HERITAGE ASSESSMENT REPORT

NAME:	Nantawarra Silo	**PLACE:**	26561
ADDRESS:	Kaurna Country 18 Silo Road, Nantawarra 5550		

The Nantawarra Silo, June 2023.

Source: DEW Files

ASSESSMENT OF HERITAGE SIGNIFICANCE

Statement of Heritage Significance:

A statement of heritage significance has not been prepared for the Nantawarra Silo as it is recommended that the place does not meet any of the criteria for listing as a State Heritage Place.

Relevant South Australian Historical Themes:

The Nantawarra Silo demonstrates the following theme and subthemes in *Historic Themes for South Australia* (2022):

5. Developing South Australia's economies

5.1 Developing South Australia's economy

5.3 Developing primary production

Comparability / Rarity / Representation:

Sites related to South Australia's agricultural industry post-1950 and, more specifically the bulk handling of grain, are not well represented in the South Australian Heritage Register.

Following the passage of the *Bulk Handling of Grain Act 1955*, the South Australian Co-operative of Bulk Handling (SACBH) constructed a network of upcountry storage sites across the agricultural areas of the State.

Only one upcountry storage site built by SACBH is registered as a State Heritage Place – Railway Station Complex and Silos at Balaklava (SHP 12942). This site is comprised of three different silo types: horizontal steel (built 1956), cylindrical concrete vertical (1965), and cylindrical steel vertical.

Railway Station Complex and Silos at Balaklava (SHP 12942). All three silos, cylindrical concrete vertical (on left), steel horizontal (centre), and cylindrical steel vertical (on right) were built by SACBH. The horizontal steel 'shed-style' silo was the first silo erected on the site in 1956.

Source: DEW Files

Three upcountry silos are listed as Local Heritage Places, namely:

- Brinkworth Railway Station Complex, Main Street, Brinkworth;
- Silos, Government Road, Redhill;
- Blyth Railway Station Complex, Guilford Street, Blyth.

Approximately 104 concrete vertical silos were constructed by SACBH between 1956 and 1977. There is only one concrete vertical silo specifically built for the bulk handling of grain pre-1950 listed as a State Heritage Place, namely Gumville Station (former Mount Remarkable Homestead), Melrose (SHP 16243). Erected in 1919, this pair of concrete silos were the first of their type to be constructed in South Australia. The first multi-cell concrete vertical silo was constructed only a year later at the Kent Town Brewery and Malthouse (SHP 10268) in Rundle Street but has since been demolished.

First bulk grain concrete silo built in Adelaide at the Former Kent Town Brewery in 1920 (since demolished).

Source: SLSA B 44104

First vertical concrete silos built in South Australia at Gumville Station, Melrose in 1919 (SHP 16242).

Source: DEW Files

Assessment against Criteria under Section 16 of the *Heritage Places Act 1993*. All Criteria have been assessed using the 2020 Guidelines.

(a) it demonstrates important aspects of the evolution or pattern of the State's history.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should be closely associated with events, developments or cultural phases which have played a significant part in South Australian history. Ideally it should demonstrate those associations in its fabric.*
>
> *Places will not normally be considered under this criterion if they are of a class of things that are commonplace, or frequently replicated across the State, places associated with events of interest only to a small number of people, places associated with developments of little significance, or places only reputed to have been the scene of an event which has left no trace or which lacks substantial evidence.*

The Nantawarra Silo is associated with the industrialisation of South Australia's grain industry through the adoption of bulk handling and, as consequence, the agricultural expansion and economic development of the State in the second half of the twentieth century. Bulk handling revolutionised South Australia's grain industry by enabling growers to harvest and deliver their grain directly in bulk to local silos, providing cost and time effective storage and transportation of grain to terminals for export, thus ensuring South Australian farmers remained competitive on the world market. Growth was rapid under the bulk handling scheme and grain receivals in the State increased dramatically from 154,260 tonnes in 1956, to 4,918,606 tonnes in 1997.

Following the passing of the *Bulk Handling of Grain Act* in 1955, the South Australian Co-operative of Bulk Handling (SACBH) constructed an extensive network of approximately 111 upcountry storage sites and seven port terminals across agricultural areas of the State. The first generation of upcountry silos fed the Ardrossan terminal on Yorke Peninsula, with the first, a horizontal shed-type, opening in Paskeville in January 1956. The Nantawarra Silo was constructed in 1956 as the first of three early concrete vertical silos, alongside Redhill and Gulnare, with general receivals beginning in January 1957. Prior to the construction of the Nantawarra Silo, local growers delivered their grain to Port Wakefield by cart, and later to the railway siding when the line opened from Snowtown to Bowman's in 1922.

Following bumper grain harvests in 1960-1961, 1963-1964, 1964-1965 and 1968-1969, SACBH erected additional storage to upcountry receival centres, and by the mid-1980s most upcountry storage sites had two or more intake systems. In contrast, the Nantawarra Silo remained a single intake facility having rarely been used at full capacity, and as such does not exemplify the pattern of rapid evolution of bulk handling occurring across the rest of South Australia. Of the three earliest concrete vertical silos built by SACBH, Gulnare is more likely to meet the criterion as it demonstrates not only the early implementation of the State's bulk handling system, but its later expansion.

It is recommended that the nominated place **does not fulfil** criterion (a).

(b) it has rare, uncommon or endangered qualities that are of cultural significance.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should demonstrate a way of life, social custom, industrial process or land use which is no longer practised, is in danger of being lost, or is of exceptional interest. This encompasses both places which were always rare, and places which have become scarce through subsequent loss or destruction.*
>
> *Places will not normally be considered under this criterion if their rarity is merely local, or if they appear rare only because research has not been done elsewhere, or if their distinguishing characteristics have been degraded or compromised, or if they are at present common and simply believed to be in danger of becoming rare in the future.*

The Nantawarra Silo was built in the first stage of a large state-wide silo construction programme following the passing of the *Bulk Handling of Grain Act 1955*. The programme saw the construction of approximately 111 upcountry storage sites and seven port terminals between 1955 and 1997. As a result, country silos for the storage of grain built by the South Australian Co-operative of Bulk Handling in the latter half of the twentieth century are not rare, uncommon, or endangered. Bulk handling is still the predominant method of storing and transporting grain in South Australia, with half of the facilities constructed by SACBH still used by current operator Viterra during the 2022-2023 grain harvest.

It is recommended that the nominated place **does not fulfil** criterion (b).

(c) it may yield information that will contribute to an understanding of the State's history, including its natural history.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should provide, or demonstrate a likelihood of providing, information that will contribute significantly to our knowledge of the past. The information should be inherent in the fabric of the place. The place may be a standing structure, an archaeological deposit or a geological site.*
>
> *Places will not normally be considered under this criterion simply because they are believed to contain archaeological or palaeontological deposits. There must be good reasons to suppose the site is of value for research, and that useful information will emerge. A place that will yield the same information as many other places, or information that could be obtained as readily from documentary sources, may not be eligible.*

The Nantawarra Silo was constructed on a portion of land 20.5 km north-east of Port Wakefield in a predominantly agricultural area. Prior to the erection of the silo, local grain growers used the site to load bagged grain onto the train following the construction of the railway from Snowtown to Bowmans in 1922. Several structures were built to this end, namely a weighbridge funded and constructed by local farmers in 1953, and six railway cottages in the north-east corner of the site erected prior to 1952. Substantial excavations also occurred on the site to accommodate the structure's foundations, digging approximately 23 feet (7m) deep. Consequently, the land occupied by the Nantawarra Silo and its associated structures are unlikely to yield any evidence that will meaningfully contribute to the understanding or appreciation of South Australia's cultural or natural history that is not already well documented through a variety of primary and secondary sources.

It is recommended that the nominated place **does not fulfil** criterion (c).

(d) it is an outstanding representative of a particular class of places of cultural significance.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

The place should be capable of providing understanding of the category of places which it represents. It should be typical of a wider range of such places, and in a good state of integrity, that is, still faithfully presenting its historical message.

Places will not be considered simply because they are members of a class, they must be both notable examples and well-preserved. Places will be excluded if their characteristics do not clearly typify the class, or if they were very like many other places, or if their representative qualities had been degraded or lost. However, places will not be excluded from the Register merely because other similar places are included.

The Nantawarra Silo is a member of the class of place known as bulk handling storage facilities. This class of place includes a variety of built structures, namely silos, including one or a combination of cylindrical concrete vertical, steel horizontal, cylindrical steel vertical, and bunker silos; weighbridge and weighbridge office; classification office; switch room; and often railway sidings. Bulk handling storage complexes in South Australia were built by SACBH and are a different class of place to bulk handling port terminals.

While the first silos erected by SACBH were of the horizontal shed type, it was concrete vertical silos that became the storage design of choice for the Co-operative, rejecting low-cost wood and iron storage in favour of a more permanent concrete type with fast inloading and reclaim facilities, and sealed floors to minimise grain loss. Between 1956 and 1977, approximately 104 concrete vertical silos were designed and constructed by silo construction company Haunstrup & Co. The general arrangement of these concrete vertical silos was identical, and the design could be easily adjusted to accommodate more cells or bins depending on the storage demands of the agricultural area.

While the silo in Nantawarra was the first cylindrical concrete vertical silo constructed by SACBH as part of the bulk handling movement, it was not the first concrete vertical silo built in South Australia for the bulk storage of grain. Two cylindrical slipform concrete silos for bulk grain storage predate the Nantawarra silo. The first was a pair of concrete vertical silos built at the Mount Remarkable Training Farm in the Upper North in 1919. The second was a seven-cell concrete vertical silo built at the Kent Town Brewery in Adelaide by the South Australian Brewing Company in 1920.

Since the sites closing in 2004, significant structural elements of the Nantawarra Silo have deteriorated or been demolished, diminishing the integrity of the class of place to such as degree that it is no longer able to demonstrate the key elements of the class at an outstanding level. For example, filling in of the receival hopper and the removal of the weighbridge office. Compared to other upcountry storage sites built by SACBH such as the Railway Station Complex and Silos at Balaklava (SHP 12942), or the silo complex at Jamestown, the Nantawarra Silo no longer exhibits the principal characteristics that define the class to an outstanding level.

It is recommended that the nominated place **does not fulfil** criterion (d).

(e) it demonstrates a high degree of creative, aesthetic or technical accomplishment or is an outstanding representative of particular construction techniques or design characteristics.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should show qualities of innovation or departure, beauty or formal design, or represent a new achievement of its times. Breakthroughs in technology or new developments in design would qualify, if the place clearly shows them. A high standard of design skill and originality is expected.*
>
> *Places would not normally be considered under this criterion if their degree of achievement could not be demonstrated, or where their integrity was diminished so that the achievement, while documented, was no longer apparent in the place, or simply because they were the work of a designer who demonstrated innovation elsewhere.*

The Nantawarra Silo is typical of the cylindrical concrete vertical silos built in South Australia, and more widely Australia, for the bulk storage of grain during the second half of the twentieth century. Designed and built by Haunstrup & Co., the four-cell silo is of a slipform construction. This widely used technique involves the continuous upward movement of a hydraulic formwork mounted on steel yoking frames to lift the formwork as the concrete is poured into the forms. This process enables a continuous pouring of concrete within the moving framework until it has reached the required height. The Nantawarra Silo does not demonstrate a breakthrough or creative adaptation of the construction method, nor did it extend the limits of the existing technology. As a consequence, the Nantawarra Silo is not considered to demonstrate a high degree of creative, aesthetic, or technical accomplishment, nor is it an outstanding representative of particular construction techniques or design characteristics.

It is recommended that the nominated place **does not fulfil** criterion (e).

(f) it has strong cultural or spiritual association for the community or a group within it.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place should be one which the community or a significant cultural group have held in high regard for an extended period. This must be much stronger than people's normal attachment to their surroundings. The association may in some instances be in folklore rather than in reality.*
>
> *Places will not be considered if their associations are commonplace by nature, or of recent origin, or recognised by a small number of people, or not held very strongly, or held by a group not widely recognised, or cannot be demonstrated satisfactorily to others.*

While the Nantawarra Silo has a strong and direct association with many of the growers and residents of the area, any association the wider South Australian community has with the Nantawarra Silo is less definitive. For approximately five decades the Silo was an active receival site for grain growers in the area and the most

significant source of revenue. While the Silo is viewed with fondness and pride by the growers who used it, the associations of the community are of local significance only and do not resonate with the wider South Australian community.

It is recommended that the nominated place **does not fulfil** criterion (f).

(g) it has a special association with the life or work of a person or organisation or an event of historical importance.

Criterion arguments have considered the *Guidelines for State Heritage Places*:

> *The place must have a close association with a person or group which played a significant part in past events, and that association should be demonstrated in the fabric of the place. The product of a creative person, or the workplace of a person whose contribution was in industry, would be more closely associated with the person's work than would his or her home. Most people are associated with many places in their lifetime, and it must be demonstrated why one place is more significant than others.*
>
> *Places will not generally be considered under this criterion if they have only brief, incidental or distant association, or if they are associated with persons or groups of little significance, or if they are associated with an event which has left no trace, or if a similar association could be claimed for many places, or if the association cannot be demonstrated. Generally the home or the grave of a notable person will not be entered in the Register unless it has some distinctive attribute, or there is no other physical evidence of the person's life or career in existence.*

The Nantawarra Silo is associated with the South Australian Co-operative of Bulk Handling, a grower's co-operative established in 1954. Under the *Bulk Handling of Grain Act 1955* the Co-operative was granted the exclusive right to handle wheat and other grains in bulk within the State and were ultimately responsible for facilitating South Australia's transition from bagged to bulk handling of grain. They did this by establishing a comprehensive network of approximately 111 upcountry storage facilities and seven port terminals, predominantly funded by a grower toll system.

It could be said that the concrete vertical silo has become an iconic symbol of the bulk handling movement in South Australia, and as such all silos demonstrate an association with SACBH, as do the seven bulk handling port terminals it built. Alterations to the facility's physical fabric such as the filling in of the receival hopper, removal of the weighbridge office and other structures has impacted the intactness of the Nantawarra Silo and thereby diminished its integrity or ability to demonstrate a special association with SACBH and the grain bulk handling system it developed and operated in South Australia in the second half of the twentieth century.

It is recommended that the nominated place **does not fulfil** criterion (g).

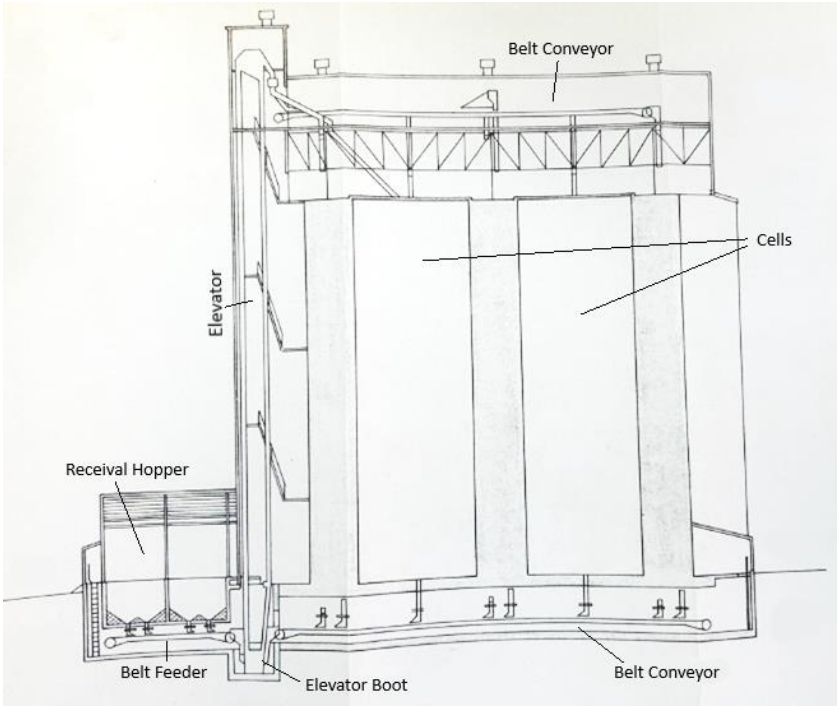
PHYSICAL DESCRIPTION

The Nantawarra Silo site is comprised of two built structures, namely a cylindrical concrete vertical silo and a weighbridge.

Silo

The Silo is a four-cell, one-interspace-cell, cylindrical-concrete-vertical silo built on a square concrete foundation. The silo is over 120 feet (36.5m) high, 40 feet (12m) in diameter and extends 23 feet (7m) below ground level. The outer surface of the silo is brush-painted white, with faint horizontal lines every metre resulting from the silo's slip-form construction. Square steel doors are located at the base of each cell on both sides.

An enclosed grain elevator is positioned on the south-eastern side of the silo. At the base of the elevator on its southern side is a steel entry door leading to the basement stairwell. On its northern side is a metal switchboard cabinet with tally board and power outlet.



Longitudinal section illustrating the general arrangement of a cylindrical concrete vertical silo. The low structure on the left is the receival hopper, with the grain elevator shown directly to its right.

Source: SRSA GRS/15569

A receival hopper extending from the base of the elevator at ground level allows trucks to unload their bulk grain into a trap door in the floor by reversing and tipping the grain into the hopper. From the hopper the grain is funnelled onto the belt feeder and into the boot of the grain elevator. The grain elevator then scoops and lifts the

grain to the top of the silo, onto the conveyor and into the correct cell according to the grain type and grade. Since the closing of the Nantawarra Silo this hopper has been filled in. The receivals hopper and switchboard were also once enclosed by a shed, since removed, and only the metal brackets associated with this shed are still attached to the silo.

On the north-west side of the silo, a metal loading spout is suspended over the railway tracks. To load freight cars on the railway siding, grain was drawn from the bottom of the cells, lifted to the top of the elevator into the spout and fed into the cars to be transported to a terminal for export. The spout is attached to a metal double storey platform with ladders accessing both levels. Behind the spout is a large opening secured by a vertical steel grating. Inside is an alcove with green doors allowing direct access into the silo cells.

Weighbridge

A weighbridge is located to the south-east of the silo, on the main entry road of the site from Bumbunga Road. The weighbridge is a single module pit or inground type constructed from treadplate steel with additional cross-treads welded into position down the centre of the bridge. Concrete approach ramps are located at either end of the weighbridge. Several concrete footings surround the weighbridge on its northern and southern sides where a weighbridge office once stood.

Photograph taken in 1970 showing the weighbridge and office in the foreground and the silo in the background. Note the enclosed receival hopper attached to the side of the silo, and the green and white office to its right. Both structures have since been demolished.

Source: Ron Catford

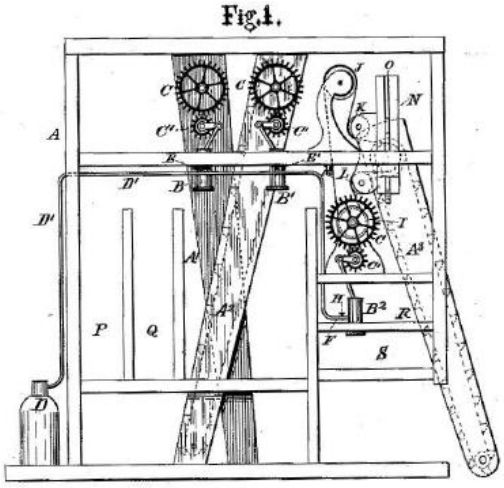
Similar perspective taken in June 2023 showing the removal of the weighbridge office, receival hopper enclosure, and office.

Source: DEW Files

HISTORY

Origins of Bulk Handling

The system of handling grain in bulk originated in the United States of America during the latter half of the eighteen century, with the invention of the first bucket grain elevator by Oliver Evans in the 1780s. Evans' design was improved upon in 1843 by Robert Dunbar, leading to the adoption of grain elevators to facilitate grain loading and unloading from ships throughout North America.[1] The construction of bulk storage and management facilities followed, and by the beginning of the twentieth century most wheat in the USA and Canada was handled in bulk, with the latter operating a bulk handling system exceeding a capacity of 150 million bushels.[2] Other countries also began adopting the bulk system, with Russia constructing a network of bulk grain elevators throughout the grain-growing provinces in the 1910s.[3]



Robert Dunbar's Grain Elevator Patent 1880.

Source: Tim Mazzarol, *'The didn't have to sell their shares,'* p. 3.

Despite proven success overseas, and an ever-growing preference from Australia's overseas buyers for deliveries of grain in bulk, the transition from bagged to bulk handling of grain in Australia was slow. In South Australia, the transition from bagged to bulk handling of grain took almost fifty years with the State becoming one of the last major wheat-producing regions in the world to adopt a bulk handling system. The delay was due, in part by fears of monopoly and loss of labour, and by the technical and financial challenges of equipping multiple port terminals with bulk loading facilities.

Bagged Versus Bulk Grain

During the first half of the twentieth century South Australia's grain was bagged in four-bushel jute or corn sacks and manually handled from the farm to local rail sidings, and then to port and onto ships.[4] This process was inefficient and had many disadvantages, foremost being the amount of time and labour involved, with Port

Adelaide alone employing hundreds for the sole purpose of receiving grain and loading ships at harvest time.[5]

Bulk handling was first considered in South Australia in 1908, when a Royal Commission was appointed on the marketing of wheat. Although the seven members of the House of Assembly commended the bulk handling system in principle, they ultimately decided the time was not right.[6] In 1914, the question was raised again, when the House of Assembly commissioned Canadian silo firm Metcalf & Co. to investigate the cost benefits of substituting a 'system of handling wheat in bulk for the present system of handling in bags.'[7] The resulting report strongly highlighted the major deficiencies of bagged handling over bulk handling, arguing:

- the cost of handling and transporting wheat in bags was excessive, with South Australian farmers losing £250,000 to £300,000 annually between purchasing and reselling their bags;
- the speed of handling in bags was slow, with each bag having to be sewn on the farm;
- the method of weighing bagged grain at country rail stations was inaccurate;
- the bag system congested railways, country stations, and ports;
- the bag system was highly susceptible to weather, vermin and pests;
- the cost of cleaning sacked wheat was excessive, with Australian wheat often incurring a large penalty overseas due to it not being fully cleaned;
- the free storage system was not equitable and gave merchants control of the crop.

Metcalf proposed a £1,100,000 bulk handling system comprised of a network of upcountry storage sites that would feed into five export terminals at Port Adelaide (Outer Harbor), Wallaroo, Port Pirie, Port Lincoln and Thevenard.[8] It was estimated that annual savings would be in the order of £275,000, and the system would pay for itself in four years. After considerable debate the motion lapsed due to heavy establishment costs and apathy from growers.[9]

Aside from the cost of the bags, the most vital argument against the bag system was the inadequacy of the inspection, grading, and selling systems it created. In 1888, South Australia developed the f.a.q or Fair Average Quality system to grade grain in bags. Each harvest season, the Chamber of Commerce drew samples from every delivery point on a percentage basis, excluding obviously inferior lots. These samples were carefully bulked and thoroughly mixed before an official composite sample was fixed and its imperial bushel weight determined. The sample was thus a weighted average.[10] This system drew constant criticism, as it disadvantaged farmers who produced a higher grade of grain, and rewarded farmers who produced a lower grade, thus removing any incentive for farmers to grow and deliver the best and cleanest wheat possible.[11]

The weaknesses of the bag system were further highlighted during the First World War when bumper crops and extreme shortages of shipping resulted in a huge accumulation of wheat.[12] Alarming quantities of stacked bagged wheat were

decimated by mice, weevils, other vermin, and the weather. In response, the Commonwealth Government offered £3,000,000 to any state to implement a bulk handling scheme. New South Wales was the only state to accept assistance and the first bulk handling terminal in Australia opened at Glebe in Darling Harbour in 1921.[13]

Allen R. Callaghan argues that the major problems that the advocates of bulk-handling faced were political, not technical.[14] Opposition was based on the cost of maintenance, fears of monopoly,[15] and concerns that bulk handling 'would seriously affect the labour market by increasing the volume of unemployment.'[16] Max Lamshed adds that heavy initial costs also played a role in arguments against bulk handling, with the proposed systems all requiring the purchase of special delivery trucks for the farmer and the establishment of siding storages and terminal silos.[17]

For the next thirty years numerous attempts to establish bulk handling in South Australia were made. In 1922, a farmers' co-operative company called the Farmers' Bulk Handling of Grain Co-operative Limited took over the Metcalf plans. In 1933, an inquiry comprising over 290 pages of evidence taken from farmers across the State was presented to the government, and in 1934 the Public Works Committee submitted recommendations for the establishment of a bulk handling scheme. All attempts were unsuccessful.

The Second World War provided another stimulus for the development of bulk handling when the Australian Wheat Board (AWB) was empowered by the Minister for Commerce to 'purchase any wheat, sell or dispose of any wheat acquired or purchased by the Commonwealth, and manage and control all matters connected with its handling, care, movement, and shipment.'[18] The War severely restricted shipping and the AWB was faced with the responsibility of constructing storage to house wheat that would normally have been shipped. From 1941-1943 the Board embarked on an extensive program for the construction of large bulk bins in Western Australia and Victoria, but this innovation never made it to South Australia.[19]

In 1948, an opportunity for South Australia to adopt bulk handling emerged when the Broken Hill Proprietary Company (BHP) constructed a jetty and conveyor belt at Ardrossan to ship dolomite interstate. By 1951, an agreement was reached between the State Government, BHP, South Australian Harbors Board (SAHB), and AWB to construct a bulk grain handling facility at the port, a decision motivated in part by a shortage of grain bags at the time.[20] Under the agreement, the AWB provided funding for construction of a million-bushel capacity, horizontal shed with a sloping internal floor and gravity-fed underground conveyor, linked to the BHP belt. The new horizontal storage facility was opened by the Premier, Sir Thomas Playford, on 25 November 1952, marking the first silo constructed as part of the bulk handling system in the State.[21]

The overseas market also played a role, with buyers ultimately dictating how grain was delivered to export destinations such as England and New Zealand. By the mid-twentieth century, a majority of export markets preferred their grain in bulk and were also prepared to pay more for grain in bulk. The continuation of bag handling would

therefore have incurred major operational and cost imposts to buyers, providing a disincentive to purchase South Australian grain.[22]

The South Australian Co-operative of Bulk Handling

In 1954, the South Australian Wheat and Woolgrowers' Association (SAWWA) prepared a detailed proposal and draft bill regarding the establishment of a bulk grain handling co-operative. The State Government referred this proposal and draft bill to its Public Works Standing Committee. The proposed entity was to be a non-distributing co-operative, with no share capital or dividends paid on shares, focussing only on bulk handling and storage of wheat, and was not to become a grain trading business.[23] Growers were to pay the company a compulsory toll of 3d per bushel for all wheat they produced, which was to be applied towards financing the construction and operation of bulk handling facilities.[24] The scheme provided for the construction of 100 upcountry sidings with an average capacity of 270,000 bushels each at an estimated cost of £4,850,000 or about 3s7d a bushel based on a normal wheat crop of 27,000,000 bushels.

Before the Bill was submitted to Parliament, the State Government required assurance that the scheme would have the support of a substantial portion of the wheatgrowers. The Government stipulated that:

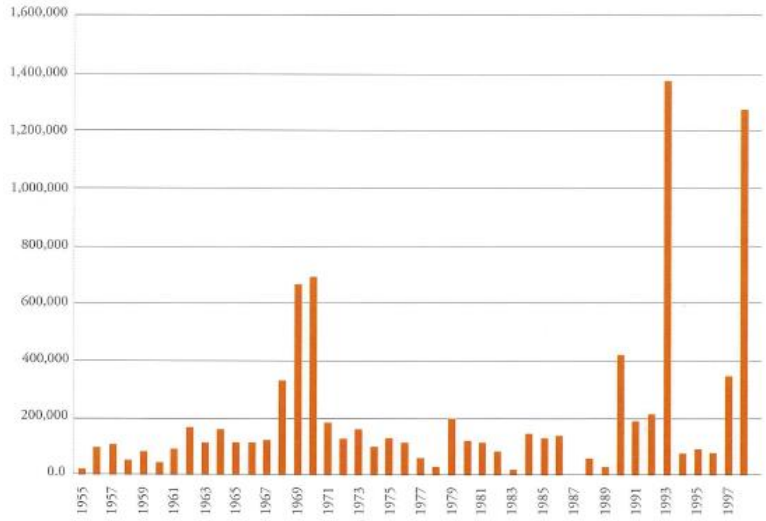
> before the legislation was introduced, wheatgrowers whose deliveries of wheat amounted to 12,000,000 bushels a year should sign contracts with the company agreeing to make payments to it of not less than 3d a bushel for 12 years for the purpose of raising capital.[25]

Grower support was overwhelming, with the Association's branches around the State reporting almost 100% in favour. SAWWA also proceeded to register a new company, the South Australian Co-operative of Bulk Handling Limited (SACBH), which was incorporated on 7 December 1954.[26] On 9 May 1955, SAWWA secretary and independent Member of Parliament Tom Stott provided the Government with 5,000 grower signatures committing to tolls on 12,379,992 bushels of wheat.[27]

The *Bulk Handling of Grain Act* (Bulk Handling Act) was assented to by Parliament on 7 July 1955, granting SACBH the exclusive right to handle wheat and other grains in bulk within South Australia with the principal objective of 'establishing, maintaining, and conducting in the State of South Australia a scheme or system for receiving, handling, transporting, and storing wheat and other grain in bulk.'[28]

As detailed in SAWWA's bill, SACBH was a private co-operative wholly owned by grain growers, raising capital through tolls.[29] Growers who signed up as members when the company was first formed agreed to pay 3d per bushel for all grain delivered to storage. In subsequent years, as the storage network expanded, growers paid 6d per bushel. If there were no bulk facilities and growers delivered their grain in bags, the toll was set at 2d per bushel.[30] Members paid these tolls over a 12-year period, after which they were refunded their contributions in 12 annual instalments. No interest was

earned or paid on the toll as all net profits were used to establish bulk handling facilities, as well as maintenance and improvements, as specified by the Bulk Handling Act.[31] Within twelve months, 8,500 members had signed up to the Co-operative, growing to 17,388 members in 1961.[32]



Chronology of storage construction in tonnes 1955 – 1997.

Source: David Thomas, *A Golden Era*, p. 32.

The Silo Construction Programme

Under the Bulk Handling Act, SACBH had a duty to, with all practicable speed,

> erect adequate bulk handling facilities - (a) at each terminal port; and (b) at a sufficient number of railway stations, railway sidings, and depots, to receive the grain which is to be taken to the terminal ports.[33]

Over the next fifteen years, the company made great effort to establish handling facilities across the State to satisfy the pent-up demand from growers.

The original infrastructure plan envisaged five port terminals and 70 upcountry silos across the State at a cost of £5,000,000.[34] Funding for the initial stages of construction was provided by a £1,000,000 State Government guaranteed loan from the Commonwealth Bank.[35] Membership tolls funded the rest. On 10 November 1955, SACBH purchased the Ardrossan silo from the AWB following agreements with the SAHB for lease of land and with BHP for use of its conveyor belt.[36] Over the first harvest period, wheat flooded into the terminal, with more than 4,000,000 bushels being exported in 21 ships by August of the following year. Pressure quickly mounted to build bulk country storage that would feed the Ardrossan terminal.

The first upcountry silo in the State, a horizontal shed type, opened at Paskeville in January 1956. Bute followed a few months later. That same year, the Co-operative received approval to erect five horizontal shed-type silos at Balaklava, Snowtown, Blyth, Hoyleton and Brinkworth, and three cylindrical concrete vertical silos at

Nantawarra, Redhill and Gulnare.[37] In two short years, a new terminal and 13 upcountry silos representing 10 million bushels of storage had been completed, with demand escalating thereafter. The order of priority for the erection of bulk handling facilities was determined by the urgency of the needs of growers and the amount of grain produced in the various parts of the State.[38] Expansion echoed the growth of members as the toll system financed silo construction - the greater the number of members, the greater the number of upcountry silos.

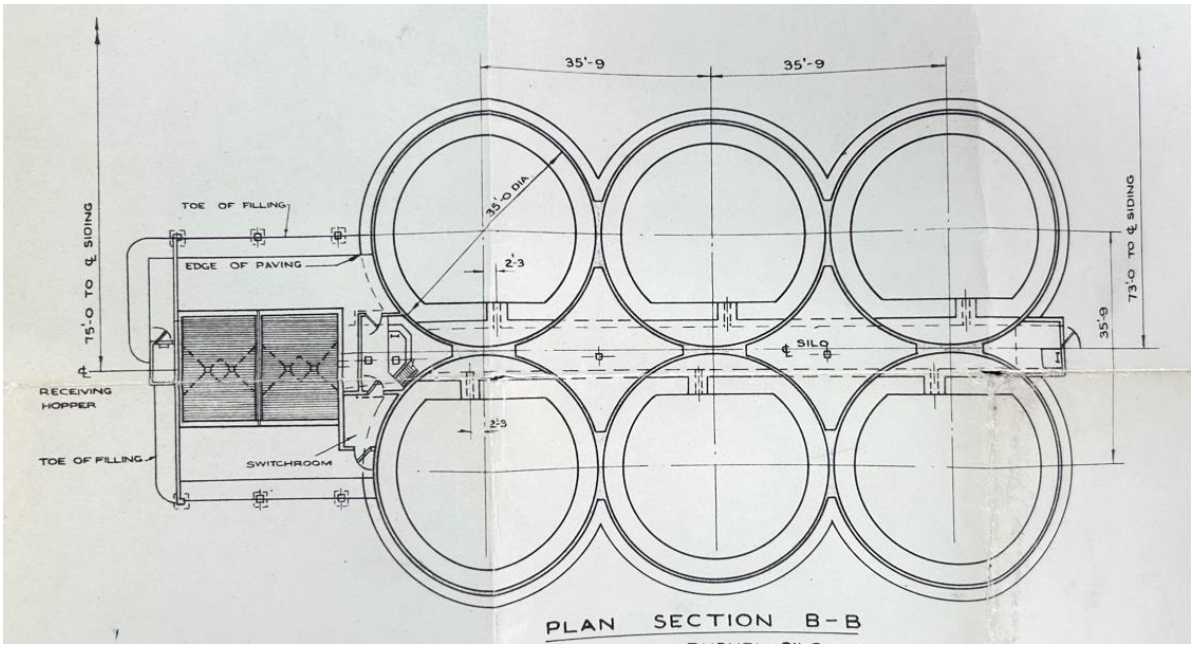
By 1965, just ten years after the passing of the Bulk Handling Act, the Co-operative had constructed provision for the storage of 48,877,000 bushels of grain.[39] The basic components of the bulk handling network were now established, propelled forward by bumper harvests in the late 1960s. By the mid-1980s, most receival centres had two or more intake systems to keep up with demand, with elevators capable of handling rates from 60 to 200 tonnes per hour. Additional storage at these facilities consisted of steel vertical, horizontal, bunker, and emergency shed type storages, and were usually a self-contained block with its own intake and outload equipment.[40] Shipping rates had also increased dramatically:

> …ships which used to take up to four weeks with 160 men to load a cargo of bagged grain now load the same tonnage in one day at Terminals like Port Lincoln, where shipping rates of up to 4000tph are possible.[41]

The bulk system operated as follows: growers would deliver grain by road to either upcountry storage receival sites or directly to port storage, where it was collected, weighed, tested, graded and stored by SACBH for later shipment or sale to local markets. From upcountry storage, SACBH was then responsible for freighting the grain by rail and road to an export terminal, where the grain was then outturned to shipping vessels through one of the seven port terminal loading facilities.[42]

Design

In its formative years, the Co-operative faced many difficult choices in relation to silo design. Many growers thought that the company should copy the low-cost horizontal wood and iron storage used extensively in Western Australia to rapidly establish a bulk handling system.[43] Initially, SACBH used in-house designs for horizontal shed storage as seen at Paskeville and Bute. However, horizontal silos had distinct inherent disadvantages such as high operating and maintenance costs and a larger footprint. Its cell-less design also made it difficult to separate grain types and grades, and to undertake grain inspection and fumigation.[44] The ability to segregate different grains was particularly important in South Australia, where larger volumes of grains other than wheat, in particular barley, were grown compared to other States like Western Australia.[45]



General arrangement plans for a six-cell, 400,000-bushel capacity country silo. This design was replicated by SACBH across country South Australia, with the number of cells and hoppers dependant on the amount of the storage capacity and intake levels required at individual locations.

Source: SRSA GRS/15569

In 1956, SACBH called for tenders for concrete vertical silos with faster intake facilities.[46] Many of the resulting storage facilities were based on a low-cost design put forward by the Australian silo construction company Haunstrup & Co., for 200,000 and 400,000-bushel capacity concrete vertical silos. Most of the units were of four or six main cell types, with a cell diameter of 30 or 35 feet (9-10m), and a height of approximately 95 feet (29m). These cells allowed wheat to be separated into Hard and F.A.Q. categories, breaking a 60-year practice of receiving one standard grade of wheat, and earning higher premiums for growers.[47] Each silo had a handling rate of 175 to 200 tonnes per hour and two receival road hoppers, each with a holding capacity of 25 tonnes enabling the rapid unloading of the largest of grower's trucks.

The vertical cell silos were modular and capable of extension by adding more cells without building more receival hoppers or another elevator tower. The capital cost of this type of silo was amortised between 30 cents and 50 cents per bushel. Vertical concrete silos became the "backbone" of the South Australian silo network, and this design was built at around 104 centres, for a total capacity of 79 million bushels.[48] By standardising one type of storage system, SACBH managed to save money and provide continuity of work for building contractors.[49]

However, by the end of the 1960s concrete vertical silos were becoming increasingly expensive to build, and SACBH turned to using steel vertical silos and iron sheds. This new generation of steel storage was quick to build, cost effective and had the further advantage of being gas-tight to facilitate more efficient grain fumigation and the use

of nitrogen and carbon dioxide-controlled atmospheres.[50] By 1971, SABCH had also constructed iron sheds at 39 centres across the State as emergency storage.[51] The last concrete silo in country South Australia was built at Kingscote in 1977, and the last concrete cells at a terminal were constructed in 1985 at Port Lincoln.[52]

That most of these early concrete silos are still functional almost 70 years later vindicates the difficult decisions that were made by SACBH in their formative years. These silos also played an important role in the existing storage system by providing segregation capacity for minor grains, as well as for grades of grain which could not be stored in either bunkers or shed storage without sacrificing valuable space.[53]

Demutualisation and Modernisation

By 1980, SACBH had reached a peak membership of over 16,300 growers and were operating bulk grain storage facilities with a capacity of more than 4 million tonnes.[54] In 1989, the *Wheat Marketing Act* was passed, deregulating the domestic wheat market. This legislation removed the monopoly power of marketing authorities such as the AWB and the Australian Barley Board (ABB), as well as that of state-based bulk handling businesses such as SABCH.[55]

According to David Thomas, by the mid-1990s, escalating competitive forces were unleashed within the grain industry, resulting from the deregulation, privatisation, and consolidation of statutory rail, marketing, storage and handling organisations.[56] For SACBH this process culminated in the repealing of the Bulk Handling Act in 1996, which took away the Co-operative's monopoly rights and gave federal organisations AWB and ABB significant powers to override State legislation.[57] The once amicable relationship SACBH had enjoyed with AWB and ABB became more competitive as the decade ended.

In response, SACBH began to modernise by appointing its first independent, non-grower director Perry Gunner to the board and by acquiring bulk handling facilities at seaports from the newly privatised SAHB, then known as Ports Corp. This move gave the Co-operative total control of the handling channel from receival point to ship. [58]

In August 2000, at a special general meeting, SACBH was formally demutualised by a vote of 96% of members. SACBH was restructured, abandoning its non-distributing co-operative business structure for a hybrid structure consisting of AusBulk, a conventional company limited by shares, and a holding company, United Grower Holdings, a solely grower-owned public company that in turn owned 51% of AusBulk.[59] The new business was known at AusBulk-UGH.

At the same time, ABB privatised into ABB Grain Ltd., creating a highly competitive business entity in South Australia. During the early 2000s the entire Australian grain industry was highly competitive, with the newly privatised AWB Ltd. and ABB Grain Ltd. and the demutualised AusBulk-UGH all keen to maximise their shareholder returns via diversification, acquisition, or mergers. AusBulk-UGH became a takeover target and merged with ABB Grain Ltd in September 2004.[60] In September 2009, the company was acquired by Viterra Canada for $1.6 billion.

Nantawarra Silo

Set in a valley between two ranges, the district of Nantawarra is located on Kaurna Country approximately 119 kilometres north of Adelaide, and is part of the Hundred of Goyder, an area of 99.5 square miles, proclaimed on 26 June 1862.[61] At the time of European settlement around 650 Kaurna people lived in the plains which stretched north and south from Adelaide and the wooded foothills of the range which borders them to the east.[62]

The name Nantawarra is a corruption of the Kaurna word nantuwara, meaning 'kangaroo speakers.'[63] The first mention of Nantawarra in census data was in 1911, when 94 persons and 17 occupied dwellings were recorded.[64] The area is predominantly agricultural, farming wheat and barley, with the latter predominating. Atlanta, Erfurt, and Cape barley varieties are grown in the area.[65]

When the first locally grown crops were harvested at Nantawarra, grain was typically bagged in four-bushel sacks and delivered by farmers to the nearest seaport at Port Wakefield. Most farmers made the arduous 40-kilometre round-trip by cart, hauled by either bullock teams or horses. Cartage was considered the lightest part of work for farmers, but the heaviest in terms of expense.[66] Delivering direct to Port Wakefield by cart continued until almost the end of World War One, when local wheat stacks were established.

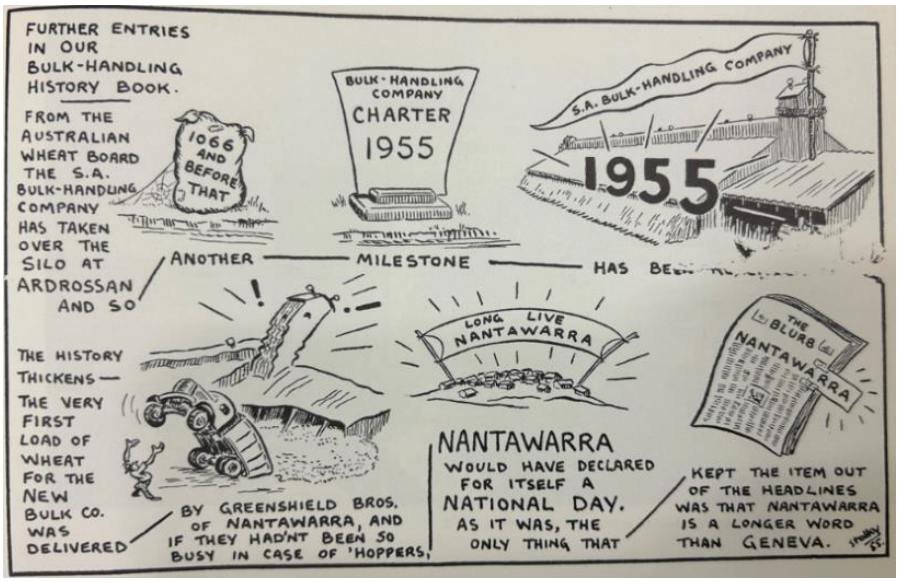
Wheat stacks on Nantawarra Recreation Reserve, 1919.

Source: Rex Penna, *Fertile Valley to Open Plain*, p. 99.

From this time local deliveries were made to a site by the scrub on the east side of the Nantawarra Recreation Reserve near the Nantawarra Hall, saving farmers the day-long trip to Port Wakefield. In February 1918 it was reported that there were 14,000 bags of wheat on the stacks. However, storing grain in stacks was risky, and in 1932, 50,000 bags were damaged by mice before they could be carted to Port Wakefield.[67]

In December 1922, eight months before the first official train passed through Nantawarra on the new line from Snowtown to Bowmans, 600 bags of barley and 200 bags of wheat were transported by rail, with the cost of freight fixed at 11s 6d per

tonne for barley and 10s per tonne for wheat.[68] In November 1953, a new weighbridge was installed at the railway siding, financed by local grain growers and installed through local working bees.[69] In November the following year, Ray and Keith Greenshield delivered the first load received by the Ardrossan bulk-handling terminal directly from their Nantawarra property 36 miles away.[70]

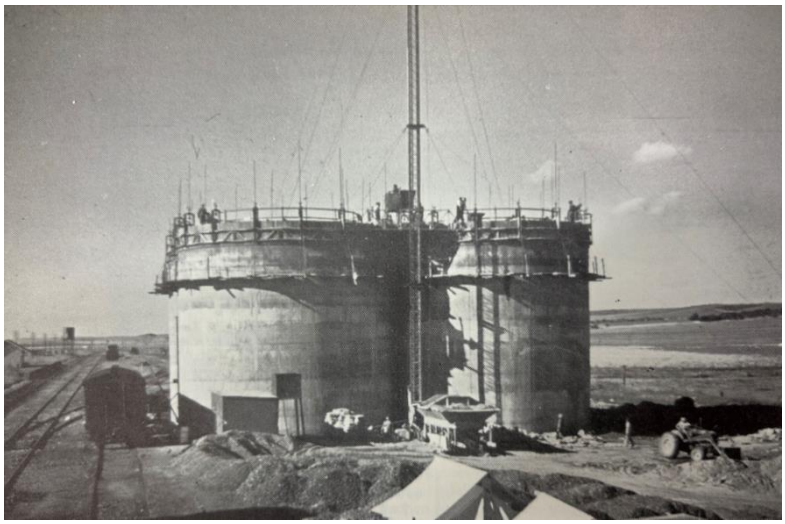


Nantawarra makes headlines in the *South Australian Wheatgrower* on 24 November 1955.

Source: Rex Penna, *Fertile Valley to Open Plain*, p. 101.

By the time SACBH selected Nantawarra as one of the first regional grain silo sites in 1956, the district was averaging yearly harvests of 51,800 bags of wheat and 11,800 bags of barley. Drilling began in June that year to obtain test samples before construction of the silo could proceed.[71] Foundations were excavated in late June to a depth of 23 feet (7m).[72] In July, it was announced the silo would be built by contractors Haunstrup & Co., and would be 100 feet (30m) high, 40 feet (12m) in diameter, and have a holding capacity of 420,000 bushels. The pouring of concrete began in October, with power supplied by a large diesel engine.

For SACBH, the overwhelming priority was to establish storage at almost any cost, and shortcuts were taken to achieve this goal. Before the Nantawarra Silo was completed, 25,000 bushels of wheat were received into the centre interspace cell, with Edward Herbert Jnr. delivering the first load. Ted Ridley, the Co-operative's Operations Manager from 1955 to 1985, recalls the challenges of these early grower receivals at Nantawarra before the addition of a roof, noting that when it rained staff had to scrounge rail truck tarpaulins, much to the disapproval of the Railway Commissioner, to cover the top of the concrete cells to prevent grain from being damaged.[73]



The Nantawarra Silo during construction in 1956, looking north.

Source: Rex Penna, *Fertile Valley to Open Plain*, p. 102.

General receivals at the Nantawarra Silo did not begin until January 1957, with the first shipment of 8,000 bushels leaving the silo in March.[74] The transition for local growers to deliver in bulk was slow, with the Nantawarra silo accepting deliveries in both bagged and bulk form until 1969.[75] Due to high rail freight charges, the Nantawarra Silo was never used to its full potential, and was bypassed by large quantities of grain, driven by road directly to the seaport at Ardrossan. Only during the big harvests of 1960-61, 1963-64, 1964-65 and 1968-69, and later during the 1990s, was the silo filled to capacity.[76] The Nantawarra Silo remained the only significant source of revenue in the area for several decades until 2004 when the site closed.[77]

Bagged sacks of grain and wheat shed in the foreground and the Nantawarra silo in the background.

Source: Rex Penna, *Fertile Valley to Open Plain*, p. 103.

Chronology

Year	Event
1837	South Australia's first wheat crop is harvested.
1845	Australia begins exporting wheat to England.
1851 - 1852	South Australian growers achieve the first million-bushel harvest.
1888	South Australia develops the Fair Average Quality (f.a.q) system to grade grain in bags.
1908	A Royal Commission is appointed on the marketing of wheat.
1911	**Census records 94 persons and 17 occupied dwellings in Nantawarra.**
1914	Canadian silo firm John Metcalf & Co. is commissioned by the House of Assembly to investigate the cost benefits of bulk versus bagged grain.
1915	Metcalf & Co.'s *Bulk Handling of Wheat* report is printed in December.
1916	A motion is submitted to the House of Assembly in August concerning the provision of terminal elevators at Port Adelaide, Wallaroo, Port Pirie and Port Lincoln, and country elevators as required. After considerable debate, the motion lapses.
1918	**14,000 bags of wheat are delivered to the Recreation Reserve in Nantawarra.**
1919	First cylindrical concrete silo built in South Australia at Gumville Station (former Mount Remarkable Homestead), Melrose (SHP 16242).
1920	First cylindrical concrete silo built in metropolitan Adelaide at the former Kent Town Brewery in 1920 (since demolished).
1921	The first bulk handling terminal in Australia opens at Glebe in Darling Harbour.
1922	Farmers' co-operative company, Farmers' Bulk Handing of Grain Co-operative Limited takes over the Metcalf plans, but a Bill to give effect to the plans is defeated in the third reading.
1923	**The first train passes through Nantawarra on the railway line from Snowtown to Bowmans.**
1933	An inquiry comprising 290 pages of evidence, taken from farmers in support of bulk handling, is submitted to the State Government.
1934	The Public Works Committee submits a recommendation for the establishment of a bulk handling scheme. No action is taken.
1935	The South Australian Wheat and Woolgrowers' Association (SAWWA) meets with the State Government proposing that a company be formed on co-operative lines.
1939	The outbreak of WWII leads to establishment of the Australian Barley Board (ABB) and the Australian Wheat Board (AWB).

1947 The South Australian Government's Public Works Committee visits Western Australia to examine their bulk handling system and to interview farmers.

1948 BHP constructs a jetty and conveyor belt at Ardrossan to export dolomite.

1952 The first wheat and bulk handling facility in the State, comprised of a horizontal shed type silo, is constructed at Ardrossan. The new facility is opened by Premier Sir Thomas Playford, on 25 November.

1953 A new weighbridge funded by local grain growers is installed at the railway siding in Nantawarra in November.

1954 First load of wheat is received by the Ardrossan terminal in November. The delivery is made by two farmers from Nantawarra.

1954 SAWWA submit a proposal and draft bill for the establishment of a bulk handling company to the Playford government. The South Australian Co-operative of Bulk Handling Limited (SACBH) is incorporated as a company in December.

1955 SAWWA submit audited figures of grower signatures pledging tolls on 12,379,992 bushels of wheat. This paves the way for the South Australian Government to pass the *Bulk Handling of Grain Act,* assented on 7 July.

1955 SACBH purchase Ardrossan storage from AWB.

1956 The first South Australian upcountry storage silo is opened at Paskeville.

1956 Grain silo built at Nantawarra.

1957 General receivals begin at the Nantawarra Silo in January.

1957 The first South Australian bulk export terminal is opened at Wallaroo.

1957 SACBH builds in-transit barley storage at Ardrossan for ABB.

1958 The Port Lincoln bulk handling terminal and the first upcountry storage on Eyre Peninsula are constructed.

1962 SACBH sign an agreement with ABB for construction of barley storage across the State.

1963 SAWWA, AWB, and SACBH move into purpose-built accommodation at Grain House on South Terrace, Adelaide.

1964 The *Bulk Handling of Grain Act 1955* is amended to include oats.

1965 SACBH celebrates its construction of 49 million bushels (1.3 million tonnes) of storage.

1968 The railway siding at Nantawarra is dismantled and levelled.

1969 Grain production soars, resulting in a huge expansion of upcountry and terminal storage.

1969 The Port Giles terminal is constructed.

1972 All weighbridges are converted to metric standards.

1974 The Fair Average Quality system of grading is replaced with the Australian Standard White system.

1980 SACBH's storage capacity exceeds 4 million tonnes, and its membership more than 16,300 growers.

1984 First bunker storage is constructed at Ardrossan.

1996 The Bulk Handling of Grain Act is repealed.

1997 SACBH purchases terminal bulk loading plants from Ports Corp.

1998 The Australian Wheat Board privatises to form AWB Ltd.

1999 The Australian Barley Board privatises to form ABB Grain Ltd.

2000 SACBH demutualises to form AusBulk, and United Grower Holdings (UGH).

2001 AusBulk receives its largest harvest ever at 8.6 million tonnes. Storage capacity reaches 10 million tonnes.

2003 The State Government confirms that Port Adelaide's Outer Harbor will be the site for a new deep-water grain port.

2003 Swiss mining company Glencore begins trading agricultural commodities in Australia as Glencore Grain.

2004 ABB Grain Ltd., AusBulk, and UGH merge, resulting in the creation of ABB Grain Ltd.

2009 Viterra Canada acquires ABB Grain Ltd for $1.6 billion in September.

2012 Glencore Grain acquires Viterra Australia and Canada.

2016 Viterra's storage capacity exceeds 11 million tonnes, located in and around 90 operational receival sites.

Viterra constructs an additional 900,000 tonnes of bunker storage.

2020 Glencore Grain rebrands to Viterra globally.

2023 Viterra operates 49 receival sites and five port terminals in South Australia.

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SITE RECORD

NAME:	Nantawarra Silo	**PLACE NO.:**	26561

DESCRIPTION OF PLACE:	A 420,000-bushel capacity, 4-cell (1 interspace cell) cylindrical concrete vertical silo and weighbridge.	
DATE OF CONSTRUCTION:	1956	
REGISTER STATUS:	5 May 2023 (provisional entry)	
PREVIOUS USE(S):	Bulk handling facility	
	January 1957 – 2004 (approximately)	
ARCHITECT:	Haunstrup & Company	
	1956	
LOCAL GOVERNMENT AREA:	Wakefield Regional Council	
LOCATION:	**Street No.:**	18
	Street Name:	Silo Road
	Town/Suburb:	Nantawarra
	Post Code:	5550
LAND DESCRIPTION:	**Title Reference:**	CT 6031/922 A11 D78671
	Hundred:	Goyder
MAP REFERENCE:	-34.007422, 138.226495	

PHOTOS

NAME:	Nantawarra Silo	**PLACE NO.:**	26561

All photographs have been sourced from DEW Files.

South-east side of the Nantawarra Silo. Note the rectangular outline at the base marking where the hopper enclosure once was. The ground in front is where the receival hopper has been filled in.

Entry door at the base of the elevator. The door on the left provides direct access to the inside of the silo cell.

Switchboard at base of the elevator.

PHOTOS

NAME:	Nantawarra Silo	**PLACE NO.:**	26561

Remnants of instructions beside the switchboard published by AusBulk.

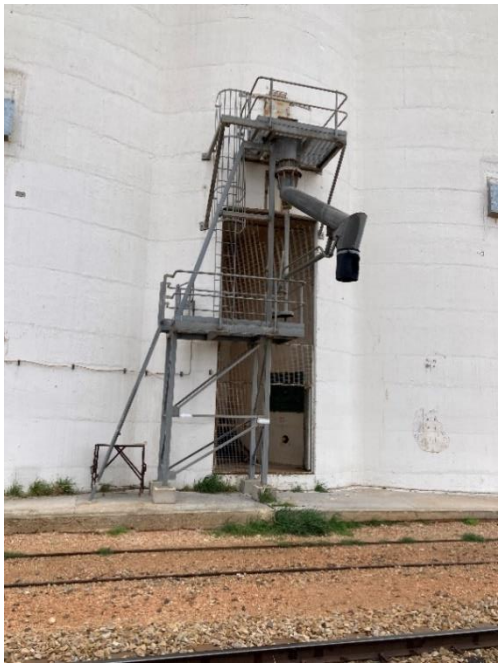
Detail of direct access door to the inside of one of the silo cells.

North side of silo with railway siding and output spout.

PHOTOS

NAME:	Nantawarra Silo	**PLACE NO.:**	26561

North-west side of the silo.



Detail of spout that feeds grain from the silo into the railway cars for transport.

The remaining foundation of a SACBH office at the base of the silo on its north-west side.

PHOTOS

NAME:	Nantawarra Silo	**PLACE NO.:**	26561

View of the Silo with weighbridge in foreground.

Inground weighbridge.

Remaining foundations of weighbridge hut and classification office.

SITE PLAN

NAME:	Nantawarra Silo	**PLACE NO.:**	26561

N ↑

LEGEND

Parcel boundaries (Indicates extent of Listing)

[1] Tim Mazzarol, 'They didn't have to sell their shares – the rise and demise of SACBH-ABB Grain,' case study research report, C.E.R.U., (2021), 3.
[2] 1 metric tonne of wheat equals approximately 37 bushels, making 1,000,000 bushels equivalent to approximately 27,027 metric tonnes.
[3] Metcalf & Co. Ltd., 'Bulk handing of wheat,' (Adelaide: Government Printer, 1915), 3.
[4] A.R. Callaghan, A.J. Millington, *The Wheat Industry in Australia* (Sydney: Angus and Robertson, 1956), 371.
[5] David Thomas, *A Golden Era: Celebrating 5 Years of Bulk Grain Handling in South Australia* (Adelaide: ABB Grain Ltd, 2006), 17
[6] Max Lamshed, *Grain is better in bulk: the story of South Australian Co-operative Bulk Handling Limited* (Adelaide: South Australian Co-operative Bulk Handling Limited, 1966), 6.
[7] Metcalf & Co., 'Bulk Handling,' 3.
[8] Metcalf & Co., 'Bulk Handling,' 42-43.
[9] Lamshed, *Grain is better in bulk*, 6.
[10] Callaghan, *The Wheat Industry*, 350.
[11] Metcalf & Co., 'Bulk Handling,' 13.
[12] Callaghan, *The Wheat Industry*, 374.
[13] Lamshed, *Grain is better in bulk*, 6.
[14] Allen R. Callaghan served as Director of the South Australian Department of Agriculture from 1949 to 1959.
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[16] Transcript of the proceedings of the Legislative Council, *Bulk Handling of Grain Bill* (second reading) (SA) 28 June, 1955, 438.
[17] Lamshed, *Grain is better in bulk*, 7.
[18] Thomas, *A Golden Era*, 20.
[19] Thomas, *A Golden Era*, 20.
[20] Mazzarol, 'SACBH-ABB Grain,' 7. And Thomas, *A Golden Era*, 21.
[21] Thomas, *A Golden Era*, 21.
[22] B.A. Kelly, G.W. Donoghue and R.J. Cowan, 'Operations and Control Systems for Grain Handling and Storage,' *Bulk Handling Workshop* (Adelaide, South Australia, 3-4 November, 1987) 67.
[23] Thomas, *A Golden Era*, 21.
[24] Legislative Council, *Bulk Handling of Grain Bill*, 433.
[25] Legislative Council, *Bulk Handling of Grain Bill*, 434.
[26] Thomas, *A Golden Era*, 24.
[27] Thomas, *A Golden Era*, 25.
[28] *Bulk Handling of Grain Act 1955*, 1.
[29] Kelly, 'Operations and Control Systems,' 69. And Thomas, *A Golden Era*, 109.
[30] Thomas, *A Golden Era*, 109.
[31] Kelly, 'Operations and Control Systems,' 68.
[32] Thomas, *A Golden Era*, 110-111.
[33] *Bulk Handling of Grain Act 1955*, 8.
[34] Thomas, *A Golden Era*, 109.
[35] Kelly, 'Operations and Control Systems,' 67.
[36] Thomas, *A Golden Era*, 27.
[37] Thomas, *A Golden Era*, 30.
[38] *Bulk Handling of Grain Act 1955*, 8.
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[40] Kelly, 'Operations and Control Systems,' 68.
[41] Kelly, 'Operations and Control Systems,' 68.

[42] Essential Services Commission of South Australia, 'Inquiry into the South Australian bulk grain export supply chain costs,' (December, 2018), 21.
[43] Max Lamshed, *Grain and co-operation: the story of South Australian Co-operative Bulk Handling Limited* (Adelaide: South Australian Co-operative Bulk Handling Limited, 1966), 13.
[44] South Australian Co-operative Bulk Handling Limited, *Bulk Handling in South Australia*. Glenelg: Smedley Press, 1971.
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