2007 Agricultural and Horticultural Studies GA 3: Written examination

GENERAL COMMENTS

Areas of strength and weakness

Students demonstrated a sound understanding of techniques for modifying climate, water, soil/growing media and topography. However, they found it more difficult to compare the advantages and disadvantages of alternative techniques. Methods for evaluating these techniques also need to receive more attention.

Students demonstrated an adequate general knowledge of specific weeds, pests and diseases; however, the recommended treatments and preventions described were often very general and/or isolated actions, rather than complete strategies. Students should study specific weeds, pests and diseases under a selection of standard headings that relate to integrated management approaches rather than just prevention or control.

A small percentage of students had obviously studied a number of innovations and were capable of explaining and evaluating them in detail. Students are expected to be able to evaluate the impact of a range of innovations (new or emerging technologies) impacting on a specific business type. A distinction must be made between how an innovation works and its advantages and disadvantages. Students should also be able to evaluate the impact on the sustainability of specific business types, not just productivity/profit. Some students are still using examples of technology that are definitely not innovations.

The key characteristics of a natural ecosystem have been rarely questioned on previous exams, which was evident in the answers. Only a few students adequately discussed how biodiversity, self-regulating systems and the minimal exporting of matter and energy related to agricultural and horticultural systems.

The case studies presented on this examination allowed students to demonstrate their knowledge of the role of indicators in aiding resource management. Many students only suggested indicators that are qualitative; these usually need to be supported by some form of quantitative measure to ascertain the specific cause and extent of the problem. If quantitative measures are used, it is more likely that the cause can be identified before the problem occurs and becomes obvious via qualitative measures. For example, measuring water table levels and salts in the sub-surface water will indicate the likelihood of salinity becoming a problem, whereas a change in the vegetative cover is usually an indicator that the problem already exists. Students generally showed a sound understanding of a variety of environmental degradations affecting agriculture and horticulture.

Students are expected to be able to evaluate the performance and outcomes of a small commercial agricultural or horticultural business in relation to its business plan. Many students could not list production skills and had poor knowledge of risk types, quality standards, and business monitoring. Answers were often generalised statements that did not adequately draw on the student's experience in planning, monitoring and evaluating their school-based small business project. Occupational health and safety issues were well understood.

Choice of options to answer

Students had to select an option from the provided lists of alternatives in Questions 2, 3, 4 and 5. In Question 5, students were also required to nominate two innovations to discuss in their answer. In Question 7 students had to select a case study from four options. In all questions, a diverse range of options was chosen.

Formula answers

When preparing students for the examination, teachers must refer to the current *Agricultural and Horticultural Studies VCE Study Design* and the examination criteria. Students need to be able to apply their understanding to a range of land, plant and animal management techniques in agricultural and horticultural businesses throughout Victoria.

Marking policies

Some questions addressed more than one of the examination criteria. A marking scheme was developed to guide assessors. Marks were allocated to specific elements of the correct answer or according to descriptive criteria.

Where lists or alternatives were provided, examination assessors had general guides for the answers as well as specific answers to the alternatives. The specific answers were provided to guide the assessors in judging the accuracy of students' responses.

Marks were not deducted if students provided answers that were not correct.

SPECIFIC INFORMATION

Note: Student responses reproduced herein have not been corrected for grammar, spelling or factual information.

For each question, an outline answer (or answers) is provided. In some cases the answer given is not the only answer that could have been awarded marks.

Question 1a.

Marks	0	1	2	3	4	5	6	7	8	Average
%	3	6	12	16	16	16	17	10	4	**4.3**

1ai.

Any two of:

- add organic matter
- add vermiculite
- add a wetting agent
- add peatmoss
- increase the clay content.

1aii.

Any two of:

- fence off and prevent stock from eroding the banks
- add alum/gypsum/lime/clean straw to the dam
- maintain ground cover in catchment draining to the dam.

1aiii.

Any two of:

- use laser grading
- use contour banks
- dig a drain
- use raised bed technology.

1aiv.

Any two of:

- shade glasshouse with shade cloth
- use lime or another commercial white out
- plant trees around it.

One mark, up to two per question, was awarded for specifying how each change to improve production could be made. Most students had no trouble giving one method to make the modification, demonstrating that they had an understanding of basic techniques for modifying climate, water and soil/growing media. However, many students could not name a second method, suggesting that the depth of their knowledge of environmental modification methods may be limited.

Question 1b.

Marks	0	1	2	3	4	5	6	7	8	9	Average
%	1	11	24	24	17	14	4	4	1	0	**3.3**

1bi.

Deep ripping

- immediate response for increase in aeration
- can cause destruction of soil aggregates and consequently soil structure
- could accelerate the oxidation of organic matter resulting in reduced OM over time
- can be expensive

Organic matter and gypsum

- long-term improvement in aeration due to improved soil structure
- may introduce weed or disease
- in the short-term, little real change in aeration

1bii.
Drip irrigation system

- delivers water to a specific site
- effectively manages water delivery
- can be cheap to set up
- less leaf disease
- holes become blocked more frequently

Overhead sprinkler

- spray drift on windy days
- unable to effectively deliver water to a specific plant
- can be costly to set up
- can be effective in preventing frost damage

1biii.
Perlite/vermiculite mix

- sterile, light in weight
- dust in perlite is a potential health hazard
- costly to use

Sand/peat moss mix

- cheap
- heavy to carry when placed in pots
- difficult to sterilise
- increased susceptibility to disease

Three marks were available for each comparison. Full marks were awarded to answers that showed a detailed consideration of the advantages/disadvantages of the two techniques. Two marks were given to answers that showed that the student clearly knew the main advantages/disadvantages of one technique compared with the other; and one mark was given for identifying isolated advantages/disadvantages of the practices being compared.

Students need to be able to evaluate the effectiveness of the techniques. This question provided an opportunity to do this by comparing two techniques for three different situations. Few students answered all three adequately.

Question 2

Diseases	% student responses	Pests	% student responses
mosaic virus	<1	lice	21
downy mildew	7	red-legged earth mite	9
grass tetany	3	aphids	28
pulpy kidney	3	snails	15
rust	5	liver fluke	8
no selection	1		

Question 2ai.

Marks	0	1	Average
%	12	88	**0.9**

Disease or pest	Business type affected
mosaic virus	• ornamental gardens • horticultural crops • cropping • grazing
downy mildew	• fruit • vine
grass tetany	• beef/dairy cattle • sheep and goats

pulpy kidney	• sheep and goats • cattle
rust	• ornamental gardens • horticultural crops • cropping • grazing
lice	• sheep and goats • poultry • cattle
red-legged earth mite	• grazing industry • cropping industry
aphids	• market garden • ornamental garden
snails	• market garden • wholesale nursery • ornamental gardens • pasture and cropping
liver fluke	• sheep and goats • cattle

One mark was given for a correct answer.

Question 2b.

Marks	**0**	**1**	**2**	**Average**
%	13	54	33	**1.2**

Disease or pest	**Symptoms (signs) that show the pest or disease is present**
mosaic virus	• leaves are pale and mottled in colour • both old and new leaves can be affected • as the disease worsens, affected tissue may die • plant growth is stunted
downy mildew	• 'oil spots' on leaves • oily brown patches spread along infected shoots, stems and tendrils • leaves on these shoots can die and fall, and shoots may break at the point of infection
grass tetany	• animals walk stiffly or stagger • no appetite • mournful look • convulsions • falling over • high temperature
pulpy kidney	• animals dying suddenly, especially after a sudden feed change or other upset • rapid rotting of carcass
rust	• brown streak • circular or irregular patch pustules with darker spores in the centre • the affected part breaks or tears easily at pustule margin • spores rub off easily • spores darken as the plant matures • plant is stunted

lice	Sheep and goats • irritates the sheep, causing the sheep to bite, scratch and rub on trees and fences; this damages the wool, causing breakage and clotting of the fibres • ragged appearance, often with tags of wool hanging from the fleece • lousy wool often has a yellow colour due to a heavy suint and skin secretions • wool has a distinctive smell Cattle • irritates cattle, causing the cattle to bite, scratch and rub • lousy cattle may cause damage to fences, yards or trees which the cattle use as rubbing posts • coats take on a rough scruffy appearance, and, at times, areas of skin are rubbed raw Poultry • small parasites which infest birds around the vent and the neck • lice eggs bundle and attach to the base of the feather • can cause severe irritation and stress • birds often stop laying
red-legged earth mite	• 'silvering' or 'whitening' of the attacked foliage • lacerated leaf tissue of plants • cell and cuticle damage which promotes desiccation, retards photosynthesis and produces the characteristic silvering that is often mistaken as frost damage • reduced seedling survival and development in newly establishing pastures and emerging crops
aphids	Market garden • large numbers of aphids on and around plants • wilted soft tissues and young leaves • misshapen leaves and shoots • curled leaves • spread of disease for which aphids are a vector Ornamental garden • aphids sitting on the plants • wilted soft tissues and young leaves • misshapen leaves and shoots • curled leaves • increase in aphid-borne diseases
snails	Market garden, wholesale nursery, ornamental garden • destruction of herbaceous vegetation • holes in leaves • seedlings disappear overnight • silvery trails Pasture and cropping • destruction of herbaceous vegetation • holes in leaves • patches where seedlings have gone • silvery trails
liver fluke	• anaemia • ill thrift • scouring • bottle jaw • death

One mark was given for providing adequate information to show that the student knew the main identifying symptoms of the disease/pest. Two marks were awarded for more detailed answers.

Question 2c.

Marks	**0**	**1**	**2**	**3**	**4**	**5**	**Average**
%	6	30	30	25	7	2	**2.0**

Disease or pest	Prevention and control
mosaic virus	Prevention • maintain vigorous plant growth using fertilisers and appropriate plant conditions • eliminate vectors • control weed hosts of vectors • plant resistant varieties – use certified free seed • use diverse pasture species Control • destroy affected plants • fertilise to encourage plant growth to outgrow infection • maximise plant growth conditions to compensate for lost production • use available pasture growth
downy mildew	Prevention • create an environment that does not promote the fungus (need low humidity and good air flow) • prune to produce an open canopy • use hygienic practices • plant resistant varieties • monitor crop carefully when climatic conditions threaten • use drip irrigation rather than overhead sprinklers • use copper spray (Bordeaux) Control • Mancozeb and systemic fungicide Bayleton • use hygienic practices to prevent spread • dispose of infected plant material correctly
grass tetany	Prevention • protect from cold • feed high roughage diet • Mg supplements • cull older, fat cows • reduce stress/excitement levels • monitor carefully, especially if it has occurred on other farms in the district Control • injection of Mg by vet • feed causmag or Epsom salts and hay
pulpy kidney	Prevention • maintain good hygiene • vaccinate • avoid sudden feed changes • dispose of carcases properly • exercise may help (anything that speeds up movement of food through the gut) Control • not usually done – antitoxin, antibiotics and electrolytes may be given to high value stock; general treatment is usually not economical
rust	Prevention • seed dressing treatments can suppress the development of stripe rust in young crops • inspect crops for the presence of stripe rust at regular intervals throughout the growing season • cool, wet weather promotes stripe rust so increased vigilance is desirable after such periods Control • wheat varieties with a rating of five or less may need spraying with foliar fungicide during the season, especially if the disease develops early in the region

lice	Prevention – cattle, sheep and goats and poultry • maintain a clean herd • quarantine imports to property and treat • keep strays off property • check regularly Control – cattle • range of products available • routine treatment usually is not warranted • treat only the heavily infested cattle (more than two lice per square centimetre) • check for other problems, such as internal parasites, which may be contributing to lowered resistance Control – sheep and goats • pour on insecticides in autumn, within 24 hours of shearing • plunge or shower dips within two months of shearing, covering all parts of the animal • use an effective chemical, at the prescribed dose and application Control – poultry • registered poultry dust or liquid insecticide • maintain hygiene to stop recurrence • quarantine birds before bringing in new stock • buy from a reliable source • keep strays off the property
red-legged earth mite	Prevention • spray omethoate on the pasture at establishment in spring and autumn • sow seeds coated in insecticide that prevent mites attacking seedlings • maintain dense, vigorously growing pasture Spring sprays • foliar sprays in the previous spring • destroy mites in the spring prior to planting susceptible crops, and before the mites start laying over-summering (diapause) eggs • spray-top pastures before the onset of seed set in the pasture species, usually before October Autumn sprays • control first generation mites before they lay eggs • insecticides used at or after crop planting should be applied within three weeks of the first appearance of mites • depending on the distribution of the mites, border sprays may be adequate Bare earth sprays • bare earth insecticides, used just after sowing, protect the germinating seedling at its most susceptible stage Foliage sprays • can be effective after the crop has emerged Seed treatments • work best when mites are active at germination and when mite pressures are not high Natural enemies • major role in reducing earth mite populations • minimise insecticide impact on natural enemies by choosing a spray that has the least impact and minimise the number of applications Cultural control • clean fallowing and then destroy weeds around the crop and pasture perimeters • control weeds, especially capeweed and thistles • crop rotations involving cereals are likely to reduce the population build up • cultivation significantly decreases the number of over-summering eggs • hot stubble burns provide a similar effect • close grazing of pastures by stock (in spring) can reduce numbers

aphids	Prevention – market garden • use resistant varieties • take care to use only uninfected plants • encourage beneficial insects; use 'soft' insecticides, which kill only aphids, and broad spectrum insecticides (which kill beneficial insects too) to control weed hosts Control – market garden • insecticide • change varieties • also see below Prevention – ornamental garden • grow 'virus-free' plants in isolation, away from potential sources of infection • growing conditions (including weed control) should discourage aphids • rogue out infested plants • enforce strict hygiene • regularly inspect plants that are not hosts of aphid-borne diseases so that the presence of aphids is detected well before any damage occurs Control – ornamental garden • spray with a suitable insecticide • avoid insecticides that may be phytotoxic to the crop plants
snails	Prevention – market garden, wholesale nursery, ornamental gardens • eliminate hiding places (so birds can get them) • use textural, desiccating and toxic barriers Control – market garden, wholesale nursery, ornamental gardens • physically remove • baits and traps • molluscicide (methiocarb) or iron phosphate Prevention – pasture and cropping • use shelter traps (wet hessian bag) around margins of crop/pasture to detect presence • encourage natural predators – plant shelter belts for birds and lizards Control • maintain ideal plant growth conditions to out grow snails
liver fluke	Prevention • eradication is almost impossible because it is usually not practical to prevent reinfestation of pastures and animals • draining and planting trees in swampy areas of paddocks to help eliminate snails Control • drench sheep in February and July and cattle in April/May and July • seek the advice of an animal health adviser to formulate an appropriate drench program, which may change slightly from year to year depending on temperature and rainfall patterns • mature fluke infestation can be monitored by using laboratory tests such as 'Fluketest', which detect fluke eggs in faecal samples

Answers needed to have the major elements of integrated pest management (IPM):

- how to control the source of the pest or disease
- how to ensure the host's environment does not favour the pest or disease species
- how to monitor the level/development of the pest or disease
- recommended combinations of specified chemical, mechanical or biological controls to treat the pest or disease
- a management plan that integrates all of the above at appropriate times.

One mark was given for each of the above elements of IPM specifically related to the chosen pest/disease. If the answers were not related to the pest or disease but stated the general principles, a maximum of three marks was awarded.

Many students successfully explained how to treat or prevent their chosen pest or disease; however, the integrated management concept requires more work. More attention should be given to understanding pest and disease management strategies, rather than isolated strategies for prevention and treatment.

Following is an example of a high-scoring student response.

> ***Lice***
> *To prevent this disease the signs of lice should be watched for, knowledge should be gained on occurrence of lice on neighbouring properties and any sheep entering the property should be quarantined until a manager is sure they're lice free. Boundary fences should be kept in good order to prevent contamination from nearby. A good shearing program should be in place. If lice do infect a flock infected mob should be quarantined immediately to prevent further spread, sheep should be shorn and backlined immediately. When mustering for shearing manager should be extra careful about not leaving sheep behind in case of reinfection. All infected sheep should be shorn at the same time.*

Question 2d.

Marks	0	1	2	3	Average
%	18	57	21	4	**1.1**

2di.
Fungal disease: downy mildew or rust

2dii.
Metabolic disease: grass tetany

2diii.
Bacterial disease: pulpy kidney

Question 3

Weeds	% student responses	Weeds	% student responses
Paterson's curse (*Echium plantagineum*)	49	Wild oats (*Avena fatua*)	8
Ragwort (*Senecio jacobaea*)	11	Liverwort *(Marchantia polymorpha)*	0
Variegated thistle (*Silybum marianum*)	11	Winter grass *(Poa annua)*	2
Silver grass (*Vulpia spp*)	3	Gorse *(Ulex europaeus)*	9
Chilean needlegrass (*Nassella neesiana*)	3	Wild radish *(Raphanus raphanistrum)*	2
No selection	3		

Question 3a.

Marks	0	1	2	3	Average
%	10	61	27	2	**1.2**

Weed	Prevention and control
Paterson's curse	• maintain vigorous pasture growth of desirable species • monitor paddocks and identify Paterson's Curse and treat early • do not allow seed set • biological controls (Crown boring weevil) • windbreaks prevent seed blowing in • ploughing/cropping/pasture improvement on arable land, mechanical and herbicide on grazing land • purchase stock from weed free areas • quarantine stock when brought on to property • use certified pasture seed • hygiene – ensure good machinery clean down protocols
Ragwort	• cultivation, grazing and herbicide treatments • prevention measures and land rehabilitation • twice yearly (autumn and spring) spray with selective herbicides and spot treat to control isolated plants • vigorous competition from pasture plants or the establishment of an over storey of trees provides a means of control • eradicate new infestations as they occur • quarantine extensive infestations • grazing with sheep can prevent or reduce flowering and seed production

Variegated thistle	• maintain a vigorous pasture • prevent over grazing and insect damage to desired species • heavily infested areas may need to be re-sown with perennial pasture grasses • hand-hoeing is effective for individual plants and small patches • ensure farm machinery is kept free of soil Biological control • thistle receptacle weevil (*Rhinocyllus conicus*) larvae feed in the thistle flower that results in decreased seed development Chemical control • MCPA, 2,4-D amine and 2,4-D ester can be used for variegated thistle control for cereals (2,4-D should not be used on oats) • in pastures, MCPA can be used at low rates and bromoxynil/diflufenican
Silver grass	• spray pasture with a mixture of simazine plus paraquat, six to 10 weeks after the autumn break, once clovers have at least three true trifoliate leaves • kill the standing mass of silver grass in winter and prevent the emergence of germinating silver grass for up to three months after application • winter cleaning has no adverse effect on clover or sown perennial grass in spring and produces a high quality pasture relatively free of silver grass for up to five years
Chilean needlegrass	• maintain vigorous pasture growth of desirable species • monitor paddocks and identify Chilean needlegrass and treat early • do not allow seed set • biological control when available • windbreaks prevent seed blowing in • ploughing/cropping/pasture improvement on arable land, mechanical and herbicide on grazing land • purchase stock from weed free areas • quarantine stock when brought on to property • use certified pasture seed • maintain good machinery clean down protocols
Wild oats	• use certified seed so weed is not introduced • use a range of herbicides (chemical rotation) including knockdown and systemic herbicides • alternate cropping with pasture phase • use cultivation, the grazing animal, pasture-topping, stubble burning, etc., together with pasture and crop rotation • strategic heavy grazing of pasture to prevent seed set in late spring • cut hay or silage • green manure • mow • grow a forage break crop between the pasture and crop phases
Liverwort	• use pre-emergence spray ‘Ronstar’ (oxydiazon) or ‘Surrender’ (benzalkonium chloride) or vinegar • mulch • remove by hand • inspect tube stock • minimise chance of spore spread by wind and water splash
Winter grass	• encourage a healthy and vigorously growing lawn • mow lawn on a regular basis • mow lawn at the correct height for the species grown • fertilise • mulch garden beds to a depth of 5–10 cm to stop sunlight penetrating to the soil

Gorse	• clean soil and mud from machinery and boots • remove gorse bushes growing on the edges of water courses • biological control – the gorse weevil (*Apion ulicis*), gorse spider mite (*Tetranychus lintearius*), gorse soft shoot moth (*Agonopterix ulicitella*), a foliage feeder, and the gorse pod moth (*Cydia succedana*) destroy seeds in both spring and autumn • burn, especially combined with grazing or other control • mechanical clearing at ground level • heavy grazing, provided sheep are confined to gorse only • grazing by goats • foliar spray and cut stump treatment with herbicide (triclopyr and picloram; for example, Grazon DS®)
Wild radish	• apply herbicides • rotate and manage crop and pastures

Answers should have included the major elements of weed prevention and control:

- how to control the source of the weed
- how to ensure the host's environment does not favour the weed by promoting active competition and the correct growth environment at the right time for the preferred species, and vice versa
- how to monitor the level/development of the weed
- recommended combinations of specified chemical, mechanical or biological interventions to combat the weed
- a management plan that integrates all of the above at appropriate times.

One mark was awarded for one to two elements of weed prevention and control; two marks for three to four elements of weed prevention and control; and three marks for five elements of weed prevention and control.

The words 'prevention and control' provided more specific guidance for student responses than 'integrated weed management' may have. However, students struggled to answer the two parts of the questions, indicating that their knowledge of weed management needs improving. More attention should be given to understanding specific weed management strategies using the points given above, rather than isolated strategies for prevention or treatment.

Following is an example of a high-scoring student response.

Gorse

- *Ensure a thick ground cover all year to stop new plants growing.*
- *If plants grow, can be burnt, cut, bulldozed or if absolutely necessary sprayed and poisoned with Roundup*
- *For biological control gorse mites can be introduced to slow growth of plant numbers over the long term*

Question 3b.

Marks	0	1	2	3	Average
%	7	33	45	15	**1.7**

Acceptable answers included:

- reduced economic sustainability because of reduced production by desirable species, lowering of product quality, cost of treatment program, opportunity cost
- reduced environmental sustainability as plant does not support animal biodiversity and reduces plant biodiversity. Control by windbreak increases environmental sustainability as it increases biodiversity and has other positive effects. The use of sprays may reduce plant biodiversity and thus habitat and faunal biodiversity
- reduced social sustainability as pesticide use risks health damage.

One mark (up to three) was awarded for each relevant example.

Question 4

Business type	% student responses	Business type	% student responses
cereal cropping	19	garden design/construction	4
poultry for meat	<1	ornamental garden maintenance	1
poultry for eggs	<1	glasshouse plants	8
beef cattle	8	container-growing ornamentals	<1
pigs	<1	field grow vegetables, herbs or flowers	8
sheep or goats	19	production of indigenous plants	<1
dairy cows	23	hydroponic production	0
grapevines	3	production of fruit/nuts from trees	<1
fish or yabbies	1	horses for recreation	2
turf production	<1	rearing rabbits for pet or meat market	0
no selection, or more than one selected	3		

Question 4a.

Marks	0	1	2	Average
%	18	34	48	**1.3**

One mark was given for each nominated innovation that was clearly a **new or emerging** method or development that related to the business type chosen.

Although not as common as in previous years, a number of students still named examples that were clearly not 'new or emerging'. Area of Study 2 of the study design requires students to have knowledge of new or emerging developments in five key management areas related to a specific business, so naming and describing two should have been easy.

Below is a listing of technologies named by students, for each business type chosen. Whether these responses were accepted as 'innovations' was dependant upon the context in which the student described the technology.

Beef Cattle

- AI
- autofarm
- cloud seeding
- cross breeding
- electric cattle crushes
- electric fence collars/invisible fence
- electronic ear tags
- embryo transfer
- genetic engineering
- genetic manipulation
- genome mapping
- Gibberalic acid (Progib)
- GPS ear tags
- grain feeding
- growth food
- high tech ear tags
- injections instead of drenching
- methane collecting/bio fuel
- new feeding sheds
- nlis ear tags
- ph in soil
- production rate
- rock and roll cradle
- selected breeding
- technograzing
- virtual fencing/GPS stock collars
- worming capsules

Cereal cropping

- automatic irrigation doors
- autosteer
- Biodiesel
- black urea
- BT cotton
- complete channel control
- controlled trafficking
- cross breeding different plants
- deepband seeding air seeders
- direct drilling
- draper fronts on combine harvester
- ez boom
- ez steering system
- genetic engineering
- genetic modification of plants/crops
- genetic modification roundup ready canola
- genetically modified wheat
- global positioning system (GPS)
- GPS aided cropping
- GPS auto steer
- GPS for precision farming
- GPS guidance systems
- GPS managing systems
- GPS navigation
- GPS precision agriculture
- GPS satellite laser levelling
- GPS seeding
- GPS self steer
- GPS tracking
- GPS tractor navigation
- infrared spot spray
- infrared weed seeking boom sprays
- inter row sowing via GPS
- knife edgepoints
- light bar
- liquid nitrogen
- long stop wetting front
- modified crops
- new chemicals
- new croppers
- new harvester
- new spraying technology
- no tillage
- pest and disease resistant varieties
- precision agriculture

- rock hopper
- roundup ready barley
- roundup ready canola
- roundup ready crops
- rust resistant wheat
- satellite irrigation watering
- soil moisture probe
- spray height controller
- swing wiper
- tracks
- tubulator
- unmanned aerial vehicle
- weed seeker
- weed whacker
- wide row spacing
- yield mapping
- zero tillage

Container grown ornamentals

- solid water

Dairy Cows

- agrimat
- AI to breed female cows
- artificial insemination innovations
- astronaut milking machine
- astronaut robotic dairy gen 3
- automatic cup removers
- automatic drenching
- automatic feeders
- automatic milker
- automatic milkers turntable
- automatic milking robots
- automatic milking systems
- automatic motorised fences
- automatic systems
- automatic tits spray
- beeline technology
- cell grazing
- computer controlled milking machines
- computer chip ear tags
- cow identification computer system
- ear sensor tags
- electronic ear tags
- electronic ID tags
- electronic milking machines
- embryo transfer
- female sperm
- female sperm/sex selection
- floodwash
- genetic modification – pasture improvement
- genome mapping
- GPS
- GPS aided cropping
- GPS cattle ear tags
- GPS controlled tractor
- GPS navigation
- GPS system
- irrigation
- Lely Astronaut robotic milker
- machinery that milks the cow
- micro chipping
- milking room
- milking technology
- mobile phones
- nlis ear tags
- nlis tag readers
- precision farming
- producing hay quicker and faster
- robot milkers
- robotic dairy
- robotic drafting
- robotic milker
- robotic milking systems
- robotic rotary milking system
- rotary dairy
- rotary milking system
- selecting female sperm
- sensor tech cell count devices
- sex selected sperm
- shedding dairy cattle
- somatic sense tech
- subsurface drip irrigation
- whole herd testing

Garden design/construction

- air pruning pots
- computer programs for garden ideas
- computers
- dripper system
- garden design
- glass house plants
- GPS mapping for gardens
- hydraulic benches
- mechanical needle arm
- power tools
- rocket pots
- solid water
- wireless watering

Poultry for eggs

- GPS mapping
- DNA and virus extraction

Field grown vegetables, herbs or flowers

- blue tooth technology
- cloning
- computerised irrigation
- computerised watering system
- drip irrigation
- electronic drip
- genetically enhanced wheat (drysdale wheat)
- genetically modified plants
- GPS
- GPS land classing
- GPS tractor systems
- hydraulic benches
- irrigation controllers using sensors
- irrigation systems
- modern day tractor
- netting
- overhead sprinklers
- plant grafting
- plant water chip
- precision agriculture
- rocket pots
- slow water releasing system
- solid water
- sprinkler system
- sustainable agriculture
- underground water tanks
- water management
- water pump sprinkler systems
- wheat cells
- wind breaks

Fish or yabbies

- aquapod
- talyria and shrimp crop rotation
- supplementary food for enhanced growth
- water containers

Production of fruit or nuts from trees

- sex pheromones (Isomate)
- spraying chemicals

Glasshouse plants

- air pruning pot
- automated overhead boom spray
- automatic computer controlled glass house
- automatic irrigation
- automatic shade cloth
- automatic watering system
- climate control
- computer controlled technology
- computer operated windows in greenhouses
- controlled spraying of water
- dairy cows
- drip irrigation
- electronically controlled climate systems
- gantry and rail system
- glasshouse plants
- heat blanket
- heating mats
- hydro heating
- IMS computer control
- light dimming glass panels
- overhead sprinklers
- plant contraceptive
- rocket pot
- sensors computer controlled
- solid water
- temp and timer regulating water systems
- temp/humidity control
- temperature heating controls
- trolley railed gantry systems
- virtual fences
- water gel
- watering systems

Grapevines

- advanced water management
- fans to reduce frost effects
- grape picking machine
- growing rose bushes
- hail cannoning
- high pitched sound pest deterrent
- insects
- irrigation systems
- netting
- new and up coming chemicals
- noise control
- precision viticulture
- soft wave systems

Horses for recreation

- artificial insemination
- bail feeder
- bunny blaster
- embryo transfer
- genetic engineering
- microchipping
- nailess horse shoe
- solar electric fencing

Ornamental garden maintenance

- genetic modification
- metered roller
- pigs
- rocket pots
- solid water

Poultry for meat

- auto winches for drinking and feeding lines
- cool pad cooling systems

Production of indigenous plants

- magnetic operated boom spray Ball industries
- Dutch computer systems Ball industries

Sheep or goats

- artificial insemination
- automated sheering plant
- automatic weigh drafter
- bioclip wool removal
- chemical sheering
- Draffin sheep handler
- e tags
- easyshear
- electric shearer
- electrical stimulation of lamb carcasses
- electronic ear tags
- electronic tenderisation
- embryo transfer
- female sperm
- fodder sheds
- gene mapping
- genetically modified bare bottom sheep
- Genome mapping
- GPS
- Heinger/Sunbeam shearers sling
- hydraulic benches
- hydroponic benches
- leaking hose/subsurface irrigation
- milking system
- mulesing clips
- mulesing gun
- new drenches

- new improved presses
- new shearing techniques
- nlis tags
- non surgical mulesing
- pipeline
- plastic mulesing clips
- pour on drenches
- racewell sheep handler/ weighing machine
- raised curved sheering boards
- roboshearing
- robotic shearing
- shear easy
- shearers
- shears
- sheep cradle
- sheep nets
- sheep turntable
- sheepholder/rotator for sheering
- UAV unmanned aerial vehicle
- ultrasound
- unmanned vehicle
- vaccinate
- virtual fencing
- water saver

Turf production

- autosteer
- Hydrosmart

Question 4bi–ii.

Marks	0	1	2	3	4	5	Average
%	12	14	25	25	18	5	**2.4**

Question 4ci–ii.

Marks	0	1	2	3	4	5	Average
%	26	28	24	14	5	2	**1.5**

Part i.

Answers should have given the assessor a broad understanding of the operation of the named technology, even if it was not an innovation. Answers did not have to contain highly technical detail.

One mark was given if the answer included adequate relevant information to show that the student had an overview of how the innovation works or is done, and two marks were awarded to answers that provided some detail of the innovation's operation.

Students were generally confident at describing one technology, although many confused how the innovation works or is done with what it does. The second example was often not as well described, perhaps indicating that many students had not studied the range of innovations likely to affect a specific agricultural and/or horticultural business (as stated in Unit 3 Outcome 2 of the study design).

Part ii.

Questions 4bii. and 4cii. tested whether the students knew the likely impact of the innovation on a specific area of sustainability, compared with traditional methods. The answers should have explained any advantages, disadvantages, problems and limitations of the innovation with regard to economic sustainability in 4bii. and social or environmental impact in 4cii.

One mark was awarded to answers that missed key elements and considered only a limited range of advantages and disadvantages. Two marks were given to answers that included the main advantages and disadvantages and three marks were awarded for a detailed consideration of the advantages and disadvantages.

Following are examples of two high-scoring responses.

Biodiesel
Part i.
Biodiesel is made from plant or animal material rather than from fossil fuels in conventional diesel. In the case of plants, plant matter (for eg Oilseeds ie. Canola) is crushed and filtered to remove husks etc and the oil is extracted. Once cleaned, glycerine is added and Biodiesel is created. Biodiesal is a cheaper and more sustainable source of fuel for farm machinery and generators etc.

Part ii.
Biodiesel creates new markets for farms products, increasing viability of a cropping enterprise
Can be produced on farm reducing costs of buying in and cuts out the middle man.
Is a cheaper source of fuel for machinery used in the business
Burns cleaner in engines, leaving less residues meaning less costs for maintenance on machinery for business
Plastic mulesing clips

Plastic mulesing clips
Part i.
Plastic mulesing clips are clamped onto the breech area of a wrinkled skinned lamb (eg Merino), this area, until now has been surgically removed by mulesers. The clip prevents blood flow to the skin so that it dies and drops off, much like castration using elastrator rings. The clips leave the breech area smooth and wrinkle free, helping remove the desired environment for fly strike.

Part ii.
Advantages: This clip is much more socially accepted by the general public than the traditional surgical removal of the skin. Animal rights people are less likely to target this method by 2010.

Disadvantages: The time when the clip will fall off varies from sheep to sheep so clips will end up scattered across the paddock, although a biodegradable clip is being invented, it isn't yet, therefore traditional mulesing was more environmentally sustainable in that it didn't pollute pastures with plastic.

Question 5

Business type	% student responses	Business type	% student responses
cereal cropping	12	garden design/construction	5
poultry for meat	1	ornamental garden maintenance	0
poultry for eggs	6	glasshouse plants	4
beef cattle	12	container-growing ornamentals	2
pigs	3	field grow vegetables, herbs or flowers	16
sheep or goats	10	production of indigenous plants	2
dairy cows	12	hydroponic production	2
grape vines	3	production of fruit/nuts from trees	3
fish or yabbies	2	horses for recreation	3
turf production	1	rearing rabbits for pet or meat market	1
no selection	1		

Question 5a.

Marks	0	1	2	3	4	5	6	7	8	Average
%	10	15	15	16	18	13	8	4	1	**3.2**

5ai.
One mark, up to a maximum of four, was awarded for each skill mentioned that was specifically production-orientated and relevant to the nominated business.

5aii.

Type of risk	Example of a risk that specifically affects your chosen business type
Environmental	• weather-related (wind, drought, flood) • topography • plague locusts • external disease factors • water logging • salinity
Marketing	• demand/supply fluctuations • government regulation changes • media fickleness
Financial	• price fluctuations of inputs and outputs • international monetary markets
Production	• machinery breakdown • changes in technology • diseases • labour shortage

One mark, up to a maximum of four, was awarded for an example of each risk type that was relevant to the nominated business.

Overall students demonstrated little formal knowledge of risks related to agricultural and horticultural businesses. Students could use headings, such as those in this question, and the time frame of the risk, such as short term, seasonal, annual or long term, in their analysis of businesses to guide the development of management strategies.

Question 5bi–ii.

Marks	0	1	2	3	4	5	Average
%	27	26	24	14	6	2	**1.5**

5bi.

Examples of some basic quality standards that were accepted included:

- dairy – bulk cell count, solids non-fat/protein percentage/fat percentage
- cattle/prime lamb – appropriate weight, fat depth
- nursery – no weeds, no disease, size and flower stage
- cereal – protein content, clean, weed free, no cracked seed, moisture content.

One mark was awarded if the description provided adequate relevant information to show that the student understood what constitutes a quality standard. Two marks were given for answers that provided a detailed quality standard.

5bii.

Answers that provided some isolated and limited relevant information were awarded one mark. Student who listed a few activities that would go towards achieving the quality standard were given two marks. Three marks were awarded when the answer integrated activities into some form of detailed strategy.

Questions 5bi. and 5bii. were poorly answered. Most agricultural and horticultural industry bodies have quality standards for their products. Many of these include quality management at the production stage and not just attributes of the farm gate/end product. Students are expected to know strategies for managing a production system to appropriate quality standards, hence the need for them to research and fully understand quality standards for a business type. If these have not been specifically defined then students should use similar industry examples to develop suitable ones for their business type.

Question 5c.

Marks	0	1	2	Average
%	13	28	59	**1.5**

Students presented a large range of occupational health and safety risks. Popular examples included:

- lifting
- hygiene
- chemicals
- animals
- equipment, such as power-take-off on tractors
- scalding in the dairy
- sunburn.

One mark, up to a maximum of two, was given for each relevant risk listed.

Question 5d.

Marks	0	1	2	3	Average
%	16	48	33	4	**1.3**

Students needed to identify the extent of the risk and develop a strategy to include things such as:

- elimination
- substitution
- isolation
- adding safeguards
- using the safest way
- personal protection and clothing
- education and staff training
- labels/information.

One mark was awarded for a relevant isolated fact, two marks for information showing the student had a logical but limited approach to addressing occupational health and safety risks and three marks for explaining a range of activities involved in an appropriate strategy.

Question 5e.

Marks	0	1	Average
%	77	23	**0.3**

A cash flow record has a timeline associated with it.

Question 6a.

Marks	0	1	2	3	4	Average
%	19	41	28	8	3	**1.4**

Agricultural or horticultural land will more closely resemble a natural ecosystem if:

- indigenous trees, shrubs and grasses are planted to encourage a wide range of invertebrates and vertebrates, thus increasing biodiversity
- the export of matter/energy in the form of waste product from the property is minimised. Managers should attempt to approximate a closed system
- the use of pesticides and herbicides, vaccines and drenches are minimised so as to approximate a self-regulating and balanced environment.

For each strategy, one mark was given if a vague link to one of the three points was made, and two marks if the strategy provided **definite** knowledge of a characteristic of a natural ecosystem.

Question 6b.

Marks	0	1	2	3	4	5	6	Average
%	32	25	20	14	7	2	1	**1.5**

Below are some appropriate examples for this question.

- Increasing the number and type of plant and animal organisms will result in an increase in biodiversity. This will allow improved checks and balances on the property, resulting in reduced dependence on pesticides and herbicides. This benefits the environment by reducing the probable contamination and the development of resistance in pest organisms.
- A reduction in the use of pesticides and herbicides could result in an improved economic situation by reducing the need to purchase expensive chemicals, but may also result in lowered yields.
- Increased biodiversity will result in the reduced use of chemicals, resulting in the community not ingesting unwanted chemicals and possibly a reduction in allergies.
- Minimising the export of matter/energy in the form of waste product from the property will result in less dependence on inputs such as fertilisers, which can be costly.
- Recycling effluent back onto the property will minimise loss of organic matter and result in improved soil structure.

Marks were awarded according to the table below.

Sustainability aspects considered	No explanation	Limited explanation	Rational, clear explanation
1	1	3	4
2	2	4	6

Question 6 was very poorly answered. Students had a very limited understanding of the relationship between natural ecosystems and agricultural and horticultural ecosystems.

Question 7

Case study	% students responses
None chosen	2
Ornamental plant nursery	28
Grazing property	38
Intensive animal production	12
Broad-acre cropping	20

Question 7ai–iv.

Marks	0	1	2	3	4	5	6	Average
%	9	8	22	18	17	16	10	**3.2**

Question 7b.

Marks	0	1	2	3	4	5	Average
%	14	19	28	29	10	1	**2.0**

Question 7c.

Marks	0	1	2	3	4	Average
%	25	31	28	11	5	**1.4**

Question 7d.

Marks	0	1	2	3	4	5	6	Average
%	48	19	11	11	7	3	1	**1.2**

Question 7e.

Marks	0	1	2	3	4	Average
%	46	18	17	14	5	**1.2**

Case study 1 – Ornamental plant nursery

Questions 7ai. and 7aiii.

Appropriate issues included:

- salinity
- water quality/algal blooms
- waterlogging.

One mark was given for a correctly identified degradation issue. The response given for part iii. needed to be different from that for part i.

Questions 7aii. and 7aiv.

Example of evidence included:

- unhealthy plant appearance, consistent with high saline soil conditions
- white crystalline substance
- plants stunted and wilted
- unhealthy plants appearance, consistent with waterlogging – plants are unable to take up the water, low lying land.

One mark was given for identifying some but not all the evidence. Two marks were given for identifying all of the evidence from the case study. Answers needed to relate to the issue identified in the previous part.

Question 7b.

Waterlogging

- identify ways to improve drainage
- grow on raised beds
- do not grow plants there

Salinity

- fence off and do not grow plants there
- identify recharge sites and catchment issues
- plant trees in recharge sites
- reduce water flow to the area
- divert water away
- plant deep rooted plants

Algal blooms

- collect runoff to settling tanks/ponds/dam on the property
- reuse the water on the property

- develop plant density in the riparian zone around the dam/creek
- reduce runoff
- maintain better irrigation control through a different system; for example, drippers, different sprinklers, lower pressure

Marks were awarded according to the following table.

Degradation issues considered	No explanation of strategy	Limited explanation of strategy	Rational, clear explanation of strategy
1	1	2	3
2	2	3	4

The fifth mark was awarded for a fully integrated strategy, rather than considering the two issues separately.

Following is an example of a high-scoring student response.

To stop nutrient run-off into the dam irrigation should be better managed to reduce water run-off, use of fertilizers should be limited and riparian zones should be planted in the course of the water near the dam to filter impurities out before it reaches the dam. Zone should be planted with plants which have a high tolerance to large amounts of nutrients in the soil. To manage the salinity, affected area should be fenced off, irrigation managed better and kept to a minimum, trees and deep rooted perennials planted where production wont be affected but they'll have access to the water table (near recharge area) on upper slope of farm. Severity should be monitored and local expert advice sought after.

Question 7c.

Salinity

- Watertable level measurement: Measurements tell exactly where the watertable level is and allow it to be monitored for change. Over time, if the strategies have been successful, it should drop.
- Salt readings: Take EC readings and measure the concentration of salt in the soil. Again, this needs to be monitored and it should reduce if the strategies are successful.
- Monitor changes in vegetative cover and the type and extent of indicator plants; for example, yellow buttons.

Waterlogging

- Monitor the depth of the water table.
- Check the water holding capacity. The amount of water the soil can hold will influence irrigation frequency.
- Air filled porosity: The drainage capability of the soil affects the rate of irrigation and the soil's ability to handle higher rainfall before surface runoff occurs.
- Look for a decrease in the presence of indicator plants, for example sedges, and an increase in quality vegetative cover, type and extent.

Algal blooms

- Check nutrient levels in runoff, dams and creek.
- Monitor the frequency and severity of the algal blooms.

For each indicator one mark was given for naming the indicator but not describing it well and two marks if it was well described, up to a maximum of four marks.

Following is an example of a high-scoring student response.

Indicator 1: The occurrence of algal blooms, if it becomes less frequent, the management of the problem has worked.

Indicator 2: The health of plants in/around salt affected area, if improves management worked. Signs of wilting, stunting, and 'thirstiness' should be monitored.

Question 7d.

Appropriate steps for a whole property management plan included:

- get a large map/plan (aerial photo) of the property

- overlay the map/plan/photo with existing structures, services, access points, land classes, drainage lines, soil/surface types, existing plantings, weeds, salting, other problems, etc.
- confirm the business objectives as suitable for the property
- on a second overlay, indicate the proposed improvements and alterations
- on a third overlay, show the existing improvements (and add improvements as they are completed)
- separately document the priorities, a proposed timeline and a budget, including a cash flow statement, that is consistent with the business's objectives.

Marks were awarded according to the following table.

steps considered	mentioned	described
1	1	2
2	2	4
3	2	4
4	3	5
5	4	6

Question 7e.
7ei.
Excess irrigation flowing onto the neighbour's property.

One mark was given for a correctly identified issue.

7eii.
Catchment and Land Protection Act 1994

7eiii.
Water from their property would not be allowed to flow into their neighbour's dam.

One mark was given if the answer was missing some important information and two marks were given if all of the important information was included.

Case study 2 – Grazing property
Questions 7ai. and 7aiii.
Appropriate issues included:

- soil erosion/gully erosion/water erosion
- poor soil structure on lower slopes, compaction, waterlogging
- weed problem – gorse.

One mark was given for correctly identifying the issue. The response to part iii. needed to be different to that given for part i.

Questions 7aii. and 7aiv.
Examples of evidence were:

- poor vegetation in the gullies
- the presence of bare soil at the base of the gullies
- a large percentage of clay in the soil
- persistent wetness of soil, poor drainage, vehicles becoming bogged
- the presence of gorse.

One mark was given for identifying some but not all the evidence. Two marks were given for identifying all of the evidence from the case study. Responses needed to relate to the issue identified in the previous part.

Question 7b.
Soil erosion/gully erosion

- revegetate the higher slopes
- fence off the gullies to restrict cattle

- revegetate with fast growing vegetation that has extensive root growth

Poor soil structure/compaction
- fence the property according to land classes
- restrict cattle from grazing on affected pasture to prevent compaction and soil structure decline
- apply organic matter to the affected area
- apply gypsum to the affected area
- restrict vehicular use on wet areas to prevent compaction and soil structural decline

Gorse
- biological and spraying control
- burn it

Marks were awarded according to the following table.

Degradation issues considered	No explanation of strategy	Limited explanation of strategy	Rational, clear explanation of strategy
1	1	2	3
2	2	3	4

The fifth mark was awarded for a fully integrated strategy, rather than considering the two issues separately.

Following is an example of a high-scoring student response.

The land needs to be classed according to its potential to degrade and uses. The steeper areas need to be fenced off and replanted with trees to avoid any further erosion and provide ground coverage. These trees will use more water reducing the drainage problems and wet areas, also used deep rooted high water using and tolerant grass species. Construct diversion banks to slow and divert water away from problem areas. Biologically control the gorse and provide competitive pasture species. Control the grazing of stock to ensure vegetative cover. Reduce use of vehicles in wet areas and therefore compaction.

Question 7c.
Soil erosion/gully erosion
- Use aerial and/or satellite imagery to measure the extent of gully erosion over time.
- Place a marker/stick at the extremities of the eroded area and revisit to assess the extent of problem and whether it has increased or decreased.

Poor soil structure
- Measure the soil structure to determine the air porosity and organic matter content over time.
- Place a marker/stick at the extremities of the problem and revisit to assess the extent of the problem and whether it has increased or decreased.
- Use aerial and/or satellite imagery to measure the extent of the affected area over time.
- Survey plant species to determine plant composition. An increased percentage of desirable clovers/medics and grasses may indicate improved soil structure.

Gorse
- Conduct a visual appraisal.

For each indicator one mark was given for naming the indicator but not describing it well and two marks if it was well described, up to a maximum of four marks.

Following is an example of a high-scoring student response.

Indicator 1 Monitor the percentage of bear ground to vegetative cover ratio, a weed to desired species ration. This will give indication if weed control has been successful.

Indicator 2 Use Dry Sheep Equivalent (DSE) to measure the carrying capacity of before and after and to monitor for success. Can link this with income per hectare as there may be an increase in production from reduced stocking rates.

Question 7d.
Appropriate steps for a whole property management plan included:

- get a large map/plan (aerial photo) of the property
- overlay the map/plan/photo with existing structures, services, access points, land classes, drainage lines, soil/surface types, existing plantings, weeds, salting, other problems, etc.
- confirm the business objectives as suitable for the property
- on a second overlay, indicate the proposed improvements and alterations
- on a third overlay, show the existing improvements (and add improvements as they are completed)
- separately document the priorities, a proposed timeline and a budget, including a cash flow statement, that is consistent with the business's objectives.

Marks were awarded according to the following table.

steps considered	mentioned	described
1	1	2
2	2	4
3	2	4
4	3	5
5	4	6

Question 7e.
7ei.
The issue is the problem of seed dispersal from the weed called gorse.

One mark was given for a correctly identified issue.

7eii.
Catchment and Land Protection Act 1994

One mark was given for the correct regulation name.

7eiii.
Helga is required to manage the gorse so that it does not impact on neighbouring properties. It means that she has to actively implement an IPM plan to control the weed.

One mark was given if the answer was missing some important information and two marks were given if all important information was included.

Case study 3 – Intensive animal production
Questions 7ai. and 7aiii.
Appropriate issues included:

- soil loss/erosion on a slope from over grazing
- contaminated water from effluent
- water waste.

One mark was given for correctly identifying an issue. The response to part iii. needed to be different to that given for part i.

Questions 7aii. and 7aiv.
Examples of evidence were:

- bare patches on the slope
- muddy dam water
- nutrients leaching into the dam/creek
- frequency of algal blooms.

One mark was given for identifying some but not all of the evidence. Two marks were given for identifying all of the evidence from the case study. Responses needed to relate to the issue identified in the previous part.

Question 7b.
An integrated management strategy for the property could include:

- control grazing pressure through rotational grazing/cell grazing or swap paddocks (graze on the higher paddock)
- manage water runoff
- collect rainwater from sheds for the animals
- manage spray irrigation to avoid splash erosion
- maintain tighter irrigation controls to reduce runoff
- rationalise land use
- manage the riparian zone
- sell surplus effluent.

Marks were awarded according to the following table.

Degradation issues considered	No explanation of strategy	Limited explanation of strategy	Rational, clear explanation of strategy
1	1	2	3
2	2	3	4

The fifth mark was awarded for a fully integrated strategy, rather than considering the two issues separately.

Following is an example of a high-scoring student response.

An IMS for George is to learn about algae and water erosion so that he has some knowledge. Around the dam he could plant a riparian zone of shrubs, tree, grasses to filter runoff water and prevent growth of alga. Planting trees will also decrease the light in order for algae to grow. Adding gypsum to the dam will help to clear the turbid water. Fencing off the dam will prevent the pigs from getting in. For the water erosion he could plant shelter belts to decrease the wind speed. He could efficiently control his irrigation by watering in the mornings to prevent evaporation. Improve grazing efficiency to make sure that the paddocks are graised evenly by fencing off ungrazed areas and putting the pigs so they can graze that area.

Question 7c.
Indicators that could be used to measure success include:

- ground cover density
- silt in dam
- faecal content of water
- nutrient levels of water
- turbidity
- macro invertebrates in water.

For each indicator one mark was given for naming the indicator but not describing it well and two marks if it was well described, up to a maximum of four marks.

Following is an example of a high-scoring student response.

Indicator 1: The quality of the water – looking to see if the colour of the water improves and the area affected by the algae decreases by using a turbidity tube or sending a sample to a laboratory.

Indicator 2: The bare patches – looking and measuring to see if the bare patches increase or decrease in size and if the pasture regrows over the bare patches and doing a soil test to see if the pH and fertility increases.

Question 7d.
Appropriate steps for a whole property management plan included:

- get a large map/plan (aerial photo) of the property
- overlay the map/plan/photo with existing structures, services, access points, land classes, drainage lines, soil/surface types, existing plantings, weeds, salting, other problems, etc.
- confirm the business objectives as suitable for the property
- on a second overlay, indicate the proposed improvements and alterations

- on a third overlay, show the existing improvements (and add improvements as they are completed)
- separately document the priorities, a proposed timeline and a budget, including a cash flow statement, that is consistent with the business's objectives.

Marks were awarded according to the following table.

steps considered	mentioned	described
1	1	2
2	2	4
3	2	4
4	3	5
5	4	6

Question 7e.
7ei.
Contaminated runoff onto adjacent land.

One mark was given for a correctly identified issue.

7eii.
Catchment and Land Protection Act 1994

One mark was given for the correct regulation name.

7eiii.
George is required to manage the runoff so that it does not impact on neighbouring properties. It means that he has to actively implement a water reuse strategy.

One mark was given if the answer was missing some important information and two marks were given if all of the important information was included.

Case study 4 – Broad-acre cropping
Questions 7ai. and 7aiii.
Appropriate issues included:

- soil acidification
- nutrient contamination of neighbouring wetlands
- soil structure decline.

One mark was given for correctly identifying the issue. The response to part iii. needed to be different to that given for part i.

Question 7aii. and 7aiv.
Examples of evidence were:

- low pH
- poor wheat yields
- soil colour indicating low organic matter
- build up of soil along the fence line
- no response to high fertiliser application
- algal blooms in neighbouring wetlands.

One mark was given for identifying some but not all of the evidence. Two marks were given for identifying all of the evidence from the case study. Responses needed to relate to the issue identified in the previous part.

Question 7b.
An integrated management strategy for the property could include:

- change cropping practices to a minimal tillage approach
- analyse soil so that fertiliser is applied in an accurate/timely way

- apply lime to reduce the pH
- monitor the pH and add further amounts of lime until the pH is acceptable
- reduce stubble burning
- monitor the quality and quantity of runoff.

Marks were awarded according to the following table.

Degradation issues considered	No explanation of strategy	Limited explanation of strategy	Rational, clear explanation of strategy
1	1	2	3
2	2	3	4

The fifth mark was awarded for a fully integrated strategy, rather than considering the two issues separately.

Following is an example of a high-scoring student response.

- *No stubble burning! This reduces organic matter/nutrients and minerals returning to the soil for the next seasons crop to use. Stubble could be rolled or slashed instead.*
- *Do a soil test. Most likely short of phosphorous as all Australian soils are. Applying wrong fertilizer perhaps? Probably need to apply trace elements to reinvigorate tired soils.*
- *Reduce cultivation. Kill weeds with chemicals instead and use crop rotations to out compete particular weeds*
- *Stubble retention will also help stop soil blowing away or running into streams which are going into the already sick wetland.*
- *Less fertilizer. Plenty of nitrogen already as acidity is high and algal blooms apparent.*

Question 7c.

- pH of soil: Measure how basic or acidic the soil is, as this will influence the availability of soluble nutrients.
- Determine the nature and amount of organic matter in the soil.
- Soil fertility: Test the nutrients in the soil that are able to be absorbed by plants.
- Water quality: Test acidity and nutrients in the wetlands and runoff areas.

For each indicator one mark was given for naming the indicator but not describing it well and two marks if it was well described, up to a maximum of four marks.

Following is an example of a high-scoring student response.

Indicator 1 Soil test biannually.

- *See if soil inputs are working/right.*
- *Check for up coming problems/issues.*
- *Acidity – change?*

Indicator 2 Water test.

- *Level of erosion increasing or decreasing (turbidity)*
- *Acidity*
- *Nutrient levels – runoff from farm changes*

Question 7d.

Appropriate steps for a whole property management plan included:

- get a large map/plan (aerial photo) of the property
- overlay the map/plan/photo with existing structures, services, access points, land classes, drainage lines, soil/surface types, existing plantings, weeds, salting, other problems, etc.
- confirm the business objectives as suitable for the property
- on a second overlay, indicate the proposed improvements and alterations
- on a third overlay, show the existing improvements (and add improvements as they are completed)
- separately document the priorities, a proposed timeline and a budget, including a cash flow statement, that is consistent with the business's objectives.

Marks were awarded according to the following table:

steps considered	mentioned	described
1	1	2
2	2	4
3	2	4
4	3	5
5	4	6

Question 7e.
7ei.
Contaminated runoff onto adjacent land.

One mark was given for a correctly identified issue.

7eii.
Catchment and land Protection Act 1994

One mark was given for the correct regulation name.

7eiii.
Nutrient runoff occurring in a neighbouring wetland is an issue covered by the legislation.

One mark was given if the answer was missing some important information and two marks were given if all important information was included.