Contact: Lindy Hoang
Phone: 02 8245 2026

Our Ref: DOC13/20908

Roger Bailey
General Manager
Lithgow City Council
PO BOX 19, Lithgow NSW 2790

11 July 2013

Attention: Karen Luka

Dear Roger Bailey

RE: PROPOSED LEP LISTING OF 63-67 PIPERS FLAT ROAD WALLERAWANG NSW 2845 AS LOCAL HERITAGE ITEM

In response to your letter dated 28 June 2013, regarding the LEP listing on local heritage item 63-67 Pipers Flat Road. State Water would like to confirm it has undertaken a heritage assessment of the Fish River Water Supply Scheme in 2010 which identified 63-67 Pipers Flat Road as local significance status. Subsequently, State Water has developed an s170 heritage register for all our assets which was endorsed by the Heritage Council in August 2011.

State Water would like to provide the *Heritage assessment: Fish River Water Supply Scheme* (as per attachment). The *Heritage assessment: Fish River Water Supply Scheme* and any information and data contained in the document provided is for convenience only and is not guaranteed for accuracy, completeness or otherwise.

To the extent permitted by law, State Water Corporation has no liability whatsoever arising out of or in connection with any:

1. Reliance on;
2. Interpretations, deductions, inferences drawn or conclusions made in relation to; or
3. Errors, omissions, representations or misrepresentations contained in, this *Heritage assessment: Fish River Water Supply Scheme* or any information or data contained in this document.

The *Heritage assessment: Fish River Water Supply Scheme* and any information and data contained in this *Heritage assessment: Fish River Water Supply Scheme* may not provide to a third party without the prior written consent of State Water Corporation and may not be relied on by any third party.

Please don't hesitate to contact our Environmental Engineer Lindy Hoang 8245 2026 if you require any further information.

Yours sincerely

Amit Chanan
Executive Manager Operations
Attachment - Heritage Assessment: Fish River Water Supply Scheme
cc. Glenn Baker & Adrian Langdon

Executive Summary

OzArk EHM was engaged to assess State Water Corporation (State Water) assets relating to the Fish River Water Supply scheme (FRWS) to identify asset items that should be included on State Water's Section 170 register. The project consisted of a visual inspection and recording of assets, background research and an evaluation of individual items' heritage significance.

The assessment identified a total of four heritage complexes (sites that include two or more items with heritage significance). These are the FRWS as a whole, the Oberon Dam complex, the Wallerawang Depot complex, and the Glen Davis Reservoir complex. Within these four complexes, eight individual items were assessed as having heritage significance. Beyond those items included within the heritage complexes listed above, four further items, associated with the FRWS but isolated from the other complexes, were identified as holding heritage significance (making a total of twelve individual items). Of these, only the FRWS scheme as a whole and Oberon Dam itself were assessed as holding heritage significance at a State level.

Table 1 outlines the heritage significance of each complex or item.

Table 1: Summary of significance evaluations.

Serial	Item	Location	Grade of Significance	Level of Significance	Applicable Criteria
Complexes					
1	**FRWS Complex**	**Oberon, Hampton, Rydal, Wallerawang, Portland, Cullen Bullen, Baal Bone, Glen Davis, Leura, Lithgow**	**High**	**State**	**a, c, d, e, f, g**
2	**Oberon Dam Complex**	**Oberon Dam**	**High**	**State**	**a, c, d, e, f, g**
	Oberon Dam	Oberon Dam	High	State	a, c, d, e, f, g
	Pre-fabricated semi-cylindrical hut / workshop at Oberon Dam	Oberon Dam	High	Local	a, f, g
	Bailey valve hut	Oberon Dam	Moderate	Local	a
	Disused chlorinator hut	Oberon Dam	Moderate	Local	a
3	**Wallerawang Depot Complex**	**Wallerawang Depot, 63 Portland Rd, Wallerawang**	**High**	**Local**	**a, c, f, g**
	Inspector's House	Wallerawang Depot, 63 Portland Rd, Wallerawang	High	Local	a, c, g
	Pre-fabricated semi-cylindrical hut / workshop at Wallerawang Depot	Wallerawang Depot, 63 Portland Rd, Wallerawang	Moderate	Local	a, f, g
4	**Glen Davis Reservoir Complex**	**Glen Davis**	**Moderate**	**Local**	**a, d**
	Glen Davis Reservoir Tank	Glen Davis	Moderate	Local	a, d
	Glen Davis pup tank	Glen Davis	Little	Local	a, d
Individual Items					
5	Break pressure tank	Duckmaloi Water Treatment Plant	Moderate	Local	a
6	Hampton Tunnel inlet	Hampton	Moderate	Local	a, d
7	Duckmaloi Weir	Duckmaloi River	Moderate	Local	a, c, e, g

Serial	Item	Location	Grade of Significance	Level of Significance	Applicable Criteria
8	Wallerawang Pumping Station	Portland Rd, Wallerawang	High	Local	a, f

In general, the FRWS has undergone constant upgrading and replacement of assets throughout its use as a water supply infrastructure. Further, the FRWS was constructed over three distinct phases: Stages One, Two and Three. As a result, the assets of the FRWS are a composite of original elements and more recent additions. The original fabric of assets associated with Stage One and Stage Two are protected by heritage legislation as they are older than 50 years. Stage Three was constructed more recently (1964) and assets associated with this portion of the FRWS are therefore less than 50 years old and do not hold heritage significance under the Heritage Council of NSW guidelines.

The purpose of this report was to assess the heritage significance of assets related to the FRWS, not to provide detailed management options on how these assets should be maintained or conserved.

In general, however, the authors hold that the following principals should be applied when considering management options for those items holding heritage significance. These include:

- Management options can not preclude the maintenance of the water supply scheme as it provides an essential service.
- Assets assessed as holding **State Heritage Significance** (Oberon Dam complex and the FRWS as a whole) should be managed so that the essential heritage features of these assets are maintained. Thus:
  - If sections of Stage One or Stage Two pipelines need to be replaced, the existing steel/concrete pipe should be left in place where possible; and
  - If assets identified in this report as holding heritage significance need to be replaced or substantially altered, the present structures should be the focus of a detailed assessment and recorded to archive quality: if it is not possible to leave them in place.
- Assets holding **Local Heritage Significance** should be maintained *in situ* if possible. If this is not possible then a detailed assessment and recording to an archival quality should be undertaken prior to the structure's demolition.

Contents

Executive Summary 2
1.0 Introduction 5
1.1 Key Issues 5
1.2 Appreciation of the Brief 5
1.3 Statutory controls 5
1.4 The Study Area 6
1.5 Acknowledgements 6
1.6 Authorship 6
2.0 Contextual History 9
2.1 Introduction 9
2.2 History of the Fish River Water Supply Scheme 9
2.3 Construction methods 12
2.3 Present use of the Fish River water Supply Scheme 13
3.0 Results of the Heritage assessment 15
3.1 Items holding heritage significance 15
3.2 Items without heritage significance 27
3.3 Condition 28
3.4 Integrity of fabric 29
3.5 Possible threats 31
4.0 Assessment of Significance 32
4.1 Introduction to the Significance Assessment process 32
4.2 Basis of Assessment 32
4.3 Historical themes 33
4.4 Summary of evaluation of Significance 36
4.5 Discussion 37
4.6 Management options 41
4.7 Relevant Legislation 41
5.0 Conclusion and Recommendations 43
5.1 Introduction 43
5.2 Recommendations 43
7.0 References 45
Plates 46

1.0 Introduction

1.1 Key Issues

The Fish River Water Supply (FRWS) is a working scheme that requires continual upgrades, maintenance and emergency works. These asset management concerns are to be considered whilst identifying ongoing heritage management policies. The objective of any policies relating to the heritage values of the FRWS must be to ensure practical and efficient conservation of heritage assets whilst recognising and operating within the framework of the working nature of this infrastructure network.

1.2 Appreciation of the Brief

OzArk EHM was engaged to conduct heritage significance assessments of State Water Corporation (State Water) assets relating to the FRWS and its major components in accordance with the Heritage Council of NSW guidelines. This assessment will then allow the FRWS to be included in State Water's s170 Register. The information will also be used to identify ongoing management requirements for these assets.

The investigation included the following aspects:

- A search of all relevant registers of information for non-Indigenous heritage: Local Environmental Plans (LEPs) and Heritage Council of NSW Register;
- A review of current legislation including Environmental Protection and Biodiversity Conservation Act 1999, Australian Heritage Council Act 2003, NSW Heritage Act 1977, Environmental Planning and Assessment Act 1979 and National Parks and Wildlife Act 1974;
- A review of available relevant literature including previous consulting reports, academic articles and available works on the history of the Fish River Water Supply;
- Consultation with relevant State Government Departments as required;
- Pedestrian field survey to identify and record all cultural heritage sites and relics within the confines of the Study Area;
- Assessments of significance of recorded sites in accordance with Section 170 of the *NSW Heritage Act*;
- Completion of documentary evidence (e.g. s170 Inventories) for any sites/relics located during the survey for the notification of the relevant authorities; and
- Completion of detailed report discussing the results of the present survey and recommending management policies to ensure that assets are managed with due regard to significance.

1.3 Statutory controls

The principle statutory controls governing the management and disposal of non-Indigenous heritage assets in NSW are:

- Environmental Protection and Biodiversity Conservation Act 1999;

- Australian Heritage Council Act 2003;
- NSW Heritage Act 1977;
- Environmental Planning and Assessment Act 1979; and
- National Parks and Wildlife Act 1974.

A full description of the requirements of these Acts is given in **Section 4.7** of this report.

1.4 The Study Area

The overall Study Area is located in eastern NSW in the vicinity of the townships of Oberon, Wallerawang and Glen Davis (**Figures 1–2**). **Figure 2** shows the general locations of the eleven key sites investigated as part of the current study:

- Oberon Dam Complex;
- Wallerawang Depot;
- Wallerawang Pumping Station;
- Glen Davis Reservoir;
- Rydal Dam;
- Hampton Tunnel inlet chamber;
- Lidsdale Reservoir;
- Break Pressure Tanks 1 to 4 at Baal Bone;
- Cullen Bullen Reservoir Tank;
- Duckmaloi Weir; and
- Duckmaloi Water Treatment Plant.

1.5 Acknowledgements

The OzArk survey team would like to acknowledge the contribution of the following State Water employees who assisted the team during the survey.

- Mr Robert (Bob) O'Bernier and Mr Martin Duffy who accompanied the team on Day 1.
- Mr Robert Nolan and Mr Neville Dyson who accompanied the team on Day 2.
- Mr Martin Prendergast accompanied the team on both survey days.

1.6 Authorship

This report was written by Mr Kim Tuovinen and Mr Ben Churcher (OzArk EHM).

Figure 1: Location of the Fish River Water Sully Scheme.

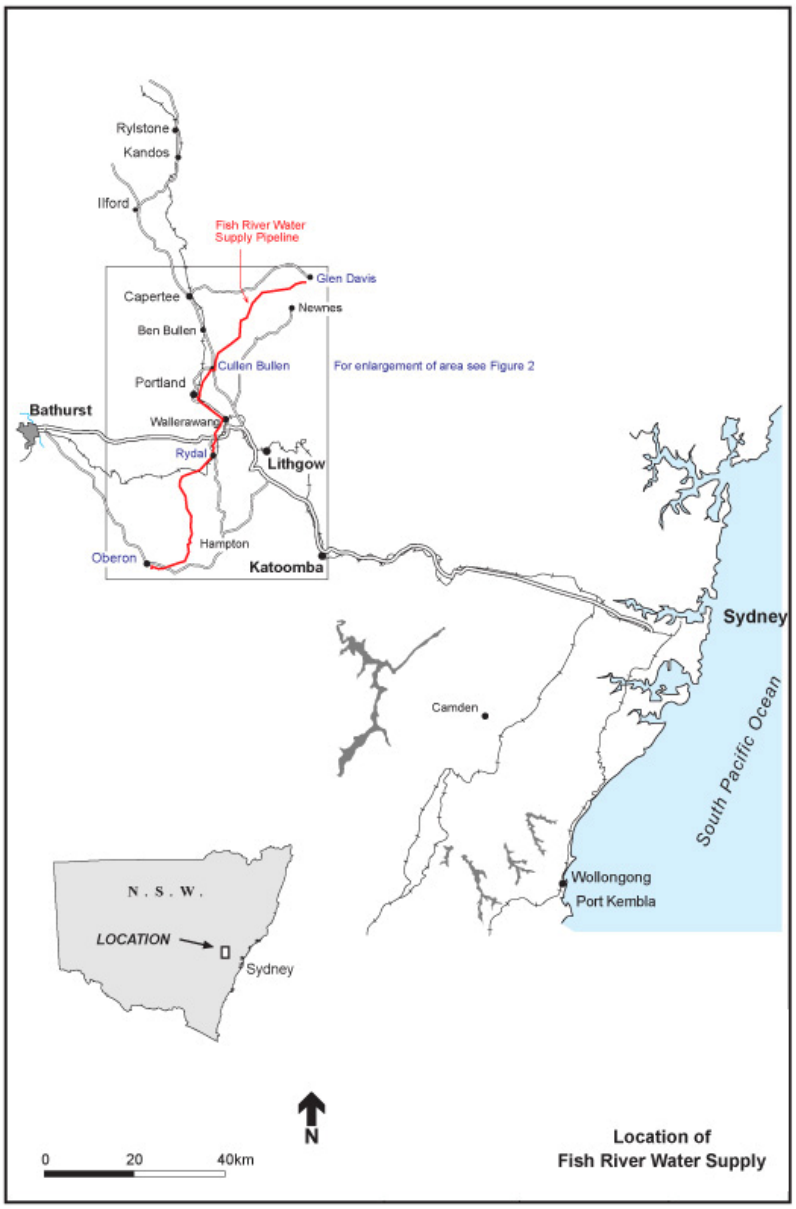
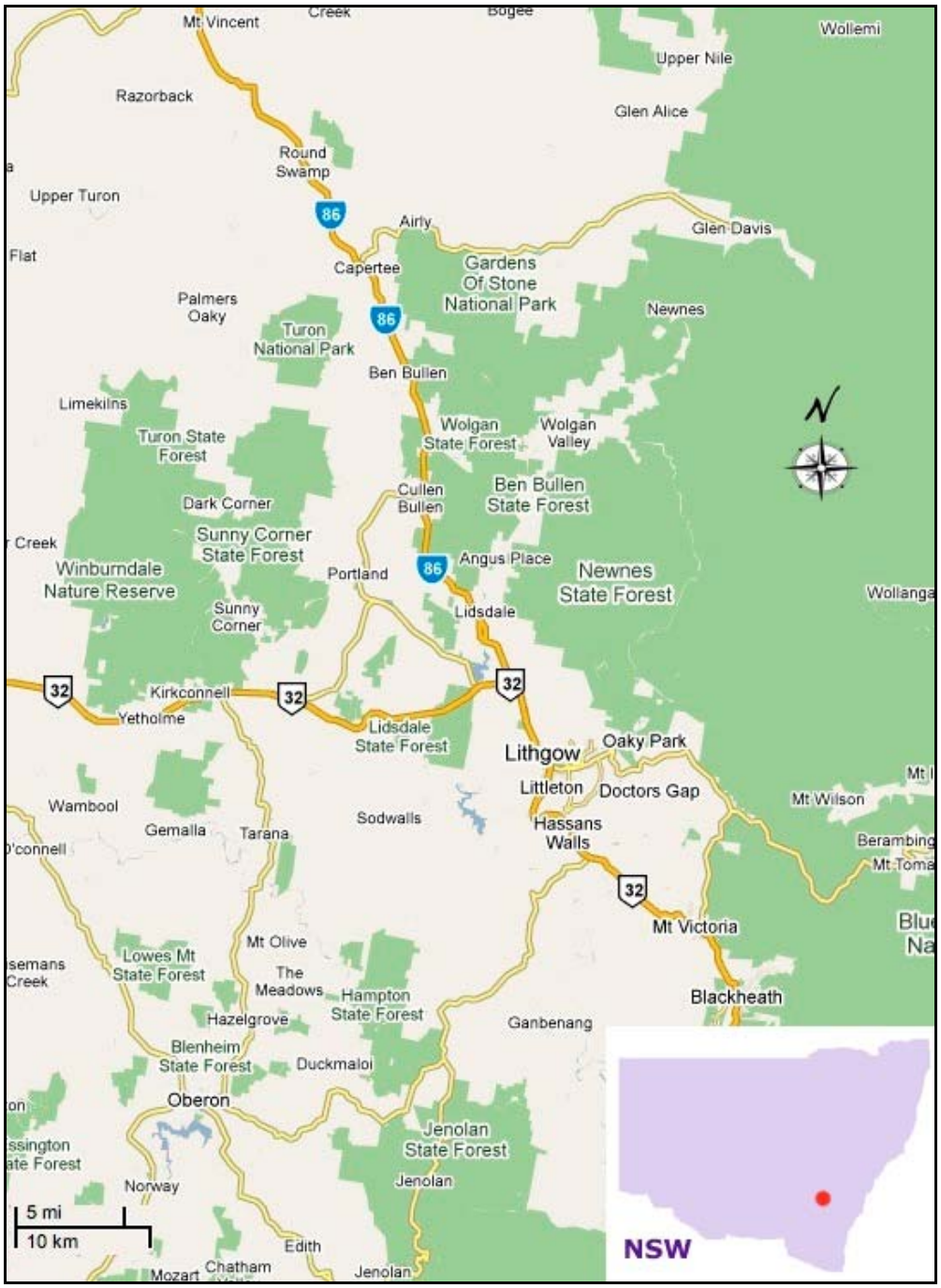


Figure 2: Fish River Water Supply Study Area with locations of key locations indicated in red (Source: Google Maps)



2.0 Contextual History

2.1 Introduction

One of New South Wales' major unfiltered water suppliers, the Fish River Water Supply (FRWS) was constructed in three stages between 1943 and 1964. Stage One consisted of the construction of Oberon Dam and the first 100 km of pipeline, providing water to communities between Oberon and Lithgow / Glen Davis. Stages Two and Three raised the height of the dam, provided pipelines to Katoomba, Leura and Wallerawang power station, and saw the construction of a weir across Duckmaloi River.

2.2 History of the Fish River Water Supply Scheme

Political background

The FRWS was planned in order to overcome late-1930s chronic water shortages in Oberon, Lithgow, Portland and Wallerawang. Abortive attempts to overcome this problem included Blaxland Shire's planned Thompson's Creek dam and Public Works Department (PWD) Minister Eric Spooner's unworkable Blue Mountains Scheme / Wollangambe Dam. Following the 1939 NSW election, United Australia Party (UAP) PWD Minister Lewis Martin instigated investigation of the Fish River system as the basis for an appropriate western Blue Mountains water supply. By 1941, Martin was satisfied with Oberon Dam as the lynchpin of such a water supply; however, the re-election of Labor in May 1941 saw the project delayed. Following a presentation by Oberon Shire Council (28 July 1941), however, PWD Minister Joseph Cahill was convinced of the advantages of a Fish River supply scheme. Funding constraints prevented immediate adoption of the plan.

The entry of Japan into WWII in December 1941 substantially increased the Commonwealth Government's need for indigenous oil supplies and the nearby National Oil Glen Davis oil shale refinery was ear-marked for improvement. The provision of water to Glen Davis therefore became a Commonwealth priority as the refinery required 464 mgpa (Jamieson and Cantwell 1958). Stephen Jones of the PWD investigated the provision of water to the Glen Davis refinery and determined that the FRWS would be the preferred option on the basis of supply security and quantity. Minister John Beasley accepted National Oil's 23 March 1942 FRWS recommendation, and following a series of negotiations throughout 1942, the FRWS was eventually approved by the Commonwealth Cabinet on 29 June 1943. Funding was to be provided by both the Commonwealth and NSW State Governments and by the local councils at Blaxland, Lithgow and Oberon (via Australian Loan Council loans arranged by Treasurer Chifley). As McLachlan points out, NSW Premier McKell and Commonwealth Treasurer Chifley 'had very neatly secured Commonwealth funding for a local water supply scheme for their state and electorate' (McLachlan 1997, p. 20).

Design and Site Selection

Oberon Dam was the first slab and buttress concrete dam in NSW. This was different from the prevailing preference for concrete 'cyclopean' dams, thin-walled concrete arch dams, gravity and arch dams, earth / rock filled construction dams. A slab and buttress dam consists of a concrete slab at 45°, thinner in thickness as it rises in height with downstream buttresses supporting the dam wall. The slab and buttress design was adopted because war-time constraints meant that the earth moving equipment required for earth filled dams was unavailable. Despite the fact that this was a more labour-intensive project, the availability of Civil Constructional Corps (CCC) workers meant that labour costs were not prohibitive. Raw materials such as cement and aggregate were available in the local

area. These war-time constraints provided an opportunity for creativity and innovation which was came from the freedom to make decisions on the spot. The dam site was selected based on the following criteria:

- Elevation: 1000+ m above sea level, thus allowing the bulk of the FRWS to operate on gravity;
- Reliable rainfall: mean = 84 cm/year;
- Stable geology (volcanic tuff); and
- Suitable river valley geometry.

Stage One

Workforce

Until late 1945, the workforce was predominantly composed of drafted and voluntary Civil Constructional Corps (CCC) labour. The CCC was a Commonwealth Government organisation under the control of the Allied Works Council known as 'the Army behind the Army' (McLachlan 1997, p. 43). The CCC's primary tasks were to construct and repair roads, airfields, harbours, Army camps, and other similar works relating to Australia's defence. CCC workers participated in the construction of Oberon Dam between September 1943 and October 1945. Following the disbandment of the CCC, many ex-CCC men remained working on the FRWS as contract labourers.

Pay and Conditions. The majority of CCC workers involved with the FRWS were aged in their 30s and 40s, as younger males were required for military service overseas. The organisation was organised along the lines of a large construction company, however, some elements of military organisation (such as a Corps badge and identification papers with service numbers) were adopted, in keeping with the defensive focus of the CCC. Wages in the CCC commenced at a minimum of £5/10 (2/6d. per hour) per day (at 54 hours per week early in the project and 48 hours from 1944), with overtime, shift penalties and higher rates for specialists also provided. Other benefits included pensions, workers' compensation for injuries, morning and afternoon breaks, travel allowances (time and fares), free mess food and accommodation, annual paid leave, sick leave and medical services.

Camps. Five camps, each with a capacity of approximately 150 to 280 men, were established at Oberon Dam, Duckmaloi, Tarana, Wallerawang, and Coco Creek (vic. Glen Davis). The camps were organised on a similar layout to military camps consisting of 14 m x 8 m (45 feet x 26 feet) prefabricated buildings: kitchen/mess, welfare/canteen, medical/administration, ablutions, drying room, and barrack-style accommodation blocks. No physical evidence of these camps remains today.

Politics. The CCC was accused by many (including Commonwealth Treasurer Ben Chifley) of cost-ineffectiveness and inefficiency, and by some within the military of shirking military service. Despite the high wages and delays associated with CCC projects such as FRWS, some of these accusations are difficult to sustain. Delays were generally associated with late or non-delivery of materials; the CCC workers cannot be held responsible for a slow supply chain. Against the accusation of avoidance of military service, it must be pointed out that the age of the average CCC worker was above that of the preferred soldiering age. Furthermore, the CCC was the means by which the Commonwealth was able to mobilise the construction of works vital to Australia's defence at a time when labour was in short supply.

Pre-fabricated semi-cylindrical huts

The term 'Nissen Hut' is commonly applied to pre-fabricated structures constructed in the earlier half of the twentieth century throughout Australia. However, the Nissen Hut was only one (albeit the original style, invented by Major Peter Nissen during WWI) of a number of derivative shed types (others include the Romney Hut, the Quonset Hut and the Igloo) used throughout the UK, USA and Australia between World War I and the immediate post-World War II years.

Further research is required to determine the correct nomenclature for these buildings. Stuart (2005) gives the dimensions of similar buildings as:

- Nissen Huts:
  - 'Bow Hut': 16 feet / 4.9 m in width by 36 feet / 11 m in length;
  - 'Hospital': 24 feet / 7.3 m in width by 96 feet / 29.3 m in length (the 'hospital'); and
  - A third pre-fabricated Nissen Hut: span of 30 feet / 9.1 m in width.
- Romney Huts:
  - Usually 35 feet / 10.7 m in width and 96 feet / 29.3 m in length.

Stages Two and Three

Duckmaloi River: Break pressure tank and weir

The FRWS plans originally included Duckmaloi River as a supplementary supply source. It was intended that a dam would be constructed 7 km from the Duckmaloi break pressure tank on a similar scale to the Oberon Dam. Funding shortfalls led to a decision to delay construction of a Duckmaloi Dam, with Duckmaloi Weir instead built as a temporary augmentation to the FRWS.

The 'interim' weir became the permanent Duckmaloi water source. Unfortunately, the weir does not produce consistently high quantities of water and is only able to supply significant quantities following rainfall. The water produced by Duckmaloi Weir is often turbid and of poor quality. Prior to the establishment of Mount Piper Power Station (Pacific Power) during the 1980s, the quantities of water required from Duckmaloi Weir enabled the extraction of significantly less water than the maximum possible. With the increased need created by the new power station, it was decided to construct a treatment plant in the vicinity of the Duckmaloi break pressure tank. This settling plant combines flows from both Oberon Dam and Duckmaloi Weir and is capable of fully treating the maximum flows from both sources. In 2003 the clarification plant was converted to a membrane filtration plant (Fernando 2007).

Hampton Tunnel

Background. A delay of approximately seven years occurred between the completion of Stage One and the commencement of Stage Two of the Fish River Water Supply (FRWS) scheme. Stages Two and Three were planned as part of the same overall development concept, however, Stage Three was delayed by two years due to funding constraints, eventually commencing in 1961. The Stages Two and Three concept involved:

- The raising of Oberon Dam to its current height (Stage Two);
- Extension of pipelines from Oberon Dam to Wallerawang (Stage Two);
- Construction of Duckmaloi Weir and associated infrastructure (Stages Two and Three);

- Construction of Rydal Emergency Storage dam, Lidsdale Reservoir (Stage Two);
- Cross-connections between Stage Two and Stage One pipelines at White Hill (Stage Three);
- Construction of Hampton Tunnel and associated infrastructure in order to pump water to Kanimbla Valley, Megalong Valley and Leura (Stage Three); and
- Construction of two reservoirs at Leura (Stage Three).

Tunnel concept. The Hampton Tunnel is 1100 m in length, 2.1 m in height, and 1.2 m in width and connects Oberon Dam to the Blue Mountains. At the highest point of the range the tunnel is located 44 m beneath the surface. Gravity feeds water from a large balance tank in the west towards the east with flows regulated at the Hampton Tunnel inlet chamber by a float controlled needle valve. The discharge point in the east consists of a covered balance tank with screens.

Hampton community. The construction of the various components of the FRWS brought significant changes to the Hampton community. The initial impact was improved roads as the increased volume of traffic during Stage Two construction in the area put excessive pressure on the existing unsealed roads. Further changes were to follow during Stage Three in the form of a significant population increase during the period of works, upgrades to the Half Way House hotel/motel, and the sealing of the road to the Jenolan Caves (McLachlan 1997).

2.3 Construction methods

Oberon Dam

Stage One of construction commenced in 1943 and was completed in 1949 at a cost of £45,000 (Jamieson and Cantwell 1958). At this point the dam stood to a height of 21.3 m (70') with a carrying capacity of 9,000 million litres and catchment area of 138 sq km. The spillway crest at that stage was 16.7 m (55'). Later, between 1954 and 1957, Stage Two saw the dam raised to a height of 33.5 m (110'). Oberon Dam now has a capacity of 45,400 ML. The ski-jump spillway consisted of 11 x 4.3 m bays with semi-circular crests. The spillway had a free overfall of 565 cubic metres per second (cumsecs) and a surcharge of 14.5 m over crest (McLachlan 1997).

Construction began with the establishment of a work site with camp, workshops, roads, railway siding, concrete batching plant with flying fox and preliminary construction work (clearing was performed by one of first bulldozers with hydraulic blade and rippers in Australia). Dam construction then proceeded to the excavation of the below-ground curtain wall site and the slab/buttress foundations, followed by the pouring of concrete for these foundations. Work then proceeded on the basis of a three step cycle of timber formwork erection, fixing steel reinforcement bars, and concrete pouring, with trenching done utilising pneumatic picks rather than explosives in order to avoid shattering rock foundations. Buttresses were constructed in pairs with a frame gantry straddling each pair (McLachlan 1997).

Horizontal expansion joints were used between the face slab and buttresses in order to enable face slab movement relative to buttresses. Adequate water seals were necessary between the face slab and rock foundation in order to prevent damaging leakage. Foundations were grouted with concrete in order to block leakage paths below the level of the cut-off trench (McLachlan 1997).

A key aspect of the construction of the Oberon Dam – particularly given that it was the first such dam in NSW – was the experimentation that occurred before and during the construction phase. Of particular note is the use of modelling. Scale sand, brick and water models were used to test design

at the DPW's Manly Hydraulics Laboratory (MHL). The MHL, despite advances in Computer Aided Design (CAD), is still operational (McLachlan 1997).

Stage Two of construction again required excavation via pneumatic picks as blasting would have damaged the existing structure. A grout curtain was placed beneath the cut-off, with an additional curtain added due to subsequent leakage. This stage used a total of 17,500 yd^3 / 13,379 m^3 of concrete in thin, heavily reinforced sections requiring care in mixing and control. Concrete used during this stage consisted of local crushed basalt and sand, with Botany or local Battery sand used for face slabs. Ordinary Portland cement (with a Darex air-entraining agent) was now used rather than the low-heat cement used for long pours during Stage One (Jamieson and Cantwell 1958).

Hampton Tunnel

Hampton Tunnel was constructed under contract by Eric Newham Pty. Ltd during Stage Three. Excavation of the tunnel was by the 'drill and blast' method. The geology encountered during construction varied from hard granite through the eastern half of the tunnel to saturated and decomposed rock in the western half of the tunnel route. The saturation levels in the western half of the tunnel necessitated the use of air compressors to prevent water flows into the tunnel. In order to prevent 'the bends' workers had to undergo end of shift decompression (McLachlan 1997).

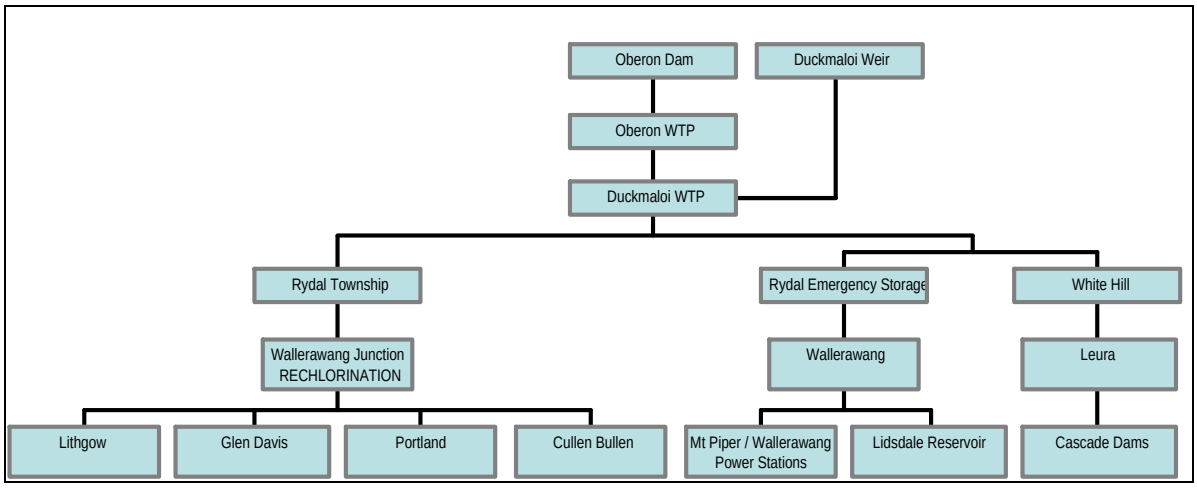
A weekend tunnel collapse near the western end resulted in the decision to alter the construction technique for the final 330 m. Instead of 'drill and blast', the remaining section would be an open excavation into which a 525 mm pipe would be laid followed by backfilling (McLachlan 1997).

2.3 Present use of the Fish River water Supply Scheme

The FRWS draws raw water from Oberon Dam and Duckmaloi Weir and includes 236 km of pipelines, reservoirs, four pumping stations, chlorinators, clarification facilities and the Hampton Tunnel. Bulk water is provided to four major customers – Oberon Council, Delta Electricity, Sydney Catchment Authority, and Greater Lithgow Council – and c. 230 individual consumers and properties (Fernando 2007). The supply system incorporates virtually all of the original Stages One to Three infrastructures, with only minor departures from the original assets. The principle installations, Oberon Dam, Duckmaloi Weir, and Hampton Tunnel still function according to their original intent. Probably the key recent alteration to the original scheme is the Duckmaloi Water Treatment Plant, which enables water from Oberon and Duckmaloi to be settled prior to transport to consumers and which replaced the adjacent, and still extant, break pressure tank. **Chart 1** is derived from information provided by Fernando (2007) and demonstrates the relationships between the various components of the FRWS as water flows from Oberon Dam and Duckmaloi Weir.

The two primary issues facing the FRWS today are drought and pipeline failure. Oberon Dam was at 13% capacity in April 2009 (ABC 2009), a situation which remains of critical concern to local councils and Delta Electricity. Pipe failure is an ongoing concern given the age of sections of FRWS pipeline. At the time of the present assessment, State Water personnel had recently repaired several major pipe failures and a minor leak was evident at Glen Davis Reservoir.

Chart 1: Flow chart showing current FRWS system flows (water gravitates from Oberon Dam and Duckmaloi Weir downwards through the chart).



3.0 Results of the Heritage assessment

The assessment identified a total of four heritage complexes (sites that include two or more items with heritage significance). These are the FRWS as a whole, the Oberon Dam complex, the Wallerawang Depot complex, and the Glen Davis Reservoir complex. Within these four complexes, eight individual items were assessed as having heritage significance. Beyond those items included within the heritage complexes listed above, four further items, associated with the FRWS but isolated from the other complexes, were identified as holding heritage significance (making a total of twelve individual items). Of these, only the FRWS scheme as a whole and Oberon Dam itself were assessed as holding heritage significance at a State level.

State Water holds numerous assets as part of the FRWS that are recent additions and have been assessed here as holding no heritage significance according to the Heritage Council of NSW guidelines.

3.1 Items holding heritage significance

Oberon Dam

Location: 55H 0765504E 6264567N (Datum: AGD 66; Elevation: 1053 m)

Oberon Dam (**Figures 3**–**4**; **Plates 1–8**) is an Ambursen Slab and Buttress concrete dam situated on a geological base of quartzitic siltstone and much jointed volcanic tuff (Jamieson and Cantwell 1958). The dam wall (**Plate 1**) is 375 m in length and stands at a height of 33.5 m (110 feet). It has a capacity of 45,400 ML. Today, the original dam wall and ski jump spillway are topped by safety fencing (**Plate 2**). The buttresses are bedded in asphalt and are spaced at 5.4 m and consist of a tapering section from bottom (1125 mm thick) to top (570 mm thick). Each buttress is numbered, and the area within the buttresses has seen the addition of spray painted graffiti (recent: at least one example of which is dated 11-9-08; **Plates 3**–**4**) and corrugated iron doorways for the secure storage of gardening equipment.

The five bay ski-jump spillway is of concrete construction and is in good condition (**Plate 1**). The spillway is 27 m in length with a radius of 4.5 m. The Top Water Level is 1067 m and the lip stands at a height of 14 m above the stream bed. The control tower, which is of concrete construction, is accessed from the top of the dam wall via a foot bridge. The control tower contains electric lifting equipment (capable of lifting 1.25 T).

Three plaques are situated on the top of the dam at the western end commemorating the three phases of construction:

- **Plaque 1 (Plate 5):** FISH RIVER WATER SUPPLY / THE TURNING OF THE FIRST SOD / WAS PERFORMED BY / THE HON. W.J.McKELL, M.L.A., / PREMIER AND COLONIAL TREASURER, N.S.W., / ON 23RD OCTOBER 1943. / TO COMMEMORATE THE OCCASION / THIS TABLET WAS UNVEILED BY / THE HON. J.J. CAHILL, M.L.A., / MINISTER FOR PUBLIC WORKS. / D. FORD. UNDER SECRETARY PUBLIC WORKS / J.M. MAIN, CHIEF ENGINEER / S.W. JONES. PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE
- **Plaque 2 (Plate 6):** FISH RIVER WATER SUPPLY / TO COMMEMORATE / COMPLETION OF THE OBERON DAM / THIS TABLET WAS UNVEILED BY / THE HON. J.J. CAHILL, M.L.A., / PREMIER AND COLONIAL TREASURER, N.S.W., / ON

21ST MARCH 1958 / THE HON. J.J. CAHILL, M.L.A., / PREMIER AND COLONIAL TREASURER, N.S.W., / ON 21ST MARCH 1958 / THE HON. J.F. McGRATH, M.L.A., / MINISTER FOR PUBLIC WORKS / J.M. MAIN DIRECTOR OF PUBLIC WORKS / F.W. POTTER PRINCIPAL ENGINEER WATER SUPPLY & SEWERAGE / SLAB AND BUTTRESS TYPE DAM HEIGHT 110 FEET / CAPACITY OF STORAGE 10,000,000,000 GALLONS

- **Plaque 3 (Plate 7):** FISH RIVER WATER SUPPLY / THIS TABLET COMMEMORATES THE COMPLETION / OF THE ABOVE WORK ON 31ST MARCH 1965. / THE HON. P.N. RYAN, M.L.A., / MINISTER FOR PUBLIC WORKS. / R.A. JOHNSTON. C.B.E., B.A., LL.B., DIRECTOR OF PUBLIC WORKS. / A.R. FORD, B.E., M.I.C.B., M.I.E. (AUST.) CHIEF ENGINEER

A fourth plaque was unveiled in 2008 by the Institution of Engineers Australia and State Water commemorating the construction of Oberon Dam. This plaque had not been mounted at the time of the heritage assessment and was stored in the workshop at Oberon Dam. The plaque reads:

- **Plaque 4 (Plate 8):** FISH RIVER WATER SUPPLY SCHEME / Engineered by the NSW Public Works Department, this scheme commenced in 1943 during World War II to supply water from Oberon Dam to the Glen Davis shale oil works and the east Central Tablelands. Stage 1 was constructed by the Civil Constructional Corps. At 33.5m Oberon Dam is the highest slab and buttress dam in Australia and, except for pumping to Oberon, gravitates water to other consumers including the upper Blue Mountains and two thermal power stations. The scheme is unique in transferring western flowing water to east of the Great Dividing Range. The 50 km Wallerawang power station pipeline was the first and is the longest pre-stressed concrete water supply pipeline in Australia. When constructed the steel pipeline to Leura sustained the greatest pressure of any in Australia. Consulting engineers A R Blair and G Haskins, and the Public Works Principal Engineer Water Supply, S Jones progressively developed the scheme concept. / The Institution of Engineers Australia / State Water Corporation NSW, 2008

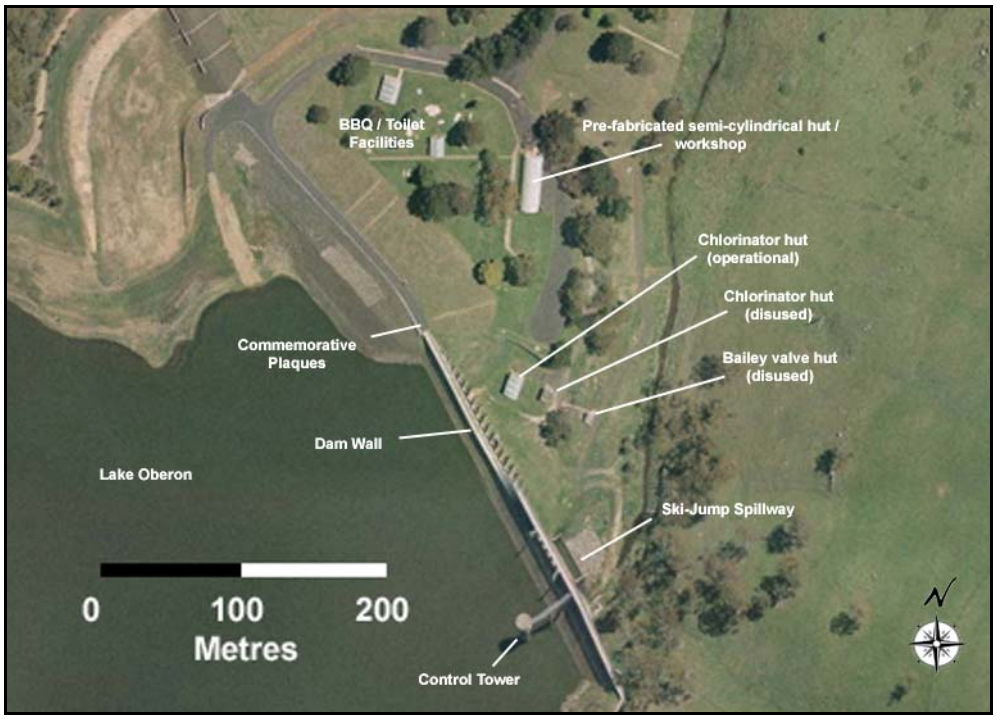
Modifications

The Dam was raised in two stages.

- **Stage One** (1943 to 1949) saw the construction of the lower 15.25 m (50 feet) of dam wall and buttresses.
- **Stage Two** (1954 to 1957) saw the addition of the ski-jump spillway and the dam, buttresses and the control tower raised to the current height of 33.5 m (110 feet).
- **Recent Additions**. The current top parapet railing and corrugated iron storage shed doors were added c. 1998.

Figure 3: Oberon Dam showing overall area (Source: Department of Lands)

Figure 4: Oberon Dam, showing detail of Oberon Dam complex (Source: Department of Lands)



Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam

Location: 55H 0765522E, 6264750N (Datum AGD 66; Elevation: 1080 m)

A pre-fabricated semi-cylindrical hut/workshop is situated to the north of Oberon Dam, adjacent to the playground and BBQ facilities (**Figures 3**–**4**). The shed is currently used as a workshop (**Plate 10**) and is constructed of corrugated iron panels with an exterior painted light grey – green. The paintwork is generally in fair condition. Access at the northern end is via a roller door or a small access door. Access at the southern end is via hinged double corrugated iron/wooden doors.

The shed's floor is concrete and bears evidence of fittings that have been removed (**Plate 11**). The building is approximately 27 m in length and approximately 10 m in width. 13 curved ribs support the structure, spaced at an average of 3 m. Minor damage exists to the ribs and other fittings, predominantly consisting of abrasions and rust (**Plate 12**). Towards the rear (southern) end of the shed stands the framework and working parts of a pulley and chain structure (**Plate 10**).

The interior of the shed is dry and well maintained and the original interior annex remains *in situ* (**Plate 10**). A number of the small windows (situated at approximately 3 m above ground height) are broken from outside the structure **(Plate 13**).

The term "Nissen Hut" is commonly applied to these types of structures throughout Australia, however, the Nissen Hut was only one (albeit the original) of a number of derivative shed types (others include the Romney Hut, the Quonset Hut and the Igloo) used throughout the UK, USA and Australia between World War I and the immediate post-World War II years. Greater precision in identification is needed (Stuart 2005) and the Oberon Dam hut has the potential to provide further resolution to our understanding of the distribution and categorisation of this type of structure.

Further research is required to determine the correct nomenclature for this building. Based on the dimensions, it would appear that the most likely term for this building is the Romney Hut. Stuart (2005) gives the dimensions of the two standard Nissen Huts as 16 feet / 4.9 m in width by 36 feet / 11 in length (the 'Bow' hut), and 24 feet / 7.3 m in width by 96 feet / 29.3 m in length (the 'hospital'). A third Nissen Hut had a span of 30 feet / 9.1 m in width. The Romney was usually 35 feet / 10.7 m in width and 96 feet / 29.3 m in length. Based on dimensions alone, the Oberon Hut (27 m x 10 m) appears more consistent with the Romney. Additional support for this conclusion is derived from an existence of a concrete floor, a feature that is not characteristic of the Nissen Hut proper (which appears to have featured timber flooring).

Modifications

The building has undergone a number of modifications.

- A number of fittings, including plumbing, were removed prior to the late 1980s. Evidence exists on the shed floor of the locations of these fittings;
- The access doors at the northern end were replaced during the 1980/1990s by a roller door and one-person access door; and
- The exterior was repainted c. 1995.

Bailey Valve Hut at Oberon Dam

Location: vic. 55H 0765504E 6264567N (Datum: AGD 66; 1053 m)

The old Bailey valve hut is situated below the old chlorinator hut and immediately forward of the Oberon Dam wall (**Figures 3**–**4**). The hut is of concrete construction and consists of a single rectangular room and bricked access panel at ground level. The building is accessed via concrete steps leading from the old chlorinator hut to a single-person door on the eastern side (**Plate 14**). The window on the western wall has a light green metal covering panel. The building is topped by a flat roof.

Modifications

The valve mechanisms were removed during the 1980/1990s. The exterior of the building has not been modified.

Chlorinator Hut at Oberon Dam

Location: vic. 55H 0765504E 6264567N (Datum: AGD 66; 1053 m)

The old chlorinator hut is situated between the new chlorinator building and the old Bailey valve hut immediately forward of the Oberon Dam wall (**Figures 3**–**4** and **Plates 15**–**17**). The hut is of concrete construction and consists of two rectangular rooms. The building is accessed via a single-person door on the eastern side or via tall double doors on the northern side. Both the larger room and the small annex have flat roofs. The smaller annex has an outside window covered with a metal panel, hinged at the top. Two similar covered windows are situated on the western wall. The interior walls of the annex are partly tiled (black ceramic) (**Plate 16**). The southern walls contain spray painted graffiti (**Plate 17**).

Modifications

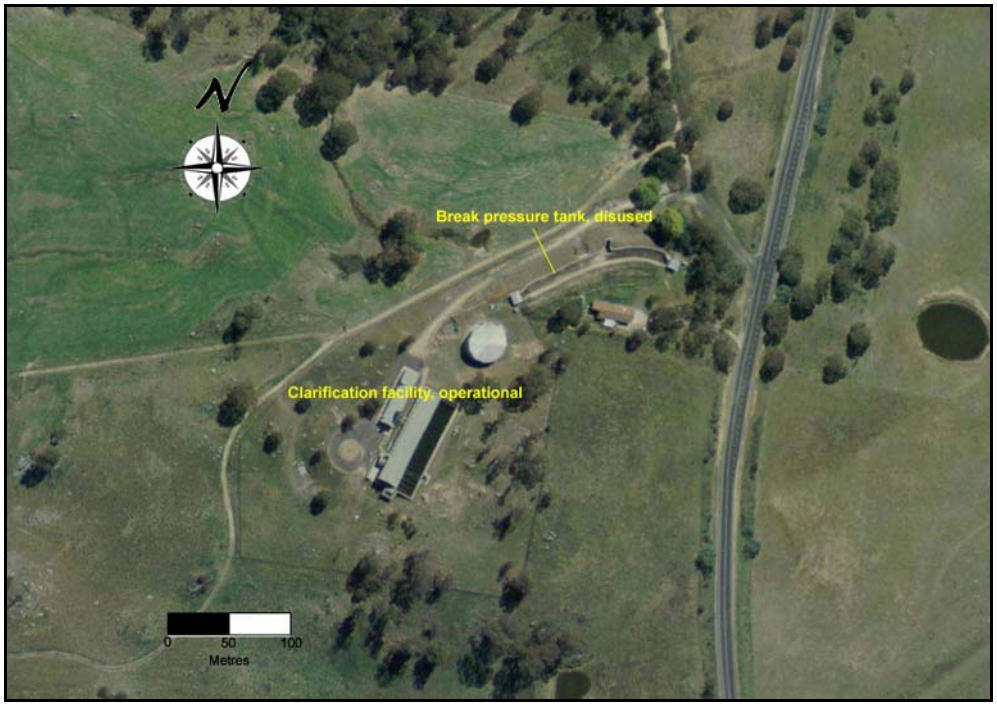
This building was disused as a chlorinator from c. 1990s when a new chlorinator building was constructed – at this point it was modified to storage shed.

Break Pressure Tank at Duckmaloi Water Treatment Plant

Location: 55H 0773795E 6266510N (Datum: AGD 66; Elevation: 1059 m)

The break pressure tank at the Duckmaloi Water Treatment Plant is a crescent shaped concrete channel with inlet pipes at each end and a central screening chamber outlet (**Figure 5**). The channel is approximately 150 m in length and is trapezium shaped in section (**Plates 18**–**20**). Access to the floor of the channel is available at the southern end via concrete steps located on the eastern side of the channel.

Figure 5: Duckmaloi water treatment plant and break pressure tank (Source: Department of Lands)



Flows were drawn from Oberon Dam at one end, and Duckmaloi Weir at the other. Two float controlled Larner-Johnson needle valves regulated flows at either end. Pressure surges, or 'water hammer', were prevented by damping the action of the floats.

The break pressure tank at Duckmaloi was constructed in order to allow flows from Oberon Dam and Duckmaloi Weir to be used singly or in combination. It was built during Stage Two in advance of the construction of Duckmaloi Weir itself (Stage Three).

The break pressure tank contained both large automatic valves and smaller automatic valves. The larger valves did not function satisfactorily; the smaller valves, however, functioned in accordance with their design. The larger valves were therefore operated manually at a low flow level whilst the smaller valves enabled a reliable flow for their 35 years of operation.

Modifications

The break pressure tank was replaced in 1991 by an adjacent sediment settling facility. The water produced by Duckmaloi Weir is often turbid and of poor quality. Prior to the establishment of Mount Piper Power Station (Pacific Power) during the 1980s, the quantities of water required from Duckmaloi Weir enabled the extraction of significantly less water than the maximum possible. With the increased need created by the new power station, it was decided to construct a treatment plant in the vicinity of the Duckmaloi break pressure tank. This settling plant combines flows from both Oberon Dam and Duckmaloi Weir and is capable of fully treating the maximum flows from both sources. In 2003 this facility was converted from a clarification plant to a membrane filtration plant (Fernando 2007).

Hampton Tunnel

Location: 56H 0225236E 6273015N (Datum: AGD 66; Elevation: 1013 m)

The Hampton Tunnel inlet is a small rectangular concrete hut with flat roof, approximately 10 m in length and 3 m in width. The building is situated in a gully in a farm paddock and is aligned on an

east-west axis (**Figures 6**–**7** and **Plates 21**–**23**). Access is via a door at the western end of the building and an opaque green metal window can be opened on the southern wall. A peaked metal skylight on the roof can be opened to provide light. The hut provides access to the Hampton Tunnel pipeline via a rung ladder and contains a float controlled needle valve.

The electrical component of the building is powered by a single solar panel on the roof.

Modifications

The current electrical circuitry and solar panel were added c. 1990/2000s.

Figure 6: Location of Hampton Tunnel inlet chamber (Source: Department of Lands)

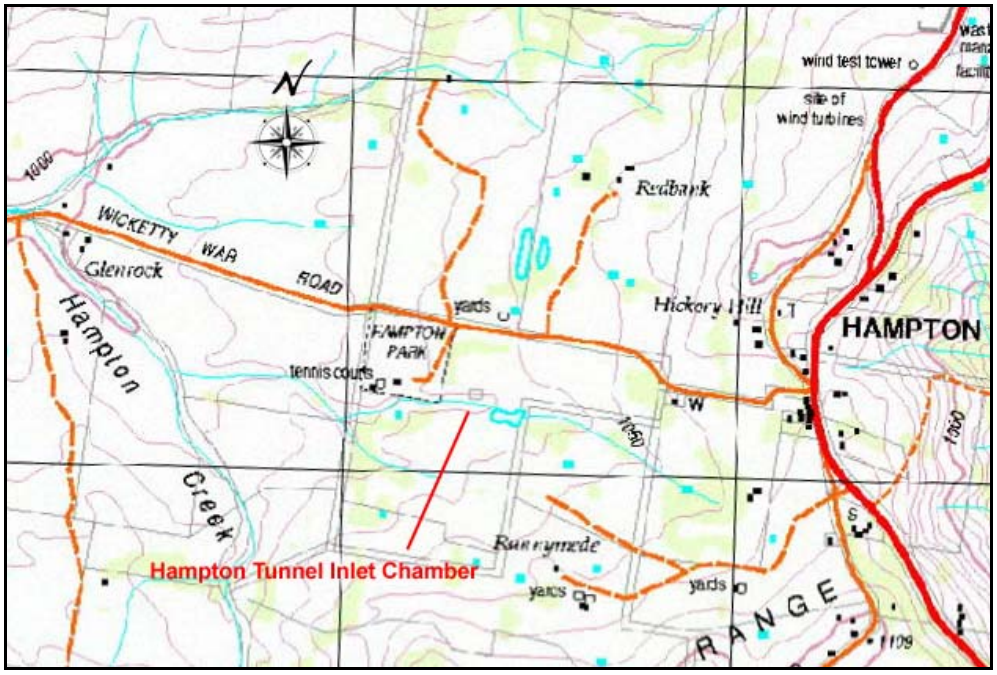
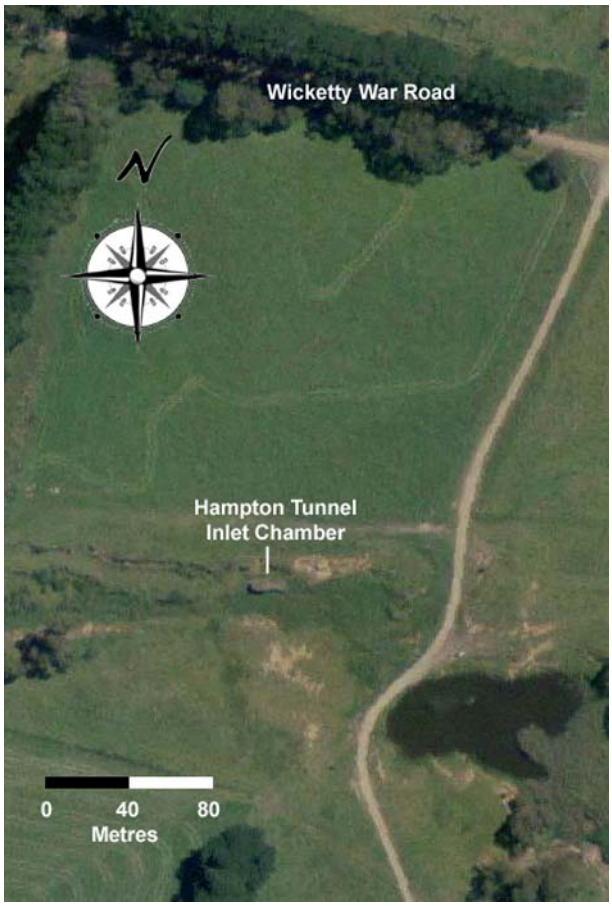


Figure 7: Detail of Hampton Tunnel inlet chamber (Source: Department of Lands)



Duckmaloi Weir

Location: 55H 077131E 6261300N (Datum: AGD 66; Elevation: 1070 m)

Duckmaloi Weir is a mass concrete overshot weir aligned north/south on the Duckmaloi River (**Plate 23**). It is located in an isolated location on private land. The Duckmoloi Weir is a small concrete arched construction approximately 13.1 m in length, 3.0 m in height, with a carrying capacity of 20 ML and TWL of 1057 m. All components are original Stage Three with the exception of the safety rail (c. 1980). It draws on a catchment area of 11,900 HA. In addition to its use as a supplementary water source for the FRWS, the weir provides a habitat for a platypus colony as it is a permanent pool surrounded by rocky ledges.

Modifications

The principle modification to the Duckmaloi Weir was the addition of a handrail c. 1980.

Wallerawang Pumping Station

Location: 56H 225901E 6299290N (Datum: AGD 66; Elevation: 901 m)

The Wallerawang Pumping Station is a small brick building situated close to Portland Rd/Piper's Flat Rd (**Figure 8** and **Plates 26** to **27**). It was originally used as a pumping station to boost water supply to Lithgow or Portland, however, it is now used as a chlorinator.

The archaeological value of the building consists of the original signage (possibly the only remaining example of original DPW signage at any of the State Water FRWS assets) and the original pulley system. The extant Department of Public Works sign (**Plate 26**) reads:

> DEPARTMENT OF PUBLIC WORKS, N.S.W.
>
> PUMPING STATION

Access to the building is via the original roller door at the front. A single small window is situated on each of the eastern and western walls, and two small windows are situated on the rear (northern) wall. The original roof slopes downwards to the rear of the building and is constructed of corrugated metal.

The interior of the building is dominated by the recent chlorination machinery, however, the original pulley system is still extant and is capable of lifting a maximum weight of 1.5 tons (**Plate 27**).

The Wallerawang Pumping Station was built as an associated structure to the FRWS, however, little specific historical detail has been uncovered by the authors relating to this structure. As the building was constructed in order to service the Stage Two/Three pipeline extensions, its construction arguably dates to the same period.

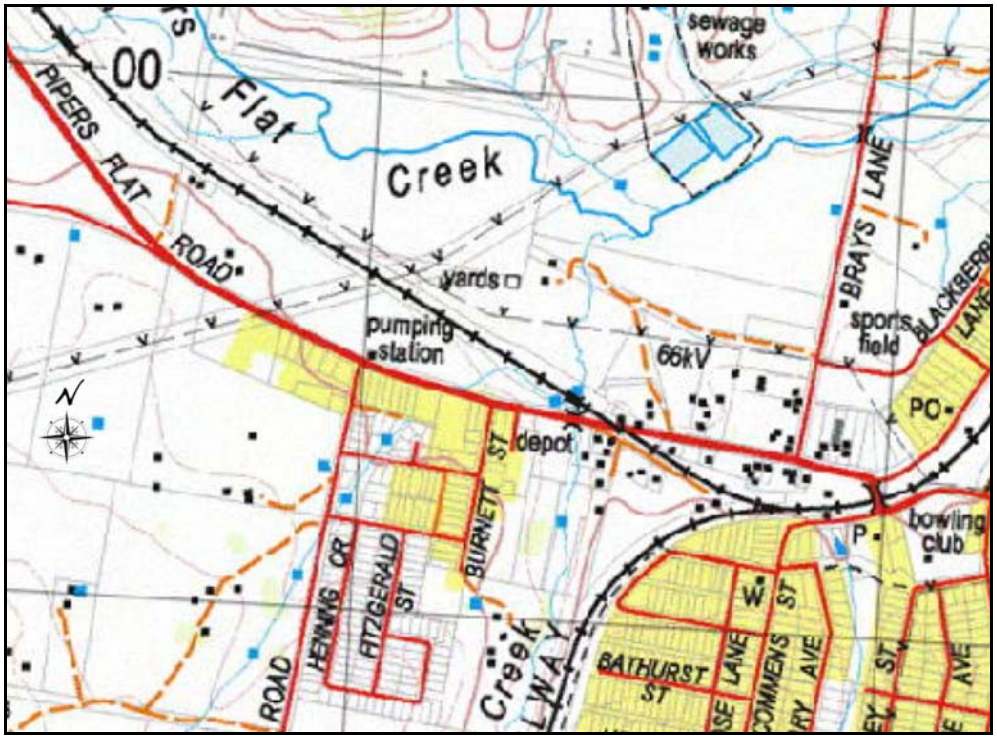
McLachlan (1997) indicates that responsibility for supply boosting to Lithgow was overtaken by East Wallerawang Pump Station in 1984, after which time the Wallerawang Pumping Station boosted supply exclusively to Portland from 5 to 7 ML/D (McLachlan 1997, p. 81). This role continued until the building's conversion to a chlorination facility.

Modifications

Prior to 1984, the Wallerawang Pumping Station was used to boost supply to either Lithgow or Portland. The East Wallerawang Pump Station was constructed in that year in order to boost supply to Lithgow, thus enabling the Wallerawang Pumping Station to boost supply exclusively to Portland. However, the East Wallerawang Pumping Station has been disused since at least 2002 (NSW DPWS 2002).

The building was converted to a chlorinator plant servicing Portland and Lithgow during the late 1990/early 2000s and no longer functions as a pumping station. At this time the two original pumps were replaced with chlorination machinery (with the exception of the original pulley and chain).

Figure 8: Wallerawang, showing locations of Wallerawang Pumping Station and Wallerawang Depot (Source: Department of Lands)



Wallerawang Depot

Location: 56H 0226181E 6299140N (Datum: AGD 66; Elevation: 900 m)

Wallerawang Depot is situated at 63 Portland/Pipers Flat Road, Wallerawang (**Figure 8**) and contains office buildings, storage rooms/sheds, a prefabricated semi-cylindrical hut/workshop and staff housing. Of these buildings, one house (at the entrance to the depot) and the workshop are over fifty years old and are therefore afforded heritage protection.

Inspector's House: house at entrance to Wallerawang Depot: 63 Portland Rd/Pipers Flat Road

The house is a red brick building and consists of brick walls at the front of the house with weatherboard additions at the rear, a tin roof, concrete verandah and new windows/extensions (**Plate 28**). The house façade consists of a central door flanked by one window on each side. The roof is recent and constructed with mid to dark green corrugated metal (Colorbond).

No documentary sources other than architectural drawings were identified in relation to this item. From these drawings, it is clear that the house had been in existence well before 1967, as repairs and alterations were planned in that year.

Modifications

Alterations and repairs were planned in 1967 as evidenced by plans held at the Wallerawang Depot. These alterations were signed by "Edwards 15.5.67 / ARCHITECT BATHURST" and consisted of replacement of original verandah floor boards with concrete, renewed flooring, conversion of rooms, internal wall additions and doorway alterations, an attached sleepout, and new fittings throughout. These proposed modifications were adopted.

More recent (c. 1980/1990s) modifications include a new roof/verandah, aluminium-framed windows and screen doors.

Prefabricated Semi-Cylindrical Hut / Workshop at Wallerawang Depot

A pre-fabricated semi-cylindrical hut/workshop is situated on the eastern side of the Wallerawang Depot. The shed is of arched corrugated iron construction with an exterior painted mid-green (**Plate 29**). Access at the northern end is via a roller door. Access at the southern end is via double corrugated iron/wooden doors. The shed is currently used as a workshop. The interior of the shed is dry and well maintained.

The pre-fabricated semi-cylindrical hut at Wallerawang Depot, apparently brought to the site from Oberon Dam, is painted mid – dark green. The most striking alteration to the original design is a new (c. 1970/1980s) brick façade. The original doors have been replaced at both front and rear, with the original door frame and brackets now visible (**Plate 30**). The car park at the front of the workshop is surrounded by trees, none of which were present in 1969 (McLachlan 1997, p. 82).

The shed's floor is concrete. The building is approximately 29 m in length and approximately 11 m in width. 13 curved ribs support the corrugated iron structure, spaced at an average of 3m.

The term "Nissen Hut" is commonly applied to these types of structures throughout Australia, however, the Nissen Hut was only one (albeit the original) of a number of derivative shed types (others include the Romney Hut, the Quonset Hut and the Igloo) used throughout the UK, USA and Australia between World War I and the immediate post-World War II years. Greater precision in identification is needed and the Oberon Dam hut has the potential to provide further resolution to our understanding of the distribution and categorisation of this type of structure.

Further research is required to determine the correct nomenclature for this building. Based on the dimensions, it would appear that the most likely term for this building is the Romney Hut. Stuart (2005) gives the dimensions of the two standard Nissen Huts as 16 feet / 4.9 m in width by 36 feet / 11 in length (the 'Bow' hut), and 24 feet / 7.3 m in width by 96 feet / 29.3 m in length (the 'hospital'). A third Nissen Hut had a span of 30 feet / 9.1 m in width. The Romney was usually 35 feet / 10.7 m in width and 96 feet / 29.3 m in length. Based on dimensions alone, the Oberon Hut (27 m x 10 m) appears more consistent with the Romney. Additional support for this conclusion is derived from an existence of a concrete floor, a feature that is not characteristic of the Nissen Hut (which appear to have featured timber flooring).

Modifications

Little historical information exists that relates directly to this building. A photograph of the depot, taken in 1968, shows the workshop on site with its original façade. The other documentary source pertaining to this building is an architectural drawing produced by DPW on 28 Feb 1968 illustrating proposed alterations (replacement of double doors with roller door and window enlargement).

The building has undergone a number of modifications:

- The shed was apparently moved from Oberon Dam to Wallerawang Dept prior to 1968. It was at least present at Wallerawang in 1968, as evidenced by a photograph reproduced by McLachlan (1997, p. 82).
- Alterations to the front elevation were proposed (and probably adopted) in 1968 involving the conversion of the front double doors to a roller door (Drawing No. 1011-C).

- The northern end saw the addition of a brick façade during the 1970/1980s. This façade retained the original window/door configuration but removed the original galvanised iron façade (**Plate 29**).
- The rear double doors have also been replaced with a roller door (post 1968) (**Plate 30**).

Glen Davis Reservoir

Location: 56H 0246539E 6331252N (Datum: AGD 66; Elevation: 338 m)

Glen Davis Reservoir is a metal roofed concrete in-ground reservoir tank. The reservoir complex contains the tank itself with a capacity of 4.5 ML, a pup tank and a new chlorinator. Access is via Glen Davis Waste Disposal facility (**Figure 9**).

Glen Davis Reservoir Tank

The Glen Davis Reservoir Tank is a metal roofed concrete in-ground reservoir tank situated above the village of Glen Davis, adjacent to the Glen Davis Waste Disposal facility. The reservoir tank is enclosed by two concentric fences, one immediately surrounding the tank itself (**Plate 31**) and one enclosing the overall reservoir complex. The tank's capacity is 4.5 ML and its TWL is 330 m.

Pup Tank

The Pup Tank is a small concrete and tin construction situated immediately to the east of the reservoir tank (**Plate 32**). A Stage One component of the complex, the pup tank contains *in situ* disused floats and the valves that have the dates 1945 (**Plate 33**) and 1986 preserved.

Chlorinator shed

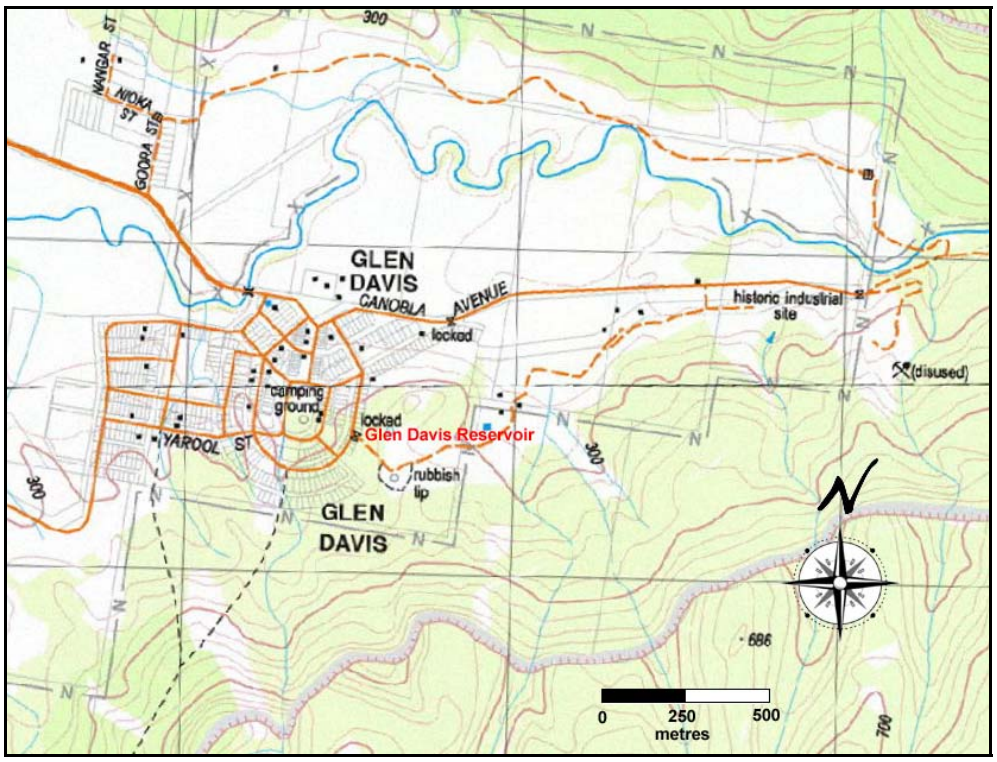
A recently built chlorinator shed constructed of green tin (Colorbond?) stands immediately to the south-west of the reservoir tank.

Modifications

The reservoir tank and pup tank retain their original Stage One concrete fabric. The fence surrounding the complex is also original.

The roofing on both tanks was added c. 2000.

Figure 9: Glen Davis, showing location of Glen Davis Reservoir in red (Source: Department of Lands)



3.2 Items without heritage significance

State Water Corporation holds a number of items that have been constructed during last 50 years. Those items less than 50 years old that have been assessed as holding no heritage significance are recorded in **Table 2**.

Table 2: Items less than 50 years old without heritage significance.

Item	Location	Remarks
Picnic facilities at Oberon Dam	Oberon Dam	Comprise of a picnic shelter and a toilet block.
Chlorinator building at Oberon Dam	Oberon Dam	Constructed during 1980/1990s.
Duckmaloi Treatment Plant	Duckmaloi 55H 0773795E, 6266510N	Used to settle water from Oberon Dam; constructed 1991.
Rydal Dam	Rydal Dam 56H 0223826E, 6292887N	New construction (1980/1990s); replaced original dam wall; condition is excellent (**Plate 24**).
Valve House at Rydal Dam	Rydal Dam Vic. 56H 0223826E, 6292887N	New construction (1980/1990s); encloses the original tin shed; condition is excellent (**Plate 25**).
Chlorinator at Rydal Dam	Rydal Dam Vic. 56H 0223826E, 6292887N	New construction (1980/1990s).
Narrowneck Pumping Station	Narrowneck	A Stage Three component of FRWS; constructed 1971; augments pressure for water to Leura.
Point Piper Pumping Station	Point Piper	Constructed 1990s; contemporary with power station.

Item	Location	Remarks
Office Block	Wallerawang Depot 56H 0226181E, 6299140N	Constructed 1980s; red brick with tin roof.
House at rear of depot	Wallerawang Depot 56H 0226181E, 6299140N	Constructed 1980s, replaced house that had burned down; extension added during 1990s; used by State Water employee; brick and tile construction.
Break Pressure Tanks 1–4	Baal Bone	Superstructure reconstructed 1999 (**Plate 36**).
Lidsdale Reservoir Tank	Lidsdale 56H 02273621E, 6301488N	Less than 50 years old, approximately contemporary with Wallerawang Power Station (1980s?); steel construction.
East Wallerawang Pumping Station	East Wallerawang 56H 227534E, 6298944N	Less than 50 years old (1990s?); in good condition; disused due to tendency to blow pipes when first constructed.
Rydal Reservoir Tank	Rydal	Steel construction.
Cullen Bullen Reservoir Tank	Cullen Bullen	Steel construction.
Point Piper Reservoir Tank	Point Piper	Steel construction.

3.3 Condition

The condition of the major State Water Corporation items included in the FRWS group ranges from fair to good (**Table 3**). All of the dams/weirs/reservoir tanks and four of the buildings retain their original – or near original – function and are still in a condition suited to their purpose. Three buildings and one break pressure tank no longer serve their original purpose; these three buildings are currently in a condition suited to their new functions. Overall, the condition of the standing structures associated with the FRWS is considered functional, however, some are in the early stages of dilapidation and will require ongoing maintenance.

Pipeline conditions vary throughout the Study Area. During the week of the current survey, numerous pipeline leaks and bursts had occurred and State Water employees had been engaged in repairs for a number of days prior to the survey. In general, newer sections of pipe remain in good condition whilst older sections are deteriorating.

Table 3: Condition of items of heritage significance.

Item	Location	Condition	Remarks
Oberon Dam	Oberon Dam	Good	Graffiti, minor alterations (safety and storage additions).
Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam	Oberon Dam	Good	Dry, well-maintained, doors functional. Some windows broken and exterior tin dented.
Bailey valve hut	Oberon Dam	Fair	Distant from buttresses and difficult to access hence protected from graffiti.
Disused chlorinator hut	Oberon Dam	Fair	Graffiti, discolouration, condition deteriorating; internal tiles dislodged.
Break pressure tank	Duckmaloi Water Treatment Plant	Good	Reeds and sediment present.
Hampton Tunnel inlet	Hampton	Fair	Concrete rot, broken lower door hinge. Other fittings intact.
Duckmaloi Weir	Duckmaloi River	Good	Still functioning as a weir.
Wallerawang Pumping Station	Portland Rd, Wallerawang	Good	Original signage intact.

Item	Location	Condition	Remarks
Inspector's House	Wallerawang Depot, 63 Portland Rd, Wallerawang	Good	Occupied by a State Water employee.
Pre-fabricated semi-cylindrical hut/workshop at Wallerawang Depot	Wallerawang Depot, 63 Portland Rd, Wallerawang	Good	Dry and well-maintained. One louver window loose.
Glen Davis Reservoir Tank	Glen Davis	Good	Minor leak.
Glen Davis pup tank	Glen Davis	Fair	Discolouration.

3.4 Integrity of fabric

The integrity of fabric varies widely as the FRWS is spread over a wide geographical area, consists of numerous buildings, pipes and dams/weirs/tanks, and was constructed and upgraded continually over a total period of more than sixty years.

Stage One fabric is only intact in a meaningful way at Oberon Dam itself. The dam wall and buttresses below the 15.25 m line retain the original Stage One concrete in good condition. The original Bailey valve hut and chlorinator retain their original Stage One building materials, however, the original working parts have been decommissioned. Finally, the workshop at Oberon Dam retains much of its original Stage One fabric and is still located in its original location at Oberon Dam. Some internal fittings have been removed and the façade has been altered.

The other key component of Stage One of the FRWS, the pipelines, does not retain intact above-ground fabric. Pipes have been upgraded and tanks have been roofed. A number of now disused, and out of *situ*, sections of original pipe are located in paddocks adjacent to the pipeline.

Stage Two fabric is intact at Oberon Dam, the Wallerawang pumping station and the Duckmaloi break pressure tank. Oberon Dam, raised to its present height during the 1950s, retains the original Stage Two components above the Stage One dam. The Wallerawang pumping station retains possibly the only extant original DPW signage at any site in the FRWS, however, the internal working parts have been altered. Of the original internal components of this building, only the pulley and chain have been retained. Finally, the Duckmaloi break pressure tank is extant but disused. Other break pressure tanks, such as that at Baal Bone Gap, retain original working parts but have seen significant modifications in the form of roofing.

Stage Three fabric is intact at Duckmaloi Weir and the Hampton Tunnel inlet. The two sites retain their original function and components with only minor modifications. Duckmaloi Weir has received a safety rail and the Hampton Tunnel inlet has seen the addition of electrical components and a solar panel. Both sites have a high degree of integrity.

Oberon Dam

Oberon Dam is in good condition. Some graffiti has defaced the lower sections of concrete between buttresses (**Plates 3**–**4**), however, this has not damaged the overall fabric of the dam. As a rare/representative example of slab and buttress concrete dam construction, Oberon Dam has much potential for future archaeological research into public works and engineering in NSW. The Dam, as a historical place, is essentially intact. The original 1940s Stage One fabric remains *in situ*, as does the additional Stage Two fabric added during the 1950s. Minor alterations have been made in recent decades to the dam in order to improve safety (fencing along the top of the dam wall – **Plate 2**) and dam site logistics (corrugated iron doors converting a number of buttresses to storage areas).

Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam

The overall condition of the pre-fabricated semi-cylindrical hut is good. The interior is dry and generally well-maintained (**Plate 10**) and the doors/locks are functional. Some windows are broken and the tin wall is dented in places, however, the shed remains in good working order and remains suited to its function (**Plates 12**–**13**). The building has seen a number of modifications, however, the overall function, structure, location, fabric and appearance have been retained.

Bailey valve hut at Oberon Dam

The Bailey valve hut is currently in fair condition (**Plate 14**). Its relative distance from the buttresses and difficulty of access has probably protected it from graffiti (unlike the old chlorinator hut and the buttresses). The hut no longer contains valve mechanisms, however, the exterior integrity of the building is high.

Chlorinator Hut at Oberon Dam

The disused chlorinator hut is currently in fair condition. Graffiti on the southern walls testify to the building's current disuse (**Plate 17**), as the new chlorinator building is fenced and is therefore protected from graffiti. The exterior concrete walls are showing signs of discolouration, particularly near the base of the walls. The building's original fabric has largely been retained, however, its condition is deteriorating and its original function has been discontinued. Some internal wall tiles have been dislodged (**Plate 16**). No chlorination facilities are currently housed in the building.

Break pressure tank at Duckmaloi Treatment Plant

The overall condition of the break pressure tank is good. The original fabric of the Duckmaloi break pressure tank is intact and in good condition. No intrusive elements, other than vegetation, are present. Fittings, such as the screening chamber grill, are extant. The northern floor of the concrete channel is dominated by reeds (**Plate 19**), however, the southern end of the channel is relatively clear of vegetation. Water and sediment were present in the screening chamber outlet on the day of the study (**Plate 20**).

Hampton Tunnel

The building's condition is fair. Concrete rot is evident and the lower door hinge is broken (**Plate 23**). All other fittings are intact. The working parts and building fabric of the Hampton Tunnel inlet chamber are intact and largely original (with the exception of the additions of electrical components and solar panel). The condition of the original building fabric is fair and some components (e.g. door hinge) are in need of replacement.

Duckmaloi Weir

The weir is in good condition, both in terms of its fabric and functionality (**Plate 23**). The weir's original fabric has been retained and its past appearance and function remain intact.

Wallerawang Pumping Station

The building is well maintained and in good condition. The archaeological value of the building consists of the original signage (possibly the only remaining example of original DPW signage at any of the State Water FRWS assets – **Plate 26**) and the original pulley system, capable of lifting a maximum weight of 1.5 tons (**Plate 27**). The building's structure and fabric are largely intact and preserve its historical integrity. The original working parts of the building, however, were almost all

replaced at the time of its conversion to its new role. As such, the building retains much of its historical integrity whilst continuing to serve a new functional purpose.

Wallerawang Depot

Inspector's House at Entrance to Wallerawang Depot: 63 Portland Rd/Pipers Flat Road

The house is a red brick building and consists of brick walls at the front of the house with weatherboard additions at the rear, a tin roof, concrete verandah and new windows/extensions (**Plate 28**). The house façade consists of a central door flanked by one window on each side. The roof is recent and constructed with mid to dark green corrugated metal (Colourbond). Whilst the house is over 50 years old, it underwent significant alterations following 1967. These alterations – including the more recent alterations such as the roof – are now as much a part of the fabric of the house as the original fabric.

Prefabricated Semi-Cylindrical Hut/Workshop at Wallerawang Depot

The overall condition of the pre-fabricated semi-cylindrical hut is good. The shed remains in good working order and remains ideal for its function. The interior of the shed is dry and well maintained and used for vehicle/equipment storage and as a workshop. All of the small windows situated at approximately 3 m above ground height are intact and in good condition. One louver window is loose on the western side of the shed. The building was re-located to Wallerawang Depot from Oberon Dam prior to 1968. During the 1970/1980s a brick façade replaced the original façade (**Plate 29**); whilst this altered the appearance of the workshop significantly when viewed from the north, the modification broadly retained the pre-existing window/door configuration. The remaining original fabric is in good condition.

Glen Davis Reservoir

Whilst much of the original fabric of the reservoir complex is intact, the new roofing is a significant alteration. The discolouration of the pup tank concrete indicates that the condition of its original fabric is deteriorating.

Glen Davis Reservoir Tank

The reservoir tank is in good condition, although a minor leak was evident on the day of the survey.

Pup Tank

The pup tank in fair condition and shows significant concrete discolouration (**Plate 32**).

Archaeological potential

A number of concrete building foundations and steps are located immediately outside the front gate of the Glen Davis Reservoir complex. These foundations are potentially the remains of workshops associated with the construction of the Fish River Water Supply (FRWS).

3.5 Possible threats

As the FRWS continues to provide water to both major corporate and government customers, as well as individual consumers, it is vital that essential maintenance and upgrades continue. The component of the system requiring the most constant and urgent maintenance is the pipeline, a fact reflected in the high tempo of pipe work conducted immediately prior to and during the current study. Additionally, some buildings exist in a deteriorating state and currently require repairs (for example the door hinge at the Hampton Tunnel inlet).

4.0 Assessment of Significance

4.1 Introduction to the Significance Assessment process

Significance assessment of non-Indigenous sites is conducted in accordance with *NSW Heritage Act 1977* requirements and is guided by the Heritage Council of NSW manual *Assessing Heritage Significance* (Heritage Council of NSW 2001). Significance assessments are carried out by qualified heritage professionals on behalf of clients in order to document and catalogue items of heritage significance on s170 registers held by clients and submitted to the Heritage Council of NSW.

The significance assessment process is a three-stage process:

- Step 1: Investigate significance;
- Step 2: Assess significance; and
- Step 3: Manage significance.

4.2 Basis of Assessment

Significance assessments are carried out on the basis that decisions about the future of heritage items must be informed by an understanding of these items' heritage values. Four categories of heritage value are recognised in the Australia ICOMOS *Burra Charter* (Australia ICOMOS 1999):

- Historic significance;
- Aesthetic significance;
- Scientific significance; and
- Social significance.

Under the Heritage Council of NSW guidelines (2001), these values have been adjusted to conform to seven criteria for assessment:

- **Criterion (a):** An item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area);
- **Criterion (b):** An item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area);
- **Criterion (c):** An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);
- **Criterion (d):** An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;
- **Criterion (e):** An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);
- **Criterion (f):** An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area);

- **Criterion (g):** An item is important in demonstrating the principal characteristics of a class of NSW's
    - cultural or natural places; or
    - cultural or natural environments.

Items are categorised as having Local or State level significance. The level of significance is assessed in accordance with the geographical extent of the item's value. An item of State significance is one that is important to the people of NSW whilst an item of Local significance is one that is principally important to the people of a specific Local Government Area (LGA).

In addition to a level of significance, items are assessed as having one of the following grades of significance (Heritage Office of NSW 2001):

- **Exceptional:** an item whose elements are rare or outstanding and contribute directly to its heritage value;
- **High:** an item that retains a high level of original fabric and where the significance is not reduced by alterations;
- **Moderate:** an item whose elements are not themselves of heritage value but which contribute to the overall significance of the item; contains alterations and modifications;
- **Little:** an item that is difficult to interpret and whose altered / modified elements detract from significance; or
- **Intrusive:** an item whose elements damage its heritage value.

Thus, an item may be said to hold **High State significance** if it satisfies one or more of the above criteria, is important to the people of NSW as a whole and retains most of its original fabric.

4.3 Historical themes

Heritage sites should, in some way, contribute to our understanding of the major themes in Australia's and NSW's history. The FRWS is a key component of the development of public infrastructure in NSW during the middle years of the twentieth century and, as such, informs our understanding of the following National and State themes:

- National theme #3. Developing local, regional and national economies
    - State themes: Environment – cultural landscape; industry; mining
- National theme #4. Building settlements, towns and cities
    - State themes: Towns, suburbs and villages; utilities
- National theme #5. Working
    - State theme: Labour
- National theme #7. Governing
    - State themes: Defence; government and administration

National theme #3: Developing local, regional and national economies / State themes: Environment – cultural landscape; industry; mining

The idea for the FRWS developed around 1937 at a time when the communities of the western Blue Mountains – Blaxland Shire, Oberon and Lithgow – were suffering chronic water shortages. The drought of 1940–43 exacerbated the problem. In order to develop the economies of, and provide services to, these communities, various plans (including dams at Thompson's Creek, Wollangambe stream, Running Stream Creek, Middle River, and Fish River) were proposed that eventually coalesced to form the FRWS proposal. Prior to the entry of the Commonwealth, Oberon Dam and the FRWS were intended to provide water to these communities, with the foresighted Stephen Jones (Principal Engineer, Water Supply and Sewerage) also envisaging a large-scale secure inland water storage facility in the event of war. Jones also saw in the FRWS the seeds of a supply scheme for the communities east of Lithgow. Taking the scheme from plan to reality, however, was a slow process and only facilitated by the entry of the Commonwealth following Japan's entry into WWII.

The Commonwealth's rationale for developing the FRWS was to provide water to the Glen Davis oil shale refinery in order to maximise an Australian source of petroleum for the war effort. Delays due to bureaucracy, debate, supply and labour-shortages resulted in the greatest irony of the entire project: Oberon Dam did not supply water to Glen Davis before the end of the war. The Commonwealth Government's finances therefore funded a supply system that never achieved its stated aim of providing water to a secure wartime petroleum supply.

Despite the failure of the FRWS as a support to Australia's war effort, the FRWS had clear benefits to the communities whose water shortages had provided the original impetus for planning. Indeed, these communities had gained significant local infrastructure with Commonwealth funding. The scheme's construction contained significant examples of engineering innovation, particularly in the design of Oberon Dam. The FRWS has continued to supply the mining (oil shale) and power industries, and Delta Electricity remains one of the scheme's four major customers. Finally, the scheme is an important feature in the cultural landscape of the region, providing employment and recreational facilities in addition to supplying water.

National theme #4. Building settlements, towns and cities / State themes: Towns, suburbs and villages; utilities

Whilst the FRWS was eventually approved in order to supply water to Glen Davis oil shale refinery during WWII, the earlier proponents of the scheme advocated its construction for the purpose of providing a necessary utility – water – to the communities of Oberon, Lithgow, Portland and Wallerawang. Ultimately the FRWS served these latter interests rather than the former. Incomplete before the cessation of hostilities, the stated aim of providing water to Glen Davis for defence needs did not come to fruition. Instead, the FRWS did become a stable and secure water supply for local communities and industrial customers, brought infrastructure upgrades in the form of improved roads, and eventually contributed to the recreational and cultural activities of the communities.

National theme #5. Working / State theme: Labour

Stage One of the FRWS was constructed by the Civil Constructional Corps (CCC), a government agency established to construct defence-related works throughout Australia. This organisation has received little attention in the annals of Australia's industrial history and the story of the FRWS enables at least one part of the CCC's story to be told.

Until late 1945, the FRWS workforce was predominantly composed of drafted and voluntary Civil Constructional Corps (CCC) labour. The CCC was a Commonwealth Government organisation under the control of the Allied Works Council known as 'the Army behind the Army' (McLachlan 1997, p. 43). The CCC's primary tasks were to construct and repair roads, airfields, harbours, Army camps, and other similar works relating to Australia's defence. CCC workers participated in the construction of Oberon Dam between September 1943 and October 1945. Following the disbandment of the CCC, many ex-CCC men remained working on the FRWS as contract labourers.

The CCC was accused by many (including Commonwealth Treasurer Ben Chifley) of cost-ineffectiveness and inefficiency, and by some within the military of shirking military service. Despite the high wages and delays associated with CCC projects such as FRWS, some of these accusations are difficult to sustain. Delays were generally associated with late or non-delivery of materials and the CCC workers cannot be held responsible for a slow supply chain. Against the accusation of avoidance of military service, it must be pointed out that the age of the average CCC worker was above that of the preferred soldiering age. Furthermore, the CCC was the means by which the Commonwealth was able to mobilise the construction of works vital to Australia's defence at a time when labour was in short supply.

Very little material evidence remains to illustrate the lives and experiences of the workers (both DPW and CCC) during construction of the FRWS other than two pre-fabricated semi-cylindrical workshop huts, one at Oberon Dam and the other at Wallerawang Depot. Camp-sites were dismantled and moved to other sites when works were completed, leaving little built heritage extant. Nevertheless, the extant infrastructure of the scheme itself – Oberon Dam, Hampton Tunnel and 236 km of pipelines built through rugged, steep terrain – remains as a testament to the fortitude and skills of the construction crews.

National theme #7. Governing / State themes: Defence; government and administration

The story of the FRWS illustrates the nature of the political landscape of the 1930s and 1940s. The early history of the FRWS is characterised by proposals, counter-proposals, debates and delays. Party politics played a delaying role at various points in the establishment process – particularly following the election of the Labor Party to the NSW Parliament in 1941. However, the most fundamental delaying factor was the search for funds. Until the Commonwealth Government saw the potential of the FRWS as a secure water supply for Glen Davis, the local councils and the State Government were in no position to implement such a major work.

The factor that convinced Sir Harry Brown and the Commonwealth Government to lend its support to the project was the now urgent need for indigenous petroleum supplies, made so by the entry of Japan into WWII in December 1941. Glen Davis oil shale refinery was seen as a secure source of petroleum and the FRWS (already proposed as a means of providing community water needs) became the preferred option as the water supply for the refinery operation. This need led to the approval of Commonwealth funding for the water scheme and work commenced in 1943. Ironically, the cornerstone of the FRWS – Oberon Dam – was not to become operational until shortly after the end of the war.

Other elements of Stage One illustrate the defensive outlook of Australian society during the war years. Pipelines were buried at creek crossings rather than raised in order to prevent observation from the air by enemy aircraft. Much of the buried infrastructure has become visible as a result of erosion in recent years, testifying to changing priorities and concerns (**Plates 34–35**). Similarly, the only remaining physical components of the construction process – the pre-fabricated semi-cylindrical

huts – were commonly used by Allied militaries from the First World War onwards. As such, they illustrate the architecture available to military forces and allied organisations (such as the CCC) during the WWII and immediately post-War years.

4.4 Summary of evaluation of Significance

The FRWS was one of NSW's major infrastructure projects during WWII, demonstrating considerable engineering ingenuity and effort. The centrepiece item within the FRWS, Oberon Dam, is a rare example of slab and buttress concrete dam construction in NSW – in fact it was the first such dam built in the State. Two items held by State Water – the pre-fabricated semi-cylindrical huts/workshops at Oberon Dam and Wallerawang Depot – are representative examples of a form of military architecture in use throughout the UK, USA and Australia during WWII. The FRWS Complex is an item of **High State Significance** as its various elements fulfil the criteria of historical, social, scientific, rarity and representative significance. Construction of the scheme commenced over fifty years ago and was completed forty-five years ago. **Table 4** summarises the specific significance evaluations of each complex/item of heritage significance held by State Water.

Table 4: Summary of significance evaluations.

Serial	Item	Location	Grade of Significance	Level of Significance	Applicable Criteria
Complexes					
1	**FRWS Complex**	**Oberon, Hampton, Rydal, Wallerawang, Portland, Cullen Bullen, Baal Bone, Glen Davis, Leura, Lithgow**	**High**	**State**	**a, c, d, e, f, g**
2	**Oberon Dam Complex**	**Oberon Dam**	**High**	**State**	**a, c, d, e, f, g**
	Oberon Dam	Oberon Dam	High	State	a, c, d, e, f, g
	Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam	Oberon Dam	High	Local	a, f, g
	Bailey valve hut	Oberon Dam	Moderate	Local	a
	Disused chlorinator hut	Oberon Dam	Moderate	Local	a
3	**Wallerawang Depot Complex**	**Wallerawang Depot, 63 Portland Rd, Wallerawang**	**High**	**Local**	**a, c, f, g**
	Inspector's House	Wallerawang Depot, 63 Portland Rd, Wallerawang	High	Local	a, c, g
	Pre-fabricated semi-cylindrical hut/workshop at Wallerawang Depot	Wallerawang Depot, 63 Portland Rd, Wallerawang	Moderate	Local	a, f, g
4	**Glen Davis Reservoir Complex**	**Glen Davis**	**Moderate**	**Local**	**a, d**
	Glen Davis Reservoir Tank	Glen Davis	Moderate	Local	a, d
	Glen Davis pup tank	Glen Davis	Little	Local	a, d
Individual Items					
5	Break pressure tank	Duckmaloi Water Treatment Plant	Moderate	Local	a
6	Hampton Tunnel inlet	Hampton	Moderate	Local	a, d
7	Duckmaloi Weir	Duckmaloi River	Moderate	Local	a, c, e, g
8	Wallerawang Pumping Station	Portland Rd, Wallerawang	High	Local	a, f

4.5 Discussion

Oberon Dam

As part of the FRWS, Oberon Dam's various elements fulfil the criteria of historical, social, scientific, rarity and representative significance. It was one of NSW's major infrastructure projects during WWII, demonstrating considerable engineering ingenuity and effort. As the centrepiece item within the FRWS, Oberon Dam is a rare example of slab and buttress concrete dam construction in NSW – in fact it was the first such dam built in the State. The earlier phases of the dam construction are visible and in good condition. Oberon Dam is over 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. It is assessed to be of **High State Significance**.

The dam is a significant historical structure and a main component of the FRWS, with dam construction taking place between 1943 and 1959. It is a significant public engineering structure which continues to function in accordance with its design and has also gained new roles, not least of which has been recreation. It has undergone improvements and maintenance works, but continues to retain much of its original fabric and function. Plaques at the top of the dam and a soon-to-be-placed new plaque serve as interpretive tools. The dam is situated on the eastern side of Lake Oberon, allowing the visitor to take advantage of views over an area of significant natural beauty. The positioning of the more functional components of the dam complex – the chlorinator buildings and Bailey Valve Hut – below the original spillway removes these from the view of the general public thus allowing pleasing vistas from the picnic area in all directions. The whole complex has social importance due both to its role in the management and supply of water, to both large customers such as power stations and domestic/agricultural customers, and its association with a works programme organised, funded and implemented during World War II and the immediate post-War years using the CCC. The complex has gained additional importance as a site for recreation in the form of boating, fishing, picnics, and even Army Cadet exercises. Oberon Dam represents innovation in dam building in NSW. Not only was this the first Ambursen slab and buttress concrete dam built in NSW, the construction process involved experimentation with various concrete mixes and slab designs, both on-site and via scale models in Sydney. Oberon Dam is intact. The original 1940s Stage One fabric remains *in situ*, as does the additional Stage Two fabric added during the 1950s. Minor alterations have been made in recent decades to the dam in order to improve safety (fencing along the top of the dam wall) and dam site logistics (corrugated iron doors converting a number of buttresses to storage areas). Minor defacement of the area amongst the buttresses has occurred in the form of spray-painted graffiti, however, this has not damaged the overall fabric of the dam.

Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam

The pre-fabricated semi-cylindrical hut at Oberon Dam is an item of high local heritage significance. As part of the Fish River Water Supply (FRWS) it fulfils the criteria of historical, rarity and representative significance. The FRWS was one of NSW's major infrastructure projects during World War II and the pre-fabricated semi-cylindrical hut is one of the few remaining items relating directly to its construction phase. The pre-fabricated semi-cylindrical hut is also a representative example of a form of military architecture invented during World War I and adapted for use throughout the UK, USA and Australia during and after WWII. Whilst this type of building is not in itself rare in NSW or Australia, other evidence of the construction phase of the FRWS is now virtually non-existent. The pre-fabricated semi-cylindrical hut is over 50 years old and is automatically afforded protection under Part 1 of the *Heritage Act 1977*. It is assessed to be of **High Local Significance**.

The building derives its heritage significance from its association with Oberon Dam/Fish River Water Supply (FRWS), two complexes of State heritage significance. The building was used during Stage One construction and clearly demonstrates the nature of facilities available during the construction of WWII-era major works. Such buildings are not rare in NSW/Australia; however, this pre-fabricated semi-cylindrical hut/workshop is one of the few surviving features of the Oberon Dam construction phase. Whilst the Stage One fabric of the dam is intact, most buildings and locations (other than this item) serving the needs of construction crews have been removed. As such, this building is a rare remnant of the infrastructure associated with the construction of the FRWS and is a good example of this type of structure. The item is in good working order and has the potential to be a valuable interpretive element that assists in understanding the construction phase of Oberon Dam. The building has seen a number of modifications, however, the overall function, structure, location, fabric and appearance have been retained.

Bailey valve hut at Oberon Dam

The now disused Bailey valve hut at Oberon Dam is a simple concrete building that derives significance from its association with the Oberon Dam Complex. Historically, very little information exists regarding this structure. It was an integral component in the original operation of the FRWS and it acquires its significance through association with the overall FRWS scheme. The Bailey valve hut is associated with Stage One of the FRWS, is over 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. It is assessed to be of **Moderate Local Significance**.

Disused chlorinator hut at Oberon Dam

The now disused chlorinator hut is a simple concrete building that derives heritage significance from its association with the Oberon Dam complex. Very little historical information exists relating to this structure. It was an integral component in the original operation of the FRWS, and it acquires its significance through association with the overall FRWS scheme. The chlorinator hut is over 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. It is assessed to be of **Moderate Local Significance**.

Duckmaloi Water Treatment Plant/Break pressure tank

The Duckmaloi Water Treatment Plant is dominated by c. 1991 sediment settling infrastructure. In addition to the relatively recent structures associated with sediment settling, the complex contains a concrete break pressure tank associated with Stage Two of the FRWS. The Duckmaloi break pressure tank derives significance from its association with the overall FRWS. It enabled the water supply provided by Oberon Dam to be augmented with, or replaced by, that provided by Duckmaloi Weir and was thus a key component of Stages Two and Three of the overall scheme. The break pressure tank is over 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. It is assessed to be of **Moderate Local Significance**.

Hampton Tunnel

The Hampton Tunnel inlet chamber has little heritage significance in itself, but its association with the engineering feat of constructing the Hampton Tunnel gives it an associated significance. Furthermore, it derives significance from its association with the overall FRWS. The construction of the Stage Two and Three works, of which the Hampton Tunnel inlet is one local above-ground component, brought great changes to the Hampton community as roads were improved in order to service the construction effort. The Hampton Tunnel derives social significance from its impact on the Hampton community. The Hampton Tunnel is approximately 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. It is assessed to be of **Moderate Local Significance**.

Duckmaloi Weir

Duckmaloi Weir is a small, unremarkable weir in a difficult to access location. It derives its heritage significance through its association with the FRWS. Duckmaloi Weir augmented the water supply provided by Oberon Dam and was a key component of Stage Three of the overall scheme. Whilst the weir itself is of unremarkable construction, the weir is located on a curved stretch of the picturesque Duckmaloi River. The upstream side of the weir has formed an ideal platypus habitat, whilst a number of large rocks forming excellent photography platforms are located immediately downstream from the weir. The platypus colony has been the focus of scientific (ecological) research at various points during the last two decades. Duckmaloi Weir is representative of mass concrete overshot weirs and of mid-twentieth century public works programmes. The Duckmaloi Weir is associated with Stage Three of the FRWS and is 45 years old. Thus, it is not automatically afforded protection under the *NSW Heritage Act 1977*. Given its fundamental importance to both Stages Two and Three it is, nevertheless, assessed to be of **Moderate Local Significance**.

Wallerawang Pumping Station

The (former) Wallerawang Pumping Station (now chlorination facility) is a simple brick building that derives its significance from its association with the FRWS and from the extant original signage on the building's façade. It was constructed in conjunction with the Stage Two/Three extension of the Fish FRWS to Wallerawang. The building is in good condition, the history of the FRWS is preserved in the signage and the building is situated in an obvious location easily seen and appreciated by the lay person. Very little additional historical information exists relating to this structure. This building contains the only original DPW signage on a State Water FRWS asset. Given the building's new function, the signage is a link with the building's – and the FRWS's – past. The building's structure and fabric are largely intact and preserve its historical integrity. The original working parts, however, were almost all replaced at the time of its conversion to its new role. As such, the building retains much of its historical integrity whilst continuing to serve a new functional purpose. The Wallerawang Pumping Station is over 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. It is assessed to be of **High Local Significance**.

Inspector's House

The Inspector's house at 63 Portland Rd, Wallerawang is a significant component of the FRWS/State Water Wallerawang Depot. It was suggested to the author that the Inspector's House had already been listed as a heritage item (Robert Nolan, pers. comm.), however, a search of the Greater Lithgow LEP revealed that this is not the case (Lithgow LEP: Schedule 1). It is a structure that is typical of housing in Wallerawang, but it is in good condition and in a visible location. It remains in use by State Water FRWS staff. The house derives heritage significance from its association with Wallerawang Depot, a complex of Local heritage significance, and FRWS, a complex of State heritage significance. The building was used to house the FRWS Inspector and clearly demonstrates the nature of facilities associated with the management of the FRWS. The house is in good condition and is an attractive component of the street-scape, helping to mask the more utilitarian depot buildings to its rear. This item is representative of housing in Wallerawang constructed during the late Victorian period (c. 1880–1900[1]). The house at 63 Portland Rd, Wallerawang is over 50 years old and is automatically

[1] The exact date of construction has not been determined accurately. However, the building style suggests a late Victorian date: probably associated with the growth of Wallerawang following the construction of the railway in 1870.

afforded protection under Part 1 of the *Heritage Act 1977*. It is assessed to be of **High Local Significance**.

Pre-fabricated semi-cylindrical hut/workshop at Wallerawang Depot

The pre-fabricated semi-cylindrical hut at Wallerawang Depot is an item of moderate local significance. As part of the FRWS, it fulfils the criteria of historical, rarity and representative significance. Its removal from its original location and the addition of a brick façade diminish the heritage significance of the building, however, the fact that it has been present at the site since at least the 1960s indicates that it has been an integral part of the fabric of the depot for at least four decades. The FRWS was one of NSW's major infrastructure projects during World War II (WWII), and the pre-fabricated semi-cylindrical hut is one of the few remaining items relating directly to its construction phase. The pre-fabricated semi-cylindrical hut is also a representative example of a form of military architecture invented during World War I and adapted for use throughout the UK, USA and Australia during and after WWII. Whilst this type of building is not in itself rare in NSW or Australia, other evidence of the construction phase of the FRWS is now virtually non-existent. The building derives significance from its association with Wallerawang Depot, a complex of Local heritage significance, and the FRWS, a complex of State heritage significance. The building was used during Stage One of construction and clearly demonstrates the nature of facilities available during the construction of WWII-era major works. The pre-fabricated semi-cylindrical hut/workshop is one of the few surviving features of the FRWS construction phase as most buildings and locations serving the needs of construction crews have been removed. This building is a good example of this type of structure. The item is in good condition and has the potential to be an interpretive element that assists in understanding the construction phase of Oberon Dam and the evolution of the depot at Wallerawang.The pre-fabricated semi-cylindrical hut is over 50 years old and is automatically afforded protection under Part 1 of the *Heritage Act 1977*. It is assessed to be of **Moderate Local Significance**.

Glen Davis Reservoir

The Glen Davis Reservoir complex derives its heritage significance from its association with the FRWS, a complex of State heritage significance. The reservoir tank is a Stage One item and reflects the importance of the Glen Davis oil shale refinery to the Australian war effort during WWII. The complex has social importance due both to its role in the management and supply of water, to both large customers such as the Glen Davis oil shale refinery and small domestic/agricultural customers located in and around Glen Davis township, and its association with a works programme organised, funded and implemented during World War II and the immediate post-War years using the CCC. The **Glen Davis Reservoir Complex** is over 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. It is assessed to be of **Moderate Local Significance**.

Glen Davis Reservoir Tank. The original fabric of the reservoir tank is over 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. The heritage value of the reservoir tank itself is assessed to be of **Moderate Local Significance**. It has good historical associations but the fabric, namely the roof, has been altered from the original.

Pup Tank. The original fabric of the pup tank is over 50 years old and is automatically afforded protection under the *NSW Heritage Act 1977*. The heritage value of the pup tank alone is assessed to be of **Little Local Significance** due to its unremarkable nature and fair condition. It has some significance due to its association with Stage One construction and the fact that some extant fittings are original.

4.6 Management options

The following management options should be understood in the context of the *Burra Charter* definitions of maintenance and repair: *Maintenance* means the continuous protective care of the *fabric* and *setting* of a *place*, and is to be distinguished from repair. Repair involves *restoration* or *reconstruction*. (Australia ICOMOS 1999, Clause 1.5).

The purpose of this report was to assess the heritage significance of assets related to the FRWS, not to provide detailed management options on how these assets should be maintained or conserved.

In general, however, the authors hold that the following principals should be applied when considering management options for those items holding heritage significance. These include:

- Management options can not preclude the maintenance of the water supply scheme as it provides an essential service.
- Assets assessed as holding **State Heritage Significance** (Oberon Dam complex and the FRWS as a whole) should be managed so that the essential heritage features of these assets are maintained. Thus:
    - If sections of Stage One or Stage Two pipelines need to be replaced, the existing steel/concrete pipe should be left in place where possible; and
    - If assets identified in this report as holding heritage significance need to be replaced or substantially altered, the present structures should be the focus of a detailed assessment and recorded to archive quality: if it is not possible to leave them in place.
- Assets holding **Local Heritage Significance** should be maintained *in situ* if possible. If this is not possible then a detailed assessment and recording to an archival quality should be undertaken prior to the structure's demolition.

4.7 Relevant Legislation

Cultural heritage is managed by a number of State and National Acts. **Sections 4.7.1** and **4.7.2** summarise the legislative requirements in relation to heritage assets and development proposals.

4.7.1 State legislation

NSW Heritage Act 1977

This Act established the Heritage Council of NSW. The Heritage Council's role is to advise the government on the protection of heritage assets, make listing recommendations to the Minister in relation to the State Heritage Register, and assess/approve/decline proposals involving modification to heritage items or places listed on the Register.

Most proposals involving modification are assessed under Section 60 of the *NSW Heritage Act 1979*. Developments classified as Major Projects or Critical infrastructure are assessed under Part 3A of the *Environmental Planning and Assessment Act 1979*.

Automatic protection is afforded to 'relics', defined as 'any deposit or material evidence relating to the settlement of the area that comprised New South Wales, not being Aboriginal settlement, and which is fifty or more years old'. Excavation of land on which it is known or where there is reasonable cause to suspect that 'relics' will be exposed, moved, destroyed, discovered or damaged is prohibited unless ordered under an excavation permit.

Environmental Planning and Assessment Act 1979 (EP&A Act)

This Act established requirements relating to land use and planning. The four areas controlled by the Act are:

- Part 3: environmental planning instruments, including cultural heritage;
- Part 3A: approvals process for Major Projects;
- Part 4: local government development assessments, including heritage. May include schedules of heritage items; and
- Part 5: environmental impact assessment requirements (for those developments not assessed under Part 3A or requiring consent under Part 4). State owned heritage items listed on LEPs are governed by Part 5.

National Parks and Wildlife Act 1974 (NPW Act)

This Act is administered by NSW Department of Environment and Climate Change (DECC). DECC manages NSW parks, natural heritage and cultural heritage. The National Parks and Wildlife Act 1974 contains provisions for the protection of Indigenous archaeological items and sites and register of Indigenous sites is maintained by DECC. Unless relating to a Part 3A EP&A Act proposal, Indigenous cultural material is managed under Section 91 (reporting) of the NPW Act, and Section 90 (excavation). Cultural heritage is grounds for a Stop Work order under the provisions of the NPW Act.

4.7.2 National legislation

Environmental Protection and Biodiversity Conservation Act 1999.

Amendments in 2003 established the National Heritage List and the Commonwealth Heritage List, both administered by the Commonwealth Department of the Environment and Heritage (DEH). Ministerial approval is required for proposals involving significant impacts to National / Commonwealth heritage places. Additionally, the Australian Heritage Council maintains the Register of the National Estate (RNE).

Australian Heritage Council Act 2003

This Act established the Australian Heritage Council as an independent advisory body regarding National / Commonwealth heritage places. The Council conducts assessments of listing nominations, advises the Minister for Environment and Heritage, maintains the RNE, and promotes the assessment and conservation of heritage items.

5.0 Conclusion and Recommendations

5.1 Introduction

The FRWS as a whole is an example of engineering innovation on a grand scale. The Oberon Dam, the centrepiece of the supply system, was the first dam of its kind in NSW and it remains as an example of only one of two such dams in the State. The vast bulk of the scheme is gravity-fed, a remarkable achievement given the terrain through which the system transports water. Stage One of the project was characterised by experimentation, both in the Manly Hydraulics Laboratory in Sydney and on-site. The original (Commonwealth) rationale for the project, the involvement of the CCC, the system's construction during World War II, the deliberate camouflaging/burial of pipelines, and the ongoing presence of pre-fabricated semi-cylindrical huts testify to the FRWS's association with Australia's wartime defensive projects. The FRWS remains the basis of the region's water infrastructure and is therefore significant both as a practical service for the local economy/community and as a collection of items with a range of heritage values.

5.2 Recommendations

The purpose of this report was to assess the heritage significance of assets related to the FRWS, not to provide detailed management options on how these assets should be maintained or conserved.

In general, however, the authors hold that the following principals should be applied when considering management options for those items holding heritage significance. These include:

- Management options can not preclude the maintenance of the water supply scheme as it provides an essential service.
- Assets assessed as holding **State Heritage Significance** (Oberon Dam complex and the Fish River Scheme as a whole) should be managed so that the essential heritage features of these assets are maintained. Thus:
    - If sections of Stage One or Stage Two pipelines need to be replaced, the existing steel/concrete pipe should be left in place where possible; and
    - If assets identified in this report as holding heritage significance need to be replaced or substantially altered, the present structures should be the focus of a detailed assessment and recorded to archive quality: if it is not possible to leave them in place.
- Assets holding **Local Heritage Significance** should be maintained *in situ* if possible. If this is not possible then a detailed assessment and recording to an archival quality should be undertaken prior to the structure's demolition.
- **Conservation Heritage Register.** In accordance with Section 170 of the *NSW Heritage Act* (1977), all items assessed as holding **Heritage Significance** ought to be included in the State Water Conservation Heritage Register.
- **Conservation Management Plans (CMPs).** In accordance with Section 170 of the *NSW Heritage Act* (1977), State Water ought to prepare CMPs for all items or item complexes assessed as holding **Heritage Significance**.

- **Local Environment Plan (LEP)/Regional Environment Plan (REP).** State Water ought to notify the relevant Local Government Authority of the identification of items of **Heritage Significance** in order to list them on the relevant LEP/REP, where applicable.
- **Statement of Heritage Impact (SOHI).** State Water should prepare a SOHI prior to the commencement of any rehabilitation, modifications or other works that may alter the function, fabric and/or design of items or item complexes assessed to be of **Heritage Significance**.

7.0 References

ABC 2009 — ABC, 28 Apr 2009. 'Lithgow looks to "drought-proofing" plan, *ABC News*, http://www.abc.net.au/news/stories/2009/04/28/2554253.htm.

Australia ICOMOS 1999 — Australia ICOMOS Inc. 1999, *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*. Brochure produced for Australia ICOMOS.

Fernando 2007 — K. Fernando 2007, *Fish River Water Supply: Strategy Study for Stage 2*. NSW Department of Commerce.

Jamieson and Cantwell 1958 — L. N. Jamieson and B. L. Cantwell, The Fish River Water-Supply Development. *The Journal* June pp. 159 – 168.

McLachlan 1997 — R. McLachlan 1997, *Let's Have Water: A History of the Fish River Water Supply*. Department of Land and Water Conservation.

Nichols et al 2007 — K. Nichols, J. Nichols, R. Hay, Y. Bain 2007, *Oberon Local Government Area: Local Environmental Study*. HDB Town Planning & Design report for Oberon Council.

Farmer and Edwards 1967 — E.H. Farmer & '[?]Edwards' 1967, Department of Public Works NSW, *Inspector's Residence, Fish River Water Supply Depot, Wallerawang: Proposed Alterations and Repairs*, Architectural drawing held at State Water Wallerawang Depot

NSW DPW 1968 — NSW Department of Public Works 1968, *Bathurst District, Proposed Repairs and Alterations to Fish River Water Supply Depot at Wallerawang, Drawing no. 1011-C*, Architectural plan held at State Water Wallerawang Depot

NSW DPW 1981 — NSW Department of Public Works 1981, *Fish River Water Supply Wallerawang Depot Detail and Contour Plan*, Site plan held at State Water Wallerawang Depot

NSW DPWS 2002 — NSW Department of Public Works and Services 2002, *Capacity Assessment of Pumping Stations*. Report for Fish River Water Supply and Department of Land and Water Conservation.

Stuart 2005 — I. Stuart 2005, Of the hut I bolted: A preliminary account of prefabricated semi-cylindrical huts in Australia, *Historic Environment*, 19:1, pp. 51 – 57

SWC 2007 — State Water Corporation 2007, *Environment Management Plan: 2006-2011*. Update June 2007, State Water Corporation.

Plates

Plate 1: Oberon Dam, showing dam wall buttresses and ski-jump spillway. View is from west.

Plate 2: Oberon Dam, showing parapet, safety fencing and control tower. View is from west.

Plate 3: Oberon Dam, showing detail of graffiti within buttress area. View is from north.

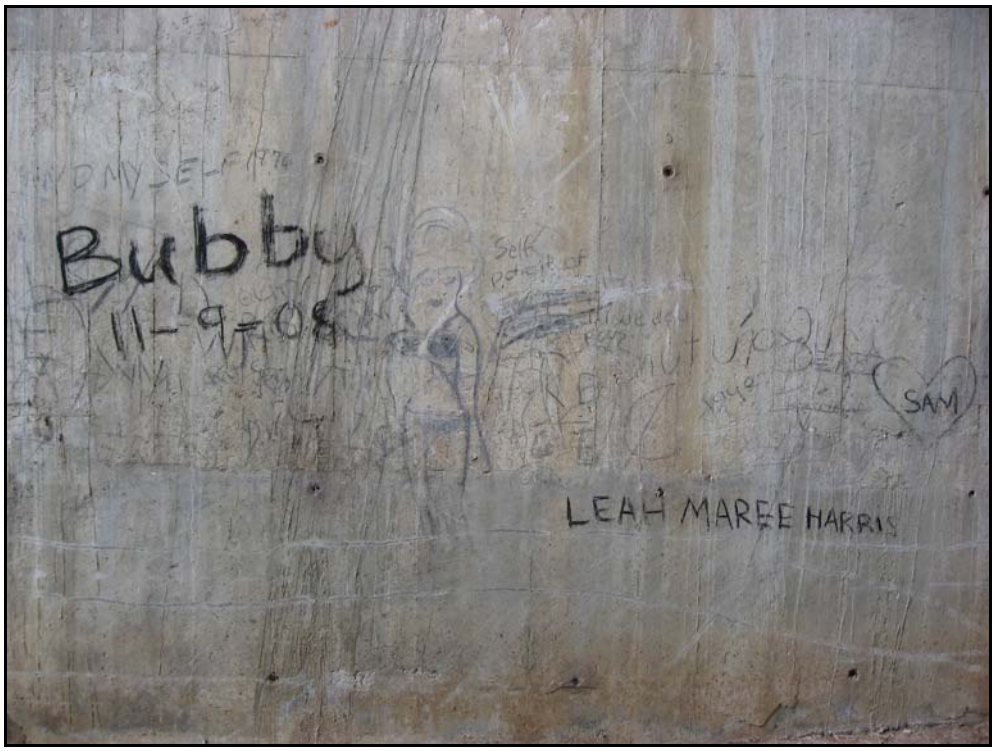


Plate 4: Oberon Dam, showing detail of graffiti within buttress area. View is from west.

Plate 5: Oberon Dam, detail of Plaque 1. View is from north.

Plate 6: Oberon Dam, detail of Plaque 2. View is from north.

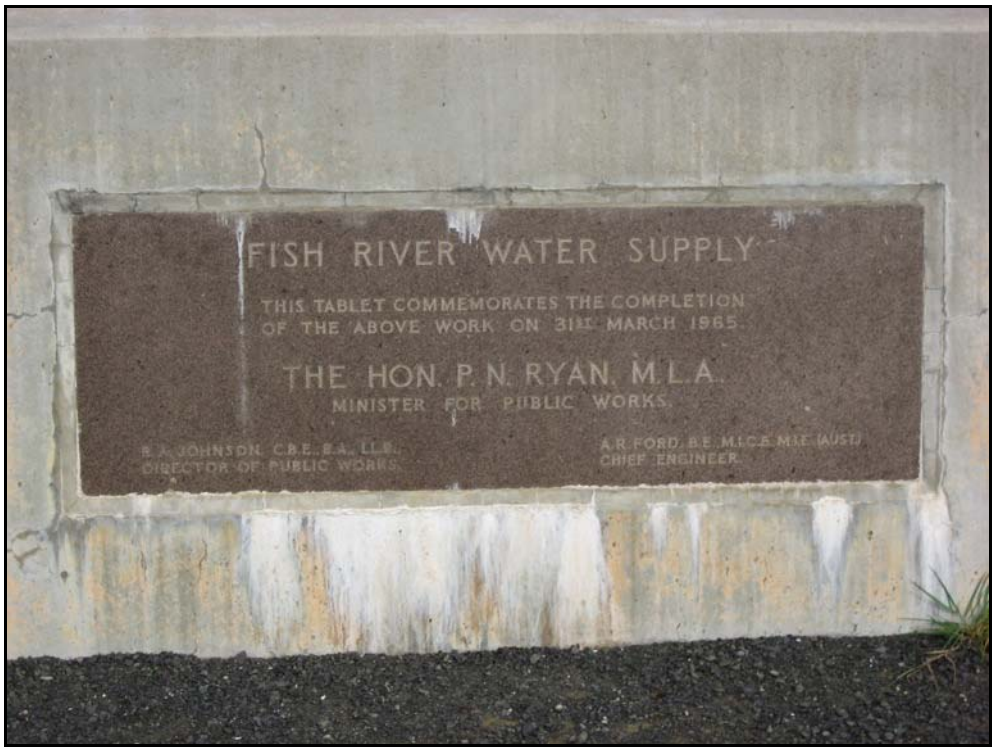


Plate 7: Oberon Dam, detail of Plaque 3. View is from north.

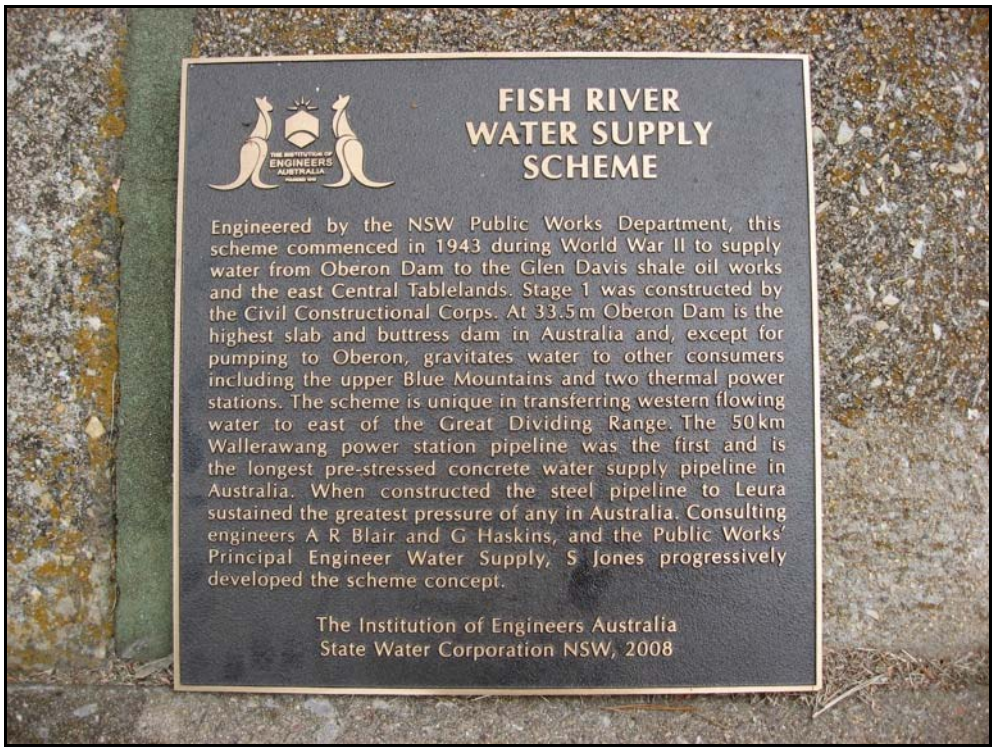


Plate 8: Oberon Dam, detail of Plaque 4. Plaque currently stored in workshop at Oberon Dam.

Plate 9: Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam. View is from west.

Plate 10: Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam, interior. View is from northern entrance.

Plate 11: Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam, detail showing evidence of a removed floor fitting.

Plate 12: Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam. Detail showing minor damage to lower part of rib.

Plate 13: Pre-fabricated semi-cylindrical hut/workshop at Oberon Dam. Detail showing broken window. View is from inside building.

Plate 14: Bailey valve hut at Oberon Dam showing access steps. View is from west.

Plate 15: Disused chlorinator hut (left) and new chlorinator hut (right) at Oberon Dam (background). View is from north-west.

Plate 16: Disused chlorinator hut at Oberon Dam, detail of interior wall tiles.

Plate 17: Disused chlorinator hut at Oberon Dam, showing wall graffiti. View is from south.

Plate 18: Break pressure tank at Duckmaloi showing concrete channel and western end valve hut. View is from centre of break pressure tank.

Plate 19: Break pressure tank at Duckmaloi showing concrete channel and eastern end valve hut. Note vegetation in channel. View is from centre of break pressure tank.

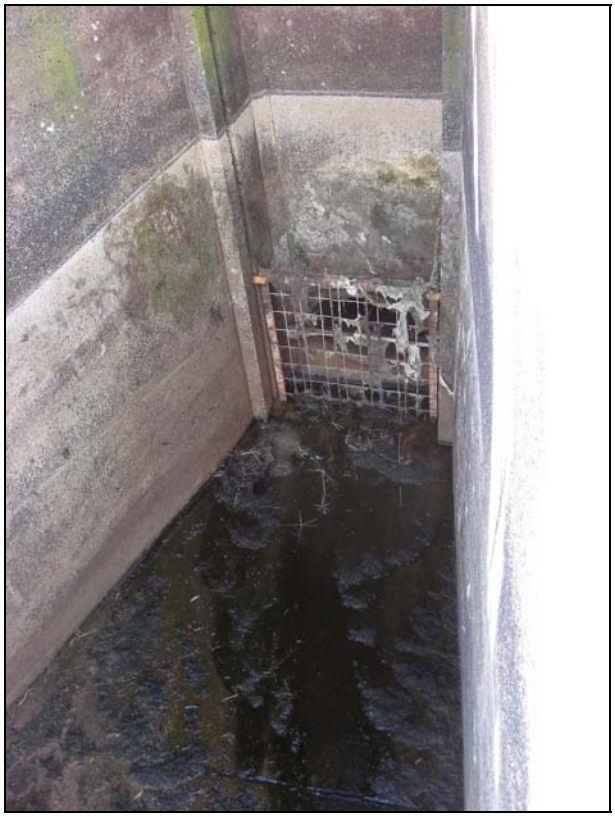


Plate 20: Break pressure tank at Duckmaloi showing central screening chamber outlet.

Plate 21: Hampton Tunnel inlet chamber. View is from north-west.

Plate 22: Hampton Tunnel inlet chamber. Interior.

Plate 23: Hampton Tunnel inlet chamber. Detail of broken hinge.

Plate 23: Duckmaloi Weir showing intact dam wall.

Plate 24: Rydal Dam, showing recently rebuilt dam wall. Chlorinator hut is visible in top-right of photograph. Valve hut is situated out-of-shot to the right of the photograph.

Plate 25: Rydal Dam, showing valve hut and vehicle car park. Current valve hut fabric encases original valve hut fabric.

Plate 26: Wallerawang Pumping Station.

Plate 27: Wallerawang Pumping Station, interior, showing detail of original pulley and chain components.

Plate 28: Wallerawang Depot, Inspector's house.

Plate 29: Wallerawang Depot, pre-fabricated semi-cylindrical hut/workshop, showing new façade. View is from north.

Plate 30: Wallerawang Depot, pre-fabricated semi-cylindrical hut/workshop, showing original door frame and brackets at rear of building.

Plate 31: Glen Davis reservoir tank. View from east.

Plate 32: Glen Davis pup tank. View is from west.

Plate 33: Glen Davis pup tank, detail of date stamp on internal pipe reading 1945.

Plate 34: FRWS pipeline in the vicinity of Baal Bone Gap. Shows above ground marker and exposed pipe.

Plate 35: FRWS pipeline in the vicinity of Baal Bone Gap. Detail of exposed pipe.

Plate 36: Break Pressure Tank 1 at Baal Bone Gap, showing the new fabric of the superstructure.