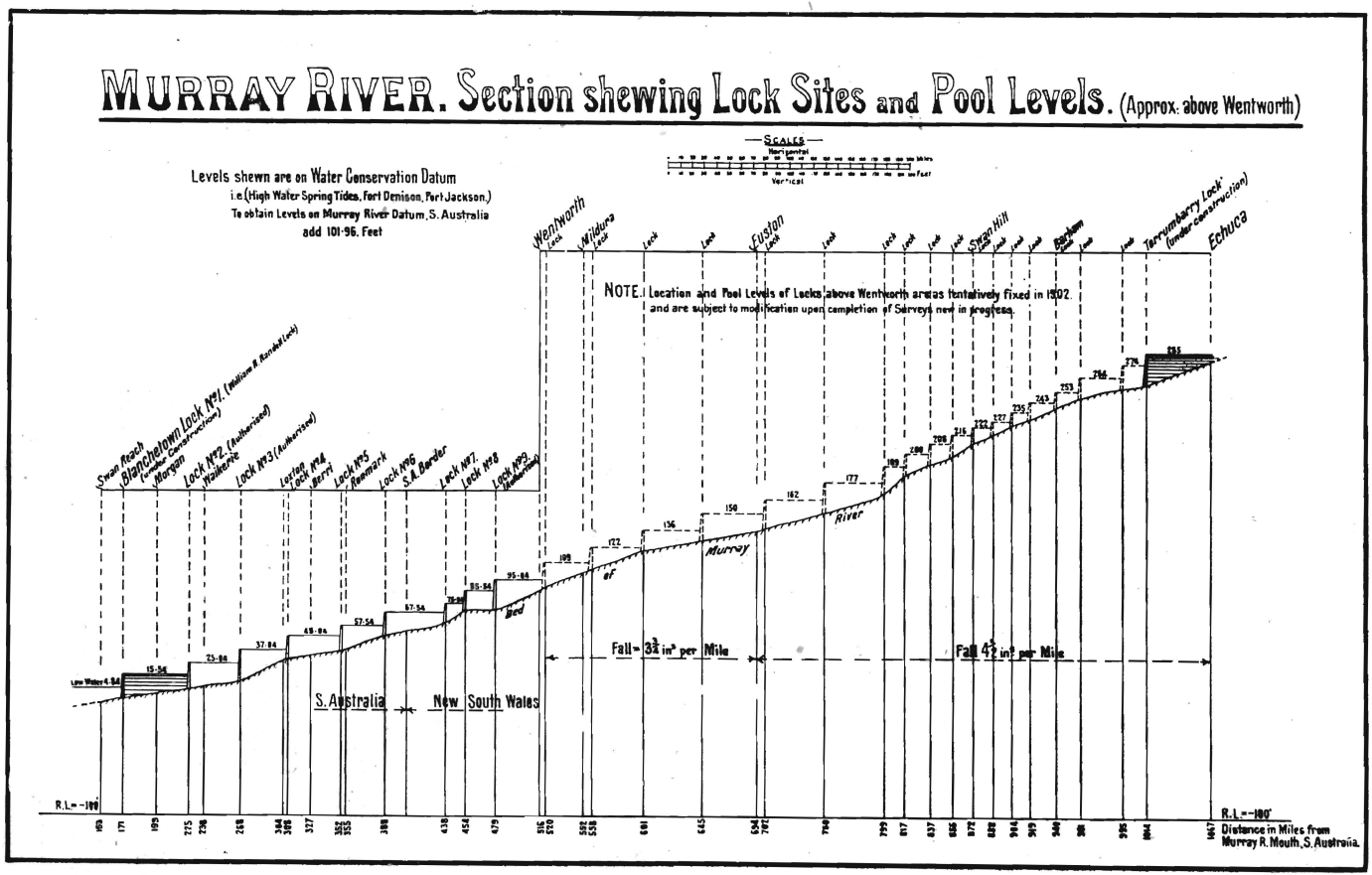
MURRAY RIVER. Section shewing Lock Sites and Pool Levels. (Approx. above Wentworth)



Echuca	- -
Swan Hill	192
Mildura	520
Wentworth (junction of Darling River	550
Renmark	716
Morgan	872
Blanchetown	900
Mannum	977
Murray Bridge	1,000
Goolwa (at mouth)	1,064

The lower portion of the river below Blanchetown is navigable under natural conditions.

On the section is shown the sites selected for the nine locks and weirs below Wentworth, with pool level of each. Extensive surveys and borings were carried out in connection with this portion of the system, by the South Australian authorities, before the sites were finally selected.

Above Wentworth surveys are in progress under the direction of the State Rivers and Water Supply Commission, Victoria, and the Water Conservation and Irrigation Commission, New South Wales; but up to the present the site of one lock only has been determined, that at Torrumbarry, the first of the series below Echuca. The sites for the remainder shown on the section are those given in the 1902 Royal Commission's Report, but are quite approximate only, and together with the levels shown for the lock pools, will probably be considerably modified after more complete investigation.

METHOD OF SURVEY FOR LOCK SITES ABOVE WENTWORTH.

It may be of interest to refer briefly to the method adopted for surveying the river from Echuca to Wentworth.

A usual method adopted in taking cross-sections of a river is to stretch a wire from bank to bank, soundings being taken at points plainly marked on the wire at intervals of, say, 30 feet. Owing to the trouble experienced in connection with the traffic on a stream such as the Murray River, a more expeditious and economical method has been devised, by which the boat from which the soundings are made is kept in position on the line of cross-section, and the intervals referred to are determined by the use of angles of depression on a theodolite, as shown on sketch. The angles to be used are given on a table supplied to the field officer.

The method adopted is as follows:—

(a) The theodolite is set up over the starting point of

the cross-section, the reduced level of this point having been obtained previously when traversing along the bank of the river.

(b) The bearing of the cross section is then taken.

(c) The height of the instrument from surface to the horizontal axis is then measured.

(d) The angle of depression and slope distance is taken to a point, say, six feet on a staff held at the water's edge. From this information can be calculated the horizontal distance to water's edge and the vertical distance of the instrument above the 6-ft mark on the staff. To the vertical distance add the 6 feet, and the height of the instrument above water level is obtained (H on table). The reduced level of the water level can then be obtained by subtraction.

(e) The boat containing the sounding party then proceeds along the line of cross-section until it intercepts the angle—calculated to give a distance of 30 feet—already obtained from the Table, and clamped on the vertical circle. A sounding is taken at this point and booked. The boat then continues along the line of the cross-section, and the operation previously described is again gone through for each length of 30 feet. This continues until the distance between the last sounding and water's edge on the opposite bank is less than 30 feet. To obtain the distance from the instrument to the opposite water's edge the angle of depression is read, and with the known height of the instrument above the water level, the distance can then be calculated.

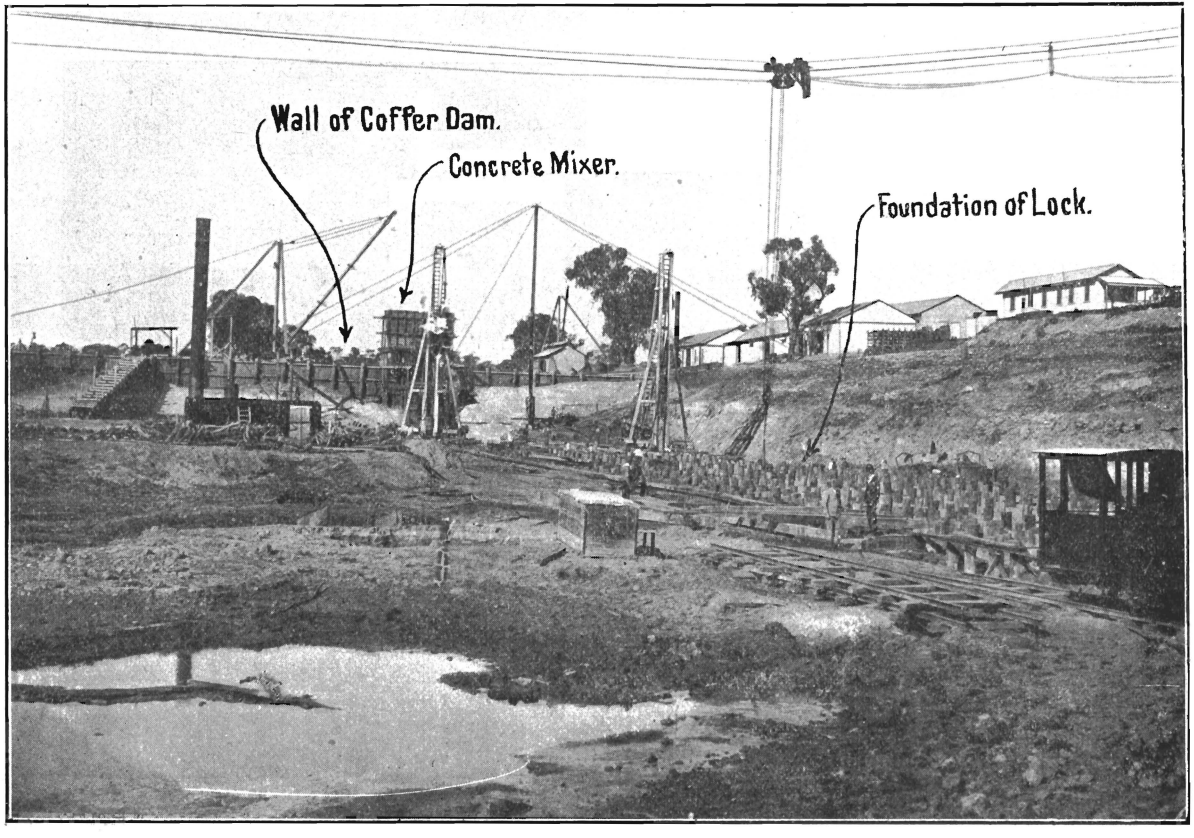
THE WILLIAM R. RANDELL ROCK, BLANCHETOWN.

On the 5th June, 1915, His Excellency Sir Henry Galway, K.C.M.G., Governor of South Australia, in the presence of a distinguished assemblage, laid a stone to mark the site of the first of the locks, that at Blanchetown, called the "William R. Randell Weir and Lock," after one of the pioneer navigators of the Murray. This structure, designed on the advice of Major E. N. Johnston, comprises—

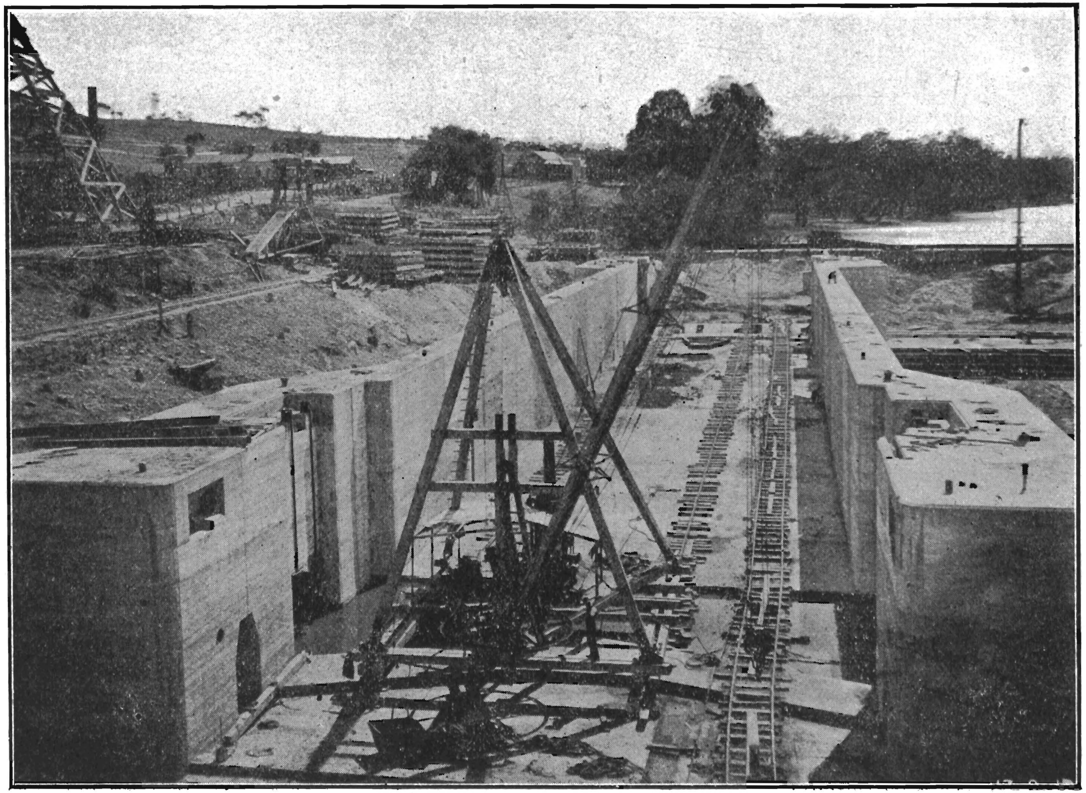
(1) A lock chamber 56 feet wide, 275 feet long, between gates;

(2) A navigable pass consisting of steel collapsible trestles supporting Boulé shutters;

(3) Sluice openings, closed by stop logs.



2.—Blanchetown Lock and Weir.



3.—Blanchetown Lock.

During periods of high river the shutters of the navigable pass will be removed, and the trestles dropped on to the bed of the river, thus affording a clear opening of 199 feet for navigation purposes.

The stop-logs will also be removed, and the only obstruction to floods will be that due to the lock walls and concrete piers of the sluice openings.

An average lift of 10 feet has been adopted throughout the lock system below Wentworth.

Alternative propositions for the size of the locks were discussed by Major Johnston in his report, referred to above, viz., 56 feet x 275 feet, and 56 feet x 170 feet between gates, involving a total estimated difference in cost for the nine locks of £108,000. The larger size, adopted at Blanchetown, is capable of accommodating at one time a towing steamer, 135 feet long, and two barges, each 130 feet x 26 feet.

For the navigable pass the use of the Boulé type of weir has been adopted in preference to the Needle or Chanoine types, on acccount of increased water tightness, less cost, and greater facility of operation. Major Johnston states:

"The Boulé type of weir is probably better suited than any other for the regulation of pool levels. . . . All that is necessary is the removal of one or more top panels in order to reduce the level of the pool, and the placing of one or more top panels is all that is required to raise the pool."

The first operation at Blanchetown was the construction of a coffer dam about 600 feet long, inclosing the site of the lock, the navigable pass and the first two piers of the sluice section of the weir. The channel of the river during periods of ordinary flow is thus confined to about one-half its normal section. Upon completion of the work within the coffer dam, this will be removed and replaced to enclose the remainder of the work, the river being then passed over the section of the work first completed.

The coffer dam wall, which is 20 feet in width, consists of steel interlocked sheet piles, 40 feet long, driven on the water faces, with timber piles and timber sheeting on the inner face, filled in between with excavated material, which was excavated by a dipper dredge, subsequently floated out through an opening left in the wall of the coffer dam. This opening was then closed up and the water pumped out. The concrete work is founded upon piles driven to rock. Concrete is mixed at one end of the coffer dam and conveyed from the mixer in trucks drawn by a small locomotive, and lifted to place by an overhead cableway. It will be noted that the length of the coffer dam is much

greater than that of the lock walls, the inside dimensions allowing ample space for construction purposes, as well as reducing the risk of a blow into the excavations under the head of water on the outside.

Owing to exceptionally high rivers the coffer dam has been flooded on several occasions, and construction has been suspended for considerable periods, but the first section is now practically completed, and the coffer dam will very shortly be removed and re-erected for the completion of the sluice openings.

Granite stone is being used for the concrete, crushed at a quarry near Mannum, and conveyed to site in barges pushed upstream by a stern-wheel steamer, specially designed for this class of work. Sand is obtained from the river bed.

The design includes timber cribs, filled with stone, downstream of the concrete work in the navigable pass and sluice openings, to obviate scour.

The work is being constructed under the charge of Mr. R. E. Cutting, Resident Engineer, acting under Mr. J. G. Stewart, Engineer-in-Chief.

LOCKS AND WEIRS, NOS. 2, 3 AND 9.

The River Murray Commission has approved of the sites and general designs for, and authorised the construction of, three additional locks and weirs, viz., Nos. 2 and 3, which are next in series above Blanchetown, and No. 9, which is the uppermost of those to be constructed by South Australia. The latter, which is situated below the off-take of the Frenchman's Creek, will divert water into the Lake Victoria Storage.

The design in each case is generally similar to that at Blanchetown, but the width of sluice openings will be somewhat less, while the length to be adopted for the locks has not yet been decided.

LOCKS AND WEIRS ABOVE WENTWORTH.

The Agreement provides for 17 locks and weirs from Wentworth to Echuca, the total lift in that section being 190 feet. The extensive surveys carried out by South Australia were commenced about 1906, and completed before the Murray Waters Act came into effect; but the surveys of the upper river above Wentworth were only commenced in 1917, with the result that, although a considerable amount of survey work has been done, the site of only one lock and weir has been definitely located to date. This is at Torrumbarry, some miles by river below Echuca.

4.—Site of Lock No. 3, South Australia.

Mr. Eaton has stated that when choosing the sites of the South Australian locks careful consideratlon was given to placing these in cuts through bends in the river, in place of constructing in the open within coffer dams; but the former method was not found practicable. It is to be remembered that in its lower reaches the river is wider and somewhat less tortuous than above the Darling junction.

The site chosen at Torrumbarry is in a bend, where the lock and weir will be constructed in the dry, and the river will then be diverted by the construction of an embankment across its channel into a new course through the neck of the bend. The principle is similar to that adopted for the weirs constructed in the Macquarie River at Warren, and Lachlan River at Cudgellico, in this State.

The lock will probably be of similar design to those in South Australia, but for the weir the scheme submitted by the Constructing Authorities is quite novel. Instead of a navigable pass and sluice openings, as in the South Australian designs, it is proposed to use a series of framed trestles, with sloping upstream faces, supporting horizontal stop-planks. These trestles will rest upon a concrete apron, and during low river the flow will be regulated by operating stop-planks. After the river reaches such a height as to admit of free navigation, the stop-planks will be removed, and the trestles will be drawn up, by means of wire ropes, on top of the bank clear of flood, thus leaving a clear passage for flood waters over the whole width of the weir section.

A test was made some months ago at Werribee of a model trestle weir on the above principle. The operation of this was quite simple, but before the detailed design of the weir section is finally decided upon it is probable that the system will be further tested on a larger scale.

Construction of the Torrumbarry lock and weir has been sanctioned by the River Murray Commission, and is now being vigorously pressed on under the direction of the State Rivers and Water Supply Commission, in consultation with Mr. de Burgh, representing the Minister for Public Works in New South Wales.

LAKE VICTORIA STORAGE.

Lake Victoria is situated in New South Wales, between Wentworth and the South Australian border. It is fed during flood through the Frenchman's and Rufus Creeks, and, when the works authorised have been completed, will form a balance storage of great value for supplying the lower Murray during periods of low flow. Some years ago a temporary needle weir regulator was constructed in the Rufus Creek,