

FOREWORD

Access to safe drinking water and hygienic sanitation facilities are enshrined in our Constitution as basic human rights. A failure to secure these basic human rights can mean the difference between life and death for the poorest of our communities. Ensuring safe drinking water is not simply a question of providing water infrastructure. Water and sanitation without the right health and hygiene practices may result in water that is not safe to drink, and sanitation that is a threat to our health. 'Water services' are therefore about providing water and sanitation services, which address the health of our communities as well as tackling the cycle of poverty and disease.

Central to safe drinking water, improved health, and poverty reduction is better-managed water, where our water resources are developed, protected, used, conserved and managed sustainably. A holistic approach is needed to avert the vicious cycle of water-related diseases, ill-health and poverty. Fundamental to this approach is developing a vision and understanding in society of sustainable water services and sustainable water resources. This vision of sustainability requires ensuring that our society is empowered with information, knowledge and skills to use water efficiently and wisely, to practice good hygiene habits for healthy living, and to protect our water resources so that they do not become contaminated.

A major initiative towards achieving this vision is the 2020 Vision for Water and Sanitation Education Programme (2020 VFWSEP), which targets learners at schools. This is a collaborative programme between the Department of Water Affairs and Forestry (DWAF) and the Department of Education (DoE). It encourages learners to participate in water resource management, to promote good health and hygiene practices and to identify problems related to water and sanitation in their schools and communities.

It is particularly significant that through the 2020 VFWSEP, water and sanitation issues have now become integrated into the school curriculum, thus ensuring continuity and sustainability of this initiative and ensuring that our children will now learn about these issues from an early stage. We also hope that this programme will stimulate the interest of learners to future career opportunities in the water sector thus addressing the skills shortage in this sector.

The integration of water and sanitation in the school curriculum necessitated the development of curriculum aligned educational resource materials for educators. Consequently, the Department of Water Affairs and Forestry in collaboration with other sector partners developed these resource materials for grades R – 9, and have been tested by 90 educators from the 9 provinces. I am confident that these materials provide excellent inputs for learners and communities about water resource management, water supply and sanitation related issues.

I would like to encourage all learners and educators to become involved in the 2020 Vision for water and Sanitation Education Programme and thereby become involved in critically important issues related to water supply, sanitation and water resource management. These are issues that have serious impacts in terms of health and well being for many communities and your involvement can make a significant difference to the quality of people's lives.

I urge all schools to identify water-and-sanitation related problems such as water leaks, blocked toilets, polluted water, and so on, and to bring these problems to the attention of their local municipalities or the Department of Water Affairs and Forestry in their respective areas.

In order to ensure continuity from Grade R to Grade 12, the Department of Water Affairs and Forestry will also develop educational resource materials for the Further Education and Training (FET) Band.

I would like to express my sincere appreciation to the team who developed the materials and to the educators who tested the resource materials. I have no doubt that your efforts will bear fruit, and instill principles of good water resource management and good hygiene, and ensure that our learners become ambassadors for sustainable water and sanitation services. This will mean better health, longer lives and greater dignity for the poorest of our people. Jointly we will work towards a better education and a better life for all.

Mrs L. Hendricks
MINISTER – DEPARTMENT of WATER AFFAIRS and FORESTRY

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INTRODUCTION

The purpose of this guide is to help educators to educate children to develop a healthy, mature and responsible attitude towards water and sanitation resource management and basic hygiene practices. The guide also aims to encourage the development of awareness to infections, so that communicable diseases do not infect people. The knowledge and skills gained from this resource pack, combined with values taught in the home, will enable and empower young children to lead healthy lives and become the ambassadors of good hygiene and water conservation. The content and teaching / learning activities are intended to be developmentally appropriate and sequential. It is appropriate that water conservation and sanitation information be infused into the established school curricula areas to ensure a comprehensive approach to health education.

This resource material, therefore, assists with the infusion mentioned above into the existing school curricula.

BACKGROUND INFORMATION

In 1996 the Department of Water Affairs and Forestry Sub – Directorate for Community Development and Environmental Education commissioned the development of the first Resource Pack as part of its commitment to support Environmental Education and Water Conservation linking directly to Outcomes Based Education (OBE). Its ultimate goal was to integrate the 2020 Vision for Water Education and Sanitation Programme into the school curriculum and community development training and capacity building programmes.

However, with the advent of the Department of Education's National Curriculum Statement, it became imperative that the second edition be developed in order to make it easy for the educators to integrate water and sanitation into the school curriculum.

Yet again, the Department of Water Affairs and Forestry, in its pursuit to support all programmes that serve to improve the immediate environment of young children invite all its partners including learners to assist in taking up the challenge of ensuring a better environment through active participation in Environmental Education for sustainable development, so that by the year 2020 the state of the said environment, water conservation and sanitation in South Africa is positively sustained.

ACRONYMS

AC -	Arts and Culture
AL -	English – Home Language
AS -	Assessment Standards
CO -	Critical Outcomes
DO -	Developmental Outcomes
EMS -	Economic and Management Science
HL -	Home Language
IAP -	Invasive Alien Plants
LA -	Learning Area
LO -	Learning Outcomes
LO -	Life Orientation
MATHS -	Mathematics
NS -	Natural Sciences
SS -	Social Sciences
Tech -	Technology

SUMMARY OF MODULES

Topics	LO's (*Main and #integration)	Environmental learning focus
1. The origin of water	*SS(G) LO1: AS3 #HL LO3: AS4 LO5 AS6	Learners will explore groundwater as a source of water.
2 Use water wisely	*SS(G) LO1: AS4,5 #MathsLO1: AS5 LO4: AS2 LO5: AS4	Learners practice interpreting data on water usage by various sectors of the South African society with an aim of making recommendations to the government with regard to efficient use of water and management of water as a scarce resource.
3. Do not waste water	*NS LO3: AS2 #HL LO4: AS1 LO3: AS1	In this activity, learners will explore rainwater harvesting as an affordable way to supply water to the poor. They acquire knowledge about different types of rainwater tanks.
4. The Aquatrap	*Tech LO1 AS3 #NS LO1 AS4	The Aquatrap is a dish device made from old car tyres, which is used to retain water and soil under the surface of the garden. This device saves water and feeds the root system of plants or vegetables to promote growth.
5.Effects of water pollution	* NS : LO1 : AS:2 , 3: SS(G) LO 1: AS 5 AL: LO 5: AS1, 2,3	This is a water quality study which will audit the quality of the water and catchment areas of different water sources. After making their findings, learners will have to evaluate factors contributing to the state of the water quality and therefore take action to address the issue.
6. Lack of clean drinking water	*LO LO1: AS2 #AL LO5:AS1,2,3	In this activity learners will explore strategies to alleviate problems of access to safe drinking water.
7.Water quality Testing	*NS : LO1; AS2,3 LO 3: AS 2 # SS(G) LO 1: AS 5: AL LO 5 :AS1,2,3 LO 2: AS: 4	This is a water quality study, which will test the quality of the water from the tap or river depending on the environment of the learners. The water we drink, use for cooking and bathing, watering the garden etc. needs to be of a particular quality to avoid health hazards and the destruction of the environment. Clean water or rather good quality water enhances the quality of life.
8. Health issues affecting the community	*NS LO3: AS2 # HL LO 4: AS1, 4,6	This is a creative writing exercise. It is an example of a "Raise the Red Flag" exercise .The purpose of this one in particular is not only to inform the community, through media publications, on matters of health and hygiene that affect them, but also the powers that be. Another aim is to expose the culprit that has deposited chemical matter into the river.
9. Assessment of streams	*NS LO1: AS2 #Maths: LO5:AS2	In this activity learners will collect organisms found in a stream and evaluate the quality of water on the basis of the organisms found in water.
10. Supporting water, sanitation and integrated development	*HL LO3 :AS5 # LO LO1:AS5	In this activity learners will exploit various types of toilets systems that the government installs in rural areas.

Topics	LO's (*Main and #integration)	Environmental learning focus
11. Develop an environmental health programme	*LO : LO1 :AS 2 : NS LO3 AS2 #AL: LO 1: AS 3, 4 HL LO 2 : AS 4 : LO 5: AS 2	In this activity, learners will listen to a presentation and use that information to design an environmental health programme that will address health problems identified in different settings. Learners in this grade will be able to assume greater responsibility making sure that the actions they agreed upon are included in the School Environmental Policy and in developing the management plans while the educator will ensure that the whole programme is part of the implementation of the curriculum. Class groups or environmental clubs in a school can prepare this activity for implementation.
12. Spot and keep away from danger	*SS(G) LO1: AS3,4 Tech LO1: AS6 LO3: AS2 # HL LO3: AS10	In this activity learners will investigate the dangers of water and explore safety ways of playing in water.
13. Why IAP's are such a problem?	HL LO3:AS2,10	In this activity learners will read and acquire knowledge on why IAP's are such a problem.
14. What damage do IAP's do?	HL LO3:AS1,4 #NS LO2: AS 4	In this activity learners will read and acquire knowledge on why IAP's threaten our environment.
15. Careers in Forestry	*LO:LO5:AS1&2 #HL: LO3: AS1	In this activity learners will acquire knowledge about foresters and forestry specialists.

MESSAGE AND GUIDANCE TO THE TEACHER ON INVASIVE ALIEN PLANTS

Introduction to the World of Invasive Alien Plants

Invasive alien plants have a damaging impact on our environment. It is causing billions of Rands of damage to South Africa's economy every year, and are the single biggest threat to our water and biological biodiversity. They intensify the impact of fires and floods and increase soil erosion. Of the estimated 9000 plants introduced to this country, 198 are currently classified as being invasive. It is estimated that these plants cover 10.1 million hectares or about 7 % of the country and the problem is growing at an exponential rate.

The inclusion of invasive alien plant content into the resource is to provide you as the educator with relevant information about the topic and to assist you in educating learners and others about this very serious environmental threat to especially our water sources. The lessons included will also assist you in taking action to adequately respond to the problem.

The lessons on invasive alien plants were developed and implemented by a diverse group of educators during a research project which focused on the development of curriculum aligned invasive alien plant resource materials. The educators were constituted from the three phases (GET band) and supported by curriculum advisors from the Western Cape (EMDC) South Metropole. Sixteen schools with 32 educators were involved in the project. The Working for Water Programme acknowledge the following schools for their contributions:

Primary schools: Hyacinth, Siyazingisa, Huguenot, Levana, St Mary's, Westville, Qingqa Mntwana, Edendale.

Senior Schools: Glendale, Grassdale, Oscar Mpetha, Cedar, Sopumelela, I.D. Mkize, Goodhope Campus, Grassy Park.

For additional information on invasive alien plants you can contact the Working for Water Programme offices. Toll free no. 0800 005376

HOW TO USE THIS GUIDE:

SCOPE AND SEQUENCE:

The scope of this resource pack includes:

- ☐ Water is life
- ☐ Water use efficiency
- ☐ Water quality management
- ☐ Sanitation, health and hygiene
- ☐ Water safety
- ☐ Forestry and invasive alien plants

The sequence of the activities contained in this Resource Pack is graded for **Grade 9** and is aligned to the National Curriculum Statements (NCS).

LAYOUT OF EACH TOPIC:

At the beginning of each topic, learning area/s, learning outcomes and assessment standards attained in that chapter are outlined and are further interpreted in the activities that the learners will achieve in that lesson.

Mostly, each chapter begins with a tuning in activity, which serves to identify existing knowledge or gaps pertaining to the topic and to introduce the learners to the activities of the whole chapter. Please use results of these activities to inform the development of the structure of the main topic.

Finally, a suggestion of what can be assessed during the learning and teaching process has been made and linked to the learning outcomes and assessment standards in that chapter. Other aspects pertaining to assessment have been left entirely to the educators because developers of this module indicate that the choice of what assessment strategies to use is a subjective one. It is unique to each school, grade and depends on the educator's professional judgment as well as availability of space and resources.

Same applies to time allocation and other aspects such as linking the lessons to the previous or forthcoming lessons. Although there are some indications here and there, those aspects can best be catered for in the development of lesson plans, which will again be unique to different circumstances.

TEACHING / LEARNING STRATEGIES:

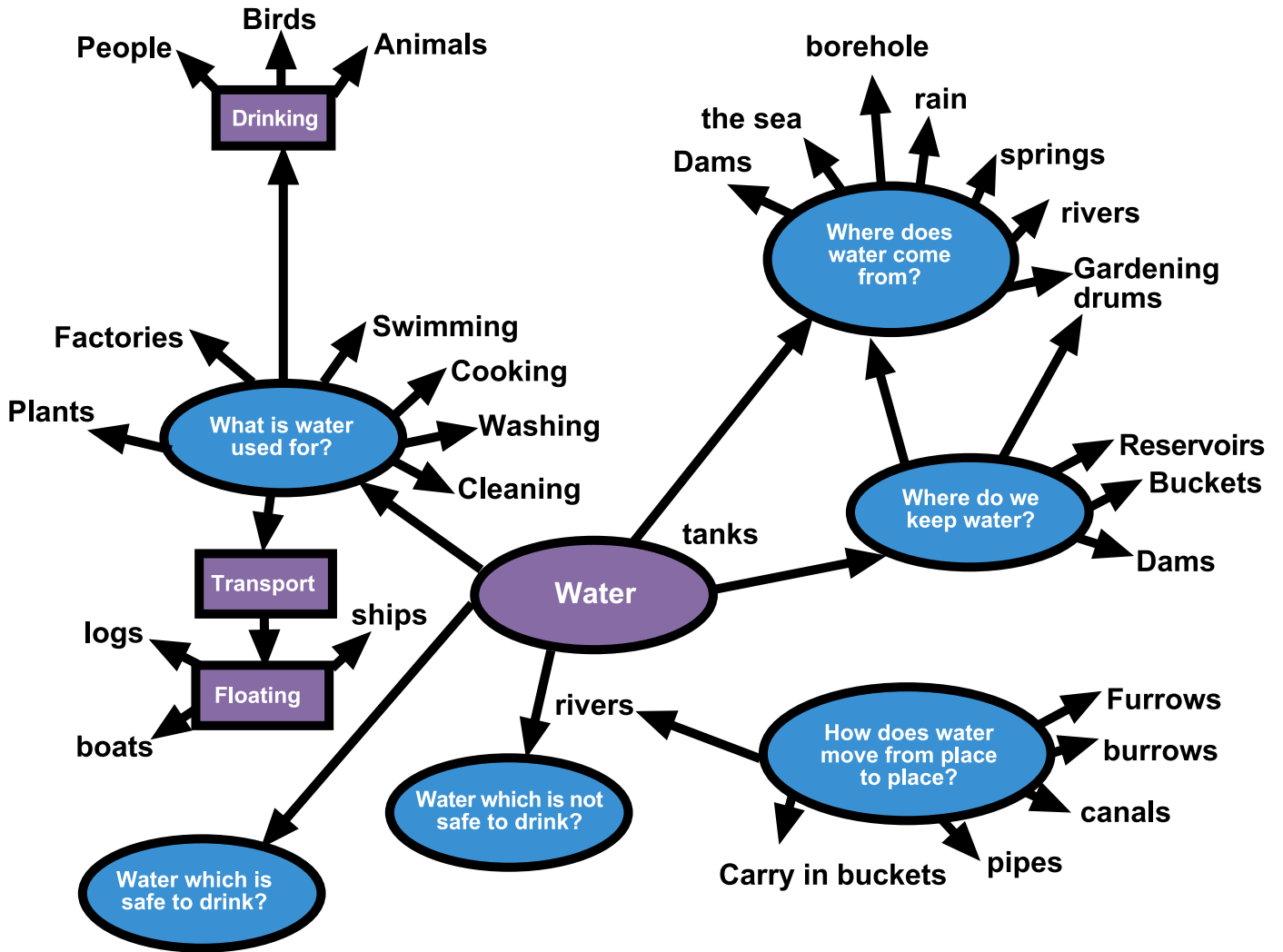
The teaching / learning suggestions in this guide are meant to serve as guidelines, not requirements. In many cases there are many suggestions for activities that will accomplish the same aspects of the outcome.

It is, therefore, not intended that you use all the given strategies. Rather, one or more of the teaching/ learning strategies will be appropriate for a particular grade or situation.

The teaching/learning strategies used in this guide use the current Outcomes Based Education (OBE) methodologies such as:

BRAINSTORMING:

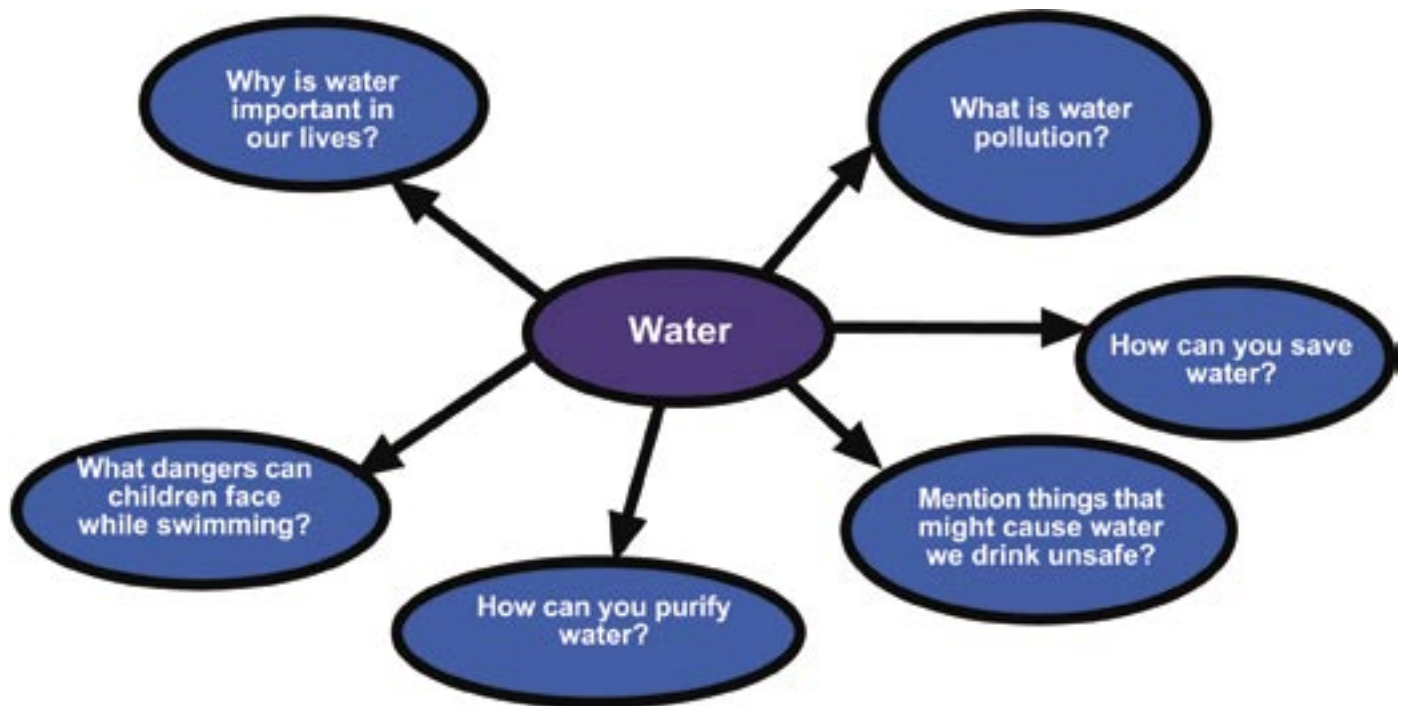
Brainstorming is used to begin discussions or generate a variety of ideas. One of the exemplars of brainstorming methodology is the use of mind / concept map shown below.



CLASS DISCUSSION:

It is used to begin a lesson, to review or to clarify information. For instance, you can use an incomplete mind map to begin a lesson an example of which is shown below.

It is important to realize that there is not only one-way to do mind maps. Different learners will know different things and you should accept these, if they are correct, even if they are not in your mind map.



GROUP DISCUSSION:

This strategy can be used to produce information or to analyse ideas while encouraging interaction among learners in line with group dynamics principles.

ROLE PLAY:

Role-play actively involves learners in learning concepts or practising behaviours in non-threatening situations by acting out an imaginary situation.

HANDS-ON ACTIVITIES:

Use of worksheets, puzzles, and games or other types of written materials to test or review learner's knowledge of a particular topic are especially effective for foundation phase grades.

ASSESSMENT:

In this guide assessment is integrated into the learning and teaching process.

An integrated approach, which assesses both the process of learning and the product of learning, is used here in order to assess holistic learning. This involves:

- ▣ Assessing learners against outcomes and assessment standards, whilst they are working on tasks and activities.
- ▣ Assess learner's investigative, problem solving and co-operative skills.
- ▣ Assessing at the end of learning cycles. This could be a product such as a project or a summative assessment.

**WATER IS
LIFE**

1. THE ORIGIN OF WATER

MAIN LEARNING AREAS**SS (G) LO1: GEOGRAPHICAL ENQUIRY**

The learners will be able to use enquiry skills to investigate geographical and environmental concepts and processes.

AS3: Analyses and reaches conclusions about information from sources such as photos, maps and atlas, graphs and statistics {works with sources}.

INTEGRATION WITH OTHER LEARNING AREAS**HL LO3 READING AND VIEWING**

The learner will be able to read and view for information and respond critically to the aesthetic, cultural and emotional values in texts.

AS4: Shows understanding of a wide range of texts: discusses different points of view.

HL: LO5 THINKING AND REASONING

The learner will be able to use the language to think and reason, as well as to access, process and use information for learning.

AS6: Uses language to reflect: reflects on and evaluates the quality and accuracy of information in own work and that of others.

ACTIVITY

In this activity learners will be able to:

- Describe different processes from the data source.
- Interpret the information from the graph through text.
- Draw a bar graph to represent the information.
- Design a poster that will communicate the information about the ground water and global water distribution.

ACTIVITY 1A: -The Water Cycle**Background**

The Earth's water is always in circulation. It has been recycled for the past 3 billion years. This process is called the water cycle. Although the balance of water on Earth remains fairly constant over time, individual water molecules can come and go in a hurry. The water in the apple you ate yesterday may have fallen as rain half-way around the world last year or could have been used 100 million years ago by Mama Dinosaur to give her baby a bath.

GUIDELINES FOR THIS ACTIVITY

In this grade they translate the schematic diagram into words. You may encourage the learners to first find out what each of the processes mean so as to give a precise description of the water cycle.

Learners are expected to engage in this exercise and respond to the following task about the water cycle:

- Where do YOU think the water cycle begins?
- To explore the water cycle, study the diagram below and give a description of how the water cycle occurs.
- Choose a topic from the diagram and find out more about it; the role it plays in the water cycle. Make sure that you do not choose the same topics.

NB: These are tricky questions since learners may begin from any process that influences the water cycle. You need to be flexible and check whether learners have mentioned all the relevant processes and whether there is any flow in those processes. The following could be their response:

Sun heat the surface of the earth → water evaporates vapour - back to the atmosphere → vapour trapped, into clouds → condensation → small drops of water → fall into the earth as rain → infiltration and surface runoff → water stored as groundwater and some run in rivers to the dams oceans and ponds process starts again.



ACTIVITY 1B: Water in the ground is part of the water cycle

In this activity learners will be able to:

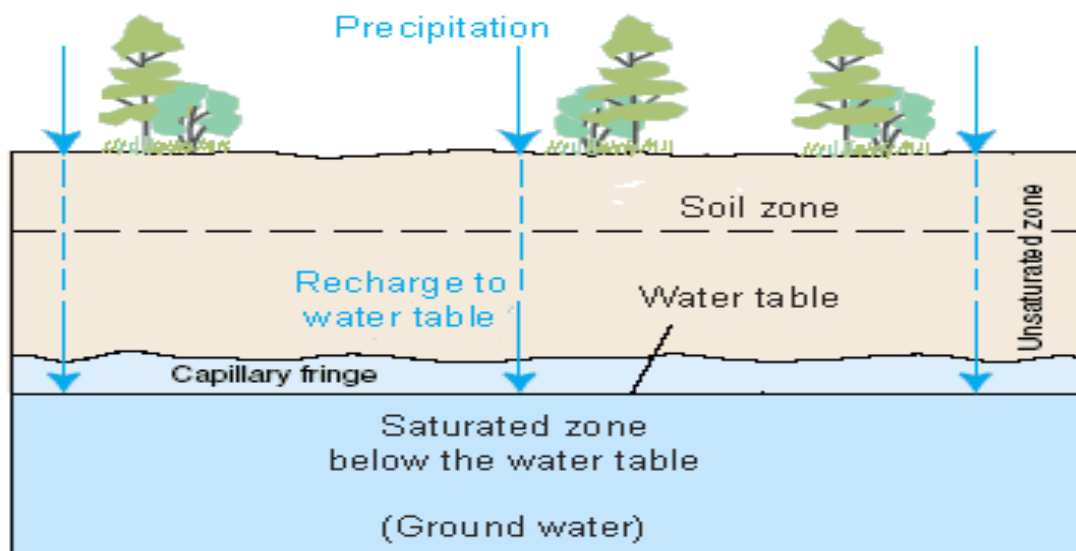
- Explore groundwater as the source of water.
- Observe different layers of groundwater .
- Explore the percentage distribution of water on Earth.

Background Information

Large amounts of water are stored in the ground. The water is still moving, possibly very slowly, and it is still part of the water cycle. Most of the water in the ground comes from precipitation that infiltrates downward from the land surface. The upper layer of the soil is the unsaturated zone, where water is present in varying amounts that change over time, but does not saturate the soil. Below this layer is the saturated zone, where all of the pores, cracks, and spaces between rock particles are saturated with water. The term groundwater is used to describe this area. Another term for groundwater is “aquifer,” although this term is usually used to describe water-bearing formations capable of yielding enough water to supply peoples’ uses. Aquifers are a huge storehouse of Earth’s water and people all over the world depend on ground water in their daily lives.

What to do?

You need to first take learners through the profile of the soil. Do you remember the soil profile? If not, refresh your memory by studying this profile.



You may take learners to a place where these layers of soil are shown, but they might not see up to the saturated zone. Observing those layers will enable the learners to master where the water table would be and thereby understand the source where groundwater is found.

Let learners engage in the following activity:

1. Look at the following schematic diagram representing groundwater.
2. Study it carefully.
3. Take the learners to a nearby place where some features of the groundwater are shown.
4. They will need to identify the different layers of the soil and draw a sketch of what they see in that environment.
5. Those learners that stay near the sea/ocean may make their own groundwater by digging down until water is shown on the surface of the soil.

In addition learners are required to answer the following quiz:

1. Where does groundwater come from? Mention the processes that are involved in the formation of the groundwater.
2. Describe how groundwater forms part of the water cycle.

This quiz will require learners to:

- (a) Master the concept of water infiltration/seepage, and soil porosity.
- (b) Know groundwater discharge leads to the formation of spring, freshwater storage and then heat from the sun evaporates water to the atmosphere to clouds, condensation and small drops of water.

ASSESSMENT

CATERGORIES	Not Achieved (1% - 35%) Level 1	Partially Achieved (36% - 39%) Level 2	Achieved (40% - 69%) Level 3	Outstanding/ Excellent Achievement (70% - 100%) Level 4
Knowledge / Understanding	The Learner:			
• Knowledge of facts and terms	• Demonstrates no or insufficient knowledge of facts and terms	• Demonstrates limited knowledge of facts and terms	• Demonstrates expected knowledge of facts and terms	• Demonstrates thorough knowledge of facts and terms
• Understanding of concepts, principles, and theories	• Demonstrates no or insufficient understanding of concepts, principles, and theories	Demonstrates limited understanding of concepts, principles, and theories	Demonstrates expected understanding of concepts, principles, and theories	Demonstrates thorough understanding of concepts, principles, and theories

WATER USE EFFICIENCY

2. USE WATER WISELY

MAIN LEARNING AREA

SS (G): LO1 GEOGRAPHICAL ENQUIRY

The learner will be able to use enquiry skills to investigate geographical and environmental concepts and processes.

AS4: Analyses and reaches conclusions about information from sources such as photos, maps and atlases, graphs and statistics [works with sources].

AS5: Observes and records information in the field [works with sources].

INTEGRATION WITH OTHER LEARNING AREAS

MATHS LO1: NUMBERS, OPERATIONS AND RELATIONSHIPS

The learner will be able to recognise, describe and represent numbers and their relationships, and to count, estimate, calculate and check with competence and confidence in solving problems.

AS5: Estimates and calculates by selecting and using operations appropriate to solving problems and judging the reasonableness of results (including measurement problems that involve rational approximations of irrational numbers.)

MATHS LO4 MEASUREMENT

The learner will be able to use appropriate measuring units, instruments and formulae in a variety of contexts.

AS2: Solve problems- including problems in contexts that may be used to develop awareness of human rights, social, economic, cultural and environmental issues – involving known geometric figures and solids in a range of measurement context by:

- Measuring precisely and selecting measuring instruments appropriate to the problem.
- Estimating and calculating with precision.

MATHS LO5: DATA HANDLING

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.

AS4: Draws a variety of graphs by hand/technology to display and interpret data including:

- Bar graph and double bar graphs.
- Pie charts.

ACTIVITY

In this activity learners will:

- Investigate how much it costs to produce clean water.
- Discover how to conserve water.
- Suggest ways of conserving water.

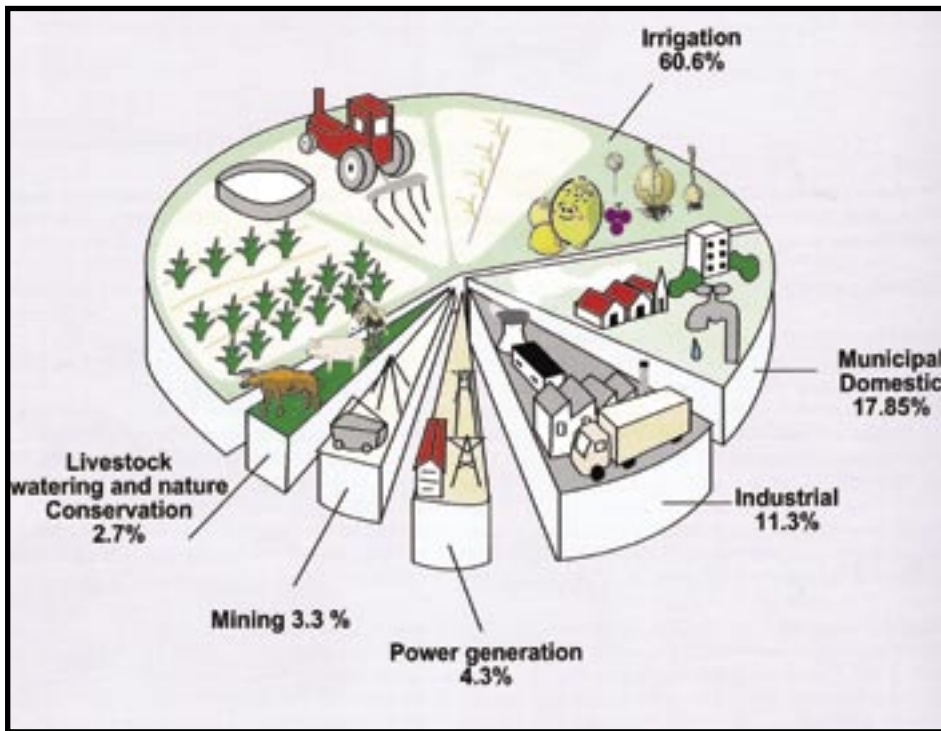
Background information

It cost a lot of money to produce clean water. Enough water has to be used to ensure good hygiene and sanitation. Care should, be taken however, that it is not wasted unnecessary. Water is a scarce and precious resource. We need to conserve it for the generations to come. This involves ensuring that we use it sparingly, by lessening the amount of water that goes down the drain each day. In this activity learners are engaged in performing water quantity audit. They measure the amount of water that different companies use. Learners are taught to always remember that we need clean water for our health and that water conservation is not about people drinking or using less water, but challenge of finding problems and of working out ways to reduce needless waste so that there can be more clean water to go around.

WHAT TO DO

- Ask learners to work as a group for this activity.
- The following pie graph represents the use of water by different sectors.

ACTIVITY 2A: USE OF WATER BY DIFFERENT SECTORS



Ask learners to:

- Conduct an audit of how much water is being used by certain companies.
- Groups should choose the companies they are interested to audit from the ones mentioned in the pie chart.
- Learners must make sure that they choose the company which is accessible to them.
- This activity may be done in two ways (a) visiting the identified company. or (b) requesting invoices with water bills.
- Learners must prepare their water use record sheet as follows:

Date	Day	Time	Reading in litres	Litres used (in days)
1.				
2.				
3.				
4.				
5.				
Total				

- Learners are supposed to record water meter readings for 5 days on the water use record sheet (preferably at the same hour of the day)
- Determine the volume of water that has been used and specify units.

Extension

In groups learners must suggest what preventative measures can be introduced to prevent water wastage in the sectors they have chosen.

It's a fact: saving water saves cents

ASSESSMENT

Learners will be assessed on their ability to:

- Follow and complete the audit activities step by step
- Interpret the results of the audit.
- Make recommendations on the basis of the results.

Or

You can use the following rubric to assess the learners.

CATERGORIES	Not Achieved (1% - 35%) Level 1	Partially Achieved (36% - 49%) Level 2	Achieved (50% - 69%) Level 3	Outstanding Excellent Achievement (70% - 100%) Level 4
Thinking /Inquiry	The learner:			
• Organisation of information / evidence	• Does not identify important evidence relevant to the problem /issue	• Identifies some of the relevant evidence but omits other evidence	• Identifies and logically organises most of the evidence	• Identifies and logically organises most of the evidence
Communication	The learner:			
• Use of various forms of communication (e.g. reports, presentations)	• Demonstrates limited or no command of the various forms	• Demonstrates moderate command of the various forms	• Demonstrates the expected command of the various forms	• Demonstrates extensive command of the various forms

3. DO NOT WASTE WATER

MAIN LEARNING AREA**NS: LO3 SCIENCE, SOCIETY AND THE ENVIRONMENT**

The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

AS2: Understands sustainable use of the earth's resources: responds appropriately to knowledge about the use of resources and environmental impacts.

INTEGRATION WITH OTHER LEARNING AREAS**HL: LO4: WRITING**

The learner will be able to write different kinds factual and imaginative texts for a wide range of purposes.

AS 1: Writes to communicate information: writes longer texts of several paragraphs describing processes and procedures, giving advantages and disadvantages, arguing for or against.

HL: LO3 READING AND VIEWING

The learner will be able to read and view for information and enjoyment, and respond critically to the aesthetic, cultural and emotional values in texts.

AS1: Reads spontaneously and extensively for pleasure and information across the range of text types studied, compares personal responses, and makes motivated recommendations to others.

ACTIVITY

At the end of this activity learners will be able to:

- Respond to questions asked.

Facts about water

We took it for granted, we wasted it. We paid too much for it, we did not know.

These are some of the words we utter everyday regarding water. Water is scarce yet it is such an essential resource. Without water life can be difficult. We need to protect our children, and that begins with protecting water. All around the world people are faced with various problems ranging from health, hunger, poverty and education, but when you stop and think about it, so many issues facing the world's poor are related to the lack of clean water and sanitation.

Did you know?

1 billion people around the world do not have access to access to clean water, and that about 2.2 billion have no access to adequate sanitation.

ACTIVITY 3A: AFFORDABLE WATER SUPPLY FOR THE POOR

In this activity learners will:

- Explore rainwater harvesting as one of affordable ways to supply water for the poor.

WHAT TO DO:

Learners must read the background information and answer the questions that follow.

BACKGROUND INFORMATION

Water in rural areas is very scarce, not only physically scarce but few households can afford to pay for conventional full pressure water-supply services. This is a personal right extended to everybody that has legal access to land. It is only intended for personal domestic use in the household of the person. It is not intended for watering of animals or for the irrigation of small gardening as this right is only available to the owner or lawful occupier. The volume of water required for irrigation in any case exceeds the sustainable volume available from a tank.

Rainwater harvesting

Rainwater harvesting simply means collecting the rain which falls onto roofs, then storing it in a tank until required for use. When required, the water is then pumped to the point of use, thus displacing what would otherwise be a demand for main-water. Rainwater is captured from the roof(s), and brought to a central point, via normal guttering and down-pipes, to enter from the main storage tank (frequently underground), where it is filtered on entry.

Reasons for rainwater harvesting

- Rainwater harvesting (including rainwater recycling and some versions of grey-water recycling) displaces a large proportion of the water that would otherwise be provided by the mains supply – thus reducing overall water supply cost.
- It can provide an off-mains supply for remote areas.

Types of rainwater tanks

Some of the most popular tanks used in rainwater harvesting are polyethylene rainwater tanks. These tanks are much liked because of the various advantages they have. They can be used above the ground and even below the ground. Polyethylene rainwater tanks are less expensive than other varieties, they are also UV resistant, and rather than being heavy and bulky they are very light in weight and easy to carry around.

Fiberglass rainwater tanks are another popular type of rainwater storage tank. They are resistant to rust and chemical corrosion. Fiberglass rainwater tanks can also withstand extreme temperatures.

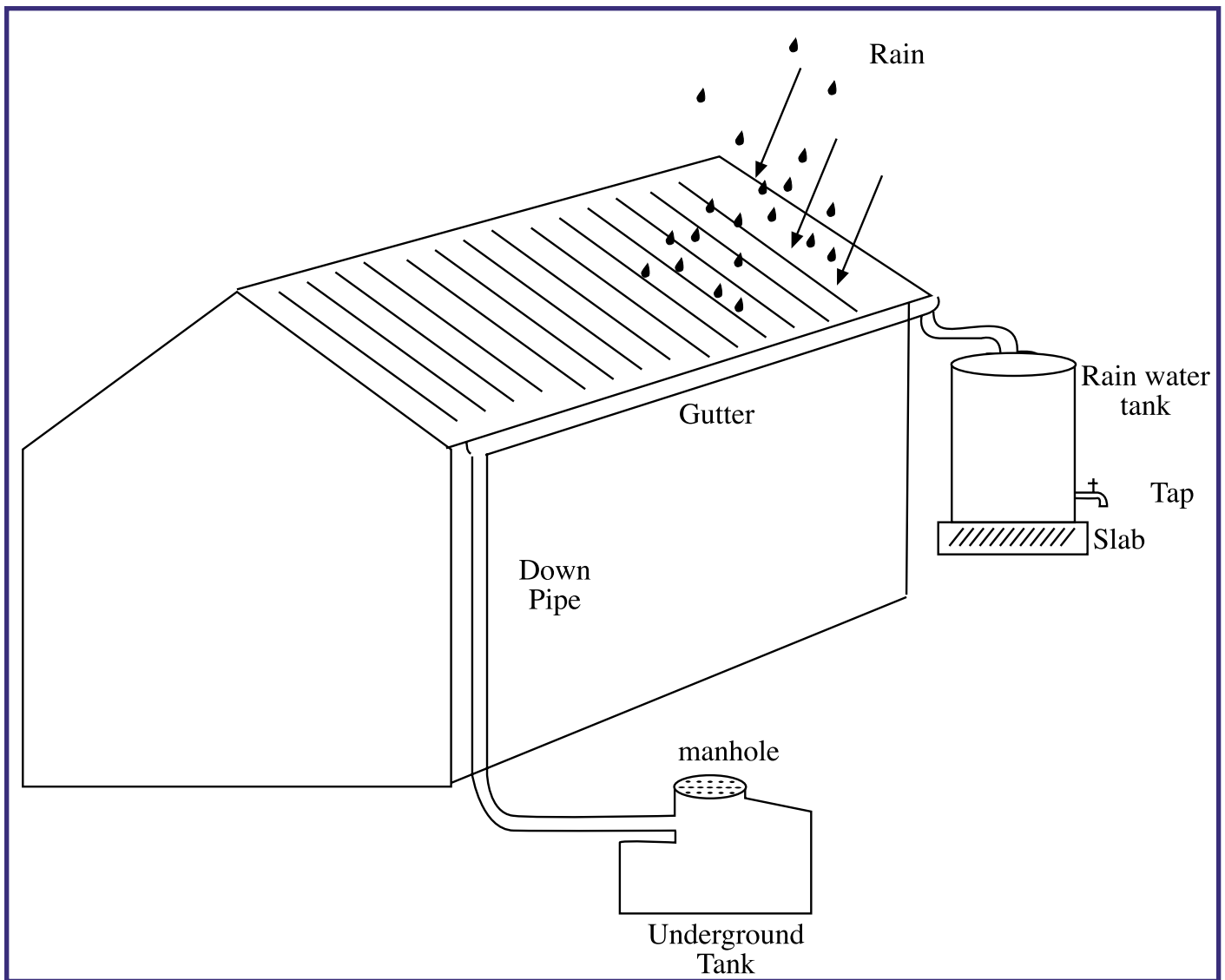
There are other rainwater tanks storage tanks like metal rainwater tanks, these tanks are manufactured from copper, stainless or colour polymer-coated steel. These materials are usually rust proof and long lasting. They can withstand extreme temperatures without showing any signs of wear and tear.

Another type is concrete rainwater tanks; the disadvantage of these rainwater storage tanks is that they usually crack over time. It is very easy to repair and will then give you many more years service before it needs to be repaired again. They can keep water cooler than many other above ground tanks that are exposed to sun and heat.

Plastic (JoJo) tanks and concrete/ masonry tanks will be the best.

To be able to make a decision as to which is the best rainwater storage tank for your use, you will need to look at the sort of climate in the area where you would like to do your rainwater harvesting. You will need to ask yourself other questions like whether the tank will be installed below or under the ground and for what purpose the water is going to be used. For example, is it going to be for household use or for irrigation?

When you answer this question you will be able to make the ideal decision as to which is the best rainwater tank to use for your rainwater harvesting storage purposes.



1. You may use the following questions to facilitate the process of teaching and learning.

- Have you seen this system before?
- If so, which area(s) are predominantly using these systems?
- What is rainwater harvesting?
- Why do we need to harvest rainwater?
- Name three types of rainwater tanks and mention one advantage of each tank.
- What is the disadvantage of the concrete rainwater tank?
- Mention one of the factors that you need to consider before you decide which rainwater storage is the best.

You can use the following rubric to assess the learners.

ASSESSMENT

CATERGORIES	Not Achieved (1% - 35%) Level 1	Partially Achieved (36% - 39%) Level 2	Achieved (40% - 69%) Level 3	Outstanding/ Excellent Achievement (70% - 100%) Level 4
Knowledge / Understanding	The Learner:			
• Knowledge of facts and terms	• Demonstrates no or insufficient knowledge of facts and terms	• Demonstrates limited knowledge of facts and terms	• Demonstrates expected knowledge of facts and terms	• Demonstrates thorough knowledge of facts and terms

4. THE AQUATRAP

MAIN LEARNING AREA

TECH: LO1 TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technology.

AS 2: Lists product and design specifications and constraints for a solution to an identified problem, need or opportunity based on some of the design key words: environment: where the products will be used or made, impact on the environment, in the long and short term.

INTEGRATION WITH OTHER LEARNING AREAS

NS LO1 SCIENTIFIC INVESTIGATIONS

The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

AS 4: Applies knowledge applies conceptual knowledge by linking a taught concept to a variation of a familiar situation.

ACTIVITIES

Learners will be able to:

- Use process skills to classify soil types.
- Use technical skills to construct improvised apparatus.

You will need:

- Used inner cubes of car tyres
- Strong glue / contact adhesive
- Coarse sand paper- a strip 30-50 cm
- A pen / koki

GUIDELINES FOR THE CHAPTER

In this lesson learners use an aquatrap i.e. (a dish device made from old car tyres; which is used to retain water and soil just under the surface of your garden or vegetable patch. Where soil has a low water holding capacity, by planting the aquatrap you can retain the water in the collected area for a longer time. Learners can use this device in their class gardens, it saves water and feeds the root system of any plant, shrub, tree or vegetable to promote growth. Learners will understand that there are various types of soils and that each type of soil has a different holding capacity.

WATER CONSERVATION

Begin your lesson by asking the learners the following questions:

- Why it is important for people to save water.
- Which is the best time of the day to water the garden? Why?

Learners are not yet acquainted with the concept of aquatrap. Build your discussion from their responses, which might include the conventional methods of conserving water like soil mulching, water in the afternoon etc.

ACTIVITY 4A: MAKING AN AQUATRAP

In this activity learners will make their own aquatrap. Assist them to follow the following steps and make sure that each learner executes the step before moving to the next step.

What to do

- Divide learners into groups of 4-5.
- Explain the activity to the learners and reasons for each group to make its own aquatrap.
- Briefly recap the previous soil types lesson and the type of soil in the school garden.
- Read and explain the instruction outlined in step 2 to the learners.
- Let each group of learners make their own aquatrap.
- Assist the groups to make the aquatrap following the instructions outlined in step 2 where necessary.

METHODOLOGY

STEP 1: First determine the type of soil in your garden.

There are three types of soil: *sand*, *loam* and *clay*. You can determine the type of soil by doing the following simple test:

- Squeeze some damp soil in your hand and roll it into a sausage. This is what learners will observe.
 - Sandy soil will fall apart,
 - Loamy soil will hold together but crumble easy,
 - Clay soil will mould into different shapes without breaking apart.

STEP 2: Make the aquatrap sample using practical technologies as follows:

- Take the “doughnut” (side wall) of the tyre wash and clean the area on the inside edge inside the tyre.
- Take coarse sandpaper and rub a strip 30-50 cm around the inside edge and make sure it’s rough and clean.
- Take the inner tube and cut it in half.
- Then cut the inner tube around the inner edge.
- Now lay the “doughnut” on top and mark it with a pen or koki.
- Cut outside your mark - allow plus minus 40mm to 60mm, now clean and sand paper inner tube as well. Make sure it is rough and clean.
- Take adhesive and apply to the tyre inner edge and the inner tube edge.
- Allow both surfaces time to dry. (plus minus 10 minutes)
- Now carefully push the two surfaces together - push down hard and check that there are no gaps in your new aquatrap dish. If there are gaps fill with a little glue.
- Let the aquatraps dry in the sun for 6-12 hours.
- Re-check them to see if the surfaces have bonded.
- You are now ready to plant your aquatrap.

ACTIVITY 4B: PLANTING THE AQUATRAP

- Read and explain the method of planting the aquatrap to the learners as described below.

WHAT TO DO:

1. For: Vegetable patch / Trench /Community gardens

- a. Dig a strip just wider than the aquatrap – about 60mm and the length you require (up to 10m).
- b. Plant aquatrap next to each other.
- c. Now fill your trench with organic compost/ soil mix/ sow your seeds/ water.

2. For a compost trench

- Dig trench width, height and line the trench with aquatraps- bottom and sides.

3. For plant beds

- Prepare beds and plant aquatraps.

4. For grass verges, lawns or sport fields

- Lay your aquatraps next to each other as close as possible for best results.

ASSESSMENT

CATEGORIES	Not Achieved (1% - 35%) Level 1	Partially Achieved (36% - 49%) Level 2	Achieved (50% - 69%) Level 3	Outstanding/Excellent Achievement (70% - 100%) Level 4
Synthesis and Application	The Learner:			
Application of procedures, equipment and technology	<ul style="list-style-type: none"> • Uses procedures, equipment, and technology safely and correctly only with supervision 	<ul style="list-style-type: none"> • Uses procedures, equipment, and technology safely and correctly with some supervision 	<ul style="list-style-type: none"> • Uses procedures, equipment, and technology safely and correctly to the expected standards 	<ul style="list-style-type: none"> • Demonstrates and promotes the safe and correct use of procedures, equipment, and technology

GLOSSARY OF WORDS

Aquatrap - a dish device made from old car tyres; which is used to retain water and soil just under the surface of your garden or vegetable patch.

Trench – a long narrow ditch in the ground.

WATER QUALITY

5. EFFECTS WATER POLLUTION

MAIN LEARNING AREA**NS: LO1: SCIENTIFIC INVESTIGATIONS**

The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

AS: 2 Conducts investigations and collects data: Contributes to a systematic data collection, with regard to accuracy, reliability and the need to control a variable.

AS 3: Evaluates data and communicates findings: Seeks patterns and trends in data collected and generalizes in terms of simple principles.

INTEGRATION WITH THE LEARNING AREAS:**SS (G) LO 1: GEOGRAPHICAL ENQUIRY**

The learner will be able to demonstrate geographical and environmental knowledge and understanding.

AS 5: Observes and record information in the field.

AL: LO 5: THINKING AND REASONING

The learner will be able to use the language to think and reason, as well as to access, process and use information for learning.

AS 1: Use language and literacy across the curriculum

AS 2: Uses language for thinking

AS 3: Collects and records information in different ways

ACTIVITY

Learners will be able to:

- Work as group to complete the audit activities step by step.
- Interpret the results of the total audit.
- Make recommendations on the basis of the results.
- Communicate their findings using appropriate communication strategies.

GUIDELINES FOR THE CHAPTER:

This is a water quality study, which will audit the quality of the water and **catchment** areas of different water sources. After making the findings, learners will have to evaluate factors contributing to the state of the water quality and therefore take action to address the issue.

BACKGROUND INFORMATION

Water quality is the term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. Although scientific measurements are used to define water quality, it's not a simple thing to say that "this water is good" or "this water is bad". After all, water that is perfectly good to wash a car with may not be good enough to serve as drinking water or for recreational purposes or for aquatic plants and animals.

The water we drink, use for cooking, bathing, watering the garden etc would need to be of a particular quality to avoid health hazards and the destruction of the environment. We need to do some investigations into our water resources because clean water or rather good quality water enhances the quality of life.

More and more these days we are hearing more about situations where the quality of our water is not good enough for normal uses. Bacterial contamination from poorly built pit latrines, septic tanks, waste water overflows from treatment plants and sewers or simple runoff from open space defecating practices, can get into drinking water sources and cause severe illnesses. Chemical pollutants from "point source pollution" (i.e. when sewage treatment plants, industrial and mining plants discharge their polluted wastewater directly into rivers, bays and oceans) and "non point source pollution" (i.e. fertilizers, **pesticides**, **herbicides** used in farmlands and lawns that can wash away into water sources of seep into underground water, oils from cars wash into wash ways etc.) contaminates water sources and lead to a variety of **waterborne diseases**.

Fertilisers, pesticides and herbicides are given the blame for polluted rivers. If applied responsibly at sustainable levels they should not be seen as pollutants. Over application comes at a cost and no commercial farmer will spend more money than absolutely required. The application can be controlled accurately.

The use in gardens and subsistent farming are not controlled that carefully and over dosing may be possible. The pollution caused by these items are generally small in comparison with bigger pollutants such as sewage spills, insufficiently treated sewage outflows and industrial waste.

Just because you have a tap or well that yields plenty of water doesn't mean that you can go ahead and just drink it,

although in many cases tap water is safe to drink. We must always remember that water is such an excellent solvent it can contain lots of dissolved chemicals. Even though there are excellent mechanisms for filtering particular matter, such as leaves, soil, bugs, etc, dissolved chemicals and gases can still occur in large enough concentrations to cause serious health problems in groundwater and surface water.

Adapted from: Draft School Package on Water Quality for Grade 4-7, Water Quality Management Communication project page 3.

ACTIVITY 5A: HOW POLLUTION AFFECTS PLANTS, ANIMALS AND HUMAN LIVES

Assess the learner’s prior knowledge of the concept pollution, its types, pollutants and its effects in our lives and the environment by:

- Ask them to list as many things as they can that might cause the air we breathe or water we drink unsafe.
- Take them outdoors for a walk to identify pollution they can see (litter, smoke etc) hear (horns, airplanes) or smell (diesel fumes, fresh paint etc).
- Alternatively, have them find examples of pollution of land (litter), air (car exhaust) or water (things that can wash into water sources or storm pipes) **pollutants**.
- As they spot different examples, have them explain how each could pollute, how did it get there, what effect could it have to plants, animals and human lives. They need to answer these questions using the following worksheet:

Resource	Examples of pollutants	Source of pollutant(s)	Effects on Plants	Effects on Animals/ Human
Water				
Air				
Land				

NB: Educator may choose to use the background information for own purposes or to supply it to the learners as well .

ACTIVITY 5B: IDENTIFICATION OF POLLUTANTS




PART A

BACKGROUND INFORMATION

“Despite large - scale water management projects, the water crisis has reached **alarming** proportions in Southern Africa. Our water resources for expanding human numbers and vital economic growth are under threat from catchment destruction and pollution. In 1991 , about 20 000 people, mainly children and the aged, died as a result of waterborne diseases and up to 80% of all medical expenditure in Africa can be traced to poor water and sanitation.”
 GREEN Water Quality Monitoring in Southern Africa: Share-net p.5

WHAT TO DO:

1. The following pictures show different sources of water and their qualities thereof.
2. Learners must study the pictures carefully and describe the condition of each picture.
3. Learners must then complete the section in each picture by:
 - Identifying water source(s) in each picture.
 - Indicating the threats in each picture.
 - Stating the reasons for the bad water quality (if there is)

Picture	Sources of water identified.	Threats to water quality	Causes of the decline in water quality
 <p>A diagram showing various water sources and their associated threats. Sources include Rain-Weeds Tank, Spring, Stream, Well, and Dam. Threats include Farmlands, Toilet, and Sewage. The diagram illustrates how these sources and threats interact to affect water quality.</p>			
 <p>An aerial view of a river flowing through a landscape. Various sources of pollution are labeled with letters A through E, showing how they contribute to water quality decline.</p>			
 <p>A detailed illustration of a water treatment plant. The title is 'Our Water - Our Health'. It shows the process of filtering and treating water to make it safe for consumption.</p>			

PART B: TAKE ACTION

Ask learners to:

- i. Use the findings from the previous activity to audit the status of their local water source/s related to the three pictures they have studied.
- ii. Audit and record their observations on the observation sheet below.

Audit Activity	Description
1. Colour of water.	
2. Smell of water.	
3. Are there plants in the river bank? How do they look like?	
4. The type of water life: Conduct hands on stream and pond life.	

RIVER QUALITY OBSERVATION

	Yes	No
• Are there dead animals or litter in water?		
• Is the water muddy?		
• Is there green slime, froth or foam in water?		
• Is there solid waste in water?		

CATCHMENT CONSERVATION

	Yes	No
Are there any of the following near the water source?		
• People residing		
• Farming		
• Waste water works		
• Factories		
• Mines		
• How deep into the water can you see?		
• What is on the river bank?		
• What is the speed of the flow of water?		

- iii. Supply the learners with the water quality audit sheet.
- iv. Let them compare their audit to the audit sheet from the educator.
- v. Determine whether their water source is healthy or unhealthy.
- vi. When they are back in class, each group should discuss, reach conclusions and make recommendations based on the following points:
 - a. Do you suspect that their water source might have bad quality water?
 - b. What can cause the water to be of bad quality?
 - c. What effects do you think this water can have on plants, animals or your skin?
 - d. Do you think further tests need to be done to ensure accuracy?
 - e. Present your groups report of your discussions, findings and recommendations to the whole class.

OBSERVATION SHEET/ EDUCATOR AUDIT SHEET

Audit activity	Healthy environment	Unhealthy environment
Colour of water (turbidity):	clear depending on the environment	Murky, depending on the environment
Smell of water	Sweet smelling	Bad odour
Stream bank vegetation: what do the plants growing next to the river looks like	Banks covered with healthy looking plants (as long as they are not alien invasive plants).	Erode and uncovered banks or covered with alien plants.
The type of water life: Consult "hands on stream and pond life"/ Water Life investigation	Sensitive organisms in majority	Hardy and/ or resistant organisms in majority
River quality observations:		
• Is there litter or dead animals in the water	No	Yes
• Is the water muddy	No	Yes
• Is there green slime, foam or froth on the water	No	Yes
• Is there solid waste in the water	No	Yes
• How deep into the water can you see	To the bottom	Not very far

• What is on the river bed sand, stones or any other objects	Sand, pebbles, boulders	Mud (silt), concrete, and any other foreign material which should not be in a water source.
• What is the speed of the flow in the water?	Usually movement	Stagnant or no movement
Catchments Conservation: are there any of the following close to the water source?		
• People residing	No	Yes
• Farming	No	Yes
• Waste water works	No	Yes
• Factories	No	Yes
• Mines	No	Yes

ASSESSMENT:

CATERGORIES	Not Achieved (1% - 35%) Level 1	Partially Achieved (36% - 39%) Level 2	Achieved (40% - 69%) Level 3	Outstanding/ Excellent Achievement (70% - 100%) Level 4
Thinking /Inquiry	The learner:			
• Organisation of information / evidence	• Does not identify important evidence relevant to the problem /issue	• Identifies some of the relevant evidence but omits other evidence	• Identifies and logically organises most of the evidence	• Identifies and logically organises most of the evidence
Synthesis and Application	The learner:			
• Evaluation and synthesis	• Reaches no or incomplete conclusions based on the evidence	• Reaches some conclusions based on the evidence	• Reaches the expected conclusions based on the evidence	• Reaches informed conclusions based on the evidence

GLOSSARY OF TERMS

Alarming – Fear aroused by awareness of danger.

Catchment – It is the area from which any reinfall or rising water will draw to a common water course.

Contaminate – To make impure/ pollute.

Herbicides – A substance used to destroy plants especially weeds.

Pesticides – A substance for killing harmful insects.

Waterborne diseases – Illnesses caused by germs living in water.

6. LACK OF CLEAN DRINKING WATER

MAIN LEARNING AREA

LO: LO1 HEALTH PROMOTION

The learner will be able to make informed decisions regarding personal, community and environmental health.

AS2: Develops and implements an environmental health programme.

INTEGRATION WITH OTHER LEARNING AREAS

AL: LO 5: THINKING AND REASONING

The learner will be able to use the language to think and reason, as well as to access, process and use information for learning.

AS 1: Use language and literacy across the curriculum.

AS 2: Uses language for thinking.

AS 3: Collects and records information in different ways.

ACTIVITY

In this activity learners will:

- Explore strategies to alleviate problems of access to safe drinking water.
- Suggest ways to clean the dirty and unsafe water.

BACKGROUND INFORMATION

One of the United Nations Millennium Development Goals is to reduce by half, by 2015, the proportion of people without sustainable access to safe drinking water and the proportion of people who do not have access to basic sanitation.



The United Nations Educational Scientific and Cultural Organisation proposes that 20 to 50 litres of water per person per day is the minimum amount necessary for basic human needs and lives of dignity. (The Water Project Organisation Reality Charity, 2007)

ACTIVITY 6A: HOW DIRTY WATER CAN BE CLEANED

In this activity learners are:

- Exploring the strategies to alleviate problems of access to safe drinking water.

WHAT TO DO:

Ask learners to work with their partners for this activity.

1. The pictures above show different environmental activities that might pollute water.
2. Highlight the environmental problems that could result from these activities; and the possible causes of those problems.

Picture	Environmental Problem	Possible Causes	Solutions
A			
B			

3. Discuss with your partner the possible solution to the problems identified.

4. Prepare a thorough demonstration of how the dirty water can be cleaned. Clue!! Filtration.

ASSESSMENT

Use the following rubric to assess learners' abilities to master the said skills.

Skills	Level Descriptors			
	1	2	3	4
1. Identification of the environmental problem or hazard				
2. Articulation of the possible causes				
3. Suggestion of the possible solution to the problem				
4. Demonstration of the solution				

You may like to qualify each of the steps by describing how each learner has performed in each of the skills mentioned. The same principles in the description of level descriptors: 1: *not achieved*; 2: *achieved with some mistakes*; 3: *achieved*; 4: *achieved beyond the expected level*.

7. WATER QUALITY TESTING

MAIN LEARNING AREA

NS: LO1: SCIENTIFIC INVESTIGATIONS

The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

AS: 2 Conducts investigations and collects data: Contributes to a systematic data collection, with regard to accuracy, reliability and the need to control a variable.

AS 3: Evaluates data and communicates findings: Seeks patterns and trends in data collected and generalizes in terms of simple principles.

NS: LO 3: SCIENCE, SOCIETY AND THE ENVIRONMENT

The learner will be able to demonstrate an understanding of the interrelationship between science and technology, society and the environment.

AS 2: Understands sustainable use of earth's resources: Responds appropriately to knowledge about the use of resources and environmental impacts. Contributes to formulating a school environment policy, including constructive ways to deal with waste material and to improve water management.

INTEGRATION WITH THE LEARNING AREAS:

SS (G) LO 1: GEOGRAPHICAL ENQUIRY

The learners will be able to use enquiry skills to investigate geographical and environmental concepts and processes.

AS 5: Observes and record information in the field

AL: LO 5: THINKING AND REASONING

The learner will be able to use the language to think and reason, as well as to access, process and use information for learning.

AS 1: Use language and literacy across the curriculum

AS 2: Uses language for thinking

AS 3: Collects and records information in different ways

AI: LO 2: SPEAKING

The learner will be able to communicate confidently and effectively in spoken language in a wide range of situations.

AS: 4: Debates social and ethical issues by arguing persuasively and responding critically.

ACTIVITIES:

Learners will be able to:

- Complete the investigation step by step.
- Conduct a fair test.
- Interpret their findings.
- Communicate their findings using appropriate strategies.
- Develop an implementation plan.

GUIDELINES FOR THE CHAPTER:

This is a teacher demonstration lesson in which an experiment will be conducted with the whole class observing and recording their findings in the record sheet provided in their Learners Books. After that learners will interpret the results in groups, discuss and develop action plans to address the problem/s identified.

BACKGROUND INFORMATION: ACIDS, BASES AND pH

Historically, chemists classified acids by their characteristics, such as their sharp or sour taste. Although taste is not the safe way to test for acids, you undoubtedly know the sour taste of vinegar and lemon juice, two common acids. A simple chemical test for acids is called the litmus test. Litmus, a natural dye obtained from lichens, (coloured growths on rocks and tree trunks) changes colour from blue to pink in the presence of an acid. Another simple chemical test is to add an acid to a carbonate – containing materials such as baking soda or eggshell. A characteristic “fizzing” occurs during the release of carbon dioxide gas. From the standpoint of chemical structures, acids are substances that release hydrogen ions (H⁺) in aqueous solution. The concentration of hydrogen ions commonly found in aqueous solution range over more than 14 orders of magnitude. As a result, a logarithmic scale called pH is often used to express the hydrogen ion concentration of aqueous solution. (A difference of 1 in pH corresponds to a factor of 10 in the concentration of hydrogen ion $\{[H^+]\}$. Pure water has a pH of 7, 00 (at 25 0C.) A solution with a pH < 7, 00 is acidic; a solution with pH > 7, 00 is basic. However, the normal range of pH in surface water systems is 6.5 to 8.5 and for

groundwater systems 6 to 8.5

The pH of a stream affect organisms living in the water, a changing pH in a stream can be an indicator of increasing pollution or some other environmental factor.

Did you also know?

That the scale on the universal indicator tells you whether a liquid is acid or basic. Check it out!!! Remember the pH value for neutral water is 7 on the universal indicator scale.

Did you know?

When phenolphthalein is used on an acid liquid It turns colorless and on a basic liquid it becomes pink

Adapted from: Illustrative Learning Programme: Exploring the world around us: Natural Science - DOE

Adapted from-Water Science for Schools <http://ga.water.usgs.gov/edu/ph diagram.htm/>

ACTIVITY 7A: WATER TESTING USING pH SCALE

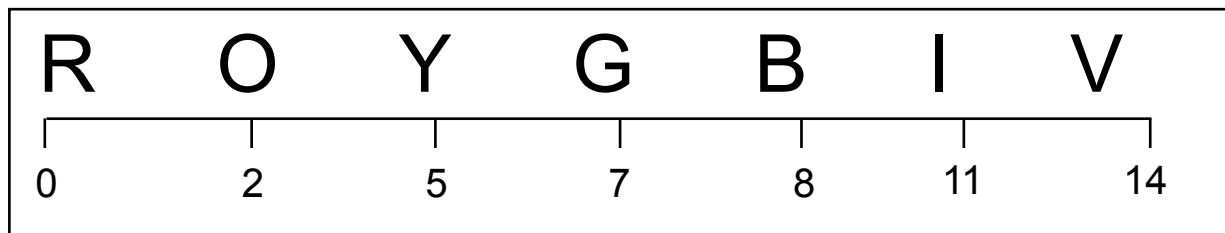
Water pH

Water pH describes the acidity and the alkalinity of water. Water pH can be determined by using pH scale. The pH scale is represented by colours and it ranges from 0-14.

pH scale



Strong acid **neutral** **strong base/alkaline**



To test the quality of water, we use a universal indicator, which changes colours as the universal indicator is clipped into different pH media.

WHAT TO DO:

- Ask the learners to work with their partners for this activity.

Supply them with the following:

- Pure water (fountain water)
- Pure acid / vinegar
- Soapy water.
- Universal indicator.

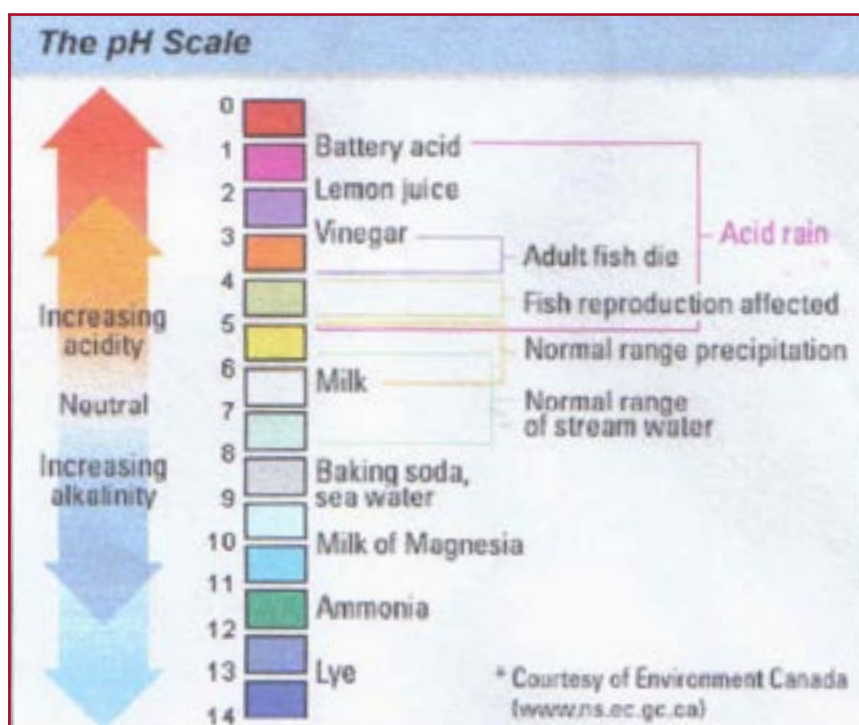
INSTRUCTIONS

Closely monitor the learners as they perform the following steps to determine the pH of different media. Note that these are pure media and learners have to observe the true changes as the pH indicators are immersed in them. Learners should:

- Pour few drops of vinegar in a small Petri dish and label that A: other drops of pure water – B; and the dish labeled C for soapy water.
- Redraw the following table in your answer book.

Sample	Colour of Indicator before	Colour of indicator after
A		
B		
C		

- Dip a strip of indicator in each of the sample.
- Record the results on the table.
- Now compare the changes in colour with the pH scale.



ACTIVITY 7B: WATER QUALITY TESTING EXPERIMENT

The aim of this activity is to investigate whether the water sources contain acidic, basic or neutral water, using two indicators:

APPARATUS:

- Universal indicators
- Phenolphthalein
- Distilled water
- Tap water
- Water from the borehole/well/spring
- Water from the river
- 8 test tubes and test tubes rack
- Medicine dropper/ syringe

- NB: Alternatives:
1. Use soapy water, white vinegar or lemon juice (as an alternative if some of the above water types is not accessible).
 2. You can use more than one sample of river water, collected at different points of the river (upstream / downstream).

WHAT TO DO:

ASK THE LEARNERS TO WORK IN GROUPS

This is a scientific investigation and learners must be assisted in carrying out these steps. Let learners follow the following steps and you may need to assess the execution of each step. Learners must:

- Divide equally each of the water types they have into two test tubes
- Use a medicine dropper to withdraw the universal indicator.
- Pour 6-8 drops of the universal indicator into the first test tubes containing each water type.
- Wash the medicine dropper. *You may intervene and ask them the question as to why it is important to wash the medicine dropper at this stage?*
- Squeeze the medicine dropper to withdraw phenolphthalein.
- Pour 6-8 drops of phenolphthalein into the 2nd test tubes containing each water type.

UI	Ph	UI	Ph	UI	Ph	UI	Ph
1	2	1	2	1	2	1	2
Distilled H ₂ O		Tap H ₂ O		Borehole/Well H ₂ O		River H ₂ O	

- Let the learners record and interpret their result using the worksheet below:

WORKSHEET: WATER QUALITY TESTING

GROUP NAME:-----

Water type	Colour after using		
	Colour before using indicator	Universal indicator	Phenolphthalein
Distilled water			
Tap water			
Borehole/Well/Spring water			
River water			

INTERPRETATION OF RESULTS:

Learners should be guided by the following questions in their interpretation of the results:

- Classify water from your experiment into acid, basic and neutral and why.
- Discuss amongst yourselves what the implications of the results are with relation to
 - (a) What causes your water to be acidic or basic?
 - (b) What effects do you think acidic/ basic water has on plants, animals or your skin?
- Would you generally say that your drinking water is safe? Report your group results orally.

TAKE ACTION

Depending on the results of the audit and test, you can let your learners proceed to the following task:

- If the results indicate that the water quality is not neutral, learners should come up with suggestions on how to address the problem.
- They are expected to discuss and formulate a plan of action as a group.
- They must finally present the implementation plan to the whole class.

NB: Remember the plan can contribute toward the implementation of the resource management or health and safety focus area of the school environmental policy

ASSESSMENT:

Learners will be assessed on their ability to:

- Demonstrate understanding of the concepts – acid, bases and pH.
- Classify substances into acids and bases.
- Interpret the experimental results or findings.
- Based on the experimental results take appropriate action.

GLOSSARY OF TERMS

DIY action project – Do it yourself action project

Red Flag - For issues that the learners cannot provide any solutions, they can take up the matter with the relevant authorities, e.g. government departments, local authorities, communities media structures etc.

8. HEALTH ISSUES AFFECTING THE COMMUNITY

MAIN LEARNING AREA

NS LO3: SCIENCE, SOCIETY AND THE ENVIRONMENT

The learner will be able to demonstrate an understanding of the interrelationships between science and technology, science and the environment.

AS2: Understands sustainable use of the earth's resources: Responds appropriately to knowledge about the use of resources and environmental impacts.

- Organises an audit of water use in sections of the community, analyses the data and prepares it for presentation in your local newspaper or radio talk show.
- Contributes to formulating school environmental policy, including constructive ways to deal with waste material and to improve water management.

INTEGRATION WITH OTHER LEARNING AREAS

HL: LO4: WRITING

The learner will be able to write different kinds factual and imaginative texts for a wide range of purposes.

AS 1: Writes to communicate information: writes longer texts of several paragraphs describing processes and procedures, giving advantages and disadvantages, arguing for or against.

AS 2: Produces a range of factual written and multi-media texts for various purposes, using a range of visual, and design elements where appropriate by means of newspaper reports.

AS4: Uses the writing process independently and with ease to generate complex texts.

AS 6: Treats writing as a process.

ACTIVITY

At the end of this activity learners will be able to:

- Apply creative writing skills.
- Write a newspaper article in which concerns about environmental health issues that affect the community are raised.

You will need:

- Pens/ pencils
- Results of the audit and testing

GUIDELINES FOR THE CHAPTER:

This is a creative writing exercise that is a follow up of the previous two exercises in this module. It is an example of a "Raise the Red Flag" exercise. The purpose of this one in particular, is not only to inform the community, through media publications, on matters of health and hygiene that affect them but also and powers that be. Another aim is to expose the culprit that has deposited chemical matter into the river.

This lesson affords learners an opportunity to be journalists for the local newspaper, reporting on water quality issues they have investigated.

WHAT TO DO:

Ask the learners to recap the writing process learnt in previous lessons / grades in a class discussion focusing on:-

- exploring a topic through brainstorming,
- organizing ideas coherently in logical order to produce first draft,
- analyzing multiple drafts, reflecting on own and on peer's writing and makes recommendations
- proofreading and
- correcting draft and publishing the final drafts.

ACTIVITY 8A: RAISING A RED FLAG ON HEALTH ISSUES

WHAT TO DO:

Ask the learners to read the following article and follow instructions:

Welcome Special Reporter. The learners' brief is as follows:

They must write an article for a local newspaper to report on the water quality audit and testing findings of their investigation. The important thing is for them to remember that the purpose of this article is not only to inform the community, through media publications, on matters of health and hygiene that affect them, but also powers that will be exercised as well as expose the culprit that has deposited chemical matter into the river.

Learners must plan their article, write a draft copy, edit, proofread and write a final draft.

Remind them to write the name of the newspaper, headline and their name.

Give learners a homework task to conduct the following interviews for the purposes of enriching their newspaper article:

- **Interview 1:** Interview the member of the community who is affected by the problem identified. The person chosen may have recently suffered a disease related to the problem themselves or in their family.
- **Interview 2:** Interview an expert in the field of investigation who might have verified the findings of their investigation. It is advisable to conduct interview 1 before interview 2 so that the expert has a chance to comment on the statements made by the member of the community.

ACTIVITY 8B: WRITE AN ARTICLE FOR THE LOCAL NEWSPAPER

Tell the learners that they are going to write an article for the local newspaper to report on water quality audit and testing findings of their investigation. It should be structured as follows:

- **Topic:** Choose a topic that is gripping and interesting.
- **Introduction :** Introduce the topic of the article, focusing on the aim of the investigation and the problem at hand
- **Interview 1:** Report on interview 1 with the member of the community who is affected by the problem identified.
- **Interview 2:** Report on interview 2 with an expert in the field of investigation who might have verified the findings of their investigation.
- **Journalist input:** Here learners have a chance to evaluate what they have discovered. They should comment on what they have learnt in interviews and at school and how these relate to the interviews themselves.
- **Conclusion:** Here learners should sum up, reiterating the main points of the article and expressing either hope or concern for the future of health and hygiene in their community.

ASSESSMENT:

Assess the learner's ability to:

- Apply creative writing skills.
- Write a newspaper article in which concerns about environmental health issues that affect the community has been raised.
- You may use the following as a guide to marking the article.

		MARKS
Topic	Is it gripping and interesting	(2)
Introduction	Is the introduction focusing on the aim of the investigation and the problem at hand	(5)
Interview 1	Is the interview targeting a member of the community who is affected by the problem identified. Is there more information gained.	(20)
Journalist input	Did the learners evaluate what they have discovered? Comment on what they have learnt	(10)
Conclusion	Did learners sum up, reiterating the main points of the article and expressing either hope or concern	(3)
TOTAL		40

GLOSSARY OF TERMS

DIY action project – do it yourself action project

Red Flag - for issues that the learners cannot provide any solutions, they can take up the matter with the relevant authorities, e.g. Government departments, local authorities, communities media structures etc.

9. ASSESSMENT OF STREAMS

MAIN LEARNING AREA

NS: LO1: SCIENTIFIC INVESTIGATION

The learner will be able to act confidently on curiosity about natural phenomena, and to investigate relationships and solve problems in scientific, technological and environmental contexts.

AS2: Conducts investigations and collects data: Contributes to systematic data collection, with regard to accuracy, reliability and the need to control a variable.

- Discusses the meaning of the data being collected, comparing them with the focus question.

INTEGRATION WITH OTHER LEARNING AREAS

MATHS: LO5 DATA HANDLING

The learner will be able to collect, summarise, display and critically analyse data in order to draw conclusions and make predictions, and to interpret and determine chance variation.

AS2: Selects, justifies and uses appropriate methods for collecting data which include questionnaires and interviews, experiments, and sources such as books, magazines and the Internet in order to answer questions and thereby draw conclusions and make predictions about the environment

ACTIVITY

In this activity learners will be able to:

- Collect organisms found in a stream.
- Evaluate the quality of water, on the basis of the organisms found in water.

You will need:

- Student sheets
- One magnifying glass per learner
- At least two buckets per team
- Two hands nets for removing stream debris
- One clipboard
- A pencil per team
- Rubber boots

BACKGROUND INFORMATION

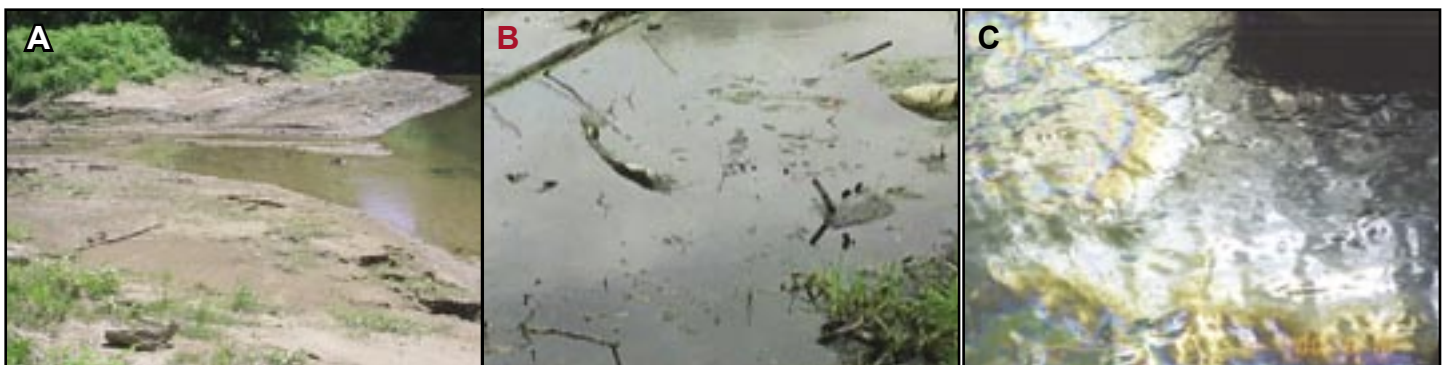
The quality of streams can be determined by analysing the microorganisms found in them. These microorganisms normally lack backbones and are referred to as macro **invertebrates**. To determine whether the quality of stream is excellent, good, fair or poor, assessment of the presence of insects, crustaceans (crayfish and others), molluscs (clams and muscles), gastropods (snails), oligochaetes (worms) etc. should be done. These macro invertebrates are predominantly found in freshwater streams, although in most streams and rivers the larval insects dominate the macro invertebrate community. The absence of these macro invertebrates indicates the poor water quality since they are restricted to their immediate habitat and cannot escape changes in water quality.

Any change in the quality of water, either due to physical stream alteration; organic pollution and enrichment and toxicity might lead to a reduction in the number of macro-organisms normally predominant in water with excellent quality.

ACTIVITY 9A: DIFFERENT CATEGORIES OF PROBLEMS AFFECTING STREAMS.

What to do:

Ask learners to study the following pictures showing different categories of problems affecting streams.



- (a) **Stream showing excessive sediments deposited in the stream.**
 - (b) **Organic pollution and enrichment. Human throwing waste in the streams and a farmer irrigating with the fertilisers and flowing into the stream.**
 - (c) **Toxicity**
 - **Metals thrown into the stream, pesticides applied through foliar application and flowing into the stream.**
 - **Small boat leaking oil into the stream.**
1. Divide the learners into teams of about five learners in each.
 2. Learners should brainstorm in the group about the problems caused by the following categories in each picture.
 - (a) Picture A: Physical alteration of the stream.
 - (b) Picture B: Organic pollution and enrichment.
 - (c) Picture C: Toxicity.

In assessing learners look for the following:

2. Whether learners have been able to spot the problem in the streams
3. Mention all the things that are causing such problem
4. Suggest ways to solve that problem.

ACTIVITY 9B: ASSESING THE QUALITY OF WATER

In this activity learners shall conduct a trip to a nearby stream to bioassess the quality of water.

You will need:

- One team member to be a recorder with a clipboard and a pencil.
- Two pairs of rubber boots for the two members who will get into the stream.

What to do:

- Assign one team member to be recorder of any organisms found in the stream; at least two members should get into water and the other two hold buckets where organisms are to be placed.

Procedure:

1. Allow one or two members of the group to get into water wearing rubber boots.
2. Using hand nets, they must scoop up mud, leaf and other streams. The scoop should be implied in the center of the bucket in each team.
3. Members guarding the buckets should go through it looking for organisms.
4. As they find the organisms, they must identify them as belonging to group 1,2,3 by comparing with the ones in the picture key.
5. The recorder should tally them.
6. Ensure that you collect as many as you can and return the animal specimen back and return the animal specimen back to the river.
7. Each team should take the data back to school, and compare the team data with other teams.
8. Determine whether the stream is of excellent, good, fair or poor quality.

EXTENSION: ADOPT A STREAM

There are many opportunities that arise as a result of water quality assessment.

- (a) The stream is of excellent quality.
- (b) The stream is of poor quality, with a lot of water and is highly polluted.

Activity:

1. Should you discover that the stream you assessed is of excellent quality, conduct a trip to a nearby stream showing one or more of the following characteristics:
 - Stream alterations such as reduced flow or temperature extremes, including excessive sediment.
 - Organic pollution and enrichment.
 - Toxicity, including chemical pollutants such as chlorine, acids, metals, oil, pesticides etc.
2. Suggest ways to clean up and eradicate pollutants in stream.
3. Ways of finding out the source(s) of pollution in the stream.

ASSESSMENT

This is a team activity that involves skills of identification, following the procedure, evaluating, comparing, sorting and analyzing and division making. Assess the learners on those skills.

CATEGORIES	Not Achieved (1% - 35%) Level 1	Partially Achieved (36% - 49%) Level 2	Achieved (50% - 69%) Level 3	Outstanding/ Excellent Achievement (70% - 100%) Level 4
Synthesis and Application	The Learner:			
• Evaluation and synthesis	• Reaches no or incomplete conclusions based on the evidence	• Reaches some conclusions based on the evidence	• Reaches the expected conclusions based on the evidence	• Reaches informed conclusions based on the evidence
• Transfer of concepts, skills and procedures in new contexts	• Transfers concepts, skills and procedures in new contexts with no limited effectiveness	• Transfers concepts, skills and procedures in new contexts with moderate effectiveness	• Transfers concepts, skills and procedures in new contexts with expected effectiveness	• Transfers concepts, skills and procedures in new contexts with a high degree of effectiveness

SANITATION, HEALTH AND HYGIENE

10. SUPPORTING WATER, SANITATION AND INTEGRATED DEVELOPMENT.

MAIN LEARNING AREA

HL: LO 3: READING AND VIEWING

The learner will be able to read and view for information and respond critically to the aesthetic, cultural and emotional values in texts.

AS5: Discusses different types of text, and explains how their key features are organised and how they contribute to the functioning of the text (e.g. long poems, short novels, news paper articles, diaries, letters, book reviews, and short plays).

INTEGRATION WITH OTHER LEARNING AREAS

LO: LO1 HEALTH PROMOTION

The learner will be able to make informed decisions regarding personal, community and environmental health.

AS5: Discusses ways to apply insights gained from participating in an activity related to national health or safety promotion programme.

ACTIVITY

At the end of this activity learners will be able to:

- Exploit various types of toilet systems that the government installs in rural areas.
- Identify the differences between the toilet systems.

BACKGROUND INFORMATION

The majority of rural schools in South Africa has no toilets, too few toilets, or has toilets that are unsafe and unpleasant to use.

(The Mvula Institute Report, 2006).

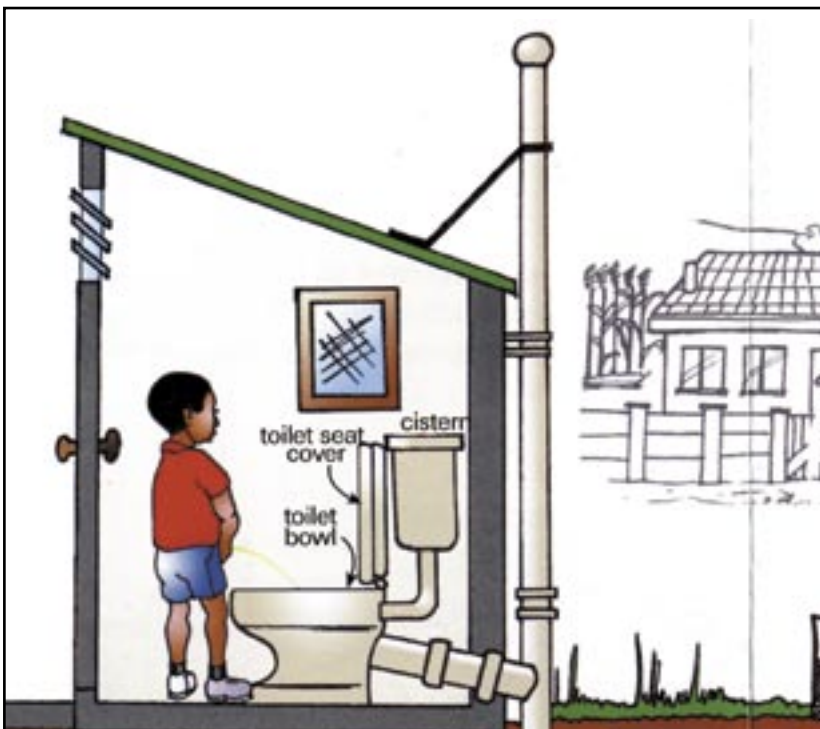
There are various types of toilet systems that the government installs in rural areas, i.e. urine diversion (UD) toilet and septic tank.

WHAT ARE THEY?

- A urine diversion toilet is a toilet that separates urine and faecal matter.
- A septic tank is a tank under the ground, which is connected to your toilet to collect all the urine and faeces, which you flush down the toilet.

(Ethekewini Municipality: Water Services brochures).

1. The two pictures provided represent the septic and urine diversion toilet systems



2. Ask learners to:

- List all the requirements for constructing each of the systems.
- Spot the similarities between the two systems.
- Identify the differences.

3. Which system would be ideal for a community that is highly challenged with water?

ACTIVITY 9B: HOW TO OPERATE AND MAINTAIN YOUR TOILET SYSTEMS?

Most toilets are built with one pit. This pit fills up quickly and must be emptied often. Emptying the pit is expensive with urine diversion; you can always maintain the toilet yourself.

HOW TO OPERATE AND MAINTAIN YOUR URINE DIVERSION (UD) TOILET

Most toilets are built with one pit. This pit fills up quickly and must be emptied often. Emptying the pit is expensive.

I cannot reach your toilet.

I cannot pay for the tanker to empty the pit.

With a urine diversion toilet you can always maintain the toilet yourself.

- Two shallow chambers will have to be built 400 mm below the ground with concrete blocks. The top structure has two holes in the floor. Place the toilet bowl over one hole and use the first chamber until it is full. Keep the second chamber covered until the first chamber is full.
- The toilet bowl has two parts - one for urine and one for faeces. When women urinate the urine goes into the front part, and flows through a narrow pipe into the soil where it soaks away. Men urinate into a separate urinal that also leads into the soil. Men and women use the toilet bowl for defecating. Faeces drop down the larger hole at the back of the bowl into the pit below.
In this way it will not cost you any money to always keep your toilet hygienic and healthy.
- Faeces collects in the chamber below. This dries quickly because there is no urine and it is covered with soil or ash.
- The contents of the chamber must break down and dry out. Help this process by throwing sand or ash into the pit after each use. No water must get into the pit.
- When the first chamber is full, use the second chamber. Move the toilet bowl and place it over the second hole and cover the first chamber. While you use the second chamber, the waste in the first chamber dries out. Do not let any water get into the chamber that is drying out.
- By the time the second chamber is full, the waste in the first chamber will be dry and safe to remove. You can dig out this dried waste in the first pit. When empty move the toilet bowl back to the hole over the first chamber. Use the first chamber while the waste in the second chamber breaks down and dries out.

You will need:

- Pen and lead pencil

What to do?

- In the extension activity only the sketches that describe the steps to maintain the urine division toilets are given to the learners.
- Next to each sketch is the blank space.
- Learners must use the blank space to describe each step to maintain the toilet. Use sentences to describe each step.

EXTENSION ACTIVITY

Keep your urine diversion toilet working healthy and hygienically.

This picture depicts good and bad ways of using the urine diversion toilet.



1. Under each picture, provide an explanation of the action taken.
2. State whether it is a good or a bad action for keeping the toilet healthy and hygienically clean.

About septic tanks

Ask learners to brainstorm with their partners why we are always warned not to:

- (a) Dispose of solid waste such as cigarette butts or sanitary towels etc. into septic tank.
- (b) Pour disinfectants (Jik, Jeyes Fluid, Dettol etc) into the septic tank.

ASSESSMENT

Assess learners ability to:

- Exploit various types of toilet systems that the government installs in rural areas.
- Identify the differences between the toilet systems.

11. DEVELOPMENT OF AN ENVIRONMENTAL HEALTH PROGRAMME

MAIN LEARNING AREA**LO: LO 1: HEALTH PROMOTION**

The learner will be able to make informed decisions regarding personal, community and environmental health.

AS 2: Develops and implements an environmental health programme.

NS: LO3 SCIENCE, SOCIETY AND THE ENVIRONMENT

The learner will be able to demonstrate an understanding of the interrelationships between science and technology, society and the environment.

AS2: Understands sustainable use of the earth's resources: responds appropriately to knowledge about the use of resources and environmental impacts.

- Contributes to formulating a school environment policy, including constructive ways to deal with waste material and to improve water management.

INTEGRATION WITH OTHER LEARNING AREAS:**AL: LO 1: LISTENING**

The learner will be able to listen for information and enjoyment, and respond appropriately and critically in a wide range of situations.

AS 3: Listens for specific information: takes own simple notes.

AS 4: Listens actively in discussion.

HL: LO 2: SPEAKING:

The learner will be able to communicate confidently and effectively in spoken language in wide range of situation.

AS 4: Debates social and ethical issues by arguing persuasively and responding critically.

LO 5: THINKING AND REASONING:

AS 2: Uses language for thinking: understands and uses evidence to support a theory or argument: draws conclusions.

ACTIVITY

Learners will be able to:

- Listen to suggestions and decide on simple practical actions to address identified health problems.
- Develop practical implementation and management plans.
- Implement the principles of your school environmental policy.

GUIDELINES FOR THE CHAPTER:

This activity assumes that audits of various aspects of the environment have been done by various grades and the results with recommendations have been presented to the various class groups/ whole school /Enviro-Club / Enviro-Committee of the school. In this activity, learners will listen to a presentation and use that information to design an environmental health programme that will address health problems identified in different settings. Learners in this grade will be able to assume greater responsibility in deciding which suggestions can be executed without too much trouble, making sure that those actions are included in the school environmental policy and in developing the management plan while the educator will ensure that the whole programme is part of the implementation of the curriculum. Class groups or environmental clubs in the school can prepare this activity for implementation.

BACKGROUND INFORMATION:

Schools face many different health and safety concerns that vary according to their particular geographical location or socio-economic context. For example, in some parts of South Africa, schools that lack access to safe drinking water or adequate sanitation facilities have experienced outbreaks of cholera. The HIV/ AIDS pandemic is a national crisis to which all schools must respond. Problems like unacceptably high levels of ill health, risk-taking behaviours, overburdened health facilities, fragmentation of health services and health education all have a negative impact on the education system. An integrated and holistic approach to health education and social and political actions to facilitate support for improving the quality of life is a necessity.

Your school environmental policy will help you design programmes that address health and safety priorities in your school, e.g. personal hygiene, communicable diseases, nutrition etc. within the framework of the curriculum. Various government department structures and non-governmental organisations can help you create a safer and healthier school and community environment.

Adapted from: School for Sustainable Environment in the City of Cape Town. P 32

ACTIVITY 11A: DEVELOP AND IMPLEMENT THE ENVIRONMENTAL HEALTH PROGRAMME

WHAT TO DO:

Learners must work in groups.

Help your learners to:

- Explain how they can develop and implement the programme.
 - Discuss and agree on what and how they can contribute to the Environmental Health Programme.
 - Conduct a research around the chosen problem.
 - Write a report on their findings.

- Give your learners the following questions to answer during / after the presentation they are going to listen:
 1. Which environmental health problem has been identified?
 2. What is the cause of the problem?
 3. Who is affected by the problem?
 4. What effect does the problem have on the lives of the people concerned?
 5. What suggested actions to address the problem are given?
 6. What impact will those suggested actions have on your programme?
 7. Agree on what and how each member of the group will contribute to the development and implementation of the environmental health programme.
 8. Consolidate your group discussions and prepare a presentation of your programme implementation plans.
 - Evaluate the suggestions in terms of their practicability, capability to best address the problems identified etc.
 - Discuss and decide on the environmental health programme that they can develop from these suggestions.

ASSESSMENT:

Learners will be assessed on their ability to:

- Listen to suggestions and decide on simple practical actions to address identified health problems.
- Develop practical implementation and management plans.
- Implement the principles of the school environmental policy.

OR

CATERGORIES	Not Achieved (1% - 35%) Level 1	Partially Achieved (36% - 49%) Level 2	Achieved (50% - 69%) Level 3	Outstanding/ Excellent Achievement (70% - 100%) Level 4
Thinking /Inquiry	The learner:			
• Organisation of information / evidence	• Does not identify important evidence relevant to the problem /issue	• Identifies some of the relevant evidence but omits other evidence	• Identifies and logically organises most of the evidence	• Identifies and logically organises most of the evidence
Communication	The learner:			
• Use of various forms of communication (e.g. reports, presentations)	• Demonstrates limited or no command of the various forms	• Demonstrates moderate command of the various forms	• Demonstrates the expected command of the various forms	• Demonstrates extensive command of the various forms

WATER SAFETY

12. SPOT AND KEEP AWAY FROM DANGER

MAIN LEARNING AREAS

SS (G): LO1 GEOGRAPHICAL ENQUIRY

The learner will be able to use enquiry skills to investigate geographical and environmental concepts and processes.

AS3: Analyses and reaches conclusions about information from sources such as photos, maps and atlases, graphs and statistics [works with sources].

AS4: Correlates information from various sources with information from maps, atlases, satellite images or orthophotos [works with sources].

TECH: LO1 TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technology.

AS6: List product and designs specifications and constraints for a solution to an identified problem, need or opportunity based on all of the design key words listed below:

- Environment: where product will be used or made, impact on the environment in the long or short term.
- Safety: for users and manufactures.

TECH LO3: TECHNOLOGY, SOCIETY AND THE ENVIRONMENT

The learner will be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment.

AS2: Impact of Technology: Recognises and identifies the impact technological developments on the quality of people's lives and on the environment in which they live, and suggest strategies for reducing any undesirable effects.

INTEGRATION WITH OTHER LEARNING AREAS

HL: LO 3: READING AND VIEWING

The learner will be able to read and view for information and respond critically to the aesthetic, cultural and emotional values in texts.

AS 10: Reflects on and evaluates own skills as a reader.

ACTIVITY

In this unit learners will be able to:

- Investigate the dangers of water.
- Explore the safety ways of playing in water
- Discuss the rescue methods.

Background Information

Children like to play with water. In most cases when children are not at school or are not at school in summer, you will find them in pools, ponds, dams and in rivers. It is during this period that higher incidents of children drowning are recorded. The risk of drowning is even high if there are no lifeguards. Water may look safe, but it can be dangerous. It is therefore important to learn how to spot and keep away from dangers by always following the Water Safety Code.


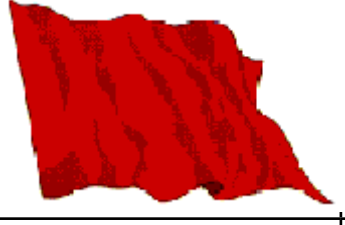

ACTIVITY 12A: TAKE SAFETY ADVICE!

Special flags and notices have been designed to warn you of any potential dangers in water. Knowing these signs and doing what they tell you will help you avoid getting into trouble. Read the following signs used to warn people that playing in water.

GUIDELINES FOR THIS ACTIVITY

1. In the following table learners are presented with the signs and the description of the signs and what the flag indicates.
2. They need to complete the table by indicating the action that they need to take if they see each of the signs.

Signs	Colour of the flag	What it means	What action to take
-------	--------------------	---------------	---------------------

	Lifeguards are on patrol	
	It is dangerous to bathe or swim	
	The area is zoned for surf boats	

3. Divide the learners into groups and let them choose the flag that interests them.
4. Assist the learners to plan on how to design the flag. Ensure that they write the key steps (in their workbooks) that they will follow and the materials they will use to design the flag.
5. Learners should then design the flag, with clear colour and durable materials.
6. Learners are expected to give a brief description of the situation where they will use the flag they have designed. This will indicate whether they understood the purpose the flag will be used for.

ASSESSMENT

Learners should be assessed on the ability to:

- Describe the action which informs the description of the sign.
- Articulate the plan that they will use to design the chosen flag.
- The artistic skill displayed when designing the flag.
- The purpose the flag will be used for (fitness for purpose).

ACTIVITY 12B: IDENTIFY THE DANGERS IN WATER

In this activity learners will:

- Conduct a water survey to identify the potential dangers.
- Design the relevant water safety codes to alert the children about the condition of water in that area.

Background

There are many dangers of water that children are subjected to, ranging from the temperature of water that brings about colds and flu if it is cold, drowning because of the depth of water, hidden currents and rubbish like broken glass, and polluting materials.

What to do?

1. Take learners to any nearby river, dam, pond or pool and conduct a thorough audit of that water.
2. In their audit, learners should look for the dangers of water which include: coldness; depth; hidden currents; hidden rubbish, e.g. shopping trolleys, broken glass; stones, iron bars, sharp objects, pollution level, steepness and sliminess of the river/pool/dam/pond banks that may make it difficult to get out (steep slimy banks); the availability of the lifeguards and or warning signs.
3. Learners should take with the following worksheet to record their audit.

Item/Factor/object/ substance found	Is it (Positive) or Negative	Potential danger that it might cause
TOTAL NUMBER OF ITEMS		Is the area suitable or safe for swimming? Yes or No

4. Based on their answer in 3, learners should suggest the type of signs that they may put in that particular area. Depending on the kind of the flag they designed in activity 1, they may need to redesign it or exchange with the other learners.

5. Learners should then brainstorm on how they will erect the flag in the identified area and how are they going to educate people about what it tells them to do.

ACTIVITY 12C: WATER SAFETY FACT SHEET

This is a data source activity where learners are required to read a passage that describes the drowning problem in South Africa. Learners must read the passage and extract information from the passage in order to answer the questions asked. Learners are also required to study the map of South Africa and locate where the major cases of drowning are recorded. By engaging in this activity, learners are able to:

- Extract information from various sources.
- Analyse the information.
- Interpret the information from various sources.

You need to assist your learners in reading the passage with understanding.

The drowning problem

The article below provides the latest drowning statistics and reveals a few interesting emerging trends. Read it and respond to the questions asked.

One would think that, over the summer holiday season, South Africa’s coastal areas experience the greatest increase in drowning incidences. The country’s beaches are jam-packed with holiday goers, young and old, who don’t necessarily put safety first while being in their relaxed environment. But the latest statistics from the emergency medical services provider Netcare 911 indicate an interesting trend.

Since the beginning of December, Netcare 911 has received more calls relating to drowning and water-related emergency incidents from the country’s inland provinces than it has for the coastal areas. Between 1 December and 14 December, 18 related calls were logged from the provinces of the Western Cape, Eastern Cape, Kwazulu-Natal and the Northern Cape collectively. During the same period, 23 calls were logged at the call centre for incidents happening in the inland provinces.

According to Peter Feurstein, Netcare 911’s Regional Coastal Operations Manager, many of the calls received from the coastal provinces, involving children, resulted from freshwater sources such as public and private swimming pools, rural dams and rivers. There is also a noticeable trend in terms of the age differences of the children involved in these incidences.

“There seems to be a definite distinction between inland and coastal incidents. Coastal incidents seem to be involving the age group of 10 to 18 year-olds more predominantly whilst, inland, the greatest number of incidents involve the 2 to 8 year-old age bracket,” says Feurstein.

Nick Dollman, a safety officer and spokesperson for Netcare 911’s incident management unit in Gauteng, confirms the alarming statistics being shown through this trend: “In Johannesburg alone, Netcare 911 has attended to 17 victims including fatal drowning and near drowning emergencies, since 1 December. 12 of these involved children under the age of 10, two were teenagers and three adults.”

Feurstein believes that this trend can be explained by the fact that warning campaigns about water safety are seemingly more adhered to, as well as the heightened sense of awareness, in the coastal areas. During last year’s holiday season, for instance, the Vodacom Netcare 911 Surf Rescue Service where five helicopters were made

available to volunteer rescue workers from the National Sea Rescue Institute (NSRI), Lifesaving SA and Netcare 911.

Dollman agrees, especially as his team in Gauteng have picked up on the fact that most of the drowning incidences they have been called out to involve the children of people who are not used to being around swimming pools.

He explains: "These past two weeks we attended to several children of domestic workers who had drowned, or nearly drowned, at their parents' place of work. Some of these children are from other provinces and come to visit their family for the holidays and are not familiar with swimming pools or the hazards that lie within. Interestingly, as many of the employers do not have small children themselves; their pools are not protected, which leads to avoidable tragedies."

But swimming pools, even those where permanent lifeguards are on duty, are not the only places where children can easily drown. 90% of children who drown are under some sort of supervision at the time.

Dollman warns that a small child can easily drown in only a few hundred millimetres of water. "We have even attended to a child who had fallen into a large plastic bucket that was being used to clean nappies. Parents and child minders should be aware of all the water hazards in and around the home, including fishponds, water features, toilets, pets' water bowls, bore holes and open drains."

One of the scariest statistics is that, for every child that dies from drowning, five are left with permanent brain damage as a result of the prolonged lack of oxygen which occurs during a near drowning. It takes only four minutes without oxygen for irreversible brain damage to occur. Drownings are listed as one of the top causes of unnatural death amongst children in South Africa. At the same time, these unfortunate events are very preventable. Should you find yourself in the position of having to call for help, please call Netcare 911 immediately on 082 911.

(Netcare latest drowning trends; www.netcare.co.za)

Learners are required to respond to the following questions after reading the passage:

Questions

1. Which is the most unnatural cause of death among children in South Africa?
2. Which part of South Africa experiences such problem of deaths?
3. Drowning features prominently as a leading cause of death in the Free State, Mpumalanga, the North West, and the Northern Cape. Why do you think those parts of South Africa experience such alarming number of deaths?
4. Which age group is mostly experiencing the problem of drowning?
5. How many cases of drowning are reported per year in which period?
6. Given the following map of South Africa, indicate by red colour the places where most deaths occur because of drowning and with a green colour where the least number of deaths occur because of drowning.



ACTIVITY 12D: LEARN HOW TO HELP!

In this activity learners are conscientised on the basic techniques of rescuing a drowning person. These techniques should be practiced with caution and learners can demonstrate these in a pool where there is no risk of drowning. You may request learners to make a nice poster that they will parade the street to educate the community on the techniques to rescue a drowning person.

Go together! Be Alert!

Important message: Children, it is very dangerous to go swimming alone. You should always go with an adult who can spot the danger and help if you get into trouble, not by yourselves. You may be able to help yourself and others if you know what to do in an emergency. If you see someone in difficulty, tell somebody, preferably a lifeguard if there is one nearby, or go to the nearest telephone, dial 10111, and ask for the **Police** for help.

Rescue methods

Rescuing a drowning person is the last resort and you should do everything possible to avoid getting into a dangerous situation in the first place. If you have to make a rescue attempt, think of your own safety first and never put yourself in danger. If the rescue is too dangerous, wait until the emergency services arrive.

Here are some rescue methods that you can use to help someone who is in difficult situation:



Reach

With a long stick, a scarf, clothes or anything else. Crouch or lie down to avoid being pulled in.

Wade

Test the depth with a long stick before wading in and then use the stick to reach out. Hold on to someone else or the bank.



Throw

A rope is best you can then pull in the person. Otherwise throw something that will float a ball, a plastic bottle, a lifebuoy...this will keep the person afloat until help comes.

Row

Use a boat if there is one nearby and if you can use it safely. Do not try to pull the person on board in case they panic and capsize the boat.



(Adapted from Red Cross Water safety materials)

ACTIVITY 12E: YOUNG PEOPLE AND DROWNING – THE FACTS

EXTERNAL CAUSES OF NON-NATURAL DEATH

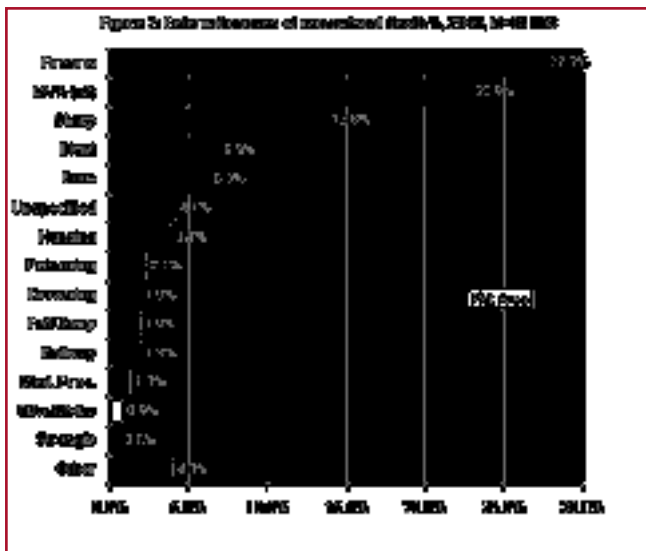
According to the statistics released by the Safety and Security Department, of the 18 858 external causes of non-natural deaths, firearms overshadowed all other external causes, and accounted for almost 28% of all cases. The total of 5 201 firearm deaths was greater than the 4 315 (23%) deaths due to all motor vehicle collision (MVC) categories combined – which includes passengers and drivers in MVCs, as well as pedestrian-vehicle accidents.

GUIDELINES TO THIS ACTIVITY

This activity further provides actual statistics on the number of deaths due to non-natural causes. In this activity learners are required to study the graph that indicates the percentages of external causes of non-natural death and work out the problems that are presented.

To be able to work out the problem, learners should be taught the principles of solving for x and also the conversion theory (converting % into actual numbers vice versa). Note that the statistics were taken in 2000 and the total number of deaths that was recorded due to non-natural causes was 18 858. For example to calculate the actual number of deaths by firearm = $18\ 858 \times 27.6\% = 5205$ deaths.

I



(www.brandon.za.org/crimestats/South_Africa)

What to do?

1. Use the following table to calculate the exact number of deaths as a result of each cause.

Cause of death	%	Actual number of deaths
Firearm		
Motor vehicle collision		
Sharp objects		
Blunt objects		
Burn		
Unspecified		
Hanging		
Poisoning		
Drowning		
Fall/Jump		
Railway		
Bike/		
Strangle		
Other		

2. Which of the mentioned causes are mostly common in young people?
3. What is the actual number of drowning cases that have been reported according to the graph?

ENRICHMENT ACTIVITY

Given that there are close to 427 people that have drowned in a particular year through certain means ranging from rivers to garden ponds learners should:

- (a) Work out the percentage of each of drowning occurred through a particular mean;
- and

(b) Plot the bar graph to represent that information.

Drownings by location

Rivers, streams etc.	167
Coastal	87
Lakes and reservoirs	50
Home baths	42
Canals	34
Docks and harbours	18
Swimming pools	15
Garden ponds	13
Other	1
Total	427

Important Information

A preventative strategy

Codes of advice

We should always strive to prevent drowning rather than to talk about rescuing people from drowning. Following the basic codes of advice will ensure that the dangers of drowning are drastically reduced.

1. You may want to design a poster and engrave the following codes of advice.
2. Pin these codes on the walls of your classrooms, at the foyer or even at the places where children normally swim.

SPOT THE DANGERS!

Learn to spot and keep away from dangers.

TAKE SAFETY ADVICE!

Know what the signs mean and do what they tell you.

DON'T GO ALONE!

An adult can point out dangers or help if somebody gets into trouble.

LEARN HOW TO HELP!

You may be able to help yourself and others if you know what to do in an emergency.

ASSESSMENT

CATERGORIES	Not Achieved (1% - 35%) Level 1	Partially Achieved (36% - 49%) Level 2	Achieved (50% - 69%) Level 3	Outstanding/ Excellent Achievement (70% - 100%) Level 4
Knowledge / Understanding	The Learner:			
• Knowledge of facts and terms	• Demonstrates no or insufficient knowledge of facts and terms	• Demonstrates limited knowledge of facts and terms	• Demonstrates expected knowledge of facts and terms	• Demonstrates thorough knowledge of facts and terms

INVASIVE ALIEN PLANTS

13. WHY IAP'S ARE SUCH A PROBLEM?

MAIN LEARNING AREAS

HL: LO 3: READING AND VIEWING

The learner will be able to read and view for information and respond critically to the aesthetic, cultural and emotional values in texts.

AS2: Reads independently, both aloud and silently, for a variety of purposes, consolidating the appropriate reading strategies developed in earlier grades.

AS 10: Reflects on and evaluates own skills as a reader.

ACTIVITY

At the end of this activity learners will be able to:

- Read and acquire knowledge on why AIP's are such a problem.

ACTIVITY 13A: WHY IAPs ARE SUCH A PROBLEM ?

Ask learners to read the following information sheet:

Alien Plant Invaders - An introduction

A species of plant or animal which does not occur naturally in an area (i.e. is not indigenous), but which has been introduced there by people, is called an alien. Examples of plants, which had been brought to South Africa by people, are roses and mealies. Not all alien species become invasive, that is, spread so rapidly that they take over the local environment and become a threat to indigenous species.

Plants, which have become invasive in South Africa include:

- Australian acacia trees - black wattle, rooikranz, Port Jackson willow, long-leaf wattle
- Other trees like the cluster pine, silky hakea, red river gum tree and bugweed
- Shrubs such as lantana, triffid weed, pom pom weed
- Water weeds such as the water hyacinth and parrot's feather

The water hyacinth is an alien from the Amazon, which creates a lot of work for the Cape Town municipality by clogging up fresh water vleis and marinas. Its growth is promoted by fertilizers, which run into these water bodies from farms, golf courses, etc. But the main invading species in the city and the province are the rooikranz, which thrives on dunes and limestone habitats, and the Port Jackson willow, which grows mainly on the sandstone slopes of the mountains and wetlands.

Why Are They Such A Problem?

Invasive aliens are one of the greatest threats to natural ecosystems and cost the country a lot of money. They reduce our already scarce water supplies, are a threat to biodiversity, take over agricultural land, create great fire hazards, and in these and other ways, cause great economic losses - the equivalent of 4 % of our Gross Domestic Product each year.

Invasive alien plants now affect almost 10 million hectares (8.28%) of the country - and they are spreading rapidly.

The Western Cape is one of the provinces hardest hit. In 1996, 3,7 million hectares of the 13 million hectare area of the province had been invaded by alien plants - that is 28%!

- Invasive alien species are regarded as the single biggest threat to our spectacular biodiversity - the variety of our indigenous plants, animals and habitats. The natural environment is a big attraction for tourists. Anything that threatens our biodiversity, also threatens tourism, and therefore our economy. Invasive aliens take over the habitats of indigenous plants and animals, use up water, and create fire hazards and all these factors can result in the loss of local species.

Ways in which alien plants are a problem in the Western Cape.

- Alien trees threaten our water security. They are using up an estimated 7 % of South Africa's mean annual run-off. That means the already limited amount of water in our streams, rivers, vleis and springs is being reduced, because the alien invaders consume so much water. They do this because of their large numbers. In addition, alien trees use more water than the plants of the indigenous shrublands (such as fynbos) and grasslands they replace. In the dry season, indigenous plants adapt and use less water; alien trees continue to use a lot. This is a big issue in Cape Town, where the demand for water from a growing population is increasing, but the supplies are limited. It has been estimated that clearing more alien trees would save us from having to build new dams; this would be much friendlier on the environment where the dams would have been built, and easier on government's pocket!
- Waterweeds like the water hyacinth clog waterways use up oxygen and block out light, so indigenous plants and animals suffer.
- Invading alien plants can destabilize river banks, making them susceptible to erosion
- Alien trees fuel extremely hot fires that are hard to control, and create conditions for worse fires to come. This too, worsens the already critical problem of erosion and the loss of topsoil. Although fynbos needs fire to regenerate, the wild fires which spread through alien trees are too hot, and can destroy even seeds in nearby fynbos.
- Alien species take over productive agricultural land, making it more difficult for us to farm, produce food and create sustainable jobs in the agricultural industry.

Why do some species become invasive?

When some alien plants are introduced to new areas where the conditions are suitable,

They also find themselves free of controlling factors - the diseases, parasites and Predators, which would keep their numbers in, check in their natural home environment.

With this average advantage, they out-compete local species and take over their habitats

– they become invasive

Why do some alien plant species spread so quickly?

The acacias which have invaded the Western Cape, found here a Mediterranean climate.

Soil and fire conditions in Australia where they originally come from, and none of their natural enemies. In addition, they produce vast quantities of seed which remain in the ground, even after the trees had been removed; they thrive on fires; can remain dormant underground for many years before sprouting; and when pulled out they simply break off and continue to grow. So they spread rapidly and are extremely difficult to control.

How Alien plant Species arrived in the Western Cape?

Human impact on the landscape - how the alien got here?

The Australian acacias which are such a problem in the Western Cape today, were Originally brought here for timber (after indigenous forests were used up), for bark products (e.g. bark was used to tan leather) and to stabilise sand dunes. Plantation forestry has been one of the country's major sources of alien infestation - 38% of the area invaded in South Africa is occupied by species used in commercial forestry (especially pines and black wattles). The water hyacinth was imported for use in fish tanks, then introduced to Kuisriver by farmers keen to feed their cattle on this prolific grower.

None of these plants cause problems in their native lands. Their invasive qualities were unsuspected, which goes to show that no alien plant or animal should ever be released into an area without screening for its invasive potential. Almost any alien could become an invader. From this we also learn that when we come up with a solution to a problem (such as wanting to stabilise sand dunes), we need to think carefully about any unintended effects, which our solution might have.

The Threat of Invasive Aliens To Biodiversity in the Western Cape

You probably know that South Africa has spectacular natural beauty and amazing wildlife.

In fact, we have a very rich diversity of plants and animals. The Western Cape is blessed with much of that biodiversity, which is an important contributor to the economy of the province.

But this biodiversity is under threat. The biggest threat is direct habitat destruction (where Indigenous plants and wildlife had to make way for urban development, farms and forests).

The second biggest threat to the biodiversity of the province is invading alien organisms.

In the case of the Cape Peninsula, almost 40% has been transformed by agriculture and Urbanisation. Of the remaining area, 10.7% is currently under dense stands of alien plants and another 32.9% is lightly invaded.

The Cape Floral Kingdom covers 90 000 km square. This area, barely 4% of the land surface of southern Africa, is home to 45% of the subcontinent's plant species. There are almost 8 600 species of plants here, of which almost 70% are endemic - they are found nowhere else on Earth.

The Cape Floral Kingdom is a global biodiversity hotspot. Currently, 1 406 of our plant species are listed in the Red Data Book of endangered plants, the highest known concentration of such species in the world. Almost one third of the Cape Floral Kingdom has already been lost to urbanisation, agriculture and forestry, and the remaining areas are under severe threat from invading alien plants.

The prognosis for the future of the Cape Floral Kingdom if there is no or little control of invading alien plants, is grim. Indications are that Southern Africa could lose almost 25% of its plant species from this province alone, due to invading alien plants.

Let them answer the following questions:

1. What does the word Invasive mean?

2. What does the word Alien mean?

3. What are Invasive Alien Plants?

4. Why were they introduced in our country?

5. Where will you usually find them?

6. Why do they become invasive?

7. How did they get into our country?

8. Why are they such a problem?

9. **Homework on AIP's**



Ask the learners to study the picture given and then write a paragraph to fill the lines below on what the picture tells you about alien plants.

The following are expected to appear in your paragraph.

- Heading for the paragraph.
- Environment where this is happening.
- People in the picture (their feelings).
- The appearance of the flag on the picture.

ASSESSMENT INSTRUMENT RUBIC

CONTENT	1	2	3	4
Heading	Heading not relevant to the picture	A part of heading is relevant	Does not fully describe the picture	Heading relevant
Environment	Did not mention the environment	Slightly describe the environment	Described it but no mention of plants	Described the environment well and included the plants
Flag	Did not the flag	Only mention what it looks like, but not its purpose	Did not mention the country but mentioned why it's here	Described the country and mention why its there

14. WHAT DAMAGE DO INVASIVE ALIEN PLANTS CAUSE?

MAIN LEARNING AREAS

HL: LO3 READING AND VIEWING

The learner will be able to read and view for information and enjoyment, and respond critically to the aesthetic, cultural and emotional values in texts.

AS1: Reads spontaneously and extensively for pleasure and information across the range of text types studied, compares personal responses, and makes motivated recommendations to others.

AS4: Shows understanding of a wide range of information texts:

- Discusses different points of view.

INTEGRATION WITH OTHER LEARNING AREAS

NS: LO2 CONSTRUCTING SCIENCE KNOWLEDGE

The learner will be able to interpret and apply scientific, technological and environmental knowledge.

AS4: Applies knowledge: Applies principles and links relevant concepts to generate solutions to somewhat unfamiliar problems.

ACTIVITY

At the end of this activity learners will be able to:

- Read and acquire knowledge on how IAP's threaten our environment.

BACKGROUND INFORMATION

Invasive aliens threaten our natural environment

- Invasive alien plants suck up water that our local plants, animals and people need.
- Our animals are in danger of dying out. Alien plants are taking over our indigenous plants, which provide homes and food for our animals.

Invasive aliens fuel fires and cause fire damage

- Invasive aliens grow in grasslands. So, there are more plants that can burn in a fire. The fires burn at much hotter temperatures than usual.
- The hot temperatures change the soil so that it cannot soak up water after the rains. This can make flooding worse.
- Usually seeds of indigenous plants grow again after a fire, even if the seeds have been in the soil for as long as 50 years! But if the heat is too powerful then the fire kills the seeds, roots and stems. Nothing grows so these areas and the soil begins to dry and crack - it erodes.



Massive alien trees burning in the Western Cape.



Soil erodes when the indigenous plants die.

Invasive aliens cause droughts

- Invasive aliens grow taller, thicker and more quickly and so use more water than Indigenous plants.
- Invasive aliens often have deeper roots than indigenous plants. So they can get more water from the soil.
- They keep their leaves all year round. So they lose water through their leaves all the time.
- Invasive aliens use up precious water that could be used for cleaning and washing instead.

ACTIVITY 14A: INVASIVE ALIENS THREATEN OUR NATURAL ENVIRONMENT

WHAT TO DO:

- Divide the learners into groups.
- Give them a copy of an article to read.
- In their groups let them discuss what they understand about the article.
- Ask learners to write a creative story or poem about Invasive Alien Plants.

ACTIVITY 14B

- Ask the learners to imagine they are an Invasive Alien Plant.
- Ask them to tell of their experiences, they can write it in a form of an essay.

ASSESSMENT

Use the following rubric to assess the ability to write a creative story.

ASSESSMENT CRITERIA	PERFORMANCE INDICATOR LEVELS						COMMENT
	0	1	2	3	4	5	
Creative/ correct scientific concept ideas used for topic and content	No logic flow	Very superficial, disorganized, lacking insight.	Completely descriptive, superficial, lacking in detail, missing the focus of the topic	Slightly more descriptive than critical and answered with understanding, analysis is vague at places	Good critical concept analysis, focused work	Excellent critical concept analysis, writing stays very focused	
Topic of the theme adhered to throughout the writing.	No logic flow	Very superficial, disorganized, lacking insight	Completely descriptive, superficial, lacking in detail, missing the focus of the topic.	Slightly more descriptive than critical and answered with understanding, analysis is vague at places	Good critical concept analysis, focused work.	Excellent critical concept analysis, writing stays very focused	
Clear thought sequence and logic	No logic flow	Very superficial, disorganized, lacking insight	Completely descriptive, superficial, lacking in detail, missing the focus of the topic.	Slightly more descriptive than critical and answered with understanding, analysis is vague at places	Good critical concept analysis, focused work.	Excellent critical concept analysis, writing stays very focused	
Correct use of learning areas	No logic flow	Very superficial, disorganized, lacking insight	Completely descriptive, superficial, lacking in detail, missing the focus of the topic.	Slightly more descriptive than critical and answered with understanding, analysis is vague at places	Good critical concept analysis, focused work.	Excellent critical concept analysis, writing stays very focused	
Concise, brief focused sentences used	No logic flow	Very superficial, disorganized, lacking insight	Completely descriptive, superficial, lacking in detail, missing the focus of the topic.	Slightly more descriptive than critical and answered with understanding, analysis is vague at places	Good critical concept analysis, focused work.	Excellent critical concept analysis, writing stays very focused	

15. CAREERS IN FORESTRY

MAIN LEARNING AREA

LO LO5: ORIENTATION TO THE WORLD OF WORK

The learner will be able to make informed decisions about further study and career choices.

AS1: Researches study and career finding providers.

AS2: Motivates own career and study choices.

INTEGRATION WITH OTHER LEARNING AREAS

HL: LO3 READING AND VIEWING

The learner will be able to read and view for information and enjoyment, and respond critically to the aesthetic, cultural and emotional values in texts.

AS1: Reads spontaneously and extensively for pleasure and information across the range of text types studied, compares personal responses, and makes motivated recommendations to others.

ACTIVITY

The learner will be able to:

- Acquire information on different careers in forestry.

INTRODUCTION

What is a Career?

A career is a job you have chosen in wide field of study that covers many aspects of work. You choose to work in a career. Since a career is a job you spend along time of your life doing, it is something that requires careful thinking from a very young age. Now is the time to think about yours. A Career is the same answer you give when you are asked: What will you be when you grow up? Your answer is your career.

A career in forestry is a combination of science, business and art. The art component lies in the imaginative skills of the graduate to interpret scientific knowledge and apply it as technology in a particular situation.

FORESTERS AND FORESTRY SCIENTISTS

The role of a forester and forestry scientist is to manage commercial forestry estates and natural forests in a sustainable manner. This is done by protecting the natural resource base, establishing and promoting the growth of planted trees and harvesting the raw material (timber). The forester must be aware of the forest pests and tree diseases that (s) he must control as far as possible. The forester further has to ensure fires and environmental damage is minimized and that the land is restored for future plantings (afforestation).

A forester must interact with local, provincial and national authorities, tourism organisation and farmers to establish the best possible protective policy for the plantations under management.

CAREER OPPORTUNITIES IN FORESTRY

Employment opportunities range from entrepreneurial enterprises to the corporate environment locally and abroad:

- Forester
- Forestry Scientist
- Plantation Manager
- Environmental Planner
- Forestry Consultant
- Forest Enterprise Development Specialist
- Forestry Local Development Specialist
- Timber Grower
- Forestry Nursery Manager
- Forestry Global Information Systems Specialist
- Forestry extension officer
- Forestry researcher
- Forest Ecologist
- Forestry lecturer
- Forestry Production Manager
- Forestry logistics Manager
- Tree Breeder
- Natural resource Manager

- Rural Development Advisor
- Furniture Maker
- Wood Technologist
- Forestry Fire Advisor

POSSIBLE EMPLOYERS

The Department of Water Affairs and Forestry, other government departments, Sappi, Mondi, Hans Merensky, Global Forest, Komati Land, SAFCOL and others.

Higher Education Institutions Offering Forestry- related Qualifications.

Only five institutions offer formal academic forestry qualifications nationally:

1. NELSON MANDELA METROPOLITAN UNIVERSITY
2. STELLENBOSCH UNIVERSITY
3. UNIVERSITY OF VENDA
4. UNIVERSITY OF KZN
5. FORTCOX COLLEGE OF AGRICULTURE & FORESTRY

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