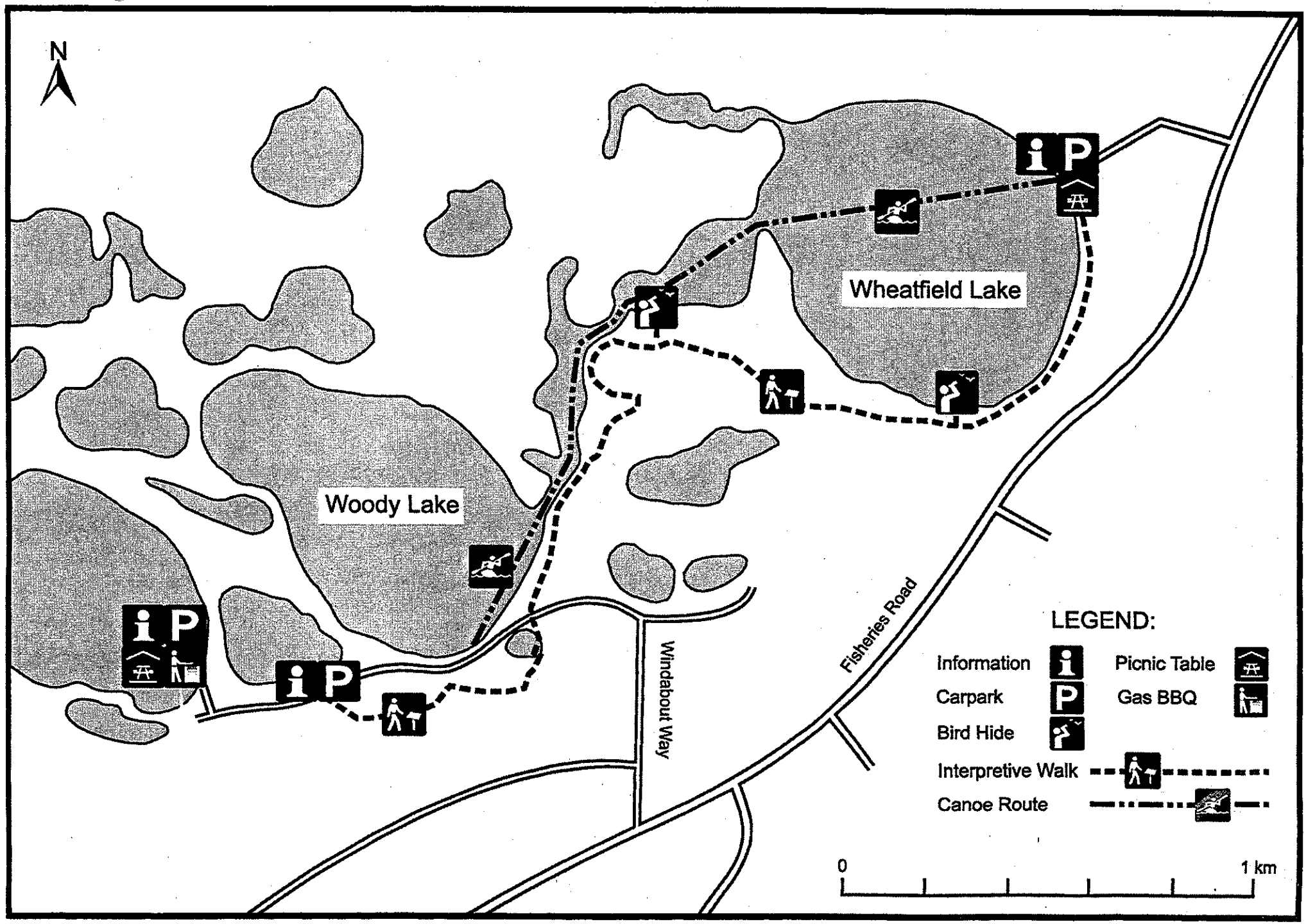
Water and Rivers Commission. Level 2 Hyatt Centre, 3 Plain St., East Perth, WA 6004:

- *Water facts* 2, September 1996
- *Watery fun and games*
- *Watertalk, wetlands*, September 1998

National Wetland Newsletter, *Wetlands Australia*, Australian Nature Conservation Agency, Canberra, March, 1996, Issue No. 3

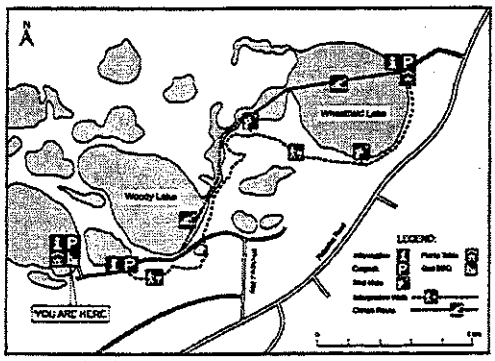
A Wetlands/Waterways Health Check, Waterwatch Australia (in WA – Ribbons of Blue)

Working for the right balance (from Educational Services, Primary Industries and resources SA) in ABCs of Groundwater by Centre for Groundwater Studies, Flinders University of SA, March 2001


N
Wheatfield Lake
Woody Lake
Windabout Way
Fisheries Road
LEGEND:
Information
Picnic Table
Carpark
Gas BBQ
Bird Hide
Interpretive Walk
Canoe Route
0
1 km

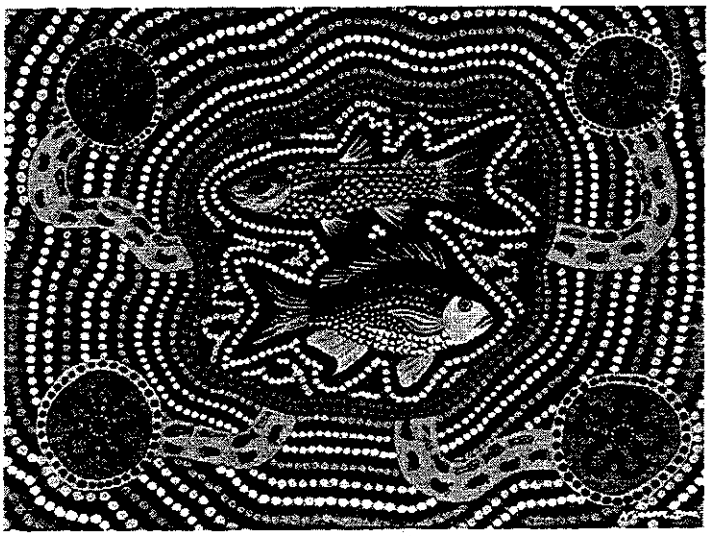
Welcome to the Lake Warden Wetland System

This important conservation area regularly supports thousands of waterbirds, mostly from November to April. The nature reserves within this system also protect a diverse community of other wetland animals and plants.



The wetlands were significant in the early development of Esperance, providing good grazing areas for stock. The Dempster brothers, who were the first Europeans to settle in the region in the 1860's, grazed sheep throughout much of the Esperance area. The remains of their woolshed are located within the reserve.

For countless generations the wetlands have been a traditional focus for the Esperance Nyoongar people for hunting, gathering, camping and social and ceremonial gatherings. This chain of wetlands was also a key route for Aboriginal people traveling between the desert and the sea.



Baingilerup Meming by Donna Beach (Nimon), direct descendant of the local Bullenbuk people of Esperance.

Things to see and do...

Picnicking: Picnic areas are provided for your use at Woody Lake and Wheatfield Lake.

Walking: Discover the diversity of wetland wildlife on the Kepwari Trail. The trail winds through fringing woodlands and sedgelands with views of the lake system and surrounding catchment (7 km or 3 hrs return).

Birdwatching: Hides are located on the Kepwari Trail to view waterbirds at close range.

Canoeing: A canoe route extends from the boat ramp on Woody Lake to the picnic area on the northeastern side of Wheatfield Lake.

Caring for the wetlands...

Protect wetland animals and plants: Please keep to formed roads and paths to help prevent erosion and restrict the spread of the Dieback fungus that is killing native plants.

Be wise: Leave this natural environment as you find it for all to enjoy. Please carry out all litter.

Be careful: Your safety and enjoyment in the Reserve are our concern but your responsibility.

Visit again: Bring your family and friends back to discover more of the wonders of these wetlands.

Further information can be obtained from your local CALM office in Esperance.

Department of Conservation and Land Management *Caring .... Naturally*

The world is watching you

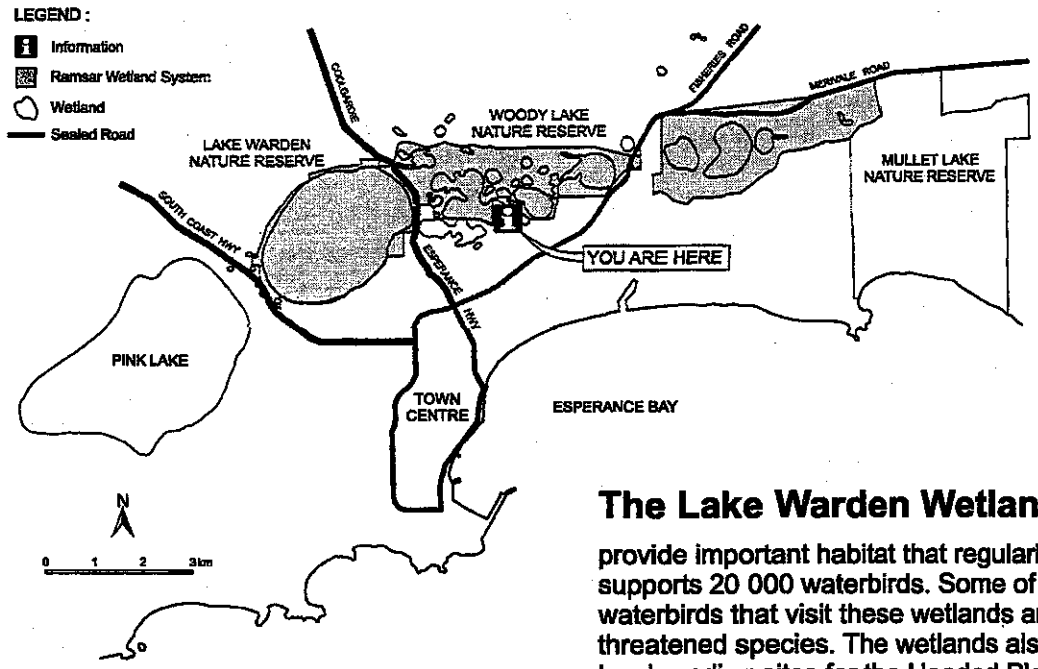
Tread lightly . . .

You are standing on the edge of a wetland of international significance.

Lake Warden, Woody Lake and Mullet Lake Nature Reserves protect a diverse mosaic of wetlands that form the Lake Warden Wetland System. It is one of only a few wetland areas in Western Australia recognised under the Ramsar Convention.

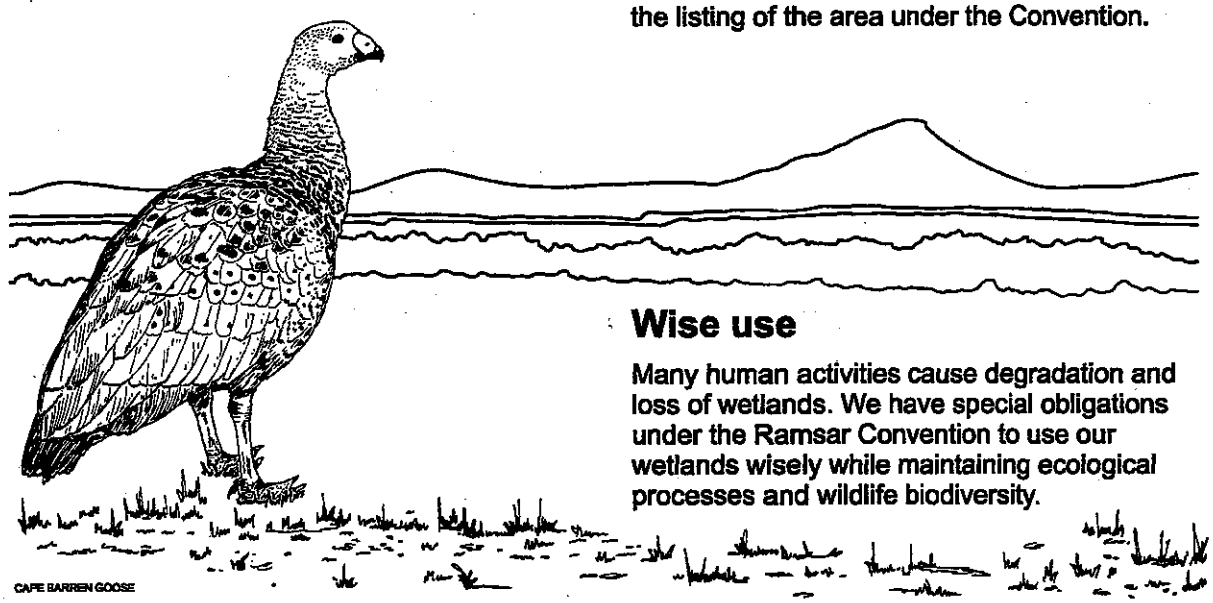
A treaty between nations

The Ramsar Convention aims to halt the worldwide loss of wetlands and to conserve, through wise use and management, those that remain. The Convention was established in 1971 in the small Iranian town of Ramsar. Presently there are over eighty countries that are partners in the conservation of wetlands under the Convention.



The Lake Warden Wetlands

provide important habitat that regularly supports 20 000 waterbirds. Some of the waterbirds that visit these wetlands are threatened species. The wetlands also contain key breeding sites for the Hooded Plover and Banded Stilt. It is these features that ensured the listing of the area under the Convention.



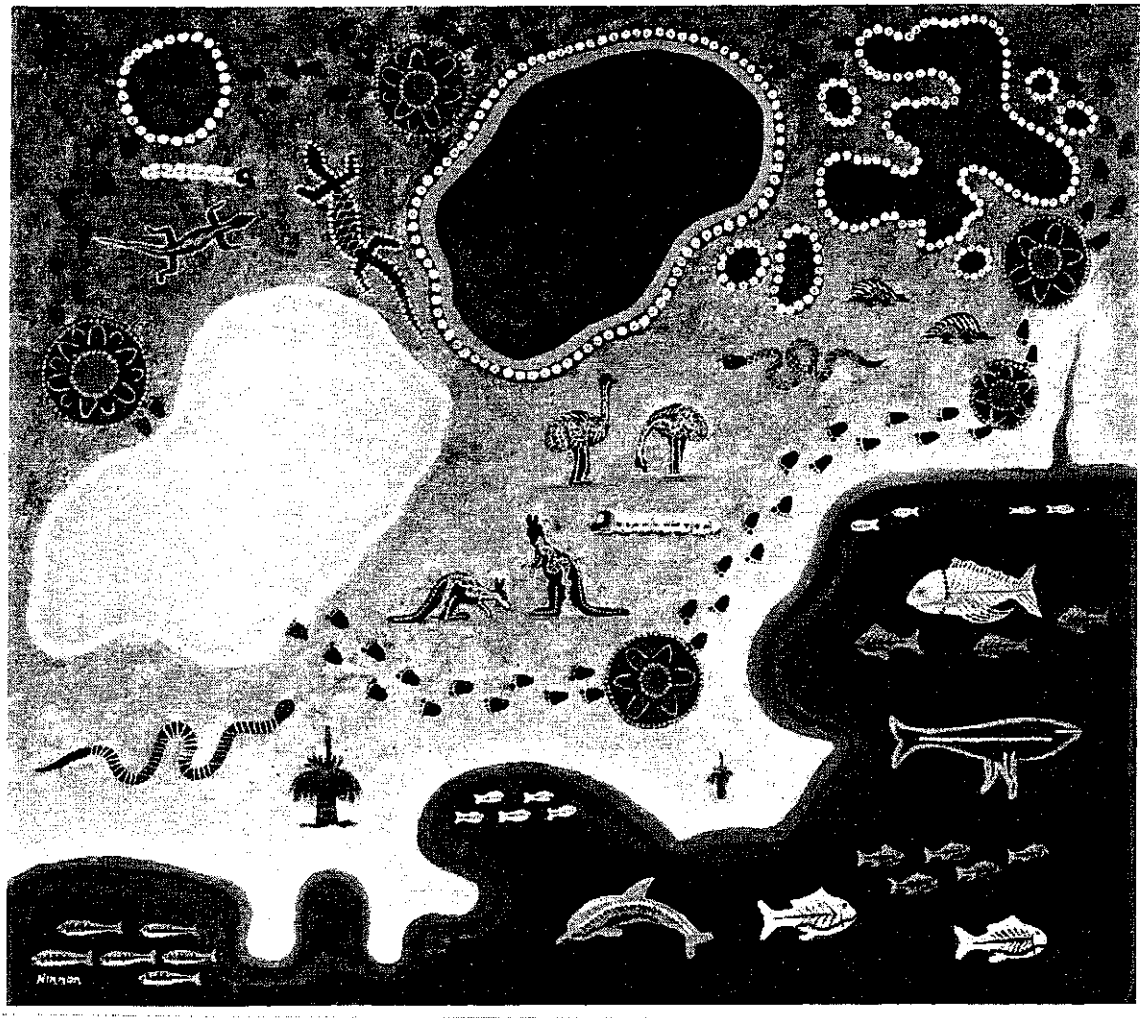
Wise use

Many human activities cause degradation and loss of wetlands. We have special obligations under the Ramsar Convention to use our wetlands wisely while maintaining ecological processes and wildlife biodiversity.

Department of Conservation and Land Management *Caring .... Naturally*

An Ancient History

In the Dreaming, the ancient time of creation, the earth was a featureless ball without mountains, rivers or seas. Beneath the earth slept a large black snake, the Norrun. The Norrun rose and slowly pushed his way through the soft earth. As he moved from the north, he formed hills, plains and gullies throughout this region. Where he slept his weight created hollows in the landscape that filled when it rained to form the lakes.



Tjaltjraak Mooraak walkabout at Kepa Kurl by Donna Beach (Ninnon), direct descendant of the Bullenbuk people of Esperance.

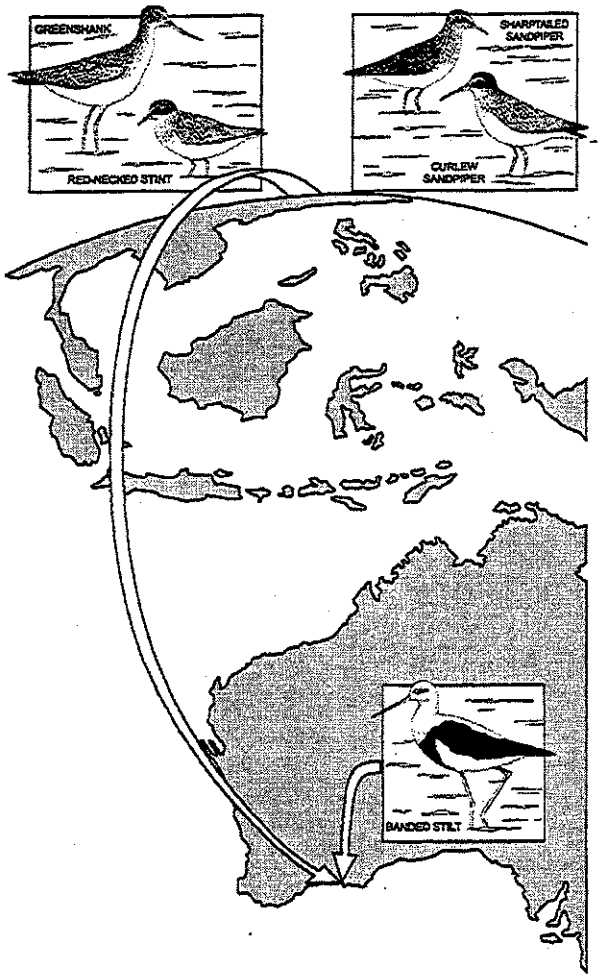
This is the Dreaming story of the wetlands that circle the town of Esperance. The Esperance Nyoongar people have maintained their strong cultural and spiritual connection to these wetlands, caring for their country and their cultural traditions as directed by their traditional elders. Despite dramatic changes to the local landscape since European settlement, this chain of wetlands remains as evidence of the *Norrun's* journey.

To the moon and back

International migrants

Approach the water's edge quietly and you may be lucky enough to spot Red-necked Stint wading in the shallows. This tiny bird, weighing little more than a box of matches, is one of several migratory species that make the long journey of about 12 000 km from the Arctic to Australasia each summer.

In their lifetimes these remarkable birds may cover a distance that is equivalent to a return journey to the moon.



Australian visitors

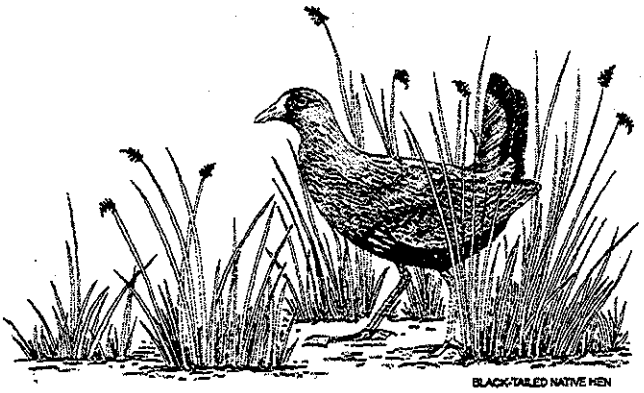
Look for the distinctive Banded Stilt wading about on long, slender legs. These birds breed on low islands in large inland salt lakes. As summer approaches and the lakes dry they disperse to coastal wetlands where you may see them feeding in flocks of thousands.

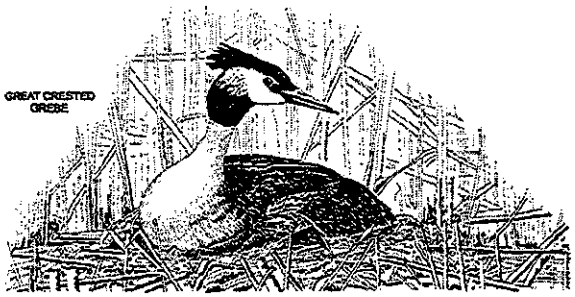
Nomads

Darting swiftly amongst the fringing sedges you may see a Black-tailed Native Hen, an irregular visitor to these wetlands. This nomad is a strong flier and follows the rain to suitable breeding grounds.

Permanent residents

Although the Great Crested Grebe is here year round you may not catch a glimpse of this elusive bird until spring when it is busy gathering plants and mud for a nest amongst the fringing Paperbark trees.


BLACK-TAILED NATIVE HEN



Coastal wetlands are a valuable resource

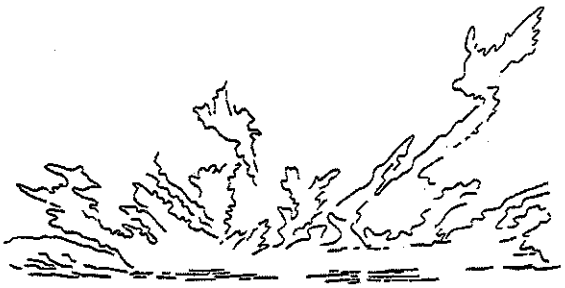
After Antarctica, Australia is the second driest continent on earth. Therefore our coastal wetlands play a vital role in supporting a diverse waterbird fauna and other wetland life.

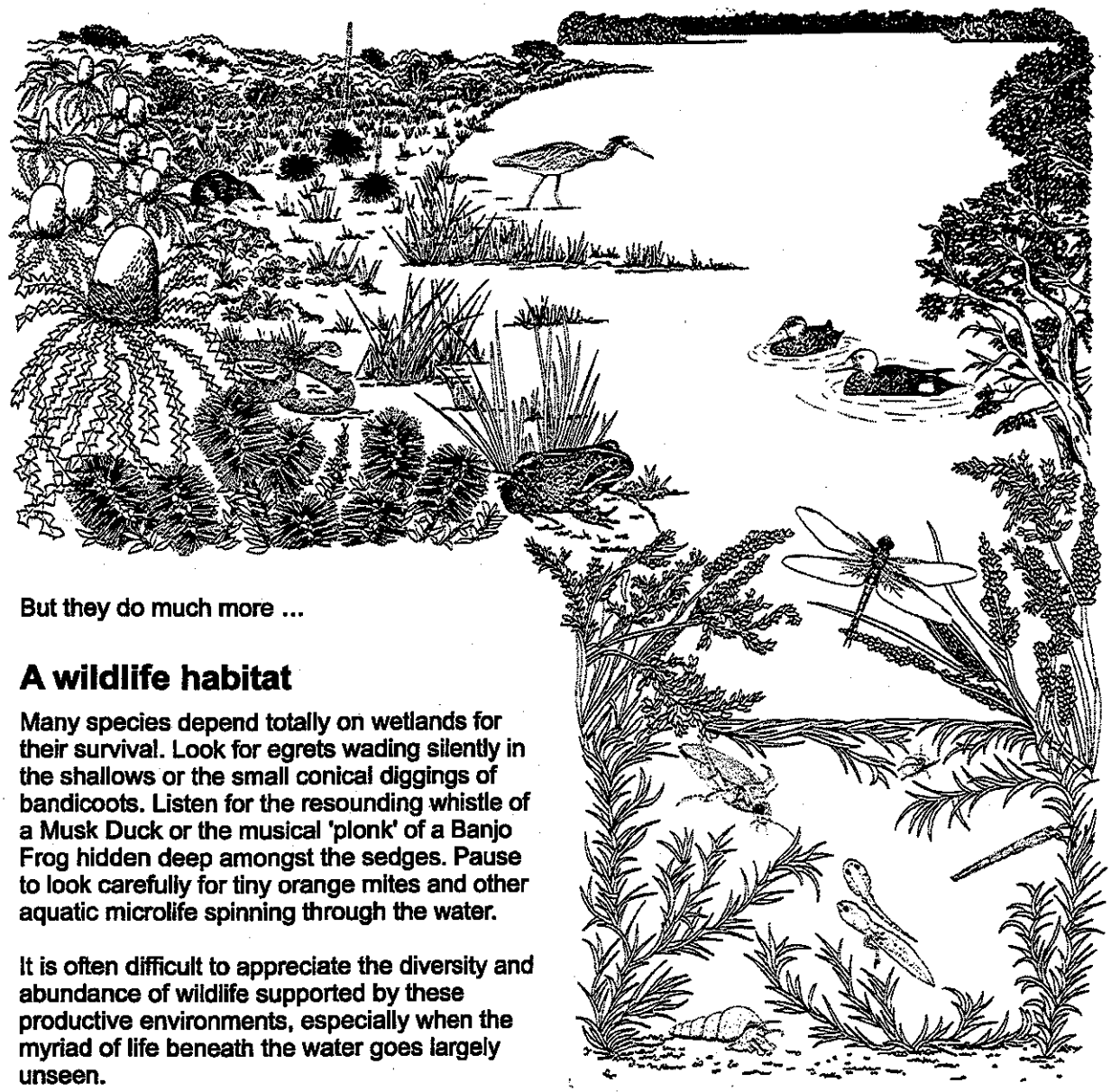
Department of Conservation and Land Management *Caring .... Naturally*

Wetlands for the future

A place of inspiration

Have you ever stopped to listen to a babbling stream, travelled far just to see a waterfall or sat quietly, overlooking the shimmering expanse of a tranquil lake? We are naturally drawn to water. Our wetlands are valued for their scenic beauty and popularity as recreational sites.





But they do much more ...

A wildlife habitat

Many species depend totally on wetlands for their survival. Look for egrets wading silently in the shallows or the small conical diggings of bandicoots. Listen for the resounding whistle of a Musk Duck or the musical 'plonk' of a Banjo Frog hidden deep amongst the sedges. Pause to look carefully for tiny orange mites and other aquatic microlife spinning through the water.

It is often difficult to appreciate the diversity and abundance of wildlife supported by these productive environments, especially when the myriad of life beneath the water goes largely unseen.

Nature's filter

Wetlands help to purify water by acting like 'kidneys' along waterways. Saltwater Paperbarks, sedges and other fringing plants trap sediments and nutrients. Wetlands also slow destructive floodwaters and act as natural firebreaks.

Ours to conserve

Since colonisation in the 1780's, over half of Australia's wetlands have been lost due mainly to urban development and agriculture. Those that remain are a precious resource we should endeavour to understand, appreciate and protect.

Department of Conservation and Land Management *Caring .... Naturally*

A link in the chain

Pink Lake is just one in a chain of wetlands that circle the town of Esperance.

Lake Warden, Woody Lake and Mullet Lake Nature Reserves protect a diverse mosaic of wetlands that form the Lake Warden Wetland System. These wetlands are recognised internationally for their importance as a habitat that regularly supports 20 000 waterbirds, including several threatened species.

During your visit to Esperance take the opportunity to discover and enjoy the wonder of our local wetlands.

A wetland walk, bird hides, picnic areas and information shelters have been provided at Woody Lake Nature Reserve off Windabout Way.

Further information on activities available within the wetland reserves can be obtained from your local CALM office in Esperance.