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AUSTRALIA, WE'VE GOT YOU COVERED...

GRAIN BUNKER STORAGE GUIDE

COMPLETE CONSTRUCTION & OPERATION PROCESS

TAIL-WIND TARPS

Contents

Introduction

Grain bunker storage has become an increasingly important component of grain handling and storage operations across Australia. Whether used as a temporary harvest storage solution or as part of a long-term grain management strategy, bunker storage offers flexibility, scalability and cost-effective storage capacity when properly designed and managed.

Like any grain storage system, successful bunker storage relies on careful planning and attention to detail. Site selection, drainage, bunker design, cover selection, sealing methods and ongoing management all play a critical role in protecting grain quality and minimising storage losses.

This guide has been developed to provide growers, grain handlers and storage operators with practical information and industry-proven recommendations for establishing and managing grain bunker storage facilities. It outlines the key stages of the storage process, from initial site selection and construction through to filling, sealing, fumigation and eventual grain removal.

While every storage site is unique, the principles contained within this handbook provide a solid foundation for achieving safe, efficient and reliable grain storage.

Benefits of Grain Bunker Storage

When properly constructed and managed, grain bunker storage can offer a number of advantages, including:

- Rapid expansion of storage capacity during harvest.
- Reduced pressure on permanent storage infrastructure.
- Improved harvest logistics and grain handling efficiency.
- Cost-effective storage for large grain volumes.
- Flexibility to accommodate changing seasonal requirements.
- Effective fumigation and pest management when correctly sealed.
- Suitability for a wide range of grain commodities.

As grain production continues to increase and harvest windows become increasingly compressed, bunker storage provides growers with an additional tool to maintain harvest efficiency and maximise marketing flexibility.

About This Guide

This handbook is divided into a series of chapters that follow the complete bunker storage process:

Part 1: Working Safely Around Grain Bunker Storage Systems
Part 2: Site Selection and Positioning
Part 3: Grain Bunker Wall Options
Part 4: Storage Capacity & Size
Part 5: Selecting Bunker Covers
Part 6: Ground Sheets and Bunker Liners
Part 7: Inloading into the Bunker & Fitting the Cover
Part 8: Bunker Management During Storage
Part 9: Fumigation of Stored Grain
Part 10: Grain Removal and Cover Maintenance
Part 11: Technical Support and Further Information

Each chapter contains practical recommendations, operational considerations and key takeaways designed to assist in achieving the best possible storage outcomes.

A Commitment to Quality Storage

At Ellis & Sons Group, we have worked alongside Australian growers and grain handlers for many years, supplying bunker covers, storage systems and practical solutions designed for Australian conditions.

Our commitment to quality, continuous improvement and customer service is reflected in our achievement of ISO accreditation, providing customers with additional confidence that our systems and processes meet internationally recognised quality standards.

Whether you are constructing your first bunker or refining an established storage facility, we trust this guide provides valuable information to support the safe and successful storage of your grain.

We appreciate the opportunity to share our experience and wish you every success with your grain storage program.

Part 1: Working Safely Around Grain Bunker Storage Systems

Grain storage operations involve a range of activities that can expose personnel to hazards including moving machinery, working at heights, heavy manual handling, confined spaces, fumigants and mobile equipment.
While grain bunker storage is a highly effective storage method, it is important that all work associated with bunker construction, filling, covering, fumigation and unloading is conducted in a safe and controlled manner.
Every storage site should operate in accordance with applicable workplace health and safety requirements, equipment manufacturer recommendations and relevant industry guidelines.
The information provided in this guide is intended to complement, not replace, site-specific safety procedures.

General Site Safety

Before commencing any work around a grain bunker:
- Ensure all personnel are familiar with site safety procedures.
- Maintain clear access for vehicles and emergency services.
- Keep work areas free from unnecessary obstacles and trip hazards.
- Ensure adequate lighting is available when working during low-light conditions.
- Restrict access to authorised personnel only.
- Use appropriate personal protective equipment (PPE) for the task being undertaken.

Regular site inspections should be conducted to identify and address hazards before they result in incidents.

Working Around Grain Handling Equipment

Augers, conveyors, loaders and other grain handling equipment contain moving parts that can cause serious injury if not used correctly.

When operating grain handling equipment:
- Follow all manufacturer operating instructions.
- Ensure guards and safety devices are fitted and functioning correctly.
- Never remove or bypass safety guards.
- Keep hands, feet and clothing clear of moving components.
- Shut down equipment and isolate power before undertaking maintenance or repairs.
- Keep bystanders away from operating machinery.

Particular care should be taken when moving augers during bunker filling operations.

Manual Handling and Cover Installation

Bunker covers can be large, heavy and difficult to manage, particularly in windy conditions.

To reduce the risk of injury:
- Use sufficient personnel for cover deployment.
- Utilise mechanical assistance where practical.
- Avoid lifting beyond individual capabilities.
- Follow safe lifting techniques.
- Wear gloves when handling covers, ropes and securing systems.
- Never attempt to install or remove covers during strong winds.

Planning the installation process before commencing can significantly improve safety and efficiency.

Working at Heights
Working on bunker covers can require climbing onto the grain stack. Take extra care, particularly when surfaces are wet, uneven or slippery.

To reduce the risk of slips and falls:
- Wear suitable footwear with good grip
- Maintain secure footing and avoid sudden movements.
- Avoid working in high winds, rain or other poor weather conditions.

Careful planning and sensible work practices will help make working on bunker covers safer and more efficient.

Fumigation Safety
Fumigants used in grain storage can be hazardous if handled incorrectly. Only trained personnel should undertake fumigation activities.

When working with fumigants:
- Follow all label directions and regulatory requirements.
- Wear appropriate PPE as specified by the manufacturer.
- Ensure fumigants are stored securely.
- Keep unauthorised personnel away from treated storage areas.
- Observe all withholding and ventilation periods.
- Monitor storage sites as required throughout the fumigation process.

If uncertainty exists regarding fumigation procedures, professional advice should be sought before treatment begins.

Vehicle and Traffic Management
Grain storage facilities often experience high levels of vehicle movement during harvest and unloading periods.

To minimise risk:
- Establish designated traffic flow patterns.
- Maintain communication between equipment operators.
- Ensure reversing manoeuvres are minimised where possible.
- Use spotters when visibility is restricted.
- Observe all site speed limits.

Well-planned traffic management improves both safety and operational efficiency.

Emergency Preparedness
Ensure basic emergency equipment and contact information are readily available at the storage site.

This may include:
- Emergency contact numbers
- A first aid kit
- Fire extinguishers
- Spill response equipment where required
- A reliable means of communication

Safety First
Successful grain storage relies not only on protecting grain quality, but also on protecting the people involved in the storage operation.

By implementing appropriate safety procedures, maintaining equipment correctly and fostering a strong safety culture, operators can minimise risk while achieving efficient and productive grain storage outcomes.

Disclaimer: *This guide provides general information only and does not replace workplace health and safety requirements, equipment operating manuals, grain industry standards or professional advice. Operators should ensure all activities are carried out in accordance with applicable regulations and safe work practices.*

Part 2: Site Selection and Positioning

Effective grain storage begins with careful site selection and planning. The location and layout of a grain bunker can significantly influence storage performance, grain quality, operational efficiency, and long-term maintenance requirements.
While this guide focuses on grain bunker storage, many of the principles outlined are equally applicable to other grain storage systems.
The following considerations should be assessed when selecting and positioning a grain bunker storage site.

1. Site Selection, Drainage and Earthworks

The bunker site should be located on a well-drained, elevated area with firm, compacted ground and a water table well below the surface. Proper drainage is essential to prevent water accumulation around the bunker and minimise the risk of moisture-related grain deterioration.

The bunker pad should be positioned higher than the surrounding ground level to promote effective drainage and prevent water from entering the storage area. Sites with a natural elevation are ideal, although imported fill can be used to create the required height where necessary. Depending on site conditions, pad elevations of 100–200 mm above surrounding ground level are common.

The finished bunker floor should be smooth, level and free from depressions that may collect water during storage or unloading operations. Ensure the pad surface is firm, stable, and thoroughly compacted to support the weight of loaded trucks, grain handling equipment, and regular machinery traffic. For best results, construct the pad using a quality road base or crushed rock foundation, topped with a layer of fine blue metal and compacted with appropriate rolling equipment. The finished surface should be smooth and free from large rocks, sharp objects, or protrusions that could damage ground sheets. The pad must also be capable of withstanding vehicle movement during both harvest and out-loading operations, particularly during wet weather conditions.

When shaping the pad, incorporate a slight crown or camber through the centre, allowing the surface to fall gently towards both sides. This design encourages any subsoil moisture or surface water to drain away naturally, helping to minimise erosion and maintain pad integrity between storage seasons. A gradient of approximately 1% towards the bunker end is ideal so rainfall drains away from the grain face and helps to prevent water pooling as grain is progressively removed.

The shape of the bunker itself should also be considered during planning. Rounded bunker ends align with the natural loading pattern of augers, creating uniform grain profile and reducing the likelihood of low spots. Square-ended bunkers will cause depressions in the corners, which have be filled manually to prevent water from pooling on the bunker surface.

All vegetation should be removed, and consideration should be given to nearby trees or overhanging branches that may damage bunker covers during adverse weather conditions.

Where possible, the closed end of the bunker should be positioned towards the prevailing wind direction. This can assist with cover deployment and reduce wind-related issues during installation and storage.

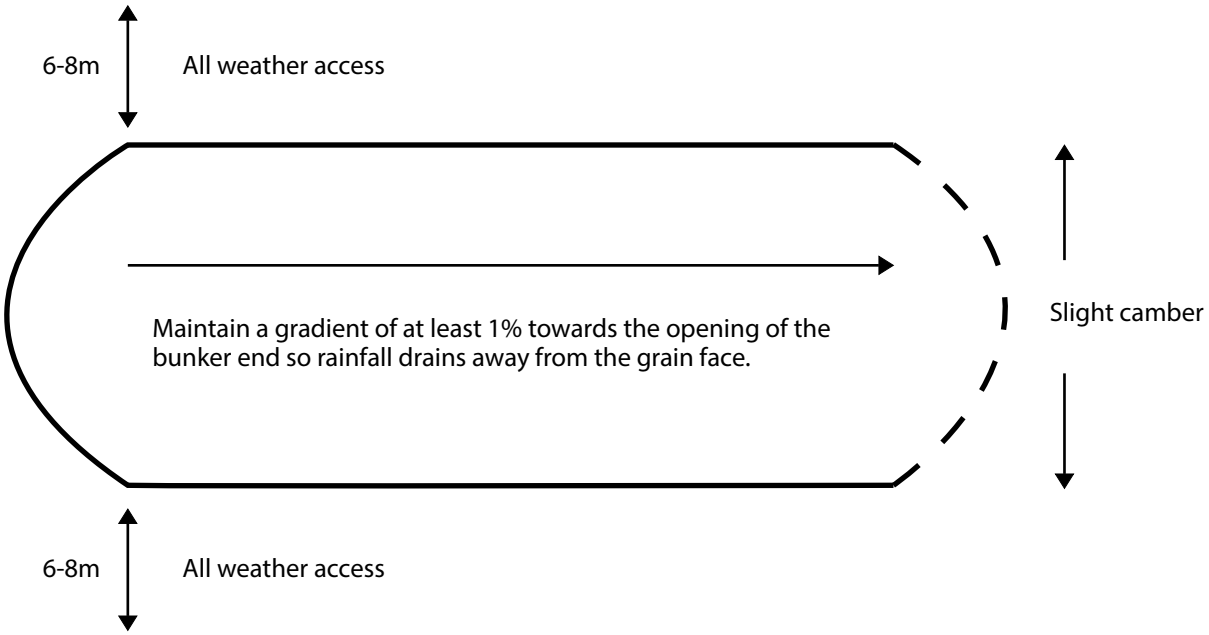
2. Surface Water Management

The bunker cover itself creates a substantial surface area that collects rainfall and directs water away from the grain stack.
On some sites, additional drainage channels may be required to divert runoff away from the storage area, particularly where natural drainage is limited.
In larger storage facilities, consideration may also be given to harvesting runoff water and directing it into farm dams or water storage systems.

3. Access and Traffic Flow

Safe and efficient access for vehicles and equipment is a critical component of bunker site design. Ensure there is all-weather access for trucks and machinery, with sufficient room along both sides of the bunker. Side access is required for loading and unloading grain, as well as for machinery to safely pull covers into position during installation.
Laneways adjacent to the bunker should be graded to slope away from the pad, directing water runoff away from the storage area.

Where practical, a continuous loop road around the storage area is recommended. This minimises reversing movements, improves safety, and increases the efficiency of both loading and out-loading operations.



For sites requiring year-round access, proximity to sealed or all-weather roads should also be considered to ensure reliable truck access during varying weather conditions.
The distance between the storage site and harvest operations is another important factor. Locating bunkers close to the point of grain receival can improve harvest efficiency and reduce transport requirements during peak periods.

4. Proximity to Trees, Insects and Bird Habitats

Careful consideration should be given to potential pest pressures when selecting a storage site.
Bunkers should be positioned away from trees, hay sheds, hay stacks and other areas that may provide shelter for insects, birds and vermin. Establishing storage facilities away from these habitats reduces the likelihood of pests migrating into stored grain.
Similarly, water sources such as dams, channels and troughs can attract birds and vermin and should be avoided where possible.

Preventing pest activity through appropriate site selection is generally more effective and economical than attempting to manage infestations after they occur.

5. Proximity to Services and Infrastructure

When planning a long-term grain storage facility, consideration should be given to future infrastructure requirements.
Access to power, fuel and other essential services may become increasingly important as the facility expands.
Equipment such as aeration systems, monitoring equipment, lighting and site offices may require access to reliable utilities.
Considering these requirements during the planning stage can reduce future installation costs and improve the flexibility of the storage facility.

Summary

Selecting an appropriate grain bunker site is fundamental to achieving safe, efficient and reliable grain storage.
Key considerations include site drainage, accessibility, pest management, traffic flow and future infrastructure requirements.
Investing time in site planning before construction can help maximise storage performance and reduce operational challenges throughout the life of the facility.

Part 3: Grain Bunker Wall Options

Bunker Wall Options

Selecting the right bunker wall system is an important decision that can influence storage capacity, grain quality, operational efficiency, and overall project cost. The most suitable option will depend on your storage requirements, budget, site conditions, and whether the bunker is intended for short-term or long-term use.

1. No Walls

Storing grain without bunker walls is a common and cost-effective approach. In this system, a groundsheet is laid directly onto the prepared pad before grain and covered with the bunker tarp once filled with grain. Once the cover is in place, it is sealed using concrete tyre weights, or soil.
The main advantages of a wall-free bunker are lower establishment costs, faster setup, and maximum flexibility. No walls also provides the advantage of easy and fast grain removal and site clean up with front end loaders. However, if soil is used to seal, care should be taken during removal, as it can be difficult to remove, causing damage to the cover.

Advantages
- Lowest establishment cost
- Quick and simple to construct
- Flexible layout and bunker sizing
- Suitable for temporary or seasonal storage
- Efficient grain removal

Considerations
- Lower storage capacity compared to walled systems
- Care required when using soil to seal covers

2. Earthen Walls

Earth walls have been successfully used in grain storage systems for many decades and remain a practical, economical solution for many growers.
Typically, earth walls are constructed in a U-shape around three sides of the bunker, leaving one end open for loading and unloading operations. Alternatively, walls can be installed along the two sides only, allowing access from both ends of the bunker and providing greater flexibility during out-loading.

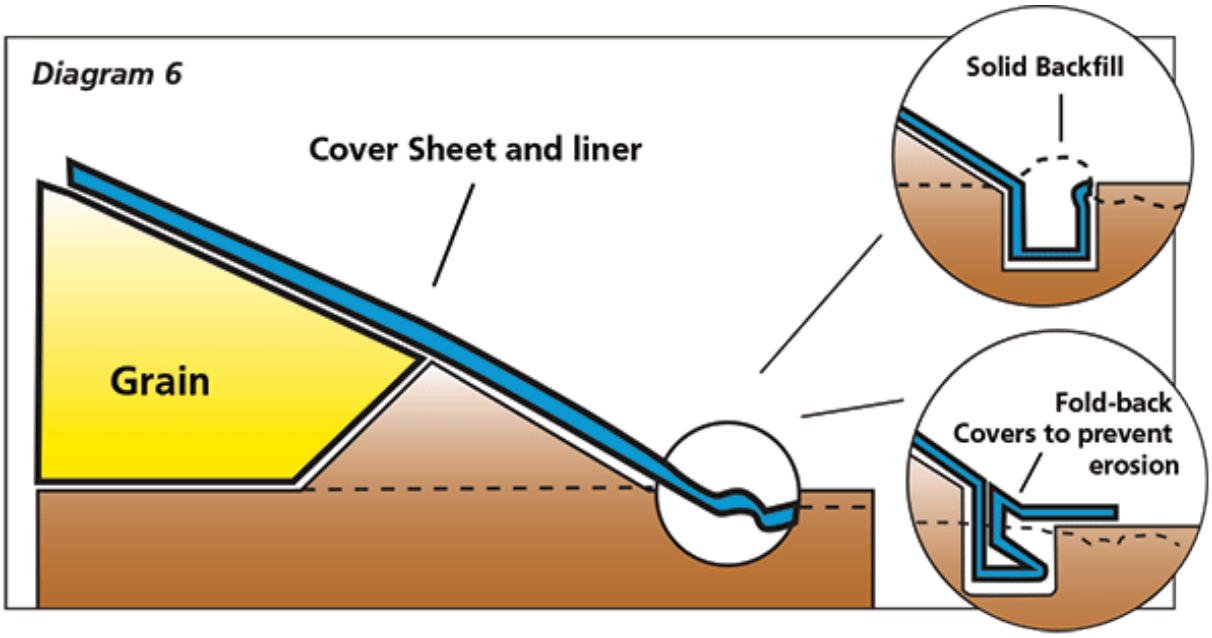
Earth walls should always be constructed with an outward slope away from the bunker pad. The soil required for the walls can be sourced from immediate area surrounding the pad, creating a drainage channel that helps collect and direct water runoff away from the storage area.
Earth walls of 500mm in height typically increase the capacity of your bunker by 10-15% while using the same as tarp as a bunker without walls. The walls also provide a guide for the auger operator when to move the auger forward.

Construction of Earthen Walls
When correctly constructed, earthen walls provide an economical and highly effective method of increasing storage capacity.
Walls may be constructed using a graders, bulldozers, offset blades on a tractor or other earthmoving equipment
The finished wall should be smooth and uniformly shaped to r improve sealing performance.

Wall Height Considerations
The suitability of wall height will depend on the soil type available for construction.
Soils that compact well generally allow retaining walls up to one metre in height to be constructed successfully.
Where soil quality is poorer, lower wall heights may be necessary to maintain stability and minimise erosion.

End Wall Design
The closed end of the bunker should be constructed in a semi-circular configuration with a radius approximately equal to half the bunker width. This design improves eliminates the need to fill the corners with grain.

Provision for Sealing
During earthworks, consideration should also be given to the eventual sealing of the bunker.
A trench approximately is common around the perimeter of the bunker to allow the cover to be securely buried and sealed once the bunker has been filled. This trench is typically 300-400mm deep at the base of the wall. The cover runs over the wall, into the trench and is then back-filled with soil.



Advantages
- Relatively low construction cost
- Soil available on-site
- Effective water management when properly designed
- Proven storage method with a long history of use

Considerations
- Requires regular maintenance to prevent erosion
- Wall stability depends on soil type and construction quality

3. Concrete Walls

Concrete walls are one of the most popular choices for permanent or long-term bunker storage facilities. They provide a durable structure that can significantly increase grain storage capacity on a given pad size by allowing grain to be stored at greater depths. Based on a 1 metre wall height, typically they increase the storage capacity by a further 10-15% from the above 500mm earthen wall.

Concrete walls also simplify bunker sealing, when used with rail and clamp systems. Most concrete-wall bunkers are constructed in a U-shape with one open end for access, although side-wall-only designs are becoming increasingly popular as they allow unloading from either end and provide opportunities for grain segregation.

Avoid square-ended bunkers as you will need to push grain into the corners to overcome low points in the corners where water can accumulate. This creates extra work and the potential for associated problems.

Advantages

- Maximises storage capacity
- Long service life with minimal maintenance
- Improved sealing options for cover systems and fumigation
- Strong, durable, and suited to high-volume operations

Considerations

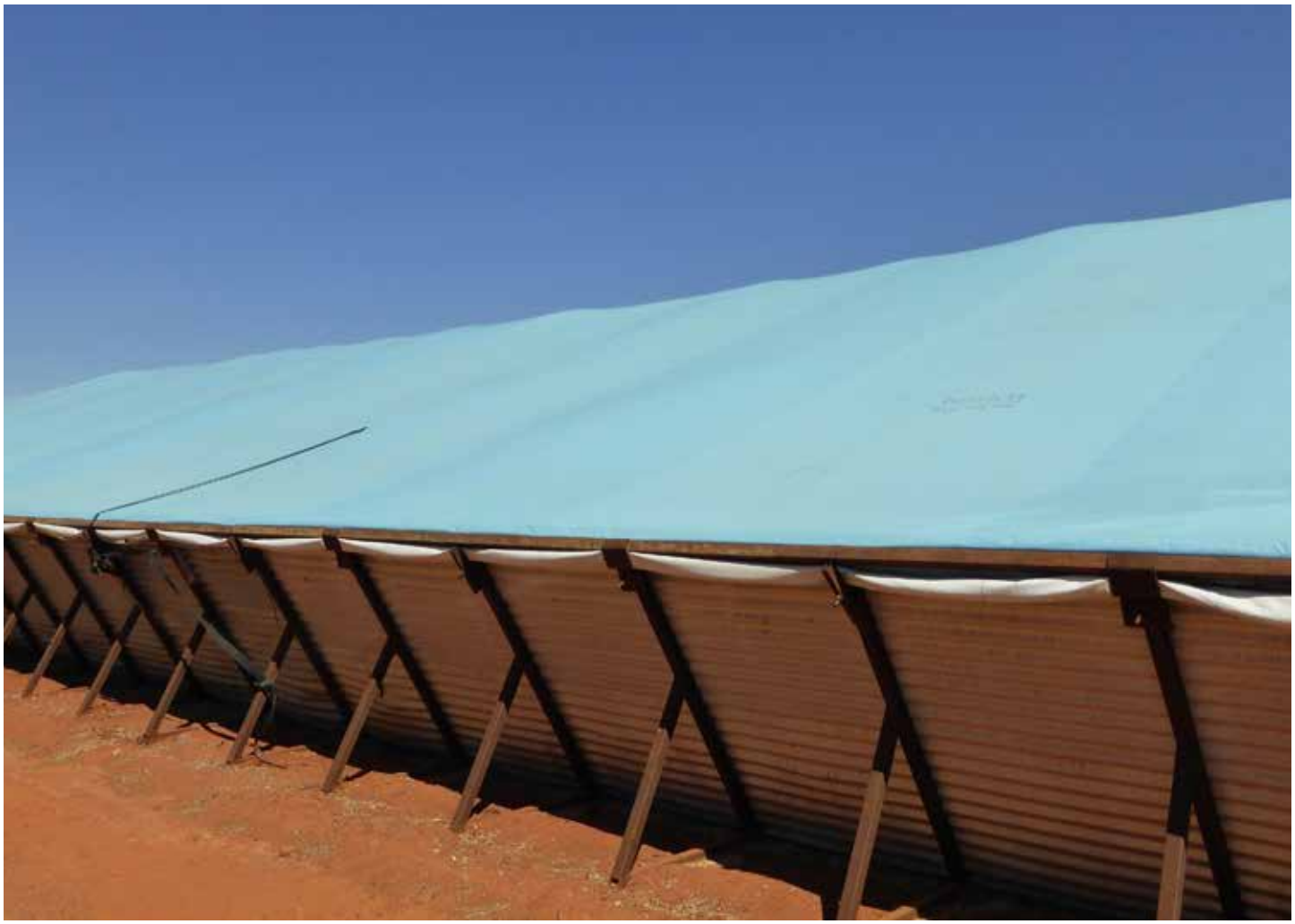
- Higher initial investment
- Requires careful planning and construction
- Less flexible once installed

4. Steel Walls

Steel wall systems can offer a lower-cost alternative to concrete while still providing the benefits of a permanent bunker structure.

However, steel walls present some unique challenges. Temperature differences between the grain and external environment can cause condensation to form and run down on the inside of the wall, potentially affecting the grain stored directly against it.

Steel wall systems are also constructed on a slant, which can make cleaning around the bunker perimeter more difficult. Unlike vertical concrete walls that can often be cleaned with equipment, grain around the edge steel wall supports requires additional manual cleaning to maintain site hygiene.



Advantages

- Lower capital cost than concrete walls
- Permanent structure with increased storage capacity
- Fast installation

Considerations

- Condensation can occur on internal wall surfaces
- Site cleaning and hygiene can be more labour-intensive
- May require additional management around wall edges

Part 4: Storage Capacity & Size

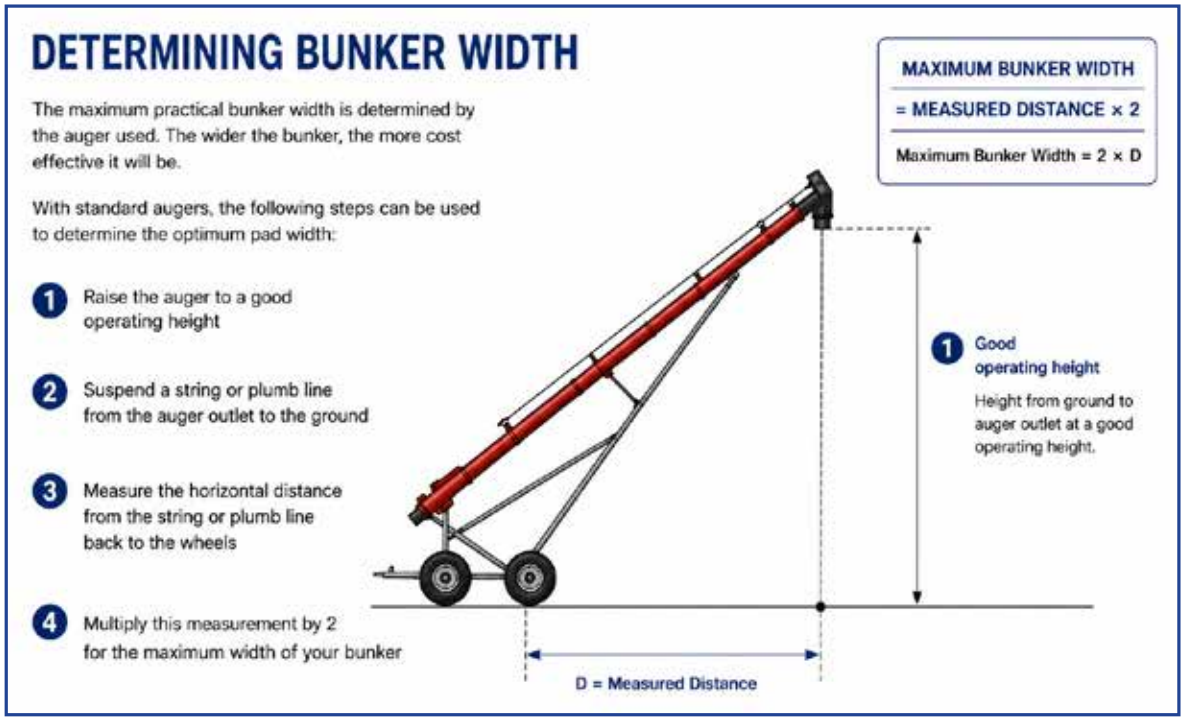
Following site selection and positioning, the next step in planning a grain bunker storage facility is determining the required bunker dimensions and storage capacity.
Accurate sizing is essential to ensure sufficient storage volume while maintaining efficient filling, covering and unloading operations. The dimensions of the bunker will be influenced by the quantity of grain to be stored, the type of grain, the wall configuration and the capabilities of the grain handling equipment available.

Determining Bunker Width

The maximum practical bunker width is determined by the auger used. The wider the bunker, the more cost effective it will be. In larger scale operations, grain stackers are used to allow loading from the side of the bunker, with a drive-over hopper, allowing trucks to unload easily and quickly.

With standard augers, the below steps can be used to determine the optimum pad width:
1. Raise the auger to its maximum operating height.
2. Suspend a string or plumb line from the auger outlet to the ground.
3. Measure the horizontal distance from the point directly below the outlet back to the auger wheels.
4. Multiply this measurement by two.

Maximum Bunker Width = Measured Distance × 2



This calculation ensures the auger remains clear during filling operations and prevents the grain spilling over the auger wheels.
An approximate guide for common auger widths is below. This is a guide only and should be checked with your equipment, as the placement of the undercarriage varies between auger brands.

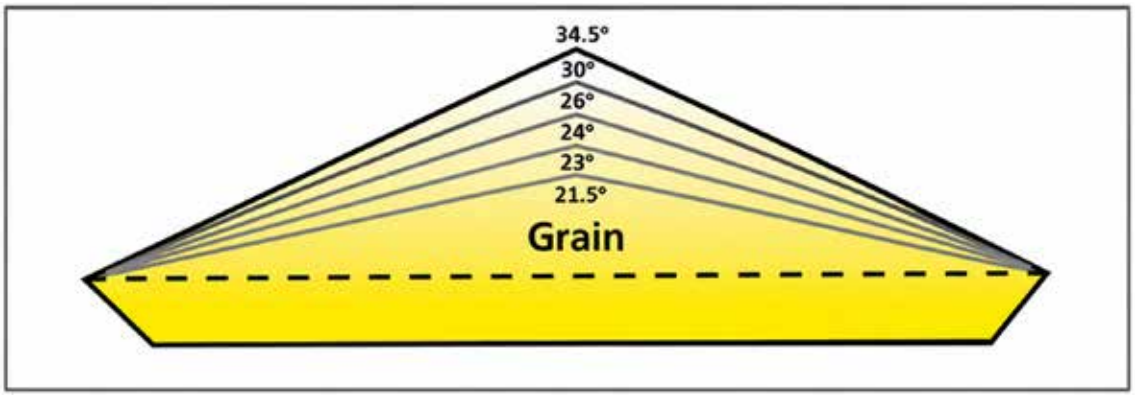
60ft auger – 15mt wide bunker
70ft auger – 20mt wide bunker
85ft auger - 25mt wide bunker
100ft auger – 30mt wide bunker
Bunker auger – wider than 30mt

Grain Angle of Repose

Different grain types naturally form stacks at different angles, known as the angle of repose. This characteristic influences the final shape of the grain stack and therefore the overall bunker capacity.

Grain Type	Angle of Repose
Wheat	23°
Barley	26°
Sorghum	26°
Oats	30°

Grain Type	Angle of Repose
Chickpeas	24°
Rice	34.5°
Rye	21.5°
Soya Beans	26°



Determining Bunker Length

Once the bunker width and anticipated stack height have been established, the required bunker length can be determined based on the quantity of grain needed to be stored.

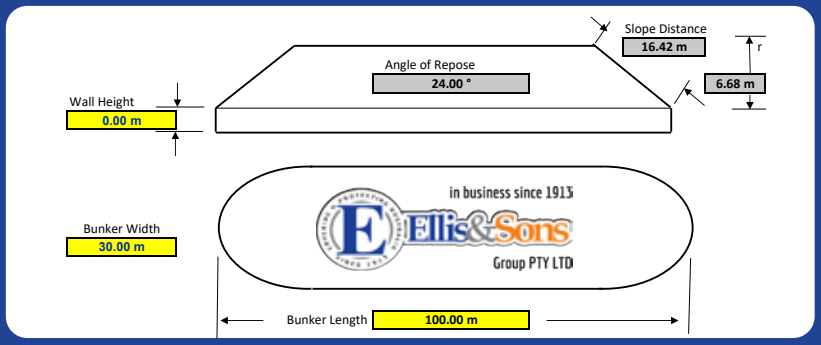
Below is a list of handy reference bunker sizing tables to allow you to quickly calculate out an approximate bunker size and capacity.

Please also go to our website for a fully comprehensive online bunker calculator or further grain types, sizes and wall options.

The capacity tables supplied in this guide are based on:

- No wall bunkers and earthen walled bunkers of 0.5 metres and 1.0 metre heights.
- Wheat, barley, sorghum and oats.

GRAIN BUNKER CALCULATOR



Use our free bunker volume and size calculator! Simply enter your bunker dimensions to accesss storage capacity, grain volume and estimated bunker cover size.

Scan the QR code or visit our website for free access!

BUNKER DIMENSIONS: WHEAT		Repose Angle 23°					750kg per cubic metre				Bank Height: No Wall			
Wheat Height (m)	Width (m)	Length												Length Per 100T
		100T	200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
1.5	7.25	28.8	54.5	80.1	105.7	131.3	156.9	182.5	208.1	233.7	259.3	387.3	515.3	643.3	25.60
2.0	9.50	18.7	33.0	47.3	61.5	75.8	90.1	104.3	118.6	132.8	147.1	218.4	289.7	361.0	14.26
2.5	11.75	14.7	23.8	32.9	42.0	51.0	60.1	70.0	78.3	87.4	96.4	141.8	187.2	232.6	9.08
3.0	14.25		19.3	25.6	31.8	38.0	44.3	50.5	56.8	63.0	69.2	100.4	131.6	162.8	6.24
3.5	16.5		17.1	21.8	26.4	30.1	35.6	40.2	44.9	49.5	54.1	77.2	100.3	123.4	4.62
4.0	18.75			19.6	23.2	26.8	30.3	33.9	37.4	41.0	44.6	62.4	80.2	98.0	3.56
4.5					21.3	24.1	26.9	29.7	32.5	35.3	38.1	52.1	66.1	80.1	2.80
5.0							24.8	27.1	29.4	31.7	34.0	45.4	56.8	68.2	2.28
5.5									27.3	29.2	31.1	40.5	49.9	59.3	1.88

COVER DIMENSIONS: WHEAT	Repose Angle 23°					750kg per cubic metre					Bank Height: No Wall			
Wheat Height (m)	Width (m)	Length												Length Per 100T
		100T	200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
1.5	11.0	45.6	58.25	83.9	109.5	135.1	160.7	186.3	211.9	237.5	263.1	391.1	519.1	647.1	25.60
2.0	13.5	30.0	37.0	51.3	65.6	79.8	94.1	108.3	122.6	136.9	151.1	222.4	293.7	365.0	14.26
2.5	15.75	23.5	28.0	37.1	46.2	55.3	64.4	73.4	82.5	91.6	100.7	146.1	191.5	236.9	9.08
3.0	18.5		23.5	29.8	36.0	42.3	48.5	54.7	61.0	67.2	73.5	104.7	135.9	167.1	6.24
3.5	21.0		21.5	26.2	30.8	35.4	40.0	44.6	49.3	53.9	58.5	81.6	104.7	127.8	4.62
4.0	23.5			24.25	27.9	31.4	35.0	38.5	42.1	45.7	49.2	67.0	84.8	102.6	3.56
4.5	26.25				26.25	29.1	31.9	34.7	37.5	40.3	43.1	57.1	71.1	85.1	2.80
5.0	28.5					30.0	32.3	34.6	36.9	39.2	50.6	62.0	73.4	150.9	2.28
5.5	31.0							32.5	34.4	36.3	45.7	55.1	64.5	127.2	1.88

BUNKER DIMENSIONS: BARLEY & SORGHUM		Repose Angle 26°					650kg per cubic metre				Bank Height: No Wall			
Barley Height (m)	Width (m)	Length												Length Per 100T
		100T	200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
1.5	6.25	36.9	70.9	104.9	138.9	172.9	206.9	240.9	274.9	308.9	342.9	512.9	682.9	852.9	34.00
2.0	8.25	22.7	41.7	60.7	79.6	98.6	117.5	136.4	155.4	174.3	193.3	288.0	382.7	477.4	18.94
2.5	10.25	16.9	28.9	40.9	52.9	64.9	76.9	88.9	100.9	112.9	124.9	184.9	244.9	304.9	12.00
3.0	12.25	14.2	22.6	31.0	39.4	47.7	56.1	64.4	72.8	81.2	89.5	131.3	173.1	214.9	8.36
3.5	14.50		19.1	25.2	31.3	37.3	43.4	49.4	55.5	61.6	67.6	97.9	128.2	158.5	6.06
4.0	16.50		17.2	21.9	26.6	31.2	35.9	40.5	45.2	49.9	54.5	77.8	101.1	124.4	4.66
4.5	18.50			19.9	23.6	27.3	31.0	34.7	38.3	42.0	45.7	64.1	82.5	100.9	3.68
5.0	20.50				21.8	24.8	27.8	30.8	33.8	36.8	39.8	54.8	69.8	84.8	3.00
5.5	22.50						24.7	27.2	29.7	32.2	34.7	47.1	59.5	71.9	2.48

COVER DIMENSIONS: BARLEY & SORGHUM		Repose Angle 26°					650kg per cubic metre				Bank Height: No Wall			
Barley Height (m)	Width (m)	Length												Length Per 100T
		100T	200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
1.5	10.0	91.8	74.8	108.8	142.8	176.8	210.8	244.8	278.8	312.8	346.8	516.8	686.8	856.8	34.00
2.0	12.25	36.3	45.8	64.8	83.7	102.7	121.6	140.5	159.5	178.4	197.4	292.1	386.8	481.5	18.94
2.5	14.5	27.0	33.0	45.0	57.0	69.0	81.0	93.0	105.0	117.0	129.0	189.0	249.00	309.0	12.00
3.0	16.75	22.9	27.0	35.4	43.8	52.1	60.5	68.9	77.2	85.6	93.9	135.7	177.5	219.3	8.36
3.5	19.25		23.8	29.9	35.9	42.0	48.1	54.1	60.2	66.2	72.3	102.6	132.9	163.2	6.06
4.0	21.5		22.0	26.7	31.4	36.0	40.7	45.3	50.0	54.7	59.3	82.6	105.9	129.2	4.66
4.5	23.75			25.0	28.7	32.4	36.1	39.8	43.4	47.1	50.8	69.2	87.6	106.0	3.68
5.0	26.0				27.2	30.2	33.2	36.2	39.2	42.2	45.2	60.2	75.2	90.2	3.00
5.5	28.0						30.2	32.7	35.2	37.7	40.2	52.6	65.0	77.4	2.48

BUNKER DIMENSIONS: OATS		Repose Angle 30°					400kg per cubic metre				Bank Height: No Wall			
Oats Height (m)	Width (m)	Length												Length Per 100T
		100T	200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
1.5	5.25	68.3	134.1	199.9	265.7	331.5	397.3	463.1	528.9	594.7	660.5	989.5	1318.5	1647.5	65.80
2.0	6.75	40.8	78.4	116.0	153.6	191.2	228.8	266.4	304.0	341.6	379.2	567.2	755.2	943.2	37.60
2.5	8.75	27.1	49.9	72.7	95.5	118.3	141.1	163.9	186.7	209.5	232.3	346.3	460.3	574.3	22.80
3.0	10.50	20.9	36.7	52.5	68.3	84.1	99.9	115.7	131.5	147.3	163.1	242.1	321.1	400.1	15.80
3.5	12.25	17.6	29.2	40.8	52.4	64.0	75.6	87.2	98.8	110.4	122.0	180.0	238.0	296.0	11.6
4.0	13.75	15.7	24.7	33.7	42.7	51.7	60.7	69.7	78.7	87.7	96.7	141.7	186.7	231.7	9.00
4.5	15.50		21.7	28.9	36.1	43.3	50.5	57.7	64.9	72.1	79.3	115.3	151.3	187.3	7.20
5.0	17.50		19.8	25.5	31.2	36.9	42.6	48.3	54.0	59.7	65.4	93.9	122.4	150.9	5.70
5.5	19.25			23.3	28.1	32.8	37.5	42.2	47.0	51.7	56.4	80.0	103.6	127.2	4.72

COVER DIMENSIONS: OATS		Repose Angle 30°					400kg per cubic metre				Bank Height: No Wall			
Oats Height (m)	Width (m)	Length												Length Per 100T
		100T	200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
1.5	9.25	105.0	138.0	203.8	269.6	335.6	401.2	467.0	528.8	598.6	664.4	993.4	1322.4	1651.4	65.80
2.0	11.0	64.0	82.5	120.1	157.7	195.3	232.9	270.5	308.1	345.7	383.3	571.3	759.3	947.3	37.60
2.5	13.25	43.0	54.4	77.2	100.0	122.8	145.6	168.4	191.2	214.0	236.8	350.8	464.8	578.8	22.8
3.0	15.25	33.6	41.5	57.3	73.1	88.9	104.7	120.5	136.3	152.1	167.9	246.9	325.9	404.9	15.8
3.5	17.25	28.2	34.0	45.6	57.2	68.8	80.4	92.0	103.6	115.2	126.8	184.8	242.8	300.8	11.60
4.0	19.0	25.5	30.0	39.0	48.0	57.0	66.0	75.0	84.0	93.0	102.0	147.0	192.0	237.0	9.00
4.5	21.0		27.1	34.3	41.5	48.7	55.9	63.1	70.3	77.5	84.7	120.7	156.7	192.7	7.20
5.0	23.25		25.5	31.2	36.9	42.6	48.3	54.0	59.7	65.4	71.1	99.6	128.1	156.6	5.70
5.5	25.25			29.3	34.1	38.8	43.5	48.2	52.9	57.7	62.4	86.0	109.6	133.2	4.72

BUNKER DIMENSIONS: WHEAT		Repose Angle 23°				750kg per cubic metre				Bank Height .5 metre			
Wheat Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	7.25	35.1	50.6	66.1	81.6	97.2	112.7	128.2	143.8	159.3	237.0	314.6	392.3	7.76
2.5	9.50	24.3	33.9	43.5	53.1	62.7	72.3	81.9	91.5	101.1	149.1	197.1	245.1	4.80
3.0	11.75	19.3	25.8	32.4	38.9	45.5	52.0	58.6	65.1	71.7	104.4	137.1	169.9	3.27
3.5	14.25	16.18	21.6	26.3	31.1	35.9	40.6	45.4	50.1	54.9	78.7	102.5	126.3	2.37
4.0	16.50		19.3	22.9	26.5	30.2	33.8	37.4	41.0	44.6	62.7	80.8	98.9	1.80
4.5	18.75			21.0	23.8	26.7	29.5	32.4	35.2	38.1	52.3	66.5	80.7	1.42
5.0	21.25					24.6	26.8	29.1	31.4	33.7	45.2	56.7	68.2	1.14
5.5	23.50						25.2	27.1	29.0	30.9	40.3	49.8	59.3	0.94
6.0	25.75								27.4	29.0	36.9	44.9	52.8	0.79

COVER DIMENSIONS: WHEAT		Repose Angle 23°				750kg per cubic metre				Bank Height 0.5 metre			
Wheat Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	12.25	39.0	54.6	70.1	85.6	101.2	116.7	132.2	147.8	163.3	241.0	318.6	396.3	7.76
2.5	14.75	28.5	38.1	47.1	57.3	66.9	76.5	86.1	95.7	105.3	153.3	201.3	249.3	4.80
3.0	17.50	23.7	30.2	36.8	43.3	49.9	56.4	63.0	69.5	76.1	108.8	141.5	174.3	3.27
3.5	19.75	21.4	26.2	31.0	35.7	40.5	45.2	50.0	54.7	59.5	83.3	107.1	130.9	2.37
4.0	22.50		24.1	27.7	31.4	35.0	38.6	42.2	45.8	49.4	67.5	85.6	103.7	1.80
4.5	25.25			26.0	28.8	31.7	34.5	37.4	40.2	43.1	57.3	71.5	85.7	1.42
5.0	27.50					29.8	32.1	34.4	36.7	38.9	50.4	61.9	73.4	1.14
5.5	30.25						30.6	32.5	34.4	36.3	45.7	55.2	64.7	0.94
6.0	32.75								33.0	34.6	42.5	50.5	58.4	0.79

BUNKER DIMENSIONS: BARLEY & SORGHUM		Repose Angle 26°				650kg per cubic metre				Bank Height .5 metre			
Barley Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	6.25	44.9	65.6	86.2	106.9	127.6	148.3	169.0	189.7	210.3	313.8	417.2	520.6	10.34
2.5	8.25	30.0	42.7	55.5	68.3	81.0	93.8	106.6	119.3	132.1	195.9	259.8	323.6	6.38
3.0	10.25	22.8	31.5	40.2	48.9	57.6	66.3	75.0	83.7	92.4	135.9	179.4	222.8	4.34
3.5	12.25	19.0	25.3	31.6	38.0	44.3	50.6	56.9	63.2	69.6	101.1	132.7	164.3	3.15
4.0	14.50	17.0	21.8	26.6	31.4	36.2	41.0	45.8	50.6	55.4	79.4	103.4	127.4	2.40
4.5	16.50		19.7	23.5	27.2	31.0	34.8	38.6	42.4	46.1	65.0	83.9	102.8	1.88
5.0	18.50			21.6	24.6	27.7	30.7	33.8	36.8	39.9	55.1	70.3	85.6	1.52
5.5	20.50				22.9	25.5	28.0	30.5	33.0	35.5	48.1	60.6	73.2	1.25
6.0	22.50					24.0	26.1	28.3	30.4	32.5	43.0	53.5	64.1	1.05

COVER DIMENSIONS: BARLEY & SORGHUM		Repose Angle 26°				650kg per cubic metre				Bank Height 0.5 metre			
Barley Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	11.25	48.8	69.5	90.2	110.9	131.6	152.2	172.9	193.6	214.3	317.7	421.1	524.6	10.34
2.5	13.50	34.1	46.9	59.7	72.4	85.2	98.0	110.7	126.5	136.3	200.1	264.0	327.8	6.38
3.0	15.75	27.2	35.9	44.6	53.3	62.0	70.7	79.4	88.1	96.8	140.3	183.8	227.3	4.34
3.5	17.75	23.7	30.0	36.3	42.6	48.9	55.2	61.6	67.9	74.2	105.8	137.4	169.0	3.15
4.0	20.25	21.8	26.6	31.5	36.3	41.1	45.9	50.7	55.5	60.3	84.3	108.3	132.3	2.40
4.5	22.50		24.8	28.6	32.4	36.1	39.9	43.7	47.5	51.2	70.1	89.0	107.9	1.88
5.0	24.75			26.7	30.0	33.0	36.0	39.1	42.1	45.2	60.4	75.7	90.9	1.52
5.5	27.25				28.5	31.0	33.5	36.1	38.6	41.1	53.6	66.2	78.8	1.25
6.0	29.50					29.8	31.9	34.1	36.2	38.3	48.8	59.3	69.9	1.05

BUNKER DIMENSIONS: OATS		Repose Angle 30°				400kg per cubic metre				Bank Height .5 metre			
Oats Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	5.25	83.0	123.1	163.1	203.1	243.2	283.2	323.3	363.3	403.3	603.5	803.6	1003.8	20.10
2.5	6.75	53.1	77.7	102.4	127.0	151.7	176.3	201.0	225.6	250.3	373.5	496.8	620.0	12.32
3.0	8.75	38.1	54.9	71.7	88.4	105.2	122.0	138.8	155.5	172.3	256.2	340.0	423.9	8.38
3.5	10.50	29.7	41.9	54.1	66.3	78.4	90.6	102.8	115.0	127.1	188.0	248.9	309.8	6.08
4.0	12.25	24.7	34.0	43.2	52.5	61.7	71.0	80.2	89.5	98.7	145.0	191.2	237.5	4.62
4.5	13.75	21.6	28.9	36.2	43.4	50.7	58.0	65.2	72.5	79.8	116.1	152.5	188.8	3.63
5.0	15.50	19.7	25.5	31.4	37.3	43.1	49.0	54.9	60.7	66.6	95.9	125.3	154.6	2.93
5.5	17.50	18.5	23.3	28.1	33.0	37.8	42.6	47.5	52.3	57.1	81.3	105.5	129.7	2.41
6.0	19.25		21.8	25.9	29.9	34.0	38.0	42.1	46.1	50.2	70.4	90.7	111.0	2.02

COVER DIMENSIONS: OATS		Repose Angle 30°				400kg per cubic metre				Bank Height 0.5 metre			
Oats Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	10.00	87.0	127.0	167.0	207.1	247.1	287.1	327.2	367.2	407.2	607.4	807.6	1007.7	20.01
2.5	12.00	57.3	81.9	106.6	131.2	155.9	180.5	205.2	229.8	254.5	377.7	501.0	624.2	12.32
3.0	14.00	42.6	59.4	76.1	92.9	109.7	126.5	143.2	160.0	176.8	260.6	344.5	428.4	8.38
3.5	16.00	34.5	46.7	58.8	71.0	83.2	95.4	107.5	119.7	131.9	192.8	253.6	314.5	6.08
4.0	18.00	29.7	39.0	48.2	57.4	66.7	76.0	85.2	94.5	103.7	150.0	196.2	242.5	4.62
4.5	20.00	26.9	34.2	41.4	48.7	56.0	63.2	70.5	77.8	85.1	121.4	157.8	194.1	3.63
5.0	22.00	25.2	31.1	36.9	42.8	48.7	54.5	60.4	66.3	72.1	101.5	130.8	160.1	2.93
5.5	24.00	24.3	29.1	33.9	38.8	43.6	48.4	53.3	58.1	62.9	87.1	111.3	135.5	2.41
6.0	26.00		27.9	31.9	36.0	40.0	44.1	48.2	52.2	56.3	76.5	96.8	117.1	2.02

BUNKER DIMENSIONS: WHEAT		Repose Angle 23°				750kg per cubic metre				Bank Height 1 metre			
Wheat Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	4.75	48.9	70.9	92.9	114.8	136.8	158.8	180.7	202.7	224.7	334.6	444.4	554.3	10.98
2.5	7.25	28.7	40.5	52.2	63.9	75.6	87.4	99.1	110.8	122.6	181.2	239.8	298.5	5.86
3.0	9.50	21.0	28.5	35.9	43.4	50.9	58.3	65.8	73.3	80.7	118.1	155.5	192.8	3.73
3.5	11.75	17.4	22.7	27.9	33.1	38.3	43.6	48.8	54.0	59.3	85.4	111.5	137.7	2.61
4.0	14.25		19.6	23.5	27.4	31.3	35.2	39.1	42.9	46.8	66.2	85.6	105.1	1.94
4.5	16.50			21.1	24.1	27.1	30.1	33.1	36.1	39.1	54.1	69.2	84.2	1.50
5.0	18.75				22.1	24.5	26.9	29.3	31.7	34.1	46.1	58.1	70.1	1.20
5.5	21.25						25.0	26.9	28.9	30.9	40.7	50.5	60.3	0.98
6.0	23.50								27.1	28.7	36.9	45.1	53.3	0.81

COVER DIMENSIONS: WHEAT		Repose Angle 23°				750kg per cubic metre				Bank Height 1 metre			
Wheat Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	12.25	54.1	76.1	98.0	120.0	142.0	163.9	185.9	207.9	229.9	339.7	449.6	559.5	10.98
2.5	14.75	34.1	45.8	57.6	69.3	81.0	92.7	104.5	116.2	127.9	186.6	245.2	303.8	5.86
3.0	17.50	26.6	34.0	41.5	49.0	56.4	63.9	71.4	78.9	86.3	123.7	161.0	198.4	3.73
3.5	19.75	23.2	28.4	33.7	38.9	44.1	49.3	54.6	59.8	65.0	91.2	117.3	143.4	2.61
4.0	22.50		25.6	29.5	33.4	37.3	41.2	45.0	48.9	52.8	72.2	91.6	111.0	1.94
4.5	25.25			27.3	30.3	33.3	36.3	39.3	42.3	45.3	60.3	75.4	90.4	1.50
5.0	27.50				28.5	30.9	33.3	35.7	38.1	40.5	52.5	64.5	76.5	1.20
5.5	30.25						31.6	33.5	35.5	37.5	47.3	57.1	66.9	0.98
6.0	30.75								33.9	35.5	43.7	51.9	60.1	0.81

BUNKER DIMENSIONS: BARLEY & SORGHUM		Repose Angle 26°				650kg per cubic metre				Bank Height 1 metre			
Barley Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	4.25	64.2	94.1	124.0	153.8	183.7	213.6	243.5	273.3	303.2	452.6	601.9	751.3	14.93
2.5	6.25	36.2	52.0	67.7	83.5	99.2	115.0	130.7	146.5	162.3	241.1	319.9	398.6	7.87
3.0	8.25	25.3	35.3	45.3	55.3	65.3	75.2	85.2	95.2	105.2	155.2	205.1	255.1	4.99
3.5	10.25	20.1	27.0	34.0	41.0	48.0	54.9	61.9	68.9	75.8	110.7	145.6	180.4	3.48
4.0	12.50	17.3	22.5	27.7	32.8	38.0	43.2	48.4	53.5	58.7	84.6	110.4	136.3	2.58
4.5	14.35		19.9	23.9	27.9	31.9	35.9	39.9	43.9	47.9	67.9	87.9	107.9	1.99
5.0	16.50			21.6	24.8	28.0	31.2	34.4	37.6	40.8	56.7	72.7	88.6	1.59
5.5	18.50				22.9	25.5	28.1	30.7	33.3	35.9	48.9	62.0	75.0	1.30
6.0	20.50					23.8	26.0	28.2	30.4	32.5	43.4	54.3	65.1	1.08

COVER DIMENSIONS: BARLEY & SORGHUM		Repose Angle 26°				650kg per cubic metre				Bank Height 1 metre			
Barley Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	11.25	69.2	99.1	128.9	158.8	188.7	218.6	248.4	278.3	309.2	457.5	606.9	756.3	14.93
2.5	13.50	41.4	57.2	72.9	88.7	104.4	120.2	136.0	151.7	167.5	246.3	325.1	403.9	7.87
3.0	15.75	30.7	40.7	50.7	60.7	70.7	80.7	90.7	100.7	110.7	160.7	210.6	260.5	4.99
3.5	17.75	25.7	32.7	39.7	46.7	53.6	60.6	67.6	74.5	81.5	116.4	151.2	186.1	3.48
4.0	20.25	23.2	28.4	33.6	38.7	43.9	49.1	54.3	59.4	64.4	90.5	116.3	142.2	2.58
4.5	22.50		26.0	30.0	34.0	38.0	42.0	46.0	50.0	54.0	74.0	94.0	114.0	1.99
5.0	24.75			28.0	31.2	34.4	37.6	40.7	43.9	47.1	63.1	79.0	95.0	1.59
5.5	27.25				29.0	32.1	34.7	37.3	39.9	42.5	55.5	68.6	81.6	1.30
6.0	29.50					30.6	32.8	35.0	37.2	39.3	50.2	61.1	72.0	1.09

BUNKER DIMENSIONS: OATS		Repose Angle 30°				400kg per cubic metre				Bank Height 1 metre			
Oats Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	3.50	123.1	182.7	242.3	301.9	361.5	421.1	480.6	540.2	599.8	897.7	1195.6	1493.5	29.79
2.5	5.25	65.8	96.7	127.6	158.5	189.4	220.3	251.2	282.1	313.0	467.4	621.9	776.3	15.44
3.0	6.75	43.5	62.9	82.4	101.8	121.2	140.7	160.1	179.6	199.0	296.3	393.5	490.7	9.72
3.5	8.75	32.3	45.8	59.3	72.8	86.4	99.9	113.4	126.9	140.5	208.1	275.7	343.3	6.76
4.0	10.50	26.0	36.0	46.0	56.0	66.0	76.0	86.0	96.0	106.0	156.1	206.1	256.2	5.00
4.5	12.25	22.2	29.9	37.6	45.4	53.1	60.8	68.6	76.3	84.0	122.7	161.3	200.0	3.86
5.0	13.75	19.8	26.0	32.2	38.3	44.5	50.6	56.8	63.0	69.1	99.9	130.8	161.6	3.08
5.5	15.50	18.4	23.4	28.5	33.5	38.5	43.6	48.6	53.6	58.7	83.8	109.0	134.2	2.51
6.0	17.25		21.7	25.9	30.1	34.3	38.5	42.7	46.9	51.1	72.0	93.0	114.0	2.09

COVER DIMENSIONS: OATS		Repose Angle 30°				400kg per cubic metre				Bank Height 1 metre			
Oats Height (m)	Width (m)	Length											Length Per 50T
		200T	300T	400T	500T	600T	700T	800T	900T	1000T	1500T	2000T	2500T	
2.0	10.00	128.0	187.5	247.1	306.7	366.3	425.9	485.4	545.0	604.6	902.5	1200.4	1498.3	29.79
2.5	12.00	70.9	101.8	132.7	163.6	194.5	225.4	256.3	287.1	319.0	472.5	626.9	781.4	15.44
3.0	14.00	48.8	68.2	87.7	107.1	126.6	146.0	165.5	184.9	204.4	301.6	398.8	496.1	9.72
3.5	16.00	37.9	51.4	64.9	78.5	92.0	105.5	119.0	132.6	146.1	213.7	281.3	349.9	6.76
4.0	18.00	31.8	41.9	51.9	61.9	71.9	81.9	91.9	101.9	111.9	161.9	212.0	262.0	5.00
4.5	20.00	28.3	36.1	43.8	51.5	59.2	67.0	74.7	82.4	90.2	128.8	167.5	206.1	3.86
5.0	22.00	26.2	32.4	38.6	44.7	50.9	57.1	63.2	69.4	75.5	106.4	137.2	168.0	3.08
5.5	24.00	25.1	30.1	35.1	40.2	45.2	50.2	55.3	60.3	65.3	90.5	115.7	140.9	2.51
6.0	26.00		28.7	32.9	37.1	41.2	45.4	49.6	53.8	58.0	79.0	99.9	120.9	2.09

Single vs Multiple Bunkers

Many operators choose to divide their storage requirements across several smaller bunkers rather than constructing a single large bunker.

Advantages of multiple bunkers include:
- Easier cover handling.
- Improved grain segregation.
- Removes the need to join and seal multiple covers

Alternatively, a single larger bunker may provide operational efficiencies depending on the scale and nature of the storage program.
The preferred approach should reflect the operational requirements of the individual business.

Part 5: Selecting Bunker Covers

Selecting the right cover is vitally important to the success of your stored grain. The degree of risk you are prepared to accept will influence the final selection of a suitable cover.
Selecting an appropriate cover requires consideration of storage duration, environmental conditions and bunker dimensions. While there are many cover options available, not all products offer the same level of performance, durability or lifespan.

Cover Performance Requirements

A quality bunker cover should provide:
• Reliable waterproof protection.
• High resistance to ultraviolet (UV) degradation.
• High tear and puncture resistance.
• High resistance to wind flap and abrasion.
• Long service life under agricultural conditions.
• Compatibility with fumigation systems where required.
The value of the stored grain often far exceeds the cost of the cover. For this reason, selecting a cover based solely on purchase price can significantly increase storage risk.

Reinforced vs Non-Reinforced Covers

As general rule, the lighter non-reinforced plastic's will not give you the degree of reliable protection warranted by the investment in your stored grains. These materials generally offer limited durability and are more susceptible to tearing, puncture damage and UV degradation.
For reliable storage protection, reinforced fabrics provide a more reliable and economical long-term solution.
Reinforced fabrics consist of a woven base cloth that provides strength and dimensional stability, combined with a waterproof coating that prevents moisture penetration and assists with gas retention during fumigation.

Key Selection Criteria

When comparing bunker cover options, consideration should be given to the following characteristics:
• UV warranty and weather resistance.
• Fabric strength and tear resistance.
• Wind flap resistance.
• Abrasion resistance.
• Ease of handling and deployment.
• Repairability.
• Suitability for the intended bunker size.

Common Cover Materials

250–300 GSM Reinforced Polyethylene
These covers are used in smaller grain storage bunkers due to their balance of affordability and performance.
Typical characteristics include:
• Minimum three-year UV resistance.
• Good abrasion resistance.
• Lightweight and easy to handle.
• Cost-effective for smaller bunker applications.
To maximise service life, these covers should be properly tensioned to minimise wind flap.
As a general guide, widths greater than 25 metres may require consideration of heavier materials.

330–400 GSM Reinforced Polypropylene

Polypropylene covers offer high strength while remaining relatively lightweight.
Typical characteristics include:

- Minimum three-year UV resistance.
- High strength-to-weight ratio.
- Improved flexibility and fatigue resistance.
- Excellent performance in larger bunker applications.
- Won't become brittle over time.
- Recyclable

These fabrics are often preferred where larger cover sizes are required.

610 GSM Reinforced PVC

PVC covers provide a high level of durability and protection.
Typical characteristics include:

- Minimum three-year UV resistance.
- Exceptional tear and puncture resistance.
- Superior wind stability due to increased weight.
- Ease of repair in the event of damage.
- Long service life under demanding conditions.

While heavier to handle, PVC covers are often selected for large-scale or long-term storage applications.

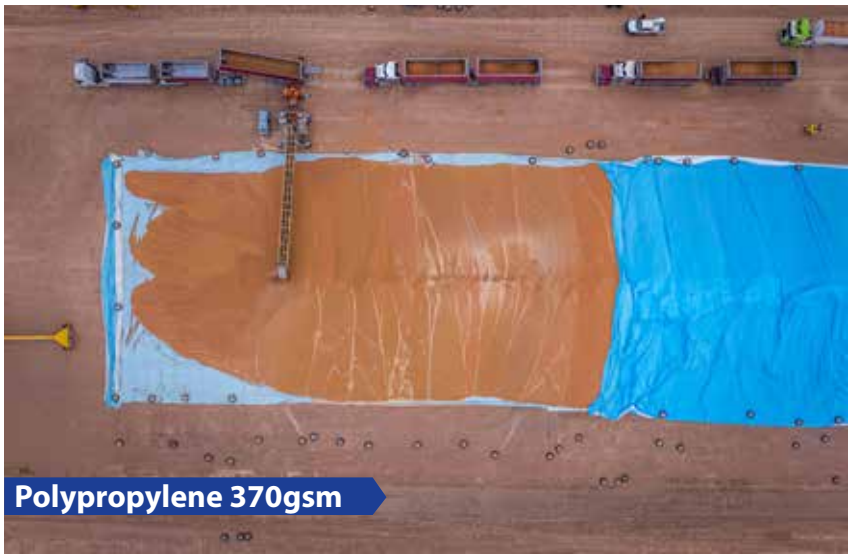
Fabrication Quality

The performance of a bunker cover is determined not only by the fabric itself but also by the quality of the fabrication. Seams should be manufactured using proven joining methods capable of producing joints that meet or exceed the strength of the base fabric. High-quality fabrication is critical to achieving optimal storage performance.

Cover Lifespan

While cover lifespan varies with use and maintenance, growers can generally expect a top tarp to last approximately three years as a top tarp and it can then be used for a ground sheet for another one to two years.


Polyethylene 260gsm


Polypropylene 370gsm


PVC 610gsm

Part 6: Ground Sheets and Bunker Liners

While considerable attention is often given to the bunker cover, the ground sheet or bunker liner plays an equally important role in protecting stored grain.
Ground sheets provide a protective barrier between the grain and the bunker floor, reducing the risk of moisture ingress, contamination and insect migration. When used in conjunction with a top cover, they also assist in creating an effective seal for fumigation.
The suitability of a ground sheet will depend on the intended storage period, site conditions and grain management requirements.

Purpose of a Ground Sheet

A properly installed bunker liner performs several important functions:
• Prevents moisture migration from the ground into the grain.
• Reduces contamination from soil and foreign material.
• Assists in creating an airtight fumigation seal.
• Facilitates cleaner grain recovery during unloading.

Storage Duration Considerations

The need for a ground sheet will vary depending on the intended storage duration.

Short-Term Storage
Where grain is stored for a relatively short period on a well-drained and properly prepared bunker pad, storage without a ground sheet may be acceptable in some circumstances.

Long-Term Storage
For longer storage periods, particularly where fumigation may be required, the use of a ground sheet is strongly recommended.
Ground sheets provide additional protection against moisture ingress and significantly improve the ability to maintain an effective gas-tight seal.

Ground Sheet Options

Prefabricated Ground Sheets
Prefabricated liners are manufactured as large, continuous sheets designed to cover the bunker floor and walls.
Advantages include:
• Faster installation.
• Fewer joins and overlaps.
• Improved sealing performance.
• Reduced risk of grain contamination.
• Easier grain recovery during unloading.
For many operators, prefabricated liners provide the most reliable long-term solution.

Roll-Out Plastic Liners
An alternative approach involves laying multiple widths of plastic sheeting across the bunker floor.
Individual sheets are overlapped and sealed using tape as the bunker is progressively filled.
While this method can reduce initial costs, it introduces additional joins and potential points of failure. Careful installation is required to maintain an effective seal and prevent grain migration beneath overlaps.

Material Quality Considerations

Ground sheets are often subjected to significant mechanical stress during installation, filling and unloading.
Low-quality materials may be prone to:

- Tearing during normal handling.
- Puncture damage.
- UV degradation during exposure.
- Delamination of coatings causing grain contamination.
- Reduced fumigation effectiveness.

Selecting a high-quality liner designed specifically for grain storage applications can significantly reduce these risks.

Reusing Existing Top Covers

Many operators successfully repurpose older bunker covers as ground sheets once they reach the end of their service life as top covers.
This is a practical and economical way to maximise the value of existing top covers.

Part 7: Inloading into the Bunker & Fitting the Cover

1. Install the Ground Sheet

If you are using a ground protection, line the bunker with a quality ground sheet, ensuring even placement with sufficient material either side of the wall for the eventual sealing. One metre to 1.5 metres each side is a good guide, depending on the wall type you are using.

The ground sheet will be concertina folded so it can pulled out over the pad easily. This can usually be done by hand, or with a machine either side if you choose, depending on the weight of the ground sheet been deployed.

Secure the ground sheet with weights on all sides. Concrete tyres are effective and cost efficient option.

2. Fill the Bunker Evenly

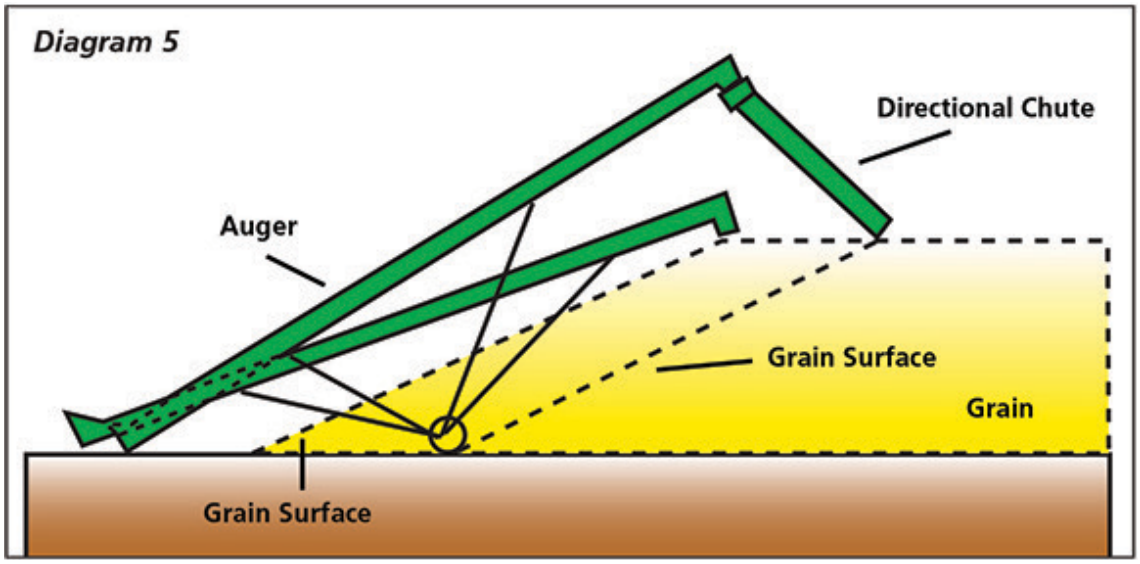
Using a side stacker is an efficient way to fill the bunker, providing suitable truck access at the side of the bunker is available. Filling from the centre with an auger is another commonly used option. Care should be taken when using an auger on a ground sheet, to prevent tearing or puncturing the ground sheet while progressively moving the auger back.

3. Mark Out the Bunker Width

For bunkers constructed on a flat pad, mark the intended bunker width with line-marking paint before filling begins. This provides a visual guide for the auger operator and helps prevent grain from being loaded too wide, ensuring there is adequate tarp width available to achieve an effective seal.

4. Maintain a Smooth Grain Profile

Move the auger in small increments during filling to create a smooth, consistent ridge along the top of the grain pile free from depressions, so that water can run freely off the cover and away from the bunker. The auger can be moved back every couple of truckloads. Once the bunker is filled and ready for covering, it may be necessary to hand-trim the stack before covering to avoid depressions in the grain mass or along the top of the wall where rain may otherwise collect. Large peaks and troughs can also trap air beneath the cover, increasing the risk of condensation.
Often a directional chute attached to the auger outlet is used as it is a valuable tool when filing the bunker. It directs the grain further away from the auger outlet and allows for greater height to be reached before burying the undercarriage (shown in above illustration).



5. Cover as Filling Progresses

Once the bunker has been filled and shaped correctly, the next step is installing the cover. Taking the time to fit the cover properly will improve grain protection, reduce the risk of weather-related damage and help maintain an effective seal. The following guidelines outline proven methods for safely and efficiently deploying, joining and securing bunker covers.
Each cover is concertina-folded and rolled onto either a steel core or a heavy-duty cardboard core, depending on the size and weight of the cover. This packaging method is specifically designed to simplify handling and installation in the field.

To deploy the cover, position the roll at the filled end of the bunker and unroll it from the core. This will create a compact, approximately 2-metre-wide concertina stack at the end of the bunker. The leading edge of the cover can then be pulled lengthwise down the bunker, allowing the cover to progressively unfold as it moves into position. This method significantly reduces manual handling requirements, as there is no need to lift or drag the full weight of the cover during installation.
The bunker does not need to be completely full before covering begins. Installing the cover progressively during filling can reduce the risk of grain damage from unexpected weather events. If the cover is left partially open ensure that it is secured with some weights if it is left open for extended periods of time.

Tarp pullers are valuable tools for safely positioning large covers. The most efficient method is to use two telehandlers, loaders, tractors, or similar machines positioned on either side of the bunker, pulling the tarp using webbing straps or a soft rope so it doesn't cut or damage the tarp. A third person should walk along the centre ridge using a tarp puller to keep the middle section elevated and prevent snagging. Clear communication between operators and ground personnel is essential so all movement can stop immediately if required. Smaller covers will be able to be installed by hand.

6. Joining Multiple Tarps

Bunkers exceeding approximately 2,500 tonnes may require multiple tarps to cover the entire grain pile. Position the first tarp over the bunker, then pull the second tarp into place so it overlaps directly on top of the first. Sew or weld the tarps together approximately 80–100mm from the edge. For additional strength, install a second seam parallel to the first. Fold the rear section of the second tarp back over so the seam is protected underneath. Repeat this process for each additional tarp required.

Union Special Sewer

Another method of joining multiple bunker covers on site is by using a site welding machine. These machines typically operate using either hot air or a hot wedge and provide an effective alternative to a handheld sewing machine. Welding the covers together creates a completely waterproof seam, eliminating the need to apply seam sealer.
Care must be taken to ensure a high-quality weld is achieved, and operator training is generally required to produce consistent results. As welding machines represent a significant capital investment, they are typically used for larger-scale operations where the benefits outweigh the initial cost.


Twinny T5/T7 Welder

The optimal time and location for joining tarps will vary depending on bunker size. For bunkers requiring only two covers, joining the tarps on the ground prior to installation is often the simplest approach. For larger bunkers requiring multiple tarps, the covers will generally need to be joined on the bunker as installation progresses.

7. Seal Tarp Joins

Apply Glo-Mastic sealant to PVC fabrics or Global Tarp Seal to polyethylene (PE) and polypropylene (PP) fabrics with loose weave membrane webbing to all sewn joins. These products create a flexible, waterproof membrane that helps prevent moisture penetration through the seam. Apply generously using a paintbrush to ensure complete coverage.

8. Work Safely

Never attempt to handle large tarps during windy conditions. Large covers can quickly become difficult to control, creating serious safety risks for both personnel and equipment.

Securing and Sealing the Bunker

Once installed, bunker covers must be secured firmly to minimise billowing and flapping in the wind. A properly sealed bunker also helps protect grain from moisture, rodents, insects, and assists with successful fumigation.

The Importance of an Airtight Seal

The effectiveness of any fumigation program depends largely on the ability of the storage system to retain fumigant gas for the required exposure period.
Poorly sealed bunkers may allow gas to escape, reducing treatment effectiveness and increasing the risk of insect survival and resistance development.

A properly sealed bunker helps to:
- Protect grain from insect infestation.
- Improve fumigation effectiveness.
- Reduce grain losses during storage.
- Maintain grain quality over extended periods.
- Improve overall storage security.

Several methods are commonly used:

Concrete Filled Tyres

Concrete filled truck tyres are a popular option where no walls or earth walls are used. For earth-wall bunkers, extend the ground sheet up and over the wall before filling. Once the grain is loaded, pull the top cover down over the wall, fold both the top cover and ground sheet back underneath, and place concrete tyres along the fold. This creates a secure seal so water sheds straight off the tarp. This method can also be used for bunkers with no walls and at the open ends of the bunker. Place the concrete tyres around the perimeter at approximate spacings of every two metres or closer to secure the tarp.
Where weights are placed higher up the bunker, wear patches (cut-up end of life bunker covers) are recommended to reduce abrasion and prolong fabric life.

Earth Trench

An earth trench provides another effective sealing method as detailed earlier in this guide. Place both the ground sheet and top cover into the trench and backfill with soil. Fold any excess tarp material back over the soil to reduce erosion.
While effective, this method can increase labour requirements and may cause damage to the buried section of the tarp during removal.

Concrete Walls

Concrete wall bunkers can be sealed using purpose-built clamp and rail systems that secure both the top cover and ground sheet to the outside of the wall.
To prevent rodents and pests entering through construction joints, seal wall joins with a suitable sealer such as Glo-Mastic and fibreglass reinforcement where a rigid seal is required.
Accurate filling is particularly important when using concrete walls. Overfilling can make covering difficult and create spillage, while underfilling may leave low points where water can collect on the cover.
Proper filling techniques are essential to maximise storage capacity, maintain grain quality and ensure the bunker can be effectively covered and sealed. Attention to detail during this stage will significantly improve the efficiency of subsequent operations and reduce the risk of storage issues.

Wind Considerations

Cover installation should only be undertaken during suitable weather conditions.
Wind can significantly increase handling difficulty and may create safety risks for personnel involved in the deployment process.
If strong winds are present, installation should be postponed until conditions improve.
Partially deployed covers should be temporarily secured to prevent movement or damage.

Part 8: Bunker Management During Storage

Protecting the Cover During Use

Ongoing site management is important to maximise cover lifespan.
To minimise damage:
- Avoid driving vehicles or equipment over the cover.
- Inspect the cover regularly for wear or damage.
- Repair small defects promptly before they become larger problems.

Even heavy-duty covers can be damaged by repeated abrasion, punctures or poor handling practices.

Ongoing Monitoring

Following installation, the bunker should be inspected regularly throughout the storage period.
Routine inspections should check for:
- Cover tension.
- Water pooling.
- Damage caused by wildlife or machinery.
- Seal integrity.

Early identification of issues can prevent costly grain losses and extend the service life of the storage system.

Site Security and Protection

Stored grain represents a significant asset and should be protected accordingly.
Where livestock or wildlife may have access to the storage area, temporary or permanent fencing should be considered to prevent damage to the bunker cover and associated infrastructure.

Maintaining Grain Quality

Maintaining grain quality begins with good site hygiene. Effective hygiene practices help minimise the risk of insect infestations, vermin activity, and grain contamination throughout the storage period.

Vermin Control

Vermin management largely depends on keeping the storage site clean and free of spilled grain. Grain residues can attract mice, birds, pigs, and other pests, increasing the risk of contamination and storage losses. Regularly inspect and clean the area surrounding the bunker to reduce vermin pressure.
For bunkers without side walls, fold the top tarp and ground sheet together to create a secure seal before placing concrete tyres or other suitable weights at regular intervals around the perimeter. This helps maintain an effective fumigation seal while also limiting vermin access.

Grain Monitoring

Regular grain monitoring is essential for identifying potential issues before they become significant problems. Inspect stored grain at least monthly by:
- Checking grain temperature
- Taking representative grain samples
- Looking for signs of insect activity or spoilage
- Assessing grain condition and moisture levels where appropriate

Fumigation access zips provide a convenient way to inspect and sample grain without compromising the integrity of the bunker cover.

Grain Moisture Considerations

Successful bunker storage relies on storing grain at safe moisture levels.
As a general guideline, grain should not be stored above 12% moisture content unless specific grain management strategies are in place.
Excessive moisture can increase the risk of:
- Grain heating.
- Mould development.
- Insect activity.
- Quality deterioration.
- Storage losses.

Moisture testing should form part of the routine grain receival process before grain enters storage.

Part 9: Fumigation of Stored Grain

Fumigation is the most effective methods of controlling insect pests in stored grain.
Bunker storage systems are particularly well suited to fumigation due to the flexible nature of the cover, which allows natural movement of the storage structure and assists in distributing fumigant gas throughout the grain mass.

In order to kill grain pests at all stages of their life cycle, fumigants need to reach, and be maintained at, a concentration possible only in a gas-tight storage. That is why it is important to get a good seal all around your bunker to provide suitable conditions for fumigation to be effective.

For best fumigation results it is recommended to engage with a licensed fumigator who will know the most current and effective fumigation methods. Licenced/commercial fumigators will have monitoring equipment to measure gas concentration throughout the fumigation and venting process.
If you will be storing grain for medium-long term you will likely need to fumigate. Ensure your ground sheets and top tarps have a good seal for best outcome.

The cover can be fitted with GrainSafe® fumigation zips into your top tarp for easy access during the fumigation process. Our fumigation zips are waterproof, gas tight and air tight providing a secure seal. They can also be used for extracting grain samples for testing. This is the best alternative to slitting and taping up tarps.
For piped gas fumigant systems such as HD Gassing, the use of a GrainSafe® fumigation zips makes this process easy and straight-forward.

This unique patented product is utilized for HD Gassing allowing bunkers to be gassed without the expensive investments in Bulkhead Gassing Systems in the wall of the bunker. The GrainSafe® fumigation zips have an option sleeve / nozzle fitted underneath the zipper. When the zipper is opened the HD Gas Pipe is fitted into the sleeve and taped around allowing the gassing to be completed quickly and efficiently through to fumigation sleeve. The sleeve is sized so to also allow for the grain to still be easily accessible for grain sampling and testing.

Besides removing the need for expensive investments in the Bulkhead Systems, it additionally means that Earthen Wall Bunkers can also be gassed in the same manner.
GrainSafe® fumigation zips systems allow fumigant introduction, grain sampling and inspection to be conducted without disturbing the primary bunker seal.
This can improve treatment efficiency while reducing labour requirements and minimising the damage to the cover system.

Part 10: Grain Removal and Cover Maintenance

Careful unloading procedures and proper maintenance of covers are essential to maximise the lifespan of the storage system.
By following a systematic approach to grain removal and cover care, operators can improve efficiency, reduce maintenance costs and extend the useful life of their bunker covers.

Grain Removal Equipment

The method used to unload the bunker will depend on the equipment available and the scale of the operation.
Common unloading equipment includes:

- Front-end loaders fitted with bulk handling buckets
- Mobile augers fitted with cross sweeps for smaller farm operations. Shovels and brooms are necessary to complete the job and a skid plate underneath the intake prevents the auger digging in due to vibrations
- Pneumatic grain conveyors.
- Fixed unloading systems.

Unloading Procedures

Grain should be removed progressively from one end of the bunker to the other.
As grain is removed, the bunker cover should be progressively folded back in a controlled manner.
A flaking or concertina-folding method of folding the cover back on itself assists in resealing the bunker and minimises the possibility of wind or mechanical damage to the covers and also assists with the eventual retrieval and storage of the cover.
The same method can be used in the removal as was used in the deployment. The corners of the cover can be bunched up and secured to the corners of the tarp with straps or a soft rope. The cover can then carefully pulled back using a telehandler or similar machinery. Hand-held tarp pullers can also be used. Proper handling of quality bunker covers can significantly extend their service life and allow them to be reused.
Secure remaining covers during outloading. Any sections of cover still on the bunker should be adequately weighted or restrained to prevent wind damage. If only part of the grain stack is removed, the remaining grain can be re-covered and sealed for continued storage. Tarp belly straps can assist in securing partially opened covers and maintaining protection of the remaining grain.

Cleaning and Inspecting the Cover

Once removed from the bunker, the cover should be thoroughly cleaned before storage.
Any grain residue, soil, vegetation or debris should be removed to minimise the risk of pest infestation and material degradation.
The cover should then be inspected for:

- Tears or punctures.
- Seam damage.
- Abrasion wear.
- UV-related deterioration.
- Damage caused by equipment or wildlife.

Repairs should be completed promptly to ensure the cover is ready for future use.

Cover Storage

Correct storage practices can significantly extend the lifespan of bunker covers. The stored covers should be swept clean of any grain or dirt and stored in a vermin proof shed or shipping container. This eliminates reodent damage and exposure to UV.

Protecting the Cover from Damage

At all times care must be taken not to damage the cover. While the fabrics are robust they can still be damaged by sharp objects, abrasion and some chemicals. Avoid all contamination from herbicides, fuel, oil and other chemicals as these can attack the UV stabilisers in the fabric and reduce the lifespan of the cover.

Planning for Future Storage Seasons

The completion of unloading provides an excellent opportunity to evaluate the performance of the storage system and identify any improvements for future seasons.
Areas to review may include:

- Site drainage performance.
- Cover condition.
- Sealing effectiveness.
- Fumigation outcomes.
- Equipment efficiency.
- Storage capacity requirements.

Regular review and maintenance help ensure the storage facility continues to deliver reliable performance year after year.

Part 11: Technical Support and Further Information

Supporting Australian Grain Storage Operations

Successful grain storage relies on more than quality products alone. It requires sound planning, practical experience, reliable equipment and access to knowledgeable support when required.

At Ellis & Sons Group, we work closely with growers, grain handlers and storage operators across Australia to provide practical grain storage solutions designed to perform in demanding Australian conditions.

Whether you are planning a new bunker storage facility, upgrading an existing site or seeking advice on storage practices, our team is available to assist with product selection, sizing, installation and ongoing support.

Our Areas of Expertise

We provide advice and solutions across a range of grain storage applications, including:

- Grain bunker covers
- Ground sheets and bunker liners
- Site planning and sizing assistance
- Bunker sealing systems
- GrainSafe® Fumigation zippers
- On-farm grain storage solutions
- Cover repairs and maintenance
- Custom manufactured storage covers

Our team can assist in determining the most suitable storage configuration for your operation and provide recommendations tailored to your specific requirements.

Quality You Can Trust

At Ellis & Sons Group, quality is central to everything we do.

Our achievement of ISO accreditation reflects our commitment to continuous improvement, quality management and delivering consistent outcomes for our customers.

From product design and manufacturing through to customer service and technical support, our systems are focused on providing dependable solutions that meet the needs of Australian agriculture.

Need Assistance?

If you require additional information regarding grain bunker storage, cover sizing, site design or product selection, we encourage you to contact our team.

We are always happy to discuss your storage requirements and provide practical advice based on your individual circumstances.

Contact Details

Phone: 1800 808 769
Email: sales@ellisandsonsgroup.com.au
Website: www.ellisandsonsgroup.com.au

Thank You

Thank you for taking the time to read this Grain Bunker Storage Guide.

We hope the information provided assists you in achieving safe, efficient and reliable grain storage outcomes.

We look forward to supporting your grain storage requirements both now and into the future.

Why Growers Choose Ellis & Sons Group

- ✓ Australian owned and operated
- ✓ ISO Accredited Quality Management System
- ✓ Custom manufactured solutions
- ✓ Technical advice and support
- ✓ Proven products designed for Australian conditions
- ✓ Nationwide service and delivery

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