Institute for Apprenticeships & Technical Education

Agriculture, Environmental and Animal Care: Agriculture, land management and production

T Level outline content: draft version

June 2020

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Introduction

Outline content

This outline content has been produced by T Level panels of employers, professional bodies and providers, and is based on the same standards as those used for apprenticeships. The outline content will form the basis of the specifications for T Level Technical Qualifications, which will be developed by awarding organisations for approval by the Institute for Apprenticeships and Technical Education. One awarding organisation will be appointed to develop and deliver each Technical Qualification following a procurement process.

Colleges and other education and training providers will decide how to structure the T Level courses they offer, based on the qualification specifications. This will enable them to deliver the study programme's mandatory components in the most effective way for students.

A T Level programme consists of a Technical Qualification, substantial industry placement, English and maths, and other occupation-specific requirements where essential for entry to skilled employment. This outline content relates solely to the Technical Qualification part of a T Level programme.

Further information about T Levels is available on the website of the Institute for Apprenticeships and Technical Education here: www.instituteforapprenticeships.org, and at www.education.gov.uk.

Agriculture, Environmental and Animal Care: Agriculture, land management and production pathway

Awarding organisations will need to ensure that students have an up-to-date knowledge of the legal and regulatory obligations relating to employment in the occupations relevant to the T Level and understand the practical implication of these on their work.

Maths, English and digital skills are set out in a separate annex. Awarding organisations should integrate these within the qualification so that they are applied in occupationally relevant contexts.

Core content

The core content relates to the whole route 'route core'. The core knowledge and understanding is assessed through an examination and core skills through a practical employer-set project.

The core knowledge and understanding focuses on the students' knowledge and understanding of contexts, concepts, theories and principles relevant to the T Level. This could include, where appropriate, assessment of knowledge and understanding relevant to the route and the pathway.

The employer-set project provides the opportunity to develop and apply a minimum range of core skills important for employability. The allocation of content to each type of assessment will need to be approved by the Institute for Apprenticeships and Technical Education.

Core knowledge and understanding across Agriculture, Environmental and Animal Care Route

Element	Content
Sustainability	Key requirements of environmental legislation • associated obligations for businesses, their employees and other stakeholders. Key government environmental policies and initiatives • the opportunities and risks they bring to agriculture, environmental and animal care sector • the associated environmental performance measure e.g. water and energy use. The concept of sustainable development • sustainable development goals at a macro (national and international) and micro (business) level • types of sustainable solutions to meet development goals including social, environmental, economic and human • concerns and expectations of key stakeholders. The concept of climate change and scientific views on causes and impacts • the impact of increased rainfall and higher temperatures upon environments, conservation practices, habitats, flora, fauna and water levels • policies and initiatives to manage these changes at national and local level. Waste management principles (e.g. recycle, reduce, reuse) • key requirements of associated legislation • types of materials that require specific actions (e.g. asbestos) • measures in place by the sector and organisation to meet requirements.

Biosecurity	Principles of biosecurity • factors influencing biosecurity e.g. international trade, new technologies • biosecurity risk factors in different types of agriculture, environmental and animal care situations • biosecurity measures including inspection, monitoring, regulation, passports, isolation and their importance in maintaining health production and service environments.
Working in the agriculture, environmental and animal care sector	Employment rights and responsibilities (e.g. union membership, working hours) of the employer and employee • expectations of professional conduct and behaviours in the workplace (including punctuality, cleanliness, respect for own and others work and work area, respect for the land, property and belongings of others (including animals) • typical activities that can lead to disciplinary and grievance procedures • how these expectations are met and demonstrated by employees. Principles of effective teamwork • how teams are developed, including the role of the team leader • team dynamics and how they are managed, and behaviours influenced • qualities of effective team members and team leaders and how these qualities are demonstrated • the importance of team work to team and project performance • techniques used to monitor and manage individual and team performance e.g. goal and objective setting, performance management reviews, providing constructive feedback • techniques used to manage team conflict (e.g. mediation) and when and how they should be applied.

Working in the agriculture, environmental and animal care sector (continued)	Progression opportunities which exist within the agriculture, environmental and animal care sector • the purpose of continuing professional development (CPD) and the benefits it brings to the individual and their employer • methods of personal and professional development (e.g. coaching, independent research) and the types of organisations that can provide this type of support, including professional bodies. • their suitability for achieving planned outcomes.
Ethics	Ethical principles (e.g. honesty, transparency, justice) • how these are used in codes of conduct, employment terms and conditions and workplace policies • how these are represented by ethical behaviours • how these are incorporated into business ethics • how these impact on business operations, including interaction with stakeholders and the supply chain.
Supply Chain	The supply chain • different types of organisations involved and their role • different ways in which the supply chain is sequenced and operates • implications of failing to meet supply chain demands • environmental impact of the supply chain including whole life cycle of a product • types of procurement (e.g. competitive bidding, direct purchase) and their suitability for different situations. Principles of stock management (including stock rotation, storage, conditions, monitoring stock levels, ordering stock, dealing with deliveries, maintaining records) • how they are applied in different types of business • implications to businesses of ineffective processes.

Business	The types of business organisations e.g. sole trader, partnership, limited company, not for profit • common business structures and hierarchies • the financial, legal and commercial implications of type of business • typical organisational policies and their relationship to legislation • types of business objectives and values associated with different business structures. The principles of enterprise skills e.g. risk taking, innovation, resilience • how they are applied to develop business growth and change including sales opportunities and diversification of the business • types of business risk (e.g. financial, reputational) and risk management methods that can be deployed. How businesses measure success (including Key Performance Indicators (KPIs), Service Level Agreements (SLAs), benchmarking, supply chain requirements) • the information used to determine if success measures are met • quality standards, quality control and quality assurance ○ their purpose, differences and application to organisations quality standards expected by internal and external stakeholders and associated quality assurance requirements e.g. audits. The principles of project management (including purpose and scope of the project, milestones and timescales, supply chain, people management, resources, budgeting).
Equality	Factors to consider (including equality legislation, cultural differences, religious needs) when working with people from diverse backgrounds and cultures • how to show empathy and respect to those from different backgrounds and cultures to our own • acceptable and unacceptable behaviours and language. Characteristics protected by equality legislation.

Communication	Different types of communication (including verbal, non-verbal and digital) • the formats used for the types of communication (e.g. business reports, emails, letters, websites) and associated business conventions • the types and value of images and visual aids to support written text and oral presentations • their suitability for different purposes and audiences • the importance of spoken language, body language and tone in communication and how each is used to convey different messages to different audiences for different purposes • the benefits and limitations of social media including risk of misuse, promoting the business.
Relationship Management	Principles of customer care (including first impressions, representing business and self, supporting customers, the difference between customer wants and needs, the importance of accurate knowledge, working to an expected timescale) • how these can be applied when dealing with different stakeholders, including internal customers • legal requirements (including legislation relating to consumer protection) when interacting with different types of customers and customer relationships including business to business (B2B) • typical procedures used to deal with customer disputes and complaints, including escalation to relevant individuals and departments • how to apply customer service principles and the benefits to the individual (e.g. increased motivation, positive feedback) and business (e.g. customer loyalty, customer confidence). Roles of different stakeholders including internal and external customers • their expectations • interrelationships between stakeholders.

Finance	The concept of profit • types of profit (including net and gross) and significance of each to business success • types of cost incurred by business (products, ancillary products, types of overheads, labour), their classifications (direct, indirect, fixed, variable) • measures used to reduce costs and implications of using these to profitability, reputation and quality • types of taxation (including payroll, business) • how costs and revenue are forecast • how profit is calculated.
Health and Safety	Key requirements of health and safety legislation e.g. for lone working, safe manual handling • the respective duties imposed on employees and employers • the importance of taking personal responsibility for health and safety of self and others • the techniques and methods used to comply with legislation e.g. use of Personal Protective Equipment (PPE), regular communication with lone workers. The purpose of risk assessments • typical structures and content • how they are developed and used • implications for poor development and application. Hazards and risks associated with working in the agriculture, environmental and animal care sector (e.g. working with hazardous materials, lone working) • typical control measures in place to minimise risks, including the types of PPE used, fatigue and stress management for lone workers. Procedures to follow when dealing with emergency situations e.g. spilt cleaning materials, slurry exposure, flooding.

Information and data	Key requirements of legislation relating to the security of information and data • types of information and data protected by legislation including client data, intellectual property • methods used by businesses to manage information and data including version control, access controls, indexing, cyber security.

Employer-set project

The employer-set project ensures students have the opportunity to combine core knowledge and skills to develop a substantial piece of work in response to an employer-set brief. The employer-set project forms part of the Technical Qualification and is a separate part of the T Level programme to the Industry Placement.

To ensure consistency in project scope and demand, awarding organisations will develop assessment objectives, which require students to:

- plan their approach to meeting the brief
- apply core knowledge and skills as appropriate
- select relevant techniques and resources to meet the brief
- use maths, English and digital skills as appropriate
- realise a project outcome and review how well the outcome meets the brief

The awarding organisation will work with a relevant employer or employers, to devise a set brief that:

- ensures a motivating starting point for students' projects, for example, a real-world problem to solve
- ensures students can generate evidence that covers the assessment objectives
- is manageable for providers to deliver
- is officially approved by the awarding organisation and employer

For Agriculture land management production, in achieving the assessment objectives and meeting the brief, students must demonstrate the following core skills:

- **Analysing**
    - e.g. identifying common features of data obtained on options to improve a business' environmental impact, classifying and organising data into types, discerning patterns.
- **Communicating**
    - e.g. using visual and oral methods to engage an audience with proposals for improving representation and diversity in the sector.
- **Critical thinking**
    - e.g. questioning information and data, evaluating pros and cons of the introduction of new machinery or plant into a business, taking out of the whole life cycle.

- **Decision making**
    - e.g. identifying likely impact of skills scarcity in the business and using evidence to substantiate conclusions.
- **Investigating**
    - e.g. developing search criteria/queries for secondary research and designing and carrying out tests for primary research into the environmental impact of a business.
- **Working in a team**
    - e.g. developing and implementing a communication plan for the introduction of a new lone working policy.

Occupational Specialist Content

Specialist content is structured into different occupational specialisms, which correspond to the apprenticeship standards listed on the relevant occupational map. Occupational specialisms ensure students develop the knowledge and skills necessary to achieve a level of competence needed to enter employment in the occupational specialism, and are organised around 'performance outcomes' that indicate what the student will be able to do, as a result of learning and applying the specified knowledge and skills.

There are some content areas that are included in both the Core and Occupational Specialism sections, this is intentional. Where in Core, it is because it is content that is applicable to all Agriculture, Environmental and Animal Care students, regardless of the occupational specialism. If the same content is also in the Occupational Specialism, it is because the knowledge and skills need to be developed within the context of the Performance Outcome. In the occupational specialism, it is therefore likely to require different content to reflect the Performance Outcome.

Occupational Specialist Content

Occupational Specialism: Crop production

Performance Outcome 1: Establish crops in field and container-based systems for optimum yield and quality

Students must demonstrate skills by establishing two different crops: one in field-based and one in container-based systems. Crops should cover 20 square metres for container-based systems and 50 metres by 10 metres for field-based systems.

Knowledge Specific to Performance Outcome	Skills
Health and safety Key requirements of health and safety legislation and the respective duties imposed on employees and employers including those relating to the safety of visitors. How employers ensure employees are aware of health and safety requirements. Key requirements of health and safety codes of practice and how they are applied when establishing crops. Contingency and emergency plans required for health and safety related incidents when establishing crops in different systems e.g. diesel spillages, electric shock. Principles of safe manual handling and their application when establishing crops. Purpose use and content of risk assessments. Typical hazards involved when establishing crops including lone working and controls in place to mitigate for these. **Environment**	***Skills applicable to both systems:*** Test condition of growing media e.g. soil texture, pH, electrical conductivity of substrate. Assess quality of planting materials e.g. seeds, plants. Set up equipment for the task e.g. calibrate. Capture environmental data e.g. temperature, climate. Interpret data. Estimate time required to scale up operations. Assess the suitability of machinery and equipment e.g. no health and safety hazards, clean. Set up equipment and machinery e.g. clean, apply grease. Manually lift and move materials, equipment or machinery. Apply aftercare to planted or transplanted crops. ***Skills applicable to field-based systems:*** Dig soil profile pit.

Key requirements of environmental legislations (including LERAPs) and implications for establishing crops. Potential positive (e.g. increasing biodiversity) and negative (e.g. soil erosion or refuse disposal) environmental effects of crop establishment decisions. The origins of different types of growing media and the potential impacts on the environment of their extraction, movement and use. The principles of soil, water, energy and pollution codes of practice and the implications of these for establishing crops. Typical malpractices (unethical, inefficient, illegal) when establishing crops and their potential negative effect on the environment. Typical and atypical pests, weeds and diseases associated with different crops that can occur in an environment, • their characteristics, symptoms and causes • techniques used to quantify their presence • pathological implications to the crops • potential impact on crop establishment, optimising yield, quality and the environment • how they are controlled including physical, chemical, cultural and biological methods. How hygiene practices are used to ensure biosecurity when establishing crops.	Operate a tractor in a straight line and to turn 180°. Spray chemicals to safely enable even coverage over a given space. Spread fertiliser to safely enable even coverage over a given space. Align crop to irrigation. Attach an implement to a tractor including electrical and hydraulic connections e.g. by three-point linkage, by pick-up hitch. Cultivate soil. Calibrate planting machinery for accurate spacing of planting material. Operate planting machinery specific to crop type. Measure with precision crop post-planting e.g. depth, soil contact. Calculate planting density. Monitor machine performance. Assess quality of planting operation undertaken by others. Provide constructive feedback to others orally. ***Skills applicable to container-based systems:*** Propagate plants by seed in pots • fill containers • firm growing media in containers • sow seeds • cover seeds Transplant seedlings.

The conditions and environments required for plant propagation • types of facilities including polytunnels, glasshouses and coldframes, outdoors, their characteristics, benefits and limitations for different purposes • conditions required for plant propagation (including light, sterility, humidity, irrigation, heat, ventilation) • techniques and equipment used to monitor and adapt conditions to support establishment in protected environments. **Information and data** Types of financial (e.g. yield per acre, direct and indirect costs) and crop production records (e.g. time, what was applied, what were the conditions) produced and how they are managed in the workplace. Key requirements of legislation relating to information and data. Types of data required to support crop establishment decisions (e.g. soil types, weather conditions) • how this is collected and measured • equipment required and how equipment it is operated • how data is recorded, presented and interpreted • how data is used to inform decision-making. **Machinery, equipment and technology**	Mix nutrients to recipe. Apply nutrients. Set environmental conditions. Irrigate crops.

Key requirements of legislation relating to the safe and effective use of crop establishment machinery and equipment. The operating principles of crop establishment machinery and equipment (e.g. shears, tractors, drones) and how they are operated safely and efficiently. Capabilities and limitations of crop establishment machinery and equipment and factors (including financial, efficiency, environmental) affecting their suitability in different situations and environments. How to maintain crop establishment machinery and equipment including cleaning, service intervals and storage. How to prepare and calibrate crop establishment machinery and equipment for use and implications of poor preparation for optimising crop yield and quality. How to use manufacturer's specifications, machinery handbooks and user's manuals to inform efficient operation and servicing of machinery and equipment. Common faults in crop establishment machinery and equipment • symptoms and typical causes • how their occurrence is minimised • how issues can be rectified. Developments in technology to support crop establishment (e.g. genetic engineering, GPS/satellite imagery) and how they can be used to establish crops and optimise their yield and quality. The relationship between machinery and soil structure and potential damage and	

benefits it can bring to crop establishment. **Crop science** Different types of crops (including cereals, grassland and forage, vegetables, fruits and nuts, ornamentals, industrial) their lifecycles, planting specifications and optimum conditions for establishment. Principles of crop rotation and the suitability of different approaches to meet specific objectives. Principles of plant growth and development for different types of crops including plant structures and their function. Types of planting material (including) seeds, seedlings, bulbs, tubers, saplings • quality characteristics required for planting and transplanting to support healthy growth (e.g. pest and disease free, root condition, certification). Growing media (including soil), their characteristics and how they can affect crop establishment for high yield and quality in different environments. Preparation techniques for the growing area (e.g. ploughing, levelling, applying nutrients, adapting soil structure) and how they are applied. Nutrients and hormones required by different types of crops • how they support crop establishment • how deficiencies are recognised in different forms of crop and	

implications of these to yield and quality • their sources (organic and inorganic). Propagation by seed • the suitability of seed propagation for a range of crops • timings of propagation by seed including seasons and germination times • seed treatments (e.g. stratification, scarification), their purpose, their suitability for different seeds, their application • techniques for sowing seeds (including small, medium and large seed) in containers and their application • aftercare requirements for sown seeds for different types of seeds (including mist benches, irrigation) to support germination and their application. Propagation by vegetative means • techniques for different vegetative propagation methods (including cuttings, ground layering, grafting, division) • the suitability of the types of vegetative propagation for a range of crops • timings of propagation by vegetative means including appropriate time of year and rooting periods	

• types of propagation material and factors that influence the selection including maturity and provenance • aftercare requirements of vegetative propagation (e.g. fogging units, heat application). Different forms of crop that can be used for crop establishment (including bulb, seed, seedling, small plant, tree, vine, root) • techniques used to plant and transplant these forms in different growing media • suitability of form and techniques for crop and growing area • how the techniques and forms impact on yield and quality. Methods of crop irrigation and their suitability for different growing media and environments and their effect on crop establishment. Types of aftercare used to support crop establishment after planting and transplanting (e.g. temperature manipulation, irrigation, formative pruning) in different growing media and environments • how they encourage independence in the landscape, growth and development • their implications for management, yield and quality • factors affecting their application (e.g. aspect, crop type) • how they are applied in after planting and transplanting.	

How environmental controls (e.g. temperature, humidity) are applied in establishing crops and implications for optimising yield and quality. Time allocation for the range of activities required to establish crops e.g. soil preparation, planting. **Business** The importance of yield and quality to a commercial business and how they are forecast and measured. Costs associated with crop establishment e.g. fixed, variable • how they are minimised to support profitable outcomes • typical profit margins • how profit is calculated. The crop production supply chain • different types of organisations involved and their role • different ways the supply chain operates for different types of crop production • types of contracts provided • associated quality standards • quality assurance requirements e.g. audits. How crop production organisations can diversify the types of crops produced and techniques, systems and media used within the space available.	

Performance Outcome 2: Manage crops in field and container-based systems to optimise yield and quality

Students must demonstrate skills by managing two different crops: one in field based and one in container-based systems. Skills can be assessed in relation to different growth stages.

Knowledge Specific to Performance Outcome	**Skills**
Health and safety Key requirements of health and safety codes of practice and how they are applied when managing crops. Contingency and emergency plans required for health and safety related incidents when managing crops in different systems e.g. toxic or harmful spillages, accident and injuries for individuals, fire. Principles of safe manual handling and their application when managing crops. Typical hazards involved when managing crops including crop spraying and controls in place to mitigate for these. **Environment** Key requirements of environmental legislations (including LERAPs) and implications for managing crops. Potential positive and negative environmental effects of actions undertaken to manage crops e.g. nutrient application, use of slug pellets. The principles of soil, water, energy and pollution codes of practice and the implications of these for managing crops. Typical malpractices (unethical, inefficient, illegal) when managing crops and their potential negative effect on the environment.	***Skills applicable to both systems:*** Measure emergence of crop. Determine crop progress e.g. growth stage. Calculate the establishment percentage. Measure root establishment. Monitor crop growth through a crop walk. Identify pests, diseases and/ or weeds. Quantify pests, diseases and/ or weeds. Apply cultural controls of pests e.g. predators. Apply cultural controls of weeds e.g. hand weeding. Identify atypical growth symptoms e.g. plant colour. Measure growing media moisture content. Determine irrigation requirement. Operate irrigation equipment. Engage in discussions with technical experts. Use questioning techniques to obtain and clarify information. Assess crops for potential adverse effects on yield. Forecast surplus/deficit yield against targets.

Typical and atypical pests, weeds and diseases associated with different crops that can occur in an environment • their characteristics, symptoms and causes • pathological implications to the crops • potential impact on crop management, optimising yield, quality and the environment • how they are controlled including physical, chemical, cultural and biological methods. How environmental controls (e.g. temperature, humidity) are applied in managing crops and implications for optimising yield and quality. How hygiene practices are used to ensure biosecurity when managing crops. **Information and data** Types of financial (e.g. cost of heating, cost of nutrients) and crop production records (e.g. updated yield projections, quality issues) produced and how they are managed in the workplace. Types of data required to support crop management decisions (e.g. soil types, weather conditions) • how this is collected and measured • equipment required and how equipment it is operated • how data is recorded, presented and interpreted • how data is used to inform decisions. How to maintain information and data digitally including the use of spreadsheet software and related applications.	Process data to support decision making. Assess suitability of information and data provided. Represent information and data using mathematical diagrams. Calculate crop/fruit balance. ***Skills applicable to field-based systems:*** Operate machinery to apply organic nutrients. ***Skills applicable to container-based systems:*** Measure irrigation runoff. Maintain crops e.g. training, disbudding, deleafing. Analyse and interpret environmental data to inform plant management decisions.

Machinery, equipment and technology Key requirements of legislation relating to the safe and effective use of crop management machinery and equipment. The operating principles of crop management machinery and equipment (e.g. sprayers, fertiliser applicators, hydraulic lifts, irrigation systems) and how they are operated safely and efficiently. Capabilities and limitations of crop management machinery and equipment and factors (including financial, efficiency, environmental) affecting their suitability in different situations and environments. How to maintain crop management machinery and equipment for use and implications of poor preparation for optimising crop yield and quality. How to prepare and calibrate crop management machinery and equipment for use and implications of poor preparation for optimising yield and quality. How to use manufacturer's specifications, machinery handbooks and user's manuals to inform efficient operation and servicing of machinery and equipment. Common faults in crop management machinery and equipment e.g. leaks, lack of oil • symptoms and typical causes • how their occurrence is minimised • how issues can be rectified. Developments in technology to support crop management (e.g. genetic engineering, GPS/satellite imagery) and how they can be used to manage crops and optimise their yield and quality.	

The relationship between machinery and soil structure and potential damage and benefits it can bring to yield and quality. **Crop science** Different types of crops (including cereals, grassland and forage, vegetables, fruits and nuts, ornamentals, industrial) their lifecycles, growing specifications and optimum conditions for growth. Principles of plant growth and development for different types of crops including plant structures and their function. Quality characteristics of healthy plants (including vigour, form, balance, root condition, soil condition, turgidity) • methods used to identify the characteristics (e.g. observation, records) • how quality affects management decisions. Growing media (including soil), their characteristics and how they can affect yield and quality in different environments. Nutrients, hormones and plant growth regulators required by different types of crops • how they support growth and development • how deficiencies are recognised in crops and implications of these to yield and quality • their sources (organic and inorganic). Practices used to manipulate crop growth and how they are applied to optimise yield and quality e.g. light manipulation, application of fertiliser.	

Methods of crop irrigation (e.g. sprinklers, rain guns) their suitability for different growing media and environments and their effect on yield and quality. Relationship between environmental conditions (including weather), plant protection methods and crop growth. Time allocation for the range of activities required to manage crops e.g. crop walking, nutrient application. **Business** The importance of yield and quality to a commercial business and how they are forecast and measured during the growth phase. Costs associated with crop management e.g. labour, materials and how they are minimised to support profitable outcomes. The crop production supply chain • different types of organisations involved and their role • different ways the supply chain operates for different types of crop production • types of contracts provided • associated quality standards • quality assurance requirements e.g. audits. Industry quality standards and assurances • implications to commercial businesses • audit processes involved in confirming compliance with requirements.	

Performance Outcome 3: Harvest crops for commercial markets

Knowledge Specific to Performance Outcome	Skills
Health and safety Key requirements of health and safety codes of practice and how they are applied when harvesting crops. Contingency and emergency plans required for health and safety related incidents e.g. injury from machinery and equipment, injury from transport. Principles of safe manual handling and their application when harvesting crops. Typical hazards involved in harvesting crops sharp cutting implements, heavy machinery and equipment and controls in place to mitigate for these. **Environment** Key requirements of environmental legislations and implications for harvest. Potential positive (increasing biodiversity) and negative (e.g. soil on the roads, run off) environmental effects resulting from harvesting. The principles of soil, water, energy and pollution codes of practice and the implications of these for harvesting crops. Typical malpractices (unethical, inefficient, illegal) when harvesting crops and their potential negative effect on the environment. Typical and atypical pests, weeds and diseases associated with different crops that can occur in an environment • their characteristics, symptoms and causes • pathological implications to the crops	***Skills applicable to both systems:*** Assess a sample of crop for yield and quality. Input, process, manipulate and interrogate data digitally. Apply physical dexterity using precise and controlled movements. Forecast crop yield. Prepare machinery for harvest. Operate harvest machinery e.g. tipping trailers, hydraulic lifts. Update harvesting records e.g. crop yield, crop quality. Clean storage buildings and facilities. Disinfect crop storage facilities. Assess a sample of harvested crops for quality. Apply the use of hand-held equipment (e.g. brush, hose) to tasks. Cost the harvesting of a crop. Identify steps involved in completing a complex task. Sequence and prioritise steps. Allocate resources (including people, equipment, materials and time) to steps. Manage own time to meet objectives. ***Skills applicable to field-based systems*** Assess the suitability of conditions for harvest.

• potential impact on crop harvesting, optimising yield, quality and the environment • how they are controlled including physical, chemical, cultural and biological methods. How hygiene practices are used to ensure biosecurity when harvesting crops. Different types of storage facilities e.g. boxed refrigerated, bulk grain store • their suitability for different types of crops and storage periods • contractual requirements • how effective storage is monitored. How different types of crops should be handled when harvested including different types of packaging (e.g. crates, pallets) and their suitability in relation to storage and transportation. **Information and data** Types of financial (e.g. yield per acre, loss from damage) and harvest records (e.g. quality standards) produced and how they are managed in the workplace. Types of data required to support crop harvesting decisions (e.g. fruit measurement, growth stage) • how this is collected and measured • equipment required and how equipment it is operated • how data is recorded, presented and interpreted • how data is used to inform decision-making.	***Skills applicable to container-based systems:*** Assess the suitability of a crop for harvest.

How to maintain information and data digitally including the use of spreadsheet software and related applications. **Machinery and equipment and technology** Key requirements of legislation relating to the safe and effective use of crop harvesting machinery and equipment. The operating principles of crop harvesting machinery and equipment (e.g. combine harvesters, knife) and how they are operated safely and efficiently. Capabilities and limitations of harvesting machinery and equipment and factors (financial, efficiency, environmental) affecting their suitability in different situations and environments. How to prepare and calibrate crop harvesting machinery and equipment for use and implications of poor preparation for optimising crop yield and quality. How to use manufacturer's specifications, machinery handbooks and user's manuals to inform efficient operation and servicing of machinery and equipment. Common faults in crop harvesting machinery and equipment • symptoms and typical causes • how their occurrence is minimised • how issues can be rectified. Developments in technology to support crop harvesting (e.g. yield mapping, autonomous vehicles) and how they can be used to support efficient and effective crop harvesting.	

The relationship between machinery and soil structure and potential damage and benefits it can bring to crop harvesting. **Crop science** Different types of crops (including cereals, grassland and forage, vegetables, fruits and nuts, ornamentals, industrial) their lifecycles, quality standards for harvesting and implications of harvesting on following crops. Growing media (including soil) and how they affect efficient harvesting. How environmental controls (e.g. temperature, humidity) are applied in harvesting, storing, packaging and transporting crops and implications for optimising yield and quality. How much time to allow for each activity involved when harvesting crops including harvesting, packaging, storage. **Business** The importance of yield and quality to a commercial business and how they are forecast and measured. Costs associated with crop harvesting and how they are minimised to support profitable outcomes. How to calculate cost of crop harvesting. The crop production supply chain • different types of organisations involved and their role • different ways the supply chain operates for different types of crop production • types of contracts provided • associated quality standards	

• quality assurance requirements e.g. audits.	

Performance Outcome 4: Maintain the areas surrounding the crop production environment

Skills can be demonstrated in relation to areas surrounding field-based or container-based crop production environments.

Knowledge Specific to Performance Outcome	Skills
Health and safety Contingency and emergency plans required for health and safety related incidents e.g. fumes in confined spaced, drowning in lakes. Principles of safe manual handling and their application when managing the non-production environment. Risks associated with utilities in non-productive areas e.g. electrical overhead wires, septic tanks, contaminated water storage and appropriate control measures. **Environment** Key requirements of environmental legislations (including LERAPs) and implications for non-production activities. Potential positive and negative environmental effects of non-production activities e.g. habitat creation, path erosion from additional visitors. Typical malpractices (unethical, inefficient, illegal) when undertaking non-production activities and the potential implications to the business and the production environment. Key requirements of waste legislation, regulations and codes of practice and how they are applied. **Business**	Clean the environment external environment e.g. power washing. Apply biosecurity PPE. Apply biosecurity measures when maintaining the area e.g. ensuring cleanliness of self when moving from one location to another. Assess a situation for potential adverse risks. Summarise information and ideas into standard forms and templates. Audit records e.g. against farm assurance quality criteria. Prepare surfaces for coating. Coat surfaces. Fix ironmongery to timber-based products. Cut timber-based products e.g. measure and saw lengths of wood. Join timber-based products e.g. nail two pieces of wood to repair a fence. Repair broken glass. Use hand and power tools, equipment and machinery to complete estate maintenance. Prune shrubs or trees. Cut back hedgerows. Create texts (e.g. notices, promotional material) for external stakeholders.

Costs of maintenance of non-productive areas and implications for profitability and business success. The relationship between costs, revenue and profit to a business • the different types of costs involved including taxation • how to price a product or service • how to maintain revenue records • how to conduct a cost/benefit analysis • how to calculate profits. Performance targets and how they are developed and applied in different situations. Principles and the application of stock management systems (including stock-rotation, storage conditions, monitoring stock levels, maintaining records) • how they are applied to harvesting of crops • the implications of failing to apply these principles when harvesting crops. Principles of customer service and how they are applied to customers and visitors to the business. The positive and negative perceptions people may have of the business and how to promote the positive aspects e.g. through social media, open days. The concepts of the actual and potential market including competition, how markets are targeted and methods of promotion that could be used by crop production businesses.	Use digital tools to communicate with others. Convey technical information to non-technical audiences. Maintain access routes e.g. clear debris, level aggregates. Repair masonry e.g. brickwork. Cut plastic pipework. Join plastic pipework. Clear drains with a pressure washer. Maintain ditches e.g. dig out existing materials. Maintain ponds e.g. trimming grass. Maintain field boundaries e.g. hedge, fence, field margin. Classify waste and allocate to storage. Audit stock e.g. seed / chemicals / fuels / nutrients / waste.

Opportunities for use of non-productive environments for financial benefit e.g. stewardship. **Estate management** Standards for maintenance of non-productive areas set by different standards setting bodies e.g. Red Tractor and implications for non-compliance. Types of boundaries, structures and surfaces in estates. The importance of habitat management (including removal of unwanted vegetation, clearance of waterways, protection and enhancement of boundaries, control of invasive species, promotion of beneficial species) and techniques applied to achieve these. Construction techniques used to maintain and repair boundaries (e.g. hedges, ditches, posts) building fabric (e.g. barn walls, doors), and surfaces (e.g. gravel, slabs). Risks to the non-productive and wider environment from the production activities e.g. biosecurity breaches, increased maintenance requirements. The potential effects of environmental control measures on productive and non-productive areas. **Machinery, equipment and technology** Key requirements of legislation relating to the safe and effective use of machinery and equipment e.g. power washers, sprayers. The operating principles of maintenance machinery and equipment (e.g. power tools, cleaning devices, monitoring	

equipment) and how they are operated safely and efficiently. Common faults in maintenance machinery and equipment • symptoms and typical causes • how their occurrence is minimised • how issues can be rectified. Techniques used to maintain equipment and machinery for use including storage, cleaning, calibration, visual and technical checks.	

Occupational Specialism: Floristry

Performance Outcome 1: Design complex floral work to meet client requirements for special events

Knowledge Specific to Performance Outcome	Skills
Defining customer requirements Demographics of the business market • factors that affect these e.g. new housing developments, cultural links • how they change over time • how these can affect design requirements including cultural differences. • techniques used to determine these including the use of open and closed questions, active listening. Differences between customer needs and wants • techniques used to determine these including the use of open and closed questions, active listening. **Communication** Methods of communication (including the use of images, electronic and digital forms and face to face) • techniques to be applied e.g. email, digital mood board • suitability for different types of customers and their design requirements. Types of digital software used to show designs in different environments. The importance of tone / style when communicating with customers	Sketch complex floral work by hand. Use digital software to produce images. Estimate space available for designs. Plan the use of visual merchandising to display goods for a retail environment. Present design ideas orally to a customer. Make novel connections between ideas. Form ideas iteratively. Synthesise ideas. Close a sale. Overcome objections to a potential sale. Use open and closed question techniques to obtain information from a customer. Convey technical information to a non-technical audience in writing. Summarise information and ideas. Create written quotations. Calculate a selling price for a design. Interpret information and data to extract relevant costing information. Check understanding of others. Develop rapport with others. Transcribe information and data onto customer records.

• how tone / style can be adapted for different situations e.g. to show empathy, to give congratulations, to engage with a businessperson. The purpose and contents of different types of records maintained throughout different stages in the design process. Strategies used to present technical information to non-technical and technical audiences including when and how to use technical language, using images rather than words. **Business** Key sales opportunities that exist across the year including Christmas, Valentine's Day, and other cultural opportunities within the business and industry • how these are used when planning complex designs. Techniques used for visual merchandising and displaying goods to maximise sales of design services. Techniques used to increase sales opportunities when designing floral work • the importance of balancing additional sales with customer needs and the impact of the final design. Sales techniques including developing rapport, establishing customer needs and wants, presenting product or service information, overcoming objections, closing the sale, follow up actions • resources that support the sales process e.g. use of mood boards, business portfolios, media shoots, customer reviews • the use of resources to close a sale	Make a 2D representation of a 3D design. Represent information and data using mathematical diagrams.

• typical products and services that add value to sales e.g. packaging, ancillary products. Application of stock management principles (including stock-rotation, storage conditions, monitoring stock levels, ordering stock, maintaining records) to developing designs • the implications of failing to apply these principles when designing complex floral work. How designs can be used to promote the business, including the use of social media, site visits with clients and in-house displays. Roles and responsibilities of different parts of the floristry supply chain • different ways the supply chain is sequenced from growers to customers • how the supply chain affects pricing, ordering requirements, delivery schedules • how floral materials are packaged and the implications these have for creating complex designs. Techniques used to minimise waste • how these are considered when designing complex floral work • implications to the business and customer of poor waste management. Sustainable principles that apply to the supply chain (including transportation, Fair Trade, storage, packaging) • how this can affect customer needs and wants from designs.	

Types of business aims and values and the relationship with the types of designs that can be produced • factors to consider when costing a design including installation and staging, floral materials, ancillary products, labour costs, intellectual property, taxation • how costs and profitability are used to create designs to meet specific budgets • process involved in calculating the selling price for a design. **Complex Designs** Flower symbolisms associated with different cultures, ethnic groups and their related events. Characteristics of the design schema and how they are applied in complex floristry designs including order category (symmetrical, asymmetrical), arrangement style (decorative, form-linear, vegetative), floral line direction (radial, parallel, free arrangement), placement of materials and point of origin. Characteristics of the elements and principles of design (including colour, form, texture, space, line, balance, contrast, dominance, harmony, rhythm, scale, proportion) • how elements and principles are applied in complex floral designs. Types and sources of inspiration including culture, botany, emotion, technique, economics • how these are used to develop designs	

• techniques used to show designs including the use of mood boards and sketching. Factors that affect designs including planned use (attached to a person, to be carried by a person or other, to be displayed, to be added to an installation) methods of packaging and wrapping, timescales, budget. Construction methods of complex designs (including hand tied, designs in a medium, different types of mediums, wired, glued) • their benefits and limitations • how they are considered when preparing designs • implications for assembly and cost. Techniques used to add individuality to designs e.g. plant manipulation, the use of ancillary products • the impact they have on the design including skills required for assembly and installation and additional costs to the customer. Design quality criteria • the methods used to evaluate the design against specification • techniques used to adapt design in response to client feedback Content of a design presentation including size, dimensions, quantity, construction methods, timings, transportation methods, packaging, skill levels required, staffing required, ancillary products and formats used. **Maths techniques**	

The four rules, percentages, area, volume and their application when designing and costing complex designs Difference between estimation and accurate measurement • units of measurement applied to designs • measurement techniques used to ensure accuracy in measurement is achieved, including the equipment to be used, • implications for poor measurement practice to the business and designs. Techniques for the 2D and 3D representation of designs.	

Performance Outcome 2: Coordinate the care and conditioning of fresh floral materials and plants

Knowledge Specific to Performance Outcome	Skills
Health and safety Key requirements of COSHH legislation and related codes of practice and their application to the care and conditioning of fresh floral materials and plants. Typical hazards (e.g. knives, chemicals, team members) associated with care and conditioning of fresh floral materials and plants • control measures used to minimise associated risks. Types of PPE for care and conditioning of fresh floral materials and plants • their purpose • implications for poor use. **Business** How stock management principles (stock-rotation, types of storage, monitoring stock levels, ordering stock, dealing with deliveries, maintaining records) are applied to the coordination of the care and conditioning of fresh floral materials, plants and conditioning materials. how stock management supports businesses to optimise saleability of fresh floral materials • the implications of failing to apply these principles when coordinating the care and conditioning of fresh floral materials and plants. Types of waste produced by florists through care and conditioning of fresh floral materials and plants	Identify fresh materials that require reviving. Revive fresh materials by shock treatment. Provide support for hollow stems. Position plants for optimised growth and development. Apply safety measures when carrying out conditioning tasks. Measure chemical resources (e.g. liquids, powders) for conditioning, for cleaning. Calculate resources required for a task, working with proportion. Remove packaging of fresh floral materials. Apply knife skills e.g. defoliate the stem, remove thorns. Remove guard petals minimising damage. Inspect floral materials for damage. Remove pollen from open flowers. Groom fresh floral materials and plants e.g. brush carnations open, apply leaf shine to foliage. Cut stems at 45-degree angles. Maintain a clean and tidy work area. Capture digital images of poor-quality products. Organise waste into types.

• how these are categorised • methods used to minimise waste when caring and conditioning fresh floral materials and plants • implications of poor waste management to the business and the environment. Types of records maintained in relation to care and conditioning of fresh floral materials and plants • their purpose and content • how they are maintained digitally. Information and data • the types of data collected by the business and methods used • how data is interpreted and presented • how data is used to plan for the care and conditioning of fresh floral materials and plants • implications to care and conditioning of fresh floral materials and plants of poor data collection and management. Different types of security measures in different floristry environments • their purpose • suitability for different situations • how they are operated. Routes of supply (including modes of transportation and storage) used for different suppliers and fresh floral materials and plants • expected quality standards of delivered products e.g. soil moisture of plants, packaging	Clean down tools and equipment after use. Measure with precision. Input, process, manipulate and interrogate sales data digitally. Organise data into usable forms. Interpret mathematical diagrams. Optimise work processes. Create and edit digital images. Convey technical instructions to team members. Demonstrate techniques to team members. Check understanding of others. Estimate time and resources. Allocate resources (including people, equipment, materials, time) to steps. Model appropriate behaviours. Make effective use of personal space. Demonstrate physical dexterity including precise and controlled movements, appropriate application of force and delicacy. Apply a logical approach to resolving issues.

• how that influences expectations for care and conditioning • typical requirements and procedures for reporting poor quality to the supplier. Sustainable principles (including transportation, growing methods, storage, packaging) and how these can affect care and conditioning of fresh floral materials and plants. **Coordination** Factors to consider (including equality legislation, importance of respect, acceptable and unacceptable behaviour and language) when working with people from diverse backgrounds and cultures and how to apply these to contribute to team success. Factors that affect decision-making when allocating and prioritising tasks including business aims, nature of business, skills, knowledge and experience of staff, sales trends, stock and deliveries, planned use for designs. The environmental requirements for staff involved in care and conditioning (e.g. ventilation, lighting, space) • how these need to be planned for when coordinating care and conditioning. Techniques used for coordinating care and conditioning tasks including developing procedures, prioritising tasks, allocating time and resources, sequencing, presenting information. Sources of information available to support care and conditioning of less common fresh floral materials and plants • how these are accessed efficiently	

• how these are interpreted efficiently. **Care and conditioning** Causes and symptoms of different types of pests and diseases • the techniques used to identify them • how they are controlled to prevent damage and spreading • the roles and responsibilities for reporting pests and diseases to the appropriate person. Activities involved in caring for and conditioning fresh floral materials and plants (including pest identification and removal, disease identification, trimming, grooming, feeding, revival, labelling) • techniques that are applied e.g. shock treatment, supporting hollow stems • their suitability for different flowers • how activities contribute to the saleability of fresh floral materials. Characteristics of fresh floral materials and plants and implications for maintaining stock and carrying out care and conditioning including • poisonous fresh floral materials and plants and those with irritants • characteristics of how fresh floral materials are harvested (e.g. by weight, length of stem, number of flower heads) • quality characteristics and how these are affected by growing method and planned designs • characteristics of different stem structures (including woody, semi-woody, hollow, soft, latex).	

Tools, equipment and materials required for care and conditioning of fresh floral materials and plants • their characteristics • their purpose • their use and operation • their suitability for different activities. Techniques used for presenting cared for and conditioned floral and non-floral materials to potential customers in retail and non-retail environments. **Plant biology** Binomial nomenclature of fresh floral materials and plants to include, family, genus, species, variety or cultivar, for a range of everyday and diverse fresh floral materials and plants • benefits, purpose and limitations of using and recognising both the common name and the binomial nomenclature of fresh floral materials and plants when communicating with others • the implication of any misunderstanding. Causes and effects of plants process including photosynthesis, transpiration, respiration, evaporation, osmosis, etiolation and tropisms • how this is used to determine care and conditioning of fresh floral materials and plants. Geographical implications of seasonality for fresh floral materials and plants.	

Performance Outcome 3: Assemble complex commercial flower, foliage and plant arrangements

Students must develop skills to assemble complex hand tied with spiral stems, complex designs in a medium, and complex wired or glued designs.

Students must develop skills to demonstrate that they can work with at least two of the following in each design:

- order categories
- arrangement styles
- floral line directions
- points of origin.

Students must develop skills to follow precise instructions in the assembly of complex designs and to develop their own procedures for the assembly of a given design.

Students must develop skills to create their own finishing as well as incorporating the finishes as required by a given design.

Knowledge Specific to Performance Outcome	**Skills**
Health and safety Typical hazards associated with assembling complex designs e.g. liquids on the floor, irritant materials • control measures used to minimise associated risks. Types of PPE available for assembling complex designs • their purpose • implications for poor use. **Business** The application of stock management principles (including stock-rotation, monitoring stock levels, maintaining records) to the assembly of complex designs • the implications of failing to apply these principles.	Manipulate fresh floral materials. Apply decorative finishes. Secure fresh materials in a design. Position fresh floral materials for assembly into a design. Provide support to fresh floral materials in a design. Manipulate wires to secure fresh floral materials in a design. Manipulate decorative materials (e.g. wire mesh) for assembly into a design. Bond floral materials in close order for the creation of shapes and profiles. Provide protection to assembled designs. Construct bows (e.g. figure of 8).

Types of waste produced by florists' assembly of complex designs • methods used to minimise waste • how methods are applied to assembly of complex designs. Types of records maintained in relation to assembly of complex designs • their purpose • formats used • how they are maintained digitally • legal requirements for maintenance of customer information and data. Routes of supply (including modes of transportation and storage) used for different suppliers and fresh floral materials and plants • Expected quality standards • How that influences expectations for assembly techniques. **Assembly** The formats used to present designs, • the information included • how they are interpreted to assemble designs. Characteristics of the design schema and how they are applied in complex floristry designs including order category (symmetrical, asymmetrical), arrangement style (decorative, form-linear, vegetative), floral line direction (radial, parallel), placement of materials and point of origin • the importance of maintaining the characteristics included in a design	Apply glue to fresh floral materials and accessories. Tie fresh floral materials in assembled designs. Apply knife skills e.g. chamfering edges. Minimise waste. Apply packaging to designs. Spray designs to support longevity. Prepare the work area. Demonstrate physical dexterity including precise and controlled movements and delicacy. Identify discrete steps involved in completing a complex task. Sequence and prioritise steps. Manage own time to achieve objectives. Monitor own performance and standards.

• how to adapt designs to ensure characteristics are included. Characteristics of the elements and principles of design including colour, form, texture, space, line, balance, contrast, dominance, harmony, rhythm, scale, proportion • how they are applied in complex floral designs, • the importance of maintaining the characteristics included in a design, • how to adapt designs to ensure characteristics included. Factors that affect assembly including planned used (e.g. attached to a person, to be carried by a person or thing, to be displayed) methods of packaging, timescales, budget • how to ensure they are incorporated into the final assembled design. Construction methods of complex designs (including hand tied, designs in a medium, different types of mediums, wired, glued) • their benefits and limitations • how they are used to plan assembly of designs. Assembly techniques and how they are used to achieve complex designs including • manipulation and decorative techniques including but not limited to basing, bows, bundling, caging, edging with fresh, dried and artificial products, framing, knots, lacing, layering, pave, plaiting, pleating, rolling/cupping, sheltering, stacking, taping, terracing, threading, veiling, weaving, winding, wrapping, wedging	

• protection and finishing techniques including but not limited to backing, covering with ribbon • attaching techniques including but not limited to binding, clamping, gluing (hot, cold, spray), knotting, pinning, stapling, tying • wiring techniques including but not limited to cross, external, feathering, hook, internal, mount wiring (single leg, double leg support), semi-internal, stitching, (branching unit, ribbed unit, natural unit), pipping, sepal pinning • water retaining techniques including but not limited to the use of floral foam, moss, tubes/phials, water gels/pearls, wax, tape. Tools used in the assembly of complex designs e.g. knives, pliers • their characteristics • how they are used safely and effectively • their suitability for different construction techniques. Design quality criteria and the methods and process used to monitor and evaluate assembled designs • prior to assembly (including quality of selected fresh floral materials and plants) • during assembly • post assembly against design and order requirements • prior to delivery	

• techniques used to adapt final product to meet quality standards. **Care and conditioning of assembled complex designs** Symptoms of different types of pests and diseases • their effect on use of fresh floral materials and plants including when they can be used and when they should be discarded. Activities involved in caring for and conditioning fresh floral materials and other products within complex designs (including removal, replacement, watering, labelling) • techniques that are applied • their suitability for different designs. Characteristics of fresh floral materials and implications for carrying out care and conditioning when incorporating into designs and once they are in designs including • poisonous fresh floral materials and plants and those with irritant • quality characteristics and how they relate to planned designs • characteristics of different stem structures (including woody, semi-woody, hollow, soft, latex). Tools, equipment and materials required for care and conditioning of assembled designs • their characteristics • purpose • use and operation • suitability for different activities.	

Performance Outcome 4: Create free standing timber-based structures decorated with complex floral designs

Students must develop the skills to create the structure individually and in small groups (e.g.) pairs but the skills to attach the floral designs to a structure individually.

Knowledge Specific to Performance Outcome	Skills
Health and safety Typical hazards associated with creating installations of complex floral designs e.g. falling objects and building materials, working at height and control measures used to minimise associated risks. Types of PPE available for creating installations of complex floral designs, their purpose and implications for poor use. **Installations** Types of environments where installations of complex floral designs may be required • the associated internal and external surfaces (e.g. brick, grass, carpet) and their implications (including stability, health and safety, protection of the environment) for installations of free-standing structures to be decorated with complex floral work • environmental conditions including light (natural and artificial), ventilation, access to utilities, space (to create the installation), existing decorations and implications to the design of installations for complex designs (e.g. glare, air flow, access to power) • principles of heritage and conservation (e.g. listed building, traditional buildings) and implications for installation.	Assemble free standing timber structures. Cut timber-based materials to required measurements. Apply joining techniques to timber-based materials. Position, secure and fix timber-based materials. Smooth surfaces of timber-based materials e.g. sanding. Prepare timber-based materials for painting. Apply coatings to timber-based materials. Position, secure and fix floral designs to decorate free standing structures. Work collaboratively to prepare timber-based structure for transportation. Work collaboratively to produce a timber-based structure. Work collaboratively to load timber-based structure into transport. Work collaboratively to unload timber-based structure from transport. Operate hand-held and power tools.

Structural science (including forces, loads, materials) and how they impact on the design and installation of complex floral designs. Design principles (e.g. shape, texture, space), the design schema and principles and elements of design • how they are applied to installations (including to complement, to physically support) • how they can be used to add individuality to designs of installations • impact they have on the design including skills required for assembly and installation and additional costs to the customer. Conventions and symbols of technical drawings and how they are used to interpret design requirements. Installation equipment and machinery (including equipment for working at height, for measuring, cutting, assembling, fixing) • their characteristics and purposes • how they are operated and used effectively and safely • how they are maintained including cleaning and storage • their suitability for different design and installation requirements. Installation logistics • typical activities involved including off-site preparations, transporting equipment and materials (including fresh floral materials and plants, accessories, installation materials), preparation of the installation	Measure timber-based materials and environments. Apply protection to the environment where installation is to be located. Monitor quality of own and others performance. Provide constructive feedback to others on performance. Evaluate own performance. Use geometry rules and formulae to design free-standing structures. Exchange ideas with others. Assess health and safety risks. Apply safe handling and lifting techniques.

environment, installation, deconstruction and waste disposal • sequencing of activities • allocating resources (including time, people, materials, costs). Types of wood used for installation (e.g. plywood, timber, medium density fibreboard (MDF) • their properties, characteristics (e.g. colour, grain), suitability for different purposes and implications for design and installation • formats (e.g. sheet, board) and their implications for use and costing • sustainable products, the supply chain and licensing and implications for use. Types of timber-based and non-timber-based materials (including metals) and fixings (including) • their characteristics and material properties • how they can be used to enhance installations (e.g. to provide movement, colour or shape) • compatibility with installation design. Materials science (including material properties, chemical composition, potential for degradation and failure and potential effects of environmental conditions) and implications for installations of free-standing structures to be decorated with complex floral work. Assembly techniques including cutting, joining, fixing, incorporating floral designs	

• how they contribute to meeting design requirements • their suitability for use in different environments • equipment, machinery and materials required • how to deal with unexpected situations e.g. uneven surfaces. **Business** Application of stock management systems (including storage conditions, monitoring stock levels, ordering stock, maintaining records) to creating installations of complex floral designs • the implications of failing to apply these principles when creating installations of complex floral designs. How installations can be used to promote the business (including the use of social media) and positive and negative implications of using them for this purpose. Techniques used to minimise waste • how these are considered when creating installations of complex floral designs • implications to the business, the installation environment and customer of poor waste management. Different types of security measures available to support the creation and the installation of free-standing structures decorated with floral designs in different environment • their purpose	

• suitability for different situations. **Maths** Standard units of measurement and conversions between imperial and metric. Techniques used to accurately measure lines and areas and associated equipment required. Geometry (including angles, shapes, points on a plane, lines and curves, Pythagoras theorem) and its application to the design, production, assembly and fixing of installations.	

Occupational Specialism: Habitat management (land and water)

Performance Outcome 1: Establish habitats to meet management objectives.

For this performance outcome, students are expected to acquire knowledge related to woodland, grassland (including moorland) and wetland habitats and niches for species within those habitats. They should develop skills related to each type of habitat and related niches and demonstrate skills related to two types of habitat as well as one niche for a specified species. The AO should determine the habitats and niches for each assessment series.

Knowledge Specific to Performance Outcome	Skills
Health and safety Typical hazards and risks associated with establishing habitats in urban and countryside environments, including unfamiliar, unexpected and emergency environments and control measures to be put in place to mitigate these health and safety risks to protect self, colleagues and others (e.g. volunteers, public). Practical first aid techniques for use when establishing habitats e.g. broken bones from falls, irritations resulting from contact with flora. **Environment** Conservation designations in the UK (e.g. National Nature Reserves, National Parks, Sites of Special Scientific Interest and Areas of Outstanding Natural Beauty) • their characteristics • benefits and limitations • legal requirements • how they affect management decisions. Characteristics of habitat sites including: • water e.g. ditches, lakes	Interpret maps. Interpret habitat establishment plans. Identify discrete steps in completing a complex task. Sequence and prioritise steps. Allocate resources (including people, equipment, materials) to steps. Identify hazards on site. Use rules and formulae to calculate the materials required for the establishment of habitats. Assess soil suitability. Assess the project for potential risks of realisation. Apply the use of hand tools when establishing habitats. Estimate distances. Identify flora and fauna through observation of characteristics. Apply manual handling techniques. Prepare tools, equipment and machinery for use. Clean tools.

• land including grassland, woodland, boundaries • flora and fauna • D.A.T.E.S (drainage, aspect, topography, exposure, situation) and microclimates • activities including business (livestock and arable farming, forestry) and leisure (e.g. rambling). Implications of habitat site characteristics to establishing habitats including • relationship with local business and communities • seasonality e.g. seasonal water levels and climatic changes, farming calendar • management objectives. The principles behind how flora and fauna (both native and non-native) live and survive and how this knowledge is used when planning for and establishing habitats. Characteristics of ecosystems found in different landscapes (including wetland, grassland and woodland environments) • key habitats and species encountered • how ecosystems affect management decisions • how conservation work complements/interacts with other land management uses e.g. recreation, game keeping, estate management. Plant and animal classification (including	Apply protection to the environment surrounding the new habitat e.g. fencing, silt / large debris traps. Apply biosecurity controls. Dig site area using hand tools. Apply shovelling techniques e.g. to excavate. Remove unwanted vegetation. ***Establishing woodlands*** Assess the quality of tree stock for planting. Dig holes for tree planting. Position the tree to planting line and planting plan. Fill holes with growing media. Cut turf for slit planting a tree. Slit plant a tree. Replace turf after slit planting. Apply tree protection. ***Establishing grassland*** Remove topsoil. Create a tilth suitable for purpose. Broadcast seed / apply vegetation. ***Establishing wetland*** Assess soil suitability. Determine water table. Assess water resistance. Dig hole to required depth. Install lining. Plant aquatic plants. ***Establishing niches***

families, genera, species,) • the format for scientific names according to the international code of nomenclature • characteristics and morphology that can be used to classify plants and animals • the techniques (e.g. observation, botanical keys) and information sources (e.g. internet and books) used to identify plants and animals • purpose of classification and use of scientific names when establishing surveys (e.g. ensure correct species is removed or saved, to identify protected or invasive species) and implications for inaccurate use. Types of invasive, protected and dangerous plant and animal species established by legislation that can be encountered when establishing habitats • characteristics that enable identification in an environment • implications of finding invasive / protected / dangerous species in an environment • how to mitigate for invasive / protected / dangerous species in an environment. The potential positive and negative environmental impacts of establishing habitats including on flora, fauna, habitats (including human) • implications for existing flora, fauna and habitats • implications for achieving	Interpret plans and drawings. Measure materials. Cut materials. Join materials.

management objectives • measures used to minimise and mitigate for negative impacts • measures used to maximise positive impacts. The purpose of environmental risk assessments • the content of an environmental risk assessment • how environmental risk assessments are conducted • the site factors that need to be incorporated into an environmental risk assessment (e.g. terrain, ground conditions, vegetation type, season, weather, vehicle use, proposed operations, management approach) their interrelationships and how they are managed. Requirements of habitats and niches (including access to food, shelter, protection and mates for reproduction) • the abiotic (e.g. soil, moisture, light intensity) and biotic (e.g. presence or absence of predators, food sources) characteristics that provide these requirements. Resources and materials which support a sustainable approach to establishing habitats • their potential internal (i.e. within the habitat) and external (i.e. outside of the habitat) sources • the benefits and limitations of sourcing internally and externally to sustainable development	

• their suitability for meeting management objectives. **Site operations** How a site operates for establishing habitats including • private and public realm considerations • logistics of transportation (including suitability of different types of transport) access, delivery, storage, utilities, signage and use of people, materials and equipment • the importance of biosecurity and keeping a site clear, clean and environmentally sound • implications for the relationship with client/customer, public and other colleagues. Factors that influence the choice of floral species (including biological, ecological and economic) • how they affect decision making for different habitats and niches e.g. soil and growing media capacity to support flora and fauna • how they impact on meeting different management objectives. Characteristics (e.g. health, size) of good quality stock (including seeds, grass, trees, aquatic plants) and techniques used to assess the condition of stock plants. Planting techniques, including support, protection and aftercare • their suitability for different species, habitats and purposes	

• how they are applied including equipment and materials required. Types of soils (including loams, clays, silts, sands, organics) and growing media (including inorganic e.g. rock and organic e.g. bark, aquatic substrate) • their characteristics and properties (including pH, nutrient availability, drainage and water holding capacity, organic matter and living organisms in the soil, colour and heat retention, ease of cultivation, existing pollutants, horizons) • their influence on flora selection and growth • techniques used to determine soil characteristics including texture testing, pH testing, digging a profile pit. Methods of vegetation clearance including hand clearance, chemical clearance and mechanical clearance • legal and environmental implications of their use • their suitability for different sites and purposes. Factors that affect the suitability of an environment for establishing wetlands e.g. potential for water retention, water table • techniques and equipment required to assess the suitability of the environment. Techniques used to prepare environments for establishment of habitats, including protection of the surrounding environment (e.g. fencing to prevent access from grazing livestock, silt	

/ large debris traps on water courses, buffer zones to prevent access by invasive species) • how the techniques are applied accurately, safely and effectively including processes involved, equipment required, information and data required • suitability of techniques for different environments and landscape features. Utilities that may be located in the environment • how they affect establishment plans and activities • information that can be used to locate them • legal requirements. The types of materials that can be used to establish habitats • their properties • the importance of sensitivity to the local environment, including local heritage • the impact of wear and tear to use in establishing habitats and implications to whole life cycle. **Business** Types of management objectives (commercial and conservation) and the types of activities undertaken to achieve them. Organisations that can support habitat establishment, including those that can provide funding	

• the relevant responsibilities of all parties • the specialist skills they can provide • the benefits and limitations of wider teamwork. Types of relationships involved with establishing habitats including with partners, contractors, stakeholders and communities • implications for completing work efficiently and effectively • how relationships affect the reputation of the organisation • how relationships affect the success of the operations at a local and national level. **Legislation** The broad framework of relevant legislation • the difference between primary, secondary legislation and byelaws • key requirements and restrictions of legislation related to establishing habitats e.g. protected activities (e.g. bird nesting) heritage assets • permissions required for establishing habitats on different land designations. **Information and data** Information required to determine characteristics of the environment and sources used to acquire the information e.g. observation, maps, plans.	

Types of information that can inform operational decisions, e.g. local D.A.T.E.S, forecasted weather • their characteristics • their sources • how they are used • their suitability for different purposes. Types of maps, their conventions and symbols • associated tools (e.g. compass, GPS) • how they are used to locate and navigate locations in different types of environments. Techniques used to present information including computer aided design, maps, mathematical diagrams. Organisations (e.g. National Biodiversity Network, Met Office) that can support decision making and the types of information and data they can provide. **Tools machinery and equipment** Tools, equipment and machinery (including vehicles) required for establishing habitats • their characteristics and purposes • how they are operated and used accurately, efficiently and safely • how they are maintained including cleaning and storage • their suitability (including limitations) for different tasks and locations involved in establishing habitats, including their	

environmental impact.	

Performance Outcome 2: Survey habitats to inform management decisions

For this performance outcome, students are expected to demonstrate skills related to surveying in land (woodland or grassland) and wetland habitats.

Knowledge Specific to Performance Outcome	Skills
Health and safety Typical hazards and risks associated with surveying habitats in urban and countryside environments, including unfamiliar, unexpected and emergency environments and control measures to be put in place to mitigate these health and safety risks to protect self, colleagues and others (e.g. volunteers, public). **Environment** Conservation designations in the UK (e.g. National Nature Reserves, National Parks, Sites of Special Scientific Interest and Areas of Outstanding Natural Beauty) • their characteristics • benefits and limitations • legal requirements • how they affect surveying activities. How habitats and vegetation are managed to promote conservation • the different types of management used • the implications for surveying activities. The principles behind how our flora and fauna (both native and non-native) live and survive and how this knowledge is used when surveying habitats. Characteristics of ecosystems found in different landscapes (including wetland, grassland, woodland environments)	Locate survey environment from a map. Verify the accuracy of measuring equipment. Establish a fixed datum. Interpret information available from digital technology e.g. bat detectors. Use equipment to carry out surveys e.g. quadrant. Identify flora and fauna from keys. Capture habitat data. Assess heritage asset values. Measure with precision. Record findings. Input data into digital software. Validate data. Interpret mathematical diagrams. Collate and classify data. Estimate populations. Substantiate conclusions with evidence. Synthesise information. Present data using mathematical diagrams. Manage own time to meet objectives.

• key habitats and species encountered • how surveying activities interact with other land uses (e.g. farming, tourism). Plant and animal classification (including families, genera, species) • the format for scientific names according to the international code of nomenclature • characteristics and morphology that can be used to classify plants and animals • the techniques (e.g. observation, botanical keys) and information sources (e.g. internet and books) used to identify plants and animals • implications for inaccurate classification and use of scientific names. Types of invasive, protected and dangerous plant and animal species (including those established by legislation) that can be encountered when establishing habitats • characteristics that enable identification in an environment. Types of heritage assets (e.g. aqueducts, ridge and furrow, sawpit) found in a surveying area • the characteristics • sources of information used to support identification. **Surveys** Different types of surveys that are undertaken e.g. preliminary ecological appraisals, species specific surveys	

• the associated techniques • their suitability for different purposes and locations • how the techniques are applied, including timescales, seasonality, resources needed. How a surveying site operates including • private and public realm considerations • logistics of transportation, access, delivery, storage, utilities, signage and use of people, materials and equipment • the importance of biosecurity and keeping a site clear, clean and environmentally sound • implications for the relationship with client/customer public and other colleagues. Potential human-animal interactions encountered when undertaking surveys • possible effects of interactions on animals and humans • actions that can mitigate for negative impacts. **Business** Types of management objectives (commercial and conservation) • how management objectives affect survey design and implementation. Organisations that can support habitat surveys • the relevant responsibilities of all parties • the specialist skills they can provide	

• the benefits and limitations of wider teamwork and networking. Types of relationships involved with surveying habitats including with partners, contractors, stakeholders and communities • implications for completing work efficiently and effectively • how relationships affect the reputation of the organisation. **Legislation** Key requirements and restrictions of legislation (primary, secondary, byelaws) related to surveying habitats e.g. protected species, trespass • permissions required for surveying habitats on different land designations. **Information and data** Types of information that can contributes to surveying activities, e.g. land ownership, boundaries • their characteristics • their sources • how they are used • their suitability for different purposes. Types of maps, their conventions and symbols • associated tools (e.g. compass, GPS) • how they are used to locate and navigate locations in different types of environments. Techniques used to present information including computer aided design, maps, mathematical diagrams.	

Tools machinery and equipment Tools, equipment and machinery (including vehicles) required for surveying habitats • their characteristics and purposes • how they are operated and used accurately, efficiently and safely • how they are maintained including cleaning and storage • their suitability (including limitations) for different tasks and locations involved in surveying habitats. Developments in technology (e.g. thermal imaging, drones) and how they can be used to support surveying activities.	

Performance Outcome 3: Manage habitats to meet management objectives

For this performance outcome, students are expected to acquire knowledge related to woodland, grassland (including moorland) and wetland habitats. They should develop skills related to each type of habitat and demonstrate skills related to two types of habitat. The AO should determine the habitats for each assessment series.

Knowledge Specific to Performance Outcome	**Skills**
Health and safety Typical hazards and risks associated with working in urban and countryside environments, including unfamiliar, unexpected and emergency environments and control measures to be put in place to mitigate these health and safety risks to protect self, colleagues and others (e.g. volunteers, public). Practical first aid techniques for use when dealing with minor injuries e.g. cuts resulting from the use of machinery and equipment, sprains from slips and trips. **Environment** Conservation designations in the UK (e.g. Areas of Outstanding Natural Beauty, listed buildings and structures) • their characteristics • benefits and limitations • legal requirements • how they affect management decisions. Characteristics of habitat sites including: • water e.g. rivers, canals, lakes, tidal variations, locks, culverts • land including grassland, woodland, boundaries • flora and fauna	Assess maintenance requirements of a site. Dynamically assess site for health and safety risks. Set out worksite signage and controls. Operate tools, machinery and equipment. Remove vegetation from a habitat • for woodland – e.g. fell / coppice / pollard trees and shrubs • for wetland – e.g. remove aquatic vegetation • for grassland – e.g. harvest, topping Maintain boundaries e.g. • cut back hedgerows • remove debris from river • reinforce canal banks • dig out existing materials in ditches • repair masonry • trimming pond grass • repair fencing. Maintain access routes and gates e.g. clear debris, level aggregates, repair ironmongery (e.g. gate / lock hinges)

• D.A.T.E.S (drainage, aspect, topography, exposure, situation) and microclimates • activities including business (gamekeeping, fisheries) and leisure (e.g. sports events, fishing). Implications of habitat site characteristics to the management of habitats (including seasonal water levels, local materials, climatic changes) and meeting management objectives. How habitats and vegetation are managed to promote conservation, amenity use and commercial values • the different types of management used • their suitability for the environment and meeting management objectives. The principles behind how flora and fauna (both native and non-native) live and survive and how this knowledge is used when managing habitats. Characteristics of ecosystems found in different landscapes (including wetland, grassland and woodland environments,) • key habitats and species encountered • how conservation work complements/interacts with other land management uses e.g. livestock farming, seed/plant production. Plant and animal classification (including families, genera, species) • the format for scientific names according to the international code	Classify waste and allocate to storage. Optimise work processes. Make good the site area following management activities. Undertake routine biosecurity measures e.g. removing debris and soil from clothing, clean machinery and equipment before leaving a site. Minimise / avoid damage to surrounding habitats.

of nomenclature. Types of invasive, protected and dangerous plant and animal species (including those established by legislation) that can be encountered when establishing habitats • characteristics that enable identification in an environment • implications of finding invasive / protected / dangerous species in an environment • how to mitigate for invasive / protected/ dangerous species in an environment. Typical pests (e.g. moths, aphids, mammals) • their characteristics (including life cycle, dispersal) • methods of prevention and treatment • benefits and limitations of prevention and treatment options to the habitat and wider environment • implication of pests to habitat development and survival. Different types of boundaries including between different land uses, ownership, designations • their relationship to their locations, usage and site characteristics • the activities involved in their management. The potential positive and negative environmental impacts of managing habitats including on flora, fauna, habitats	

(including human) • implications for existing flora, fauna and habitats • implications for achieving management objectives • measures used to minimise and mitigate for negative impacts • measures used to maximise positive impacts. The purpose of environmental risk assessments • the content of an environmental risk assessment • how environmental risk assessments are conducted • the site factors that need to be incorporated into an environmental risk assessment (e.g. terrain, ground conditions, vegetation type, season, weather, proposed operations, management approach) their interrelationships and how they are managed. **Asset management** Types of assets including infrastructure (bridge), historical (e.g. ruin), functional (e.g. sluice) • their characteristics • assess management whole life cycle • their location • the contribution to national and organisations responsibilities and protection of communities • how asset management contributes to management of	

habitats and meeting management objectives. **Habitat management** How a site operates for managing habitats including • private and public realm considerations • logistics of transportation, access, delivery, storage, utilities, signage and use of people, materials and equipment • the importance of biosecurity and keeping a site clear, clean and environmentally sound • implications for the relationship with client/customer, public and other colleagues. Potential human-animal interactions encountered when undertaking surveys • possible effects of interactions on animals and humans • actions that can mitigate for negative impacts. Utilities that may be located in the environment • how they affect establishment plans and activities • information that can be used to locate them • legal requirements. Types of maintenance e.g. planned, reactive and their suitability for different situations and environments • the purpose of planned maintenance	

• the content and formats of planned maintenance programmes • the process involved in developing maintenance programmes • documentation required for maintenance and verification of maintenance activities. Techniques (including soft engineering techniques) used to maintain and repair habitats (woodland, grassland, wetland), access routes (e.g. paths, gates), assets (e.g. culverts, sluices) • how they are applied • equipment and materials required and their suitability to meet sustainable and heritage management. Resources and materials available which support the management of habitats • their potential internal (i.e. within the habitat) and external (i.e. outside of the habitat) sources • the benefits and limitations of sourcing internally and externally to sustainable development • their suitability for meeting management objectives. **Business** Types of management objectives (commercial, conservation, recreation) and the types of activities undertaken to achieve them. Organisations that can support habitat management, including those that can provide funding (e.g. Stewardship Council)	

• the relevant responsibilities of all parties • the specialist skills they can provide • the benefits and limitations of wider teamwork. Types of relationships involved with managing habitats including with partners, category 1 responders, contractors, stakeholders and communities • implications for completing work efficiently and effectively • how relationships affect the reputation of the organisation • how relationships contribute to and affect meeting management objectives. **Legislation** Key requirements and restrictions of legislation (primary, secondary and byelaws) related to the management of habitats e.g. emergency situations (e.g. flooding) that require immediate habitat management, heritage assets • permissions required for management activities on different land designations. **Information and data** Types of information that can contributes to managing decision making e.g. management objectives, survey data • their characteristics • their sources • how they are used	

• their suitability for different purposes. Types of maps, their conventions and symbols • associated tools (e.g. compass, GPS) • how they are used to locate and navigate locations in different types of environments. Organisations that can support management decision making and the types of information and data they can provide. **Tools machinery and equipment** Tools, equipment and machinery (including vehicles) required for managing habitats • their characteristics and purposes • how they are operated and used accurately, efficiently and safely • how they are maintained including cleaning and storage • their suitability (including limitations e.g. potential for polluting the environment) for different tasks and locations involved in managing habitats.	

Performance Outcome 4: Facilitate public interaction with habitats

For the purpose of this performance outcome, the public refers to visitors to a managed habitat environment and volunteers. Students are expected to demonstrate skills engaging with both visitors and volunteers.

Knowledge Specific to Performance Outcome	Skills
Health and safety Typical hazards and risks associated with working in urban and countryside environments, including unfamiliar, unexpected and emergency environments and control measures to be put in place to mitigate these health and safety risks to protect self, colleagues and others (e.g. volunteers, public). Practical first aid techniques for use in situations when dealing with the public e.g. heart attacks, unresponsive after being submerged in water. **Environment** Conservation designations in the UK (e.g. National Nature Reserves, National Parks, listed buildings and structures) • their characteristics • benefits and limitations • legal requirements. Characteristics of habitat sites including: • water e.g. ditches, lakes • land including grassland, woodland, boundaries • flora and fauna • D.A.T.E.S (drainage, aspect, topography, exposure, situation) and microclimates	Use technology solutions available to communicate with others. Configure digital technology. Instruct others on habitat information e.g. health and safety, identifying flora and fauna. Demonstrate habitat management practices. Represent information and data using mathematical diagrams. Create digital media to enhance work. Control digital functions. Convey technical information orally to non-technical audiences. Create texts. Check understanding of others. Identify sources of information. Develop search criteria or questions to be answered. Monitor own performance and standards. Produce interpretation material. Assess the need for volunteer services. Allocate volunteers and associated resources to roles. Assess a situation for potential adverse effects.

• activities including business (livestock and arable farming, forestry) and leisure (e.g. rambling). How habitats and vegetation are managed to promote conservation, amenity use and commercial value • the different types of management used. The principles behind how flora and fauna (both native and non-native) live and survive. Characteristics of ecosystems found in different landscapes (including wetlands, grassland, woodland environments) • key habitats and species encountered • how conservation work complements/interacts with other land management uses including recreational and commercial. Plant and animal classifications (including families, genera, species) • the format for scientific names according to the international code of nomenclature • characteristics and morphology that can be used to classify plants and animals • the techniques (e.g. observation, botanical keys) and information sources (e.g. internet and books) used to identify plants and animals • how the information is used to inform members of the public. Types of invasive, protected and dangerous plant and animal species (including those established by legislation) that can be encountered when the public interact with habitats	Convey information to an audience to stimulate discussion. Adapt style and tone to meet the needs of the message and audience. Model appropriate behaviours.

• characteristics that enable identification in an environment • implications of finding invasive / protected / dangerous species in an environment • how to mitigate for invasive / protected/ dangerous species in an environment. The potential positive and negative environmental impacts of managing habitats including on flora, fauna, habitats (including human) • implications for existing flora, fauna and habitats • measures used to minimise and mitigate for negative impacts • measures used to maximise positive impacts. Requirements of habitats (including access to food, shelter, protection and mates for reproduction) • the abiotic (e.g. soil, moisture, light intensity) and biotic (e.g. presence or absence of predators, food sources) characteristics that provide these requirements • how these are identified and used when managing habitats. Resources and materials available which support a sustainable approach to the management of habitats and assets • their potential internal (i.e. within the habitat) and external (i.e. outside of the habitat) sources • the benefits and limitations of sourcing internally and externally to sustainable development	

• their suitability for meeting management objectives. The principles of access management • the legal status of a Right of Way and Open Access to the Countryside legislation • different types of boundaries and their relationship to their locations, usage and site characteristics • different types of surfaces (aggregate, paving, woodchip, pitching) and furniture/structures (such as gates, bridges, boardwalks, benches, bins) and their suitability for different areas and usage such as multi-user access paths • best practice in design (e.g. path width, surface usability). **Asset management** Types of assets including infrastructure (bridge), historical (e.g. ruin), functional (e.g. sluice) • their characteristics • assess management whole life cycle • their location • the contribution to national and organisations responsibilities and protection of communities • how this asset management contributes to management of the environment. Techniques used to establish, maintain and survey woodland, grassland and wetland habitats and their application. **Site operations** How a site operates for managing habitats	

including • private and public realm considerations • logistics of transportation, access, delivery, storage, utilities, signage and use of people, materials and equipment • the importance of biosecurity and keeping a site clear, clean and environmentally sound • implications for the relationship with client/customer, public and other colleagues. **Business** Types of relationships involved with managing habitats including with partners, contractors, stakeholders and communities • how relationships affect the reputation of the organisation and the success of the operations at a local and national level. The purposes of visitor interpretation including to stimulate change, explain ideologies, enhance knowledge • related interpretive devices including people, media, objects, self-guiding tools, built structures • complementary visitor management tools e.g. signage, trail design • the significance and contexts to be included in any interpretation messages • how to use tools, devices and message content to engage an audience. How to convey organisational messages • to influence others	

• to promote awareness with the public and stakeholders • to enhance the business reputation • formats used to convey messages and how images and diagrams can enhance a message • tools and technology available to use to communicate with a range of people e.g. social media, e-mail, digital applications. **Volunteers** Typical roles undertaken by volunteer to contribute to achieving operational outcomes • the costs, benefits and limitations of using volunteers to contribute to achieving operational outcomes • techniques used to promote volunteering opportunities and recruit volunteers • typical induction and training programmes used to support volunteers to carry out their roles • techniques used to brief and inform volunteers (including small and large groups) on their roles • techniques used to motivate individual and groups of volunteers. **Legislation** Key requirements and restriction of legislation (primary, secondary, byelaws) related to public interaction with habitats e.g. employment, rights of way and access routes. **Information and data** Types of maps, their conventions and symbols	

• associated tools (e.g. compass, GPS) • how they are used to locate and navigate locations in different types of environments. **Tools, machinery and equipment** Tools, equipment and machinery (including vehicles) required for managing habitats • their characteristics and purposes • how they are operated and used accurately, efficiently and safely • how they are maintained including cleaning and storage • their suitability (including limitations e.g. potential for polluting the environment) for different tasks and locations involved in managing habitats.	

Occupational Specialism: Land-based engineering

Performance Outcome 1: Maintain complex land-based machinery and equipment

This performance outcome relates to scheduled and preventative maintenance and preparation for out of season storage.

Knowledge Specific to Performance Outcome	Skills
Health and safety Hazards (e.g. release of stored energy, contaminated products) and risks associated with the maintenance of complex land-based equipment and machinery and related controls. **Land-based equipment and machinery** Types of complex land-based equipment and machinery (including those used in construction, agricultural engineering, outdoor power equipment, professional turf, forestry, fixed plant, hire equipment) • the operating principles of complex integrated and stand-alone systems (including power units, transmission, hydraulics, electric/electronic, air conditioning) • the components required to support those operating principles (e.g. drivelines, gaskets) • their implications to maintenance activities. How the environment (e.g. climate, soil types), maintenance schedules (e.g. timescales, activities) and operation (e.g. incorrect use, incorrect application) of complex land-based equipment and machinery influences their performance and maintenance requirements	Prepare the workplace/site for maintenance tasks. Assess health and safety risks associated with maintenance tasks. Determine resource (parts, materials) requirements for maintenance activities. Prepare machinery and equipment for maintenance tasks. Decontaminate machinery and equipment. Drain fluids. Clean filters. Fill components with fluids. Bleed fluid systems. Set machinery and equipment parameters using manual and electronic methods. Measure machinery and equipment parameters. Extract worn components from equipment and machinery e.g. sealing components. Insert new components into machinery and equipment e.g. air filter. Jack machinery and equipment. Stabilise raised land-based machinery and equipment. Prepare surfaces for sealing.

• the implications of maintenance activities on performance of machinery and equipment. The function of software (e.g. diagnostic, servicing) in the operation of machinery and equipment • how the software ensures effective performance • how the software is used to support maintenance activities • methods used to adapt software during and following maintenance activities e.g. installation, updating, amending. **Legislation** The implications of maintenance activities to the terms and conditions of warranties and licences • terminology associated with warranties and licences. Legal obligations to report issues associated with complex land-based machinery and equipment encountered during preventative maintenance activities. Implications of waste regulations on maintenance activities including disposal of contaminates, fluids and components. **Maintenance operations** Types of preventative maintenance (e.g. predictive, scheduled, out of season) • the benefits of each type. • implications (including financial, performance) of poor maintenance. Components of typical preventative maintenance schedules (including out of season) and their application.	Seal components. Classify waste products for disposals. Collect samples for analysis. Verify machinery and equipment conforms to manufacturer's specifications. Manage own time to meet objectives. Assess machinery and equipment for potential defects. Record activities completed, time taken, and consumables used. Adjust mechanisms. Apply preventative coatings. Clean machinery and equipment e.g. for out of season storage.

Factors influencing maintenance operations (e.g. machine availability and location, parts availability, timeframe) • how they influence the planning and scheduling of maintenance tasks. Techniques used to safely jack and support machines and equipment • their application including the use of equipment. Causes (e.g. brake fluids, battery acid), effect and prevention of corrosion. Machinery and equipment samples required for completion of maintenance activities • the contribution samples make to maintenance operations. • methods used to collect samples. • data available following analysis of samples and how these inform maintenance activities • benchmarking data for samples that indicate optimum performance of machinery and equipment. Causes and implications of component contamination • measures used to avoid contamination when carrying out maintenance activities. • techniques, materials and equipment used to remove contamination where it exists. Procedures used to remove and replace service items e.g. filters, wearing parts. Techniques used in sealing and securing components	

• their suitability for different components • their suitability for different maintenance requirements • tools, equipment and materials required • their application during maintenance activities. Types of calibration • their suitability for different purposes, components, machinery and equipment. • equipment used for implementation. • their application during maintenance activities. Techniques (including sensory inspection) used to verify machinery and equipment operates to specification throughout and following maintenance operations. Techniques for cleaning complex land-based equipment and machinery (including for out of season maintenance) including techniques used for cleaning of external and internal surfaces, systems and components. **Maintenance materials** The different types of fluids (including coolants, lubricants and gases) and consumables (e.g. washers, seals) used in land-based machinery and equipment • their applications • their properties • how the properties affect their application • the effect of fluids on machinery performance	

• how fluids affect maintenance activities. **Maintenance tools, equipment and machinery** Types of hand and power tools (e.g. torque wrench, dynamometer, flowmeter) used for maintenance activities • their suitability for the maintenance task • how they are applied and operated. Types of equipment used for maintenance tasks (including digital hardware and software) • their suitability for different maintenance tasks • their operation and application. **Information and data** Post maintenance information required for the key stakeholders including owner, user and the methods of reporting e.g. service advisors, quotations Types of information and data required to complete maintenance tasks (including technical data, customer information, service history, analysis samples) and their sources. Maintenance information to be recorded • types of records used (e.g. service history records, job cards) • the information they hold • their purpose • the importance of accurate and timely completion • audiences for different information e.g. manufacturer, owner.	

Performance Outcome 2: Repair complex land-based machinery and equipment

Knowledge Specific to Performance Outcome	Skills
Health and safety Hazards (e.g. welding, cutting) and risks associated with repair of complex land-based equipment and machinery and associated control. **Land-based equipment and machinery** Types of complex land-based equipment and machinery (including those used in construction, agricultural engineering, outdoor power equipment, professional turf, forestry, fixed plant, hire equipment) the operating principles of complex integrated and stand-alone systems (including power units, transmission, hydraulics, electric/electronic, air conditioning) • the components required to support those operating principles (e.g. drivelines, gaskets) • typical causes and effects of component failure leading to repair requirements. The function of software (e.g. performance, transmission) in the operation of machinery and equipment • methods used to adapt software following repair activities e.g. installation, updating, amending. **Legislation** The limitations of terms and conditions of warranties and licences • associated terminology	Retrieve data from equipment and machinery software. Upload data to machinery and equipment software. Clean components. Release stored energy. Secure mechanical components to prevent movement. Prepare tools and e equipment prior to carrying out repair activities. Disassemble mechanical components. Extract damaged (e.g. seized, broken) fixings. Cut threads. Use equipment to support machinery and equipment being repaired. Mark components. Layout components. Measure components. Balance components. Flush components. Align mechanical components. Route flexible components e.g. wiring harnesses, pipes. Secure flexible components against chafing. Determine mathematically machinery and equipment parameters.

• implications for making repairs to machinery and equipment. Implications of waste regulations on repair activities including disposal of contaminates, fluids and components. **Repair operations** Factors influencing repair operations (e.g. severity of repair required, contractual requirements) • how they influence the planning, allocation and scheduling of repair tasks. Techniques for removal, disassembly, refitting, re-assembly of systems and components • their suitability for different equipment and machinery and repair tasks • tools, equipment and materials required • their application when carrying out repairs. Techniques used to safely jack, lift and support complex land-based machinery and equipment and their components for repair • their application, including the use of equipment. Techniques used to thermally join materials (e.g. MIG, MMA, soldering, brazing) • their suitability for different machinery and equipment repair requirements • tools, equipment and materials required	Use equipment to confirm mechanical settings e.g. rolling resistance, torque limiting devices. Fit seals. Fit bearings. Make good electrical/electronic connections. Insulate electrical/electronic connections. Seal components. Calibrate systems. Calculate the cost of a repair. Convey technical information to different audiences. Allocate resources (e.g. time, materials, equipment) to a repair task. Remove electrical / electronic / mechanical / hydraulic components. Fit electrical / electronic / mechanical / hydraulic components. Configure electrical / electronic / mechanical / hydraulic components. Demonstrate physical dexterity with appropriate force and delicacy. Sharpen cutting components of machinery and equipment.

• their application when carrying out repairs. Techniques used to cut and shape (including threads) materials • their suitability for different machinery and equipment repair requirements • tools, equipment and materials required • their application when carrying out repair tasks. Techniques used in sealing (including chemical bonding) • their suitability for different repair requirements • tools, equipment and materials required • their application when carrying out repair activities. Types of calibration • their suitability for different purposes, components, machinery and equipment • equipment used for implementation • their application when carrying out repair activities. Techniques used to verify repairs conform to manufacturers specifications. Scientific laws relating to electrics, power, hydraulics and friction (e.g. Ohm's, Pascal's) • how they are applied to complex land-based machinery and equipment	

• calculations required to ensure they are applied effectively to achieve optimum performance of complex land-based machinery and equipment. **Repair materials** Types of fluids used in land-based machinery and equipment (including coolants, lubricants and gases), their applications and properties • their applications • their properties • how the properties affect their application • the effect of fluids on machinery performance • how fluids affect repair activities. **Repair tools, equipment and machinery** Types of specialist hand and power tools used for repair activities (e.g. for protection of seals, for compression) • their suitability for carrying out different repair tasks • how they are applied and operated. Types of equipment (e.g. rails, lifting) used for repair tasks (including electronic) • their suitability for use in different repair tasks • their operation and application. **Information and data**	

Pre and post repair information required from and by the key stakeholders including owner, user. Conventions and symbols associated with drawings and schematics and their use in interpreting information provided. Types of information and data required to complete repair tasks (e.g. service records, drawings, schematics) and their sources. Types of repair records (e.g., quotations, insurance reports) • the information they hold • their purpose • the importance of accurate and timely completion. Costs associated with repair operations including parts, labour, surcharges, specialist costs (e.g. coded welding, crack detection, specialist machining) • difference between quotations and estimates including content and purpose • implications to the business of each.	

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Performance Outcome 3: Diagnose complex land-based machinery and equipment faults

Students must develop skills to carry out diagnostic activities on hydraulic, electronic and technologically advanced systems on complex land-based engineering machinery and equipment.

Knowledge Specific to Performance Outcome	Skills
Health and safety Site related hazards (e.g. animals, diseases) and risks associated with conducting complex diagnostic activities on land-based equipment and machinery and associated controls. **Land-based equipment and machinery** Types of complex land-based equipment and machinery (including those used in construction, agricultural engineering, outdoor power equipment, professional turf, forestry, fixed plant, hire equipment) • the operating principles of complex integrated and stand-alone systems (including power units, transmission, hydraulics, electric/electronic, air conditioning) and their components (e.g. drivelines, gaskets) • how systems interrelate and affect each other. How the environment (e.g. climate, soil types), maintenance schedules (e.g. timescales, activities) and operation (e.g. incorrect use, incorrect application) of complex land-based equipment and machinery can be used to support a diagnosis. Causes and effects of system and component failure. Normal and abnormal characteristics of machinery performance.	Gather information from different sources. Prepare machinery and equipment for diagnostic activities. Verify test equipment accuracy. Sequence and prioritise diagnostic tasks. Apply open questioning and listening techniques. Simulate machinery and equipment operations to replicate fault symptoms. Use test equipment (e.g. electrical, hydraulic) to establish diagnostic data. Use digital software to collect diagnostic information. Connect electronic components to software. Record diagnostic data. Use visual inspection and sensory perception to establish diagnostic information. Isolate circuits and components in a system. Analyse information and data. Present information and data. Convey proposals in written form. Measure with precision.

The function of software (e.g. engine control systems, machine stability) in the operation of machinery and equipment. • how the software ensures effective performance • how software can be used to support diagnostic activities • methods used to adapt software to support diagnostic activities including installation, updating, amending, licensing. **Diagnostic operations** Causes and implications of component contamination • measures used to avoid contamination when carrying out diagnostic activities • how evidence of contamination can be used to support a diagnosis. Machinery and equipment samples required for completion of diagnostic activities. • the contribution samples make to diagnostic activities • methods used to collect samples • how data provided from sample analysis can be used to support a diagnosis • benchmarking data for samples that indicate optimum performance of machinery and equipment. Current and emerging technologies and their effect on system operation, integration and diagnostics. Techniques used in the preparation of machinery and equipment before diagnostic activities	Validate data. Configure digital technology. Use software to manipulate data. Manipulate software to interrogate data. Substantiate conclusions with evidence. Apply a logical approach to solving problems. Sequence and prioritise diagnostic tasks. Synthesise provided information.

• their suitability for different diagnostic activities, machinery and equipment and environments • their application for different machinery and equipment and environments. Techniques for removal, disassembly, refitting, assembly of systems and components in preparation for diagnostic operations. Diagnostic techniques (including sensory, electronic, benchmarking, monitoring) • their purpose • their suitability for different situations • their application. The processes used to formulate a logical diagnostic conclusion e.g. isolation, substitution, comparison. Methods used to verify machinery and equipment and their components conform to manufacturers specifications. Types of calibration • their suitability for different purposes • techniques and equipment used for implementation. Scientific laws relating to electrics, power, hydraulics and friction (e.g. Ohm's, Pascal's) • how they are applied to complex land-based machinery and equipment • calculations required to ensure they are applied effectively to achieve optimum performance of complex land-based machinery and equipment. **Diagnostic tools, equipment and machinery**	

Types of tools, equipment and machinery used for diagnostic tasks (including mechanical, electronic, digital) • their characteristics • their operation • their calibration. Techniques used to maintain equipment and machinery for use including storage, cleaning, visual and technical checks. **Information and data** Information that can be provided by the key stakeholders (including owner, user) to support a diagnosis. Methods used to verify the accuracy of information provided by key stakeholders e.g. observation, machinery operation. Information and data required to support diagnostic tasks • techniques used obtain data • suitability of techniques for different types of data and situations. Conventions of diagnostic reports, complex drawings and schematics (wiring and hydraulics) including symbols • how these are used to interpret and present information and data.	

Performance Outcome 4: Install land-based machinery and equipment

Students are not required to demonstrate the use and operation of complex land-based machinery and equipment which would normally be included in the installation and handover process. They must be able to apply their knowledge of complex land-based machinery and equipment to any example from any manufacturer, when provided with relevant and appropriate information and data.

Knowledge Specific to Performance Outcome	**Skills**
Health and safety Hazards and risks associated with the installation of complex land-based equipment and machinery and related controls. **Land-based equipment and machinery** Types of complex land-based equipment and machinery including those used in construction, agricultural engineering, outdoor power equipment, professional turf, forestry, fixed plant, hire equipment. The operating principles of complex integrated and stand-alone systems (including power units, transmission, hydraulics, electric/electronic, air conditioning) • their components (e.g. drivelines, gaskets) • how components and systems interrelate and affect each other. Equipment and machinery applications • their performance limitations • causes and effects of inappropriate system, machinery or equipment use • implications for incorrect use. The function of software (e.g. global positioning) in the operation of machinery and equipment	Plan the logistics required to carry out a machinery and equipment installation. Assess suitability of an installation site. Prepare the site to enable safe and effective installation of machinery and equipment. Interpret information and data provided e.g. operator's manual, customer reviews. Summarise information. Convey technical information to different audiences. Verify machinery and equipment is prepared to requirements e.g. customer order. Use open and closed questions to gain information. Present information and ideas orally to others. Check understanding of others.

• how the software ensures effective performance • how the software is used to support maintenance activities • methods used to adapt software during and following maintenance activities including installation, updating, amending, licensing. The relationships between the environment (e.g. climate, soil types), maintenance schedules (e.g. timescales, activities) and operation (e.g. incorrect use, incorrect application) of complex land-based equipment and machinery and the implications for installation and handover information and activities. Types of fluids used in land-based machinery and equipment (including coolants, lubricants and gases), • their properties • how the properties affect their application and performance. Techniques (including sensory inspection) used to verify machinery and equipment operates to specification after installation. Current and emerging technologies and their effect on system operation and integration. **Legislation** The legal requirements when installing and handing over a new or used machine including the technical advice and assistance that can be offered to customers. The benefits and limitations of terms and conditions of warranties (including extended warranties) and licences	

• terminology associated with warranties and licences. **Installation Operations** The requirements for preparing machinery and equipment to be presented and installed with the owner / operator e.g. checking customer order, cleanliness, operational checks, performance capabilities. Characteristics of installation sites (e.g. noise levels, potential bystanders, space, topography) • their suitability for specific installation requirements • actions required to ensure the site is suitable. **Handover of Machine** The techniques used to establish that the machine operator can operate the installed machine and understands information provided on completion of the installation e.g. (observation, questioning, demonstration). The processes used to establish customer satisfaction e.g. customer satisfaction surveys, customer visits. Types of customer related issues that may be encountered when installing and handing over machinery equipment and how they arise (e.g. customer expectations, machine performance). The information required by the operator as part of the handover including how to operate machinery and equipment, the safe stop procedure and reasons for use, the importance of the operator's handbook, the meaning of universal symbols in the operator's handbook, maintenance and	

warranty requirements, the importance of serial numbers, issues related to second-hand equipment and machinery. **Information and data** The information, documentation and equipment required prior to installing machinery and equipment. The information required to complete the installation documentation, including acceptance criteria and meet legislative requirements.	

Occupational Specialism: Livestock production

Performance Outcome 1: Establish conditions for animal breeding

This performance outcome should take students to the point of birth but does not include birth.

This occupational specialism relates to cattle, sheep/lamb, pig and poultry production. For this performance outcome, students are expected to acquire knowledge related to all types of animals and the skills to work with two.

Knowledge	Skills
Legislation and regulation Hazards that can lead to health and safety, hygiene issues • risks associated with establishing conditions for livestock breeding • the associated control measures that should be applied, including first aid techniques. **Animal biology** Natural and artificial methods of insemination • the benefits and limitations • suitability for different situations (e.g. breed, business targets). Physiology of the male and female reproductive systems of different farmed animals including • their purpose • the structures of those systems • how the different elements interrelate to ensure they function effectively • the estrus cycle • primary and secondary signs of heat	Visually assess animals' health. Visually assess animals' mobility. Capture an animal from within a herd / flock. Isolate an animal from a herd / flock. Take animals' temperature. Physically measure animals' weight. Operate restraint equipment e.g. cattle crush, rope halter. Apply markings to animals. Physically check the condition of the anatomy for breeding e.g. udder, eggs. Calculate calving/lambing/hatching time. Calculate nutritional requirements when in calf. Provide a vitamin bolus. Prepare semen for artificial insemination (AI). Identify number on AI straw. Thaw AI straws. Load semen into gun. Maintain semen at correct temperature. Use online applications to communicate with others.

• characteristics that suggest suitability for breeding • gestation periods. Types of different farmed animal breeds including • their key characteristics • their suitability for different environments • their suitability for different production requirements e.g. short-term achievement of meat-based products, non-meat-based products (e.g. milk, wool). **Animal health and welfare** The five welfare needs of animals (e.g. how eggs are stored, how cows should be handled) and how they are delivered in practice when animals are being prepared for breeding. Potential effect of human-animal interaction on livestock • techniques used to mitigate for negative effects. Techniques used to monitor and assess the health and wellbeing of farmed animals • baseline expectations for farmed animals in different stages of breeding. Nutrition and feed requirements of different farmed animals during different breeding stages (e.g. pre-conception, pregnancy) • sources of nutrients and related supplements	Instruct others how to carry out a task. Assess a situation for adverse health and safety risks. Apply physical dexterity with delicacy. Substantiate conclusions with evidence from data analysis. Create texts e.g. risk assessment, health check report Determine a body conditioning score for livestock. Assess suitability of livestock for breeding (e.g. signs of heat). ***Sheep*** Harness a sheep. Cleanse a teat. Take a sample from a teat. Insert a tube into a teat. ***Poultry*** Set up an incubator. Load eggs into an incubator. Assess the health of eggs (e.g. for breeding, hatching eggs). Collect eggs for breeding. ***Cattle/sheep*** Cleanse a teat. Take a sample from a teat. Insert a tube into a teat. ***Pig*** Prepare accommodation for pig breeding.

• how different nutrients affect health and successful breeding. **Animal breeding** Factors that affect the condition and physical characteristics of different male and female farmed animals (e.g. temperament, heritage, provenance) and the implications for their use in breeding. Genetic reproduction technology (e.g. selective breeding, embryo transfer) • its contribution to animal breeding and husbandry • use in determining breeding stage of livestock e.g. birds in lay, pigs in farrow. Techniques used to handle males during semen collection to maintain good welfare and maximise semen quality. How semen should be maintained (including handling, storage and recording) to maximise semen quality. Procedures (e.g. incubation times) and techniques (e.g. incubation) involved in supporting and monitoring eggs to hatch • characteristics that determine suitability of eggs for incubation • factors that affect suitability of eggs for incubation and hatching. Diseases and ailments that can affect the fertility and pregnancy of different farmed animals • their physical and behavioural indicators	

• action required to prevent and mitigate them • how they are monitored if in existence. **Animal Husbandry Environment** Environmental requirements of accommodation (e.g. ventilation, lighting, heating) used for breeding stock (including poultry) and their impact on successful breeding. Types of technology (e.g. embryonic transfer) and equipment (e.g. incubators, AI straws) used to support effective breeding of farmed animals • their operation • their suitability for different purposes. **Business management** Organisations involved in the end to end process of animal husbandry (including assurance schemes) and their roles in the breeding stage. Performance indicators of the operation and industry (including cost, growth, mortality, waste, hygiene, safety, environmental impact) • how they are used to make breeding decisions regarding animals • how they are monitored e.g. audits • implications for failing to meet performance indicators. The value of breeding and newly bred livestock to a business	

• different types of security measures in livestock production environments • their purposes • suitability for different breeding environments • how they are operated.	

Performance Outcome 2: Rear livestock from birth to production standard

This occupational specialism relates to cattle, sheep/lamb, pig and poultry production. For this performance outcome, students are expected to acquire knowledge related to all types of animals and the skills to work with one.

Students are expected to show that they can collaborate with at least one other person to herd animals.

Knowledge	Skills
Legislation and regulation Hazards that can lead to health and safety, hygiene and welfare risks associated with rearing livestock from birth to production and the associated control measures that should be applied. **Animal biology** Anatomy of the respiratory, digestive, nervous and cardio-vascular systems of different farmed animals including their purpose and structures. Physiology of the respiratory, digestive, nervous and cardio-vascular systems • how the different elements interrelate to ensure they function effectively • how the physiology changes during different life stages. **Animal health and welfare** The five welfare needs and how they are delivered in practice when animals are being reared. Diseases, parasites and ailments that can affect the rearing of farmed animals • how they are caused • symptoms that are displayed • how they can be prevented • how they can be treated	Tag an animal. Feed animals from a bottle / tube. Sterilise a bottle used for feeding. Mix feed to be provided in a bottle. Calculate feed requirements for bottle feeding. Weigh an animal using scales / weigh bands. Spray disinfectant over animal accommodation. Measure animal enclosures. Use hand tools (e.g. brush, spade, fork) to maintain animal enclosure cleanliness and hygiene. Sterilise / disinfect equipment used for food and water. Clean food and water equipment. Cut strings (e.g. on hay bale) with a knife. Place restraints on young animals. Manually lift a young animal and move to another location. Collaborate with a team member. Herd animals. Measure with precision.

• the impact they can have on growth and development. Techniques used to monitor and assess the health and wellbeing of farmed animals • baseline expectations for farmed animals at different life stages • the types of restraints (e.g. pig board, cage) and other equipment (e.g. weighing equipment) that can be used, their suitability for different animals and situations and how they are applied. Nutrition and feed requirements of different farmed animals during different stages of development • sources of nutrients and related supplements • how different nutrients affect their health, welfare and growth • types of equipment used to provide food and water to farmed animals. Characteristics of farmed animals that indicate they are ready for production (e.g. from hatching to despatch as layers or broilers) and how they are monitored. Accommodation requirements (e.g. ventilation, stocking densities) of different farmed animals at different growth stages • the effects of poor accommodation on growth • the types of equipment required e.g. heaters, shed alarms • how accommodation requirements are maintained	Cost (individual components/compound individual components) a proposal. Configure digital tagging. Transcribe information. Apply physical dexterity with an appropriate application of force. Assess hygiene risks. Manage waste. Maintain personal hygiene. Prepare accommodation for a new arrival. Administer vaccines /vitamins. Calculate stocking densities. Update livestock records e.g. registration documentation. ***Cattle*** Apply a calf coat. ***Poultry*** Debeak a chicken. Determine environmental requirements for growth. Monitor bird growth. ***Pigs*** Provide enrichment. ***Sheep*** Assess teeth quality. Tip a sheep. Age a sheep from its teeth.

including temperature of hatchery, cleaning of sty. The factors that can affect the movement of animals • the condition of animals making them unfit for transport • the equipment and facilities (e.g. lighting, ventilation) required to support the arrival of young animals • the need to avoid stress in animals and techniques used to move and handle them • requirements when transporting animals for different purposes e.g. for transfer to new accommodation, for sale. Vaccinations required by different breeds / species through their life stages • the benefits and limitations of their use in supporting animal growth and meeting production targets • implications for incorrect administration • requirements for storage and application of medicines including record keeping. Factors (e.g. spread of hatch, accommodation) that can affect livestock achieving performance targets for different breeds / species and how to optimise them. **Business management** Organisations and roles involved in the end to end process of animal husbandry (including assurance schemes) and the roles in the growth stage.	

Performance indicators for rearing livestock (including cost, growth, mortality, environmental impact) • how they are used to make decisions regarding animals during the growth stage • how they are monitored e.g. standard operating procedures • implications for failing to meet performance indicators. Types of technology and equipment (e.g. brooders, EID tags, software) used to support effective rearing of farmed animals, their operation and suitability for different purposes. Ethical issues associated with the rearing of animals including animal-human interaction • how these are resolved, including expectations and requirements of the wider supply chain e.g. the public, supermarkets. Requirements for registering the birth of livestock • techniques used to identify livestock including tagging • the importance of traceability and how this is managed. The value of livestock to a business at different growth stages • different types of security measures in livestock production environments • their purposes • suitability for different types of livestock in different environments • how they are operated.	

Performance Outcome 3: Optimise livestock production

This occupational specialism relates to cattle, sheep/lamb, pig and poultry production. For this performance outcome, students are expected to acquire knowledge related to all types of animals and the skills to work with one.

Knowledge Specific to Performance Outcome	Skills
Legislation and regulation Hazards that can lead to health and safety, hygiene and welfare risks associated with optimising livestock production and the associated control measures that should be applied. **Animal biology** Physiology of the respiratory, digestive, nervous and cardio-vascular systems • how the different elements interrelate to ensure they function effectively • how the physiology affects production quality and yield • faeces and urine output and abnormalities and implications for production quality and yield. **Animal health and welfare** The five welfare needs and how they are delivered in practice when animals are being used for production. Health and welfare issues (including condition of coat, eyes, ears, nose / beak, mouth, feet and behavioural issues) • physical and behavioural symptoms that indicate issues • actions required to mitigate them • how they are monitored e.g. taking temperatures, measuring weight.	Hitch a trailer to a tractor. Reverse a tractor with a trailer 10 metres in a straight line. Reverse a tractor around a corner. Use equipment to move bales of hay/straw/pallets to a trailer. Operate equipment to mix feed. Use equipment to scrape a yard. Restrain an animal limb to carry out a task. Remove wrap / string from a bale. Process animal performance data. Validate animal performance data. Identify discrete steps involved in completing a complex task. Sequence and prioritise steps. Estimate time and resources. Allocate resources. Apply physical dexterity with precise and controlled movements. Apply a logical approach to solving problems. Represent animal performance data using mathematical diagrams. Remove litter from the site. Clean equipment for storage. Apply biosecurity measures.

Nutrition and feed requirements of different farmed animals during production • sources of nutrients and related supplements • how different nutrients affect their health, welfare and production. Techniques used to monitor and assess the health and wellbeing of farmed animals during production. Diseases, parasites and ailments that can affect farmed animals • how they are caused • symptoms that are displayed • how they can be prevented • how they can be treated • the impact they can have on production yield and quality. The factors that can affect the movement of animals • the condition of animals making them unfit for transport • requirements when transporting animals for different purposes e.g. for slaughter, for processing. **Machinery and equipment** Types of equipment and machinery used for monitoring animal production, their characteristics, function, operation and suitability for tasks. Equipment and machinery maintenance • techniques used e.g. servicing, cleaning • how they are applied • implications of poor maintenance.	Assess growth against targets. Apply protective equipment for transportation of livestock. Gather transportation documentation. Visually assess condition of the transport for livestock safety and wellbeing e.g. partitions, level of ventilation. Load livestock onto transport. ***Cattle/sheep*** Strip foremilk from an animal. Use equipment to milk livestock. Set up milking equipment. Clean down milking equipment. Calculate chemicals required to go through milking equipment. Measure water temperature throughout cleaning process. Handle chemicals required to go through milking equipment. Mix chemicals required to go through milking equipment. ***Sheep*** Dip sheep. Shear sheep. Crutch sheep. ***Poultry*** Assess poultry against targeted outcomes. Grade eggs. Store eggs. Prepare birds for transportation. Apply processes to bring birds into lay.

Animal production Factors that can affect performance of farmed animals (e.g. egg quality, milk yield, take off rate) and the different systems used (e.g. indoor, hill based, automated)) • farmed animals' production lifecycles • finishing processes including culling, despatch and transportation • how these factors are optimised to improve yield and quality. Different types of grasses used for livestock production • their characteristics • their suitability for different types of animals, systems and production requirements • factors affecting quality of grassland and how these are managed to support high yield and quality • how to maintain grassland to meet animal needs and high production yield and quality. **Business environment** The livestock farming industry and its trends, breeds, consumption versus production data, supply chain options, types of contracts and implications for the livestock farmer. Organisations and roles involved in the end to end process of animal husbandry (including assurance schemes) and the roles in the production stage. Performance indicators of the production operation (e.g. flock / herd performance, egg quality) and of the industry	

• how they are used to make decisions regarding animals during the production stage • how they are monitored • implications for failing to meet performance indicators. Types of technology and equipment (e.g. robotics, product testing equipment) used to support effective production of farmed animals, their operation and suitability for different purposes. Ethical issues associated with optimising livestock production including animal-human interaction • how these are resolved including expectations and requirements of the wider supply chain. The value of livestock to a business during production and finishing • different types of security measures • their purposes • suitability for different types of livestock used for different production purposes • how they are operated.	

Performance Outcome 4: Maintain areas surrounding the production environment

Knowledge Specific to Performance Outcome	Skills
Legislation and regulations Hazards that can lead to health and safety risks associated with maintaining areas surrounding the production environment (e.g. slurry spillage, working with electrical supply) and the associated control measures that should be applied. Key requirements of biosecurity legislation, regulations, codes of practice and organisational policies and how they are applied to the maintenance of non-production environments. Key requirements of environmental legislation, regulations, codes of practice and organisational policies and how they are applied to the maintenance of non-production environments. **Business** Types of records to be produced and stored in relation to maintenance of non-productive areas and related systems for management of information and data. Costs of maintenance of non-productive areas and implications for profitability and business success. Performance targets for non-productive environments and how they are developed and applied in different situations. Opportunities for use of non-productive environments for financial benefit (e.g. stewardship) and implications for use e.g. meeting assurance requirements. Features of non-productive farm environments (e.g. footpaths, hedgerows, lakes)	Assess health and safety risks. Join wood (e.g. with nails, screws) for styles and fences. Cut wood. Prune hedges. Fix ironmongery (e.g. hinges and locks). Prepare wood for coating. Apply coatings to surfaces. Stone paths. Erect wired fencing. Clear paths. Take a soil sample. Test a soil sample for nutrients. Mow grassland for different purposes (e.g. strip grazing, grass topping). Cut grass for sileage or hay. Bale grass for sileage or hay. Estimate resource requirements. Summarise information and ideas. Use questioning techniques to obtain and clarify information. Identify sources of information. Develop search criteria/questions to be answered. Gather relevant information and data. Audit compliance with assurance scheme requirements.

• standards for maintenance of non-productive areas set by different standards setting bodies e.g. red tractor • the effects of techniques used to protect and enhance non-productive areas e.g. field margin. Wildlife species (e.g. insects, flora) that occur on farmland • their ecology • characteristics of their habitats • techniques used to encourage habitats of beneficial species • benefits and limitations of maintaining species and habitats for the non-productive environment (e.g. assurance scheme requirements) • legal and regulatory requirements for maintaining species and habitats. Risks associated with utilities in non-productive areas (e.g. electricity overhead cables, septic tanks) and the associated controls and PPE requirements. Factors to consider (e.g. costs, legislation, assurance standards) when conserving grass and the techniques used to optimise its use in non-productive environments. Waste management plans • classifications of waste from productive and non-productive environments and their sources • legal and regulatory requirements including Nitrate Vulnerable Zones (NVZ)	

• sources of organic and inorganic waste. **Maintenance** Maintenance techniques used to maintain and repair boundaries (e.g. hedges, ditches, posts) building fabric (e.g. barn walls, doors), and surfaces (e.g. gravel, slabs) habitats (e.g. birdboxes, deadwoods) and how they are applied. The types of assets held in a livestock production and non-production environments and their value of livestock to a business • different types of security measures • their purposes • suitability for different environments • how they are operated. **Machinery and equipment** Characteristics, operation and suitability of different types of equipment and machinery used for maintenance of non-productive areas. Techniques used to maintain equipment and machinery for use including storage, cleaning, calibration, visual and technical checks.	

Occupational Specialism: Ornamental and environmental horticulture and landscaping

Performance Outcome 1: Establish ornamental and environmental horticultural areas

Knowledge	Skills
Ornamental and environmental horticulture areas Types of ornamental and environmental horticultural areas (including public, amenity, botanical, heritage, private) • their characteristics • their purposes • similarities and differences • benefits and limitations (including environmental, health and wellbeing, society and community, economic (e.g. employment GDP). The physical characteristics of a site (including drainage, aspect, topography, exposure and situation (D.A.T.E.S) and its microclimates including • information required to determine characteristics and sources used to acquire the information e.g. observation, maps and plans • implications of site characteristics when establishing ornamental and environmental horticultural areas for different situations e.g. to meet a design brief, for plant selection. Types of common landscaping features including hard (horizontal (e.g. paving, paths), vertical (e.g. walls, fencing), structures) and soft (including planting	Interpret maps and garden design plans. Assess existing physical characteristics, challenges and opportunities for establishment of an ornamental and environmental horticultural area. Identify plants through observation of characteristics. Identify plants through use of research tools (e.g. botanical key, internet). Take a soil sample. Analyse a soil sample. Situate garden features aligned to planned design. Carry out primary soil cultivation using hand tools • apply organic matter to the soil using a spade or a fork • distribute organic matter on the soil surface • use a spade to remove a spit depth of soil • use a spade to create a trench • use a wheelbarrow to move soil • turn over the soil with a spade. Carry out secondary soil cultivation using hand tools • roughly level soil

beds, turf, trees, shrubs, rock gardens, water features) • their purposes • different types • their suitability for different sites and horticultural situations including different aesthetic schemes, heritage styles and maintenance requirements • implications for establishing ornamental and environmental horticultural areas. **Environmental** The potential positive and negative impacts of establishing ornamental and environmental horticultural areas including on flora, fauna, habitats (including human) • measures used to minimise and mitigate for negative impacts • measures used to maximise positive impacts. Factors (e.g. objectives for horticultural area, business values, biosecurity) that influence sourcing of plants and related materials • how provenance of plants and related materials are verified • the economic, environmental and social importance of responsible plant sourcing. Plant species protected by legislation • the potential impact of establishing ornamental and environmental horticultural areas on protected species	• level soil • create a tilth suitable for purpose. Identify hazards on site. Set out shapes from a plan including an irregular shape. Use hand tools to remove weeds from cultivated areas. Use a mechanical device to remove weeds from a cultivated area. Sow in open ground using hand tools: • set out a straight line with a string or other marker • create a drill (furrow) for continuous sowing • create holes for station sowing • sow seeds, bulbs and/or tubers for determined spacing, depth, orientation • cover seeds with soil • label seed planting • irrigate seeds • erect supports for seedlings and / or plants • apply protection for seedlings / plants • remove weeds from a seed bed • broadcast turf seed for determined rate. Calculate sowing requirements for seeds / tubers and / or tubers. Plant in open ground • mark out the site with planting areas

- how to mitigate for negative impacts of establishing ornamental and environmental horticultural areas on protected species
- actions required when protected species are identified, including reporting procedures.

Types of invasive plant species established by legislation that can be encountered when establishing ornamental and environmental horticultural areas

- characteristics that enable identification in an environment
- implications of finding invasive species in an environment to establishing ornamental and environmental horticultural areas
- how to mitigate for invasive species in an environment when planning for and establishing ornamental and environmental horticultural areas.

Plant identification and classification

Plant classification (including families, genera, species, varieties, cultivars, both botanical and legal)

- the format for scientific names according to the international code of nomenclature
- characteristics and morphology that can be used to classify plants
- the techniques (e.g. observation, botanical keys) and information sources (e.g. internet and books)

- make a hole with a hand tool
- insert plant
- firm in plants adequately.

Plant a tree in open ground

- assess the quality of a tree for planting
- dig a hole for tree planting
- loosen the sides of the planting pit
- appropriately loosen the roots of the tree
- position the tree in the planting pit
- spread out the roots
- fill in the hole with soil
- firm the tree into the hole
- stake the tree
- apply a tree tie
- apply pest guards to the tree
- irrigate the tree
- mulch the tree.

Lay turf

- create a fine soil tilth with hand tools
- lay turf onto soil
- butt joints together
- stagger joints in subsequent rows
- firm the turves
- fill cracks with top dressing
- trim turf with hand tools

used to identify plants • implications for inaccurate classification and use of scientific names • the purpose and uses of plant records. Types of plants including monoecious, dioecious, evergreen, deciduous, hardy, tender, annuals, biennials, perennials, herbaceous, shrubs, trees • their key characteristics including physical characteristics, lifecycle, • their contribution to ornamental and environmental horticultural areas • implications for inclusion in ornamental and environmental horticultural areas. **Plant Growth and Development** The physical structure of plants (including roots, stems, leaves, flowers, buds, bulbs, tubers, fruit, seeds) • their functions • their morphology. Physical processes involved in plant growth • including germination, photosynthesis, respiration and transpiration • how these affect plant establishment and growth. Environmental factors which affect plant growth • including microclimate, light, irrigation, nutrients, site specific (including boggy, marginal,	• cover outer edges of turf with soil • irrigate turf Assess health and safety risks. Apply health and safety controls to activities. Use rules and formulae to set out shapes and measurements. Measure with precision. Assess biosecurity risks. Model appropriate behaviour.

aquatic, dry, sunny, shady, sheltered, exposed, frost pockets) • how environmental factors can be applied to the manipulation of indoor and outdoor plant establishment environments • issues arising in plant establishment and growth as a result of sub-optimal growing environments • how these issues are identified • techniques used to remedy these issues. **Soils** Soil types (including loams, clays, silts, sands, organics) and their textures • their characteristics (including pH, nutrient availability and cation exchange, drainage and water holding capacity, organic matter and living organisms in the soil, colour and heat retention, ease of cultivation, existing pollutants, horizons) • techniques used to take a soil sample including the W method • techniques used to determine soil characteristics including texture testing, pH testing, digging a profile pit, a feel test • how soil characteristics affect suitability for different types of plants in different types of ornamental and environmental horticultural areas • how previous land use affects	

characteristics. Types of soil cultivation (including primary, secondary, no dig) • their purpose • manual and mechanical techniques involved • their suitability and scheduling for different types of soil and pan removal • and how they are applied for creating different types of tilth required for seeding, turfing and planting. Soil amelioration methods (e.g. liming, use of hydrogels and mycorrhizae) • how they are used for structure remediation • how they are used for pH remediation • their suitability for the soil and optimum plant establishment. **Establishing ornamental and environmental horticultural areas** How a site operates • private and public realm considerations • logistics of transportation, access, delivery, storage, utilities, signage and use of people, materials and equipment • the importance of keeping a site clear and clean • implications of exceeding optimum time on cleaning • implications for the relationship with client/customer, public and	

other colleagues. Techniques (including offsetting, triangulation, electronic plotting) used to set out (including straight lines, curves, circles) an ornamental and environmental horticultural area • how the techniques are applied accurately, safely and effectively including processes involved, equipment required, information and data required • suitability of techniques for different environments and landscape features. Utilities that may be located in the environment • how they affect establishment plans and activities • information that can be used to locate them • legal requirements. Types of vegetation that can have an adverse effect on plant establishment • their characteristics and morphology and how these are used to identify species • method of spread • implications for the environment and plant establishment activities. Methods of vegetation clearance including hand clearance, chemical clearance and mechanical clearance, heat and cold treatment • legal implications of their use • their suitability for different sites	

and purposes when establishing ornamental and environmental horticultural areas. Considerations for planting (space, depth, orientation, soil, environment, condition and format and quality of stock) of plants (including annual, herbaceous, perennial, shrubs) and trees • sourcing of plants • plant stock type and production method • the processes and techniques to be applied when planting • how they differ in relation to the environment and different plants. Processes involved in direct sowing annual and perennial mixes. Different establishment methods (including seed, turf) for grass areas and benefits and limitations of each. Types of aftercare (nutrition, irrigation, protection) required to support plant and turf establishment until they gain independence in the landscape. The different types of turf surfaces • different uses for turf surfaces • suitability of grass mixes to achieve objectives. Techniques (manual and mechanical) used to sow grass seeds • benefits and limitations • their suitability for different purposes • types of equipment and materials	

required. Techniques used to establish areas of grass by turf • processes to be followed • types of equipment and materials required. **Plant health** Quality characteristics of healthy plants (including vigour, form, balance, root condition, soil condition, turgidity) • methods used to identify the characteristics (e.g. observation, records) • how quality affects planting decisions. Biosecurity measures (including inspection, monitoring, regulation, plant passports, quarantine) and their application when establishing ornamental and environmental horticultural areas. Typical pests (e.g. insects, vertebrates) and diseases (fungal, viral, bacterial) in ornamental and environmental horticulture areas • indicators of their existence • how they enter horticultural areas • implications of their existence to establishing ornamental and environmental horticultural areas • control methods that can be used (including tolerance, cultural control, biological controls, chemical controls) and how these are applied • factors (including Integrated Pest	

Management Systems, impact on non-target species and the environment) that affect decisions about the use of control methods. Typical plant disorders (e.g. wilting, distortion) resulting from poor planting and aftercare and how to mitigate for these. Techniques used to monitor the establishment of plants, trees and turf in ornamental and environmental horticultural areas against design specification • methods used to mitigate for problems and issues identified **Business** The principles of project management (including purpose and scope of the project, milestones and timescales, supply chain, people management, resources, budgeting) • their application when planning the establishment of ornamental and environmental horticultural areas. Site management considerations including planning, allocating tasks, monitoring, setting timescales, checking quality, monitoring health and safety, teamwork, employment rights and responsibilities • how they are applied when managing the establishment of ornamental and environmental horticultural areas. **Communication** Types of plans of ornamental and	

environmental horticultural areas (including drawings, sketches, digital plans) • symbols and conventions to be applied • suitability of different types for different audiences and purposes. **Health and Safety** Typical hazards associated with the establishment of ornamental and environmental horticultural areas and control measures used to minimise associated risks. Types of PPE available for the establishment of ornamental and environmental horticultural areas • their purpose • implications for poor use. **Tools, equipment and machinery** Tools (e.g. spade, trowel), equipment (e.g. wheelbarrow, hoses) and machinery (rotary cultivator, tractor) required for establishing ornamental and environmental horticultural areas • their characteristics and purposes • how they are operated and used accurately, efficiently and safely • how they are maintained including cleaning and storage • their suitability (including limitations) for different tasks involved in establishing ornamental and environmental horticultural areas.	

Performance Outcome 2: Maintain ornamental and environmental horticultural areas

Knowledge	Skills
Ornamental and environmental horticultural areas Types of ornamental and environmental horticultural areas (including public, amenity, botanical, heritage, private) • their characteristics • their purposes e.g. promote and support wellbeing, conservation, economic • similarities and differences • how the type of ornamental and environmental horticultural area affects maintenance requirements. The characteristics of a site (including drainage, aspect, topography, exposure and situation (D.A.T.E.S).) and its microclimates including • information required to determine characteristics and sources used to acquire the information e.g. observation, maps and plans • implications of site characteristics when maintaining ornamental and environmental horticultural areas for different situations e.g. for different types of ornamental and environment horticultural areas, for different microclimates. Types of common landscaping features including hard (horizontal (e.g. paving, paths), vertical (e.g. walls, fencing), structures) and soft (including planting beds, turf, trees, shrubs, rock gardens,	Apply mulch to an area. Mow an area of turf in straight lines using a rotary mower. Improve the health of the turf surface mechanically e.g. aerate, scarify. Irrigate plants with a hose. Prune a hedge with a hedge trimmer. Make a clean cut with secateurs. Make a clean cut with pruning shears. Prune a plant to encourage winter stem colour. Prune a plant to maintain its natural form. Remove annual weeds by hoeing. Remove perennial weeds by digging. Assess the health of plants. Assess risks to plant health e.g. pests, environmental conditions. Assess maintenance requirements for hard and soft landscaping features in a given area. Identify discrete steps involved in completing a complex task. Sequence and prioritise steps. Allocate resources (time, equipment, materials) to steps. Optimise work processes. Manage own time to meet objectives.

water features) • their purposes • different types • implications for maintenance of ornamental and environmental horticultural areas. **Environmental** The potential sources of negative impacts of maintaining ornamental and environmental horticultural areas including on flora, fauna, habitats (including human) • environmental protection measures used to minimise and mitigate for negative impacts when planning and carrying out maintenance activities • measures used to maximise positive impacts. Factors (e.g. objectives for horticultural area, business values, biosecurity) that influence sourcing of materials used for maintenance of ornamental and horticultural areas • how provenance of materials is verified. Plant species protected by legislation • the potential impact of maintaining ornamental and environmental horticultural areas on protected species • how to mitigate for negative impacts of maintaining ornamental and environmental horticultural areas on protected species • actions required when protected	

species are identified, including reporting procedures. Types of invasive plant species established by legislation that can be encountered when maintaining ornamental and environmental horticultural areas • characteristics that enable identification in an environment • implications of finding invasive species in an environment to maintenance of ornamental and environmental horticultural areas • how to mitigate for invasive species in an environment when maintaining ornamental and environmental horticultural areas. **Plant identification and classification** Plant classification (including families, genera, species, varieties, cultivars, both botanical and legal) • the format for scientific names according to the international code of nomenclature • characteristics and morphology that can be used to classify plants • the techniques (e.g. observation, botanical keys) and information sources (e.g. internet and books) used to identify plants • implications for inaccurate classification and use of scientific names when maintaining ornamental and environmental horticultural areas. Types of plants including monoecious, dioecious, evergreen, deciduous, hardy,	

tender, annuals, biennials, perennials, herbaceous, shrubs, trees • their key characteristics including physical characteristics, lifecycle, • implications for their maintenance in ornamental and environmental horticultural areas. **Plant Growth and Development** The physical structure of plants (including roots, stems, leaves, flowers, buds, bulbs, tubers, fruit, seeds) • their functions • their morphology. Physical processes involved in plant growth • including photosynthesis, respiration and transpiration • how these affect plant growth and development • how maintenance activities affect physical processes. Environmental factors which affect plant growth • including microclimate, light, irrigation, nutrients, site specific (including boggy, marginal, aquatic, dry, sunny, shady, sheltered, exposed, frost pockets) • issues arising in plant establishment and growth as a result of sub-optimal growing environments • how these issues are identified • techniques used to remedy these issues and how these are	

incorporated into maintenance planning. **Soils** Soil types (including loams, clays, silts, sands, organics) and their textures • their characteristics (including pH, nutrient availability and cation exchange, drainage and water holding capacity, organic matter and living organisms in the soil, colour and heat retention, ease of cultivation, existing pollutants, horizons) • techniques used to take a soil sample including the W method • techniques used to determine soil characteristics including texture testing, pH testing, digging a profile pit, a feel test • how soil characteristics affect plant health. Soil enhancement methods including but not limited to mulching • different types of mulches, their properties, benefits and limitations of use • how they are used to enhance soil condition and maintain plant health • their suitability for use with different soils in different seasons. **Maintaining ornamental and environmental horticultural areas** Types of maintenance e.g. planned, reactive ad their suitability for different situations and environments	

• the purpose of planned maintenance • the content and formats of planned maintenance programmes • documentation required for maintenance and verification of maintenance activities • types of actions required when issues are identified and implications to the environment and the business. Types of maintenance activities including for • turf (including mowing, scarification, aeration, repair) • trees and shrubs (including pruning) to meet specific objectives e.g. winter colour, safety • plants (including feeding, irrigation) • hard landscaping (e.g. painting, repairs to fencing) • the purpose of the activities e.g. aesthetics, to support establishment and growth • times when activities should be undertaken for different types of features in different types of ornamental and environmental horticultural areas • how planned maintenance activities differ for low maintenance, limited access, limited resource, high profile areas and different types of ornamental and environmental	

horticultural areas • typical timeframes to complete maintenance activities. How a site operates • private and public realm considerations • logistics of transportation, access, delivery, storage, utilities, signage and use of people, materials and equipment • the importance of keeping a site clear and clean • implications of exceeding optimum time on cleaning • implications for the relationship with client/customer, public and other colleagues. Key signs that unplanned maintenance is required • for hard landscaped features e.g. cracked paving, rotting wooden structures • for soft landscaped features e.g. pest damage in turf, sudden death • for trees e.g. branches on the ground, fungi in trunks. The purposes of tree and shrub pruning activities including the removal of dead, diseased, damaged, dangerous and displaced materials, ornamental concerns, formative, to support production of flowers and fruit • the different pruning requirements and correct pruning times of various common plants	

• techniques used for different purposes including hedge cutting, coppicing, pollarding, formative, pruning to natural shape, ornamental specimen • tools required to carry out pruning activities (including secateurs, loppers, saws) their suitability, use and safety implications. Types of vegetation that can have an adverse effect on the maintenance of ornamental and environmental horticultural areas • their characteristics and morphology and how these are used to identify species • method of spread • implications for the environment. Methods of vegetation clearance including hand clearance, chemical clearance and mechanical clearance, heat and cold treatment • legal implications of their use • their suitability for different sites and purposes. The different types of turf surfaces • different uses for turf surfaces • maintenance requirements of different turf species. Nutritional requirements of different types of plants • nutrients available on a site e.g. from soil • sources of nutrient supplements • how to determine the correct	

number of nutritional supplements required • implications of over and underfeeding. Different types of irrigation e.g. natural, hoses, sprinklers • irrigation requirements of different types of plants and suitability of sources to plants • how to apply the use of irrigation equipment without causing harm or damage to the plants and their environments • implications of inappropriate irrigation including over watering. Types of protection required by plants and trees including protection against pests, weeds and climate • the suitability for different types of plants in different locations and seasons. Techniques used for the maintenance of hard structures including paving, ditches, paths, steps, walls, fences. **Plant health** Quality characteristics of healthy plants (including vigour, form, balance, root condition, soil condition, turgidity) • methods used to identify the characteristics (e.g. observation, records) • how quality affects maintenance decisions. Biosecurity measures (including inspection, monitoring, regulation, plant passports, quarantine) and their application when carrying out	

maintenance of ornamental and environmental horticultural areas. Typical pests (e.g. insects, vertebrates), diseases (fungal, viral, bacterial) and disorders in ornamental and environmental horticulture areas • indicators of their existence • how they enter horticultural areas • implications of their existence to maintaining ornamental and environmental horticultural areas • control methods that can be used (including tolerance, cultural control, biological controls, chemical controls) and how these are applied • factors (including Integrated Pest Management Systems, impact on non-target species and the environment) that affect decisions about the use of control methods. Causes of failure in trees including branch failure, uprooting, summer branch drop • indicators of failure • environmental considerations • actions to be taken • health and safety issues arising from failure. **Business** Site management considerations including planning, allocating tasks, monitoring, setting timescales, checking quality, monitoring health and safety, teamwork, employment rights and	

responsibilities • how they are applied when maintaining ornamental and environmental horticultural areas. Factors considered in the development of budgets for maintenance programmes including maintenance options (e.g. low maintenance, high maintenance), business objectives and values, type, purpose and characteristics of ornamental and environmental horticultural area, resources required (human, time, materials, equipment) and available • the implications of budgets to maintenance activities • cost implications of decision-making. **Communication** Types of plans of ornamental and environmental horticultural areas (including drawings, sketches, digital plans) • symbols and conventions to be applied • suitability of different types for different audiences and purposes. **Health and safety** Typical hazards associated with the maintenance of ornamental and environmental horticultural areas and control measures used to minimise associated risks. Types of PPE available for the maintenance of ornamental and environmental horticultural areas	

• their purpose • implications for poor use. **Tools, equipment and machinery** Tools, equipment, and machinery required for establishing ornamental and environmental horticultural areas • their characteristics and purposes • how they are operated and used accurately, efficiently and safely • how they are maintained including cleaning and storage • their suitability (including limitations) for different tasks involved in maintain ornamental and environmental horticultural areas.	

Performance Outcome 3: Install landscape features

Knowledge	Skills
Ornamental and environmental horticultural areas Types of ornamental and environmental horticultural areas (including public, amenity, botanical, heritage, private) • their characteristics • their purposes • similarities and differences • the use of hard landscaping features in the area. The characteristics of a site (including drainage, aspect, topography, exposure and situation (D.A.T.E.S).) and its microclimates including • information required to determine characteristics and sources used to acquire the information e.g. observation, maps and plans • implications of site characteristics to the installation of hard landscaping features. Types of common landscaping features including hard (horizontal (e.g. paving, paths), vertical (e.g. walls, fencing), structures) and soft (including planting beds, turf, trees, shrubs, rock gardens, water features) • their purposes • different types • implications for installing hard landscaping features. Types of water environments (e.g. ponds, canals)	Apply health and safety controls to activities. Apply appropriate posture when completing activities. Interpret plans to locate existing features and services e.g. gas, water electricity. Assess existing landscape features, faults and challenges for development. Adapt drawings to reflect actual features and dimensions of a site. Estimate resources required (including time, people, equipment, materials) to complete installation project. Calculate the volumes of materials required for the installation. Instruct others on health and safety practices required for completion of installation project. Allocate resources (including time, people, equipment, materials) to installation tasks. Assess the project for potential risks of realisation. Dynamically assess site for health and safety risks. Use a range of senses (hear, feel, see) whilst excavating to identify when close to utilities and adapt approach when close to utilities. Measure lines, curves and areas on a site.

• their function in different ornamental and environmental horticultural areas • their construction • implications for installation of hard landscape features. **Environmental** The positive and negative impacts of installing hard landscaping features including on flora, fauna, habitats (including human) • measures used to minimise and mitigate for negative impacts • measures used to maximise positive impacts. Factors (e.g. objectives for horticultural area, business values, biosecurity) that influence sourcing of materials used for the installation of hard landscaping features • how provenance of materials is verified. Plant species protected by legislation • the potential impact of installing hard landscape features on protected species • how to mitigate for negative impacts of installing hard landscape features on protected species • actions required when protected species are identified. **Plant identification and classification** Plant classification (including families, genera, species, varieties, cultivars, both botanical and legal)	Set out installation requirements from information in a construction drawing. Use levelling tools to set out depths, falls and position of features. Compact sub-base / foundation. Dig site area using tools. Apply shovelling techniques e.g. to excavate, to prepare mixes. Confirm alignment of masonry and wood products by sight. Apply mortar to masonry materials. Lay masonry materials to specified configurations. Tap / tamp masonry materials to achieve levels. Point gaps between masonry materials. Mark masonry materials with scribing tools. Cut masonry materials using hand and power tools. Apply manual handling techniques when carrying masonry materials. Remove concrete and debris using hand tools e.g. hammer, bolster. Mix materials (e.g. aggregates, cement, water) for application. Secure timber-based materials for permanent fixing. Cut timber-based materials using hand and power tools. Join timber-based materials with temporary and permanent fixings using hand and power tools.

• the format for scientific names according to the international code of nomenclature • characteristics and morphology that can be used to classify plants • the techniques (e.g. observation, botanical keys) and information sources (e.g. internet and books) used to identify plants • implications for inaccurate classification and use of scientific names when installing hard landscape features. **Plant growth and development** The physical structure of plants (including roots, stems, leaves, flowers, buds, bulbs, tubers, fruit, seeds) • their functions • their morphology. Physical processes involved in plant growth • including photosynthesis, respiration and transpiration • how these affect plant growth and development • how hard landscapes affects physical processes and implications for their installation and installation activities. Biosecurity measures (including inspection, monitoring, regulation, plant passports, quarantine) and their application when installing hard landscape features in ornamental and environmental horticultural areas.	Apply coatings to timber based or masonry materials. Clean tools. Prepare tools for use. Prepare working environment for installation of hard landscape feature(s). Inspect quality of materials e.g. timber based products, masonry. Apply protection to the environment surrounding the installation. Maintain a clean and safe working environment. Represent information and data using mathematical diagrams e.g. maps. Cost an installation project. Apply precise and controlled movements with appropriate application of force.

Soils Soil types (including loams, clays, silts, sands, organics) and their textures • their characteristics • how soil characteristics affect installation of hard landscape features. **Site environment** How a site operates • private and public realm considerations • logistics of transportation, access, delivery, storage, utilities, signage and use of people, materials and equipment • the importance of keeping a site clear and clean o implications of exceeding optimum time on cleaning o implications for the relationship with client/customer, public and other colleagues. Site management considerations including planning, allocating tasks, monitoring, setting timescales, checking quality, monitoring health and safety, teamwork • how they are applied when managing the delivery of an installation project. Existing site features including soft landscaping, hard landscaping, utilities, soil condition, drainage, levels of maintenance • how to assess levels of damage	

• associated risks • implications for installation of hard landscape features. The use of soft landscape features to provide architectural structure to the landscape including hedges, standards, topiary, avenues, lawns, screens, ha-ha's, focal points. Utilities likely to be encountered when installing landscape features • the utilities required for installation and how they are located • utilities avoidance techniques including chamber inspections, ground exploration with hand tools. Protection of the site environment when installing landscape features including protection of plants, trees, growing media, building fabric • including those elements already in place and those that will be introduced to the landscape • techniques to be applied e.g. protecting existing tree root zones, avoiding soil turning to mud, shielding paths from vehicle damage, 'heeling in' plants awaiting their final planting location • how techniques are applied including the effective and efficient use of tools, equipment, machinery and materials. **Hard landscape installation**	

Different types of excavation (including single digging, double digging, trenches, foundations, tree pits) • their function • their suitability for achieving specified outcomes. Different types of surface treatments for ground level construction (including patios, paths, loose aggregates, concrete, cold asphalt, edging, paving, decking, land formation) • their suitability for varying locations • implications for installation of new hard landscape features • requirements to make good following installation of new landscape features. Different types of vertical level construction including posts, fences, walls, steps, pergolas, planters, gazebos, seating) • their purpose • techniques for their effective implementation into landscapes • implications for installation of new hard landscape features • requirements to make good following installation of new landscape features. Different types of cutting techniques for different types of materials (including wood, masonry, metal) • the tools and equipment (including abrasive wheels)	

required for carrying out the techniques • how to operate tools and equipment safely and effectively to achieve required outcomes. Different joining methods for wood, metal, stone and concrete structures • their effectiveness in differing environmental situations • the associated bonding materials (including adhesives, mortar, nails, screws) • mix ratios and consistencies for mortar and concrete required to achieve specific requirements • how they are mixed • techniques for application of joining methods for horizontal and vertical surfaces • the tools and equipment required for carrying out the techniques • how to operate tools and equipment safely and effectively to achieve required outcomes. Irrigation equipment used to water plants and create features • techniques for installation of irrigation equipment. **Information and data** Information and data required for installation activities • risk assessments and method statements, typical formats and content, implications for use and non-compliance	

• symbols, conventions and terminology associated with digitally produced garden designs to aid interpretation and implementation • the content of manufacturers specifications for tools, equipment and materials and implications for failing to follow instructions and guidance. **Health and safety** Safety hazards associated with working in landscaped environments, including the controls (including PPE) that need to be in place to maintain the safety of self, colleagues and visitors to the site. Principles of posture and body mechanics and their application for safe and efficient installation of landscape features. **Business** The principles of project management (including purpose and scope of the project, milestones and timescales, supply chain, people management, resources, budgeting) • their application when planning the installation of hard landscaping features. **Measurement** Standard units of measurement. Techniques for marking and setting out design requirements, including the use of mathematical rules and formulae. **Tools equipment and materials** Types of tools, equipment and materials used for measuring, marking out,	

cutting, joining, levelling, shaping, installing, soil excavations and assembling landscape features • their characteristics, purpose and suitability for tasks • operation and handling requirements. Storage facilities required for different tools, equipment and materials • security requirements for valuable and dangerous tools, equipment and materials • protection of valuable and dangerous tools, equipment and materials • implications of poor storage. Maintenance of tools equipment and machinery • methods of maintenance including cleaning, calibration, sharpening, greasing • implications for poor maintenance to individuals, the landscape and installation tasks. Movement and transfer tools, equipment and materials across varied terrains and heights • techniques to be applied and their suitability • equipment required and their suitability • implications for inappropriate decisions.	

Performance Outcome 4: Manage existing designed landscapes

Knowledge	Skills
Designed Landscapes Types of designed landscapes (including public, amenity, botanical, heritage, private) • their characteristics • their purposes • benefits and limitations (including environmental, health and wellbeing, society and community, economic (e.g. employment, GDP)). The ideological characteristics of a designed landscape • spirit of place/local distinctiveness (e.g. aesthetic scheme, heritage styles) and what makes the site unique • the relationship (including conflicts) between spirit of place / local distinctiveness and functionality, economics and specific objectives of a designed landscape • how this relationship influences the management of existing designed landscapes. The relationship between common landscaping features and the spirit of place/local distinctiveness of a site • different types of features including historical • their purposes of the features in the landscape • the suitability of existing and	Define the spirit of place of an area. Assess the management requirements of a horticultural area in a designed landscape. Create texts e.g. a management plan. Present information orally. Plan the management of a designed landscape. Schedule work for an operational plan. Interpret a designed landscape plan. Convey technical information to different audiences e.g. staff, members of the public. Summarise information and ideas. Synthesise information e.g. from different site assessment techniques. Assess the environmental impact of a proposed horticultural activity on a given site. Propagate plants by seed in pots and two different cutting techniques • fluff growing media • fill containers • firm growing media in containers • sow seeds • cover seeds • prick out seedlings • collect cutting material • prepare cuttings • insert cuttings.

proposed features for different types of designed landscapes. Factors which influence the management of designed landscapes • legal status and protected status of landscape features e.g. buildings, trees • functionality of the designed landscape e.g. visitor requirements, accessibility • aims and objectives of the space e.g. sustainability, environmental improvement, social wellbeing • maintenance requirements and financial and resource implications • the opportunities and challenges these present for the development of designed landscapes. Management considerations • the maintenance (e.g. replacement of planting schemes, expansion of paths) of an area that supports medium and long-term development • factors that need to be taken into account (e.g. site and situation, public access and wildlife, style and maturity of planting) • the implications for management activities and how these are managed • resources (human, financial, physical) required for development and sustainability including ongoing maintenance	Pot on plants, inserting plants into pots and backfilling growing media. • insert plant into pot • backfill growing media. Apply advanced pruning to meet specified objectives. Prune a trained form of shrub or tree. Assess suitability of provided information and data. Create digital media to enhance work. Make effective use of personal space. Assess a situation for potential adverse effects. Apply precise and controlled movements with delicacy. Apply a logical approach to resolving issues / problems.

• factors that affect long term planning (e.g. climate, funding, unexpected findings and short-term planning (e.g. weather, breakages, staffing) and their impact on implementation of management plans • timescales involved in operational implementation of a plan • techniques (including the use of digital software) used to monitor and evaluate progress of the management plan. **Environmental** The potential positive and negative impacts of managing existing designed landscapes including on flora, fauna, habitats (including human) • the purpose and content of environmental risk assessments and how they are conducted • how management of the landscape can be used to maximise the positive and the mitigate for the negative impacts. Factors (e.g. objectives for horticultural area, business values, biosecurity) that influence sourcing of plants and related materials for differing designed landscapes • how provenance of plants and related materials are verified • the economic, environmental and social importance of responsible plant sourcing. Plant species protected by legislation	

• the potential impact of developing existing designed landscapes on protected species • how to mitigate for negative impacts when managing existing designed landscapes on protected species • actions required when protected species are identified. Types of invasive plant species established by legislation that can be encountered when managing existing designed landscapes • characteristics that enable identification in an environment • implications of finding invasive species in an environment to the management of existing designed landscapes • how to mitigate for invasive species in an environment when managing existing designed landscapes. **Plant identification and classification** Plant classification (including families, genera, species, varieties, cultivars, both botanical and legal) relating to existing designed landscapes for different purposes • the format for scientific names according to the international code of nomenclature • characteristics and morphology that can be used to classify plants • the techniques (e.g. observation, botanical keys) and information sources (e.g. internet and books)	

used to identify plants • implications for inaccurate classification and use of scientific names • the purpose and uses of plant records. Types of plants including monoecious, dioecious, evergreen, deciduous, hardy, tender, annuals, biennials, perennials, herbaceous, shrubs, trees • their key characteristics including physical characteristics, lifecycle, • their contribution to existing designed landscapes • implications for inclusion when managing existing designed landscapes. **Plant Growth and Development** The physical structure of plants (including roots, stems, leaves, flowers, buds, bulbs, tubers, fruit, seeds) • their functions • their morphology. Physical processes involved in plant growth • including germination, photosynthesis, respiration and transpiration • how these affect plant establishment and growth in existing designed landscapes. Environmental factors which affect plant growth in existing designed landscapes • including microclimate, light, irrigation, nutrients, site specific (including boggy, marginal,	

aquatic, dry, sunny, shady, sheltered, exposed, frost pockets) • the manipulation of microclimates when developing existing designed landscapes (e.g. improving drainage, adding windbreaks) • issues arising in plant establishment and growth as a result of sub-optimal growing environments • how these issues are identified • techniques used to remedy these issues **Soils and Growing media** Different types of growing media including peat, coir, composted bark, loam, green waste, vermiculite, perlite) • their characteristics and properties • their suitability for use in different situations when developing existing designed landscapes • their suitability for use in the propagation of plants when managing existing designed landscapes • their implications for the environment. Soil types (including loams, clays, silts, sands, organics) and their textures • their characteristics (including pH, nutrient availability and cation exchange, drainage and water holding capacity, organic matter and living organisms in	

the soil, colour and heat retention, ease of cultivation, existing pollutants, horizons) • how soil characteristics affect suitability for different types of plants in different types of designed landscapes • how previous land use affects characteristics. Soil amelioration methods (e.g. liming, use of hydrogels and mycorrhizae) • how they are used for structure remediation • how they are used for pH remediation • their suitability for the soil and optimum plant establishment. **Plant propagation for collections management** The conditions and environments required for plant propagation • types of facilities including polytunnels, glasshouses and coldframes, outdoors, their characteristics, benefits and limitations for different purposes • conditions required for plant propagation (including light, sterility, humidity, irrigation, heat, ventilation) • techniques and equipment used to monitor and adapt conditions to manipulate growth in protected environments. Propagation by seed	

• the suitability of seed propagation for a range of plants • timings of propagation by seed including seasons and germination times • seed treatments (e.g. stratification, scarification), their purpose, their suitability for different seeds, their application • techniques for sowing seeds (including small, medium and large seed) in containers and their application • aftercare requirements for sown seeds for different types of seeds (including mist benches, irrigation) to support germination and their application. Propagation by vegetative means • techniques for different vegetative propagation methods (including cuttings (including soft tip, semi-ripe, leaf, hardwood), ground layering, grafting, division) • the suitability of the types of vegetative propagation for a range of plants • timings of propagation by vegetative means including appropriate time of year and rooting periods • types of propagation material and factors that influence the selection including maturity and provenance	

• aftercare requirements of vegetative propagation (e.g. fogging units, heat application) Plant propagation plans • quantities required to meet management objectives • scheduling of activities including sequencing, timing, prioritisation • resource requirements e.g. space, equipment • legal framework around plant production including plant breeders' rights and restrictions on propagation of wild sourced plants. Process for growing on plants in a production environment • including potting on, irrigation and feeding • techniques for potting on including manual, machine based • techniques for irrigation e.g. hose, overhead • techniques for feeding in a plant production environment e.g. dosing pump • tools, equipment and materials required • the suitability of techniques to meet different management objectives. **Advanced pruning** Objectives to be achieved by advanced pruning including space, style, functionality, form, propagation, seasonal interest	

• suitability of different plants for advanced pruning • plant responses to pruning events e.g. apical dominance, compartmentalisation • advanced techniques for creating an ornamental specimen, fruit in trees and bushes, winter colour, topiary, a specified foliage size and inclusion in a planting scheme and how these are applied • advanced techniques for manipulating, clinging, self-supporting climbing plants and well-trained shrubs including support techniques • how techniques are applied safely and effectively. **Aquatic and marginal areas** Types of water features and aquatic environments and their use in different landscape contexts • types of planting areas in aquatic environments e.g. marginal, bog and their suitability for different types of plants • management requirements of aquatic features including seasonal maintenance, f water quality, safety and aesthetics, plants • the risk to aquatic environments from horticultural operations. **Health and safety** Typical hazards associated with the management of designed landscapes	

ornamental and environmental horticultural areas and control measures used to minimise associated risks. Types of PPE available for the management of established designed landscapes of ornamental and environmental horticultural areas • their purpose • implications for poor use. **Tools, equipment and machinery** Tools (e.g. secateurs, pruning saw), equipment (e.g. mist units) and machinery (tractors, computers) required for the development of established designed landscapes • their characteristics and purposes • how they are operated and used accurately, efficiently and safely • how they are maintained including cleaning and storage • their suitability (including limitations) for different tasks involved in managing ornamental and environmental horticultural areas.	

Occupational Specialism: Tree and woodland management and maintenance

Performance Outcome 1: Grow trees and woodlands

Knowledge Specific to Performance Outcome	Skills
Health and safety Typical hazards and risks associated with growing trees and woodlands (e.g. soil and water borne diseases) and control measures to be put in place to mitigate these risks. **Environment** Characteristics of ecosystems found in different landscapes (e.g. parks, woodland) • the contribution made by trees to ecosystems and habitats including ecosystems services • the role of trees, wood and woodlands in the carbon, water and nutrient cycles • how ecosystems affect tree planting decisions. The health, environmental and economic benefits and limitations of trees and green infrastructure in urban areas and woodland • how benefits are increased • how limitations are minimised • products and uses e.g. timber, recreation and learning • how benefits and limitations affect tree planting decisions. **Business** Similarities and differences in how arboriculture and forestry organisations obtain revenue	Sow seeds. Take cuttings. Prepare cuttings for propagation. Graft trees. Bud trees. Pot plants. Spray materials onto tree stocks Obtain information on sources of tree stocks from different information sources Clear sites for tree growth operations using hand tools and mechanical equipment. Assess soil type and condition. Prepare soils and growing media for tree planting. Assess condition of tree stock. Dig planting pits. Position trees to planting plan and planting line. Apply tree protection materials e.g. mulch. Apply tree supports. Measure quantities of materials with precision. Convey technical information to different audiences.

• how arboriculture and forestry organisations maximise revenue generation opportunities. Organisations in the supply chain and their role • the role of the marketplace in determining price • the factors that affect price • how this is used to support tree planting decisions. Factors that can affect profitable tree and woodland operations e.g. additional time, increased waste, damage to the environment • methods used to minimise negative factors during preparation, operation and post operation. **Tools and materials** Types of tools (e.g. grafting knife, spade materials (e.g. stakes, ties) required for tree planting related operations • their characteristics • function • preparation requirements e.g. checks/inspections, adding materials, calibration • operation • suitability for carrying out tasks in different environments • maintenance and storage requirements to manufactures' requirements. **Tree biology, botany and health** The characteristics of different types of parts of a tree including leaf, bud, flower,	

seed, reproductive parts, branches, stems, basal flare, root • their function • structure • their role in the tree life cycle • how they interrelate to support each other • processes involved in tree development e.g. photosynthesis, respiration, transpiration, reproduction • implications of tree growth from dysfunction in tree parts and processes Plant growth responses e.g. phototropism, gravitropism, thigmotropism, hydrotropism. Factors affecting plant growth and development including environmental, microclimate, light, water, nutrients • typical plant responses to these factors. Tree root growth and morphology and the implications on tree survival and the immediate growing environment. Abiotic and human causes of ill health and damage to trees • their symptoms • implications for growth and development. Typical pests, (e.g. moths, beetles, aphids, mammals) • their characteristics (including life cycle, dispersal) • methods of prevention • implications of pests to tree growth and development	

• the benefits and limitations of treatment options • monitoring and risks of contagion to other trees and the local environment. Typical pathogens, (e.g. rusts, blotches, bracket fungi, phytophthora), their characteristics (including life cycle, dispersal) • implications to tree growth and development • methods of prevention • the benefits and limitations of treatment options • monitoring and risks of contagion to other trees and the local environment. Tests (including soil and foliar sampling) and associated technology (e.g. chlorophyll fluorimeter) • samples to be taken • how samples are taken • when samples are taken • why samples are taken • information provided by samples on ill health. Key responsibilities under plant health legislation when planting trees. **Tree stocks and Tree Planting** Principles and purpose of nomenclature and taxonomy systems • position of trees and shrubs within the taxonomy of the wider kingdom • characteristics and morphology of common tree and shrub families, genera, species and variety at differing life stages • techniques (including botanical keys) and information sources (e.g.	

literature, digital technology) to aid correct identification • the value of using and writing scientific names and implications for improper use • types and use of tree tags and signs Different types of propagation including by seed, cuttings, grafting, budding, layering • how materials (e.g. seed, cutting) are obtained • the processes involved • the benefits and limitations of each type • their suitability for different species and environments • identifying features of each type used Factors that influence the choice of tree species (including biological, ecological and economic) • how they affect decision making for different environments (e.g. urban, parkland, woodland) • how they impact on meeting different management objectives (e.g. timber, amenity, shade, habitat). Characteristics of different tree planting stock types (e.g. containerised, root ball, whips, plugs) and their suitability for different environments. Characteristics of good quality stock plants (e.g. health, size, root stock) • how to grow trees of good health • how these are used to assess the condition of plants and materials against specification.	

Characteristics of responsible sources for tree stocks including biosecurity measures, sustainable propagation, working practices of labour. Tree planting techniques (e.g. pit, notch, tree spade), including support and protection • their suitability for different stock types (e.g. whips, standards, semi mature) and environments (e.g. exposure, vandalism) and purpose (e.g. restocking, afforestation, specimen plants, amenity plantings) • how they are applied including equipment and materials required. Types of aftercare for establishing trees in both forestry and arboriculture environments e.g. formative pruning, tie and stake adjustment, pest and disease control • how they encourage independence in the landscape, growth and development • their implications for long term tree management, function and wood quality • factors affecting their application (e.g. aspect, stock type) • how they are applied in after tree planting. Tree planting plans in arboriculture and forestry • information required from site survey to recommend species, stock, protection, support and aftercare. • specifications for planting stock • design and format of plans and sketches including locations of	

trees, stock and planting specifications. • marking out of site. **Soils and growing media** The properties of different types of site soils (e.g. clay, sandy) and growing media for propagation (e.g. peat, peat free, vermiculite) • characteristics • how soils and growing media are formed • their impact on tree selection and growth • methods of assessment. Techniques for preparing (e.g. drainage), cultivating (e.g. ploughing) protecting (e.g. mulching, erosion prevention) and manipulating (e.g. fertilisation, aeration) soils and growing media for tree growth • the suitability of techniques for different soils and growing media, environments and tree species • how they are applied in practice. **Woodland management and maintenance** Growing trees by artificial and natural regeneration • benefits and limitations of each approach to meet different management and site objectives e.g. improving timber quality, timber quantity • factors (e.g. space, light, shade) that affect successful establishment and how these are used to support management decision-making. **Information**	

Types of information required for growing tree operations including work specifications, tree planting plans, different types of maps (including Ordnance Survey (OS), sketches, computer aided (CAD)) • their content and format • conventions and symbols • how they are produced • how they are used in planning and carrying out operations.	

Performance Outcome 2: Undertake complex felling operations

Students must develop skills to carry out complex felling operations with a chainsaw in a woodland area and with an obstacle for rigging.

Knowledge Specific to Performance Outcome	**Skills**
Health and safety Typical hazards and risks associated with undertaking complex felling operations (e.g. falling debris, power lines), and control measures to be put in place to mitigate these risks. Responsibilities of key roles in felling sites in relation to the FISA Guidance on Managing Health and Safety in Forestry document. **Environment** Environmental legislation, regulations and codes of practice relating to conservation, plant health, wildlife, pollution and water quality • relationship between legislation, regulations and codes of practice • responsibilities placed on organisations by environmental legislation, regulations and codes of practice when planning and carrying out felling activities. The purpose of environmental risk assessments, • their relationship with other documents e.g. forestry management plan • the content of an environmental risk assessment • how environmental risk assessments are conducted • the site factors that need to be incorporated into an environmental risk assessment (e.g. terrain, ground	Inspect lifting equipment. Locate trees to be felled from information sources e.g. a map, planting plan. Set out worksite signage and controls (highway & non highway). Prepare tools and machinery for use including hand tools, chainsaw, wood chipper. Clean tools and machinery. Operate tools and equipment on and off ground. Fell trees over 380mm with assisted felling techniques. Fell trees using aerial rigging techniques. Support aerial tree rigging operations from the ground. Cut wood using step cuts. Cut wood using directional cuts. Cut timber to length. Manually move and stack timber e.g. roll, lift, use of aids. Lift and drag branches. Rake ground to clear debris. Sort timber to product specification. Load a woodchipper. Make good the felling area.

conditions, vegetation type, season, weather, proposed operations, management approach) their interrelationships and how they are managed **Business** Stakeholders in the supply chain (including land/tree owners, land agents, contractors, subcontractors, Forest Works Manager) and their role • the role of the marketplace in determining price and the factors that affect price • the relationship between price and management decisions (e.g. thinning). Factors that can affect profitable tree and woodland operations e.g. distance to market, timber quality site access, obstacles • Options available to minimise negative factors during preparation, operation and post operation (tools, equipment, labour). **Tools, equipment and machinery** Types of tools (e.g. felling bar, wedges), equipment (e.g. Personal Protective Equipment) and machinery (e.g. chainsaws, wood chippers, forwarders) required for tree felling, tree work, and woodland work-related operations • their characteristics • function • preparation requirements e.g. checks/inspections, adding materials, calibration • operation	Undertake routine biosecurity measures e.g. removing debris and soil from clothing, clean machinery and equipment before leaving a site. Use rules and formulae to determine rigging data. Assess health and safety risks.

• suitability for carrying out tasks in different environments • maintenance and storage requirements to manufactures requirements. **Tree biology, botany and health** Characteristics of unhealthy or structurally weak trees (including dieback, bulges, slenderness, infection, infestation, cavities, broken branches, compression and tensile forks, fibre buckling, cracks, ribs, hazard beams) • causes of defects • implications for tree felling and forest products. Characteristics of species causing decay in trees (e.g. *Meripilus giganteus, Inonotus hispidus*) • implications for felling operations • implications for timber use. Characteristics of defects in timber (e.g. knots, grain) • and how this affects felling decisions and operations. • grading of timber • potential uses of timber of different grades. Factors affecting the quality of timber (including tree planting and establishment techniques, storage, handling) and how these are optimised to maximise yield and quality. **Preparing for felling operations** The principles of site management including, • logistics	

• allocation of resources (time, labour, equipment, materials) • decision-making and problem-solving responsibilities • the role of the Forest Works Manager • activities to be undertaken and their application in both arboriculture and woodland contexts. Types of infrastructure that may be encountered when carrying out tree and woodland operations e.g. roads, power lines • key requirements of related legislation • implications for planning and completing felling operations. Features and designations (e.g. of ancient monuments, archaeological digs) of sites where tree and woodland operations take place including terrain, buildings, ground conditions, climate and microclimate, geology, hydrology, existing tree species, access, timing, habitats and their effect on • the preparation for felling operations • the types of felling operations that can be undertaken • successfully meeting objectives. Potential damage to the environment caused by tree and woodland felling operations • causes of damage • levels of damage acceptable • how unacceptable levels can be prevented including techniques, materials and equipment to be used. **Information** Reference sources of information for undertaking tree and woodland work	

operations including British Standards (e.g. BS3998,), Industry Codes of Practice (ICoPs), AFAG/FISA Guidance (Arboriculture and Forestry Advisory Group/Forest Industry Safety Accord), manufactures guidance. • the information provided • their status in relation to regulatory and legal requirements. Types of information required for tree and woodland management and operations including work specifications, tree planting plans, different types of maps (including Ordnance Survey (OS), sketches, computer aided (CAD)) • their content and format • conventions and symbols • how they are produced • how they are used in planning and carrying out operations. **Tree work and felling operations** Tree and woodland operations including: • felling of small trees up to 380mm with hand tools and chainsaws • felling of larger trees over 380mm • assisted felling techniques including winching • sectional tree felling, including the use of rigging equipment • methods for stump treatment or removal and the conditions and situations in which they can be applied cross cutting and snedding • timber extraction systems and their suitability for different situations (e.g. slope, timber use)	

• propping and bracing • benefits and limitations of those operations to different trees in different environments • techniques used to fell trees and their suitability for different trees, in different environments (e.g. residential, woodland) to meet different management objectives (e.g. timber length, firewood) • how to apply techniques safely, to recognised standards and guidance, minimising risks to the operators and the environment. Different forms of ground protection e.g. boards, brash mats • how they are applied • implications for route planning and tree operations. Different purposes for felling trees in arboriculture and woodland management • how the purpose affects the felling technique to be applied and associated operations e.g. ground protection. Techniques for accessing trees for tree works (e.g. rope and harness and Mobile Elevated Work Platforms (MEWP)), • suitability for different trees in different environments • the equipment and materials required • how they are applied when felling trees • current industry good practice. Techniques for aerial cutting of trees from a MEWP and using a rope and harness.	

Different techniques for aerial tree rescue operations • their suitability for different situations • the equipment required • how the techniques are applied. The processing of tree and woodland work arisings e.g. wood chipping, stacking, sorting. **Woodland management considerations** Factors to consider when carrying out felling activities to the UK Forestry Standard including • timber and products • the landscape • cost • access • ownership • woodland management plans • the UK Forest Standard • permissions required e.g. felling licences. Different silviculture systems (e.g. coppice, clear fell, continuous cover • different forestry thinning regimes (e.g. pre-commercial, systematic, thinning) • their benefits and limitations. The concept of tree harvesting and techniques that can be used (including motor-manual, mechanical) • their suitability for different species, environments and timber uses • the equipment, techniques, machinery and materials required.	

Methods used to extract harvested trees • their suitability for different species, environments and timber uses • the equipment, machinery and materials required.	

Performance Outcome 3: Maintain trees and woodland to meet prescribed objectives

Students must demonstrate skills of reducing, reshaping and thinning of trees over 15m in height.

Knowledge Specific to Performance Outcome	Skills
Health and safety Typical hazards and risks associated with undertaking maintenance of trees and woodlands e.g. uneven ground, chainsaw use, and control measures to be put in place to mitigate these risks. **Business** Similarities and differences in how arboriculture and forestry organisations obtain revenue • how arboriculture and forestry organisations maximise revenue generation opportunities • how tree and woodland maintenance contributes to revenue generation. Stakeholders in the supply chain (including land/tree owners, land agents, contractors, subcontractors, Forest Works Manager) and their role • the role of the marketplace in determining price and the factors that affect price • the relationship between price and management decisions (e.g. brashing, high pruning, pollarding). Factors that can affect profitable tree and woodland maintenance operations e.g. objectives, access, • options available to minimise negative factors during preparation,	Construct a climbing system. Climb a climbing system. Access trees using a rope and harness. Achieve work position in a tree. Redirect a climbing system. Descend a climbing system. Install a climbing line from ground level. Rescue an incapacitated person from a tree. Position a ladder for a safe climbing ascent. Ascend a ladder to safely access the crown of a tree. Position a MEWP. Operate a MEWP from the basket. Operate a MEWP from the ground level (e.g. rescue). Carry out tree maintenance using a rope and harness and a Mobile Elevated Work Platform (MEWP). Carry out aerial pruning including reducing, reshaping and thinning. Prune trees using the three-cut technique.

operation and post operation (tools, equipment, labour). **Tools, equipment and machinery** Types of tools (e.g. pole saws), equipment (e.g. climbing equipment,) and machinery (e.g. Mobile Elevated Work Platforms,) required for tree work, and woodland work-related operations • their characteristics • function • preparation requirements e.g. checks/inspections, adding materials, calibration • operation • suitability for carrying out tasks in different environments • maintenance and storage requirements to manufactures requirements. **Tree biology, botany and health** Characteristics of unhealthy or structurally weak trees (including dieback, bulges, slenderness, infection, infestation, cavities, broken branches, compression and tensile forks, fibre buckling, cracks, ribs, hazard beams) • causes of defects • implications for tree and woodland maintenance planning and operations. • suitability of different management options (e.g. reduction, thinning, aeration) to alleviate or improve condition. Characteristics of species causing decay in trees (e.g. *Meripilus giganteus, Inonotus hispidus*)	Support aerial tree workers using both Mobile Elevated Work Platform (MEWP) and rope and harness. Prune roots. Minimise / avoid damage to surrounding trees, other plants, animals and structures such as fences, paths and signs. Install bracing. Formatively prune trees from ground level.

• implications to tree and woodland maintenance. **Soils** Techniques for manipulating (e.g. fertilisation, aeration, mulching) soils for tree growth • the suitability of techniques for different soils, objectives, environments and tree species • how they are applied in practice. **Timber and forest products** Characteristics of wood including its structural elements and properties, cell types, cell structure • environmental conditions that affect growth and development e.g. moisture, light. Characteristics of defects in timber (e.g. knots, grain) • their possible causes • how this affects maintenance decisions and operations. Factors affecting the quality of timber (including, environmental conditions) and how these are optimised through maintenance activities to maximise yield and quality. How pruning (including brashing, high pruning, formative pruning) can help improve timber quality. **Preparing for tree and woodland maintenance operations** The key roles and responsibilities of people on tree work and woodland sites (including operative, supervisor/team leader, client, visitor) and their contribution to tree and	

woodland maintenance (including emergency tree work operations) and emergencies. The principles of site management including • logistics • allocation of resources (time, labour, equipment, materials) • decision-making and problem-solving responsibilities • maintenance activities to be undertaken and their application in both arboriculture and woodland contexts. Types of infrastructure that may be encountered when carrying out tree and woodland operations e.g. roads, power lines • key requirements of related legislation • implications for planning and completing maintenance operations. Features of sites where tree and woodland operations take place including terrain, buildings, ground conditions, climate and microclimate, geology, hydrology, existing tree species, access, timing, habitats and their effect on • the preparation for tree and woodland maintenance operations • the types of operations that can be undertaken • successfully meeting objectives. Potential damage to the environment caused by tree and woodland maintenance operations • causes of damage • levels of damage acceptable	

• how unacceptable levels can be prevented including techniques, materials and equipment to be used. **Information** Reference sources of information for undertaking tree and woodland maintenance operations including British Standards (e.g. BS3998, BS8545), Industry Codes of Practice (ICoPs), AFAG/FISA Guidance (Arboriculture and Forestry Advisory Group/Forest Industry Safety Accord), manufacturers guidance. • the information provided • their status in relation to regulatory and legal requirements. Types of information required for tree and woodland management and operations including work specifications, tree planting plans, different types of maps (including Ordnance Survey (OS), sketches, • their content and format • conventions and symbols • how they are produced • how they are used in planning and carrying out operations. **Tree work and felling operations** Tree and woodland operations including: • felling of small trees up to 380mm with hand tools and chainsaws • cross cutting and snedding • extraction of timber and arising • managing the rooting environment of trees • controlling unwanted root growth	

• pruning including natural target pruning, formative pruning, crown thinning, crown lifting, crown reduction, branch reduction • horticultural pruning • propping and bracing • benefits and limitations of those operations to different trees in different environments • techniques used to carry out of tree and woodland operations and their suitability for different trees, in different environments to meet different management objectives • how to apply techniques safely, to specified quality standards and guidance, minimising risks to the environment both undertaking and supporting each technique. Different forms of ground protection e.g. boards, brash mats • how they are applied when maintaining tree and woodland areas • implications for route planning and tree operations. Techniques for accessing trees for tree works (e.g. rope and harness and Mobile Elevated Work Platforms (MEWP)), • suitability for different trees in different environments • the equipment and materials required • how they are applied when maintaining tree and woodland areas • current industry good practice. Techniques for aerial maintenance of trees from MEWP and using a rope and harness.	

Different techniques for aerial tree rescue operations • their suitability for different situations • the equipment required • how the techniques are applied. The processing of tree and wood land work arisings e.g. wood chipping, stacking, sorting. **Woodland management and maintenance** Factors to consider when maintaining woodland environments to the UK Forest Standard including • timber and products • the landscape • cost • access • ownership • woodland management plans • works exempt from permissions. Different silviculture systems (e.g. shelterwood, continuous cover) • their use and implications for woodland maintenance operations how they are applied. Features of woodland infrastructure (e.g. fences, drainage, footpaths, roads, archaeology) • different types of each feature • their suitability in different environments • indications of infrastructure defects • their maintenance requirements.	

Different techniques for control of unwanted woodland vegetation (including manual, motor-manual or chemical) • their suitability for different situations • how they are applied.	

Performance Outcome 4: Manage tree populations and woodlands to meet objectives

Students must demonstrate skills to manage at least two trees that require some form of management e.g. management of soil condition, pruning, felling, tree health care, replanting, reinspection, detailed assessment.

Knowledge Specific to Performance Outcome	Skills
Health and safety Typical hazards and risks associated with undertaking surveys and site visits (e.g. permissions, lone working), and controls measures to be put in place to mitigate these risks. **Environment** Characteristics of ecosystems found in different landscapes (e.g. parks, woodland) • how ecosystems affect tree and woodland management decision making and objectives setting. The health, environmental and economic benefits and limitations of trees and green infrastructure in urban areas and woodland • how benefits are increased • how limitations are minimised • how benefits and limitations affect management decision making and objectives setting. The purpose of environmental risk assessments • the content of an environmental risk assessment • the relationship with other documents e.g. forestry management plan	Locate site boundaries from a map. Verify the accuracy of measuring equipment. Measure the volume of standing timber. Measure a stack of timber. Measure the diameter of timber at breast height (DBH). Measure the diameter of trees at 1.5m above ground level. Identify silvicultural system in use. Forecast timber yields. Assess tree health. Assess risks from trees. Take and preserve samples e.g. leaves, fungi, insects. Estimate tree age. Assess a tree against criteria for a Tree Preservation Order. Assess tree quality by the cascade chart. Determine minimum root protection areas. Draw a basic tree location plan digitally. Amend a basic tree location plan digitally. Create a Tree Constraints Plan. Value trees. Identify common tree and plant species.

• how environmental risk assessments are conducted • how site variables (e.g. terrain, proposed operations) affect decision making. **Business** Factors that can affect profitable tree and woodland operations (including organisation purpose and objectives, market prices and fluctuations, tree and woodland operations, waste, damage to the environment) and how this affects tree and woodland management decision making and objectives setting. **Tree biology, botany and health** The characteristics of health, unhealthy and structurally weak trees • how they relate to different parts of a tree and their interrelationships • characteristics of wood cells and their effects on tree growth and fungal decay • factors that affect growth (including tree root growth) and development • abiotic and human causes of ill health and damage to trees • implications on tree survival and immediate growing environment from dysfunction • typical pests and pathogens, their characteristics and methods of management and prevention • implications of tree health for the management of tree populations and woodlands.	Identify the presence of common pests / diseases / disorders. Input tree survey data into digital software.

Tests (including soil and foliar sampling) and associated technology (e.g. chlorophyll fluorimeter) • samples to be taken and their purpose • processes followed to take samples • their use in tree and woodland management decision making and objectives setting. **Tree stocks and Tree Planting** Principles and purpose of nomenclature and taxonomy systems • position of trees and shrubs within the taxonomy of the wider kingdom • characteristics and morphology of common tree and shrub families, genera, species and variety at differing life stages • techniques (including botanical keys) and information sources (e.g. literature, digital technology) to aid correct identification • the value of using and writing scientific names and implications for improper use • types and use of tree tags and signs. Factors that influence the choice of tree species (including biological, ecological and economic) for different environments (e.g. soils, urban, parkland, woodland) and to meet different management objectives (e.g. timber, amenity, shade, habitat). Characteristics of different tree planting stock types (e.g. containerised, root ball, whips, plugs)	

• the associated tree planting techniques • the types of aftercare used • associated guidance and standards e.g. BS8545 • their suitability for meeting different tree and woodland management objectives. Characteristics of responsible sources for tree stocks and the economic, environmental and social importance of responsible tree sourcing. **Timber and forest products** Factors affecting the quality of timber (including tree planting and establishment techniques, storage, handling) and how these affect management decisions for maximising yield and quality. **General surveying and management** Features of sites where operations take place (e.g. woodland, urban) including terrain, buildings, ground conditions, climate and microclimate, geology, hydrology, existing tree species, access, timing, habitats and their effect on • their effect on tree and woodland operations that can be undertaken • the implications for tree and woodland decision making and achieving objectives. Plans, sketches and mapping • techniques for digitally creating and editing (including scaling, identifying specific trees and features). • hand drawn styles and appropriate use.	

• their content and format • conventions and symbols • how they are used in planning, reporting and undertaking practical operations. Tree measurement • parts of tree measured • methods (e.g. over bark, under bark) • equipment required (e.g. tape measure, clinometer) • basic mensuration units and terminology for forestry and non-forest trees (e.g. diameter, length, volume) • information sources used (including yield tables, measurements, equations, calculations) and their suitability for different purposes (e.g. log volume) • methods to determine stocking density. Methods to estimate tree age (e.g. Mitchell, White) • how they are applied • their suitability for different purposes and locations. **Managing woodlands** Woodland maintenance operations (including brashing, high pruning, formative pruning) and thinning regimes used to meet management objectives and contribute to forest management plans	

• the techniques and resources required (including time, labour, materials, equipment) • time periods when best undertaken to meet management objectives e.g. improve timber quality. Types of woodland (e.g. ancient, natural) • their characteristics (trees, site, ecology, horizontal and vertical structure) • their features (e.g. fences, drainage, footpaths, roads, archaeology) • their benefits to silvicultural systems • protections provided by law • the relationship between characteristics, features, legal protections and silvicultural systems and management decision making and objective setting. Woodland management plans • typical content • factors to consider in development (including timber and products, landscape, risk, cost, access, fire, ownership) • relationship to UK Forest Standard • their use in setting and reviewing management objectives, making management decisions and monitoring tree and woodland management activities. Different silviculture systems (e.g. coppice, continuous cover) • their characteristics	

• their benefits and limitations to different environments • benefits and limitations of artificial and natural regeneration for different systems • factors (e.g. space, light, shade) that affect successful tree establishment and how these are used to support management decision-making • different forestry thinning regimes (e.g. pre-commercial, systematic, thinning) and their benefits and limitations • tree harvesting techniques and methods (including motor-manual, mechanical) and their suitability for different silviculture systems • methods used to extract harvested trees and their suitability for different silviculture systems • how systems are applied to create habitats, products and timber Different techniques for control of unwanted woodland vegetation (including manual, motor-manual or chemical) • their suitability for different situations • how they affect management decision making and setting objectives. Sampling methods (including systematic sampling, simple random sampling, stratified random sampling) • the suitability of the sampling method to the management objectives	

• the procedures and equipment required to apply the sampling methods. **Managing tree populations** Benefits and limitations of single tree operations (e.g. felling, pruning) to different trees in different environments and how they support meeting management objectives (e.g. light, safety) see how it was previously The role and responsibilities of local planning authorities in relation to tree protection legislation including Conservation Areas, Tree Preservation Orders (TPO) and planning conditions: • methods used for assessing the suitability for a Tree Preservation Order e.g. TEMPO, Helliwell • tree inventory data required for the planning process • associated guidance and standards (e.g. BS3998, BS5837) • the purpose and content of Tree Constraint Plans, Arboriculture Impacts Assessments, Tree Protection Plans and the factors that lead to their implementation • the relationship between planning conditions and developments constrained by trees and permitting work to a TPO tree. Tree inspections • levels and types of surveys and inspections (e.g. formal, informal, detailed), their purposes, characteristics and guidance information	

• inspection methodologies e.g. systematic, diagnostics • data gathering e.g. field notes, tablets, survey programs • qualitative and quantitative approaches to assessing risks from trees. • risk mitigation options e.g. improving tree health, remove target, pruning • reporting of findings e.g. detailed tree inspections, negative recording Direct and indirect damage to surfaces and structures resulting from tree management activities • implications of growing trees near infrastructure • signs of direct and indirect tree root damage • species associated with tree root damage • mitigation measures e.g. root pruning, root barriers, removal • preventative measures including utility pruning • associated guidance and standards e.g. National Housebuilding Council (NHBC) standards • role of the arboriculturist (e.g. not a structural surveyor). Different tree valuation methods (including manual (e.g. Cavat, Heliwell) and digital (e.g. iTree) • their purpose and focus	

• information, data and resources required • processes involved • factors that affect valuation including market forces • their suitability for different purposes and locations.	