Summary of Key Findings in the Mersey River Catchment Water Resources Information

Supporting the Review and Amendment of the Mersey Water Management Plan

September 2022

Primary Industries and Water Division
Department of Natural Resources and Environment Tasmania

Tasmanian Government

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The Department of Natural Resources and Environment Tasmania

The Department of Natural Resources and Environment Tasmania's purpose is to deliver a sustainable Tasmania and the Department's vision is a Tasmania where our natural resources, cultural values and environment are recognized and used sustainably to support our future prosperity.

The Primary Industries and Water Division provides a focus for water management and water development in Tasmania through a diverse range of functions, including implementing the *Water Management Act 1999* and the National Water Initiative; design of policy and regulatory frameworks to ensure sustainable use of surface water and groundwater resources; monitoring, assessment and reporting on the condition of the State's freshwater resources; and facilitating water infrastructure development projects.

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1 Summary

The Mersey Water Management Plan 2005 (2005 Plan) was reviewed by the Department of Natural Resources and Environment Tasmania (NRE Tas) over the past three years. This review was conducted in consultation with key stakeholders, with an interest in water management, through the Mersey River Catchment Water Management Plan Consultative Group. A range of technical assessments were undertaken between 2019 and 2022 that supported discussion and decisions related to key areas of the Plan that are being amended and updated. This document is the summary section of the Mersey River Catchment Water Resources Information document and provides summaries the assessments. For more detail see the full Mersey River Catchment Water Resources Information document.

The Mersey River Catchment Water Resources Information document provides scientific and technical, demographic and industry information to inform the Consultative Group about the current status of the catchment and trends in hydrological, ecological and water management indicators. This information is based on the best available data and knowledge, and provides the background needed to make evidence-based decisions. This document lists summaries of the key findings of the different sections.

Key knowledge about the Mersey River catchment

Key Issues Identified for the Plan Review in 2020

- Key Issues within scope of the statutory Plan review included, rewording and reassessing cease-to-take (CTT) thresholds from December to May, cease-to-takes (CTT) thresholds from June to November, winter allocation limits, opportunistic flood takes and opportunity for review in periods less than 10 years.
- Key issues in scope for the water management protocols document which supports the Plan's implementation include, restriction thresholds above cease-to-take, metering to align with state-wide metering requirements, management and access/issues in the tributaries and flexibility related to restrictions in months where seasonal flows transition from high to low flows rapidly.

- Key issues out of scope of the Plan review included the environmental flow release from Lake Parangana, geographical extent of the Plan, flood mitigation and warning, supply agreements and arrangements between Hydro Tasmania and stakeholders, Tasmanian Irrigation wanting a further supply from Hydro Tasmania, issues relating to extraction from and releases into Caroline Creek, transmission losses, pumping at night and related impacts, impact of dams on flow and natural values, post flood riparian remediation and service delivery.

Climate

- There is a significant decreasing trend in summer rainfall and annual total rainfall, with the annual average over the last 10 years being 2.5% less than the historical average.
- There is a significant increasing trend in summer, winter and annual evaporation over the last 50 years; with the last 10 years showing a marked increasing trend with evaporation increasing by 2.5 mm per year.
- There is a significant increasing trend in the annual average monthly maximum temperature, with an increase of about 0.2°C per decade recorded over the last 50 years.
- Annual average water yield across the Mersey catchment is predicted to reduce by 11% under a future dry climate.

Surface water hydrology

- The Mersey River has a strong seasonal flow pattern that is wetter in winter and drier in summer.
- The flow at the gauge at Shale Road reflects the seasonal variations from major tributary inflows (Dasher, Lobster, Mole and Minnow) into the Mersey River.
- The winter and summer yields at the gauge are around 80% and 20% of total annual volumes respectively.
- The construction of Lake Parangana in 1972 and cross-catchment transfer of water to Forth River catchment resulted in significant reduction in post-dam flow downstream of the dam.
- Annual 7-day low-flows show a decreasing trend post construction of Parangana Dam prior to the environmental water release. Since the environmental flow release, there has been an increasing trend in the annual 7-day low-flow.

Groundwater systems

- Poorly understood and planned groundwater development may lead to unsustainable levels of extraction over time, particularly at the local scale. This could cause several adverse impacts (e.g., well drawdown interference, reduced groundwater discharge to streams or to groundwater-dependent ecosystems, seawater intrusion in coastal aquifers, etc.).
- The largest component of flow into the aquifers is rainwater recharge and the major discharge component is baseflow to rivers. Current understanding indicates that groundwater discharge is a significant contributor to stream flows in the catchment,

particularly in Mole Creek and Lobster Rivulet, which has important implications both for surface water availability and for water quality.

- Water level data from the available monitoring bores indicate a stable condition over the last 30 years, and demonstrate similar winter-summer recharge, and discharge trends. Observed winter-summer water level oscillations of up to 7.5 m are predominantly influenced by climate (variable rainfall).
- Despite the limitations with available monitoring data, all available information suggests that current levels of groundwater extraction are not having lasting, significant impacts on groundwater levels in monitored areas of the catchment.
- A Groundwater Risk Management and Evaluation Framework will monitor and evaluate changes to risk to support future groundwater management.
- Where extraction of groundwater represents a higher risk to water users and the environment, NRE Tas may consider higher levels of groundwater management such as formal restriction processes and access rules, declarations of groundwater areas, and licensing and allocation.

Freshwater ecosystem values

- There are a range of important freshwater dependent ecosystems in the Mersey River Catchment Water Management Plan area including: Mersey estuary, sections of river along the Mersey mainstem, and parts of Caroline, Redwater, Minnow and Dasher creeks; and Mole Creek karst system.
- Mole Creek is an extensive karst system that is of state and national significance, providing important habitat for a range of unique and threatened cave fauna, including those that are threatened.
- Many of the river sections in the Plan area have been rated as high or very high conservation value as they are good representative examples of particular types of aquatic macroinvertebrate (waterbug), fish and tree communities, or because of their geomorphology (the interaction between streams and landscape around them) (described as the Mersey Forth river type)
- Freshwater ecosystems within the Mersey River Catchment Water Management Plan area support many threatened animal and plant, species and communities, including the endangered North Central burrowing crayfish, the vulnerable giant freshwater crayfish and Australian grayling, as well as rare cave fauna.
- Burrowing crayfish may be directly connected to streams and waterbodies, may connect to groundwater, or may simply rely on runoff for water. In the Mersey River catchment, *Engaeus* burrows are found in drainage channels, riverbanks and wetland areas, where there is a clear connection to a permanent water supply.
- Large, adult giant freshwater crayfish inhabit deeper pool habitat in rivers, preferring locations with an abundance of decaying timber and with good riparian cover. These areas are generally less impacted by changes in flow associated with summer water extraction. However, in smaller streams risks are greater.
- Juvenile giant freshwater crayfish prefer shallow (0.1 – 0.25 m) riffle habitat dominated by larger rocks (boulder and cobble) where fine sediments and silt are absent. When

flow reduces juvenile crayfish don't move from shallow areas, instead they burrow deeper into the substrate.

- Australian grayling require adequate flows (especially during autumn) to allow for movement down the river to use downstream habitats for spawning and then migrate up rivers for the remainder of the year, to seek refuge and food resources.

Aquatic ecosystem condition

- The waterbugs present at monitoring sites indicate that the health of the Mersey River system appears to be relatively stable in recent years, with some sites showing small declines and some sites showing improvements in river health.
- There are healthy populations of native fish in the Mersey River
- The abundant brown trout population found throughout the Mersey River forms one of the most productive and popular recreational river fisheries in the State.

Demographic and industry profile

- The health care and social assistance sector employs the greatest number of people in the Mersey River and Sassafras Wesley Vale Water Management Plan areas.
- The main agriculture businesses operating in the Mersey River catchment area are specialised beef cattle farming, dairy farming, sheep-beef cattle farming and grain-sheep and grain beef cattle farming, whereas the main agriculture businesses in the Sassafras Wesley Vale area are outdoor vegetable growing, other agricultural and fisheries support services, sheep and grain beef cattle farming and specialised beef cattle farming.
- The main industry in the Mersey River catchment that relies on water is irrigated pasture for grazing. Irrigated cropping and irrigated perennial horticulture are also present.
- There is potential for an additional 34.5% or 225 km^2 of the Plan area (in the area currently mapped for land capability) to be expanded for irrigation purposes, assuming all irrigable land (land capability classes 1 to 4) is available for further development.
- The brown trout fishery in the Mersey River forms one of the most popular river fisheries in Tasmania and is very important in a state-wide context.

Water entities within the Plan area

- Hydro Tasmania
- Tasmanian Irrigation
  - ➢ The Sassafras Wesley Vale Irrigation Scheme, with the capacity to supply 5,460 ML of water commenced operation during the 2011/12 irrigation season and supplies water to users within the Scheme area, from a pump station at Big Bend in the Mersey River.
  - ➢ The Greater Meander Irrigation Scheme supplies water to right holders in Lobster Rivulet.
- Tas Water has a small allocation from Mole Creek.

Surface water management

- Since 1999, there has been an increase in the volume of licensed surface water allocated for commercial use (primarily irrigation) by approximately 29,000 ML. Of this 3186 ML was allocated at Level Surety 6 to reflect historic use in the catchment under the Plan. In 2010 12,410 ML was allocated to Tasmanian Irrigation and 4197.5 ML was allocated to members of the Mersey Irrigators Group at Surety Level 5, which was previously allocated to the Wesley Vale Pulp and Paper Mill at Surety Level 4.
- The periods over which allocations endorsed on water licences under the *Water Management Act 1999* have been issued is highly variable. This is a result of different allocation policies through time. The months with the highest volume of allocation due to overlapping allocation periods are September, October and November.
- There is a total of 473 registered dams in the catchment holding a capacity of 9733.4 ML. While most dams in the catchment are small (<10 ML). There are 14 dams with a capacity of greater than 100 ML and another 6 that have been approved and not yet built.
- NRE Tas's analysis of days of summer access in the last 15 years show the following:
  - Surety 5 licence holders had unrestricted access for 11 out of 15 years, partial restrictions for less than 20 days in 2 years out of 15 and full restrictions for 35 and 47 days in two years. If the 'Water resource management during extreme dry conditions policy' was not applied in 2016 there most likely would have been about 30 days of restriction that were not implemented in that year.
  - Surety 6 licence holders had unrestricted access for 9 out of 15 years, partial restrictions for less than 20 days in 2 years out of the 15. Surety 6 water users had full restrictions for 31 to 73 days in 5 years out of the 15 years and for 4 days restriction in 1 year.

Allocation Limits

For the Mersey River catchment plan area:

- For the period from 1 November to 30 April there is no further water available to allocate.
- For the period from 1 May to 31 October the Plan has an allocation limit of 96,811 ML. In September 2022, there was 77,071 ML of water available for new allocations at Surety Level 6 and there is no further water available for allocation at Surety Level 5.

Water regime for cease-to-take thresholds from June to November

- NRE Tas uses the Tasmanian Environmental Flows Framework for assessing environmental flows for rivers in the State. This approach recognises the fundamental role that a 'natural' pattern of flow has in sustaining freshwater-dependent ecosystems and values.
- Revised cease-to-take thresholds for winter (June-November) based on 5th percentile flow statistics for the Mersey River at Shale Road are proposed. This revision decreases the cease-to-take thresholds in June to September, with cease-to-take thresholds

remaining unchanged in October and November as the existing thresholds are lower than the 5th percentile flows.

- The revised cease-to-take thresholds for winter (June-November) will maintain seasonality in baseflows and provide adequate flows conditions for riverine ecosystems, and overall deliver improved access to water for water users

Trial of Changes to Water Management in the Mersey River Catchment

Water use

- A total of 5609 ML was extracted by the main licensed water users in the catchment in the 2021/2022 between October and February 2022.
- The month with the highest amount of water use was December totalling 2042 ML or about 66 ML/day. Water use in January and February was between 1400 and 1450 ML (45-55 ML/day), which most likely continued into March.
- Alternative water sources in the catchment vary depending on water users' location in the catchment and what works for their businesses. Many water users on the main stem have access to water from Hydro Tasmania when Surety Level 5 restrictions occur. Most water users in the tributaries have storages and/or have access to the Greater Meander irrigation scheme, Sassafras Wesley Vale irrigation scheme, have arrangements with Tas Water or to groundwater.
- Most water users extract water at night which is driven by the lower cost of off-peak power at night and to minimise evaporative loss.

Feedback from water users

Water users provided a variety of feedback on the cease-to-take and restriction thresholds, allocation, groundwater management, the release from Lake Parangana, notifications and information sharing, other operational and general policy issues, and concerns about changes from, and ongoing impacts of, the 2016 floods.

Climate and flow conditions

- Winter-spring 2021 was reasonably wet, and this resulted in high baseflows and several high flow events in the Mersey River during this period. These conditions also recharged groundwater systems in the catchment.
- Summer 2021/22 was quite dry, particularly December and February. Despite these dry conditions in summer, strong groundwater inflows associated the wet preceding winter resulted in a steady recession in flows in the Mersey River in November and December 2021.
- Baseflows in the Mersey River were moderately low in summer 2021/22 (minimum flows in February approximated 40th percentile flows) and flows did not fall below the cease-to-take (CTT) thresholds that were trialled.
- An analysis of flow data for the Mersey River from immediately downstream of the Parangana Dam and from the Liena gauging station during February-March 2022 indicates that the magnitude of the increase in flows ('catchment pickup') between these locations was greater than 10 ML/day during a relatively dry period.

- Mole Creek is highly connected to groundwater in the karst system that lies in the Mole Creek area, and hence, in comparison to other tributaries of the Mersey River, it has elevated and relatively stable baseflows during dry climatic conditions. Analysis of flow data from Mole Creek indicates that it will contribute >20 ML/d to flows in the Mersey River during very dry periods and during most years it will contribute >25 ML/d.
- Analysis of flow data from the recently installed gauging station on the upper Dasher River (owned by TasWater) suggests that the upper reaches of this tributary are likely to contribute >10 ML/d to the Mersey River.
- The findings of the assessment of low flows show that in mid-February 2022 the combined flow contributions in the upper Mersey catchment were approximately 250 ML/day. This included 178 ML/day in the upper Mersey River at Liena plus a total of 72 ML/d from the main tributaries (Mole Creek, Lobster Rivulet, Dasher River, Coilers Creek and Redwater Creek). This contribution from the upper catchment approximated the flow recorded in the Mersey River at Shale Road at the time of the assessment (233-288 ML/d).
- The low flow assessment did not explicitly account for real-time water extraction from the river system for commercial purposes (e.g., irrigation), nor spatial variation in interactions (losses or gains) with groundwater systems. Furthermore, summer 2021/22 was not an extremely dry period and inflows would be less under drier conditions.
- Despite these limitations, the low flow assessment provides a useful snapshot of flow through the river network in the Mersey River catchment, especially catchment pickup and how it relates to flows recorded in the Mersey River at Shale Road. Further investigations of catchment pickup should be undertaken in drier climatic conditions than those observed in 2021/22 to improve understanding of flows in the catchment when tributary inflows are lower, groundwater inflows are reduced, and direct water extraction is higher.

Comparison of flows in the Mersey River at Liena and Shale Road gauges and an assessment of tributary flow data and pickup.

The purpose of this document is to address three key questions posed by water users during the consultative group process, which included:

1. What were historic low flows in the Mersey River in the past, and how do they compare with the proposed flow releases?
2. What is the flow pick up between the Liena stream flow gauge and the Shale Road gauge during dry times, and is it lower than 22 ML/day?
3. What will the change of access likely be for water users if: (1) Hydro Tasmania agree to a minimum flow release from Lake Parangana of 160 ML/day with the intent to meet a minimum flow of 173 ML/day at the Liena flow gauging station, and (2) the Mersey Water Management Plan retains the existing Plan's (2005) provision of a December to May cease-to-take threshold of 195 ML/day measured at the Shale Road gauging station, but without the step down rule that reflected the reduced release from Lake Parangana during dry periods in the past? This is in part addressed here, and a more detailed monthly assessment of reliability is presented in a separate section (NRE Tas, 2022, Section 16).

The 195 ML/day provision assumes that that there is at least 22 ML/day of tributary pickup between the Liena and Shale Road gauging stations when flows are greater than 173 ML/day under the current Plan rules. A detailed analysis of concurrent flow records from the Liena and Shale Road gauging stations was undertaken to answer the above questions. Historic records from Mole Creek were also analyses to assess the contribution of flows from Mole Creek to the main stem of the Mersey River during dry conditions.

The findings from the analysis are:

- For all available records from 1962 to 2022, whilst flows were at or above 173 ML/day in the Mersey River at the Liena gauge, flows at the Shale Road gauge (corrected for a reach travel time of 1 day) were above 195 ML/day 99% of the time between December and May. *This analysis is based on measured flow at Shale Road and is after irrigation takes have been extracted from the river.*
- For the period of quality coded data, from January 2008 to May 2022, that the difference between flows at the Liena and Shale Road gauging stations, for all measured flows at the Liena gauge, taking into consideration reach travel times *after irrigation water takes have been extracted from the river*, is at least 21 ML/day for 99% of the time.
- Analysis of Mole Creek flow records from 2008 to 2022 show the recorded minimum average daily flow to be 22.7 ML/day.

From this analysis of observed flow records, it can be concluded that there is high likelihood that tributary inflows exceed 22 ML/day when flow is greater than 173 ML/day at Liena under historic flow conditions.

Reliability assessment of the trial summer cease-to-take for the Mersey River Catchment Water Management Plan review

Comparison of the reliability of summer flows being greater than the cease-to-take under the existing plan rules with the trial rules from 2020 to 2022 under the new flow release conditions show there is little difference between the theoretical reliability of access under the current plan rules compared to the proposed trial rules. Access under either scenario is generally greater than 95%.

Comparison of the reliability of summer flows being greater than the cease-to-take under the existing plan rules with a cease-to-take of 195 ML/day under the new flow release conditions show the theoretical reliabilities for April, May and December are the same or slightly better than the current plan rule access. The reliabilities for January, February and March are slightly lower than the reliabilities the current plan rules provide.

Except for March (94%) all reliabilities are greater than 95% highlighting the excellent access to water in this catchment under this scenario.

Dewatering Operations by Cement Australia

There is no direct connectivity between the Mole Creek Limestone aquifer and karst system and the Railton Gordon Limestone aquifer and karst system (Railton Aquifer) in the Railton area. Dewatering practices and groundwater extraction from the Railton Aquifer by Railton Cement Australia (CA) will not affect the Mole Creek cave and karst system.

There is very little groundwater connectivity between the Railton CA works site and groundwater fed base flows to the Mersey River in the proximity of the Shale Road gauging station. Groundwater flows down a gradient in the Railton Aquifer, predominantly in a north-west direction. The Mersey River Shale Road gauging station lies to the north of this area.

Historic dewatering practices in the now decommissioned Old Mine (Goliath) Pit would not have affected gauged flows at Shale Road gauge in the Mersey River during low flow periods.

This is due to:

- Cement Australia never discharged Old Mine Pit water or any water directly into Redwater Creek.
- Old Mine Pit dewatering rates were very low, with historic Cement Australia documents and comment estimating maximum infilling and subsequent dewatering rates to be around 5 to 10 l/s (0.4 to 0.8 ML/day).
- Redwater Creek is an ephemeral (ceases to flow during dry periods), losing stream that is upgradient of the Old Mine (Goliath) Pit. Conceptually, pit-dewatering practices in the Old Mine Pit may have reduced flow in Redwater Creek at times that Redwater Creek was flowing, and subsequently flows in the Mersey River at the Shale Road gauge; as opposed to elevating flows in Redwater Creek. However, Redwater Creek is an ephemeral stream that would naturally cease to flow during dry, low flow periods in the Mersey River.

Flood frequency analysis and opportunistic take threshold determination

- The flood frequency analysis indicates that a 1:2 year peak flood event is approximated to be 21,515 ML and a 1:1.4 to 1:1.5 year peak flood event is approximated to be between 14,600 ML and 16,200 ML when measured at Shale Road flow gauge.
- However, in the Mersey the main stem of the river is much larger than the tributaries and it is anticipated that a 1:1.4 to 1:1.5 year event recorded at the Shale Road stream gauge would have resulted in bank full events in many of the smaller tributaries.
- An event analysis of flows above 15,000 ML and 21,500 ML, with a duration of at least 1 hour and 1 day separation between events, was undertaken and indicated that since 1973 there has been 108 events that exceeded a flow of 15,000 ML at Shale Road, with an average duration of 29.75 hours with a maximum duration of 211 hours. The analysis of 21,500 ML threshold indicated that since 1973 there has been 55 events with an average duration of 19.75 hours with a maximum duration of 64 hours.
- This analysis would indicate that 1 in 2 of the 15,000 ML flood events progress to exceed a peak event of 21,500ML.
- The Shale Road stream gauge is towards the end of the catchment and a large flood event or flow measured at this site is considered to have provided an event through the catchment that has provided benefit to the flood plain and environment and facilitated access to water above a high flow threshold base on flows at the Shale Road stream gauge would pose minimal risk to the greater catchment.

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