Agricultural and Horticultural Studies

Victorian Certificate of Education Study Design

Victorian Curriculum and Assessment Authority
2010

Updated December 2015
Latoya BARTON
The sunset (detail)
from a series of twenty-four
9.0 x 9.0 cm each, oil on board

Tarkan ERTURK
Visage (detail)
207.0 x 170.0 cm
synthetic polymer paint, on cotton duck

Liana RASCHILLA
Teapot from the Crazy Alice set
19.0 x 22.0 x 22.0 cm
earthenware, clear glaze, lustres

Nigel BROWN
Untitled physics (detail)
90.0 x 440.0 x 70.0 cm
composition board, steel, loudspeakers, CD player, amplifier, glass

Kate WOOLLEY
Sarah (detail)
76.0 x 101.5 cm, oil on canvas

Chris ELLIS
Tranquility (detail)
35.0 x 22.5 cm
gelatin silver photograph

Christian HART
Within without (detail)
digital film, 6 minutes

Kristian LUCAS
Me, myself, I and you (detail)
56.0 x 102.0 cm
oil on canvas

Meryn ALLEN
Japanese illusions (detail)
centre back: 74.0 cm, waist (flat): 42.0 cm
polyester cotton

Ping (Irene VINCENT)
Boxes (detail)
colour photograph

James ATKINS
Light cascades (detail)
three works, 32.0 x 32.0 x 5.0 cm each
glass, fluorescent light, metal

Tim JOINER
14 seconds (detail)
digital film, 1.30 minutes

Lucy McNAMARA
Precariously (detail)
156.0 x 61.0 x 61.0 cm
painted wood, oil paint, egg shells, glue, stainless steel wire

Updated December 2015
Contents

5 Important information

7 Introduction
   Rationale

8 Aims
   Structure
   Entry
   Duration
   Changes to the study design

9 Monitoring for quality
   Safety
   Animal welfare
   Use of information and communications technology
   Employability skills
   Legislative compliance

10 Assessment and reporting
    Satisfactory completion
    Authentication
    Levels of achievement

12 Unit 1: Agricultural and horticultural operations
    Areas of study and Outcomes
    Assessment

16 Unit 2: Production
    Areas of study and Outcomes
    Assessment

20 Unit 3: Technology, innovation and business practices
    Areas of study and Outcomes
    Assessment

27 Unit 4: Sustainable management
    Areas of study and Outcomes
    Assessment

Updated December 2015
Advice for teachers

Developing a course
Use of information and communications technology
Investigations using scientific methodology
Glossary
Suitable resources
Victorian Essential Learning Standards (VELS)
Employability skills
Learning activities
School-assessed Coursework
IMPORTANT INFORMATION

Accreditation period
Units 1–4: 2011–2019
The accreditation period commences on 1 January 2011.

Other sources of information
The *VCAA Bulletin VCE, VCAL and VET* is the only official source of changes to regulations and accredited studies. The *VCAA Bulletin VCE, VCAL and VET*, including supplements, also regularly includes advice on VCE studies. It is the responsibility of each VCE teacher to refer to each issue of the *VCAA Bulletin VCE, VCAL and VET*. The *VCAA Bulletin VCE, VCAL and VET* is sent in hard copy to all VCE providers. It is also available as an e-newsletter via free subscription on the Victorian Curriculum and Assessment Authority’s website at www.vcaa.vic.edu.au

To assist teachers in assessing School-assessed Coursework in Units 3 and 4, the Victorian Curriculum and Assessment Authority publishes online an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment.

The current *VCE and VCAL Administrative Handbook* contains essential information on assessment processes and other procedures.

VCE providers
Throughout this study design the term ‘school’ is intended to include both schools and other VCE providers.

Photocopying
VCE schools only may photocopy parts of this study design for use by teachers.
Introduction

RATIONALE

Australia is reliant on its primary industries. The sustainable management of Australia’s finite land and water resources is vital for the continued production and supply of food and fibre to local, national and global markets. VCE Agricultural and Horticultural Studies provides opportunities for students to experience and understand these primary industries.

VCE Agricultural and Horticultural Studies is designed to develop students’ understanding of the operations and practices involved with sustainable agricultural and horticultural systems within an economic, social and environmental context. This study allows students to develop and apply theoretical knowledge and skills to real world business and practices. An understanding of agribusiness operations involves a broad familiarity with interdisciplinary skills and knowledge of technology, science, economics and business management, marketing, geography and information and communications technology (ICT). Students apply their acquired knowledge and skills to design, develop and manage an agricultural and/or horticultural business as a project within this study.

The study provides a contextual overview of the scientific, management and operational skills and knowledge required to run a small agricultural and/or horticultural business. The study considers current and future practices within the Australian and international agribusiness sector. Students are expected to research change and innovation with regard to agricultural and/or horticultural businesses, responding to a range of drivers and demands.

The broad applied nature of the study of agribusiness operations prepares students to make decisions about career opportunities or further studies in agriculture, horticulture, land management, agricultural business practice and natural resource management. It complements the skills focus of competency-based training available through VET certificates in Agriculture, Horticulture and Conservation and Land Management.
AIMS

This study enables students to:

• develop an interdisciplinary approach to the study of agriculture and horticulture
• gain an understanding of the role of agriculture and horticulture in a local, national and global economy
• understand scientific methodologies and applications in agriculture and horticulture
• understand the concepts of environmental, economic and social sustainability as applied to agriculture and horticulture
• develop knowledge and skills associated with ethical and sustainable land, plant and animal management
• understand the systems and activities required to operate a variety of agribusinesses
• develop an awareness of the innovative practices being developed by and applied to a variety of agricultural and/or horticultural businesses.

STRUCTURE

The study is made up of four units.

Unit 1: Agricultural and horticultural operations
Unit 2: Production
Unit 3: Technology, innovation and business practices
Unit 4: Sustainable management

Each unit deals with specific content contained in areas of study and is designed to enable students to achieve a set of outcomes for that unit. Each outcome is described in terms of key knowledge and key skills.

A glossary explaining terms used across Units 1 to 4 in the VCE Agricultural and Horticultural Studies study design is included on pages 37 to 39 under ‘Advice for teachers’.

ENTRY

There are no prerequisites for entry to Units 1, 2 and 3. Students must undertake Unit 3 prior to undertaking Unit 4. Units 1 to 4 are designed to a standard equivalent to the final two years of secondary education.

DURATION

Each unit involves at least 50 hours of scheduled classroom instruction.

CHANGES TO THE STUDY DESIGN

During its period of accreditation minor changes to the study will be announced in the VCAA Bulletin VCE, VCAL and VET. The VCAA Bulletin VCE, VCAL and VET is the only source of changes to regulations and accredited studies and it is the responsibility of each VCE teacher to monitor changes or advice about VCE studies published in the VCAA Bulletin VCE, VCAL and VET.
MONITORING FOR QUALITY

As part of ongoing monitoring and quality assurance, the Victorian Curriculum and Assessment Authority will periodically undertake an audit of VCE Agricultural and Horticultural Studies to ensure the study is being taught and assessed as accredited. The details of the audit procedures and requirements are published annually in the VCE and VCAL Administrative Handbook. Schools will be notified if they are required to submit material to be audited.

SAFETY

This study may involve the handling of potentially hazardous substances and/or the use of potentially hazardous equipment and/or the handling of potentially hazardous plants and animals. It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking the study.

ANIMAL WELFARE

When students and teachers include animals within their projects or educational activities they must comply with the appropriate codes of practice for animal welfare available from the Victorian Department of Primary Industries. These may be accessed via the ‘Animal Welfare’ page within the ‘Animals and Livestock’ section of the ‘Agriculture’ area of the Department of Primary Industries’ website: http://new.dpi.vic.gov.au/agriculture

It is a legal requirement that an application be lodged with the Victorian Schools Animal Ethics Committee to seek approval for keeping any animals at school for the purpose of teaching and learning. Information on this process can be found at: www.education.vic.gov.au/management/schooloperations/animalcare/default.htm

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

In designing courses for this study teachers should incorporate information and communications technology (ICT) where appropriate and applicable to the teaching and learning activities.

EMPLOYABILITY SKILLS

This study offers a number of opportunities for students to develop employability skills. The ‘Advice for teachers’ section provides specific examples of how students can develop employability skills during learning activities and assessment tasks.

LEGISLATIVE COMPLIANCE

When collecting and using information, the provisions of privacy and copyright legislation, such as the Victorian Information Privacy Act 2000 and Health Records Act 2001, and the federal Privacy Act 1988 and Copyright Act 1968, must be met.
Assessment and reporting

SATISFACTORY COMPLETION

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher’s assessment of the student’s performance on assessment tasks designated for the unit. Designated assessment tasks are provided in the details for each unit. The Victorian Curriculum and Assessment Authority publishes online an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment for Units 3 and 4.

Teachers must develop courses that provide opportunities for students to demonstrate achievement of outcomes. Examples of learning activities are provided in the ‘Advice for teachers’ section.

Schools will report a result for each unit to the Victorian Curriculum and Assessment Authority as S (Satisfactory) or N (Not Satisfactory).

Completion of a unit will be reported on the Statement of Results issued by the Victorian Curriculum and Assessment Authority as S (Satisfactory) or N (Not Satisfactory). Schools may report additional information on levels of achievement.

AUTHENTICATION

Work related to the outcomes of each unit will be accepted only if the teacher can attest that, to the best of their knowledge, all unacknowledged work is the student’s own. Teachers need to refer to the current VCE and VCAL Administrative Handbook for authentication procedures.

LEVELS OF ACHIEVEMENT

Units 1 and 2

Procedures for the assessment of levels of achievement in Units 1 and 2 are a matter for school decision. Assessment of levels of achievement for these units will not be reported to the Victorian Curriculum and Assessment Authority. Schools may choose to report levels of achievement using grades, descriptive statements or other indicators.
Units 3 and 4
The Victorian Curriculum and Assessment Authority will supervise the assessment of all students undertaking Units 3 and 4.

In VCE Agricultural and Horticultural Studies students’ level of achievement will be determined by School-assessed Coursework and an end-of-year examination. The Victorian Curriculum and Assessment Authority will report students’ level of performance on each assessment component as a grade from A+ to E or UG (ungraded). To receive a study score, students must achieve two or more graded assessments and receive S for both Units 3 and 4. The study score is reported on a scale of 0–50; it is a measure of how well the student performed in relation to all others who took the study. Teachers should refer to the current VCE and VCAL Administrative Handbook for details on graded assessment and calculation of the study score. Percentage contributions to the study score in VCE Agricultural and Horticultural Studies are as follows:

- Unit 3 School-assessed Coursework: 33 per cent
- Unit 4 School-assessed Coursework: 33 per cent
- End-of-year examination: 34 per cent.

Details of the assessment program are described in the sections on Units 3 and 4 in this study design.
Unit 1: Agricultural and horticultural operations

In this unit students study local agricultural and horticultural operations and the economic, social, environmental and historical factors that influence these operations. Students develop an understanding of how the biological and physical components of the environment and human resources influence the type of agribusinesses undertaken at particular locations. They consider the importance of using scientific methodology when investigating agricultural and horticultural systems.

Students apply their knowledge and skills in researching the feasibility and establishment of a small agricultural and/or horticultural business project. Students consider business opportunities and financial aspects, and growth and production of plants and animals. They use appropriate production skills, plan and use resources sustainably, and evaluate and report on the progress of the small business.

AREA OF STUDY 1

Influences on agricultural and horticultural systems
This area of study focuses on the components that constitute Australian agricultural and horticultural systems. These components include the biological aspects: varieties/breeds, structure, function and growth of plants and animals; physical aspects: soils, water, climate and weather, infrastructure, inputs and outputs; and human resources. Using a case studies approach, students learn how these components influence the type of agricultural and/or horticultural enterprises undertaken in their local area. Students consider the importance of using the scientific approach when investigating aspects of agricultural and horticultural systems.

Outcome 1
On completion of this unit the student should be able to describe a range of biological, physical and human resources and their influence on agricultural and/or horticultural systems in the local area, and explain the importance of the application of scientific principles in production.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 1.
Key knowledge
This knowledge includes:
• the role of plants and animals in agricultural and/or horticultural businesses in Australia
• identification of types/varieties, structure and function of plants, and their growth
• identification of breeds and structure of animals, and their growth
• types and compositions of soil and other growing media
• regional climate and weather and their influence on agricultural and/or horticultural production
• water availability and quality
• physical resources including infrastructure, boundaries, inputs and outputs of agricultural and/or horticultural systems
• human resources and their role in agricultural and/or horticultural businesses
• production cycles in agricultural and/or horticultural businesses
• the influence of economic, social, environmental and historical factors on the sustainability of agricultural and horticultural systems
• scientific methodology and the importance of controlled experiments in an agricultural and/or a horticultural context.

Key skills
These skills include the ability to:
• use a case study approach to:
  – explain the role of plant and animal varieties in a range of production systems
  – describe the operation and production cycle/s of local agricultural and/or horticultural businesses using a simple systems model
  – analyse the suitability of location and physical resources and their availability for an agricultural or a horticultural system in relation to environmental, economic, social and historical factors
  – identify and explain the role of human resources in an agricultural and/or a horticultural system
• describe the basic structure and function of plants, including photosynthesis and transpiration
• describe how the structure of animals relates to their production outputs
• research and analyse the environmental and/or genetic factors that influence the growth of plants and animals
• measure the characteristics of the main soil types and growing media, including composition, structure, texture, water holding capacity, pH, organic matter content and electrical conductivity
• interpret climate and weather data and its impact on plant and animal production
• conduct an experiment related to plant or animal growth and explain how it relates to plant or animal production.

AREA OF STUDY 2

Agricultural and horticultural operations
In this area of study students work individually and/or in a group to plan and conduct a small business project involving the monitoring and care of living plants or animals, using available resources. Students develop a detailed business and operational plan for the small business project. As part of the planning and implementation of the business, students consider the viability of a business opportunity and the
requirements for the production of plants and/or animals. Students consider the financial aspects and
use tools, equipment and production skills. They record production data and evaluate the progress of
the business.

In this area of study, students’ small business projects may be solely agricultural or horticultural or
may be a mixture of both. Suitable small business projects are:

- Aquaculture
- Container growing of ornamental plants
- Growing flowering plants in a glass house
- Hydroponic crop production
- Managing poultry for fresh eggs or meat market
- Milk production
- Rearing lambs for meat
- Rearing sheep to produce wool or prime lambs
- Turf management/sporting turf management
- Aquaponics
- Field growing of a vegetable, herb or flower crop
- Growing indigenous plants for revegetation use
- Intensive animal systems for meat, fibre, egg or milk markets
- Managing trees to produce a crop of fruit, seed or oil
- Rearing cattle for the beef market
- Rearing piglets for sale
- Rearing fish or yabbies for farm dams
- Worm farming
- Bee keeping
- Growing a grain or pulse crop
- Horse agistment, grooming and training
- Landscape design installation and maintenance
- Managing vines to produce a crop of grapes
- Rearing dairy heifer replacements
- Rearing rabbits for the pet or meat market
- Seedling production

**Outcome 2**

On completion of this unit the student should be able to plan, implement and evaluate management and
production activities to operate a small agricultural and/or a horticultural business project involving
the care and monitoring of living plants or animals.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of
Study 2.

**Key knowledge**

This knowledge includes:

- the nature of an agricultural and/or a horticultural business
- the components of small business and its planning, including researching resources and potential
  markets, budgeting, operation and evaluation
- safe methods to implement procedures to conduct a small business project
- the relationship between available resources and appropriate business type
- strategies to use resources in a sustainable manner.

**Key skills**

These skills include the ability to:

- work effectively as a team member
- identify and compare potential business opportunities appropriate to the available resources
- identify a potential market for the product/s to be produced
- research and analyse requirements for growth and production of specific plants and/or animals,
  including appropriate animal welfare considerations
- select and justify a business project to be undertaken
• develop a production plan, including an expected timeline of operations
• plan for, and implement, the sustainable use of resources
• calculate costs of production
• predict possible outcomes of the production and sales, including estimates of profit/loss
• select and use appropriate production skills
• safely use tools and equipment appropriate to the business project
• collect and record appropriate production data, including visual material (for example, photographs)
• evaluate and report on the progress of the business project, and suggest improvements.

ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher’s assessment of the student’s overall performance on assessment tasks designated for the unit.

The key knowledge and key skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and key skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and key skills should not be assessed separately.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Teachers should select a variety of assessment tasks for their assessment program to reflect the key knowledge and key skills being assessed and to provide for different learning styles.

For this unit students are required to demonstrate achievement of two outcomes. As a set these outcomes encompass both areas of study.

Demonstration of achievement of Outcomes 1 and 2 must be based on the student’s performance on a selection of assessment tasks. Where teachers allow students to choose between tasks they must ensure that the tasks they set are of comparable scope and demand.

Assessment tasks for this unit are selected from the following:
• annotated visual displays
• website presentations
• multimedia presentations
• tests (short answer, open book)
• short written reports (including case study report where appropriate)
• oral reports
• practical demonstrations
• production plan, costing, production records, including visual material, evaluation report
• media response
• scientific investigation and report.
Unit 2: Production

This unit focuses on plant and animal nutrition, and growth and reproduction and their relationships within agribusiness systems. Students analyse agricultural and/or horticultural production systems in terms of timelines for production, taking into account physical, biological, economic, social and environmental factors. They consider the impacts of climate extremes on plant and animal production and use a scientific approach to investigating aspects of production.

Students use a small business project to explore the role of agribusiness in value adding to the product of an agricultural and/or a horticultural business. They consider business and production operations, production and environmental risks, sustainability of operations, and marketing. Students monitor and evaluate the outcomes of the small business project.

AREA OF STUDY 1

Biological and environmental factors
This area of study focuses on nutrition, reproduction and genetics in plants and animals, and how these relate to agricultural and horticultural systems. Students consider the influence of biological factors, such as disease causing organisms and pests which increase or decrease production, along with the impacts of climate extremes such as frost or wind chill. Students develop an understanding of the role of scientific research to improve efficiency of plant and/or animal production.

Outcome 1
On completion of this unit the student should be able to describe the nutritive and reproductive processes of plants and animals, their application to agricultural and/or horticultural production systems, and specific biological and environmental factors that influence production systems.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 1.

Key knowledge
This knowledge includes:

- animal nutrition, including digestive systems, food composition, nutrients and their relationship to growth
- plant nutrition, including specific nutrients for plant function and growth
• animal reproduction, including reproductive organs, processes, developmental stages and basic animal genetics
• plant reproduction, including reproductive structures, sexual and asexual reproduction, growth cycle and basic plant genetics
• the role of hormones in plant and animal growth and reproduction
• the role and relationship between nutrition and reproduction of plants and/or animals
• biological factors that improve or decrease production system efficiency, including nutrient-fixing organisms, disease causing organisms, and pests
• role of scientific research methodology to improve efficiency of plant and animal systems
• impacts of seasonality and climate extremes, such as frost and wind chill, on animal and plant production.

**Key skills**

These skills include the ability to:

• identify and describe the main anatomical and physiological structures associated with growth and reproduction of plants and animals
• explain the processes associated with plant and animal nutrition and reproduction
• explain the influence of hormones on plant and animal growth and reproduction
• describe the principles of plant and animal genetics
• explain the range of biological factors that could influence plant and animal production efficiency, including nutrient-fixing organisms, disease causing organisms, and pests
• explain the range of environmental factors that could influence plant and animal production efficiency, including seasonality, climate and weather, soils and water
• plan, conduct, analyse and report on an experiment involving plant/s and/or animal/s and relate this to plant and/or animal nutrition or reproduction.

**AREA OF STUDY 2**

**Production systems and processes**

In this area of study students explore the role of agricultural and horticultural businesses in adding value to primary products. The student’s small agricultural and/or horticultural business project is used to investigate and report on factors related to production processes, risk management and marketing. Students consider sustainable production and marketing processes, and how they contribute to the value of a product and are influenced by and have an impact upon the environment in which they operate. Students’ small business projects may be solely agricultural or horticultural or a mixture of both, and may be conducted individually and/or as a member of a team.

**Outcome 2**

On completion of this unit the student should be able to plan, implement, monitor and evaluate the production processes and marketing for a small agricultural and/or horticultural business project, demonstrating how the business adds value to the product and manages risk.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.
**Key knowledge**

This knowledge includes:

- factors that influence the operation of the business, including management, financial, production and animal welfare
- sustainability factors through the production cycle to minimise resource use, waste and environmental impact
- environmental factors such as the long-term climatic extremes caused by wind, water and temperature
- physical and human resource inputs into agricultural and/or horticultural production
- the effects and implications of production outputs, intended and unintended
- production processes and timelines
- risks involved with production processes, such as health and safety, day-to-day weather extremes, pests and diseases
- methods of developing a budget
- methods of marketing agricultural and/or horticultural products to local and national markets
- methods of collecting and reading data and reporting on outcomes of an agricultural and/or a horticultural business in relation to its business plan.

**Key skills**

These skills include the ability to

- identify production inputs for a small business project
- prepare a timeline and schedule for the operation of a business
- identify costs and production returns and develop a budget to support production processes
- describe and implement the production processes for an agricultural and/or a horticultural product
- describe and implement the marketing strategies for an agricultural and/or a horticultural product and relate these to local and national markets
- identify and evaluate sustainable business practices, including the use of resources, the management of waste and other environmental considerations relevant to the business
- identify risks (such as business, environmental and occupational health and safety) in production and monitor and adjust for change in operations
- use appropriate production skills, including adherence to animal welfare requirements
- safely use appropriate tools and equipment
- evaluate production outcomes, both intended and unintended
- collect and record appropriate production data, including visual material
- prepare a profit and loss statement
- evaluate and report on the outcomes of the business project, including suggested modifications to improve its operation.
ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher’s assessment of the student’s overall performance on assessment tasks designated for the unit.

The key knowledge and key skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and key skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and key skills should not be assessed separately.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Teachers should select a variety of assessment tasks for their assessment program to reflect the key knowledge and key skills being assessed and to provide for different learning styles.

For this unit students are required to demonstrate achievement of two outcomes. As a set these outcomes encompass both areas of study.

Demonstration of achievement of Outcomes 1 and 2 must be based on the student’s performance on a selection of assessment tasks. Where teachers allow students to choose between tasks they must ensure that the tasks they set are of comparable scope and demand.

Assessment tasks for this unit are selected from the following:

- annotated visual displays
- website presentations
- multimedia presentations
- tests (short answer, open book)
- short written reports
- oral reports
- research reports
- practical demonstrations
- business plan, including budgets
- evidence of production, including visual material (for example, photographs)
- business report, including production and financial evaluation
- media response
- scientific investigation and report.
Unit 3: Technology, innovation and business practices

In this unit technology refers to the equipment, management techniques and processes that can be used to maintain and/or enhance efficiency and effectiveness of agricultural and horticultural systems in order to achieve socially, economically and environmentally sustainable agricultural and horticultural systems. Students develop an understanding of the range of available equipment and processes that may be used in agricultural and horticultural businesses, including the current commonly used technologies and innovative technologies. They learn how the capabilities of equipment and application of processes assists decision making and management practices in agricultural and horticultural enterprises.

Management of soil/growing media, water, pests and diseases of plants and/or animals and weeds are considered through an integrated management approach. For Outcome 1 a selection is made from the Prescribed List of Pests, Diseases and Weeds, published annually in the *VCAA Bulletin VCE, VCAL and VET*.

This unit also focuses on a range of technology that is currently used by commercial agricultural and/or horticultural businesses; students review the areas where change and innovation are occurring. Students consider and analyse the likely impacts of new and emerging developments in technology.

Students individually design a small agricultural or horticultural business that involves the management of plants and/or animals. Using a range of production techniques and equipment they commence their business and report on its progress. Students will continue to manage this business in Unit 4.

In undertaking this unit students concentrate on any one or two commercial agricultural and/or horticultural business/es. The business/es selected must allow for the study and achievement of the knowledge and skills required for Outcomes 1 and 2. The business/es selected for study for Outcomes 1 and 2 may be related to the business being planned by the student for Outcome 3 of this unit. The following commercial business areas are suitable for study for Outcomes 1 and 2:
• Agroforestry
• Aquaculture
• Community supported agriculture or horticulture
• Fruit or nut production
• Grape production
• Milk production
• Production of biofuels
• Small-scale diverse agriculture or horticulture
• Alley farming
• Broad acre dry land cropping
• Conversion from traditional to organic farming
• Garden design and construction and/or maintenance
• Intensive animal production
• Nursery production of ornamental plants
• Revegetation contracting
• Urban agriculture or horticulture
• Alternative agriculture or horticulture systems (e.g. organics, permaculture, biodynamics)
• Broad acre grazing of animals
• Field growing of vegetables, herbs or flowers
• Glasshouse production of flowers or vegetables
• Irrigated cropping
• Producing crops using hydroponics
• Seeding/tube stock production

AREA OF STUDY 1

Current management techniques
In this area of study students focus on technology and practices commonly used in agriculture and/or horticulture. Using a case study approach, students explore the technologies and management techniques used by one or two fully commercial agricultural and/or horticultural business/es.

Students learn about the decision making and management tools that business managers use to improve outputs. They investigate techniques used by business operators to modify specific aspects of plant and/or animal growing environments including climate, soil/growing media and topography. Growing environments include outdoor, protected and covered areas including greenhouses. Students explore how land and water resources are managed. They learn how integrated management is used to prevent and control pests, diseases and weeds. Pests and diseases of plants and/or animals and weeds to be studied for Outcome 1 are selected from the Prescribed List of Pests, Diseases and Weeds.

Outcome 1
On completion of this unit the student should be able to analyse and evaluate a range of technologies commonly used in agricultural and/or horticultural businesses, and explain the reasons for the selection and application of technology for a specific business.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 1.

Key knowledge
This knowledge includes:
• modification techniques to alter or control local climatic and environmental conditions including temperature, frost, wind, humidity, precipitation, sunlight and carbon dioxide levels
• techniques of sustainable soil/growing media management to improve soil structure, moisture retention, organic matter content, nutrient and pH levels
• techniques to change topography, including laser levelling, contouring, terracing and creating raised beds
• techniques of sustainable water management, including water harvesting, conservation and irrigation
• pests and diseases of plants and/or animals, including metabolic, metazoal and microbial
• prevention and control of pests and diseases in plants and/or animals, including chemical, biological, selective breeding and integrated pest and disease management
• weeds commonly affecting agricultural and/or horticultural production
• prevention and control of weeds, including chemical, biological, mechanical, and integrated weed management
• decision-making and management tools, including record keeping, analysis methods and modelling software to assist in making decisions to improve outputs.

Key skills
These skills include the ability to:
• describe appropriate techniques to modify local climatic and environmental conditions, soil/growing media and topography, improve water availability and quality, and evaluate the effectiveness of these techniques
• identify and describe pests associated with plants and/or animals and their impact on an agricultural and/or a horticultural business
• identify and describe causes of plant and/or animal diseases and their impact on an agricultural and/or a horticultural business
• identify and describe weed species and their impact on an agricultural and/or a horticultural business
• explain the components of biosecurity plans for the integrated management of pests, diseases and/or weeds and their application in an agricultural and/or a horticultural business
• use and evaluate methods of manual and electronic record-keeping, analysis methods and modelling for decision-making to improve outputs.

AREA OF STUDY 2

New or emerging technology
In this area of study, students focus on new or emerging technology that has been adopted by only a small number of agricultural and/or horticultural businesses. New technology is defined as having been readily available for fewer than five years preceding the year of study; emerging technology is still in the development stages and not commercially available. Students source recent publications and search the Internet to assist in their research. They assess the impact of innovative developments in areas selected from biotechnology, biological control, reproduction manipulation, genetic manipulation, plant or animal breeding, alternative energy sources, chemical pest or disease control, resource management methods, information and communications innovation, Global Positioning System (GPS) technology, precision agriculture/horticulture, radiation usage, alternative materials and environment or system modelling. Students analyse the drivers for the adoption of the new and emerging technologies and the impacts on the sustainability of an agricultural and/or a horticultural business.

Outcome 2
On completion of this unit the student should be able to describe and analyse a range of new or emerging technologies, and evaluate the likely impact of a selected innovation on the sustainability of a specific agricultural and/or horticultural business.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.
Key knowledge
This knowledge includes:
• new or emerging techniques to modify climate, soil/growing media and topography
• new or emerging developments in land management techniques
• new or emerging developments in water management and conservation techniques
• new or emerging biotechnology developments
• new or emerging methods of prevention, control and treatment of pests and diseases in plants and/or animals
• new decision-making and management tools such as record keeping, analysis methods and modelling software
• impacts of new or emerging technologies, including the positive and negative social, economic, and environmental factors on an agricultural or a horticultural business.

Key skills
These skills include the ability to:
• describe and critique current technologies and management practices used in a specific agricultural and/or horticultural operation
• analyse the drivers that influence the adoption of new or emerging technologies
• undertake research to analyse new or emerging technologies
• compare current with new and emerging technologies and management practices, and assess their impacts on the sustainability of an agricultural and/or a horticultural business
• select and justify appropriate new or emerging technologies for a specific agricultural and/or horticultural business and evaluate their likely social, economic and environmental impacts.

AREA OF STUDY 3

Business design
In this area of study each student designs a small business project including aspects of production, marketing and financial planning, for a small commercial agricultural and/or horticultural business that involves the management of living plants and/or animals. Students consider production strategies for local, national and global markets, including value adding within the supply chain. They analyse and plan for financial, environmental and occupational health and safety risks, taking into account the quality standards related to the business. Students begin to implement their plan using appropriate equipment and production skills. Each student reports on the progress of the business, including outputs, cash flow, and how well targets and quality standards are being met. The small business is completed in Unit 4, Outcome 3.

Suitable types of business for students to develop are:

- Aquaculture
- Container growing of ornamental plants
- Growing flowering plants in a glass house
- Hydroponic crop production
- Aquaponics
- Field growing of a vegetable, herb or flower crop
- Growing indigenous plants for revegetation use
- Intensive animal systems for meat, fibre, egg or milk markets
- Bee keeping
- Growing a grain or pulse crop
- Horse agistment, grooming and training
- Landscape design installation and maintenance

Updated December 2015
• Managing poultry for fresh eggs or meat market
• Milk production
• Rearing lambs for meat
• Rearing sheep to produce wool or prime lambs
• Turf management/sporting turf management
• Managing trees to produce a crop of fruit, seed or oil
• Rearing cattle for the beef market
• Rearing piglets for sale
• Rearing fish or yabbies for farm dams
• Worm farming
• Managing vines to produce a crop of grapes
• Rearing dairy heifer replacements
• Rearing rabbits for the pet or meat market
• Seedling production

**Outcome 3**

On completion of this unit the student should be able to design, implement and report on progress of a small commercial agricultural and/or horticultural business that involves the management and care of living plants or animals.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 3.

**Key knowledge**

This knowledge includes:

- components of a design plan for a small agricultural and/or horticultural business project, including production, marketing and financial strategies
- strategies for production to meet requirements of local, national and international markets with consideration of market specifications
- business analysis for value adding opportunities in the supply chain
- routine and regular activities that need to be performed to operate the business
- factors influencing the productivity and sustainability of the business, including risk analysis
- strategies for managing a production system to appropriate quality standards for the small business
- health and safety issues associated with the small business
- methods of reporting on the progress of a small business against its business plan, including written and photographic evidence of production.

**Key skills**

These skills include the ability to:

- research and analyse potential local, national and/or global markets, and promotional and value adding opportunities for the proposed small business
- prepare a business plan, including production, marketing and financial strategies
- develop budgets, cash flow estimates and compare budget and actual figures
- prepare a calendar of business activities, including management of all production, marketing and financial activities
- research and analyse alternative production technologies related to the small business
- analyse financial, environmental and occupational health and safety risks, and identify and implement strategies to minimise these risks
- identify, list and safely use appropriate tools, equipment, materials and production processes and adhere to animal welfare requirements as appropriate
- record and justify decision making and modifications to the small business project plan
• record and analyse data associated with the business
• report on the progress of the small business, including production outputs, cash flow, and meeting timeline targets and quality standards.

ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher’s assessment of the student’s overall performance on assessment tasks designated for the unit. The Victorian Curriculum and Assessment Authority publishes online an assessment handbook for this study that includes advice on the assessment tasks and performance descriptors for assessment.

The key knowledge and key skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and key skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and key skills should not be assessed separately.

Assessment of levels of achievement

The student’s level of achievement in Unit 3 will be determined by School-assessed Coursework and an end-of-year examination.

Contribution to final assessment

School-assessed Coursework for Unit 3 will contribute 33 per cent.

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination, which will contribute 34 per cent.

School-assessed Coursework

Teachers will provide to the Victorian Curriculum and Assessment Authority a score representing an assessment of the student’s level of achievement.

The score must be based on the teacher’s rating of performance of each student on the tasks set out in the following table and in accordance with the assessment handbook published online by the Victorian Curriculum and Assessment Authority. The assessment handbook also includes advice on the assessment tasks and performance descriptors for assessment.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Where teachers provide a range of options for the same assessment task, they should ensure that the options are of comparable scope and demand. Teachers should select a variety of assessment tasks for their program to reflect the key knowledge and key skills being assessed and to provide for different learning styles.
### Outcomes

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Marks allocated*</th>
<th>Assessment tasks</th>
</tr>
</thead>
</table>
| **Outcome 1**<br>Analyse and evaluate a range of technologies commonly used in agricultural and/or horticultural businesses, and explain the reasons for the selection and application of technology for a specific business. | **30** | Student performance in each outcome will be assessed using one or more of the following formats:  
• an annotated visual display  
• a website presentation  
• a visual presentation including a poster or multimedia presentation  
• a test (short answer, open book)  
• a short written report (including laboratory report where appropriate)  
• an oral report  
• a research report  
• a practical demonstration. |
| **Outcome 2**<br>Describe and analyse a range of new or emerging technologies, and evaluate the likely impact of a selected innovation on the sustainability of a specific agricultural and/or horticultural business. | **20** | Extended coursework task (Part 1)  
A written business plan and  
Production work and record of production (text and images) and  
An interim report on the progress of the small business. |
| **Outcome 3**<br>Design, implement and report on progress of a small commercial agricultural and/or horticultural business that involves the management and care of living plants or animals. | **50** | |
Unit 4: Sustainable management

This unit focuses on the management of agricultural and horticultural systems within the context of economic, social and environmental sustainability. The unit takes a holistic ecological approach to issues associated with land, plant and animal management. Students apply the principles and concepts of such an approach across a range of agricultural and horticultural situations.

Students consider the effects of climate change and how business responds to these effects. They develop an understanding of the importance of identification, rectification and prevention of environmental degradation for the sustainability of agribusinesses. Students consider strategies for economic, social and environmentally sustainable resource management within agriculture and horticulture. The scientific approach is used as an aid in monitoring environmental change.

Students continue to operate their small business project commenced in Unit 3 Outcome 3. They monitor and report on the operations of the business, including analysing productivity, profitability and sustainability, and make recommendations for improving business outcomes.

AREA OF STUDY 1

Sustainability in agriculture and horticulture

In this area of study students focus on concepts of environmental sustainability and how they relate to productivity. Agricultural and horticultural practices have the potential to cause environmental degradation. Students learn that the ability to identify, rectify and prevent environmental degradation is intrinsic to sustainable practice, and involves an understanding of how ecological and production management practices work together to create sustainable businesses. Students consider the effects of climate change and the need to adapt management techniques in response to these effects.

Outcome 1

On completion of this unit the student should be able to explain and evaluate sustainable resource management practices within agriculture and/or horticulture, and analyse adaptations in response to climate change.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 1.
Key knowledge
This knowledge includes:
• agricultural and/or horticultural operations as managed ecosystems
• ecological principles of management, including biodiversity, biomass, the cycling of matter and efficient use of energy
• types of environmental degradation: erosion, mass wasting, salting, waterlogging, compaction, soil acidity and issues of water quality related to agricultural and/or horticultural businesses
• management practices for the conservation of water usage and quality
• techniques for preventing environmental degradation and rectifying degraded land and water
• effects of agricultural and horticultural processes and operations on climate change
• climate change and its likely impacts on agricultural and/or horticultural production.

Key skills
These skills include the ability to:
• compare and contrast a natural ecosystem with a managed ecosystem
• explain the principles of ecology relevant to a managed ecosystem
• recognise types of degraded land and water
• describe and justify appropriate techniques for rectifying degraded land and water
• describe the effects of agricultural and/or horticultural processes and operations on climate change
• describe and evaluate the likely effects of climate change on agricultural and/or horticultural production
• analyse and evaluate the management options available to an agricultural and/or a horticultural business to adapt in response to the effects of climate change.

AREA OF STUDY 2

Resource management and maintenance
In this area of study students consider sustainable resource management practices within agricultural and/ or horticultural systems. Students examine case studies that explore economic, social and environmental resources, concepts and strategies that apply to agricultural and/or horticultural businesses. Students learn about the development of a property management plan. Resources may include but are not limited to government and non-government agencies that assist sustainable operations. Students use a scientific approach to aid in environmental management.

Outcome 2
On completion of this unit the student should be able to apply and analyse management techniques that promote the economic, social and environmental sustainability of agricultural and/or horticultural businesses.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 2.
Key knowledge
This knowledge includes:

- concepts of economic sustainability, including business viability through planning
- concepts of social sustainability, including contributions of agricultural and/or horticultural businesses to local communities and the provision of infrastructure and essential services
- concepts of environmental sustainability, including biodiversity, and stewardship of land, air and water
- strategies for sustainable resource management for biodiversity, land, air and water
- property management plans and how they are developed
- government policies and regulations regarding biodiversity, and land, air and water management in agricultural and/or horticultural businesses
- indicators of environmental health to monitor agricultural and/or horticultural businesses
- scientific methodology as a tool in environmental management.

Key skills
These skills include the ability to:

- identify and analyse strategies for managing economic, social and environmental sustainability in an agricultural and/or a horticultural business
- analyse the purpose and developmental stages of a property management plan to achieve sustainable production operations
- identify and describe the government policies and regulations that impact on the sustainability of an agricultural and/or a horticultural business
- identify and analyse environmental indicators to determine environmental health of an agricultural and/or a horticultural business
- conduct and report on a scientific investigation involving environmental health indicators and relate these to sustainable agricultural or horticultural production.

AREA OF STUDY 3

Business plan implementation and evaluation
In this area of study students continue to operate the small business project they commenced in Unit 3 Outcome 3. Students continue to monitor progress, modify operations as required, and record the production skills used in management of the small business. Students evaluate the performance of the business against its business plan and make recommendations to improve the sustainability of the business.

Outcome 3
On completion of this unit the student should be able to monitor the progress of, and complete the operation of, a small business project, and evaluate and report on its operation and outcomes in relation to the business plan, and its adherence to sustainability concepts.

To achieve this outcome the student will draw on key knowledge and key skills outlined in Area of Study 3.
Key knowledge
This knowledge includes:
• production skills appropriate to the operation of the agricultural and/or horticultural business
• tools and techniques of monitoring performance of the business and associated quality assurance standards
• methods of analysing financial performance of the business, including budget versus actual comparisons and profit and loss statements
• techniques of reporting on activities of the business, including written and photographic evidence of production and analysis activities
• strategies for improving sustainability of the business, including the use of ICT to calculate the ecological impact of the business.

Key skills
These skills include the ability to:
• select and safely use appropriate tools, equipment, materials and production skills, and adhere to animal welfare requirements as appropriate to the business
• record and analyse data associated with the business, including written and photographic evidence of production
• calculate the ecological impact of the product produced by the business using an ICT application
• justify the decisions for changes and modifications to the operations of the small business
• evaluate the business against its business plan
• analyse financial performance of the business
• report on the conduct of the business and its adherence to quality assurance standards, factors influencing productivity, profitability and sustainability, and make recommendations for improvements.

ASSESSMENT
The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher’s assessment of the student’s overall performance on assessment tasks designated for the unit. The Victorian Curriculum and Assessment Authority publishes online an assessment handbook for this study that includes advice on the assessment tasks and performance descriptors for assessment.

The key knowledge and key skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and key skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and key skills should not be assessed separately.

Assessment of levels of achievement
The student’s level of achievement for Unit 4 will be determined by School-assessed Coursework and an end-of-year examination.

Contribution to final assessment
School-assessed Coursework for Unit 4 will contribute 33 per cent.

The level of achievement for Units 3 and 4 is also assessed by an end-of-year examination, which will contribute 34 per cent.
School-assessed Coursework

Teachers will provide to the Victorian Curriculum and Assessment Authority a score representing an assessment of the student’s level of achievement.

The score must be based on the teacher’s rating of performance of each student on the tasks set out in the following table and in accordance with the assessment handbook published online by the Victorian Curriculum and Assessment Authority. The assessment handbook also includes advice on the assessment tasks and performance descriptors for assessment.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Where teachers provide a range of options for the same assessment task, they should ensure that the options are of comparable scope and demand. Teachers should select a variety of assessment tasks for their program to reflect the key knowledge and key skills being assessed and to provide for different learning styles.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Marks allocated*</th>
<th>Assessment tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome 1</strong></td>
<td></td>
<td>Any one or a combination of the following formats:</td>
</tr>
<tr>
<td>Explain and evaluate sustainable resource management practices within agriculture and/or horticulture, and analyse adaptations in response to climate change.</td>
<td>25</td>
<td>• an annotated visual display</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• a website presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• a datashow presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• a multimedia presentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• a test (short answer, open book)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• a short written report (including laboratory report where appropriate)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• an oral report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• a research report</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• a practical demonstration.</td>
</tr>
<tr>
<td><strong>Outcome 2</strong></td>
<td></td>
<td>A short report that refers to a property management plan.</td>
</tr>
<tr>
<td>Apply and analyse management techniques that promote the economic, social and environmental sustainability of agricultural and/or horticultural businesses.</td>
<td>25</td>
<td>or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A test (short or extended answer) that refers to a case study and includes a property management plan.</td>
</tr>
<tr>
<td><strong>Outcome 3</strong></td>
<td></td>
<td>Extended coursework task (Part 2)</td>
</tr>
<tr>
<td>Monitor the progress of, and complete the operation of, a small business project, and evaluate and report on its operation and outcomes in relation to the business plan, and its adherence to sustainability concepts.</td>
<td>50</td>
<td>Production work and record of production including pictorial and written material. and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>An evaluation report of the outcomes of the small business project with recommendations for improvement. Pictorial and written material is included in the report.</td>
</tr>
</tbody>
</table>

Total marks 100

*School-assessed Coursework for Unit 4 contributes 33 per cent.
End-of-year examination

Description

The examination will be set by a panel appointed by the Victorian Curriculum and Assessment Authority. All the key knowledge and key skills that underpin the outcomes in Units 3 and 4 are examinable. Students will not be required to demonstrate practical skills related to the production of the student’s small business project; however, their knowledge and understanding of these is examinable.

Conditions

The examination will be completed under the following conditions:

• Duration: one and a half hours.
• Date: end-of-year, on a date to be published annually by the Victorian Curriculum and Assessment Authority.
• Victorian Curriculum and Assessment Authority examination rules will apply. Details of these rules are published annually in the VCE and VCAL Administrative Handbook.
• The examination will be marked by assessors appointed by the Victorian Curriculum and Assessment Authority.

Contribution to final assessment

The examination will contribute 34 per cent.

Further advice

The Victorian Curriculum and Assessment Authority publishes specifications for all VCE examinations on the Victorian Curriculum and Assessment Authority website. Examination specifications include details about the sections of the examination, their weighting, the question format/s and any other essential information. The specifications are published in the first year of implementation of the revised Units 3 and 4 sequence together with any sample material.
Advice for teachers

DEVELOPING A COURSE

A course outlines the nature and sequence of teaching and learning necessary for students to demonstrate achievement of the set of outcomes for a unit. The areas of study broadly describe the learning context and the knowledge required for the demonstration of each outcome. Outcomes are introduced by summary statements and are followed by the key knowledge and key skills which relate to the outcomes.

Teachers must develop courses that include appropriate learning activities to enable students to develop the key knowledge and key skills identified in the outcome statements in each unit.

For Units 1 and 2, teachers must select assessment tasks from the list provided. Tasks should provide a variety and the mix of tasks should reflect the fact that different types of tasks suit different knowledge and skills and different learning styles. Tasks do not have to be lengthy to make a decision about student demonstration of achievement of an outcome.

In Units 3 and 4, assessment is more structured. For some outcomes, or aspects of an outcome, the assessment tasks are prescribed. The contribution that each outcome makes to the total score for School-assessed Coursework is also stipulated.

Course arrangements will vary from school to school depending on such aspects as regional location of the school, available resources, expertise of the teacher and teacher/student preferences. The nature of the local agricultural/horticultural systems will influence the examples selected or the field studies selected for learning activities.

Wherever possible, teachers are encouraged to integrate practical components with theoretical knowledge to provide opportunities for students to enhance their understanding of key knowledge through practical application of skills.

The order in which the outcomes are addressed may vary from unit to unit. However, generally key knowledge and skills associated with two outcomes may be acquired concurrently. For example, in Unit 1, the key knowledge and skills for Outcome 1 would be taught concurrently with Outcome 2. A similar approach would be appropriate for all units and there may be opportunities for concurrent learning over the three outcomes in Units 3 and 4. For example, in Unit 3, the key knowledge and skills for Outcome 1 would be taught concurrently with Outcome 3. It would also follow that, at times, the key knowledge and skills of Outcome 2 would overlap with key knowledge and skills associated with Outcome 1, especially if fieldwork is incorporated. The key knowledge and skills associated with the small business project extend across each unit.
Case studies through site visits are a useful approach for Unit 1, Area of Study 1 to provide students with firsthand experience of the components of a particular agricultural or horticultural enterprise. This allows students the opportunity to discuss various aspects of the business with the manager or other staff. Site visits can provide a starting point for discussing a systems model approach to agricultural and horticultural operations and the range of components and sub-systems necessary within that system. If field visits are not possible, there are numerous documented case study resources available from government and non-government organisations. Case studies can also be used to introduce the concepts of sustainability within the agribusiness sector. The scientific investigation could relate in some way to an aspect of the case study.

If students have studied Unit 1, then Unit 2, Area of Study 1 will build on their skills and knowledge of plants and animals. It focuses on the interrelationship between environmental and biological factors and their influences on the production efficiency of plants and animals, particularly in relation to nutrition and reproduction. In order to obtain a more in-depth perspective it is advised that students concentrate on several plant and animal enterprises found locally. Guest speakers and the use of industry resources, for example DVDs and websites, as well as practical investigations, can support student learning in this area of study.

In Unit 3, Area of Study 1, students study the technologies and practices currently used in commercial agricultural and horticultural enterprises. These are the current commonly used practices of managing land and water resources and of dealing with climatic and environmental conditions, pests, diseases and weeds. Once again a case studies approach will assist student understanding of these management techniques. Increasingly, agribusiness managers are using ICT applications to assist with recording, analysing and interpreting data to make better informed decisions about their business. Again, guest speakers who can demonstrate the use and application of these technologies will increase student understanding. Water Catchment Authorities, the Department of Primary Industries and other organisations have a wide range of resources to support student research into plant and animal pests, diseases and weeds. The Farmbiosecurity website is an excellent resource to support this area of study (www.farmbiosecurity.com.au).

The CSIRO is a key organisation involved in developing new technologies. By using a key word search within their website (www.csiro.au), students can access information on emerging technologies within their area of interest in agriculture or horticulture. The Australian Government’s Department of Innovation, Industry, Science and Research Cooperative Research Centres, ABC Landline and the Weekly Times provide resources for recently introduced technologies (the focus of Unit 3, Area of Study 2). Students need to be aware that innovations can have both a beneficial and a detrimental effect. They need to understand how new or emerging technologies can affect the sustainability of an agricultural or a horticultural business. There are a range of drivers that influence a manager’s decision to introduce new technology to a business, such as saving time, convenience and economy of scale, and long-term sustainability. In addition, the increasing importance of consumer acceptability of primary products in relation to issues such as animal welfare, use of chemicals, product origins and traceability needs to be considered.

Unit 4 focuses on the sustainable management of agricultural and horticultural businesses. Area of Study 1 looks at the practices that have caused or have the potential to cause environmental degradation and how these may be prevented or rectified. The increased media coverage on climate change and its impact on future agricultural production gives students insight into how businesses will increasingly need to adapt in order to maintain sustainable food and fibre production. Scenario planning that use ‘What if …’ statements are a useful approach in helping students to analyse and evaluate viable options for rectifying degraded land and water, or to consider adaptations in response to the effects of climate change.
To understand the role of property management planning, students should focus on a particular site to consider sustainable strategies. They draw on environmental health indicators to determine potential improvements. The LandLearn resource *Planning for Sustainable Land Use* provides a good starting point for both Areas of Study 1 and 2 of Unit 4.

In each unit, students will be working on planning, implementing and evaluating a small business. In Units 1 and 2 the small business may be either a one or two-semester project. However, in Units 3 and 4 the small business continues for the whole year.

Unit 1, Area of Study 2 includes the initial planning for a business, including developing a production plan and timeline, calculating costs of production and potential sales, identifying a market, undertaking production, and reporting on the progress of the business.

Unit 2, Area of Study 2 additionally includes safety aspects of production, the sustainable business practices, including the management of waste, developing and implementing marketing strategies, and developing a budget for the potential production costs and returns. Students undertake production in a safe manner, and evaluate the business in terms of production outcomes and produce a profit and loss statement.

In Unit 3, Area of Study 3 and Unit 4, Area of Study 3 students develop a holistic business plan which includes researching alternative production technologies, a detailed calendar of production activities, strategies for producing to a quality standard for the industry, researched potential markets within a broader global context, potential value adding, financial considerations including budgets and cash flow estimates, identification of environmental and occupational health and safety risks and reduction strategies. The production aspects include producing a quality product, safely using appropriate tools and equipment, using ongoing recording of data associated with the business and justification of choices and modifications made to the initial business plan. Evaluation includes analysing the financial performance of the business and its profitability, how the business compared with its initial plan, the ecological impact of the product, the sustainability of the business and recommendations for future production.

**USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**

In designing courses and developing learning activities for Agricultural and Horticultural Studies, teachers should make use of applications of ICT and new learning technologies, such as computer-based learning, modelling software to aid in the analysis of a business, multimedia and the World Wide Web, where appropriate and applicable to teaching and learning activities.

A wide range of ICT applications can be used in teaching Agricultural and Horticultural Studies, from using spreadsheets to store and analyse the small business project information, to using multimedia resources to explore a species of plant. The following list provides examples of a range of activities that make use of applications of ICT:

- use of presentation software to accompany an oral presentation outlining current usage of technology in agriculture and/or horticulture
- development of web pages as a tool for presenting research findings
- use of a spreadsheet to prepare a small business project budget
- accessing databases to collect information
- use of a database to store production information, such as growth rates of plants or animals
- use of computer-based learning to investigate the theory of plant and animal genetics

Updated December 2015
• use of global and geographic positioning systems to prepare a property management plan
• use of multimedia resources to research plant species or identify plant and animal diseases
• use of multimedia kits to investigate soil properties and plant and animal biology
• use of appropriate modelling software to manage and monitor a small agricultural/horticultural business project; for example, feed ration calculators, pasture management calculator, ecological footprint or food miles calculator
• a web search to collect information on agricultural and/or horticultural systems, new technologies, environmental degradation, government regulations
• obtaining current information on weather, commodity prices and technical information that may relate to the small agricultural and/or horticultural business project
• searching university and agricultural and horticultural teachers’ web pages to source information from other students and schools
• completing a webquest specific to agriculture and/or horticulture by visiting the global education site <http://globaleducation.edna.edu.au>
• accessing online modelling software to make business decisions, for example environmental management assessment tools such as DairySAT.

INVESTIGATIONS USING SCIENTIFIC METHODOLOGY

All units incorporate scientific investigations to inform agricultural and horticultural practices. Experiments are applicable to, and can occur in, a variety of locations such as on farms, in vineyards, in orchards, in gardens, or in laboratories.

The scientific methodology should include:
• an aim or purpose for the investigation
• the formulation of an investigable question or a testable hypothesis
• the design of the method to be undertaken to carry out the investigation
• identification of the dependent and independent variables within the experiment
• establishment of the controls against which the data is compared
• selection and use of appropriate materials
• safe and ethical processes when performing the investigation
• application of randomisation and repeatability when necessary
• recognition and elimination of experimental errors whenever possible
• record of all the relevant data and interpretation of it in a suitable form
• a report and analysis of the data
• a discussion of the results with reference to published information to support the outcomes
• a summary of the outcomes of the investigation and conclusions drawn with reference to the original aims and hypothesis
• a report on the investigation in an appropriate manner – oral, written, multimedia, including a list of references.
The table below lists examples of investigations using the scientific method for Units 1 to 4.

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Unit 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant</strong></td>
<td><strong>Animal</strong></td>
<td><strong>Plant</strong></td>
<td><strong>Animal</strong></td>
</tr>
<tr>
<td>Investigate the effects of salinity on tomato plants.</td>
<td>Compare growth rates of different crosses of chickens.</td>
<td>Investigate the effects of different wavelengths of light on the growth of plants.</td>
<td>Compare the summer and winter temperatures affecting the hatching of intestinal worms on pastures.</td>
</tr>
<tr>
<td>Investigate the effects of different nutrients on hydroponically grown lettuces.</td>
<td>Investigate the effects of different brands of starter crumbles on the growth of chicks.</td>
<td>Investigate the effects of effluent water on plant growth.</td>
<td>Investigate the effects of polluted water on micro-invertebrate biodiversity.</td>
</tr>
</tbody>
</table>

**GLOSSARY**

For the purposes of this study design the following definitions will apply.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural/horticultural weed</td>
<td>An unwanted plant in a particular situation that is harmful, dangerous or economically detrimental to an agricultural or a horticultural business.</td>
</tr>
<tr>
<td>Biosecurity plan</td>
<td>A set of measures put in place to reduce the risk of transmission of pests and/or diseases or weeds.</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>The micro and macro life forms in a particular environment including plants, animals and micro-organisms, their genes and the ecosystems of which they are a part.</td>
</tr>
<tr>
<td>Compaction</td>
<td>Relates to the density of the material being considered. For example, soil density is often increased by compaction caused by machinery or animal traffic and by slumping when saturated with water. Hence the term 'a compacted soil'.</td>
</tr>
<tr>
<td>Controlled experiment</td>
<td>An experiment in which the variables are limited so that the effects of varying one factor at a time may be observed. The control is the standard to which the varying factor is compared.</td>
</tr>
<tr>
<td>Cycling of matter</td>
<td>The natural cycles of specific types of matter such as the energy cycle, the nitrogen cycle, the carbon cycle and the water cycle. These natural cycles interact with the production systems of agriculture and horticulture.</td>
</tr>
<tr>
<td>Ecological sustainability</td>
<td>The ability of the relationship between biological organisms and their environment to remain diverse and productive over time.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Environmental degradation</td>
<td>The deterioration of the environment through the depletion of resources such as air, water and soil, causing the destruction of ecosystems. Degradation can occur naturally or through human processes.</td>
</tr>
<tr>
<td>Erosion</td>
<td>The process by which the surface of the earth is worn away by the action of water, wind, animals, etc. In agricultural and horticultural systems this is commonly wind or water erosion expressed as rill, tunnel, sheet or gully erosion.</td>
</tr>
<tr>
<td>Growing medium</td>
<td>Substances that support a plant’s roots and from which the plant draws water and nutrients.</td>
</tr>
<tr>
<td>Integrated pest management</td>
<td>To bring together as a whole the methods of control of organisms harmful to agriculture. It is the process of monitoring the likelihood of pest or disease problems and, when justified, selecting and applying (a variety of) appropriate solutions.</td>
</tr>
<tr>
<td>Mass wasting</td>
<td>The movement of soil and rock down a slope under the force of gravity and can include creep, slides, flows, topples and falls. Takes place over varying periods of time.</td>
</tr>
<tr>
<td>Metabolic disease</td>
<td>A disease caused by an inappropriate quality or quantity of chemicals being received (or not being received) by an organism.</td>
</tr>
<tr>
<td>Metazoal disease</td>
<td>A disease caused by an animal composed of many cells, and hence usually visible to the unassisted eye.</td>
</tr>
<tr>
<td>Microbial disease</td>
<td>A disease caused by an organism that is so small as to be invisible or indistinct without the use of a microscope.</td>
</tr>
<tr>
<td>Modelling software</td>
<td>Computer software that attempts to relate the level of output of natural or production systems and the input and environmental variables.</td>
</tr>
<tr>
<td>Modification techniques</td>
<td>Methods for accomplishing change in an agricultural or a horticultural context; for example, soil modification techniques include the addition of substances to change pH, fertility, porosity or water-holding capacity and the use of mechanical implements to alter its physical structure.</td>
</tr>
<tr>
<td>Physiological structures</td>
<td>The function of cells, tissues, organs, and systems within living plants and animals.</td>
</tr>
<tr>
<td>Plant structures</td>
<td>The parts of any living organism which is characterised by the capacity to synthesise food from inorganic substances and by the presence of cellulose in its cell walls, and which is incapable of voluntary motion, has limited response to stimuli, and lacks specialised sense organs and a nervous system.</td>
</tr>
</tbody>
</table>
### Term definitions

- **Production efficiency**: The ratio of work done to the energy supplied when creating something. In a financial sense the ratio of costs to income.

- **Productivity**: The measure of efficiency of production, usually as a ratio of some measure of inputs compared with outputs.

- **Property management plan**: A scheme of action to manage a piece of land with the intent of improving its sustainability.

- **Soil pH**: The extent to which a portion of the earth's surface in which plants grow has a pH between 1 and 14. Acid soils have pH less than 7, alkaline soils above pH 7. The pH affects the absorption of nutrients and therefore the types of plants able to be grown in a particular soil.

- **Sustainability concept**: Sustainability integrates three main goals: environmental health, economic profitability and social and economic equity. It rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs.

- **Value adding**: The extent to which the value of a finished product exceeds the cost of the raw material components, for example potting flowering annuals into attractive individual pots, bunching and wrapping cut flowers, processing milk into cheese and yoghurt.

### Suitable resources

Courses must be developed within the framework of the study design: the areas of study, outcome statements, and key knowledge and key skills.

A list of suitable resources for this study has been compiled and will be available via the Agricultural and Horticultural Studies study page on the Victorian Curriculum and Assessment Authority website: www.vcaa.vic.edu.au/vce/studies/index.html

### Victorian Essential Learning Standards (VELS)


The key skills in VCE Agricultural and Horticultural Studies build on the concepts in the Design, Creativity and Technology dimensions of Investigating and designing, Producing and Analysing and evaluating. Throughout all units of this study, students extend their knowledge and skills in planning, producing, managing timelines and evaluating outcomes of production. Students initially research potential products they can develop. Production work involves students selecting and using tools and...
equipment to safely implement production processes and manage resources efficiently and effectively. Students evaluate their production outputs and suggest how these could be improved.

Students further develop their understanding of the domain of Science knowledge and understanding through their study of plants and animals within their environments, genetic inheritance, chemical reactions, and the pH scale for soils. Agricultural and Horticultural Studies builds skills in the dimension of Science at work through the use of the scientific method for conducting investigations, which incorporates the use of equipment, taking measurements, recording data, and drawing conclusions. Students further their understanding of risk assessment in practical situations developed in both Design, Creativity and Technology; and Science.

Students build on the knowledge and skills developed in the Humanities dimension of Economic reasoning and interpretation when they make connections between enterprising activity and its effect on the economy, and develop their understanding of the use of resources, how goods are produced, ethical production and how markets work. In addition, students can build on their knowledge of cost-benefit analysis and understanding of current economic conditions that may influence their small business.

Students use the knowledge and skills developed in Geogrpahy in the Geospacial skills dimension when they read and interpret maps, use scale, develop plans, and gather firsthand data from fieldwork studies, make observations and conduct interviews during site visits to agricultural and horticultural businesses.

Students build on the skills and knowledge gained in the Interpersonal Development dimension of Working in teams through learning activities they undertake in Agricultural and Horticultural Studies. In Unit 2 Outcome 2 students can work as a team member to plan, implement, and monitor and evaluate production process and marketing for a small business project. Through participation in a range of other production activities, for example the completion of practical investigations, students can further develop their ability to contribute to team goals and work cooperatively by supporting each other.

The skills underpinning the Presenting dimension of the Communication domain enable students to develop their ability to present information clearly and confidently. Further development of these skills occurs throughout this study as students read and interpret information such as farm case studies. They also create documents using a range of presentation techniques such as annotated visual displays, multimedia presentations or online communication products. They further develop their ability to present findings clearly and concisely.

The domain of Thinking Processes encourages students to reason, process information, and to reflect on and evaluate their ideas. When planning, implementing and evaluating their small agricultural and/or horticultural business, students build on the thinking skills gained in earlier years. Production work requires problem-solving skills, analysis of complex information, reflecting on and possible courses of action and making decisions on how to meet the requirements of the business plan.

Through the domain of Personal Learning, students work towards becoming positive, confident and successful learners. Throughout all units of Agricultural and Horticultural Studies, students build on these skills, particularly when they are engaged in planning, implementing and evaluating their small business. As they plan their small business students set production goals and consider their use of resources, including time management strategies. Students may also undertake multiple tasks within the one activity and evaluate and monitor their own performance, seeking feedback from others.
EMPLOYABILITY SKILLS

Units 1 to 4 of the VCE Agricultural and Horticultural Studies study provide students with the opportunity to engage in a range of learning activities. In addition to demonstrating their understanding and mastery of the content and skills specific to the study, students may also develop employability skills through their learning activities.

The nationally agreed employability skills* are: Communication; Planning and organising; Teamwork; Problem solving; Self-management; Initiative and enterprise; Technology; and Learning.

Each employability skill contains a number of facets that have a broad coverage of all employment contexts and are designed to describe all employees. The table below links those facets that may be understood and applied in a school or non-employment related setting, to the types of assessment commonly undertaken within the VCE study.

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Employability skills: selected facets</th>
</tr>
</thead>
</table>
| Annotated visual displays                           | Communication (writing to the needs of the audience; sharing information)  
Initiative and enterprise (initiating innovative solutions; being creative)  
Planning and organising (collecting, analysing and organising information; planning the use of resources including time management)  
Problem solving (developing practical solutions) |
| Business plan                                       | Communication (writing to the needs of the audience; reading independently; sharing information)  
Initiative and enterprise (initiating innovative solutions; being creative)  
Planning and organising (collecting, analysing and organising information; planning the use of resources including time management)  
Problem solving (showing independence and initiative in identifying problems and solving them)  
Technology (using IT to organise data) |
| Business reporting including an interim and final   | Communication (writing to the needs of the audience; using numeracy; sharing information)  
Planning and organising (collecting, analysing and organising information)  
Problem solving (using mathematics to solve problems; applying a range of strategies to problem solving)  
Self management (evaluating and monitoring own performance; articulating own ideas and visions)  
Technology (using IT to organise data) |
| final evaluation report                             |                                                                                                                                                                                                                                    |
| Case study                                          | Communication (writing to the needs of the audience; reading and independently sharing information)  
Planning and organising (planning the use of resources including time management)  
Technology (using IT to organise data; having a range of basic IT skills) |
| Essay                                               | Communication (writing to the needs of the audience; sharing information)  
Planning and organising (planning the use of resources including time management) |
| Media response                                      | Communication (sharing information; speaking clearly and directly; writing to the needs of an audience)  
Planning and organising (collecting, analysing and organising information)  
Technology (having a range of basic IT skills; using IT to organise data) |

*The employability skills are derived from the Employability Skills Framework (Employability Skills for the Future, 2002), developed by the Australian Chamber of Commerce and Industry and the Business Council of Australia, and published by the (former) Commonwealth Department of Education, Science and Training.
### Assessment task

**Multimedia presentation**
- **Communication** (sharing information; speaking clearly and directly)
- **Planning and organising** (collecting, analysing and organising information)
- **Self management** (evaluating and monitoring own performance)
- **Technology** (having a range of basic IT skills; using IT to organise data; being willing to learn new IT skills)

**Practical demonstrations**
- **Communication** (speaking clearly and directly)
- **Planning and organising** (planning the use of resources including time management)
- **Team work** (working as an individual and as a member of a team; knowing how to define a role as part of a team)

**Report (oral/written/visual)**
- **Communication** (sharing information; speaking clearly and directly; writing to the needs of the audience; using numeracy)
- **Planning and organising** (collecting, analysing and organising information)
- **Technology** (using IT to organise data)

**Scientific investigation and report**
- **Communication** (sharing information; speaking clearly and directly; writing to the needs of the audience; using numeracy)
- **Initiative and enterprise** (generating a range of options; initiating innovative solutions; being creative)
- **Planning and organising** (planning the use of resources including time management; establishing clear project goals and deliverables)
- **Problem solving** (developing practical solutions; testing assumptions taking the context of data and circumstances into account)
- **Self management** (evaluating and monitoring own performance; taking responsibility)
- **Team work** (working as an individual and as a member of a team; knowing how to define a role as part of the team)

### LEARNING ACTIVITIES

Examples of learning activities for each unit are provided in the following sections. Shaded examples are explained in detail in accompanying shaded boxes.
Unit 1: Agricultural and horticultural operations

AREA OF STUDY 1: Influences on agricultural and horticultural systems

Outcome 1

Examples of learning activities

Describe a range of biological, physical and human resources and their influence on agricultural and/or horticultural systems in the local area, and explain the importance of the application of scientific principles in production.

use a case study to analyse an agricultural and/or a horticultural system by defining the components that comprise a natural ecosystem on a mind map; contrast these with the range of components that make up an agricultural and/or a horticultural system following site visits and fieldwork to a range of local businesses, develop an annotated visual display that describes the physical resources of local agricultural and/or horticultural systems conduct a dissection of a plant to reveal major structures

research varieties of plants and/or breeds of animals using a range of resources; classify these varieties/breeds using a table on an interactive whiteboard to present findings to the class
describe and compare the basic structure of plants and animals by presenting an annotated visual display that highlights how the structures relate to the function of the plants or animals, e.g. the development of breast meat in broiler chickens compared with laying chickens or comparing the inflorescence of 2-row and 6-row barley plants

make comparisons between different breeds of livestock, relating the differences and similarities to their purpose, e.g. dairy cattle to beef cattle, meat sheep to wool sheep, egg laying poultry to meat poultry

research the environmental and genetic factors that influence the growth of plants and animals using the Internet and other resources: analyse these factors and prepare a group presentation for the class

investigate the annual production cycle of a specific commercially produced plant or animal and present the findings as an annotated visual display

investigate how the rate of transpiration can affect the production of particular vegetables

conduct a simple scientific experiment to investigate the factors that influence the growth of plants and/or animals

measure the characteristics of the main local soil types and growing media during a site visit

set up a number of demonstrations or practical exercises to show a range of soil types and growing media, and illustrate the characteristics of texture, colour, structure, pH, porosity

investigate the characteristics of soils (excluding soil fertility) and their implications on the growth of plants (e.g. tomatoes, cereals, pastures)

analyse the weather patterns from weather reports sourced online or from live media over a period of time in terms of highs, lows, fronts, precipitation, temperature, winds
interpret climatic and weather data by using the Bureau of Meteorology website (www.bom.gov.au) to investigate yearly variations in weather features and occurrence of climatic zones

use the Bureau of Meteorology website (www.bom.gov.au) to gather climate and weather data of a region and to analyse climate and weather patterns

as part of a case study, research the facilities on the SILO website (www.bom.gov.au/SILO/) and relate their usefulness to a local agricultural or horticultural business

use the SILO website (www.bom.gov.au/SILO) and demonstrate how land managers are able to use this information to make business decisions

analyse the suitability of a location for an agricultural or a horticultural system by visiting a local operation; investigate the factors that influence the businesses conducted at that location; prepare a fieldwork report that describes factors influencing the location of the operation

identify the different roles and responsibilities that people can play within a specific agricultural or horticultural business and present the information as a series of profiles to the class

use a spreadsheet to develop an information table that identifies the most appropriate tools and equipment suitable for a specific agricultural or horticultural business

use a graphic organiser to identify the physical components, including buildings, storage facilities, fencing, water storage and transfer facilities, roadways, etc. for a specific local agribusiness

draw a systems diagram showing the inputs, processes and outputs of a local agribusiness

prior to a site visit, design a survey to investigate the economic, social, environmental and historical factors that influence the business, ask the site manager to respond to the questions, and later discuss the responses in class
Detailed example

VISIT A LOCAL AGRICULTURAL AND/OR HORTICULTURAL OPERATION

Visit a local operation and investigate the factors that influence the enterprise conducted at that location.

During the visit, collect and evaluate the following data to determine which factors have influenced the business. Have particular factors had a greater influence than others?

- Description of business/site being evaluated.
- Area utilised to run the business (map of layout).
- District of Victoria/location of the site.
- Topography, e.g. aspect, slope, water courses, natural vegetation.
- Soil types and characteristics – pH, texture, salinity, organic matter content, major limitations.
- Weather and climate.
- Fences and subdivisions, major roads, railway.
- Capital facilities and equipment needed to run the business, e.g. buildings, storage, water holding capacity, machinery.
- Specific consumables of the enterprise, e.g. fertilisers, feed, seed.
- Operations, e.g. annual production cycles.
- Production outputs, supply and demand, marketing options.
- Human resources and roles within the business, e.g. availability of labour and skills needed.

Report on the findings of the site visit.

AREA OF STUDY 2: Agricultural and horticultural operations

Outcome 2

Plan, implement and evaluate management and production activities to operate a small agricultural and/or horticultural business project involving the care and monitoring of living plants or animals.

Examples of learning activities

- work effectively as a team member by developing a plan for a small agricultural or horticultural business project which involves the care of living plants or animals; carry out the plan and make adjustments as needed throughout the unit
- identify and compare potential business opportunities appropriate to a particular site; research the history of the site, market needs, and the availability of resources to the site
- work effectively as a team member by developing a class definition of the components of a business plan through research and interviews
- research and analyse the requirements of specific plants and animals that may be selected for the small business; use presentation software such as PowerPoint to present findings
- design a checklist for the production cycle of a selected plant or animal for the small business; the checklist must include the production processes, a timeline and the selection and safe use of appropriate tools and equipment
- use a graphic organiser to analyse a suitable business opportunity for the small business project
- invite a former student from the previous year's class to discuss the process of designing and operating the small business project
- develop a timeline for the operations for the development of the small business, including key implementation dates, production tasks and resources required
identify potential markets and develop a survey to determine customer preferences for the sale of proposed products from the small business project

use a spreadsheet to prepare a budget for the small business project

in small teams, use computer-based visualisation software such as Inspiration or Mindmanager to brainstorm annual operations required for an agricultural or a horticultural business

use an online occupational health and safety training program such as Safe@Work <www.education.vic.gov.au/safe@work/index.asp> to undertake safety training relevant to the small business

select and justify a proposed small business project and prepare a written business plan that includes: a production schedule, calculation of costs of production, sustainable use of resources, data collection methods, a prediction of possible outcomes of the production, an identified market and potential sales

photograph practical operations undertaken as part of the small business and present a PowerPoint using the sequenced photographs

report on the progress of the business by presenting a written report that details production skills utilised, collection of appropriate production data, how tools and equipment were used appropriately and how the progress of the business differed to the plan

conduct a class discussion of the progress made by students for their small business projects; individual students ask questions about successes and aspects that could be improved

**Detailed example**

**SMALL BUSINESS PLAN**

1. The small business project should be conducted over the semester.
2. Identify the components of a business plan by researching local operations to see how plans are developed. Talk to local nurseries, farmers and business managers to identify key elements of the business plan.
3. Prepare a written business plan that incorporates the following components:
   - outline of the type of business, potential outputs and predicted sales
   - identification of markets
   - proposed costs of production
   - expected timeline of operations, including daily, weekly and seasonal tasks
   - methods for sustainable use of available resources
4. Develop a risk management plan that outlines hazards associated with the small business and how these will be eliminated or reduced.

Note:
- Keep the business manageable: small and simple, rather than big and complex.
- The business needs to operate within the available resources suited to a particular location.
- Start early in the semester to allow for problems.
- Be aware of, and follow, all health and safety and ethical requirements relevant to the small business. This includes adherence to all animal welfare requirements.
Unit 2: Production

AREA OF STUDY 1: Biological and environmental factors

Outcome 1

Examples of learning activities

- Use anatomical models to describe the main structures associated with plants and animals; draw diagrams of these models indicating the structures associated with nutrition and growth, for example the roots, nodes and axils of plants and the digestive systems and skeletal systems in animals.

- Conduct fieldwork to local suppliers of plant and/or animal products for nutrition or reproduction; collect manufacturers’ brochures and prepare a matrix that analyses the differing needs of the plants and/or animals using information provided.

- Work as a member of a team to design and prepare a range of feeds for a specific animal at different stages of growth and development, for example poultry (hatchling, grower, layer) or dairy cattle (newborn calf, weaner heifer, pregnant heifer, early lactation cow, late lactation cow).

- Present an annotated visual display that identifies the main structures associated with plant and animal reproduction.

- Develop a PowerPoint presentation accompanied by diagrams and notes on one specific plant or animal that explains the processes associated with plant and/or animal reproduction; develop an overview by taking notes on other presentations.

- Describe the principles of plant and animal genetics through a series of comprehensive exercises using current agricultural and horticultural texts; present the information using an interactive whiteboard (IWB).

- Invite a guest speaker to discuss the main aspects of plant genetics, including recessive genes, dominant genes, genotype, phenotype, simple characteristics, intermediate inheritance.

- Access dissections using multimedia and real specimens that illustrate the main aspects of plant reproduction, including sexual and asexual reproduction, flower structures, growth cycles – annual, biennial, perennial.

- Access dissections using multimedia resources that illustrate the main aspects of animal reproduction, including male and female anatomy, egg and sperm development, pregnancy, parturition, lactation, egg incubation, foetal development and hatching.

- Use applied exercises to explore the range of biological factors that could influence production efficiency, such as nutrient fixing organisms or disease causing organisms and pests.

- Classify a range of plant varieties or animal breeds into different groups on the basis of the environmental factors that influence production efficiency; justify the decisions made about the groupings.

- Use the BOM website (www.bom.gov.au) to identify the implications of temperature (minimum and maximum), rainfall and light intervals on the production of plants and/or animals.
undertake an investigation into the effects of a range of nutrients on hydroponically grown vegetables

use a range of liquid fertilisers to investigate the implications of nutrients on the growth of plants

use a variety of commercial chicken crumbles to investigate the growth of chickens; tabulate collected data and draw conclusions

research the impacts of seasonality on hormone production and the implications for reproduction in plants and/or animals

develop a list of desirable characteristics for a particular livestock enterprise and use the list to score and rank five potential breeding males for this enterprise, for example rams, bulls, boars or roosters

### Detailed example

**GROWTH COMPARISON OF CHICKENS USING COMMERCIAL FEED**

1. Obtain different brands of commercial starter crumbles. Obtain 10 one-day old chickens for each brand of feed acquired.
2. Set up a small pen for each brand of feed, ensuring the size of the pen and access to feed and water is the same for each pen. Allow room for 10 chickens for each pen.
3. Feed the chickens daily, ensuring adequate feed to allow ad lib access to feed. Weigh and record the total feed provided on a daily basis. Wastage is included in the daily feed ration.
4. Weigh the chickens twice weekly for three weeks.
5. At the end of the experiment, compare the nutritional status of each brand of chick starter crumbles based on the average daily growth of the chickens, and the feed conversion ratios for the chickens fed each brand of feed. Draw conclusions from the investigation and discuss in the report.

Note: Animal welfare requirements must be observed.
## Area of Study 2: Production systems and processes

### Outcome 2

Plan, implement, monitor and evaluate the production processes and marketing for a small agricultural and/or horticultural business project, demonstrating how the business adds value to the product and manages risk.

### Examples of learning activities

- Collect weather data/climatic conditions that may affect the outputs of the business to make an informed decision on day-to-day operations.
- Research potential pests or diseases that may impact on the small business.
- Develop an information table that identifies the most appropriate tools and equipment for safely undertaking all operations of the small business.
- Prepare a written business plan that describes the production process for an agricultural or a horticultural product, incorporates a budget, describes marketing strategies and indicates a timeline and schedule for the operation of the business project.
- Discuss how best to evaluate the success of the small business project.
- Present an evaluation report (using multimedia, images of the production processes, spreadsheets and databases) at the end of the unit for the small business project; in the report describe how monitoring and adjustment for change occurred, evaluate the unintended and intended production outcomes, and suggest modifications to improve the outcomes of the business.
- Prepare a short media release on the outcomes of the enterprise for the local paper, school magazine, or local television station.
- Develop a peer assessment of all team members’ contribution to the small business.
- Use appropriate software to prepare a profit and loss statement.
- Undertake a risk management plan for the small business, identifying strategies to eliminate or minimise these risks.
- Develop a matrix of sustainable business practices for the operations of a small business, including the use of resources and waste minimisation strategies.
- Develop a business marketing brief for the small business, including letterhead, logo, advertisement, and a variety of marketing strategies.
- Research appropriate marketing methods for the product to potential local and national markets.
- Take photographs to show a sequence of the ongoing production and outputs of the small business; use suitable software to document the progress of the business.
- Evaluate sustainable practices used in the small business.

Updated December 2015
**Detailed example**

**SMALL BUSINESS EVALUATION PRESENTATION**

Students develop a multimedia report that details the outcomes of their small agricultural and/or horticultural business project.

Students may use journals such as the *Australian Farm Journal* or a media program such as the ABC's Landline to provide ideas on how to present their report.

The report describes:
- the inputs into the production
- production processes and timelines
- risks involved with the production process
- environmental considerations such as waste minimisation strategies, climatic influences
- outputs – both intended and unintended
- factors that influenced the operation of the small business project
- budgeting – planned and actual
- marketing of products
- success of the business and aspects for future improvement.

A presentation of the report is made to the class – this may involve an oral presentation and peer evaluation.
Unit 3: Technology, innovation and business practices

AREA OF STUDY 1: Current management techniques

Outcome 1

Examples of learning activities

- Analyse and evaluate a range of technologies commonly used in agricultural and/or horticultural businesses, and explain the reasons for the selection and application of technology for a specific business.

- Conduct fieldwork and describe appropriate techniques currently in practice to modify climate, water, soil and growing media in a business.

- Evaluate the effectiveness of modifying techniques by using video or other visual media to record current techniques to modify climate such as glasshouses, cloud seeding, frost controls, irrigation.

- Visit a commercial agricultural or horticultural business to observe the current practices used to modify climate, soils/growth media and water usage and quality.

- Invite an agronomist or a soil scientist to explain current techniques to modify soil, for example fertilisers, cultivation techniques, gypsum, mulch crops; evaluate the effectiveness of these techniques.

- Produce a series of annotated photographs or a video showing current practices to alter topography, including laser levelling, contouring, terracing and creating raised beds; annotate on an interactive whiteboard (IWB).

- Research the Keyline sustainable agricultural system developed by PA Yeomans; discuss the appropriateness of this system for a particular agricultural business.

- Use a case study to analyse the water management techniques used in a commercial agricultural or horticultural business.

- Use the Internet, multimedia, and library references to research the historical impact of a technology on a commercial business.

- Prepare a matrix that identifies the main pests and diseases associated with plants and/or animals associated with commercial businesses, including metabolic, metazoal and microbial pests and diseases; identify the major causes of the pests and diseases, and evaluate current treatments for the main pests and diseases.

- Conduct demonstrations to illustrate the main plant diseases that affect a commercial business; identify and evaluate the effectiveness of the current treatments for the plant diseases.

- Collect and identify the main plant insect pests that affect a commercial business; identify and evaluate the effectiveness of the current treatments for the insect pests.

- View a video about the main infectious diseases that affect a commercial business; identify and evaluate the effectiveness of the current treatments for the infectious diseases.

- Conduct experiments to provide pre- and post-treatment data to evaluate the effectiveness of the main control measures for plant and animal pests and diseases.

- Use the Internet and multimedia resources to research the main weed species affecting an agricultural or a horticultural business and evaluate treatments to control weeds.
invite a guest speaker such as the weeds officer of the local government authority to explain the role of local authorities in monitoring and controlling weeds

visit a fully commercial business to identify methods of prevention and treatment of weeds; prepare a virtual fieldwork by using a series of photographs taken at the business to describe the methods it uses; evaluate treatments to control weeds in a short report accompanying the virtual fieldwork

design and conduct a quiz that tests students’ knowledge of weeds, pests and diseases of plants and animals

design a biosecurity plan for the integrated management of pests, diseases and weeds for a specific agricultural or horticultural business

use the Internet and multimedia resources to research methods of keeping financial and production records associated with a business that may assist in maintaining or improving outputs

invite a guest speaker to demonstrate decision-making software currently used in agribusinesses; evaluate the advantages of these compared to current manual systems

view a demonstration of agricultural systems modelling software; analyse its usefulness in planning modifications to physical and biological aspects of the business

---

**Detailed example**

**DEVELOP A BIOSECURITY PLAN FOR WEEDS**

To develop a biosecurity plan for weeds, students need to complete the following tasks.

1. Visit a site which has a weed problem and photograph and identify the weeds.
2. Research the control strategies for the identified weeds.
3. Develop a weed management plan to control the weeds, using the various integrated control measures available; for example, biological, mechanical, chemical, burning.
4. Research methods to help prevent any future introduction of weeds, including establishing biosecurity measures for the passage of staff and produce.
5. Identify record-keeping measures required, including monitoring of potential weed invasion.

Useful references include Plant Health Australia (<www.planthealthaustralia.com.au>)

Note: this activity could be adapted to cover pests and diseases of plants or animals.
AREA OF STUDY 2: New or emerging technology

**Outcome 2**
Describe and analyse a range of new or emerging technologies, and evaluate the likely impact of a selected innovation on the sustainability of a specific agricultural and/or horticultural business.

**Examples of learning activities**

- prepare a report that describes current technologies used in a specific agricultural or horticultural operation
- prepare a Venn diagram to demonstrate the similarities and differences between current and new technologies available for a specific agricultural or horticultural business
- research the potential drivers for the adoption of new and emerging technologies in a specific agricultural or horticultural business
- undertake a case study of an existing property and assess current and potential new technologies for the business
- conduct a site visit to a commercial agricultural and/or horticultural business; investigate the innovative technologies utilised at the site; prepare a written report that examines the impact of the new technology, now and into the near future
- use recent publications and the Internet to research and analyse new or emerging technologies that relate to a specific agricultural and/or horticultural business
- visit a research facility, or access their website, to investigate an emerging technology that may be adopted in the near future; assess the opportunities for increased sustainable operations for a specific agricultural or horticultural business should the new technology be adopted
- present a PowerPoint presentation that selects and justifies appropriate technologies for a specific agricultural and/or horticultural business; evaluate the likely impact of new and emerging technologies on the operation
- evaluate the likely impact of new and emerging technologies on a specific fully commercial business, through research and class discussion
- undertake a PMI (plus, minus, interesting) analysis of a range of new and emerging technologies; consider the social, economic and environmental impacts on a particular agricultural or horticultural business
- research the Bureau of Meteorology website (www.bom.gov.au) and evaluate how weather forecasts have been improved; prepare a report that identifies the impact this has had on commercial agricultural and/or horticultural businesses
- attend an agricultural or a horticultural field day; interview business representatives on the features of the new technologies available for a range of production activities for a specific agribusiness
- select a tool, a piece of equipment, or software that features a recent technological development; use information brochures or the manufacturer’s website to identify the economic, social or environmental advantages of using this tool/equipment/software in an agricultural or a horticultural business
Advice for teachers

Using a site visit or the Internet, each student researches an area of new and emerging technologies for one fully commercial agricultural and/or horticultural business. Specific areas include:

- biotechnology
- biological control
- reproduction manipulation
- genetic manipulation
- plant or animal breeding
- resource management methods
- information and communications innovation
- Global Positioning Systems
- precision agriculture or horticulture
- radiation usage
- alternative energy sources
- chemical pest or disease control
- alternative materials
- environment or system modelling

Students are then placed as ‘experts’ in their area and discuss some of the following areas:

- How does the technology actually work?
- What is the likely impact of the specific technology in the near future in terms of productivity of the business?
- What are the negative impacts on the business?
- What are the positive impacts on the business?
- Who will benefit most from the technology? How?

Discussion centres on the question: What will be the most significant new technology utilised by agricultural and/or horticultural businesses in the near future?

The ‘experts’ may be called upon at various times to help explain the new and emerging technology, as well as the impacts of that technology.

Students will have their own views based upon their own area of expertise, and need to justify why their technology will be the most significant.

Alternatively, the activity may be set up as a class debate.

Detailed example

EVALUATING THE IMPACT OF NEW AND EMERGING TECHNOLOGIES

Updated December 2015
AREA OF STUDY 3: Business design

**Outcome 3**
Design, implement and report on progress of a small commercial agricultural and/or horticultural business that involves the management and care of living plants or animals.

**Examples of learning activities**

- compare potential local, national and international markets for the small business and use a nested circle diagram to represent findings
- examine case studies of commercial businesses and discuss strategies for marketing the business product
- undertake research for an opportunity to value-add to an agricultural or a horticultural business product
- prepare a Gantt chart to show the activities, their order and time allocations required to establish the small business
- brainstorm examples of ongoing evaluation and decision making that takes place as students undertake production activities in the small business, for example producing vegetables, grapes or meat chickens, and deciding when the products are ready for harvest or market
- discuss key factors involved in setting up a business, including the components of a business plan such as budgets and cash flow estimates, production operations and timeline, marketing and financial strategies
- design a written business plan and include production, marketing, risk management and financial strategies
- use appropriate software to develop a budget and cash flow estimates for the small business; analyse the financial risks and implement strategies to reduce these risks
- use a fieldwork case study to show the steps in the preparation and design of a business plan for the business; include a budget and cash flow statement as well as production, financial and marketing strategies
- use the Internet to research and analyse alternative production technologies appropriate to the small business project
- conduct a web search of a range of state and national codes of practice; examine these codes of practice to investigate health and safety issues relevant to the small business project
- set up a class blog to develop and share strategies for minimising waste in the small business projects
- use an environmental management system such as DairySAT to assist in planning for environmental risks in the small business
- access the Department of Primary Industry website <www.dpi.vic.gov.au/science/em> and do a PMI chart on how an environmental management system can be used to reduce environmental risks in the small business
- prepare a list of recommendations of quality standards to be used in the small business and suggest how these can be monitored to ensure a quality product
- undertake research on the role of HACCP in the dairy or broiler industry; prepare a list of key points and apply these to the small business
view a video or vodcast on food processing and identify areas where hygienic and safe food practices are critical in the primary production of particular foods; prepare a mindmap or knowledge map of the key information applicable to the small business

identify, list and safely use appropriate production processes, tools and equipment while conducting the small business; evaluate their effectiveness and efficiency; make modifications as appropriate; document all decisions and stages of the production operations for the small business

write an interim report that describes the progress of the small business project, including reference to production outputs, cash flow, meeting timeline targets and whether quality standards are met

**Detailed example**

**DESIGN A WRITTEN PLAN OF A SMALL BUSINESS**

The small business project should be conducted over Unit 3 and Unit 4.

The components of a business plan include:

- **production plan** – including research and analysis into alternative production technologies, applicable industry standards and codes of practice
- **marketing strategies** – including an analysis of local national and international markets, value adding, promotional opportunities, production presentation and packaging
- **financial strategies** – including budgets and cash flow estimates
- **estimated timeline** of activities
- **risk analysis** that would affect the productivity and sustainability of the business.

These headings should be incorporated into a written report that can then be referred to at review stages of the business.

1. Identify the components of a business plan by researching local operations for how plans are developed. Talk to local nurseries, farmers and business owners to identify key elements of the business plan.
2. Prepare a written business plan that incorporates all areas in detail.
3. Develop a timeline, using a calendar of events. Include daily, weekly and seasonal tasks.
4. Research and follow all health and safety and ethical considerations relevant to the business, including animal welfare requirements.
## Unit 4: Sustainable management

### AREA OF STUDY 1: Sustainability in agriculture and horticulture

<table>
<thead>
<tr>
<th>Outcome 1</th>
<th>Examples of learning activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explain and evaluate sustainable resource management practices within agriculture and/or horticulture, and analyse adaptations in response to climate change.</td>
<td>conduct fieldwork at local sites to compare a natural ecosystem, for example forest, native grassland, with a managed ecosystem, for example dairy farm, wheat farm, nursery, vegetable garden, local park, recreation reserve; write a fieldwork report that compares similarities and differences between managed and natural systems.</td>
</tr>
<tr>
<td></td>
<td>examine a local ecosystem to explain the main principles associated with sustainable management, for example biodiversity, biomass, cycling of matter and efficient use of energy.</td>
</tr>
<tr>
<td></td>
<td>prepare a table that describes types of degradation, including erosion, mass wasting (for example, landslips), salting, water logging, compaction, soil acidity, water quality issues; include images of each type of degradation.</td>
</tr>
<tr>
<td></td>
<td>conduct fieldwork to provide examples of environmental degradation, including erosion, mass wasting (for example, landslips), salting, water logging, compaction, soil acidity, water quality issues.</td>
</tr>
<tr>
<td></td>
<td>research appropriate techniques for rectifying degraded land and water at a specific site and write a report.</td>
</tr>
<tr>
<td></td>
<td>show videos which illustrate techniques to rectify degradation problems, for example tree planting, drainage, ground water pumping, deep ripping, liming, track farming, raised bed technology, water management, water quality management and nutrient management.</td>
</tr>
<tr>
<td></td>
<td>brainstorm techniques to rectify degraded land and water for a specific agricultural or horticultural business.</td>
</tr>
<tr>
<td></td>
<td>use the Internet to examine climate change impacts and greenhouse gas emissions issues in agriculture and/or horticulture.</td>
</tr>
<tr>
<td></td>
<td>undertake a media analysis that examines the potential effects of climate change and how agribusinesses are adapting to these effects.</td>
</tr>
<tr>
<td></td>
<td>use the website Greenhouse in Agriculture &lt;www.greenhouse.unimelb.edu.au/&gt; to calculate and evaluate the carbon emissions for a particular agricultural or horticultural business.</td>
</tr>
</tbody>
</table>
Detailed example

RECTIFYING LAND AND WATER DEGRADATION REPORT FOR A SPECIFIC SITE

The major types of environmental degradation include:
- erosion
- mass wasting
- salting
- waterlogging
- compaction
- soil acidity
- issues of water quality.

Visit a site, identify and photograph types of land or water degradation at the site.

Prepare a written report that covers each of the types of environmental degradation and suggest methods for rectifying them. Use library and Internet resources to research techniques for preventing and rectifying degradation. Use the Resources list on the VCAA website <www.vcaa.vic.edu.au> as a starting point for web searches.

Area of study 2: Resource management and maintenance

Outcome 2

Apply and analyse management techniques that promote the economic, social and environmental sustainability of agricultural and/or horticultural businesses.

Examples of learning activities

- research the concept ‘sustainability’ and the components of sustainability, including social, economic and environmental factors that influence sustainability of an agricultural and/or a horticultural operation
- develop a definition of sustainability through class discussion and debate
- use the Internet to research information on the economic, social and environmental aspects of intensive farming practices used in the production of eggs, lamb or pork; prepare a PMI chart to present the information researched
- work in small teams to research information about fair trade; use a computer-based visualisation program to prepare a concept map of the main issues related to fair trade both in developing countries and within the Australian agricultural and horticultural communities
- access the website of Biological Farmers of Australia (www.bfa.com.au) or TM Organics (www.tmorganics.com); draw up a PMI chart of information on the value of adopting organic farming methods to the environment, farmer and to consumers
- use presentation software to outline the purpose and steps for developing a property management plan for a selected agricultural and/or horticultural business
- demonstrate a range of indicators of environmental health, for example soil characteristics (pH, texture, nutrients, organic matter, microorganism), water table depth, ground water salinity, production levels, presence of weeds and vermin, water quality, operator/s’ level of awareness of sustainability issues, oxygen levels, pollution
- discuss the concept of ‘environmental health’
undertake a media analysis by accessing articles or podcasts that describe
practices consistent with sustainable resource management, for example
tree planting, minimum tillage, laser grading, nutrient management, irrigation
management, waste disposal systems, Integrated Pest Management; write a
review of a range of these articles/reports

undertake fieldwork using environmental health indicators and relate them to the
sustainability of an agricultural or a horticultural business

invite a representative from a local Landcare group to outline their activities and
how they develop sustainable catchment management practices

review government policies and regulations on soil and water management in
agricultural and/or horticultural businesses and prepare a written essay on the
findings

using the Internet, research strategies for sustainable resource management for
land and water for an agricultural and/or a horticultural business

work in small teams to research strategies Australian agribusiness companies
are using to address environmental issues in food and fibre production such as
reducing water consumption, energy use and minimising waste sent to landfill; use
visualisation software to prepare a summary of the findings

develop a matrix that identifies organisations that can aid managers in developing
strategies for sustainability; describe how these organisations can help manage for
sustainability

monitor changes to water quality at a field site and use the analysed data to
recommend changes for improvements at the site

**Detailed example 1**

**INDICATORS OF ENVIRONMENTAL HEALTH**

Landowners wanting to adopt sustainable land use practices need simple ways of assessing the
condition of their land and water resources. The first of these usually being visual observations.

While the initial indicator may be observational, assessing the condition of land and water can be
done with a series of indicators of ‘environmental health’.

Such indicators provide information on the state of the land (condition indicators) and also measure
trends or changes in conditions over time (trend indicators). This information can be compared to
some desired state to assess the ‘health’ of the land and water resources, and the sustainability of land
use at a particular point in time.

While a wide range of measures are possible, those selected need to be easy to measure and record,
and must be measured on a regular basis. Some of the more commonly used indicators include:

- soil structure
- soil texture
- soil pH
- soil fertility
- extent of bare soil
- extent of soil erosion
- area of salt affected land
- extent of mass wasting (landslips, slumps)
- abundance of pest plants and weeds
- abundance of pest animals and vermin
- tree cover
- area of remnant vegetation
- watertable level
- groundwater salinity
- stream water turbidity
- diversity of macro-invertebrates in the water.

(continued)
For each indicator, a range of thresholds is determined against which each measurement can be assessed. The following table shows the range of thresholds for pH level:

<table>
<thead>
<tr>
<th>pH value</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>Too acid for plant growth.</td>
</tr>
<tr>
<td>4–5</td>
<td>Too acid for rhizobia.</td>
</tr>
<tr>
<td>5–6</td>
<td>Too acid for sensitive plants such as lucerne.</td>
</tr>
<tr>
<td>6–7</td>
<td>Neutral. Satisfactory for most plants – optimum threshold range for nutrient uptake.</td>
</tr>
<tr>
<td>7–8</td>
<td>May be too alkaline for some plants.</td>
</tr>
<tr>
<td>8–14</td>
<td>Too alkaline for growth of plants.</td>
</tr>
</tbody>
</table>

By regularly measuring and assessing such indicators, landowners can gain an idea of the present state of their land and water. Over time they can then assess the impact of changes in land management practices.

Activity:
1. Select two condition indicators and carry out measurements on a local property. Research the thresholds for each indicator and comment on the level of health as shown by each indicator.
2. Select two trend indicators and carry out measurements over time on a local property. Research the thresholds for each indicator and comment on the level of health as shown by each indicator.
3. What land management practices may have had an impact on the level of health?
4. What advice would you give to the property owner?
5. Present this advice in a report that clearly communicates the information on the environmental health of the property to the property manager.

### Detailed example 2

#### MEDIA ANALYSIS

1. Students should collect ten to twenty articles/reports that describe a variety of practices consistent with sustainable resource management in Australia. The articles/reports should cover both the agricultural and the horticultural sectors – at least five (5) for each sector.

   Examples of topics include:
   - Tree planting
   - Minimum tillage
   - Laser grading
   - Nutrient management
   - Irrigation management
   - Water management
   - Waste disposal systems
   - Integrated pest management
   - Whole farm planning
   - Energy usage
   - Soil management
   - Integrated weed management
   - Environmental monitoring

2. When collecting the articles, use current newspapers, agricultural and horticultural journals and magazines, and podcasts from websites such as ABC Landline, and the library databases.

3. Select a range of these articles/reports (minimum of one for agriculture and a minimum of one for horticulture) and write a review of each ensuring that all of the following points are covered.
   - Discuss how the practices mentioned in the article/report have influenced any sustainable strategies the business or farmer may have implemented or be planning to implement.
   - Discuss government policies or regulations on soil and/or water management that may have had an influence on the practices mentioned in the article/report.
   - Discuss environmental indicators that were used to determine the outcomes of the practices mentioned in the article/report.
   - Evaluate physical resources mentioned in the article/report, which were used to develop a sustainable management plan for the business.
AREA OF STUDY 3: Business plan implementation and evaluation

Outcome 3
Monitor the progress of, and complete the operation of, a small business project, and evaluate and report on its operation and outcomes in relation to the business plan, and its adherence to sustainability concepts.

Examples of learning activities
- list and apply appropriate production skills to the operation of the business
- research and visit business/es in the local area to assist in the selection and safe use of tools, equipment and materials appropriate to the small business project
- discuss examples and content of business evaluation reports
- record data associated with the business project onto spreadsheets and databases
- use a logbook to record progress and modifications made during the operation of the small business
- discuss, and evaluate as a class, the level of adherence to quality assurance standards required for students’ small businesses
- write a short article to post on a blog for one of the local fresh food farmers’ markets highlighting the advantages to consumers of using seasonally available fresh vegetables produced in the small business; include the concept of ‘food miles’
- analyse the financial performance of the business project through class discussion of all financial reports
- use a carbon footprint calculator to assess the ecological impact of the small business operations
- use visualisation software to prepare a SWOT (strengths, weaknesses, opportunities, threats) analysis of the concept of ‘food miles’ and apply this to the inputs and outputs of the small business
- evaluate in a written report the outcomes of the business project relative to the business plan
- use presentation software to present a report on the outcomes of the business project; include factors influencing its productivity, profitability and sustainability and make recommendations for improvements
Use presentation software to present a report to the class.

The report should detail the outcomes of the business project and include discussion under each of the following slide headings:

- factors affecting adherence to the business project’s quality assurance standards
- factors influencing the business project’s productivity
- factors influencing the business project’s profitability
- factors influencing the business project’s sustainability
- recommendations for improvements.

Each of the above areas need to be expanded and described in terms of the particular agricultural and/or horticultural business project. Ideally, each area would be linked to the initial business plan.

The report may be accompanied by an oral presentation.

The class may then be called upon to ask five questions related to the outcomes of the business project and comment specifically on the slide headings.

Students would then individually prepare an evaluation of the presentation and respond to questions in a written format.
SCHOOL-ASSESSED COURSEWORK

In Units 3 and 4 teachers must select appropriate tasks from the assessment table provided for each unit. Advice on the assessment tasks and performance descriptors to assist teachers in designing and marking assessment tasks will be published online by the Victorian Curriculum and Assessment Authority in an assessment handbook. The following is an example of a teacher’s assessment program using a selection of the tasks from the Units 3 and 4 assessment tables.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Marks allocated</th>
<th>Assessment tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit 3</strong>&lt;br&gt;<strong>Outcome 1</strong>&lt;br&gt;Analyse and evaluate a range of technologies commonly used in agricultural and/or horticultural businesses, and explain the reasons for the selection and application of technology for a specific business.</td>
<td>30</td>
<td>After conducting fieldwork based on commercial business/es, a multimedia presentation is prepared that outlines the current technology used at the specific agricultural and/or horticultural site/s visited and discusses how decision making is influenced by the application of technology.</td>
</tr>
<tr>
<td><strong>Outcome 2</strong>&lt;br&gt;Describe and analyse a range of new or emerging technologies, and evaluate the likely impact of a selected innovation on the sustainability of a specific agricultural and/or horticultural business.</td>
<td>20</td>
<td>A research report is presented that describes the predicted impact of innovations, and evaluates the impact of the innovations on the sustainability of agribusiness/es that choose to adopt them. An oral presentation is developed that examines the impact of biotechnology developments.</td>
</tr>
<tr>
<td><strong>Outcome 3</strong>&lt;br&gt;Design, implement and report on progress of a small commercial agricultural and/or horticultural business that involves the management and care of living plants or animals</td>
<td>50</td>
<td>Extended coursework task (Part 1)&lt;br&gt;A written business plan for a small hydroponic crop production. and&lt;br&gt;Production work and a record of production (text and images) detailing how the business plan has been carried out. and&lt;br&gt;An interim report on the progress of the small hydroponic crop production business.</td>
</tr>
</tbody>
</table>

**Total marks for Unit 3** 100
<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Marks allocated</th>
<th>Assessment tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outcome 1</strong></td>
<td>25</td>
<td>A multimedia presentation is prepared to explain the principles of ecology related to a managed ecosystem and investigates land and water degradation and techniques for rectifying degradation. This will also include reference to the impacts of climate change and management adaptations.</td>
</tr>
<tr>
<td><strong>Outcome 2</strong></td>
<td>25</td>
<td>A test (requiring short and extended answers) based on a case study of an agricultural and/or a horticultural business’ property management plan, including questions on environmental health indicators.</td>
</tr>
<tr>
<td><strong>Outcome 3</strong></td>
<td>50</td>
<td>Extended coursework task (Part 2) Production work and a record of production and modifications, including digital photos, graphs and other data showing outputs of the small hydroponic crop production business. and An evaluation report of the outcomes of the small hydroponic crop production business that explains factors that influenced production and adherence to quality standards and comments on its productivity, with recommendations to improve productivity and sustainability. Pictorial and written material is included in the report.</td>
</tr>
</tbody>
</table>

**Total marks for Unit 4** 100