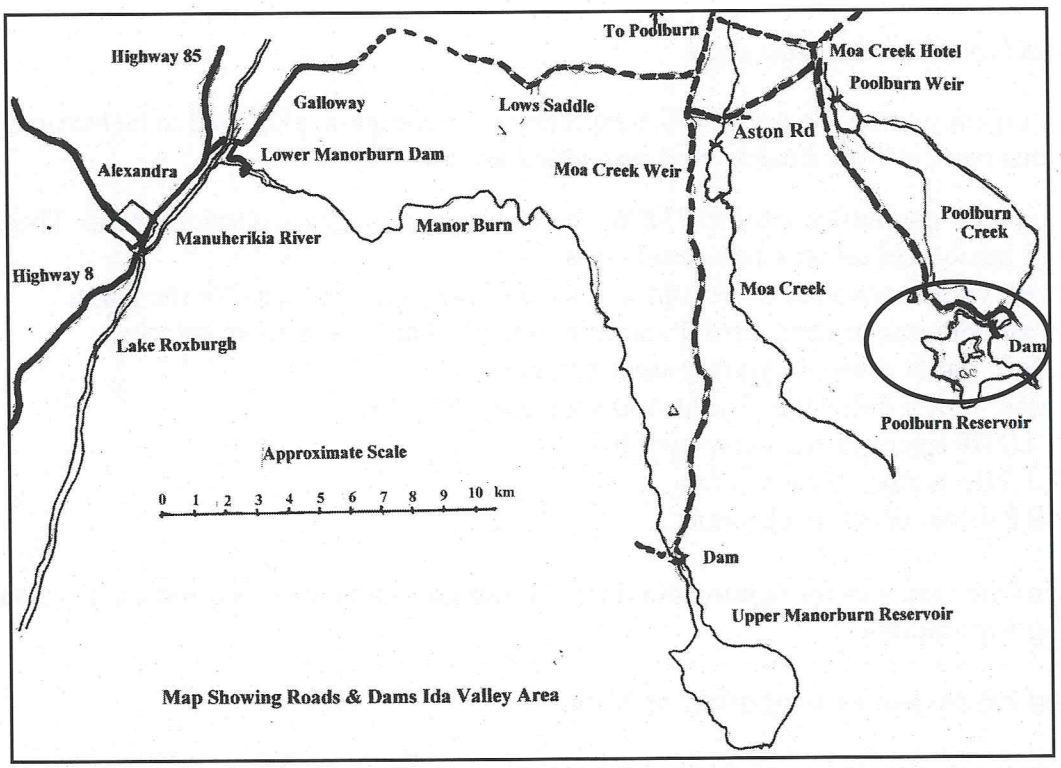
Poolburn Dam

Concrete Arch Dam	4,000 cu yd concrete
Completed	1931
Height Above Stream bed	83ft
Radius of dam	230ft
Length of Crest	535ft



Poolburn Concrete Arch Dam

This account is compiled from the Construction Report by T. M. Ball to the NZ Society of Civil Engineers Proceedings 1933-4 and information obtained from the Public Works Department File held at NZ Archives Dunedin.

Reason for building the dam

The Ida Valley irrigation scheme started in 1912 and by 1929 it had been apparent that the supply obtained from the Manorburn Dam was not sufficient to meet the needs of the irrigators. According to T. M. Ball when the Government started construction of the Manorburn dam the annual rainfall was 36 inches per annum but this had steadily fallen off until it was only 15 inches prior to the Poolburn Dam being built.

Work on the Poolburn Dam had to be started hurriedly both for irrigation and to provide employment. The complete field work for building the dam was not available when orders were received that the work was to be started. Besides there was an insistent demand from farmers for the area under irrigation to be extended as the existing irrigators were getting excellent results from the secure water supply.

Plant used to construct the dam

With the urgency given the project by head office in Wellington, plant had to be hurriedly collected from various parts of New Zealand and assembled on site.

- Two diesel engines coupled to 75KW alternators were purchased second hand. These operated using heavy fuel oil on a full diesel cycle.
- Power was generated at 3000 volts and stepped down to 400 volts for the plant.
- The air compressor used a 50HP motor to operate 3 drills and an air winch.
- A 25HP motor drove a gyratory stone crusher.
- A 10HP motor drove the ½ yard Anderson concrete mixer.
- A 7 1/2HP motor drove a conveyor belt.
- A 7 1/2Hp motor operated a fan.
- A 5HP motor drove an elevator.

The rest of the load was for lighting buildings, floodlights at the dam site and a small pump for dewatering foundations.

Proposed extension to irrigation scheme

The Government decided to establish another storage reservoir by damming the Poolburn Stream and conserving the spring run off. The water could then be used to irrigate the eastern side of the Ida Valley by using the existing races which would relieve the demand on the Manorburn Dam, and additional land could be commanded by a race from the Poolburn Stream 6 miles below the dam. The reservoir has a storage capacity of 21,000 acre feet.

Location of the dam

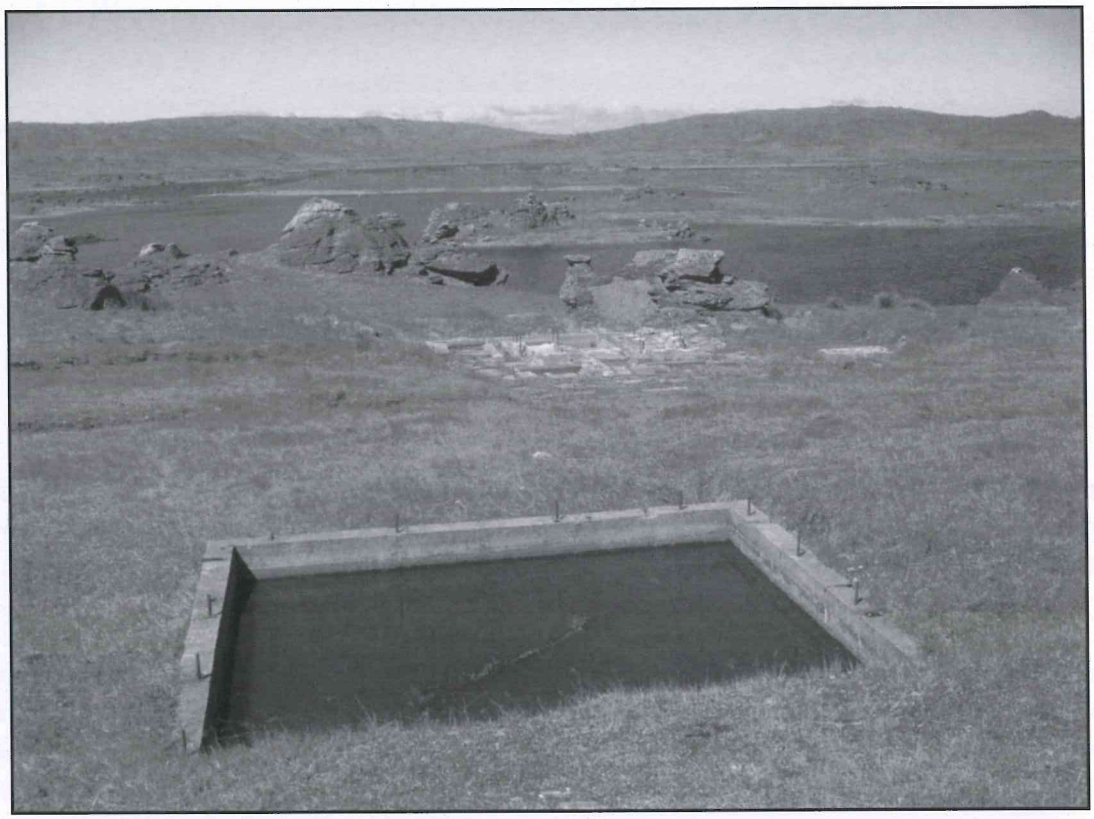
Five sites were investigated. The location chosen was about 8 miles from the Moa Creek Hotel where the Old Dunstan Road crossed the stream. An adequate supply of sand was available from a site adjacent to the Hotel. The Ida Valley railway station was 24 miles from the dam site and all the timber, cement, plant and general provisions were carted to the dam site from the station. The cartage contract was one shilling per ton mile.

Authorisation of the project

In a letter from T. M. Ball the District Engineer in Dunedin, to the Permanent Head Wellington, on 26 August 1929, Ball stated that he has inspected the dam sites with F. W. Lindup the Resident Engineer at Alexandra. He agreed with Lindup that the site chosen was the most economical to develop. He was satisfied that the rock abutments would provide adequate strength for a concrete arch dam and that the soft rock appeared to be local and not a fault or crush zone. Aggregates for the dam could be obtained at a quarry site on the left bank set at a height where the rock could be fed by gravity to a mixer located near the top left hand bank of the dam.

Estimate of dam cost and approval to start

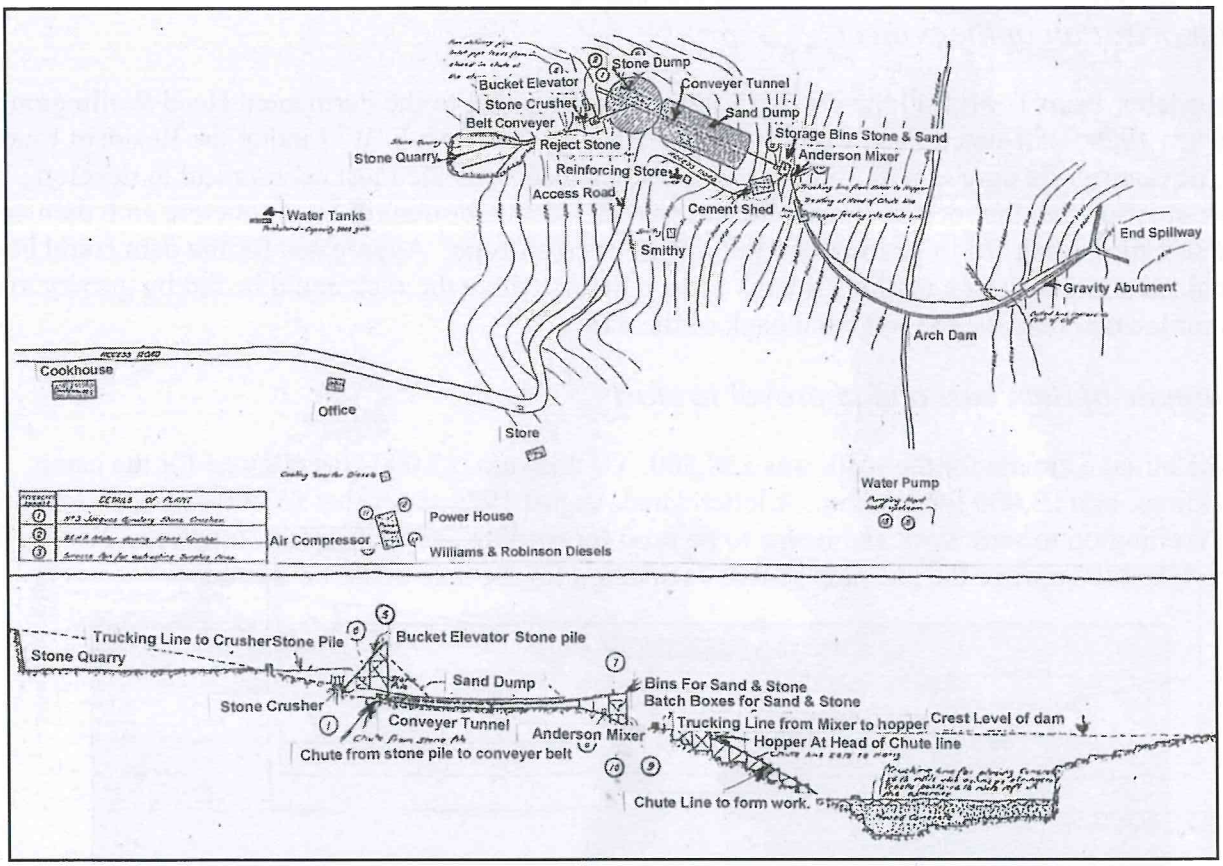
The initial estimate for the work was £58,500. Of this sum, £5,000 was allowed for the camp buildings, and £3,000 for roading. A letter dated August 1929 states that £5,000 had been authorised by Wellington to start work and it was to be used for roading and requisitions for plant. Head Office was asked to approve the site plan so that excavation for the dam could be started.



The water cooling unit for the diesel engines is in the foreground, and towards the lake, the foundations for the diesel generators and air compressor. The diesel tanks were located at the side of the generator building.

Power for the dam

In September 1929 a letter from Lindup to the District Engineer in Dunedin stated that a 17 mile power transmission line would be required to link with the Otago Central Electric Power Board. However the Power Board was operating with the Teviot River source for power and did not have sufficient power available to supply the dam. The proposed use of a diesel plant at the dam was easily the best proposition he said.



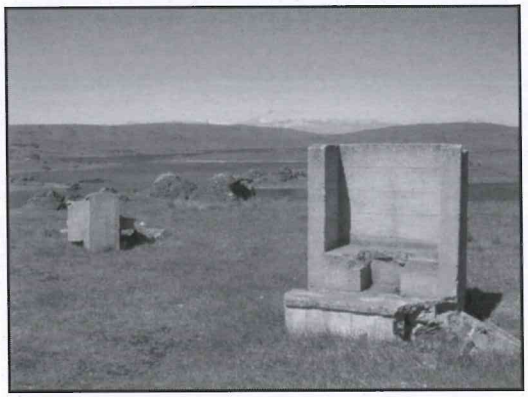
Work at the site

By December 1929 the bathhouse was being fitted out at the camp site and the cookhouse was nearly completed. J. T. Gilkison had arrived on site as an Assistant Engineer and was in charge of the work. By 28 January 1930 Gilkison advised that a 10HP engine was required on site to pump water, so that the camp could be used.

The drawing of the dam site shows the access road from Moa Creek on the left and the outline on the side of the road is the cookhouse. Below to the right is the diesel generator site together with the air compressor for the project and associated cooling water and diesel tanks. On the lower right is the 10HP motor and water pump at the creek. A water tank was sited above the access road on the hillside.

At the dam site the quarry with the associated stone crusher provided rock into storage heaps located above the covered conveyer belt. Sand was carted to this site from Moa Creek. The conveyer fed the aggregate and sand to the holding boxes which were then mixed in a half yard Anderson batcher together with the cement which was stored in a nearby shed. The concrete was trucked out to the dam crest from the mixer and delivered in shutes to the pours on the dam below.

An advertisement was placed in the Dunedin and Alexandra Papers in January for applications to cater for approximately 100 men at the Poolburn Dam Cookhouse.



All that remains of the camp are fireplaces from the buildings which were sited alongside the road to the dam.

The timber framed canvas covered huts used by the PWD on construction works. Fireplaces at the end of the huts provided for warmth and cooking. This photo is not identified as being at Poolburn, but it illustrates the conditions that existed there.

The conditions of contract for catering

The Department would provide a rent free cookhouse with kitchen, dining room, storeroom and reasonable accommodation for the contractor and his staff. Free electric lighting and an Orion Island range for cooking was also provided. The Contractor was to supply all cooking utensils, plates, cups and cutlery and all fuel for the range. Firewood landed at the dam would cost £4-10 shillings a chord, lignite coal £3 per ton, and Southland coal £4-10 shillings a ton. The tenders were to submit a schedule of the type of meals to be supplied and the tender was to offer on the basis of a weekly charge for 21 meals. The total number of men employed would be approximately 100 but no guarantee could be given as to the number likely to patronise the cookhouse. Generally three shifts would be worked which would entail supplying about five meals in all between 7am and midnight.

James Craig was the successful tenderer, and agreed to supply the week's meals per man for 22 shillings and sixpence. Extra meals were to be charged at 1 shilling and sixpence each.

Men arrive at the dam site

Men were being sent to the site with the first group from the Hawea road works in October 1929. Ten men able to blast rock were requested in November from the District Engineer. Men transferred from road works at Arrowtown in February 1930.

The Public Works Department file showed that the survey of the dam site was completed in March 1929 and the excavations were completed by 31 March 1930. A letter from the Resident Engineer to the District Engineer dated April 1930 gave an updated estimate of cost based on the excavation encountered in the base of the dam and the larger volume of concrete to fill it. The cost to complete the dam was now estimated to be £69,000.

The date when the two second hand 75KW diesel engines were commissioned at the site is not given but it would have been before the cookhouse was opened, and before the quarrying for aggregate commenced. Ball reports the first concrete was poured on the 17 May 1930 and at this stage three shifts were being worked. The work closed down a month later due to the water supply at the site being frozen solid, with air temperatures down to 8° Fahrenheit or –13° C.

A comment by Stan Wragg who is now 90 gives some insight into the conditions at the site. His father worked for the PWD and was in charge of irrigation at Poolburn. Stan recalled that the camp at the dam was short of food and two volunteers set out on foot through the snow to Moa Creek in the valley below. They walked through a snow storm and arrived at Nicolson's farm near the Moa Creek Hotel in a distressed condition. Both men had very bad frost bite to their feet.

It cannot have been a coincidence that J. T. Gilkison, the site engineer, made an impassioned plea to T. M. Ball the District Engineer at this time for a phone link to be provided at the camp. Finally a twin wire was approved by Head Office in Wellington and installed.

Key men retained for work after the winter

Gilkison was very concerned that the key men on the construction should be available after the winter to continue the construction of the dam. A letter from Ball, the District Engineer, to the Resident Engineer Alexandra advised that the Main Highways Board had approved the employment of thirty picked labourers from the Poolburn Dam, on the main highway work on the Clarksville Springvale Highway. In addition, the District Engineer at Kurow found work for the three tradesmen nominated. In all fifty men were placed at other work over the winter. It was a condition that the cost of transport and tenting would be charged to Poolburn Dam. Some tents were relocated for the men. It was made clear by the Main Highways Board that the men must be taken off the highway work at the end of winter.

In July 1930 a letter from W. A. Bodkin MP to F. W. Lindup stated that he had taken up the proposal of Dr Gladstone from Alexandra about forming a Medical Club at the dam for workers with the Minister. He said the men were willing to meet a weekly contribution. The Minister had agreed provided the workers authorised the Department office to deduct payment from their wages. It remained unspecified what services Dr Gladstone was to provide to the Medical Club.

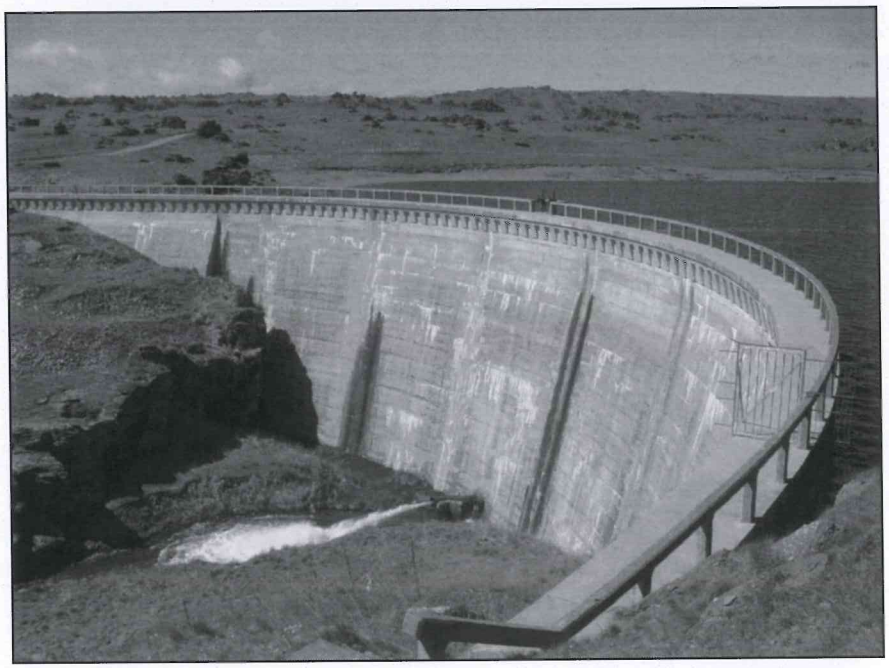
At the end of a long winter, work was resumed at the Poolburn Dam on the 3 October 1930.

Design of the dam

The solid rock at the site proved suitable for the adoption of a concrete arch type of dam with an upstream radius of 220ft. The crest length was 400ft with a gravity right hand abutment 135ft long. At the gravity abutment end, two walls were constructed, one upstream and one downstream to direct water into a side spillway channel. The dam was designed using Wade's cylinder formula to derive the thickness of the arch. The original height was lowered by 5ft when it was found that the dam capacity would exceed the expected annual runoff of the catchment area. The thickness of the concrete arch was not altered, the base remained 30ft thick. The foundation rock, which was found to be crushed, was excavated to 34ft below the original ground level with the rock replaced by concrete. The crest width of 4ft allowed a workable width for construction and extra strength to resist ice pressure. The reservoir freezes over in winter to a depth of 2ft! A cut off trench was provided below the upstream face of the dam which was 4ft wide and 8ft deep. Grouting was undertaken to a depth of 8ft below the wall to fill any fissures in the rock.

Concrete was poured in sections 50ft long, and spaces of 4ft were left until the main blocks were completed. After the blocks had cooled and initial shrinkage had taken place, these sections were filled with concrete. Sealing of horizontal and vertical joints on the dam was done by means of copper strips placed 12 inches from the upstream face. A concrete testing laboratory was set up at the site equipped with a 100 ton compressive testing machine. Continuous tests were made of the concrete strength throughout the progress of the arch dam construction.

In the discussion on T. M. Ball's paper F. W. Furkert who at this stage was Engineer in Chief of the Public Works Department, said that he regarded the work at the Poolburn Dam to be the finest piece of concreting he had ever seen in New Zealand.



View of the structure from the left abutment with the gravity abutment on the left of the photograph. Water is being discharged from the foot of the dam through an outlet valve.

Looking down from above the quarry used to provide the aggregate for the dam. To the far right of the photograph can be seen the downstream face of the dam and beyond the old Dunstan Road.

As it is today looking back up the recess for the covered conveyer used to bring stock-piled aggregate and sand to the mixing bins located at the concrete mixer. At the top left is the discarded stone from the crusher with the quarry above.

Foundations for the track that allowed the concrete to be trucked out to the left abutment of the dam site from the batching plant. Concrete was delivered in shutes to the pours as the dam was raised.

Construction of the dam

The stone for the concrete was obtained from a quarry located above the left abutment. The hard blue schist crushed into good quality concrete aggregate. A contract party quarried the rock and were paid 4 shillings and 6 pence per yd delivered to the crusher. The Department supplied air drills and compressed air, but the explosives were provided by the contractor and included within the rate. The rock was crushed to a maximum size of a 9 inch cube and taken by a bucket elevator onto the stock pile. A covered 18 inch belt conveyor 250ft long was used to transport aggregate and sand from the stock piles to the mixer.

The stone and sand contracts were let in advance of concreting at the site so the conveyor was necessary to save re-handling the stock piles. The conveyor discharged directly into batch hoppers with cement stored in a separate shed. When the correct amount of stone, sand and cement, was measured, it was tipped into the mixer below.

After mixing, the concrete was transferred into a truck transported 20 yards and tipped into a hopper. A chute 200ft long allowed the concrete to be directed into side tipping trucks that were run on a trestled tram line along the dam. This was raised as the lifts on the dam were completed. The concrete was placed in lifts of 5ft every 4 days, and 6ft by 5ft shutters were used to box the pours. These were held by wire ties and removable struts.

The arch section of the dam contained 13,200 cu yds of concrete and the gravity abutment, 800 cu yds. The concrete surface was brushed and hosed down and ½ inch of grout spread evenly before the next concrete lift was added. The concrete was spaded against the forms as the 9 inch layers were added. Gaps left between the monoliths were concreted when the dam was within 10 ft of the crest in May 1931. The concrete was lowered in a ½ yd hopper by an air winch to fill these gaps.

Final cost of the work

Survey	384
Workers accommodation	1,779
Dam excavation	4,952
Access road	2,980
Power house diesel	2,069
Administration	2,706
Plant & stock	3,522
Land compensation	2,000
Miscellaneous	2,900
Concreting 14,000 cu yds	48,708
Total Cost	**£ 72,000**