



Citrus Orchard Foreman Occupational Learning

Work Scenario Guide

B2: Orchard Layout

Qualification:	110667 – Occupational Certificate: Orchard and Vineyard Foreman
Work Scenario:	B2: Orchard Layout
Learning Area:	B: Lead the establishment of new citrus orchard
Scenario Description:	Your new orchard needs to be placed in a way that maximises sunlight, has good drainage, and fits into the surrounding environment. You must plan the physical orchard layout and oversee the beginning of construction to be sure it is properly performed.

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Alignment Information

Qualification

The content of this learner guide is aligned to the following occupational qualification:

SAQA QUAL ID	Qualification Title			
110667	Occupational Certificate: Orchard and Vineyard Foreman			
Originator				
Development Quality Partner – AgriSETA				
Primary Or Delegated Quality Assurance Functionary			NQF Sub-Framework	
-			OQSF - Occupational Qualifications Sub-Framework	
QUALIFICATION TYPE		FIELD		SUBFIELD
Occupational Certificate		Field 01 - Agriculture and Nature Conservation		Primary Agriculture
Abet Band	Minimum Credits	Pre-2009 NQF Level	NQF Level	Qual Class
Undefined	147	Not Applicable	NQF Level 04	Regular-ELOAC

Modules

The content of this learner guide is aligned to the following modules of the occupational qualification above.

Module Code	Module Title	Level	Credits
Knowledge Modules			
611202-001-00-KM-01	Plant Structure and Physiology	4	5
611202-001-00-KM-02	Vineyard or Orchard Establishment	3	2
611202-001-00-KM-03	Vineyard or Orchard Manipulation Processes	3	8
611202-001-00-KM-04	Harvesting	3	4
611202-001-00-KM-05	Basic Principles of Plant Nutrition	4	4
611202-001-00-KM-06	Crop Protection	3	3
611202-001-00-KM-07	Assets in Horticultural Production	3	2
611202-001-00-KM-08	Farm Business Management and Farming Process Management	4	8
611202-001-00-KM-09	Human Resource Management and Processes	4	8
611202-001-00-KM-10	Overseeing Farming Resource Utilisation	4	8
Practical Skill Modules			
611202-001-00-PM-01	Organise, Allocate and Monitor Availability and Productive Use of Resources	4	5
611202-001-00-PM-2a	Set Team and Individual Performance Goals to Enhancing Team Performance	4	10
611202-001-00-PM-2b	Control Vineyard or Orchard Practices	4	10

611202-001-00-PM-03	Supply Accurate Daily Orchard or Vineyard and Production Information	4	10
Work Experience Modules			
611202-001-00-WM-01	Vineyard or Orchard Resource Optimisation	4	20
611202-001-00-WM-02	Skilled and Motivated Work Team Output	4	20
611202-001-00-WM-03	Daily Orchard or Vineyard and Production Information Availability	4	20

Learning Outcomes

The content of this learner guide is aligned to the following learning outcomes of the modules above.

Knowledge Topics	
Outcome Code	Module Title
KM-02-KT02	Farm Lay-Out
IAC0201	Farm lay-out is described in terms of resource requirements and optimisation thereof
IAC0202	The effect of farm lay-out on natural resources is described in terms of the impact on the protection thereof
IAC0203	Agricultural infrastructure planning and layout principles are explained
IAC0204	The effect of topography on block lay-out and row direction is outlined
IAC0205	The impact of wind condition and direction on row direction and the need for protection of crop is described
IAC0206	The effect of physical soil limitations on block and row lay-out are reported
IAC0207	Free standing systems are compared to trellised systems in order to determine the impact on farm lay-out
IAC0208	Specific requirements regarding production under protection (i.e. hail netting) is discussed
IAC0209	Provision for sufficient cross pollination by the correct lay-out of the orchard is explained
KM-08-KT06	Farm renewal strategy
IAC0603	Planning and costing aspects related to the establishment of new orchards/vineyards are discussed
IAC0606	Planning and costing aspects related to the replacement of orchards/vineyards are discussed
Practical Skills	
PM-01-PS07	Describe the relationship between the farm and the environment in terms of resources
PA0702	Draft a map of the farm and the environment indicating all resources and infrastructure

Chapter 1

Layout and Infrastructure

learning outcomes

The content of this chapter is aimed at helping you to:

- Describe the roles and types of infrastructure needed for a new farm or orchard.
- Design, evaluate, and determine necessary infrastructure for a new orchard.

1. Introduction to Infrastructure

definition

Infrastructure

Infrastructure refers to services and facilities that support day-to-day economic activity, in this case the services and facilities that support citrus production.

Having high-quality, well-maintained infrastructure is an important part of running an efficient, profitable citrus farm. Poorly maintained or lacking infrastructure can slow production processes down and ultimately affect productivity and profitability on a farm. The specific production that is practiced on a farm or in a production area determines the required infrastructure.

Infrastructure is necessary to enable all day-to-day activities on a farm, and is the bare essentials required to operate a commercial farm. Infrastructure can be either external or internal (on-farm).

External infrastructure is infrastructure that is located 'off-farm', and mostly the responsibility of other people or bodies beside the farmer, such as Eskom, cellular networks, and national and local government. External infrastructure includes electricity supply, access roads, and roads and railways to towns, cities, and harbours.

Internal infrastructures include structures built, erected, or bought on or for the farm. Examples are stores and sheds, housing, water storage dams and tanks, roads on the farm, irrigation systems, fencing, vehicles, and equipment.

Different pieces of infrastructure have different purposes and function in different ways. We cannot describe every possible piece of infrastructure that you may encounter on a farm, as the list is very long and varied. Therefore, it is important that you familiarize yourself with the infrastructure on your specific farm.

When establishing a new orchard or farm, production potential (in terms of environmental factors and natural resources) will usually be the main consideration, with infrastructure generally being a secondary element in the decision-making process since infrastructure can be improved or built.

Despite this secondary nature, infrastructure does play a very important role in the planning process. This is because though any needed infrastructure can theoretically be built, the cost can be so high that it can be unfeasible to do so. The medium- and long-term costs of infrastructure development and maintenance must always be considered carefully.

The amount and size of infrastructure required will be determined by the size of the farm. A large farm needs a large internal infrastructure to support all the many activities in the production process. For example, a very large farm may require its own packhouse with all the necessary equipment and workforce. On the other hand, a small farm will usually make more use of external infrastructure, as these small operations may not warrant high expenditure on internal infrastructure.

Infrastructure can also be used to minimize the impact that farming has on the environment. For example, protective barriers can be built to maintain the integrity of wetlands and bunds or dykes can be built to channel run-off to recycle and re-use water.

When reading about infrastructure in this chapter, you may find certain technical terms confusing. Infrastructure (or at least, major infrastructure) should always be constructed with the help of qualified professionals, such as architects, civic engineers, construction firms, electrical engineers, etc. Therefore, it is not necessary for you to understand every technical term and aspect of the infrastructure, but it does help to have a general idea of what we are discussing.

2. External Infrastructure

External infrastructure depends on the location of the farm. The transport of supplies and produce over long distances from remote farms is costly and has a negative impact on the efficiency of production. When considering a new orchard or farm, the following external infrastructure-related factors must be investigated carefully:

- Access roads
- Locality
- Communication systems
- Availability of service providers
- Community services

2.1 Access Roads

Access roads refer to roads that lead to the farm, and are generally the concern of the local Department of Public Works or the local municipality. The quality of access roads must be considered when the decision is taken to develop a farm or orchard. These are the roads that workers must use to get to the farm, and over which fruit must be transported to the packhouse or the market.

2.2 Locality

The following is important in terms of locality:

- Surrounding production area
- Proximity to town
- Road and rail transport

Well-settled citrus production areas tend to develop a citrus culture over the years. This manifests itself in the products and services available, as well as local expertise regarding all production-orientated activities.

2.3 Communication Systems

Communication infrastructure refers to telecommunication and radio systems. In some areas, telephone connections are not available, which makes the management of a farming enterprise more difficult.

2.4 Availability of Service Providers

The availability of the following types of service providers must be considered:

- Suppliers of equipment and stock
- Maintenance services
- Infrastructure design and installation
- Extension services
- Packhouse and cold storage

Service providers are a big part of running a citrus enterprise, as they provide support and production materials in the technical and maintenance fields. Ease of access to their services and goods therefore plays an important role. Day-to-day management becomes increasingly demanding and costly with distance, and therefore availability, of service providers.

2.5 Community Services

The following community services play an important role:

- Shops
- Schools
- Medical services
- Churches

Farms in outlying areas have to make additional provision in remuneration and time for employees and their families to enable them to access the above services.

3. Internal (On-Farm) Infrastructure

When building a new farm or orchard, any necessary internal infrastructure is planned along with the orchard layout as part of the land utilisation plan. On-farm infrastructure includes:

- Fencing
- Farms roads
- Irrigation and water supply systems
- Electricity supply
- Boundary fencing
- Farm buildings
- Sustainability infrastructure

3.1 Fencing

A farm is private property and should therefore be well fenced off with limited access to ensure control of movement and security.

The most common types of fencing that is erected on and around a farm are security fencing, cattle fencing, and game fencing, which includes small game and large game fencing. The types of fencing vary in construction and cost depending on its purpose and where it is erected.

Boundary fencing must be erected according to the title deed for the farm. If it is unclear where boundary of the farm is, a survey must be done to ensure that the fences are put up in the right area.

The type of fencing erected is determined by location of the farm and the purpose of the fence. A boundary fence on a farm that is in a highly populated area near a town has to be much more secure, and therefore costly, than one in a sparsely populated area.

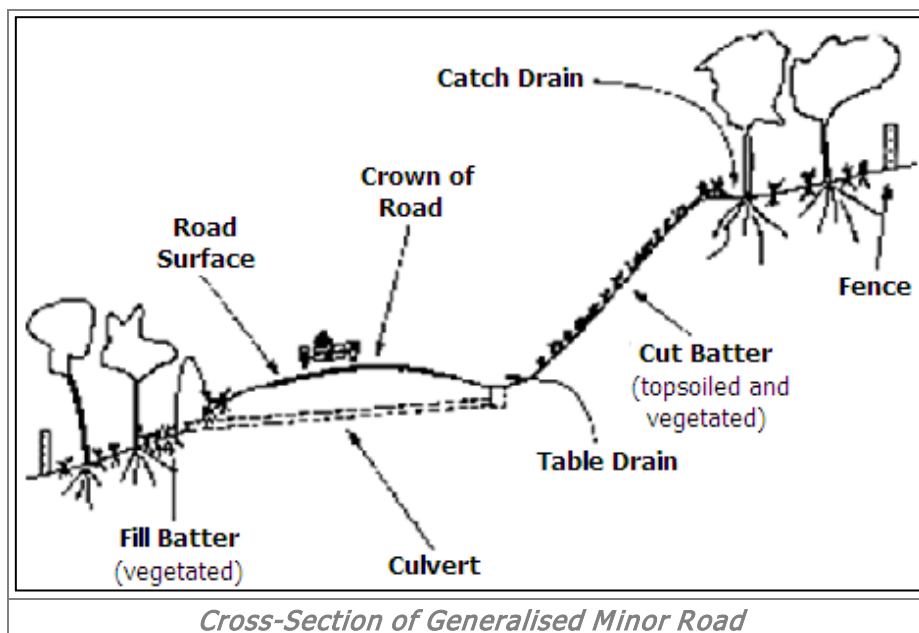
On citrus farms, security fences are sometimes erected around orchards if there is a danger of crop theft. Cattle fencing are also used to keep livestock out of the orchards, where they pose not only a physical danger to the trees, but also a danger of contamination which may compromise food safety. If the farm is located in an area where there is a lot of wildlife, wildlife fencing is used to protect the orchards.

Security fencing, especially if it is electrified, is considerably more expensive than other types of fencing. It is therefore rarely used for a boundary fence, and is more likely to be used to enclose farm buildings, especially housing.

To evaluate existing fencing, determine whether the fences around the farm have been erected according to the title deed of the farm. This is easiest done by having the farm surveyed. All fences should also be in a good condition and effective for what is required, for example a cattle fence will not control movement of game or be effective as security fence around a citrus orchard. Having to erect new fences is costly and should be considered at purchase.

3.2 Farm Roads

The primary engineering function of a road is to provide a surface giving good foot and wheel traction over a range of weather conditions. Usually, this requires a relatively impermeable surface and a transverse crown. In other words, rain should 'shed' off the road, rather than being absorbed or pooling on it, as quickly as possible.



Main roads should be located on ridgelines or at the top of slopes, not in midslope or footslope positions, so that they do not catch and concentrate water flows that cause soil erosion. However, they may be used to divert water flows, provided table drains are designed with adequate hydrological capacity, adequate pipe drainage is incorporated, and water is conveyed to a stable water disposal area (i.e. waterway or natural water course).

Minor access roads within the orchard can be designed in conjunction with waterways or should be located at the upslope end of tree rows. Wherever possible, minimise

road grades and plan to drain runoff generated by roads to natural drainage lines via diversion banks or waterways.

Main roads on a farm should be positioned to serve all main action areas without causing too much farm traffic in and around the orchards. It is ideal to have the offices, packhouse, stores and housing area situated as near as possible to the farm entrance, so that movement in and around orchards is limited and only linked to production.

Farm roads have to be planned very carefully in relation to entrance roads and the location of farm buildings. Traffic to and on the farm are mostly the following:

- Light vehicles for transport and deliveries
- Heavy vehicles delivering items like fertiliser, cement, or sand
- Heavy vehicles transporting bins with fruit to the packhouse
- On-farm traffic such as bakkies, tractors and trailers

Entrance to the farm from the main road should be secure to prevent unauthorised entry. The type of roads that are used, the off-loading and loading areas, and movement on the farm has to be considered very carefully, and especially in terms of safety of movement. The roads that are used most often must not run through or adjacent to orchards to minimise dust on the trees and fruit.

To evaluate existing roads, the two points to consider are access onto the farm and access on the farm to offices, workshops, orchards, and other structures like stores and a packhouse. Access onto the farm should be secure and entrance controllable. Access on the farm to the various work stations and orchards should be such that there is very little movement past orchards by the daily traffic on the farm.

3.3 Irrigation and Water Supply

Irrigation and water supply systems are discussed in detail in the material regarding irrigation installation.

3.4 Electricity Supply

If you are designing a new orchard, you will probably only need to extend an existing power system by adding more lines, if any additional electrical infrastructure is required at all. If, however, you do need to design a new electricity supply system, the first concern is efficiency and cost-effectiveness.

A power supply system should be planned carefully to include possible future development of orchards and infrastructure. Installation of new power supply points is costly and careful attention to initial planning will save costs at a later stage.

Electricity infrastructure includes:

- Main supply – buildings, pump-houses, and pumps
- Reticulation to in-field installations

In South Africa, electricity is supplied to farms by Eskom or certain municipalities who sub-contract to Eskom. As service providers, they have to supply and maintain the service line up to the transformer. The connection from there to where the electricity is needed, such as a building or a pump, has to be installed by a qualified electrician according to prescribed legal standards.

Future needs for expansion of orchards, buildings and other structures must be taken into consideration in developing the electricity supply system. It must therefore form

part of the overall development plan, and it is important to include a representative of Eskom in the planning phase.

Electricity supply to housing, offices, pump-houses, and other structures is required. The quality of the reticulation system, as well as wiring in all existing structures, must conform to local governmental standards and safety regulations in the Occupational Health and Safety Act.

3.5 Farm Buildings

The major types of farm buildings include:

- Housing and Worker Facilities (such as toilets, changing rooms, etc.)
- Stores and Workshops
- Offices
- Packhouses

The placement of the various buildings in relation to other infrastructure and production activities needs to be considered carefully in developing a new farm or orchard. Buildings must be situated so that they will complement the farm activities, as well as assist with management and control.

Farm buildings are normally grouped together for the sake of electricity supply, water supply, and access control. Noise factors must however be considered – for instance, the offices should not be placed right next to the packhouse or maintenance shed.

The extent of housing needed on a farm depends on the size of the farm as well as the distance to the nearest labour source or town. The number of houses that are required increases with the distance from a town or labour source, and special provision must be made for management, middle management, and supervisory staff. The quality of the housing with regard to water supply, electricity, ablution, and runoff has to conform to health, safety and GlobalGAP requirements.

Stores must be planned in such a way that access can be controlled to keep the equipment and stock items secure. Stores must also be easily accessible for authorised persons. There are also special requirements with regard to the design of stores for specific goods, such as agrochemicals, and these requirements must be considered when planning is done.

Offices must be as close as possible to the main access road to the farm to limit on-farm traffic. The packhouse must however be easily accessible from the orchards to limit traffic during harvesting. The packhouse or loading platform should be situated equidistant from the furthest orchards to ensure minimum time lost in transporting the fruit to those areas.

Buildings are not erected regularly, and the investment is usually substantial. The farmer and workers have to live with and use the buildings for a long time. For this reason, careful planning is required to make sure that the building will fit the farm's needs. Again, it is important that you work with reputable, high-quality professionals during the planning and construction of buildings.

All buildings must also comply with local and national regulations with regard to construction, safety, and environmental matters. For certain buildings, such as agrochemical stores, there are very specific requirements, and the farmer must be aware of these when the building is planned.

3.6 Sustainability Infrastructure

The most common types of sustainability infrastructure are bunds, gabions, and wetland contours.

Bunds are constructed to regulate and direct the flow of water. Bunds come in a wide variety of shapes and sizes. Small bunds that are used to divert and channel the flow of runoff water can be easily constructed by using simple tools such as picks and shovels. More complicated and bigger bunds, also called dykes, are constructed using tractors and road scrapers. Some bunds are constructed using prefabricated concrete blocks or slabs that are positioned in place.

Gabions are cages, normally constructed using wire mesh, which are filled with stone and positioned so that they slow down water flow and lessen erosion. Gabions are normally made elsewhere, and brought to the site on trucks where they are then placed in position using cranes. The area where gabions are placed must be prepared and flattened by using shovels and picks or mechanical equipment such as tractors or back actors.

Wetland contours are, depending on the size of contours, constructed using either shovels and picks or mechanical equipment such as tractors, back actors, and road scrapers. Wetland contours should be constructed by professional earth moving companies after an official survey has been performed by environmental agencies.

4. Infrastructure Maintenance

Proper maintenance and repair of infrastructure on any farm is a prerequisite for success. It is important to develop a culture of neatness and care around infrastructure and all production aids within the ranks of management and employees. This is easier said than done, as it requires ongoing attention to detail, training, encouragement, and monitoring from senior management through to supervisors to all employees.

Maintenance and care of infrastructure is discussed in the material regarding general maintenance.

summary

Chapter 1 – Layout and Infrastructure

- Infrastructure refers to services and facilities that support day-to-day economic activity, in this case the services and facilities that support citrus production.
- Poorly maintained or lacking infrastructure can slow production processes down and ultimately affect productivity and profitability on a farm.
- Infrastructure can be either external or internal (on-farm).
- External infrastructure is infrastructure that is located 'off-farm', and is mostly the responsibility of other people or bodies beside the farmer.
- Internal infrastructures include structures built, erected, or bought on or for the farm.
- During orchard establishment, production potential will be the primary consideration, with infrastructure being a secondary element in the decision-making process.
- The medium- and long-term costs of infrastructure development and maintenance must always be considered carefully.
- The amount and size of infrastructure required will be determined by the size of the farm.

- Infrastructure should always be constructed with the help of qualified professionals.
- When considering a new orchard or farm, access roads, locality, communication systems, availability of service providers, and community services must all be considered.
- Access roads refer to roads that lead to the farm, and are generally the concern of the local department of public works or the local municipality.
- In terms of locality, surrounding production area, proximity to town, and road and rail transport are all important.
- Communication infrastructure refers to telecommunication and radio systems.
- Service providers are a big part of running a citrus enterprise, as they provide support and production materials in the technical and maintenance fields.
- Community services that play an important role in production include shops, schools, medical services, and churches.
- On-farm infrastructure includes fencing, farms roads, irrigation and water supply systems, electricity supply, farm buildings and sustainability infrastructure.
- The most common types of fencing that is erected on and around a farm are security fencing, cattle fencing, and game fencing.
- Boundary fencing must be erected according to the title deed for the farm.
- Security fencing, especially if it is electrified, is considerably more expensive than other types of fencing.
- The primary engineering function of a road is to provide a surface giving good foot and wheel traction over a range of weather conditions.
- Main roads should be located on ridgelines or at the top of slopes, as in midslope or footslope positions, so that they can catch and concentrate water flows that cause soil erosion.
- Minor access roads within the orchard can be designed in conjunction with waterways or should be located at the upslope end of tree rows.
- A power supply system should be planned carefully to include possible future development of orchards and infrastructure.
- Electricity infrastructure includes the main supply and reticulation to in-field installations
- In south Africa, electricity is supplied to farms by Eskom or certain municipalities who sub-contract to Eskom.
- The major types of farm buildings include housing and worker facilities, stores and workshops, offices and packhouses.
- Farm buildings are normally grouped together for the sake of electricity supply, water supply, and access control.
- Buildings are not erected regularly, and the investment is usually substantial.
- The most common types of sustainability infrastructure are bunds, gabions, and wetland contours.
- Proper maintenance and repair of infrastructure on any farm is a prerequisite for success.

assessment activities

- ✓ **Activity P1:** Complete this activity to test your knowledge of layout and infrastructure.
- ✓ **Activity F1:** Complete this activity to test your knowledge of the entire module.