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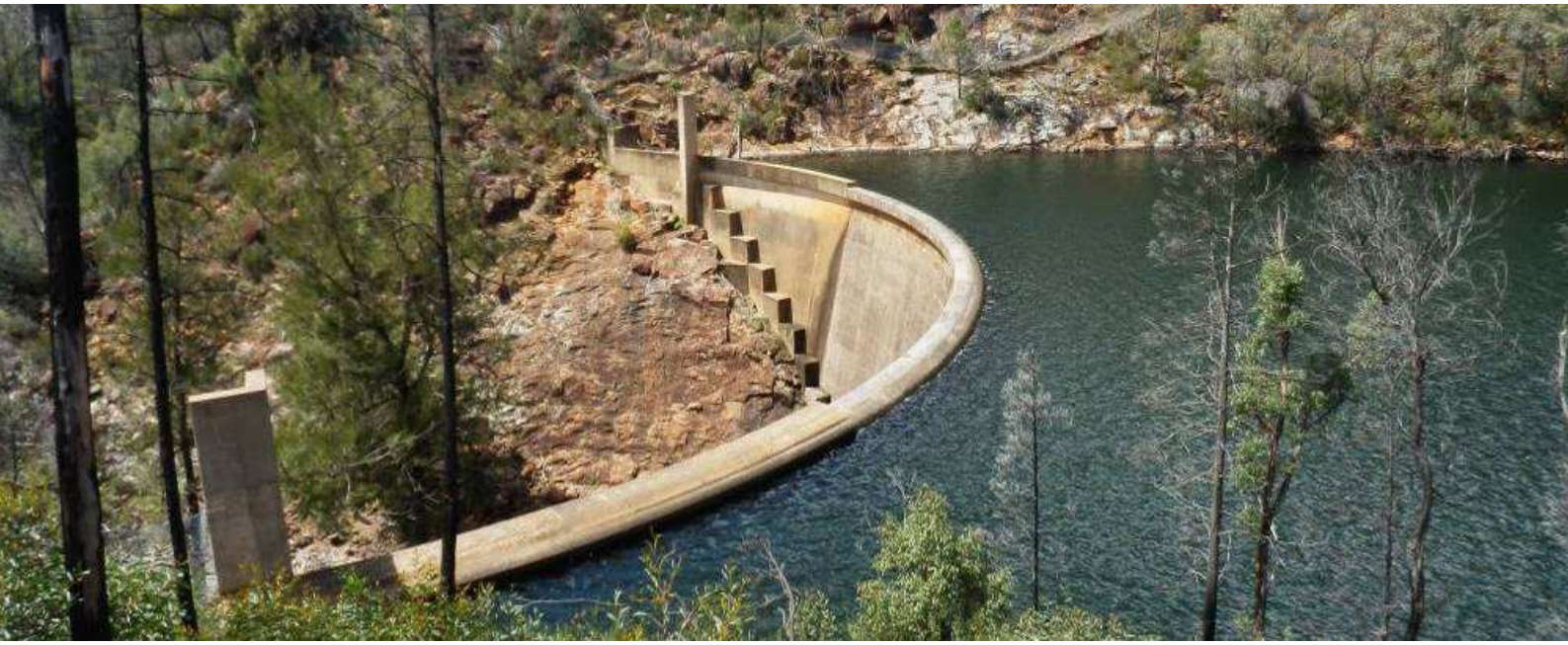

TIMOR DAM

SURVEILLANCE REPORT (TYPE 2)

(Inspection: 6th November 2015)

Report Number: DC15219

February, 2016

warrumbungle SHIRE COUNCIL

A division of the Department of Finance, Services & Innovation

Timor Dam Surveillance Report

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Foreword

This is the fifth Surveillance Report on Timor Dam prepared for Warrumbungle Shire Council for submission to the NSW Dams Safety Committee (DSC). Timor Dam is a prescribed dam under the NSW Dams Safety Act (1978) on the recommendation of the Dams Safety Committee based on the consequence category of the dam.

The DSC has endorsed a **SIGNIFICANT** Sunny Day Consequence Category (SDCC) and a **HIGH C** Flood Consequence Category (FCC) for Timor Dam.

The report has been prepared by NSW Public Works in accordance with the requirements of the DSC for **Type 2** Surveillance Reports under the NSW Dams Safety Act (1978). The DSC requires Type 2 Surveillance reports for dams with High C consequence categories.

Glossary of Terms / Abbreviations

Abutment

That part of the valley side against which the dam is constructed.

AHD

Australian Height Datum.

ANCOLD

Australian National Committee on Large Dams.

Annual Exceedance Probability (AEP)

The probability of a specified magnitude of a natural event being exceeded in any year.

Appurtenant Works

All ancillary structures of a dam including but not limited to spillways, inlet and outlet works, tunnels, pipelines, penstocks, power stations and diversions.

Base of Dam

The general foundation area of the lowest portion of the main body of the dam.

BoM

Bureau of Meteorology

Catchment

The land surface area that drains to a specific point, such as a reservoir.

Collapse

The physical deformation of a structure to the point where it no longer fulfils its intended purpose.

Consequence

Effects of an action or event (e.g. the potential for loss of life, property or services).

Consequence Category

The scale of adverse consequences subsequent to a dam failure (refer to DSC Information Sheet 13). See Flood Consequence Category and Sunny Day Consequence Category.

Council

Warrumbungle Shire Council (WSC).

Dam Crest Flood (DCF)

The flood event which, when routed through the reservoir, results in a still water reservoir level at the lowest crest level of the dam.

Dam Owner

Any person, organisation or entity legally deemed to be the owner of a dam.

Dam Safety Emergency Plan (DSEP)

A continually updated set of instructions and maps that deal with possible emergency situations or unusual occurrences at or related to a dam or reservoir.

Dams & Civil

DFSI, Dams & Civil Section.

DEUS

NSW Department of Energy, Utilities and Sustainability, now DPIWater

DFSI

The Department of Finance, Services & Innovation (formerly DFS, DSTA, DPWS, PWD and Department of Commerce)

DLWC

NSW Department of Land and Water Conservation.

DPWS

NSW Department of Public Works and Services, now DFSI

D/S

Downstream.

DSC (The Committee)

NSW Dams Safety Committee.

DWE

NSW Department of Water and Energy, now DPI Water

Emergency

An emergency in terms of dam operation is any condition which develops unexpectedly, endangers the integrity of the dam or downstream property and life and requires immediate action.

Failure

The uncontrolled release of the contents of a reservoir through collapse of the dam or some part of it, or the inability of a dam to perform functions such as water supply, prevention of excessive seepage or containment of hazardous substances.

Failure Impact Rating Category (FIRC)

An estimate of the adverse consequences emanating from flood failure of the dam, such as loss of life, property and services damage and environmental effects.

Flood Consequence Category (FCC)

An estimate of the adverse consequences emanating from flood failure of the dam, such as loss of life, property and services damage and environmental effects.

The maximum differential impact between the "with failure" and "without failure" cases, over the full range of possible flood magnitudes, is the basis for assignment of the FCC on an incremental consequences basis.

With regard to the incremental consequences, the assessor should be mindful that, in the aftermath of a dam failure, it might not be a simple matter to distinguish between the consequences directly attributable to the dam failure, and the flooding consequences from the flood event which caused the dam's failure. For this and other reasons, the Committee needs to consider both incremental and total consequences.

The Committee will normally base its FCC on incremental consequences but may sometimes base the FCC on total consequences. The owner is to provide estimates of both the incremental and the total consequences.

Foundation

The undisturbed material on which the dam structure is placed.

Freeboard

The vertical distance between a stated water level and the top of the non-overflow section of a dam.

Full Supply Level (FSL)

The maximum normal operating water surface level of a reservoir.

H & V

Horizontal and Vertical e.g. 1.5V:3H describes the steepness of slope.

Height of Dam

Normally the maximum height from the lowest point of the general foundation area to the top of the dam.

Incident

An event, which could deteriorate to a very serious situation or endanger the dam.

Inspection (Dam)

A careful and critical viewing and examination of all visible aspects of a dam.

LHS/RHS

Left Hand and Right Hand Side looking downstream, i.e. in the direction of flow.

Maintenance

The routine work required maintaining existing works and systems (civil, hydraulic, mechanical and electrical) in a safe and functional condition.

Maximum Credible Earthquake (MCE)

The earthquake which produces the most severe ground motion conditions at the site under the currently known tectonic conditions. This earthquake is analogous to the PMF.

Maximum Design Earthquake (MDE)

The maximum design earthquake that the dam is designed to withstand. Some, possible major, damage to the structure is to be expected but the dam must not fail.

Monitoring

The observing of measuring devices that provide data from which can be deduced the performance and behavioural trends of a dam and appurtenant structures, and the recording and review of such data.

NOW

NSW Office of Water, formerly DWE, now DPIWater

NPWS

NSW National Parks and Wildlife Service.

Operator

The person, organisation, or legal entity that is responsible for the control, operation and maintenance of the dam and/or reservoir and the appurtenant works.

Operation Basis Earthquake (OBE)

The earthquake which is expected at most to occur once in a lifetime of the structure. Sensibly the OBE would be the earthquake with an AEP of between 1 in 100 and 1 in 500. For such earthquake, the dam must not suffer significant damage and all components are to remain functional.

Outlet Works

The combination of intake structure, conduits, tunnels, flow controls and dissipation devices to allow the release of water from a dam.

O&M Manual

Operations and Maintenance Manual - The collection in one document the complete accurate and current operating and maintenance instructions for the dam and its appurtenant works.

Population at Risk (PAR)

All those persons who would be directly exposed to floodwaters within the dambreak affected zone if they took no action to evacuate.

Prescribed Dam

A dam is prescribed under the NSW Dams Safety Act (1978) on the recommendation of the Dams Safety Committee and is usually based on size and Consequence Category hazard ratings.

Probable Maximum Flood (PMF)

The flood resulting from PMP and, where applicable, snow melt, coupled with the worst flood-producing catchment conditions that can be realistically expected in the prevailing meteorological conditions.

Probable Maximum Precipitation (PMP)

The theoretical greatest depth of precipitation for a given duration that is physically possible over a particular catchment area.

PWD

NSW Public Works Department, now DFSI

Recommended Design Flood (RDF)

The flood event which has the recommended annual exceedance probability or proportion of PMF inflow and which produces the highest flood surcharge for the dam.

SES

NSW State Emergency Services.

SMP

Surface movement point.

Sunny Day Consequence Category (SDCC)

An estimate of the adverse consequences emanating from the non flood (e.g. earthquake) failure of a dam, such as loss of life, property and services damage and environmental effects.

TWT&R

Town Water Treatment & Recycling (a section of the then DLWC)

U/S

Upstream.

USBR

United States Bureau of Reclamation.

XP-Rafts

A proprietary computer program for rainfall/runoff routing.

2D

Two Dimensional

3D

Three Dimensional

Contents

List of Appendices

1 Introduction

The NSW Dams Safety Committee (DSC) has advised owners of prescribed dams, under the Dams Safety Act (1978) that Surveillance Reports are to be submitted in respect to these dams, at five yearly intervals.

The DSC has endorsed a **SIGNIFICANT** Sunny Day Consequence Category (SDCC) and a **HIGH C** Flood Consequence Category (FCC) for Timor Dam.

Timor Dam was constructed in 1962 to provide the water supply for Coonabarabran. It is located on the Castlereagh River approximately 12km west of Coonabarabran. The dam is a concrete arch structure 19.5m in height, with a crest length of 59m and a storage capacity of 1140ML.

As understood, Council is currently planning on raising the Timor Dam by 2m to provide additional water supply for Coonabarabran. The feasibility study and concept design stage is scheduled to commence shortly. Council plans to address many of the issues identified in this report as part of the proposed dam raising/upgrade studies and works.

Warrumbungle Shire Council accepted the offer by the NSW Public Works to prepare the Fifth Surveillance Report for the Dam in 2015.

A visual inspection of the dam was carried out on the 6th November 2015. Photos of the inspection are provided at the back of this report at Appendix D.

2 Summary, Conclusions and Recommendations

2.1 Summary and Conclusions

Visual inspections carried out on the 6th November 2015 indicate that the dam and appurtenant works are generally in a satisfactory condition. There is no indication of any differential movement, instability, significant cracking or excessive seepage from the dam. However, some routine maintenance items require attention as detailed in Subsection 2.2.

2.2 Recommendations

Although the dam appears to be performing satisfactorily at present there can be no guarantee that this will continue into the future. Continual surveillance of the dam's physical behaviour is therefore necessary to identify the development of any changes. To detect the development of any unsafe trends Council should undertake collection of data, formal routine inspections of the dam and appurtenant works in addition to the five yearly surveillance inspections.

To ensure the continuing satisfactory performance and future integrity of the dam and appurtenant works, Council should carry out the recommendations listed below in this Section.

Rec. No.	Recommendation	Criticality Rating (See legend below)
1.	Repair or replace the seepage weir and commence seepage monitoring on at least a weekly basis in accordance with ANCOLD (2003).	3
2.	Finish the security fencing repairs to deter unauthorised access to the dam-site.	4
3.	Access to various components of the dam, including the scour outlet and seepage weir, is inadequate. Carry out a WHS Audit of the dam and implement the recommendations of the audit so that the dam complies with the WHS Act and Regulations.	3
4.	Continue to remove debris that collects on the upstream face of the saddle dam.	4
5.	Carry out a comprehensive condition assessment of all mechanical equipment associated with the operation of the dam and appurtenant works and upgrade the outlet system to meet acceptable modern standards.	3
6.	Update the Operation and Maintenance Manual in accordance with NSW Dam Safety Committee Guidelines (DSC2F).	3
7.	Carry out routine inspections at least on a weekly basis, in accordance with ANCOLD (2003) and utilise a formal routine inspection sheet that is reviewed and signed-off by the Water Manager.	1
8.	Continue to provide all Council dam inspectors and relieving staff with suitable refresher training at an approved Dam Safety Inspection course every five years to comply with ANCOLD guidelines.	4

Rec. No.	Recommendation	Criticality Rating (See legend below)
9.	Formally engage a Dam Safety Specialist who is responsible for advice on “other than normal” conditions, emergency responses/inspections, review of monitoring data and annual audits if required.	3
10.	Plot seepage, storage level and rainfall against time and provide the plots to Council’s nominated Dam Safety Specialist for review and assessment at least every 3 months (following repair of the seepage weir).	3
11.	Consider installing a surface survey system to enable monitoring of dam wall and abutment movement in accordance with ANCOLD (2003).	4
12.	Continue to update the Dam Safety Emergency Plan in accordance with NSW Dam Safety Committee Guidelines (DSC2G) and test the DSEP at least every 5 years.	4
13.	Determine the Maximum Flood Level associated with the Acceptable Flood Capacity and carry out a structural review to assess the ability of the dam to handle the design flood loading.	3
14.	Carry out a seismic structural review to assess the ability of the dam to withstand the appropriate design earthquake loading in accordance with ANCOLD (1998).	3
15.	Install a rain gauge at the dam-site and monitor rainfall at least weekly.	2

Legend of Criticality Rating

Rating 1 Rectification required immediately, i.e. within 1 month

Rating 2 Rectification required within 3 months

Rating 3 Rectification required within 12 months

Rating 4 Ongoing

3 Dam Safety

3.1 Philosophy of Dam Safety

The safety of a dam, generally, depends upon its stability and its ability to pass floods. To ensure the continuing safety of a dam, periodic safety assessments should be carried out. The periodic assessment of a dam's safety is the procedure for determining whether a dam is safe, by examining where relevant its hydrology, its hydraulic and structural design, its physical condition, and surveillance records. This periodic assessment is normally only necessary where surveillance indicates the development of an unsafe condition. It may also be necessitated by changes in guidelines and accepted standards.

Surveillance in this context may be defined as a detailed inspection of the dam and ancillary structures, together with an examination and review of the operation, maintenance, monitoring procedures and records, to determine if unsafe trends are developing. A brief review of the dam's hydrology may also be needed to determine if further investigations are warranted.

3.2 Dam Safety Legislation in New South Wales

In 1974 the State Government passed the Local Government Safety on Dams Amendment Act giving the then Minister for Public Works certain powers with respect to the safety of Council owned dams. The Act also enabled the Minister to provide advice to Local Government Councils on the design, modification and operation & maintenance of their dams. The Local Government Act (1993) restricted the Minister's powers to giving approval for construction or extending a dam only.

In 1978, the State Government passed the Dams Safety Act and established the NSW Dams Safety Committee (DSC) as a Statutory Authority having certain powers with respect of the safety of all dams in New South Wales.

Under the Dams Safety Act (1978), the DSC requires the owner of any dams prescribed under the Act to inspect and monitor such dams and may also require the dam owner to supply information and records related to the dam. The DSC prescribes all dams that meet certain criteria related to height, storage size and the consequences of failure.

In 2004, the management of the Local Water Utility Dam Safety program was transferred to the Department of Energy, Utilities and Sustainability, which is now the NSW DPI Water formerly, the NSW Office of Water (NOW). The relevant powers and responsibilities in the Local Government Act are now vested in the DPI Water's Minister.

This does not, however, remove the basic responsibility from councils for maintaining their dams' safety, and for conducting a dam safety program.

3.3 Surveillance Requirements

The NSW Dams Safety Committee has advised owners of prescribed dams that it requires them to submit Surveillance Reports on their dams at about five yearly intervals and it has issued information sheet DSC2C (2010) to assist dam owners or their representatives with the preparation of these reports.

Note that all DSC information sheets can be downloaded at the DSC's website: http://www.damsafety.nsw.gov.au

In accordance with DSC3A (2010), the higher of Sunny Day Consequence Category or Flood Consequence Category is used to determine the need for prescription of a dam, determination of its surveillance requirements, and the frequency of safety reviews.

A dambreak study and consequence category assessment was undertaken for Timor Dam by the Department of Commerce (now NSW Public Works) in 2006. The consequence category assessments indicated that the Sunny Day Consequence Category is **SIGNIFICANT**, and that the Flood Consequence Category for the dam is **HIGH C**.

This is a Type 2 Surveillance Report and has been prepared to comply with the requirements of the DSC. This is the fifth surveillance report for Timor Dam. Type 2 reports are required for High C Consequence Category dams over 15m in height.

3.4 Previous Surveillance Reports

3.4.1 General

This 5 yearly Surveillance Report on Timor Dam has been prepared in accordance with the DSC's requirements by NSW Public Works. This is the fifth surveillance report for Timor Dam.

The previous 5 yearly Surveillance Report was prepared by The Department of Commerce (now NSW Public Works) (May 2008). The previous audit inspection report was prepared by the NSW Office of Water (now DPIWater) in 2013.

3.4.2 Recommendations of the Previous (2008) Surveillance Report

1. Prepare an Operation and Maintenance Manual on the dam in accordance with the ANCOLD Guidelines on Dams Safety Management **(1992 O&M available but needs updating)**

2. Prepare a Dam Safety Emergency Plan as a matter of urgency **(Completed)**

3. Carry out a structural review to determine the ability of the dam to withstand the relevant earthquake loading **(Outstanding, proposed as part of dam raising studies)**

4. Complete a finite element analysis of the dam at the Acceptable Flood Capacity to determine the structural stability of the dam **(Outstanding, proposed as part of dam raising studies)**

5. Access in and around the dam is sub-standard and should be upgraded to meet the acceptable standard, pending the outcome of the OH&S audit **(Outstanding)**

6. Maintain the access road to the dam to ensure it is trafficable in all weather **(Completed/Ongoing)**

7. Develop an improved electronic database system to capture and store all dam safety monitoring data including storage level, rainfall and seepage, which also requires the installation of a telemetry system to transfer seepage readings to council office. The electronic database would facilitate transmittal of data trends to DWE and future surveillance reporting. Records should be made of each of these parameters at least 3 times per week. **(Completed for storage level, seepage and rainfall outstanding)**

8. Ensure both council and DWE inspect the dam at intervals required by ANCOLD guidelines for HIGH C hazard Dam **(Ongoing/DWE no longer relevant)**

9. Provide all Council dam inspectors and relieving staff with suitable refresher training at an approved Dam Safety Inspection course every five years to comply with the ANCOLD guidelines **(Completed/Ongoing)**

10. Restore rainfall recorder at the dam with appropriate security measures to prevent vandalism **(Outstanding)**

11. Monitor minor leakage at the points mentioned, detect and report any changes, carrying out repairs where required **(No longer occurring)**

12. Carry out a full audit inspection of all mechanical equipment associated with the operation of the dam and appurtenant works to allow Council to assess the condition of the dam assets for maintenance and planning upgrades **(Outstanding, proposed as part of dam raising studies)**

13. Investigate the possibility of extending the scour outlet to include a hydraulically operated valve downstream of the existing manual gate valve **(Outstanding)**

14. Carry out an OH&S Audit on the dam and carry out the recommendations of the audit so that the dam complies with the OH&S Act and Regulations **(Outstanding, proposed as part of dam raising studies)**

15. Upgrade and repair the security fencing at the dam site to prevent access to both the area itself and the dam crest **(In-progress)**

16. Ensure that Council has in its possession all reports that have been completed on the dam including geological, hydrological, dambreak and all other relevant reports. A copy of all future reports should be sent to DWE for records **(Completed)**

17. Carry out a search to determine whether any design report, construction report or construction photos exist for Timor Dam. In the case of any construction photos being found copies should be made and sent to the DWE **(Complete, no design report or construction report)**

18. Install a surface survey system to enable monitoring of the dam structure and its surrounds and complete surface surveys every two years, reporting any unusual findings to the DWE **(Outstanding)**

19. Complete the D6 Flood Security Status form for the dam to reflect the Flood Hydrology study completed **(Status Unknown)**

20. Remove debris that has collected on the upstream face of the saddle dam **(Ongoing)**

21. Monitor loose boulders that are situated on the right abutment above the dam wall **(Ongoing)**

4 General Information

4.1 Coonabarabran Water Supply

Coonabarabran's initial water supply was based on a system of bores sunk in the alluvial flats of the Castlereagh River outside the town. To meet increased demand, Timor Dam was constructed in 1962. It also serves as a source of water supply for the Siding Springs Observatory in the Warrumbungle Mountains. The supply to Coonabarabran is supplemented by run of river pumping water from a weir on the Castlereagh River at Poundyard just upstream of the town.

4.2 Dam Data

Timor dam is located on the Castlereagh River 12 km west of Coonabarabran. The dam is accessible by an unsealed road off Timor Road. Timor dam was designed and constructed by Public Works, being completed in 1962.

The dam is a concrete arch structure with overfall spillway. The dam has a maximum height of 19.5m, a crest length of 68m, a crest width of 1.4m and an arch radius of 33m. The upstream face is vertical and downstream face slopes at 1H to 5V. The dam wall is divided into 13 units with vertical expansion joints between adjacent units. A nappe aeration column is provided at each end of the wall.

There is a saddle dam of homogeneous earthfill construction located 300m north of the main dam. The saddle dam has a maximum height of 4.9m, is 55m long and has a crest width of 3.7m. Its upstream face has a slope of 3.5H to 1V and is protected by rip-rap. The downstream face has a slope of 2.5H to 1V and is topsoiled and grassed.

The dam catchment area is 20km^2, and the reservoir storage area at full supply level is 3.6 km^2. The storage capacity of the reservoir at Full Supply Level (FSL) RL611.16m AHD is 1140 ML, however there is a dead storage of approximate 220 ML due to the outlet works arrangement. Drought conditions have led to the installation of a pump system to access the dead storage. The system was installed in 2002.

Both the main dam and the saddle dam are located on a north-south axis with the downstream face to the east.

4.3 Dam-site Geology

Timor dam is constructed in a narrow gorge on the south eastern edge of the Warrumbungle Mountains volcanic complex of the Tertiary Period.

The dam site is described (NSWPWD, 1982) as being founded on massive trachyte which crops out over the whole of both abutments and downstream for at least 800m. The volcanic rocks comprise the pinnacle above the right abutment and cover the ridge between the left abutment and the saddle dam area, but it seems that sandstone forms the foundation of the saddle dam.

The limited construction details available suggested that a strong, suitable, massive, relatively unjointed and unweathered foundation was easily obtained. The rock fragments excavated and piled in the downstream bed reveal a fresh rock fabric.

The construction records indicate that grouting was not considered necessary.

4.4 Spillway Structure & Capacity

The dam has a low level overfall spillway section 36.6m long and 0.3m deep. The design flood surcharge shown on the WAE drawings is 3.6m which leaves a freeboard of 1.2m at the saddle

dam. A flood equivalent to the design flood surcharge would result in an outflow of approximately 890 m^3/s.

The spillway crest level is RL 611.16m AHD, and the saddle dam crest level is RL 616.04m AHD. The height difference is 4.88m, giving a freeboard of 0.58m at peak PMF flood level. The spillway discharge capacity was therefore sufficient to safely pass the PMF calculated for the second surveillance report without overtopping of the saddle dam.

The design flood surcharge for the main concrete dam was RL 614.82m AHD, based on information provided on WAE drawings. The PMF obtained for the second Surveillance Report was estimated to overtop the dam to RL 614.46m AHD, ie 0.36m below the design flood surcharge. The main dam wall was therefore considered to be able to safely pass the PMF without failure of the structure on the basis of the PMF estimate in the second surveillance report.

The latest PMF estimates (2004) determined a peak outflow to be 1200 m^3/s with a surcharge level of RL 615.46m AHD, 4.3m above FSL. This leaves 0.58m freeboard on the saddle dam crest. However, the maximum flood level for the PMF is above the original design flood level (Refer to Section 9.2 for discussion on the flood handling capacity of Timor Dam).

4.5 Outlet Works

Water is drawn from a reservoir through a 250mm diameter floating trunnion attached to an operating platform on a 450mm square concrete column. The outlet works are located northwest of the main wall towards the storage area, upstream of the saddle dam. From there, a 250mm diameter cement lined cast iron gravitation main was laid beneath the saddle dam. The lowest intake level is 11.5m above the reservoir bottom level, resulting in a dead storage of 220 ML.

Due to drought conditions, Council installed a low level offtake in 2002. This consisted of a pipeline with a pump attached.

There is a scour outlet located in the dam wall. This is operated manually and consists of one 600mm diameter gate valve and a 100mm diameter pressure release valve. The 600mm valve is reported (by dam operator) to be functioning when last tested.

4.6 Hydrology and Dambreak Studies

A preliminary hydrology study was carried out for the second surveillance report as a screening exercise. The Probable Maximum Flood (PMF) was obtained using the Cordery-Webb Method (1974), adjusted as recommended Australian Rainfall and Runoff (1987) to derive a synthetic unit hydrograph. This was convolved with the Probable Maximum Precipitation (PMP) derived from the Bureau of Meteorology's Bulletin 51 (1984) to form an inflow flood hydrograph which was then routed through the storage.

The resulting PMF was estimated to have a peak inflow of 770 m^3/s which resulted in a peak outflow of 760 m^3/s, and a maximum depth above the spillway crest level of about 3.3m. The 0.5 PMF was estimated to have a peak inflow of 385 m^3/s, and a maximum water depth above the spillway crest level of about 2.1m.

As noted in the previous surveillance report, there were numerous changes made in the field of extreme flood estimation between the two previous surveillance reports. These include:

- changes in the method of estimating Probable Maximum Precipitation (PMP), formerly Bureau of Meteorology's Bulletin 51 (1984) now Bulletin 53 (1996)
- changes in the method of convolving extreme rainfall and runoff formerly Institution of Engineers AR&R (1987) now Institution of Engineers AR&R book VI, estimation of large to extreme floods (1998)

- Changes to the Australian National Committee on Large Dam Guidelines (ANCOLD) formerly guidelines on Design Floods for Dams (1986), now Guidelines for Selection of Acceptable flood capacity for dams (2000).

As a result of the above changes, a hydrology update study, assessing Timor Dam's probable maximum flood, was carried out in 2004.

Table 4.1 below shows the peak PMF inflow hydrographs for various storm durations. They are outlined in the PMF flood study (2004).

Table 4.1: Peak Inflow Hydrograph

Duration (Hours)	Peak Inflow (m^3/s)
1	932
2	1247
2.5	1239
3	1207
4	1122
5	1038
6	944

The results of the various flood studies are summarised in Table 4.2 below in chronological order.

Table 4.2: Development of PMF Estimates

Year	Method of Analysis	Critical PMP Storm Event	PMF Peak Inflow m^3/s	Peak Outflow m^3/s	Depth Over Spillway Crest (m)
1994	Cordery - Webb		770	760	3.3
2004	RORB	2.5 hrs	1239	1200	4.3

NSW Department of Commerce (now NSW Public Works) carried out a dambreak study for Timor Dam in 2006. Based on the theoretical inundated area and number of residences potentially affected the Consequence Categories were assessed as HIGH C for flood. The consequence category for Sunny Day was found to be SIGNIFICANT.

The following cases were analysed:

- PMF with and without dam failure
- PMF with saddle dam failure
- Dam Crest Flood with and without dam failure
- Sunny Day Failure storage at FSL

The Sunny Day dambreak flood inundates no residences downstream of the dam.

Approximately 37 residences with a PAR of 93 may be submerged by the PMF without dambreak, while the dambreak flood would inundate up to 56 residences with a PAR of 140. The incremental flood area would therefore affect approximately 19 residences and a PAR of 47 has been adopted for carrying out the Flood Consequence Category (FCC) assessment.

4.7 Consequence Categories

Below the dam, the Castlereagh River flows for a distance of about 1 km through a valley, then opens out into undulating country. At a distance of 5.5 km downstream of the dam, the river flows around an amusement park and crosses Timor Road). It then flows along the back of a motel which could be affected by major flood discharges. The river continues to flow east and reaches Coonabarabran 17km downstream of the dam where it crosses the main street and the Wallerawang Gwabegar Railway Line.

About 15 rural properties are located close to the river upstream of Coonabarabran. Within the township are public facilities such as parks and picnic areas as well as a number of local residences that are close to the river.

The damage and losses were assessed as “medium” for all the dambreak cases based on the estimated cost for repair and clean up, service, social and environmental factors. This resulted in the Sunny Day Dambreak and the DCF Dambreak cases having a Low consequence category. However, both of these have been upgraded to **SIGNIFICANT** in the dambreak report because of the cost of repairs, social and environmental aspects. A summary of the assessment is provided in Table 4.3 below.

Table 4.3: Consequence Category Assessment

Category	PAR	Severity of Damage and Loss	Consequence Category
Sunny Day	0	Medium	Significant
Flood (Incremental)	47	Medium	High C
Flood* (total)	140	Medium	High A

** With regard to the incremental consequences, the assessor should be mindful that, in the aftermath of a dam failure, it might not be a simple matter to distinguish between the consequences directly attributable to the dam failure, and the flooding consequences from the flood event which caused the dam's failure. For this and other reasons, the DSC needs to consider both incremental and total consequences.*

The Committee will normally base its FCC on incremental consequences but may sometimes base the FCC on total consequences. The owner is to provide estimates of both the incremental and the total consequences.

The **HIGH C** FCC rating was determined on an incremental flooding basis. A HIGH A rating applies if the FCC was based on total consequences. However, for the dam’s flood handling capacity the incremental category normally applies.

4.8 Dam Safety Review Investigations

An engineering geological inspection of Timor dam was carried out by Public Works (1982). Public Works prepared the First, Second and Fourth Surveillance Reports on Timor Dam in August 1987, April 1994 and May 2008 (named Department of Commerce for fourth surveillance report). The Third Surveillance Report was prepared by the DLWC in February 2000.

It was recommended in the 2000 Surveillance Report that a structural review be carried out for the dam To date, this hasn't been completed, however as understood Council intends to undertake this assessment shortly as part the dam raising feasibility study and concept design (Refer to Recommendations 13 and 14).

4.9 Instrumentation Monitoring

There are no stream gauging stations established upstream or downstream of Timor Dam.

There is no specific seismic monitoring station located at the dam. Regional earthquakes in New South Wales are measured by Geosciences Australia and the Seismic Research Centre (Melbourne).

A telemetry system has been installed to monitor reservoir levels which are relayed to the Council offices.

There is a V-notch weir downstream of the dam that measures seepage, however the weir is in disrepair (Refer to Photos 18 and 19 at Appendix D) and is difficult to access safety, therefore seepage has not been measured. The seepage weir should be repaired or replaced and seepage rates recorded on at least a weekly basis in accordance with ANCOLD (2003) (Recommendation 1).

Plots of storage level and rainfall (from BOM) are provided at Appendix E.

4.10 Engineering Information

Work-as-executed drawings of the dam of Timor Dam are provided at Appendix C.

There is no record of design or construction reports being completed for Timor Dam. Council and NSW Public Works have carried out a search for available documents and neither a design report nor construction report was discovered. Other relevant documents encountered by NSW Public Works have been scanned and forwarded to Warrumbungle Shire Council.

4.11 Mining Activities

The dam does not fall under a mining "Notification Area" defined by the DSC and as understood no mining activities are undertaken under or near the dam.

4.12 Security and Access

The access road to the dam is satisfactory. Dam-site fencing has been damaged as a result of bush fires and should be repaired to deter unauthorised access to the dam site (Recommendation 2). As understood this work is in progress. Access to various components of the dam, including the scour outlet and seepage weir, is inadequate. Council should carry out a WHS Audit of the dam and implement the recommendations of the audit so that the dam complies with the WHS Act and Regulations (Recommendation 3). As understood, these activities are planned as part of the proposed dam raising works.

Dam-site vehicular access is secured by a substantial fence and locked gate. Overall the security measures provided at the dam are considered satisfactory. It would be very difficult to deter all unauthorised access to the structure.

4.13 Seismic Activity

Since the last surveillance report was carried out in 2008, there have been no earthquakes with a Richter magnitude 3 or greater within approximately 150km of Timor dam and there have been no seismic events that have raised concern in relation to dam safety.

5 Visual Inspection of the Dam and Appurtenant Works

5.1 Inspection Details

Inspection Party:	Council Staff	Cornelia Wiebels, Manager Warrumbungle Water and Sewerage Scott Stanley, Technical Services Water Technical Officer Ben Smith, Dam Operator
	NSW Public Works	George Samios, Assistant Principal Dams Engineer David Guest, Dams Engineer
Inspection Date	6th November 2015	
Weather	Fine and sunny	
Rainfall	Nil	
Storage	Approximately 350mm below FSL	
Type	Main Dam: Concrete Arch Saddle Dam: Embankment	
Purpose	Water Supply	
Sunny Day Consequence Category	Significant	
Flood Consequence Category	High C	
Previous Inspection	NSW Office of Water Annual Inspection (2013)	

Photos from the surveillance inspections carried out on the 6th November 2015 are provided at the back of this report in Appendix D.

5.2 Concrete Arch Structure

5.2.1 Upstream Face

The visible portion of the upstream face of the dam appeared to be in satisfactory condition. (Photos 1 and 5).

5.2.2 Downstream Face

The downstream face of the dam appeared generally in satisfactory condition (Photos 2 to 4). No seepage from the downstream face was observed during the inspection. There was some minor calcification at some of the concrete joints. The concrete appeared to be generally in good condition.

5.2.3 Dam Crest and Spillway Structure

The dam crest appeared to be in satisfactory condition (Photo 5). The crest was level and even with no movement or misalignment at the joints. The nappe aeration columns were in a satisfactory condition.

5.3 Dam Abutments and Foundations

The dam appears to be well founded on massive sound bedrock. There was no sign of any erosion at the interface of the dam and its foundations. The stepped concrete plinths at the toe of the dam were in a good condition, with no erosion occurring (Photos 3).

The abutments appeared sound with no indications of movement (Photos 6 to 8)

On the day of the inspection, there were no noticeable leaks at the base of the dam.

5.4 Saddle Dam

The embankment forming the saddle dam was generally in good condition. The slope on the upstream face was even with a good covering of rip rap generally free of vegetation (Photo 11 and 12).

The slope on the downstream face was even with a light covering of grass (Photo 13). No erosion or seepage has been detected. The crest appeared sound with no evidence of differential settlement or cracking (Photos 11 and 12).

Some trees that had grown on the right abutment of the saddle dam had been cleared since the 2008 surveillance inspection. Council should continue to remove debris from the upstream face of the saddle dam on a regular basis (Recommendation 4).

5.5 Outlet Works

The 600mm diameter scour outlet appeared to be in reasonable condition; however it was only viewed from a distance during the inspection (Photos 9 and 10). The scour outlet is rarely operated but was reported to function adequately when last tested. The scour valve is only operated manually. It requires 2 people to open and close the valve.

The water supply outlet trunnion and storage mixer (Photos 15 and 16) appeared to be in reasonable condition; however they were only viewed from a distance during the inspection and much of the structures were submerged.

The dead storage line was located on the left hand side of the saddle dam and the pump had been removed for repair (Photo 17).

A comprehensive condition assessment should be undertaken on the outlet works components and the system should be upgraded to acceptable modern standards (Recommendation 5). As understood, Council plans to undertake these activities as part of the proposed dam raising works.

5.6 Reservoir Storage Area

The reservoir foreshores are well vegetated (although fire damaged) with little evidence of instability, significant wave scouring or erosion of the storage foreshore (Photos 20 and 21). There was no evidence of any blockage of the downstream river channel.

6 Operation and Maintenance

Procedures for operation and maintenance are an integral part of the safety of a dam.

6.1 Operation and Maintenance Manual

The DSC requires that appropriate standards of operation and maintenance be applied to prescribed dams. In particular, the Committee requires the owners of high Consequence Category dams to have an effective O&M manual prepared for their dams. These manuals are to be regularly upgraded at least every 5 years.

An operation and maintenance manual exists for Timor Dam, however it is outdated (1992 version) and needs updating. Council should update the Operation and Maintenance Manual in accordance with NSW Dam Safety Committee Guidelines (DSC2F) (Recommendation 6).

6.2 Maintenance

The general condition of the dam was described in Section 2.1. The condition of the dam and appurtenant works indicates a satisfactory standard of maintenance in general.

Council's routine program for:

- routine inspections and reporting;
- clearing of vegetation from the faces of the saddle dam regularly;
- repairing areas of minor erosion or animal activity;
- other maintenance work as required (discovered during inspections)

will help significantly to maintain the dam and appurtenant works in a satisfactory condition.

7 Surveillance Procedures

7.1 Inspections and Procedures

The Sunny Day Consequence Category (SDCC) for Timor Dam was assessed as SIGNIFICANT (2006). The ANCOLD *Guidelines of Dam Safety Management* (2003) advise on the frequency of inspections required for different consequence category dams based on the SDCC of the dam. The table below outlines the frequency of various inspections recommended in the ANCOLD Guidelines (for Significant SDCC dams) and compares them to the current frequency of inspections carried out for Timor Dam.

Inspection	ANCOLD Recommended Frequency (for Significant SDCC)	Current Frequency	Comment
Comprehensive	Five yearly	Nominally five yearly	Adequate
Intermediate	None required	Normally annually until 2013	Adequate
Routine Inspection	Twice weekly to weekly	Weekly	Adequate
Special	As required	None required	Adequate

As is outlined in the table above, the current frequency of all inspections are generally in accordance with the recommendations of the ANCOLD Guidelines. Therefore, the current inspections and frequency of inspections for Timor Dam are considered adequate at this time. However, there are no formal routine inspection procedures including inspection sheet, review and signoff. Council should utilise a formal routine inspection sheet that is reviewed and signed-off by the Water Manager (Recommendation 7)

It is understood that Council provides dam surveillance training to all its dam site personnel. This is good practice and should be refreshed at least every 5 years (Recommendation 8).

The DSC requires that dam owners have a Dam Safety Specialist who is responsible for advice on “other than normal” conditions, emergency responses/inspections (emergency contact in DSEP) and review of monitoring data. Council should formally engage a Dam Safety Specialist for Timor Dam (Recommendation 9).

7.2 Monitoring

7.2.1 Dam Monitoring Frequencies

The *Guidelines on Dam Safety Management*, ANCOLD (2003), outlines the recommended frequency of monitoring based on the Sunny Day Consequence Category (SDCC) of a Dam. The recommended frequencies are outlined in the table below and compared to the current practises for Timor Dam.

Monitoring	ANCOLD Recommended Frequency (for Significant SDCC)	Current Frequency	Comment
Rainfall	Twice Weekly to Weekly	Not Monitored	Inadequate
Storage Level	Twice Weekly to Weekly	Continually (Telemetry)	Adequate

Monitoring	ANCOLD Recommended Frequency (for Significant SDCC)	Current Frequency	Comment
Seepage	Twice Weekly to Weekly	Nil	In-adequate
Chemical Analysis of Seepage	Consider	Nil	Not considered necessary.
Pore Pressure	N/A	N/A	N/A
Surface Movement Control	Nil	Nil	
Surface Movement Normal	Consider	Nil	Should consider as part of upgrade works
Internal Movement/Stress	Consider	Nil	Not considered necessary.
Seismology	Nil	Nil	Adequate as the dam is located in low seismic activity area

As is outlined in the table above, the current frequencies of monitoring types are generally in accordance with the recommendations of the ANCOLD Guidelines (2003), however seepage and rainfall should be monitored at least weekly. Council should repair the seepage weir, provide safe access to the weir and measure and record seepage rates on at least a weekly basis (Recommendation 1 and 3)

7.2.2 Storage Levels and Rainfall

Currently, reservoir levels are continually monitored using a telemetry system. Rainfall is not monitored at the dam-site and Council should install a rain gauge to record rainfall at least weekly (Recommendation 15). Council should plot reservoir and rainfall data in an appropriate format and provide it to its nominated Dam Safety Specialist for review along with seepage monitoring data, to allow identification of any unsafe trends (Recommendation 10). Refer to Appendix E for plots for storage level and rainfall data (from BOM).

7.2.3 Seepage

The seepage weir located downstream of the dam is not functioning appropriately and needs repair. Council should repair the seepage weir, provide safe access to the weir and measure and record seepage rates on at least a weekly basis. (Recommendation 1 and 3).

7.2.4 Monitoring Data

When seepage and rainfall data collection commences, the data should be plotted with storage level provided to Council's nominated dam safety engineer for review and assessment every 3 months (Recommendation 10).

7.2.5 Deformation Survey

There is currently no deformation survey network at Timor Dam so the dam is not monitored for movement in any way aside from visual inspection. ANCOLD (2003) does not stipulate that deformation monitoring must be undertaken for Significant SDCC dams, however it does suggest surveys be considered. Council should therefore consider building a survey network to enable monitoring of wall and abutment movements (Recommendation 11).

8 Emergency Management

8.1 Dam Safety Emergency Plan

The DSC requires a DSEP for prescribed dams where non-itinerant persons could be at risk. Council have prepared a DSEP for Timor Dam and it was updated in February 2014. Council keeps copies of the DSEP at its office and should regularly review and update the document to reflect any new names and contacts or organisations and personnel as appropriate. Council should continue to update the Dam Safety Emergency Plan in accordance with NSW Dam Safety Committee Guidelines (DSC2G) and test the DSEP at least every 5 years (Recommendation 12).

8.2 Emergency Dewatering

In accordance with DSC18, it is desirable that the outlet works cater for adequate emergency dewatering, and if practicable, conform to the USBR criteria set out in “Criteria and Guidelines for Evacuating Storage Reservoirs and Sizing Low-Level Outlet Works” US Department of the Interior, ACER Technical Memorandum No. 3, 1982.

A 600mm scour outlet exists in Timor Dam wall. The scour outlet valve is only manually operable and requires two men for operation. A comprehensive condition assessment should be undertaken on the outlet works components and the system should be upgraded to acceptable modern standards (Recommendation 5). This is to ensure that an emergency dewatering facility is maintained for Timor Dam.

9 Status of Dam Safety

9.1 General

The dam structure appears to be performing adequately. This comment is based on the following:

- The condition of the foundation and abutments is considered satisfactory.
- The dam wall concrete and reservoir surrounds are in good condition.
- No issues have been detected with the saddle dam
- Routine surveillance has not identified any issues of concern

Although the dam appears to be performing satisfactorily at present there can be no guarantee that this will continue into the future. Continual surveillance of the dam's physical behaviour is therefore necessary to identify the development of any changes. To detect the development of any unsafe trends Council should undertake collection of data, formal routine inspections of the dam and appurtenant works in addition to the five yearly surveillance inspections.

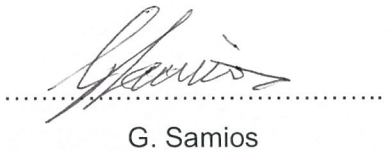
9.2 Flood Handling Capacity

Based on the dambreak study carried out in 2006, Timor Dam has been assigned a HIGH C Flood Consequence Category in accordance with definitions provided in ANCOLD (2012). On this basis according to DSC3B (2010), the Acceptable Flood Capacity (AFC) is the maximum annual exceedance probability of the 10^{-5} AEP flood or the PMP Design Flood (the more frequent flood to apply). The latest PMF estimates (2004) determined a peak outflow to be 1200 m^3/s with a surcharge level of RL 615.46m AHD, 4.3m above FSL (this leaves 0.58m freeboard on the saddle dam crest). The design flood surcharge for the main concrete dam was RL 614.82 m AHD, based on information provided on WAE drawings. Therefore, the current Design Flood could potentially result in a maximum flood level above that which the dam was originally designed for. Therefore the maximum flood level for the AFC should be determined and a structural review undertaken to assess if the dam can safely handle the design flood loading (Recommendation 13).

9.3 Earthquake Handling Capacity

No design report has been encountered and there is no evidence of any earthquake handling capacity assessments for Timor Dam, therefore a structural review of the dam under the appropriate design earthquake loading should be undertaken in accordance with ANCOLD (1998) (Recommendation 14). Since Timor Dam has a Significant Sunny Day Consequence Category, the dam should be able to safely handle the 1:500 AEP event in accordance with DSC3C (2010).

10 Signatories



G. Samios
Assistant Principal Dams Engineer
NSW Public Works

D. Guest
Dams Engineer
NSW Public Works

11 References

1. Australian National Committee on Large Dams, Guidelines on Dams Safety Management, 2003.

2. Australian National Committee on Large Dams, Guidelines on Selection of Acceptable Flood Capacity for Dams, March 2000.

3. Australian National Committee on Large Dams, Guidelines on the Consequence Categories for Dams, October 2012.

4. Australian National Committee on Large Dams, Guidelines for Design of Dams for Earthquake, August 1998.

5. Australian Rainfall & Runoff (ARR), A guide to Flood Estimation, Revised Edition, 1987

6. Bureau of Meteorology, Bulletin 51 - August 1984. The Estimation of Probable Maximum Precipitation for Short Durations and Small Areas.

7. Bureau of Meteorology, Bulletin 53 - December 1996. The Estimation of Probable Maximum Precipitation in Australia: Generalised Short Duration Period.

8. Bureau of Meteorology, The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method, June 2005.

9. Cordery and Webb, Flood Estimations in Eastern New South Wales. Institution of Engineers, Australia Civil Engineering Transactions, 1974

10. Dam Safety Act, 1978.

11. Dams Safety Committee, DSC3C: Acceptable Flood Capacity for Dams, June 2010.

12. Dams Safety Committee, DSC3A: Consequences Categories for Dams, June 2010.

13. Dams Safety Committee, DSC2C: Surveillance Reports for Dams, June 2010.

14. Department of Land & Water Conservation, Timor Dam, 3rd Surveillance Report, Report No. 198, February 2001

15. Laurenson, E.M. and Mein, R.G., “RORB - Version 4, Runoff Routing Program, User Manual”, Monash University, May 1988

16. Local Government Act, 1993.

17. Nathan, RJ AND Weinmann, PE, 1999. Book VI ARR, The estimation of large to extreme floods, NCWE (Eds)

18. NSW Department of Commerce, Dams & Civil Unit, Dambreak Study for Timor Dam, Report No. DC040158, April 2006

19. NSW Office of Water, Timor Dam Audit Inspection Report, 2013

20. NSW Department of Commerce ,Hydrology Group, Timor Dam Probable Maximum Flood Study 2004

21. NSW Department of Commerce, Dams & Civil Unit, Timor Dam, Fourth Surveillance Report, Report No. DC08003, May 2008

22. Public Works Department, NSW, Coonabarabran Water Supply Augmentation: Timor dam – Report on Engineering Geological Inspection (Report No EG82002), August, 1982

23. Public Works Department, NSW, Timor Dam Surveillance Report, Report No. SUR 68, August 1987

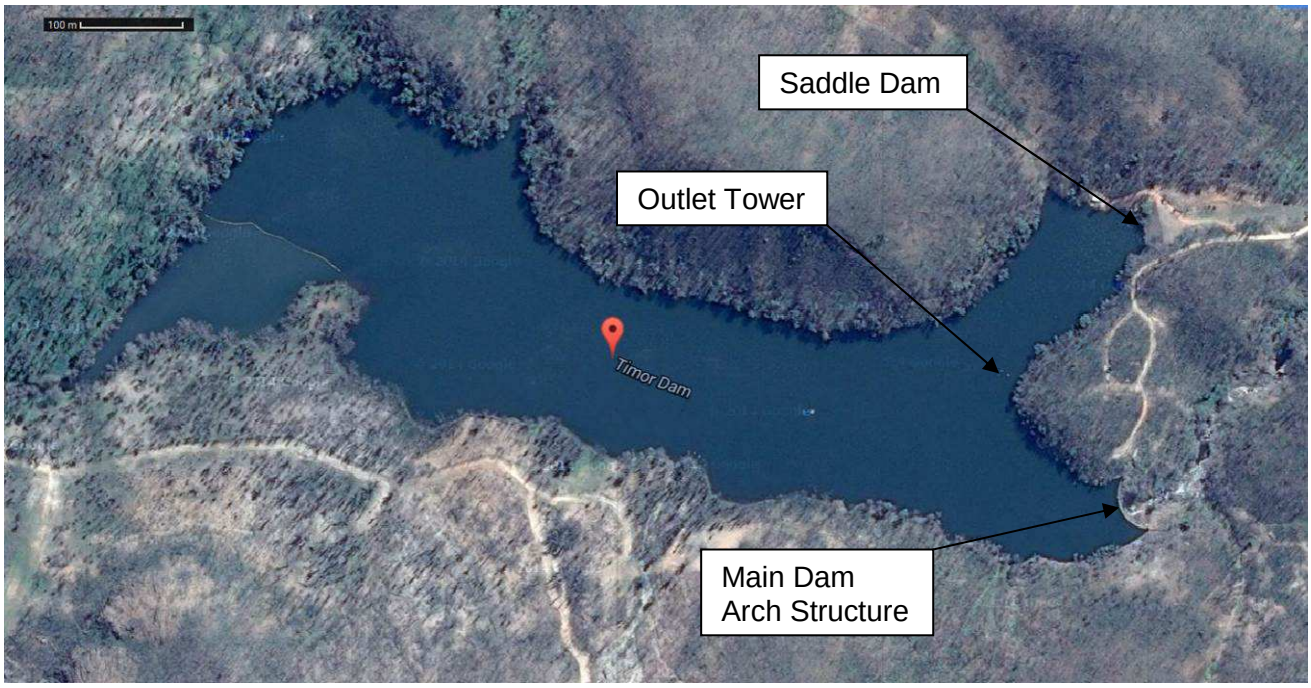
24. Public Works Department, NSW, Timor Dam 2nd Surveillance Report, Report No. SUR 129, April 1994

25. Work Health and Safety Act, 2012

Appendices

Appendix A – Locality Map and Aerial Photo of Timor Dam

Timor Dam Location



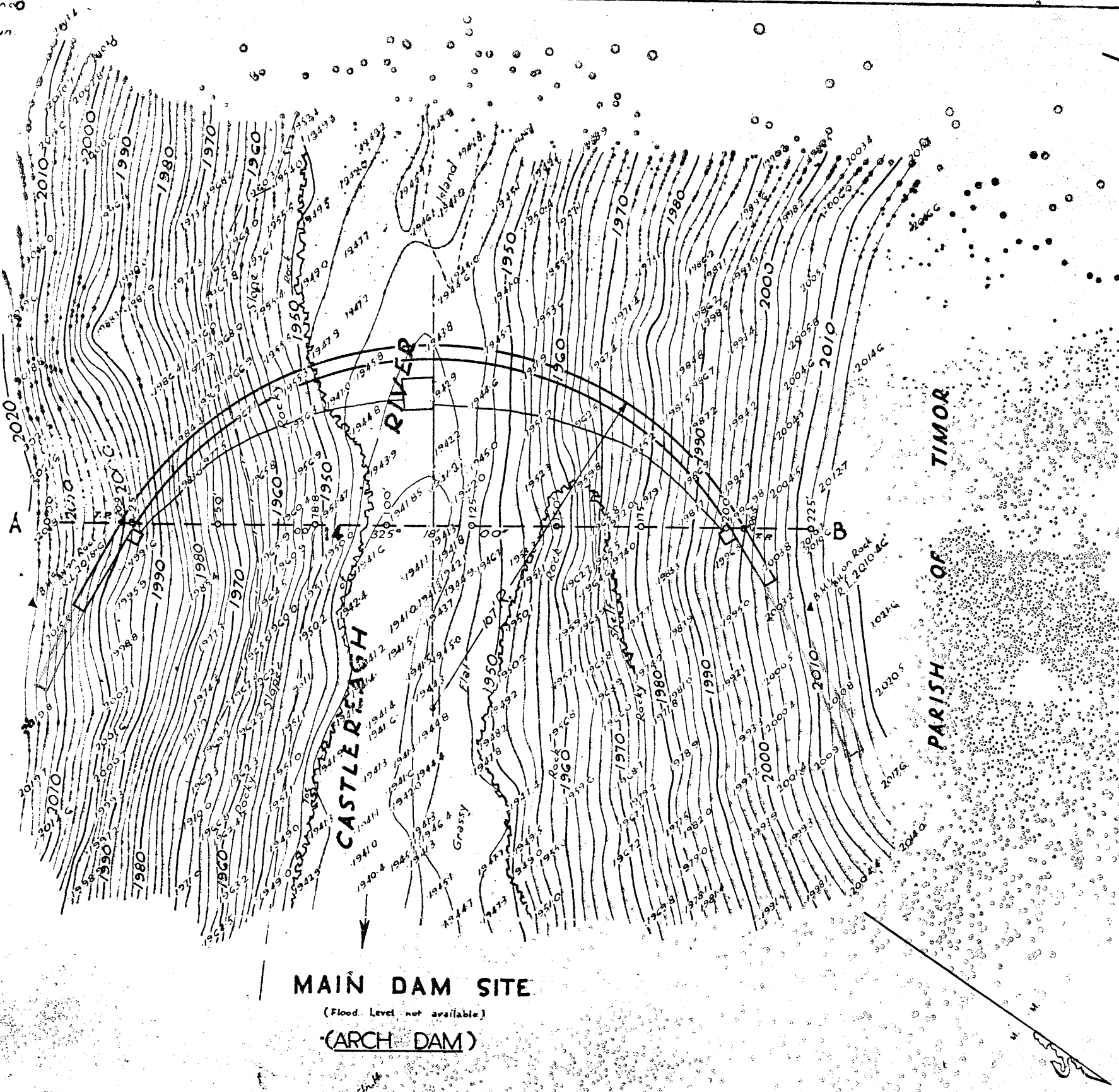
Timor Dam Aerial Photo

Appendix B – Dam Data Sheet

Dam Data Sheet	
Name of Dam	Timor Dam
Owner	Warrumbungle Shire Council
Designed	Department of Public Works & Services
Constructed	Department of Public Works & Services
Year of Completion	1962
River	Castlereagh River
Nearest Town	Coonabarabran (12km)
Purpose	Water Supply
Type	Concrete Arch Dam
Height above Lowest Foundation	19.5m
Length	68m
Capacity of Reservoir	1,140 ML
Catchment Area	20km²
Reservoir Area	3.6km²
Probable Maximum Flood Inflow (2004)	1,239m3/s inflow for a 2.5 hr PMF
Probable Maximum Flood Outflow (2004)	1,200m3/s
Probable Maximum Flood Level	615.46 m (AHD)
Spillway	Free overflow
Spillway Design Discharge Capacity (1962)	890 m3/s (3.6m surcharge)
Full Supply Level	RL611.16m (AHD)
Dam Crest Level	RL611.47m (AHD)
Saddle Dam Level	RL616.04m (AHD)
Freeboard at Saddle Dam (PMF 2004)	0.56m
Saddle Dam Length	55m
Sunny Day Consequences Category (2006)	Significant
Flood Consequence Category (2006)	High C

Appendix C – Drawings of Dam

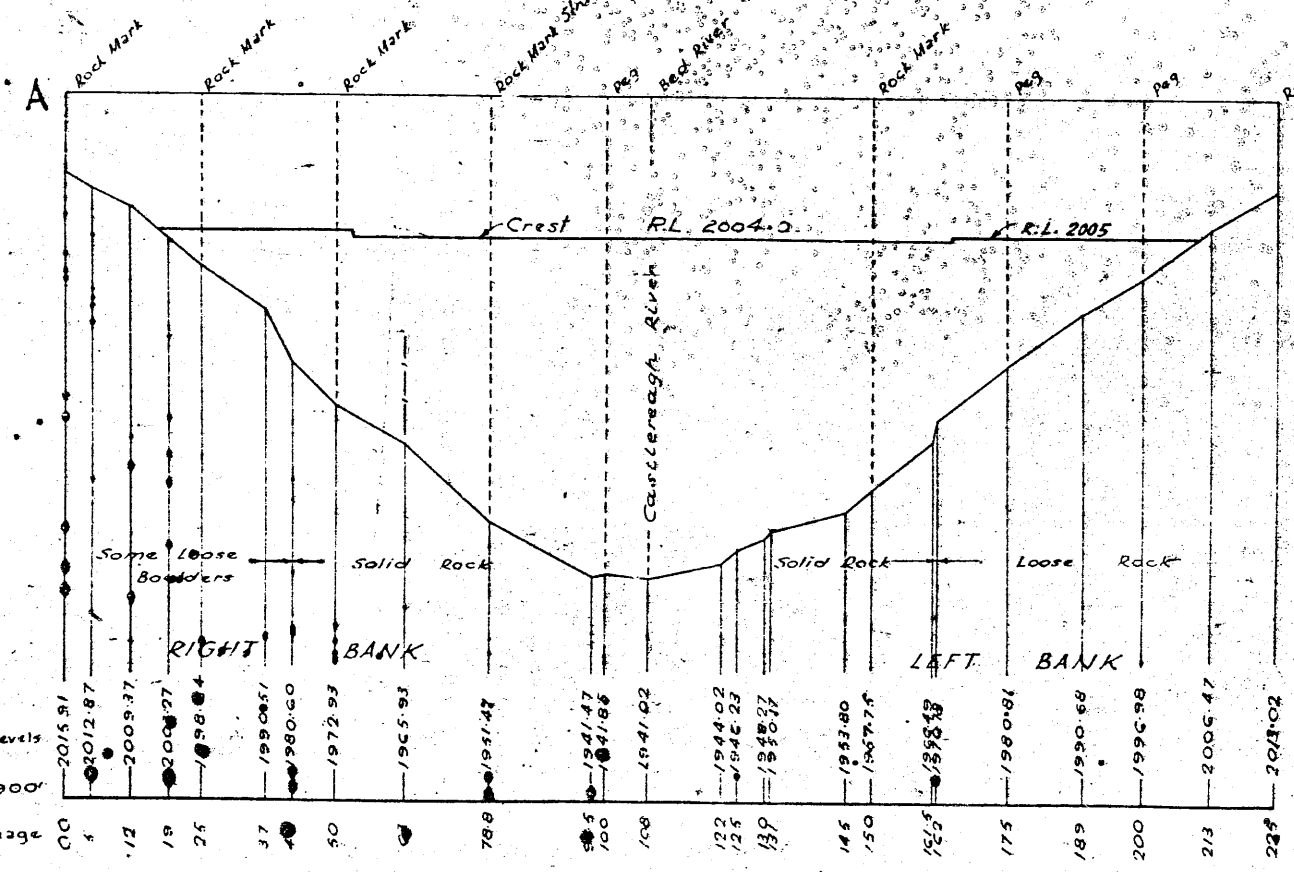
Parishes of Timor & Gundi
County of Gowen
Shire of Coonabarabran



MAIN DAM SITE

(Flood Level not available)

(ARCH DAM)



LONGITUDINAL SECTION

(ARCH DAM)

STANDARD DATUM

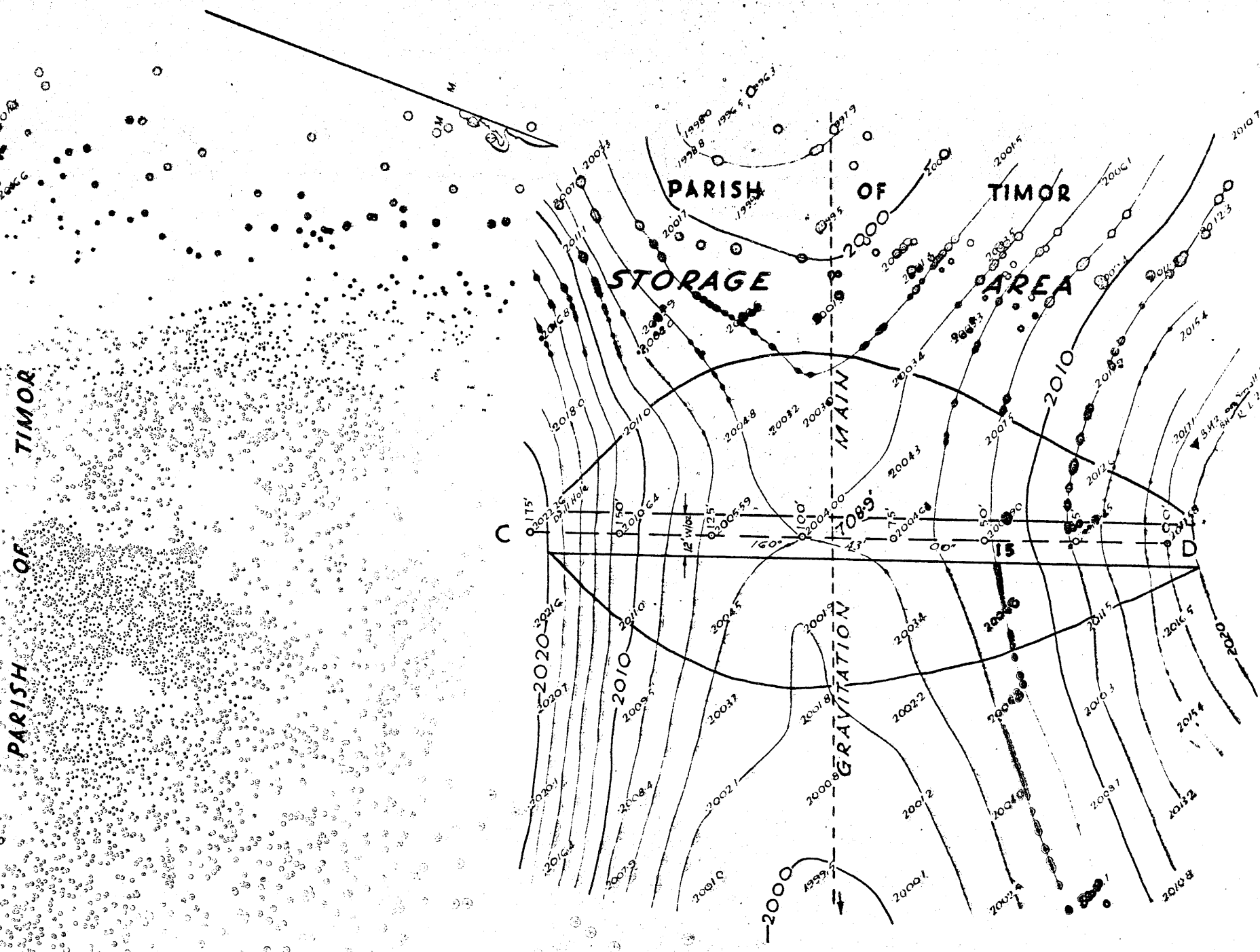
Plotted from Mr R Beach's LB's 03398-399-400 supplied by Coonabarabran Shire Council - F
Origin of Levels B.M. on Stringybark on River R.L. 1957.40'
Survey completed May 1958. Pa

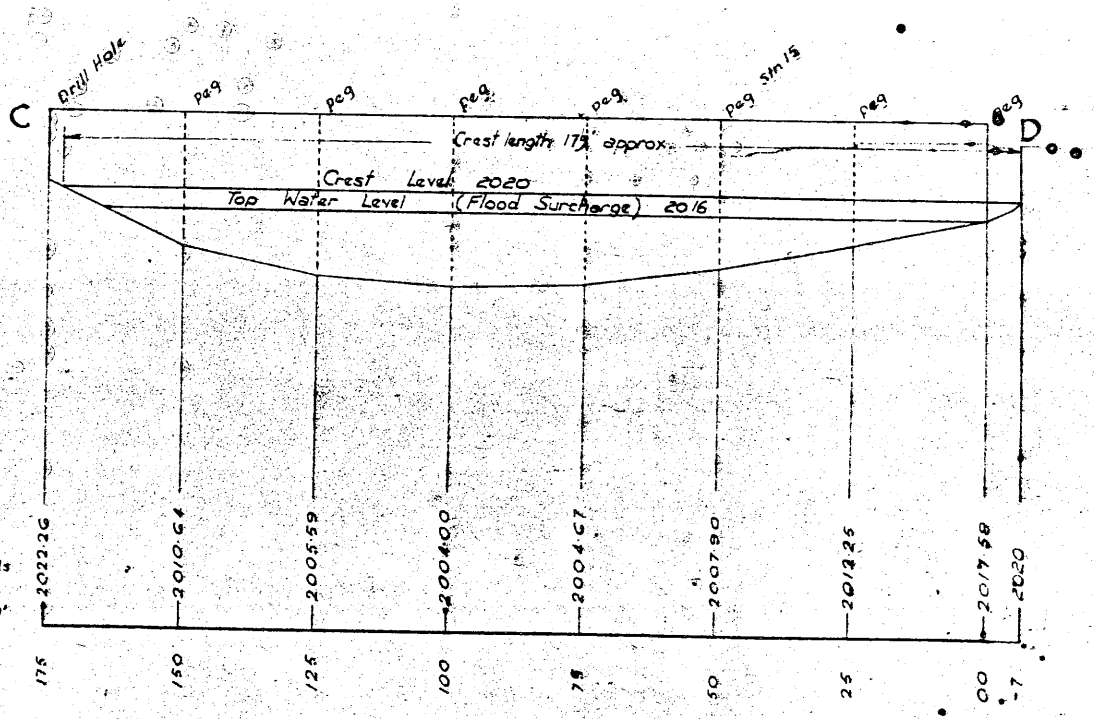
DRAWN G.M.F.
CHECKED L.R.Y. Feb. 24.3.60.

F. J. Mathews
PRINCIPAL SURVEYOR
3. 10. 58

20.4.60
PRINCIPAL DESIGNING ENGINEER

12" ON ORIGINAL





LONGITUDINAL SECTION

STANDARD DATUM

from Mr R Beach's LB's 03398-399-400 & Boring information
d by Coonabarabran Shire Council - F.B. 02266
of Levels B.M. ½ on Stringybark on right bank Castlereagh
R.L. 1957·40'
Survey completed May 1958. Papers W.S. 1083/4.

WORK AS EXECUTED

14/3/62.

W. R. CARROLL
DIRECTOR OF PUBLIC WORKS 32056

INEER

6-6-60
PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE

2-93 58/59

DEPARTMENT OF PUBLIC WORKS, N.S.W.

COONABARABRAN WATER SUPPLY AUGMENTATION
TIMOR DAM SCHEME - UPPER SITE
DAM SITES & LONGITUDINAL SECTIONS

Survey Sheet 3 of 6 Sheets

Scales: 20 Ft. to an Inch

PARISH

CASTLEREAGH

OF

39 Ph

TIMOR

25 Ph

PARISH

45 Ph

OF

1 CHAIN

ROAD

Trial

River

Road

1990

2000

2010

1980

TABLE O

Contour R.L.	Height (Ft)	Acre Fe
1942	0	0
1945	3	0·0
1950	8	0·9
1955	13	4·2
1960	18	11·8
1965	23	28·0
1970	28	57·3
1975	33	101·1
1980	38	163·4
1985	43	251·4
1990	48	369·3
1995	53	521·3
2000	58	713·1
2005	63	950·5
2010	68	1234·7

STANDARD DATUM

Plotted from Mr. R. Beach's L.Bs 03398-399-400 & Boring information supplied by Coonabarabran Shire Council - F.B. 02266
Origin of Levels B.M. ½ on Stringybark on right bank Castlereagh River.
R.L. 1957·40'
Survey completed May 1958 Papers W. S. 1083/4

PRINCIPAL DESIGNING ENGINEER

PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE

12" ON ORIGINAL

TABLE OF CAPACITY

Contour R.L.	Height (Ft)	Acre Feet	Capacity (Gallons)
1942	0	0	00
1945	3	0·032	8,700
1950	8	0·937	254,300
1955	13	4 236	1,149,000
1960	18	11 847	3,216,000
1965	23	28 044	7,613,000
1970	28	57 391	15,580,000
1975	33	101·190	27,470,000
1980	38	163 429	44,366,000
1985	43	251 457	68,243,000
1990	48	369 319	100, 259,000
1995	53	521·398	141,544,000
2000	58	713·116	193,606,000
2005	63	950·573	258,052,000
2010	68	1234·711	335,187,000

INSET

SADDLE DAM

OUTLET TOWER SITE

SADDLE DAM SITE

MAIN DAM SITE

ARCH DAM

TIMOR

RIVER

GUNDI

39 PA

WORK AS EXECUTED

12/3/62

32097

W. R. CARROLL
DIRECTOR OF PUBLIC WORKS

3-93 58/59

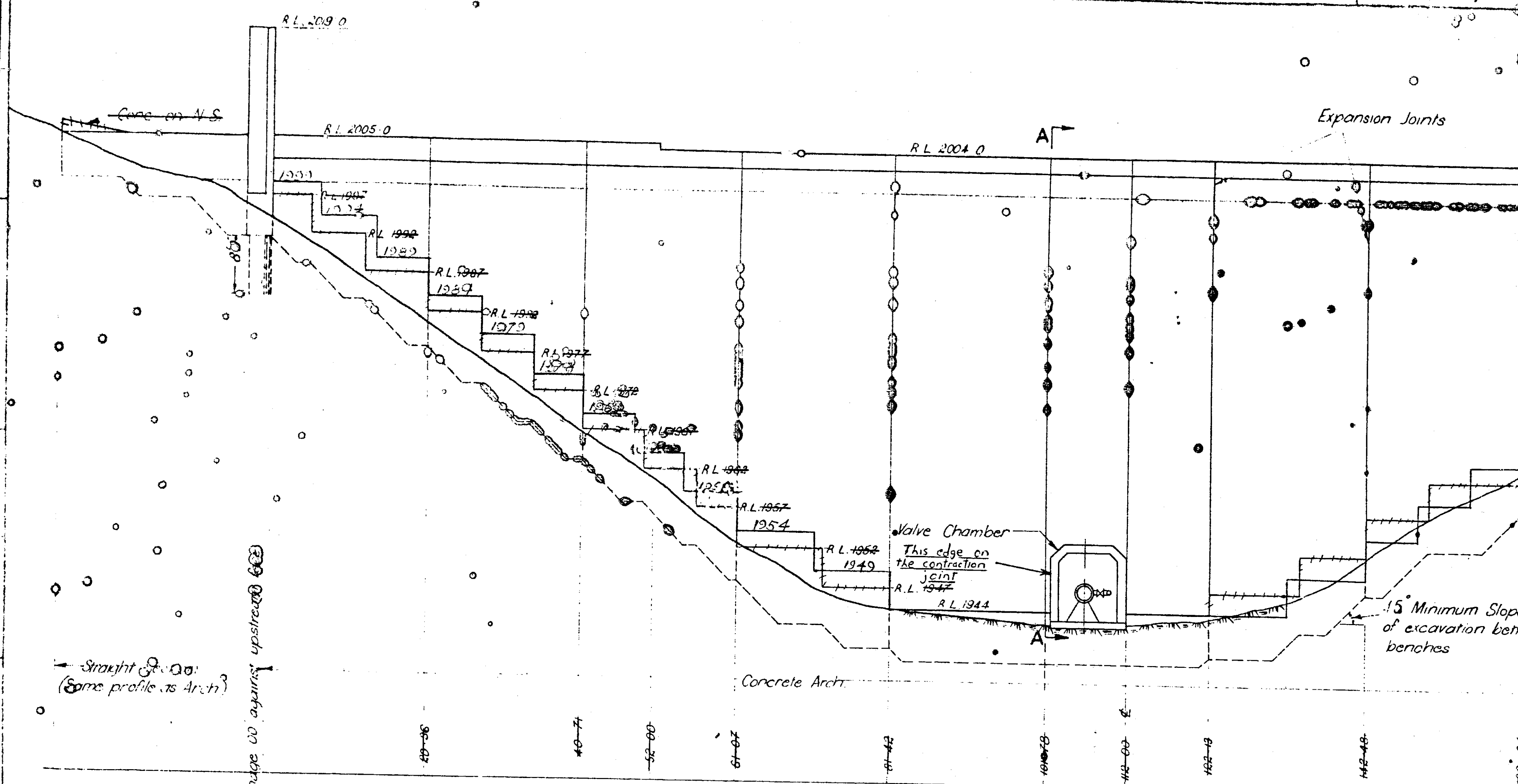
DEPARTMENT OF PUBLIC WORKS - N.S.W.

COONABARABRAN WATER SUPPLY AUGMENTATION TIMOR DAM SCHEME-UPPER SITE STORAGE AREA - CONTOUR PLAN

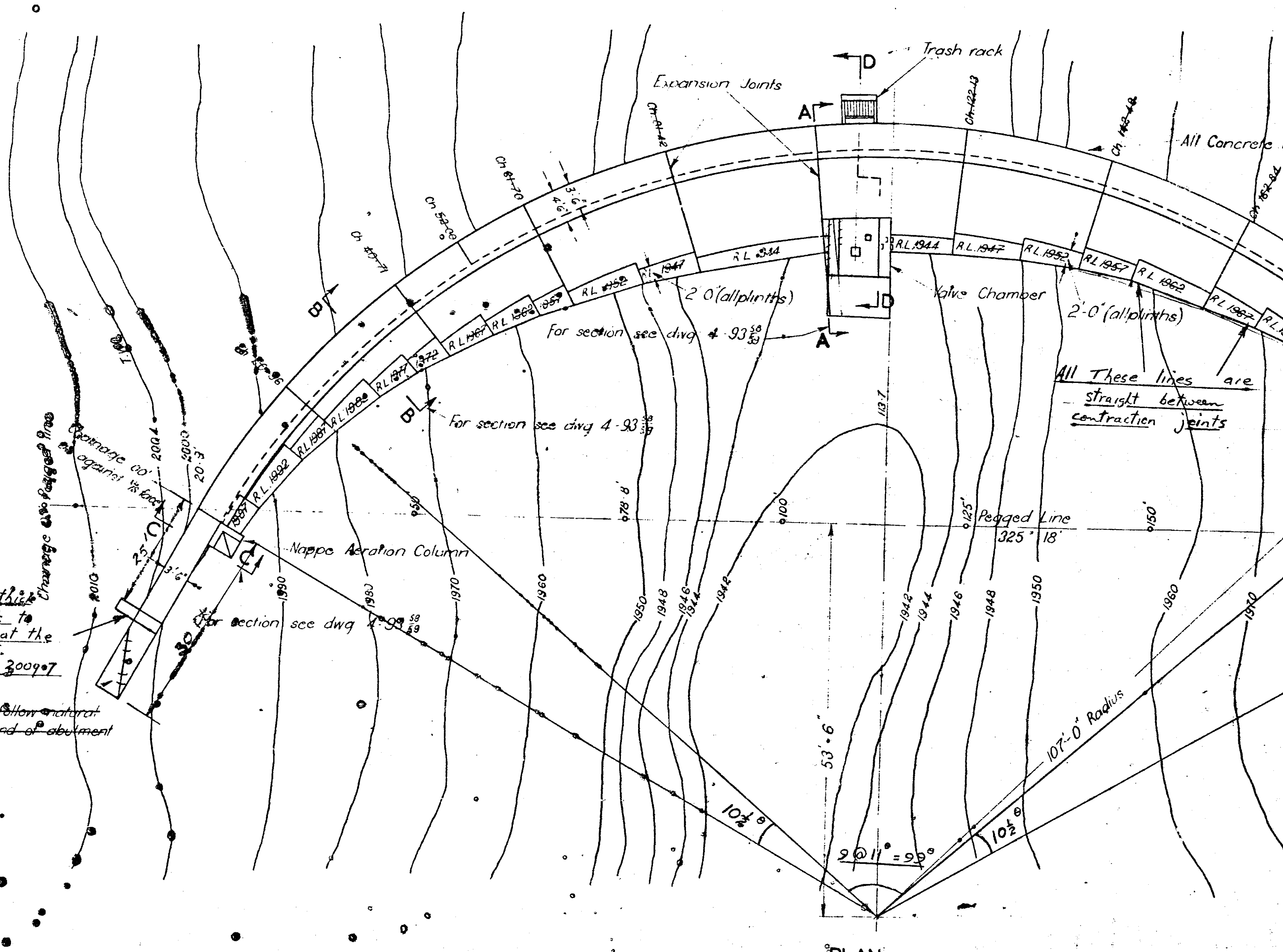
SURVEY SHEET 2 OF 6 SHEETS

Scale: 80 feet to an inch

FI



DOWNSTREAM ELEVATION PROJECTED RADIALLY ONTO UPSTREAM FACE OF DAM



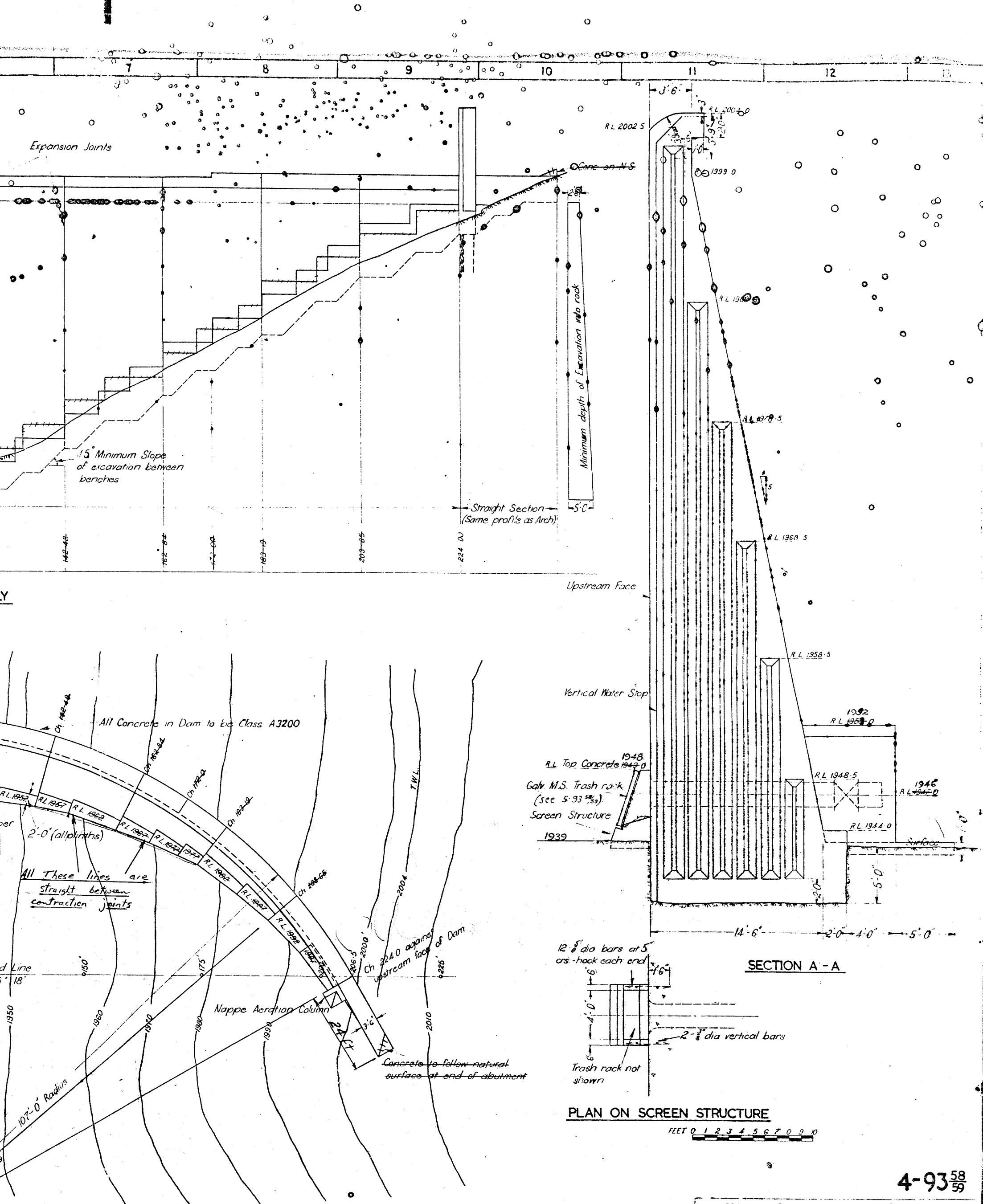
PLAN

DRAWN M. Colvin R.L.S.
TRACED
CHECKED 24.3.60

20.4.60
PRINCIPAL DESIGNING ENGINEER

6.5.60
PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE

12" ON ORIGINAL



WORK AS EXECUTED

I hereby certify that the works have been carried out in accordance with these plans and the amendments shown thereon in red.

J. R. RIGBY
RESIDENT ENGINEER.
PER:

15 FEB 1962

W. R. CARMICHAEL
DIRECTOR OF PUBLIC WORKS

4-93 58/59

DEPARTMENT OF PUBLIC WORKS N.S.W.

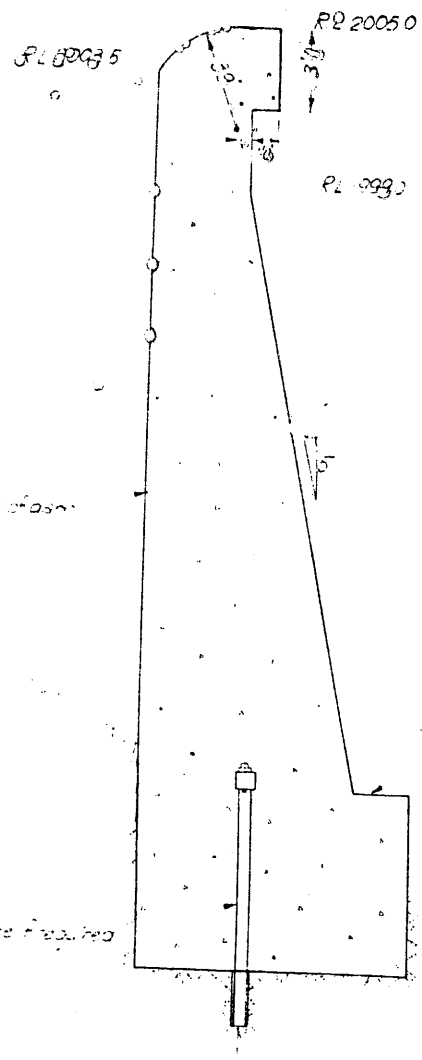
COONABARABRAN WATER SUPPLY AUGMENTATION

TIMOR DAM

GENERAL ARRANGEMENT

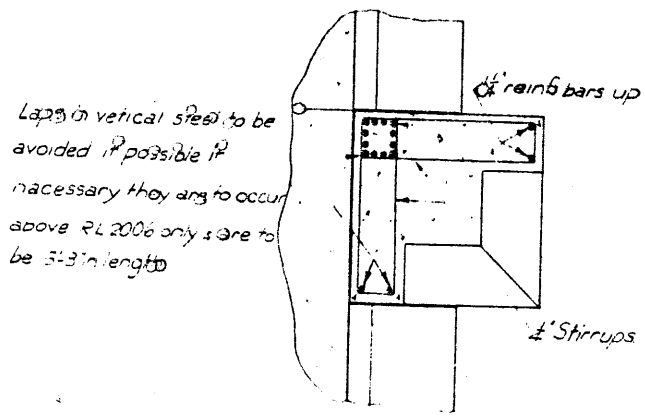
B 32057

SCALE:- As shown

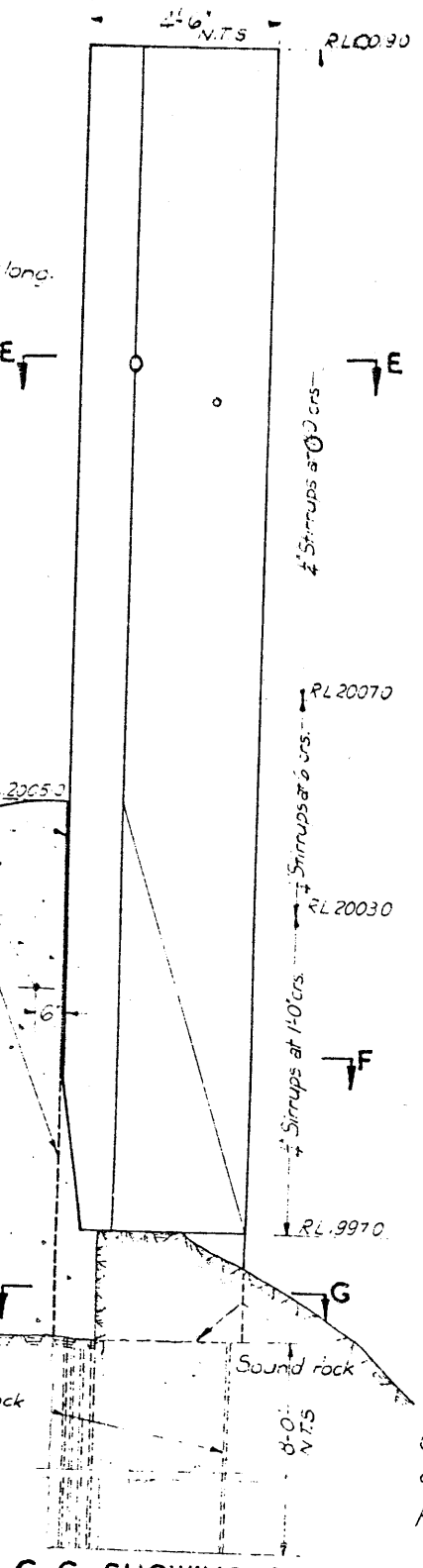


SECTION B-B

FEET 0 1 2 3 4 5 6 7 8 9 10



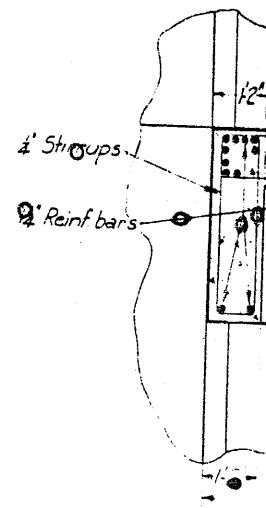
SECTION F-F



SECTION C-C SHOWING COLUMN

(See Dwg. No 4-93 58/59 for Location of Section)

INCHES 12 6 0 1 2 3 4 5 FEET



COLUMN

Note. Concrete to be ... have

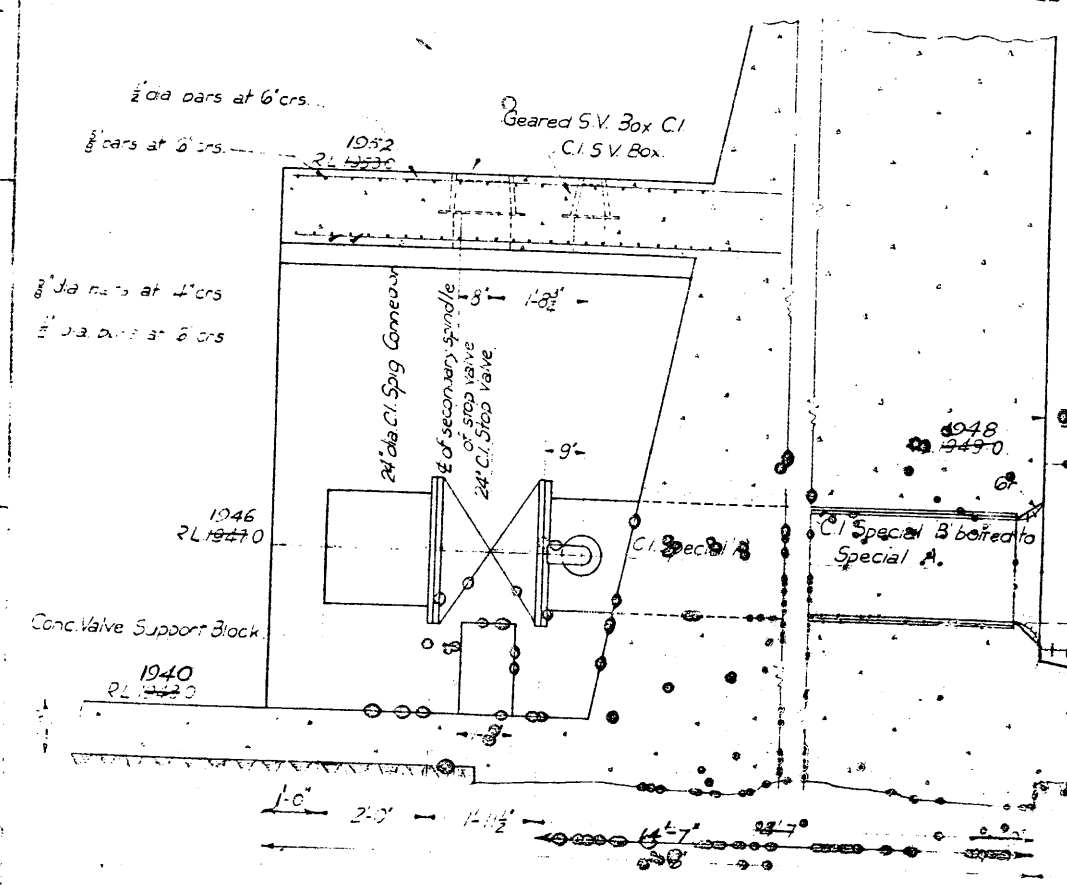
(See Dwg. No 4-93 58/59 for location of Section)

WORK AS EXECUTED

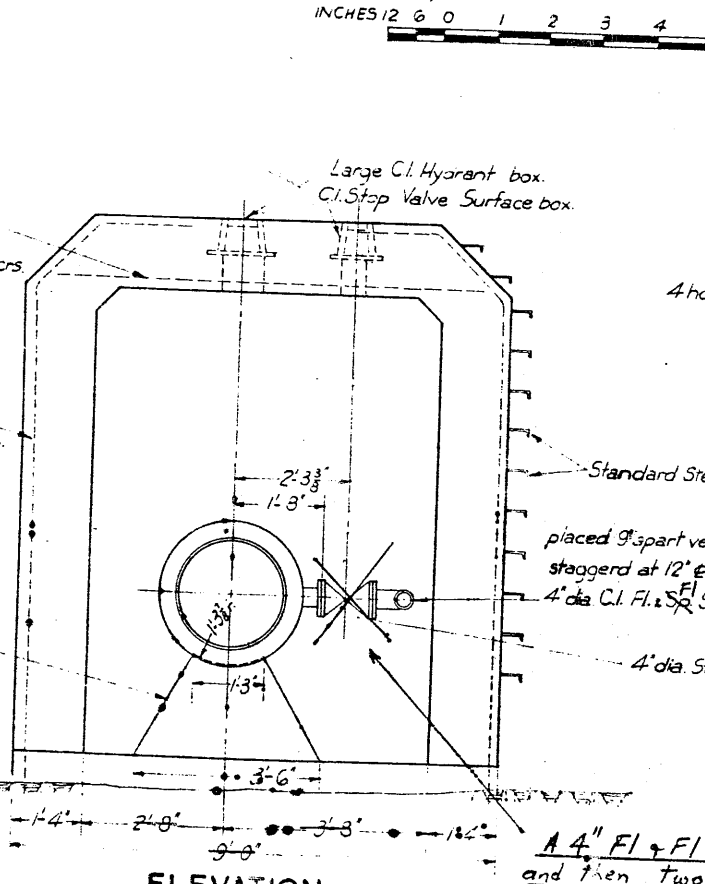
I hereby certify that the works have been carried out in accordance with these plans and the amendments shown thereon in red.

J. R. RIGBY
RESIDENT ENGINEER
PER:

15 FEB 1962



SECTION D-D



ELEVATION

R.C. CHAMBER FOR SCOUR & COMPENSATION VALES

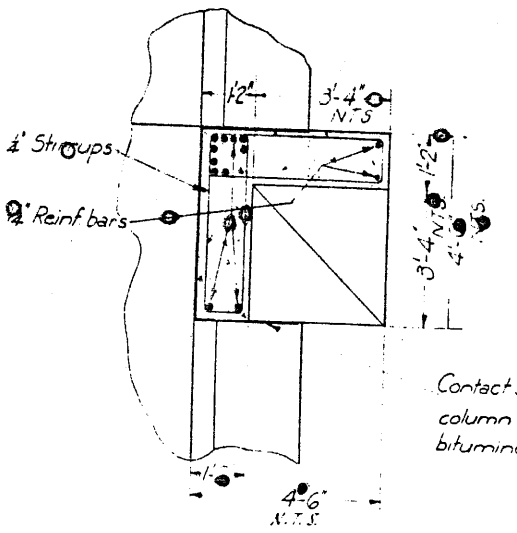
DRAWN R.J. Slater
TRACED A.D. Keith.
CHECKED

INCHES 12 6 0 1 2 3 4 5 FEET

PRINCIPAL DESIGNING ENGINEER 28.4.60

J.W. Potts 6-5-60
PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE.

12" ON ORIGINAL

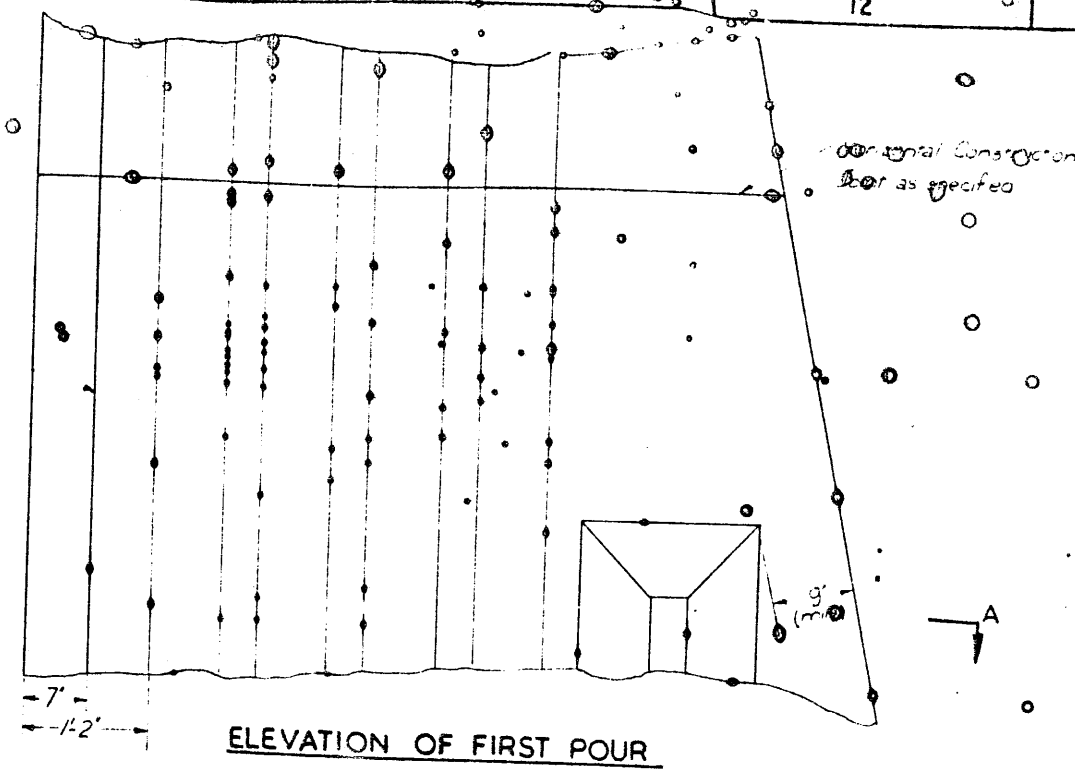


Contact surface between dam and column to be painted with bituminous paint

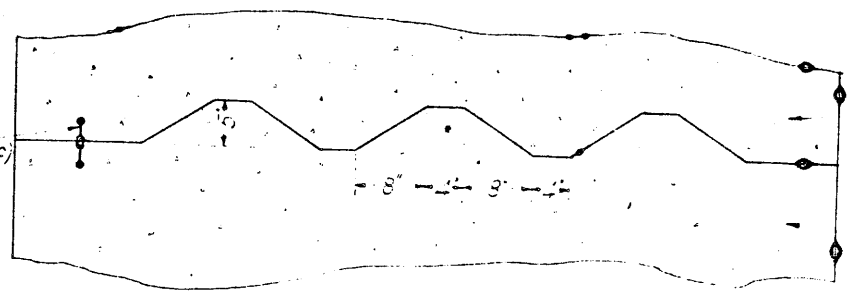
COLUMN SECTION E-E

Note. Concrete in Column & Footing to be class A 4000 Reinforcement to have 2 in cover.

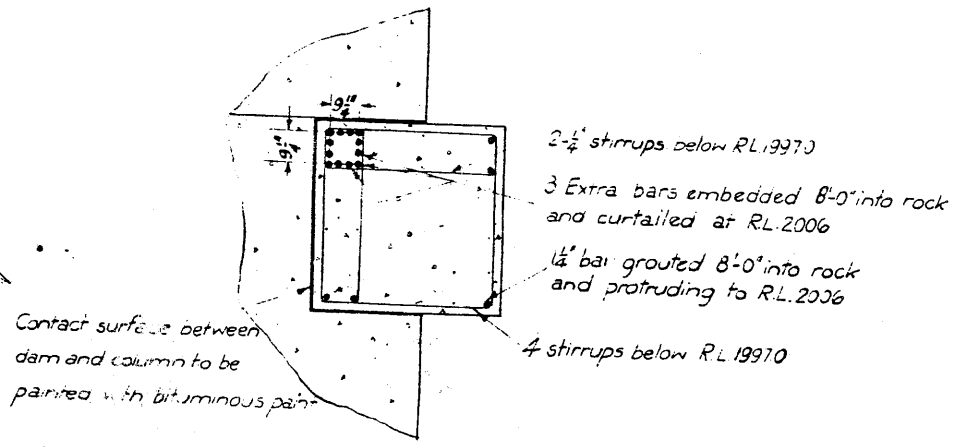
5½" P.V.C Vertical Water Stop



ELEVATION OF FIRST POUR

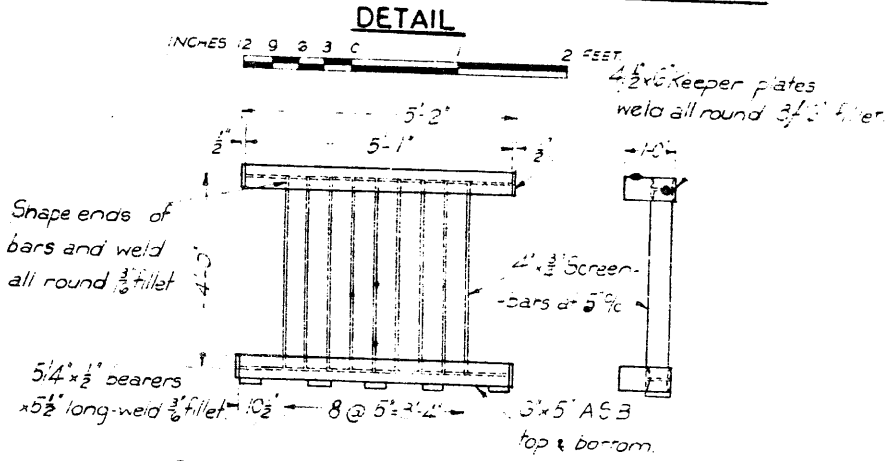


SECTION A-A



SECTION G-G

VERTICAL & HORIZONTAL CONSTRUCTION JOINTS DETAIL



GALV. M.S. TRASHRACK - 1 OFF

INCHES 12 6 0 1 2 3 4 5 FEET

0 1 2 3 4 5 FEET

rant box.
Surface box.

SPECIAL 'A'

Contractor to supply 1" dia jointing bolts and moulded rubber insertion for this joint

SPECIAL 'B'

DETAIL OF C.I. SPECIALS

INCHES 12 9 6 3 0 1 2 FEET

W. R. CARROLL
DIRECTOR OF PUBLIC WORKS
per

6-5-60

PLY & SEWERAGE.

5-93 58/59

DEPARTMENT OF PUBLIC WORKS N.S.W.

COONABARABRAN WATER SUPPLY AUGMENTN

TIMOR DAM

DETAILS

B 32058

SCALE - AS SHOWN

Screen - see detail

1½" G M S. Pipe

1" G M S. Pipe

Each stile to be attached to the adjacent handrail post by ⅜" dia bolt, 6" long, with ¾" dia pipe packing piece cut to fit.

Platform R.L. 2008

Float - see detail

3" x ⅜" M.S. Plate Bracket

Spillway Crest Level 2004

Ladder Braces - See Detail

Stiles 3" x ⅜" M.S. spaced 1'-8½" apart to the inside face

Position of footing to be determined on Site

R.L. 1980.92

R.L. 1980

Std. 10" Trunnion without glands, bolted to concrete base by 8 - ⅞" dia. bolts 8" long. Bolts set 6" into concrete

5'-0" into sound rock

Trunnion Stay Anchorages

Std. 10" C.I. hydrant tee with blank flange bolted to branch.

℄ of Trunnion

R.L. 1980.92

R.L. 1979.63

2 Std. 10" C.I. ⅛ bend

10" Std. C.I. Spigot Connection

Concrete block to support stop valve

12'-0"

These bolts can be removed through the concrete

Limit of Contract for pipes & valves

Trunnion

INTAKE

Inches 12 6 0 1 2

RUNG DETAIL

Inches 0 ½ 1 2 3 4 5 6

6'-10"

2 - ⅝" dia bolts 21" long with washers

3" x ⅜" Plate

1'-6"

4½" 9" 4½"

3" x 3" x ⅜" A S A

⅝" dia bolt, 2" long

LADDER BRACE

0 6 1 2 3 4 5 Feet

Note - All steelwork, with the exception of the float and trunnion pipe to be galvanized by the hot dipped process.

All concrete to be Class A 4000

Float & trunnion pipe to receive one coat rust inhibitive primer and two coats bituminous enamel, (cold application).

WORK AS EXECUTED

I hereby certify that the works have been carried out in accordance with these plans and the [illegible] as shown in red.

J. R. RIGBY
RESIDENT ENGINEER
PER:
15 FEB 1962

½" dia. bars as reinforcement around hinge bolt

3" x ⅜" M.S. welded to gate.

3" x ⅜" M.S. Flat 2'-6" long

⅝" dia. bolt 10" long, set 5" into concrete to act as hinge for gate.

3" x 2" timber bolted to M.S. Flat by 3 - ½" dia. bolts with heads set into the timber

GATE DETAIL

Approved commercial winch of 1 ton min. capacity with drum modified if necessary to receive 45 ft. of 5/16 galv. chain. Mount for pull to be normal to drum axis in raised position.

Handrail attached to concrete by 4 - ½" dia bolts, 5" long, set 4" into concrete.

⅝" dia. bolts, 5" long, set 3¾" into concrete.

Rungs omitted from this view.

Gate - see detail

⅝" dia. bolt, 2" long

Stiles welded to 3" x ⅜" PL. 1'-7½" long.

Ladder attached to concrete by 2 - ⅝" dia bolts 5" long, set 3¾" into concrete.

Details of Winch, modifications if any, and mounting to be submitted for approval by the Engineer.

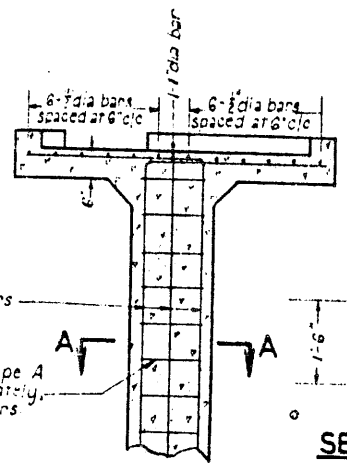
DRAWN E.J.K.
TRACED E.R.B.
CHECKED [illegible]

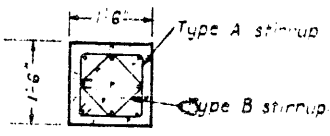
20.4.60
PRINCIPAL DESIGNING ENGINEER

6.5.60
PRINCIPAL ENGINEER WATER SUPPLY AND SEWERAGE

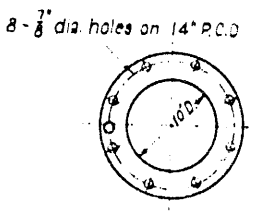
12" ON ORIGINAL

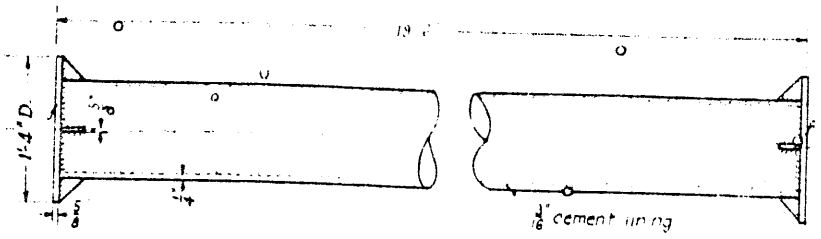
Minimum clear cover for reinforcement is 2" in columns, 1½" in platform.



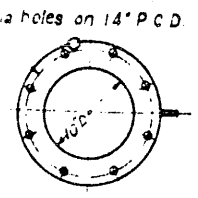


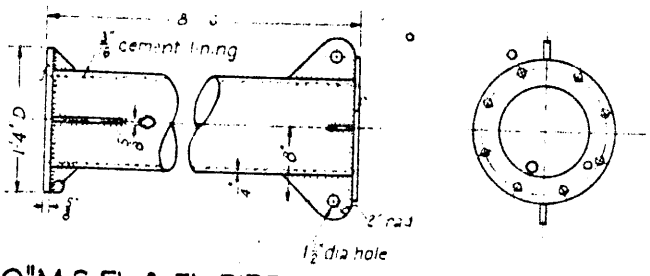
SECTION A-A



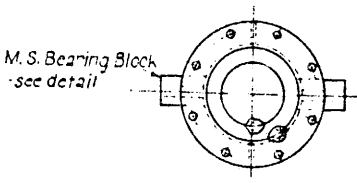


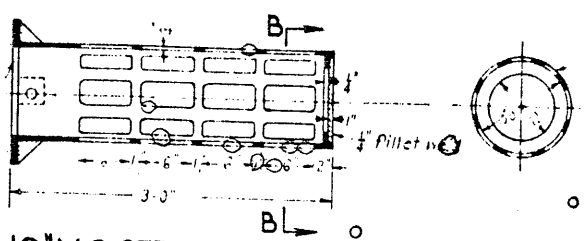
10" M.S. FL. & FL. PIPE





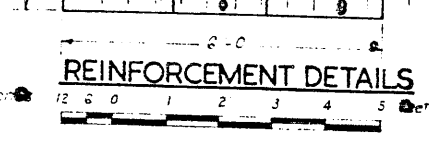
10" M.S. FL. & FL. PIPE



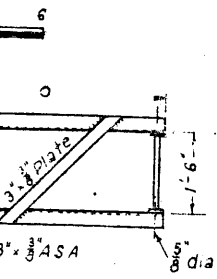


10" M.S. STRAINER PIPE

SECTION B-B

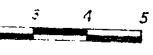


REINFORCEMENT DETAILS

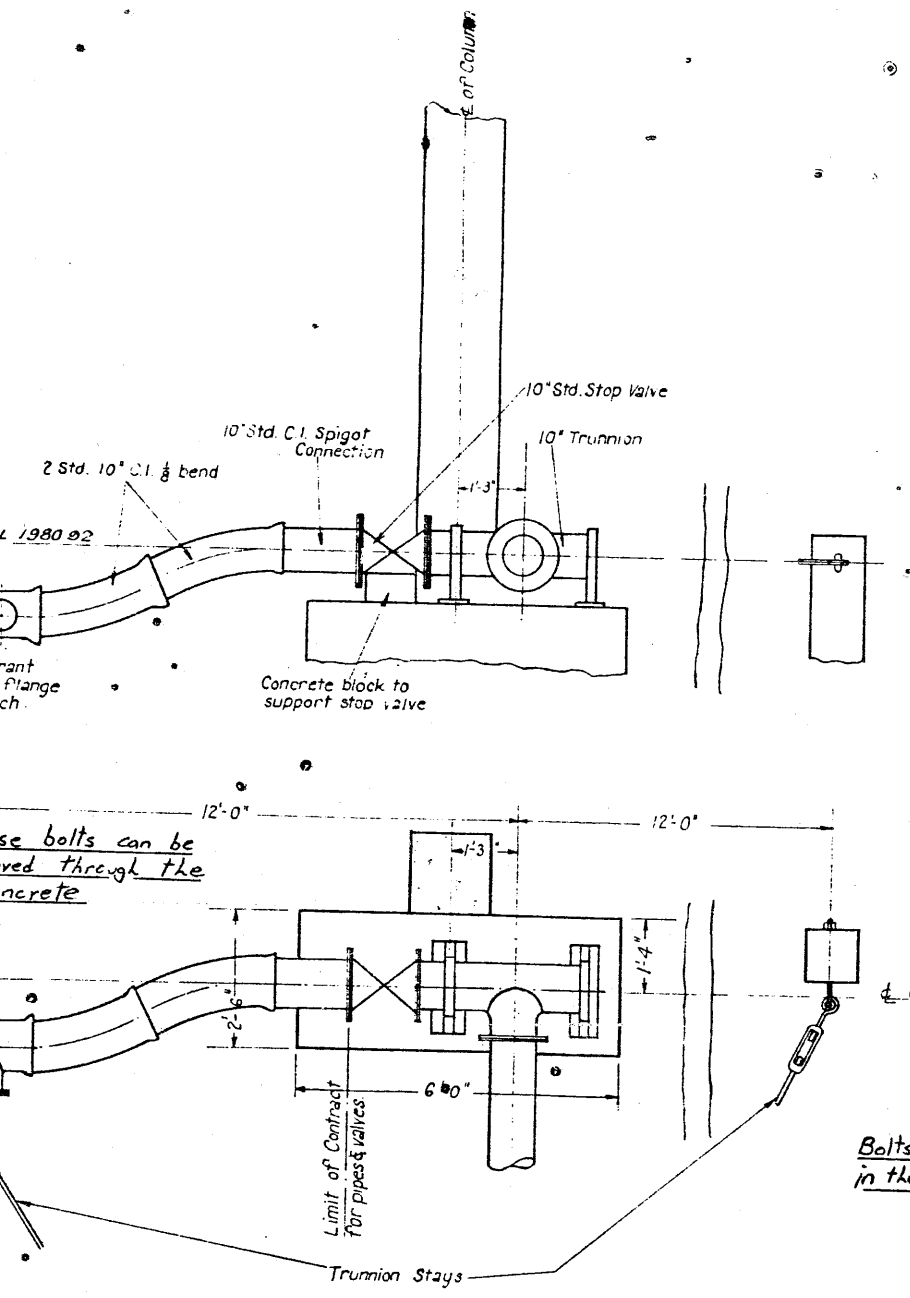


⅝" dia bolt, 2" long

BRACE



...ork, with the exception ... float and trunnion pipe ... ...ized by the hot dipped process.
...crete to be Class A4000
... trunnion pipe to receive ... rust inhibitive primer ... coats bituminous enamel, ...plication).

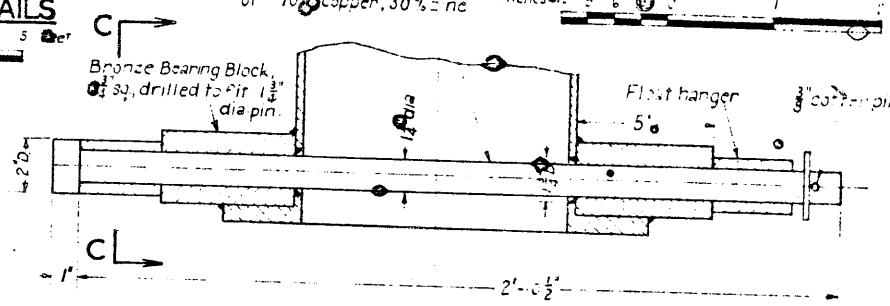


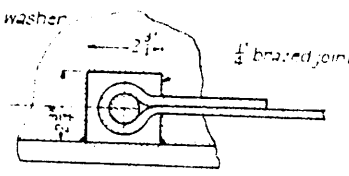
...se bolts can be ...ved through the ...ncrete

INTAKE DETAILS

Inches 12 6 0 1 2 3 4 5 Feet

Brass pin, brass to consist of 70% copper, 30% zinc

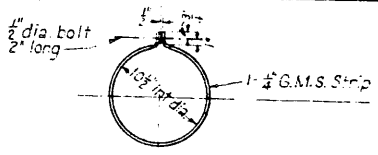


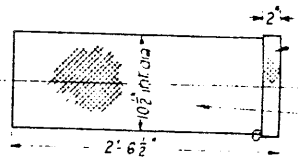


DETAIL OF STRAINER PIPE, PIN & BEARING BLOCKS

Inches 12 9 6 3 0 1 Feet

SECTION C-C

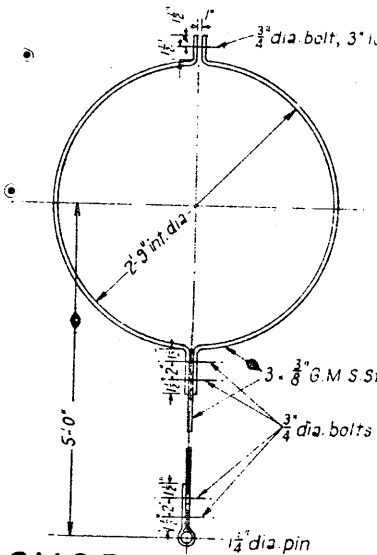




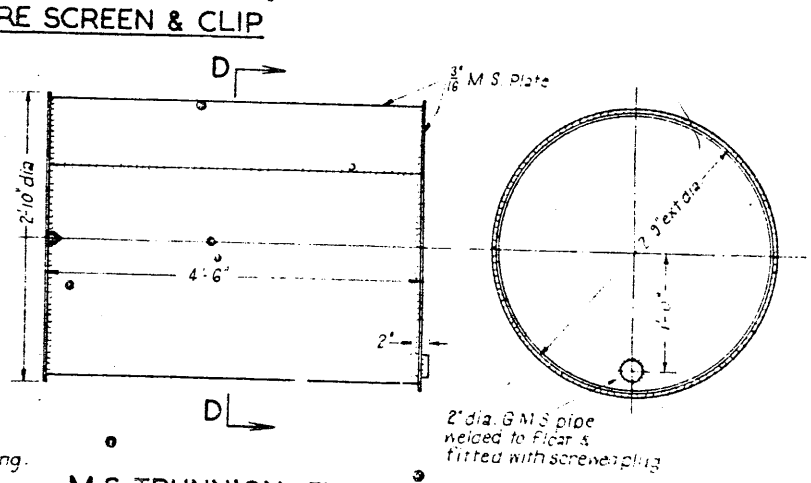
End to be soldered to side

Brass wire mesh, sides and ends, 20 gauge, 7 meshes per inch.

WIRE SCREEN & CLIP



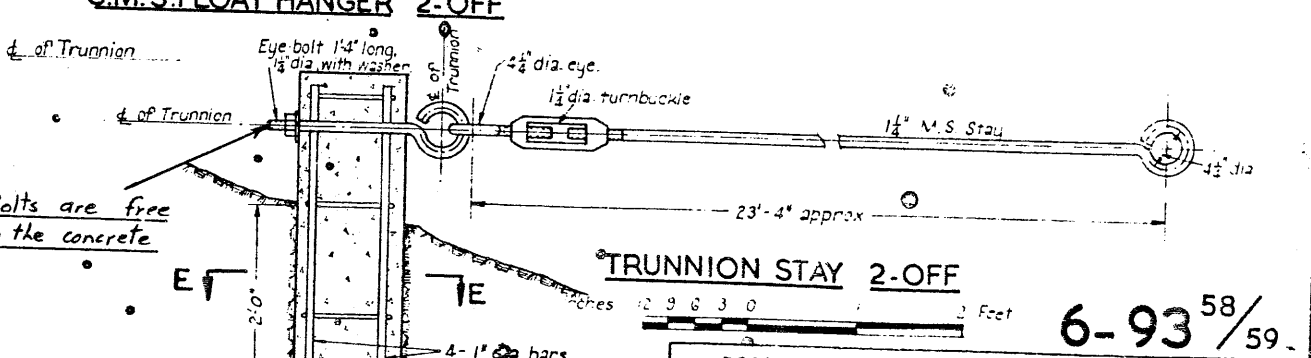
G.M.S. FLOAT HANGER 2-OFF



2" dia. G.M.S. pipe welded to Float & fitted with screwed plug

M.S. TRUNNION FLOAT

SECTION D-D



TRUNNION STAY 2-OFF

Inches 12 9 6 3 0 1 2 Feet

SECTION E-E

W. R. CARROLL
DIRECTOR OF PUBLIC WORKS
per

6-93 58/59

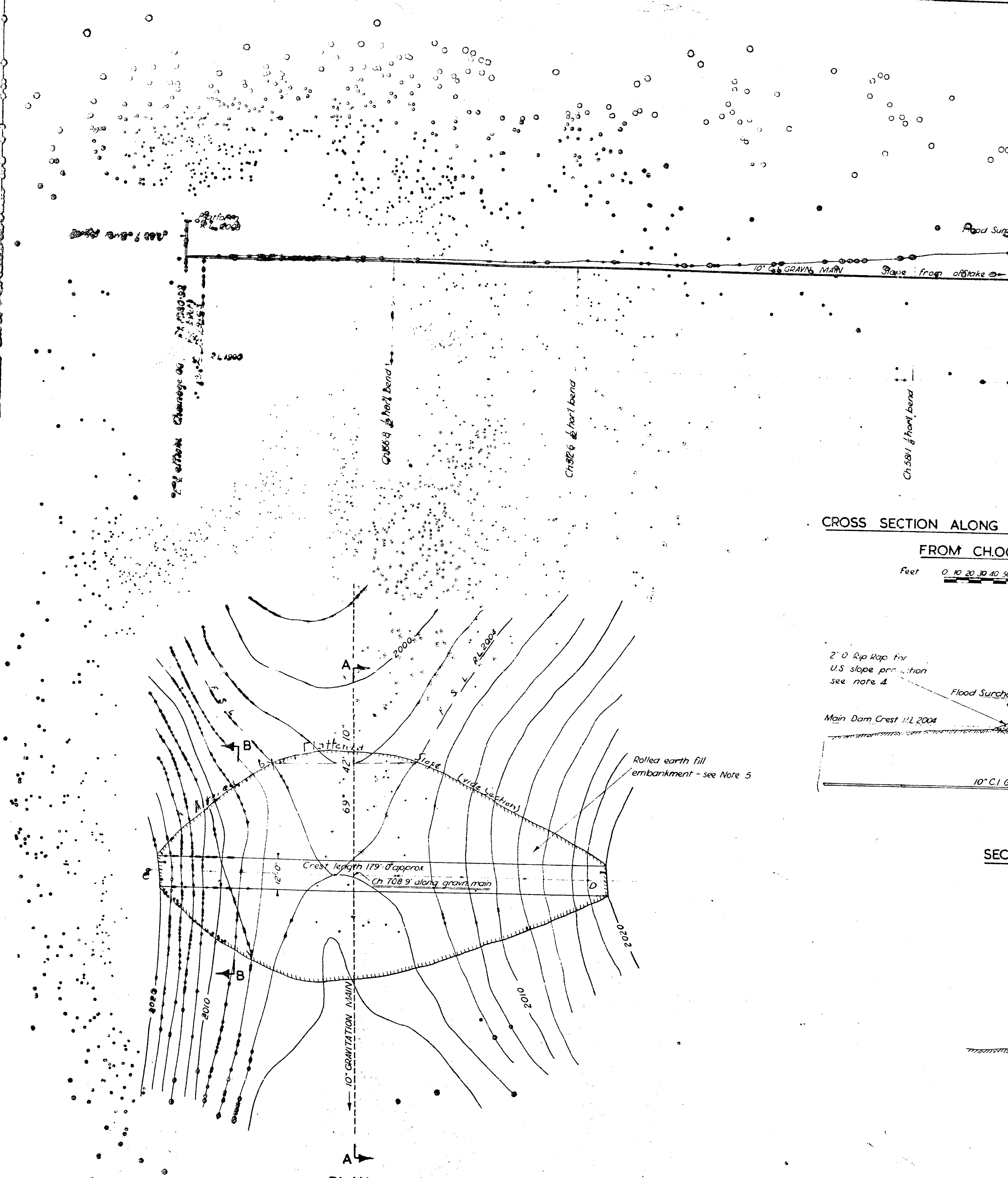
DEPARTMENT OF PUBLIC WORKS N.S.W.

COONABARABRAN W. S. AUGMENTATION

TIMOR DAM
OUTLET TOWER & INTAKE

B 32059 SCALE:- As shown

...Potter 6.12.60
...NEER WATER SUPPLY AND SEWERAGE



SADDLE DAM DETAILS

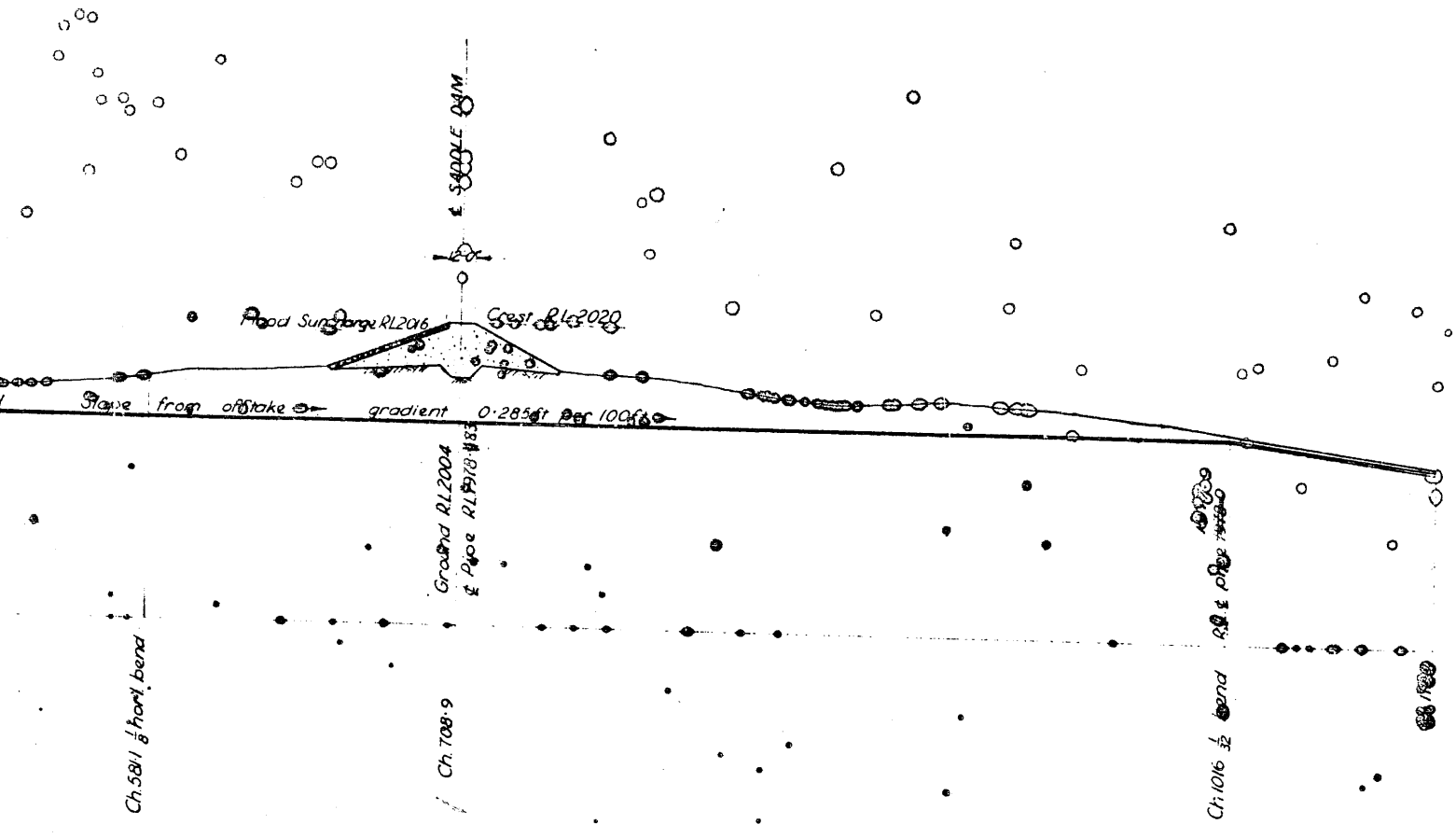
Feet 0 10 20 30 40 50

DRAWN M. Poole
TRACED N.M.
CHECKED 19.4.60

20.4.60
PRINCIPAL DESIGNING ENGINEER

6.5.60
PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE

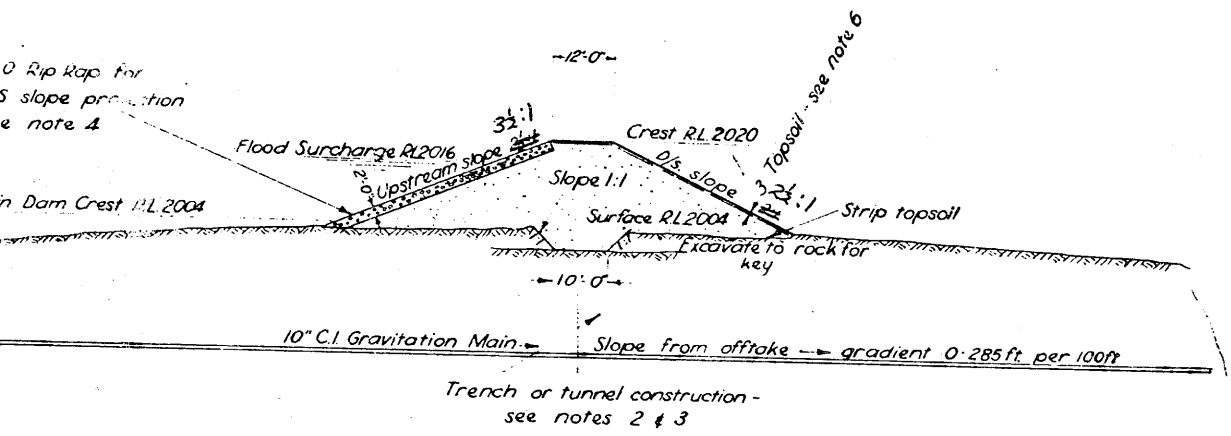
12" ON ORIGINAL



CROSS SECTION ALONG GRAVITATION MAIN

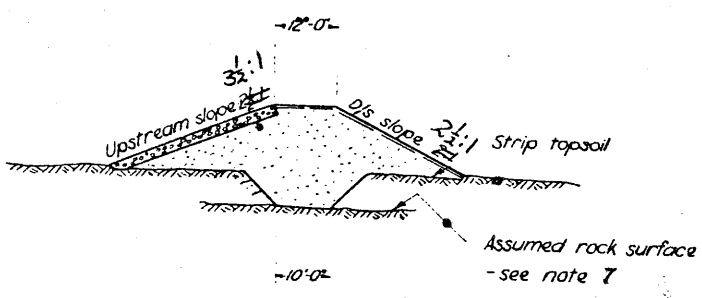
FROM CH.00 - CH. 1100

Feet 0 10 20 30 40 50 100



SECTION A-A ALONG GRAVITATION MAIN

Cut-off was taken to an impervious layer at a depth of 10 feet.



SECTION B - B

NOTES

1. For further details of gravitation main survey see Drawing No 8 - 93 58/59
2. Trench backfill under dam to be compacted to same degree as embankment fill (95% of Max Dry Density)
3. Tunnelling. In the event of tunnelling being carried out, backfilling shall be in accordance with Section B, schedule to Specification; in addition provide two concrete plugs beneath the embankment spaced 50 ft. apart. Each plug shall be at least 2'-0" long
4. 2'-0" Rip-rap. Bottom 9" thickness to be evenly graded rock with a maximum particle size of 6". Remainder of rip-rap layer shall contain rock fragments with no dimension larger than 2ft
5. Earth fill classification to be either GC or SC compacted at optimum moisture content to a density of at least 95% of the maximum dry density.
6. Downstream slope and crest of dam to be covered with 3" topsoil, fertilised and grassed
7. Assumed rock surface. Cut off to rock may be eliminated if solid rock is more than 6'-0" from natural surface and underlying strata are impervious.

WORK AS EXECUTED

I hereby certify that the works have been carrisd out in accordance with these plans and the amendments shown thereon in red.

J. R. RIGBY
RESIDENT ENGINEER
PER:

15 FEB 1962

W. R. CARROLL
DIRECTOR OF PUBLIC WORKS

7 - 93 58/59

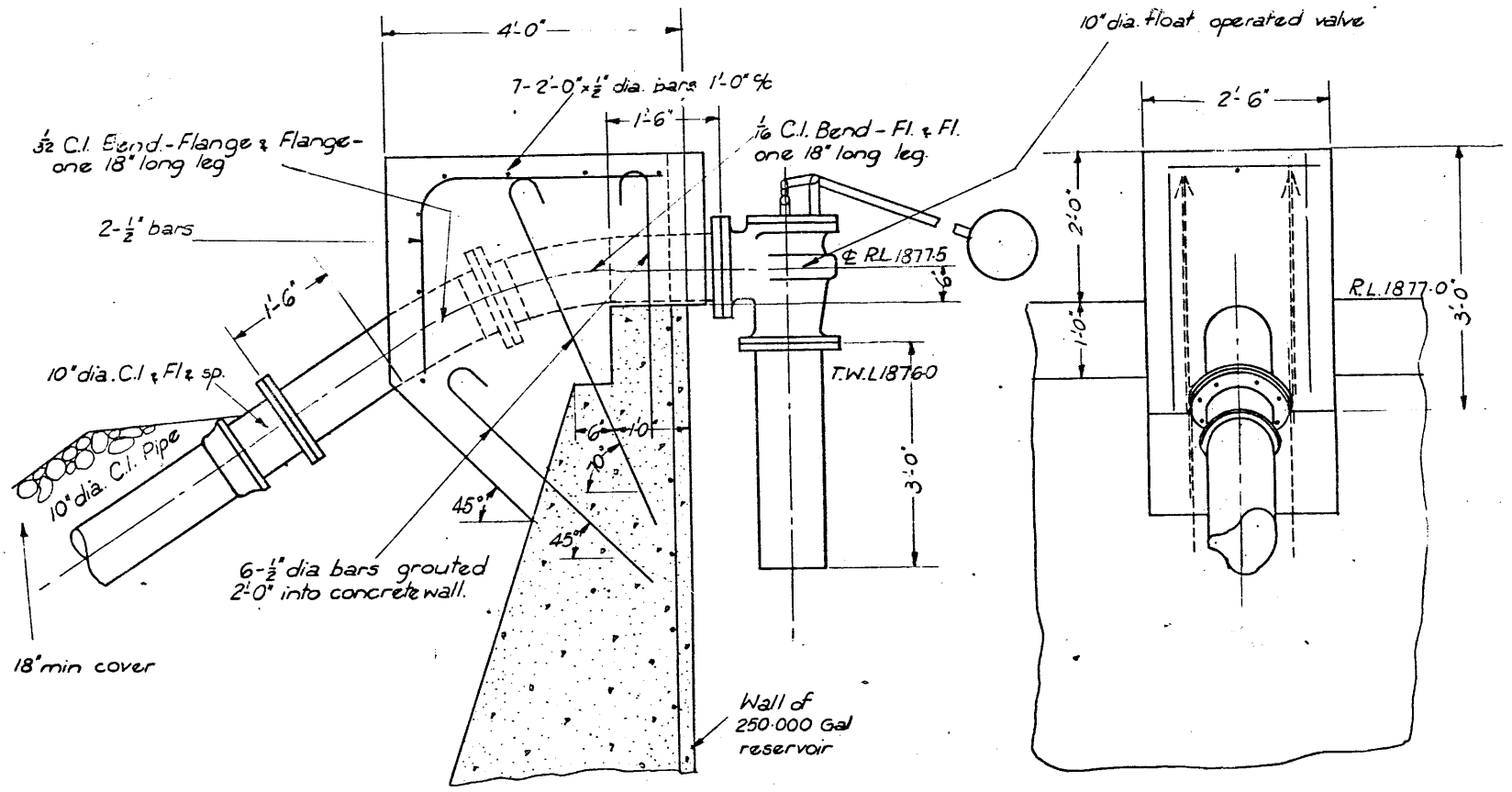
DEPARTMENT OF PUBLIC WORKS N.S.W.

COONABARABRAN WATER SUPPLY AUGMENTATION

TIMOR DAM

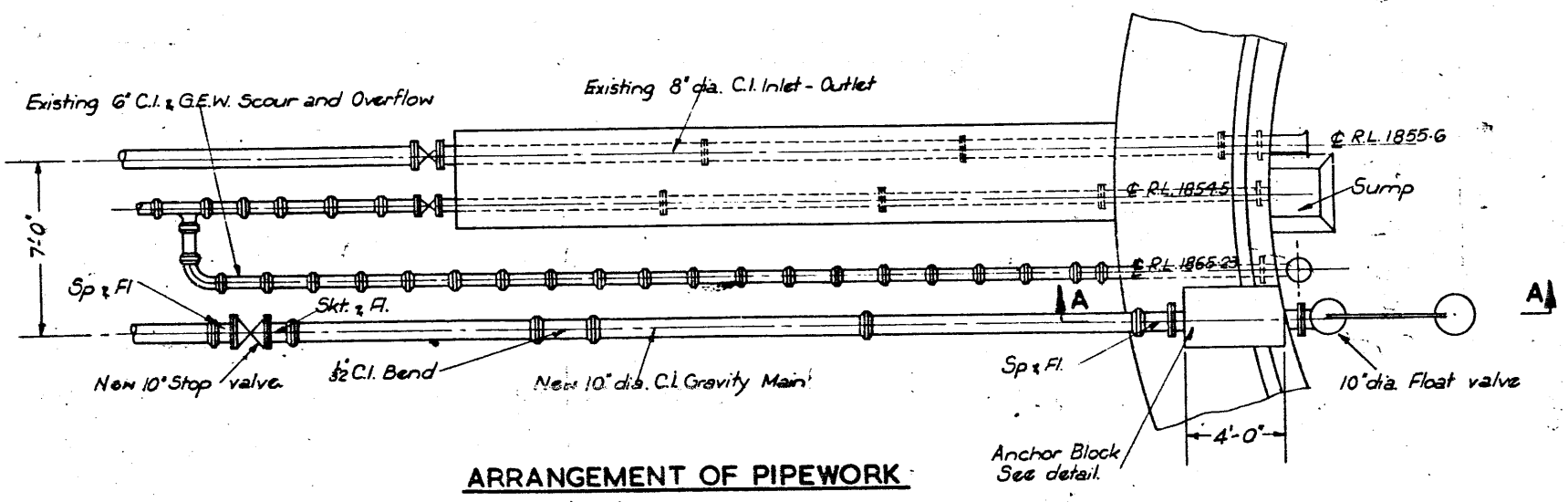
10 C.I. GRAVITATION MAIN CH.00-1100 & SADDLE DAM DETAILS

B 32060 SCALE:- as shown.



DETAIL OF ANCHOR BLOCK

Inches 12 6 0 1 2 3 Feet



ARRANGEMENT OF PIPEWORK

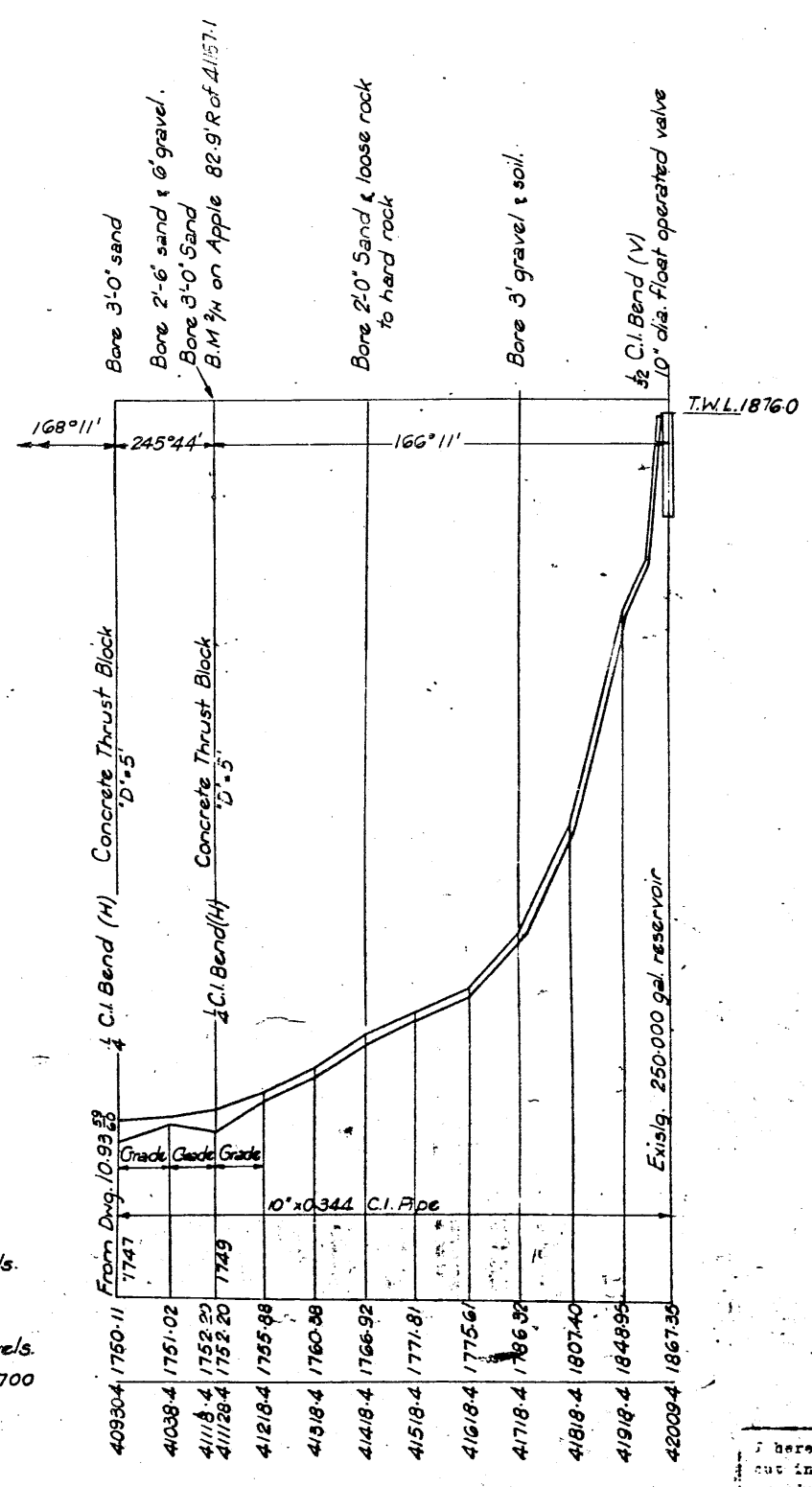
Feet 0 1 2 3 4 5 6 7 8 9 10

DRAWN N. Robins
TRACED R.B.
CHECKED 8·2·61.

PRINCIPAL DESIGNING ENGINEER
20/2/61

3·3·61
PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE

12" ON



HORIZONTAL SECTION

Hor. Feet 0 100 200 300 400 500

Vert. Feet 0 10 20 30 40 50

STANDARD DATUM.

Plotted from Mr. K.E. Harners F.Bk. No. 01464
L.Bk. No. 01907
Papers W.42/2958.

R.A. JOHNSON
DIRECTOR OF PUBLIC WORKS.
per: [signature] CHIEF ENGINEER.

I hereby certify that the works have been carried out in accordance with these plans and the amendments shown thereon in red.

John Whitehead Shire Engineer.

15/12/70 Date.

73564X 11-93 58/59

DEPARTMENT OF PUBLIC WORKS N.S.W.

COONABARRABRAN W.S. AUGMENTN
GRAVITATION MAIN
40930·4 To 42009·4
AND ANCHOR BLOCK AT RESERVOIR

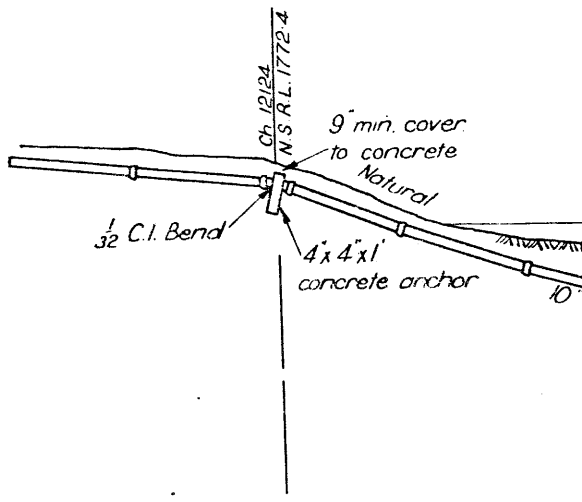
B SCALE:—AS SHOWN

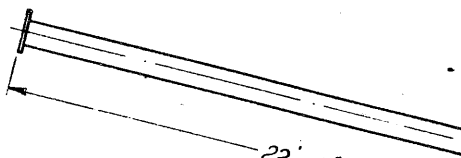
3'-0"

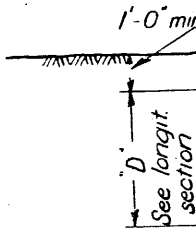
855·6

Float valve

ON ORIGINAL







TYP

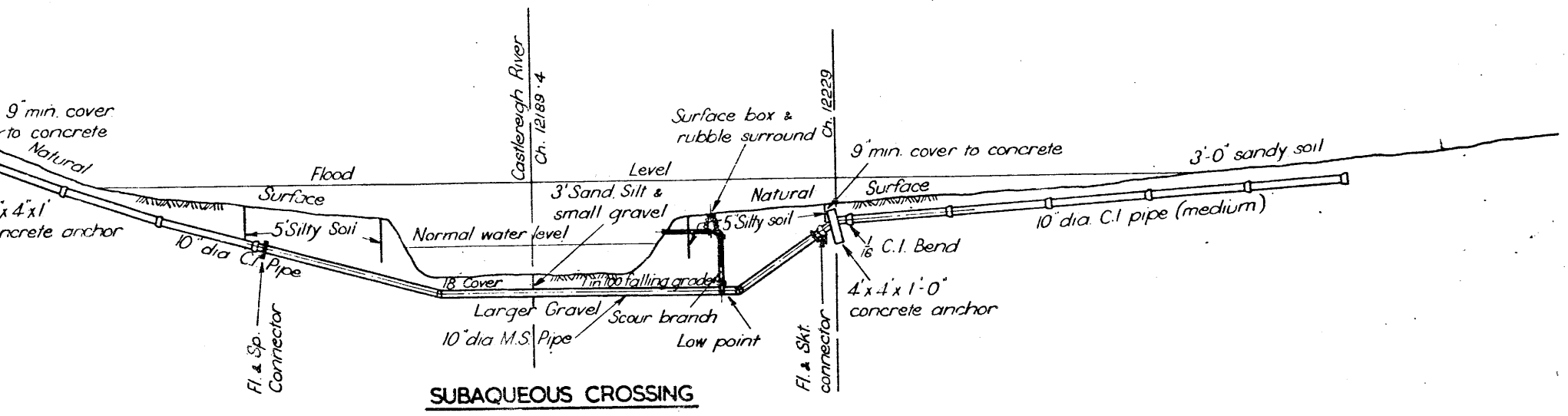
Inches 12 6

DRAWN N. Robins
TRACED J. E.
CHECKED MWH 8.2.61.

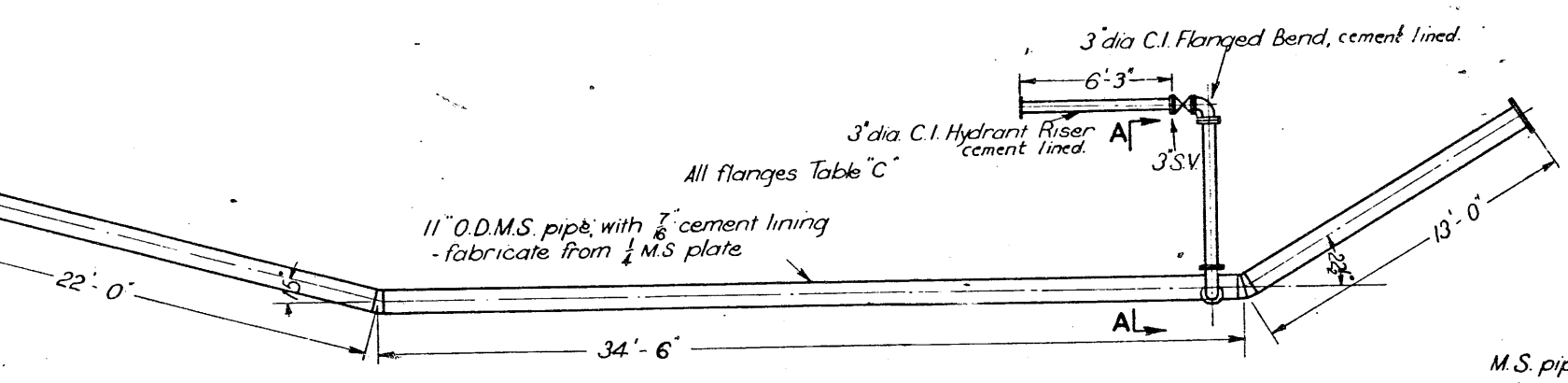
PRINCIPAL DESIGNING ENGINEER
20/2/61

PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE
3·3·61

12" ON

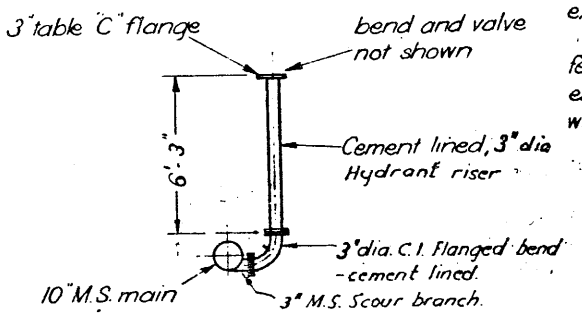


SUBAQUEOUS CROSSING



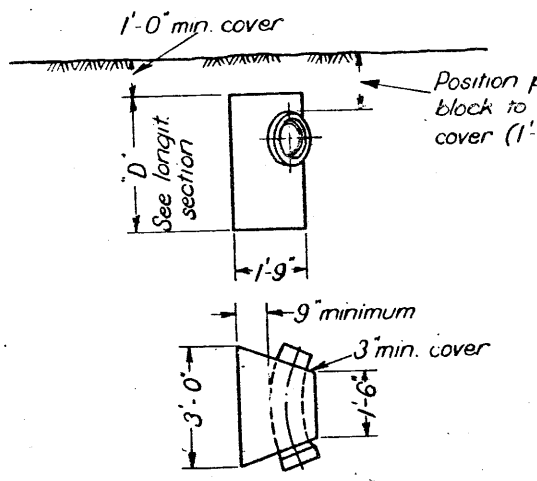
WELDED STEEL SECTION

Feet 0 1 2 3 4 5 6 7 8 9 10



SECTION A-A

M.S. pipe shall be cleaned and coated externally with one wrap of fibre glass mat followed by one wrap of asbestos-felt applied in conjunction with coal-tar enamel and white wash all in accordance with specification AWWA 203-57



TYPICAL THRUST BLOCK

Inches 12 6 0 1 2 3 4 5 6 7 Feet

Note :- Anchor block shown is for 1/8 bend. Blocks for other bends are to be similarly constructed. Dimensions "D" for all blocks are given at their respective chainages on plan nos. 8,9,10-33 58/59

I hereby certify that the works have been carried out in accordance with these plans and the amendments shown thereon in red.
John Whitehead Shire Engineer.
15/12/72 Date.

73565 X 12-93 58/59

DEPARTMENT OF PUBLIC WORKS N.S.W.

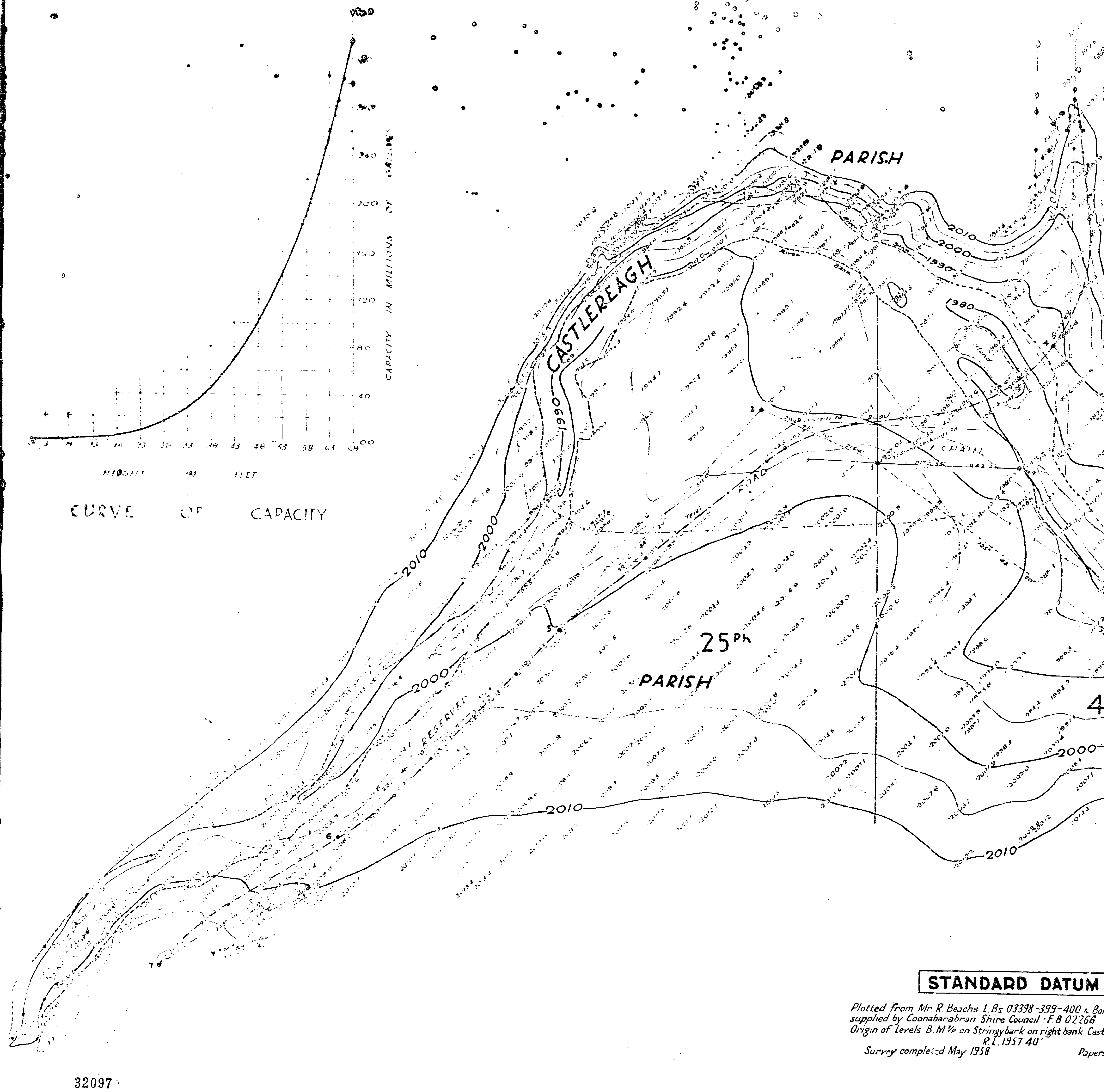
COONABARABRAN W.S. AUGMN.
GRAVITATION MAIN
CASTLEREAGH RIVER CROSSING & TYPICAL THRUST BLOCK

B SCALE:- As shown

R. A. JOHNSON
DIRECTOR OF PUBLIC WORKS
per Harold CHIEF ENGINEER

ON ORIGINAL

County of Gowen
Shire of Coonabarabran



STANDARD DATUM

Plotted from Mr. R. Beach's L.B's 03398-399-400 & Bo
supplied by Coonabarabran Shire Council - F.B. 02266
Origin of Levels B.M.1/P on Stringybark on right bank Cast
R.L. 1957·40'
Survey completed May 1958 *Papers*

32097

DRAWN ....
TRACED ....
CHECKED ....

F. L. Mathews
PRINCIPAL SURVEYOR 30.10.58

20.4.60
PRINCIPAL DESIGNING ENGINEER

12" ON ORIGINAL

PARISH

OF

39 Ph

TIMOR

INSET

RIVER

45 Ph

OF

GUNDI

TABLE OF CAPACITY

Contour R.L.	Depth (Ft)	Acre Feet	Capacity (Gallons)
1942	0	0	0
1945	3	0 042	8,700
1950	8	0 937	254,500
1955	13	4 236	1,149,000
1960	19	11 647	3,216,000
1965	23	28 044	7,613,000
1970	28	57 391	15,580,000
1975	33	101 190	27,470,000
1980	38	163 429	44,360,000
1985	43	251 457	68,253,000
1990	48	369 319	100,259,000
1995	53	521 398	141,544,000
2000	58	713 116	193,606,000
2005	63	950 573	258,052,000
2010	68	1234 771	335,187,000

STANDARD DATUM

Plotted from Mr. R. Beachs L.Bs 03398-399-400 & Boring information supplied by Coonabarabran Shire Council - F.B. 02266
Origin of Levels B.M.½ on Stringybark on right bank Castlereagh River R.L. 1957·40'
Survey completed May 1958 Papers W. S. 1083/4

F.W. Potter 6.56
PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE

W. R. CARRO
DIRECTOR OF PUBLI

F2

Appendix D – Inspection Photographs (6th November, 2015)

Photo 1: General view of the dam from left hand side

Photo 2: Downstream face

Photo 3: Downstream face

Photo 4: Downstream face

Photo 5: Dam crest (and unsubmerged portion of upstream face)

Photo 6: Right abutment

Photo 7: Left abutment

Photo 8: Left abutment

Photo 9: Scour Outlet

Photo 10: Scour Outlet (photo taken by council staff in June 2014)

Photo 11: Saddle Dam from left hand side

Photo 12: Saddle Dam downstream face

Photo 13: Saddle dam upstream face

Photo 14: Saddle dam right abutment upstream side

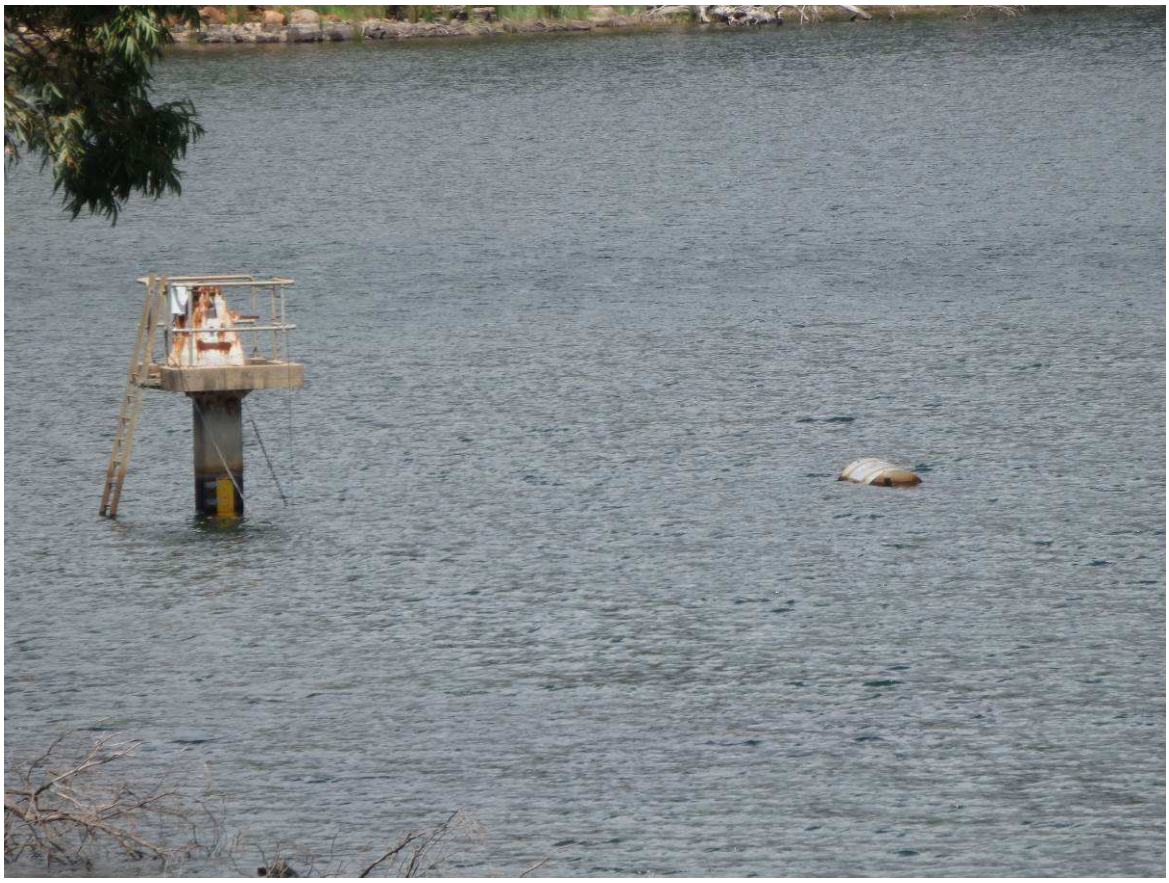


Photo 15: Trunnion for water supply outlet

Photo 16: Storage mixer

Photo 17: Dead storage line (pump removed for repairs)

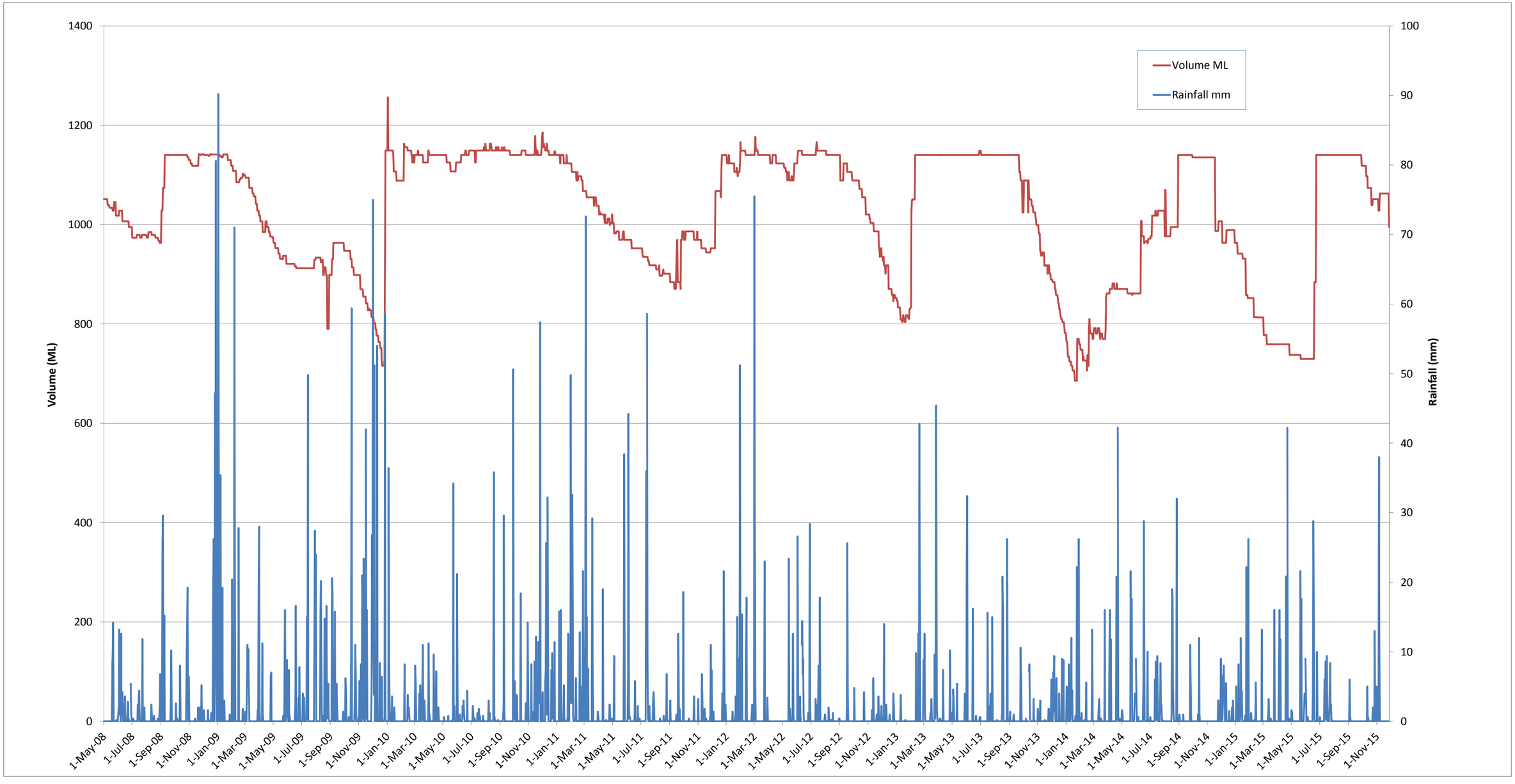
Photo 18: Seepage weir (photo taken by Council staff in June 2014)

Photo 19: Seepage weir wall with under-seepage (photo taken by Council staff in June 2014)

Photo 20: Reservoir storage looking from saddle dam

Photo 21: Reservoir storage looking from left hand side of main dam

Appendix E – Dam Monitoring Data


Volume ML
Rainfall mm
Volume (ML)
Rainfall (mm)
1400
1200
1000
800
600
400
200
0
100
90
80
70
60
50
40
30
20
10
0
1-May-08
1-Jul-08
1-Sep-08
1-Nov-08
1-Jan-09
1-Mar-09
1-May-09
1-Jul-09
1-Sep-09
1-Nov-09
1-Jan-10
1-Mar-10
1-May-10
1-Jul-10
1-Sep-10
1-Nov-10
1-Jan-11
1-Mar-11
1-May-11
1-Jul-11
1-Sep-11
1-Nov-11
1-Jan-12
1-Mar-12
1-May-12
1-Jul-12
1-Sep-12
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1-May-13
1-Jul-13
1-Sep-13
1-Nov-13
1-Jan-14
1-Mar-14
1-May-14
1-Jul-14
1-Sep-14
1-Nov-14
1-Jan-15
1-Mar-15
1-May-15
1-Jul-15
1-Sep-15
1-Nov-15

Appendix F – DSC D12 Status of Safety Management System Reporting Form

New South Wales Government

Dams Safety Committee

D12 Form

Status of Safety Management System Reporting Form

1. Purpose

To inform the DSC of the status of the dam *safety management system* in place for the named dam at the date of reporting in terms of the *normal* DSC requirements. Include the completed form in the *surveillance report* for the dam.

For Type III surveillance reports only the underlined items require completion.

2. Dam

Name: Timor Dam .....

Flood Consequence Category: High C .....

Sunny Day Consequence Category: Significant .....

3. Status of the Safety Management System [see Section 5 of DSC2A]

Key program elements	Meets the *normal* requirements of DSC2A?	Details of departures from *normal* SMS[1]
Inspections (levels, frequency, trained staff, checklists, sign-off, retention)	☐ Yes ☑ No	No routine inspection sheet, checklists, sign-off or retention
Monitoring (ANCOLD 2003-Table 5.3)	☐ Yes ☑ No	Seepage and rainfall not monitored
Instrumentation	☐ Yes ☑ No	Seepage weir needs to be repaired or replaced
Surveillance evaluation	☐ Yes ☑ No	Inspection and monitoring records not captured and therefore not reviewed
Security	☑ Yes ☐ No	
Quality assurance	☑ Yes ☐ No	
Data file	☑ Yes ☐ No	

Key program elements	Meets the *normal* requirements of DSC2A?	Details of departures from *normal* SMS[1]
O&M manual	❒ Yes ☑ No	Needs Updating
DSEP	☑ Yes ❒ No	
Documentation	❒ Yes ☑ No	No design report or construction report exist
Education and training	☑ Yes ❒ No	

(Note 1: Attach list if space is insufficient)

4. Deviations Agreed by DSC

List deviations from the *normal* DSC requirements which have been agreed with the DSC (cite DSC advice date - attach list if space is insufficient)

5. Application for Deviations

If a deviation from the *normal* DSC requirements is sought in respect of any item, a submission setting out the reasons which are thought to justify the deviation is required. The DSC will either seek additional information or advise its decision as soon as reasonably practicable.

6. Improvement of Safety Management System

List the activities and completion dates for achieving the *normal* DSC requirements or with other requirements agreed with the DSC. (Attach list if space is insufficient)

7. Submitted for the Owner

Signed: _____

Name: David Guest

Position: Dams Engineer, NSWPW

Date: 10/02/2016

Appendix G – DSC D15 Requirements for Surveillance Reports Checklist

New South Wales Government

Dams Safety Committee

D15 Form

Requirements for Surveillance Reports

Checklist for owners and consultants preparing Type 1 & Type 2 Surveillance Reports

The following checklist covers the minimum items to be included in Type 1 and 2 Surveillance Reports submitted to the NSW Dams Safety Committee (DSC). Type 3 Surveillance Reports are prepared using the DSC D5 form. Please tick against each item to indicate completion of the item in the Report, and enclose the signed D15 Form with the copy of the Report submitted to the DSC. Please note that Reports which do not address all relevant items may not be accepted.

- ☑ Owner to provide cover letter containing program to carry out recommendations and a completed "Dam Owners Address Form" (D8 form).
- ☑ Conclusions (in point form), including the necessity or otherwise for a *safety review.*
- ☐ Recommendations (in point form), separate from the Conclusions.
- ☑ Dam details – location, type of dam, height, crest length, storage volume, etc.
- ☐ Assessment of Sunny Day Consequence Category & Flood Consequence Category in accordance with DSC3A. Include the Population At Risk (PAR) and Potential Loss of Life (PLL) values for the Sunny Day, Total Flood and Incremental Flood dam failure cases.
- ☑ Appurtenant works, e.g. outlet works – details of type, nature, number, size.
- ☐ Spillway type and Hydrologic data – dated and in accordance with DSC3B.
- ☐ Description of site geology, highlighting any problems.
- ☑ Monitoring – type of instrumentation and frequency of monitoring.
- ☑ Comment on compliance with storage level monitoring requirements in DSC2F/2G.
- ☐ Comparison to the previous Surveillance Report, action taken as a result of the previous Report's recommendations and recommendations not carried out.
- ☐ Details of inspection – names of inspection team and qualifications/experience, date, weather conditions, storage level.
- ☑ Condition of dam - evidence of slips, erosion, cracks, sink holes, piping, subsidence, seepage, settlement, movement, misalignment, etc. & history (old, recent or continuing).
- ☑ Abutments & foundations – seepages related to the storage, slips, erosion, piping, etc. & history.
- ☐ Spillways – stability, erosion, blockages, movement, etc. & history.

- ☑ Reservoir basin & downstream areas.
- ☑ Condition & operability of inlet & outlet works, spillway gates and other mechanical & electrical equipment.
- ☑ Comment on compliance/frequency of inspection and monitoring procedures with the ANCOLD "Guidelines on Dam Safety Management, August 2003".
- ☑ Comment on the instrumentation data over the period since the previous Surveillance Report – seepage rates, pore pressures, deformation surveys, rainfall, storage level, etc.
- ☑ Comment on status of O & M Manual and Dam Safety Emergency Plan (DSEP).
- ☑ Provide information on mining activities close to the dam or storage.
- ☑ Findings of any reports produced since the previous Surveillance Report.
- ☑ Incidents which have occurred since the previous Surveillance Report and actions taken.
- ☑ Changes including operating procedures, developments, management, operating staff.
- ☑ The effect on dam safety of any modifications to the dam undertaken since the last Surveillance Report.
- ☑ Review the likelihood of dam failure in the light of current criteria e.g. flood capacity, structural stability, earthquake capacity, seepage, piping, etc.
- ☑ Statement on security measures.
- ☑ Signatures of Report writers.
- ☑ Dam data sheet.
- ☑ Drawings, e.g. Site, General Arrangement, Cross-Section, Spillway, Outlet Works, etc.
- ☑ Photographs of main aspects of dam taken during the inspection, particularly areas commented on in the Surveillance Report.
- ☑ Monitoring data summary sheets.
- ☑ Completed D15 form.
- ☑ Completed D12 form.
- ❑ An IBM compatible CD, or equivalent, containing a Microsoft Word format file of the text and a PDF of the entire report including drawings and photos.

Checklist completed by: David Guest (NSWPW) .....

Level 13E McKell Building
2-24 Rawson Place
Sydney NSW 2000

www.publicworks.nsw.gov.au