9. SURFACE WATER

9.1 DRAINAGE

Little River is a major tributary of the Macquarie River. It rises on the southern edge of the Macquarie Catchment just east of Goobang National Park, and joins the Macquarie just downstream of Ponto, about 20 kilometres upstream of Dubbo. The Macquarie River is part of the Murray-Darling River system and feeds the Macquarie Marshes - a very significant and world-class wetland.

Tributaries of Little River include Buckinbah, Balrudgery, Wanda Wandong, Myrangle, Hanover, Googodery, Gundy, Sandy and Barney's Creeks. These creeks rise on different geological formations and consequently vary in their chemistry, turbidity and salt concentration. Buckinbah Creek, the largest tributary of Little River, rises near Killenbutta State Forest. Spring Creek is a major tributary of the Buckinbah and contributes substantial amounts of salts to the drainage system during intermittent periods of flow (50).

A small section of the plan area drains into Curra Creek, which flows into the Bell River. The Bell River joins the Macquarie at Wellington. The Bell and Little Rivers are the only two tributaries between Burrendong Dam and Dubbo, where the Talbragar enters the system.

9.2 DAMS AND WEIRS

Two major storage dams; Burrendong and Windamere, have been constructed on the Macquarie River upstream of Wellington. There are also a number of weirs and diversion works along the Macquarie River. However, there is only one large instream structure on the Little River, which has a significant impact on the migration of fish (67).

Significant volumes of water are extracted for irrigation purposes and town water supplies, especially in the lower reaches below Dubbo. There is very high natural variability in river flows due to seasonal conditions. Water harvesting into storages and water extraction have a significant effect on the natural flow of the river. These effects are most obvious downstream of the dams an in the major irrigation areas. In the area near Dubbo average flows have not altered; however, high flows occur less frequently and annual average flows during spring and summer are higher than under natural conditions (32).

Figure 9a, which shows streamflow immediately downstream of Burrendong, shows that in 1999 water releases from the dam ceased after 19th March, and consequently downstream flow was significantly reduced in the Macquarie at Dubbo during autumn and into winter. See Fig 9b. Consequently, tributary flows, especially from the Little River and Talbragar River, contribute much of the flow into the Macquarie during the winter months. This has an important impact on water quality that will be discussed in Section 16 – Surface Water Quality and Quantity. (Note the difference in scales on the vertical axis for Figures 9a-c when viewing the graphs.)

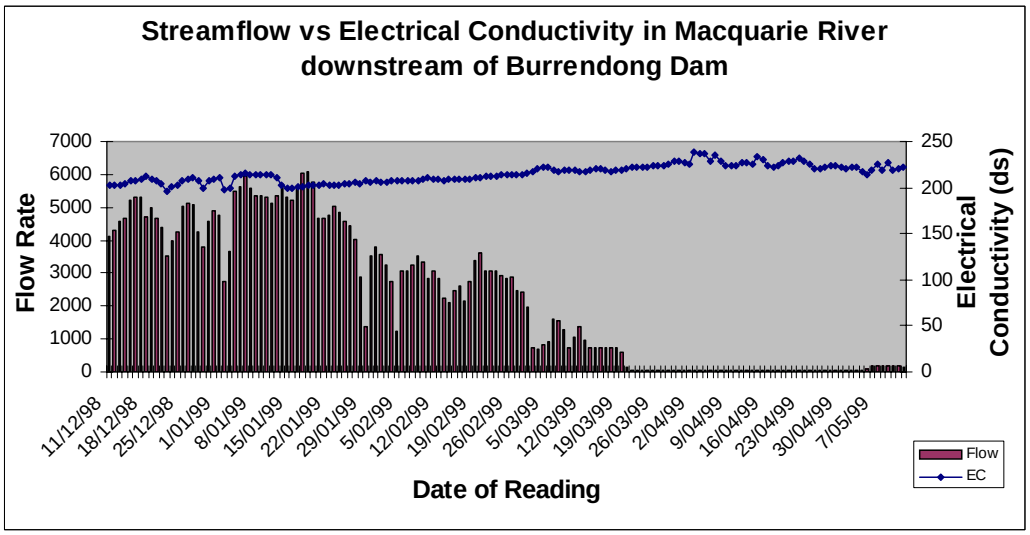

Figure 9a: Streamflow and Electrical Conductivity - Macquarie R. at Burrendong

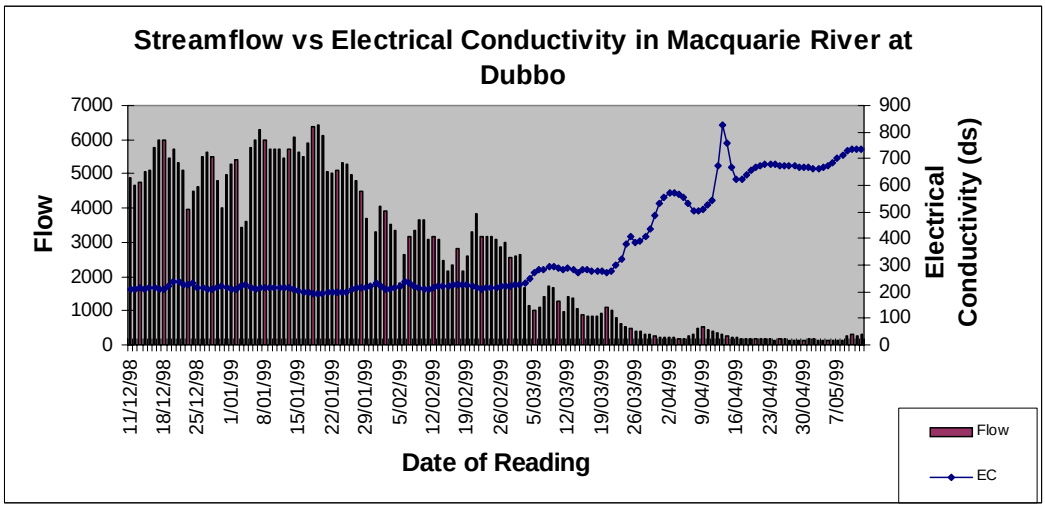

Figure 9b: Streamflow and Electrical Conductivity - Macquarie R. at Dubbo

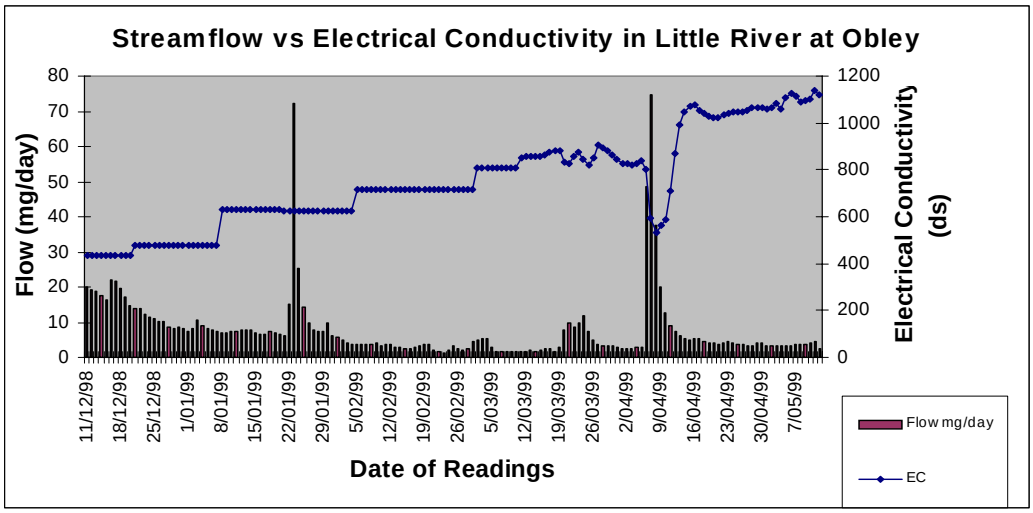

Figure 9c: Streamflow and Electrical Conductivity – Little River at Obley

9.2.1 Farm Dams

Considerable changes can occur in streamflow as a result of water harvesting in farm dams. The NSW Farm Dams Policy was introduced to control the amount of water that could be harvested from an individual property. The policy allows farmers to harvest 10% of total annual runoff on farm. In some upper catchments, the increase in the number of dams is thought to be reducing the amount of streamflow in a river system. The Murray Darling Basin Commission instigated a review of the impact of farm dams on streamflow because of the scarcity of water in the river system and the need for information about the potential for further losses. Three catchments in the Upper Macquarie were investigated using rainfall and runoff models compared to actual streamflow data (49).

There was no significant loss in streamflow in the upper Macquarie Valley, despite an increased number of farm dams in the area. Analysis was not carried out in the Little River Catchment, but the Ben Chifley catchment (Campbells River) was assessed. Prior to 1984, reductions in streamflow were apparent. However, there have been increased flows in the river since then. This is thought to be due to pasture degradation and poor groundcover from a reduction in fertiliser applications, while maintaining stock numbers, and the impact of the 1980's and 1990's droughts. The trend analysis used for other catchments of the Macquarie Basin provided similar results.

Loss of streamflow may be more noticeable in a smaller upland catchment such as tributary catchments of Little River where the catchment is heavily used for grazing (49). Along with the number of farm dams increasing, the size of farm dams has also increased over the last two decades. Kazemi (50) reports there are about 60 dams just in the Upper Buckinbah catchment, which has a significant impact on the hydrology and salt transport within the catchment (50).

9.3 WETLANDS

The Macquarie Marshes are an extensive wetland area covering more than 150 000 hectares north of Warren. The Marshes are semi-permanent wetlands and are one of the largest in south-eastern Australia. The Marshes are an environmentally significant area and are recognised as a Wetland of International Importance under the Ramsar Convention. The actual Nature Reserve covers 18 150 hectares and is managed by the National Parks and Wildlife Service (NPWS) (34, 66).

Grazing and dryland wheat production in the Marshes area returned approximately $7 million in 1996 (34). The natural flow regime and inundation patterns of the Marshes have been changed and reduced due to river regulation and abstraction of water. The construction of Burrendong Dam, to store water and regulate river flows, has increased the use of the water for other purposes and decreased the amount of water available to the wetlands. Changes from grazing to cropping and irrigation have also resulted in the decline of native vegetation due to clearing and a loss of native fauna (34).

Only ten per cent of the Marshes is controlled by NPWS and the rest is privately managed. For this reason, local communities have become increasingly aware of the need for a cooperative approach to managing the Marsh issues. There is, however, still some degree of conflict between extractive water users, marsh graziers and the environment.

Landholders have been very involved in the land and water management planning processes in the Marshes. The Macquarie Marshes Water Management Plan 1996 (DLWC and NPWS) deals with water allocations across the Macquarie Valley and establishes environmental flows to the Marshes. The Nature Reserve Plan of Management 1993 (NPWS) is responsible for specific on-park responsibilities of NPWS. The Macquarie Marshes Land and Water Management Plan (1997) provides a framework for dealing with land and water management issues (34).

Under the Macquarie Marshes Water Management Plan, irrigation is restricted in a Prohibited Area. Irrigation adjacent to the Marshes is subject to an environmental impact assessment. An Environmental Flows Allocation of 50 000 Ml high security water and an additional 75 000 Ml available as general security has been made specifically for the Marshes. Rainfall across the catchment can also influence the nature of flows in the river downstream of Burrendong Dam and additional water flows into the Marshes in periods of medium to high flow. Stock and domestic supplies are unaffected by the water management plan as these have minimal effects on the flow of the river (34).

Salinity is a potential problem for the Macquarie Marshes, as wetlands act as a filtering systems. Considerable amounts of salt enter the Macquarie River from subcatchments upstream of Narromine. Diversions for irrigation redistribute a significant proportion of the salt load back into the landscape. However, a greater proportion is deposited in the Macquarie Marshes (63). Table 10 shows the breakdown of the fate of annual salt loads in the Macquarie River (Figures are shown in tonnes per year) (63).

Table 10: Fate of average annual salt loads in the Macquarie River down stream of Narromine

Year	River @ Narromine	Diversions for Irrigation	Wetlands and Other Losses	Stock & Domestic Water Supply	End of System	% Wetland Health Threshold Exceeded
1998	234 400	77 900	111 600	1 000	43 900	<5
2020	508 400	169 850	243 250	2 200	93 100	10
2050	677 400	225 350	322 750	2 900	126 400	15
2100	818 900	271 800	389 300	3 500	154 300	20

Wetlands have a critical threshold of 1600 EC for health. Within 100 years it has been predicted that the threshold level will be exceeded for approximately 3 months per year within the Macquarie Marshes. As the Marshes are a "flow through" system, the impacts will be in individual areas, which are isolated when the water evaporates, and salinity will concentrate in pools or depressions (63). These impacts may start to be noticed by 2020. The high salt loadings may lead to increased salinity within isolated wetlands, with potential salt scalding. One implication of these predictions is that the environmental flows may be required to flush the saline areas rather than assisting bird breeding, as is the currently nominated purpose of these flows (63).

The problem is made worse by the presence of a saline aquifer beneath the Marshes. Piezometers have been installed and monitored by NPWS, DLWC and landholders for four years to better understand bore pressures and salinity processes and risks. (Sue Jones, pers. comm).

9.4 IRRIGATION

There are 29 irrigation licenses and 6 other licenses on unregulated streams in the Little River Catchment. These licenses cover approximately 475 hectares of irrigation land; however, only around 130 hectares is estimated to be actively used (67).

Downstream irrigators in the Lower Macquarie are concerned about the salt loads coming from the upper reaches. The major concerns are about the long- term effects of salt from tributaries on riparian zones, irrigation enterprises and the Marshes. (Ian Rogan, pers. comm., May 1999). The Murray Darling Basin Salinity Audit predicts that Electrical Conductivity (Ec) readings will exceed 1500EC by 2050, which means extreme caution will be necessary to avoid accumulation of salts in the soil profile from irrigation water. Increased quantities of water may be required to flush salts through the soil; however, these will ultimately end up in the ground water and return to the stream.

9.5 FISH POPULATION

The Little River has a high population of native fish. Officers in NSW Fisheries regard Little River as a "1950's river" for its condition and habitat value (comparable with streams in the Upper New England). The Little River has minimal floodplain, so there is not much cropping adjacent to the river. This has meant there is relatively very little pumping and not much chemical contamination.

It is one of the best populated rivers in the area with good stocks of cod, river blackfish, silver and golden perch. See Appendix 12b. Trout cod, an endangered species, may also be found here. There is evidence of breeding as there are fish of all ages and sizes. Native fish are part of the food chain being eaten by large cod. The native species are acclimatising to changes in the river system. Carp are present, although in lesser numbers than other tributaries of the Macquarie. (See Figure 10 and 22.) Even so, they are thought to do some damage to the riverine environment and water quality in the Little River catchment.

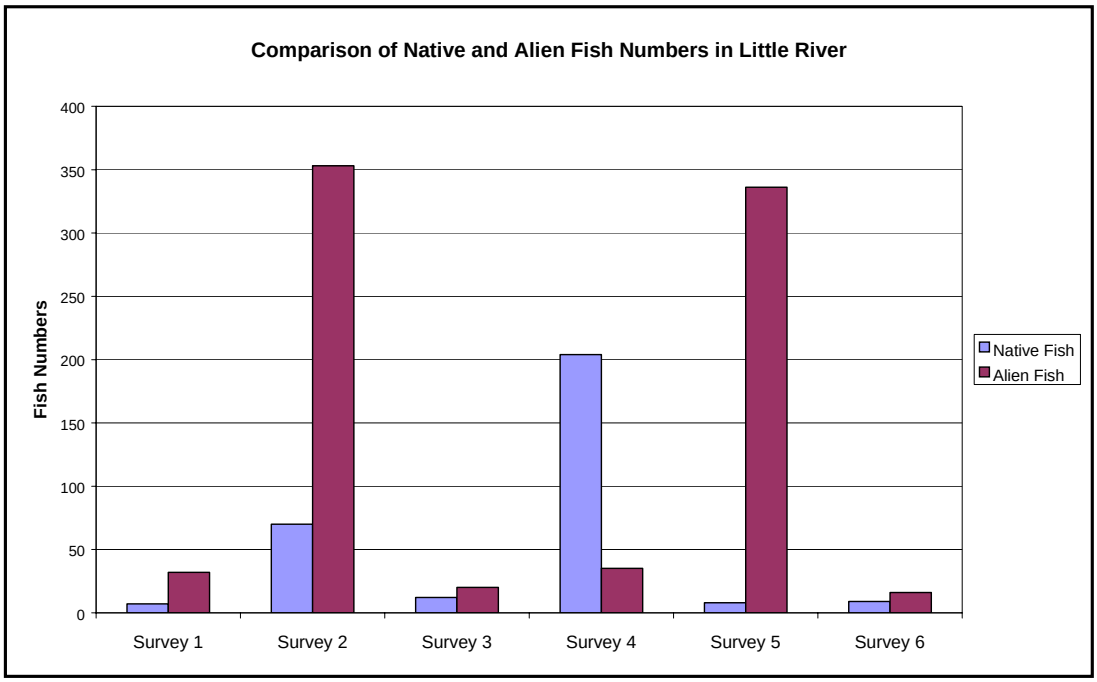

Figure 10. **Native and Alien Fish Numbers in Little River.**

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