Appendix A- Estuary Summaries

BVSC Estuary Summaries

Provided below is a summary of each catchment including land use, management, condition and issues.

Wallaga Lake

Wallaga Lake is situated at the northern end of the Bega Valley with a portion of the catchment and northern side of the Lake managed by Eurobodalla Shire Council. It is a wave dominated barrier estuary with an intermittently closed entrance, Council manually opens the entrance as per the Wallaga Lake Entrance Management Policy. Narira Creek and Dignams Creek are the two main tributaries which run into the lake. Sections of Wallaga Lake are part of the Batemans Marine Park with five declared sanctuary zones, two habitat protection zones and one special purpose zone. A new Batemans Marine Park Management Plan pilot project is currently underway.

<u>Issues</u>

The Wallaga Lake Estuary Management Plan identified the following issues:

- Sedimentation and the growth of deltas
- Water quality – nutrient input from urban areas, septic systems, urban stormwater, catchment runoff and poor flushing.
- Conservation – concerns for protection of aquatic and terrestrial wildlife, seagrass and loss of riparian vegetation (stock access to foreshore).
- Reduction in fish stocks – overfishing, commercial haul netting and bycatch, reduction in food sources and loss of habitat.

- Human use and access to foreshore and waterway – protection of Aboriginal and non-Aboriginal heritage, effects of recreational boating and lack of facilities and visual amenity of the foreshore.

Recent issues which have arisen include community concern over health of the lake during extended periods of closure and algal blooms. There has also been increasing incidents of unauthorised clearing and vegetation management around the lake. In 2016 the east coast low event caused significant damage to the board walk to Murunna Point on the southern side of the lake resulting in the loss of this access for an extended period of time, access was only reinstated in 2020.

The Wallaga catchment was impacted by bushfires in 2020 with approximately 50.2% of the catchment burnt. Burnt areas are focused more in the upper catchment and along the two tributaries north of the highway.

Management

There has been a range of actions completed around Wallaga Lake however many of the objectives of the previous EMP have not been achieved. Actions completed include update to LEP and DCP; upgrade of the Beauty Point boat ramp (NSW Boating Now funding) and connection of Cobargo and Wallaga Lake residential areas to the sewerage network.

Additional studies have been undertaken including a fish assemblage study, causeway assessment, and studies into runoff impacts. An entrance management policy for Wallaga Lake was also endorsed in 2016.

A key issue in this catchment is engagement with private land holders, Council and LLS have had a reasonable amount of success with fencing out stock, riparian revegetation, bank stabilisation and weed control however most attempts around Wallaga Lake have been unsuccessful.

Existing studies and management plans

- Wallaga Lake Data Compilation Study (1994)
- Wallaga Lake Estuary Processes Study (1996)
- Wallaga Lake Estuary Management Plan (2000)
- Wallaga Lake Causeway Options Assessment (2001)
- Wallaga Lake Foreshore Vegetation Management Plan (2003)
- Wallaga Lake Nutrient Exports and Water Quality Synthesis (2004)
- Wallaga Lake Urban Stormwater Review (2004)
- Wallaga Lake Entrance Management Policy (2016)
- Review of Environmental Factors for The Artificial Opening of Wallaga Lake (2016)
- Wallaga Lake Entrance Management Policy (2016)
- Fish Assemblages of Wallaga Lake Report (2019)
- NPWS Plan of Management Yuin Bangurri (Mountain Parks) (2014)

Bermagui River

Bermagui River is located at the northern end of the shire and is surrounded by the town of Bermagui. Bermagui River is a wave dominated barrier estuary and has a trained entrance. Major tributaries include Coolagolite Creek, Myrtle Creek and Nutleys Creek. Almost half the catchment (47%) is set aside for conservation as Biamanga National Park, Bermagui Nature Reserve and Murrah Flora Reserve. The rest of the catchment consists largely of private land (46%) with a small portion on the northern side utilised for forestry activities (Bermagui State Forest – 5%). Bermagui town is situation around the entrance with urban residential development with agriculture and grazing occurring further inland on private land.

Bermagui Harbour supports a commercial fishing fleet and is a key location tourism wise with Bermagui Harbour a key launching site for fishing charters providing the closest access to the edge of the continental shelf. Commercial oyster aquaculture occurs in Bermagui with lease located along the main river channel and Jaggers Bay. The river has a high usage for recreational purposes including fishing, swimming and kayaking with two formal boat ramps and an enclosed swimming area provided on the southern side of the entrance (Bruce Steer Pool). This region is a popular tourism location with population numbers in the region increasing during peak holiday periods.

<u>Issues</u>

There is no complete previous study for Bermagui River however a series of targeted plans for specific projects and some previous water sampling. Due to lack of previous study or management plan had been produced for Bermagui, Council saw this as a gap in knowledge and completed a Bermagui River Estuary Processes Study (2018). This document provided a summary of estuary processes, ecological characteristics and objectives and environmental values and objectives. A list of priority threats to the estuary was developed, these being:

- Unsustainable land-use and management
- Poorly maintained and poorly constructed unsealed roads

- Terrestrial weed incursion
- Recreational usage of the waterway
- Pollution from stormwater and other sources

Key issues into the future include development (Sapphire Cove subdivision) and associated increased population and tourism putting increasing pressure on the environment and facilities. The Coastal Processes and Hazards Definition identified low lying areas of Bermagui to be at risk of coastal inundation. Recent events have also caused additional issues in the area, the 2016 east coast low event caused significant loss of dune vegetation from Horseshoe Bay Beach and resulted in loss of an access track. The bushfires in 2020 impacted 42% of the Bermagui catchment with burnt areas largely located in the upper catchment and along the tributaries.

Management

Despite not having a complete study for Bermagui, a series of on ground works have been completed by BVSC, Crown Lands, SRCMA (no longer exists), SELLS and community groups (Friends of Salty Lagoon) in the catchment as issues have arisen. The plan of management has been reviewed with other projects completed also identified. Significant projects include large areas saltmarsh preservation and restoration on both the north and south side of the river; weed control (Norfolk Island hibiscus) via engagement with the Bermagui Country Club (ongoing relationship), upgrade of boat ramps and improvements to all abilities access.

Existing studies and management plans

- Bermagui River Flood Study (1987)
- Bermagui Foreshore reserves – Plan of Management (2004)
- Biodiversity Plan of Management for Salty Lagoon (2015)
- Monitoring Evaluation and Reporting Water Quality Report (2012 – 2013)
- Bermagui River Estuary Processes Study (2018)
- Bermagui Boat ramp Environmental Impact Assessment (2000)
- Bermagui Bank Management Study (1992)
- NPWS Plan of Management Yuin Bangurri (Mountain Parks) (2014)

Baragoot Lagoon

Baragoot Lagoon is located south of Bermagui in a largely forested catchment consisting of National Park, State Forest with some rural residential and agricultural grazing land situated around the foreshore of the lake (approx. 30% cleared). Council has some small reserves on the south western edge of the lake. The lagoon is shallow and generally closed tending to only open to the ocean for short periods of time. The lagoon contains sections of saltmarsh with small areas of seagrass. DLWC study identified Baragoot Lake as being 'highly vulnerable' to land use changes and catchment disturbance.

Previous water sampling with the lagoon found that nutrient levels often exceeded ANZECC guidelines and supported an abundance of macroalgae for extended periods. Wiecek (2001) concluded Baragoot is a mesotrophic system and naturally prone to eutrophication given the largely undeveloped nature of the catchment Council undertook MER water sampling of the lagoon over a period from 2010-2013 with results providing a score of 3.5 (B-) which is 'good'. During the monitoring period the entrance opened naturally during heavy rainfall events. As shown in previous data, water column nutrient levels often exceeded guidelines for both nitrogen and phosphorus.

State of catchment report 2.6 rating as poor to fair based on chlorophyll a (poor), turbidity (good), extent of seagrass (very poor) and saltmarsh (very good) and fish (poor). Seagrass had declined 70-100% over a 20-year period from 1985-2006. Risk level rating of 4.5 which is low to very low pressure in term of threats within the catchment.

There is unlikely to be any significant changes in this zone, no development planned, threats should remain stable, education and work with land holders regarding estuary health.

Issues

Due to land usage in the catchment there is potential risk of agricultural runoff, clearing of riparian vegetation and stock grazing of small sections. Closures can result in inundation of the

edge of private properties with the estuary left to open naturally. Minor impacts of coastal hazards including tidal and coastal inundation could be expected in this location.

Management

Constraints and zoning in the LEP and DCP should limit further impact on this estuary and the impact of threats is likely to remain stable into the future.

Existing studies and management plans

- Monitoring Evaluation and Reporting Water Quality Report (2010 – 2013)
- Estuary Health Monitoring Report Series Number 1 (2010-2013)
- State of Catchment Report 2010 (DECCW 2011)
- Coastal Lakes - Healthy Rivers Commission (2002)
- Estuary Vulnerability Study (DLWC)
- Trophic Status of Selected Estuaries on the Far South Coast of NSW with Largely Cleared Catchments (2001)

Cuttagee Lake

Shallow, saline coastal lagoon classified as a semi-mature, wave dominated, intermittent estuary (Roy et al. 2001). Cuttagee Creek is main source of fluvial input which is creating a delta in the middle of the lake (Elgin 2014). The catchment is 90% forested (45% Biamanga National Park, 47% Murrah Sate Forest) and < 5 % cleared (Elgin 2016). Cuttagee is an ICOLL with the entrance artificially opened by Council as per an Entrance Management Policy which has been in place since 2016.

The entrance area is a popular recreational site, particularly when the entrance is open with common activities including swimming, fishing and kayaking. Commercial fishing activities are permitted with the lake as part of NSW Estuary General Fishery.

Previous observations from 2010-2013 have estimated a significant loss of seagrass in comparison to seagrass mapping undertaken in 2006 (Elgin 2014) likely due to the impact of

sedimentation. More recent field visits in 2019 indicated seagrass meadows had somewhat recovered (Elgin, 2009).

Issues

The main issues identified in the Rapid Catchment Assessment relate to sediment input from road runoff, weeds, some road/embankment issues, livestock access to riparian zone, degraded vegetation, bank erosion, excessive sediment deposition and risk of septic runoff.

Recent issues which have arisen since the last study include community concern over health of the lake during extended closures; death of melaleuca around the lake foreshore; and impacts on residents and access with elevated water levels.

Management

A series of works have been completed around the lake including road sealing and improvements and some works on private land involving fending, revegetation and weed control. An entrance management policy for Cuttagee Lake was endorsed 2016.

Existing Studies and management plans

- Monitoring Evaluation and Reporting Water Quality Report (2012 – 2013)
- Review of Environmental Factors for The Artificial Opening of Cuttagee Lake (2016)
- Cuttagee Lake Entrance Management Policy (2016)
- Rapid Catchment Assessment – Cuttagee Lake (2016)

Murrah River

Murrah River a wave dominated barrier estuary with a predominantly open entrance however it has been known to close during periods of low rainfall. The upper catchment is made up of State Forest and National Park with the sections of the lower reaches either side of the Murrah River cleared for agricultural use. The catchment is largely unmodified however is slightly affected (HRC 2002). The State of catchment report rating was 4.7 with medium certainty which is good to very good condition.

Issues

Murrah is mostly open however does close occasionally which can pose inundation issues for land holders on foreshores of lake affecting movement of stock. Based on land usage within the catchment there is potential for agricultural runoff, loss of riparian vegetation and stock access to foreshore.

Bunga Lagoon

Bunga is a small coastal lagoon which is prone to extended periods of closure. The catchment a largely a mix of State Forest (Mumbulla SF) and rural residential land with some clearing for agricultural purposes. There are also small sections on the south side which fall within the Mimosa Rocks National Park.

State of catchment report rated it as 2.7 which indicates a poor to fair condition however the confidence level for this assessment was low. Pressure indicator score of 4.9 indicating a very low risk (high confidence).

Riparian corridor largely intact however there is potential for agricultural runoff and stock access to river.

Bunga Lagoon is classified as 'significant protection' in terms of management in HRC report.

Wapengo

Wapengo Lake is located north of Tathra and is a wave dominated barrier estuary with an open entrance with Wapengo Creek the primary tributary. Approximately 70% of the catchment is forested which includes Mumbulla State Forest (upper sections) and Mimosa Rocks National Park (mainly on the coast). Private land makes up 35% of the catchment with 20% cleared for agricultural uses and 15% forested or wetlands (SCRMA 2012).

Wapengo Lake is a priority oyster growing area and contains Bega Valleys second largest area of operational leases (Elgin 2016). The lake is also designated as estuary general fishery with commercial fishing using mesh and haul nets for species including bream flathead and sea mullet. Other uses include recreational boating, kayaking, walking and fishing with public access and facilities provided on the south side at Bithry within the Mimosa Rocks National Park. There are no formal boat launching facilities in this location with informal boat ramps on either side of the lake largely used by oyster farmers. This area exhibits relatively low usage area for a majority of the year with spikes in the peak holiday periods.

There are a range of estuarine habitats including seagrass meadows, mangroves and saltmarsh within the Wapengo estuary. The waterway and foreshore also holds considerable value for indigenous communities with known shell middens present along the shoreline (SCRMA 2012).

<u>Issues</u>

In 2005 SRCMA developed a Rapid Catchment Assessment of faecal and sediment pollution sources, resulting identification of problem sites including unsealed roads/crossing, unrestricted cattle access, and bank erosion.

SCRMA in conjunction with the Wapengo Lake Oyster growers produced the Wapengo Lake Oyster Growers Environmental Management System in 2010. This document outlined impacts from industry related activities and other external activities.

Oyster industry related high risks include:

- Phasing out and disposal of tarred products
- Inefficient boat motors
- Water and lease tenure
- Poor communication with rest of the NSW oyster industry

Potential high risks from external activities include:

- Deterioration of water quality (unsealed roads, stock access, camping close to water ways, lack of toiler facilities, forestry activities and agricultural runoff)
- Changes in hydrological processes – sedimentation
- Boat mooring on leases

The EMS reviewed yearly, Sapphire Coast Wilderness Oysters (SCWO) is currently working with Wapengo oyster farmers to review and develop an updated EMS. Data collected by oyster farmers on water quality and oyster health year round in line with the NSW Shellfish Program, not publicly available but issues are flagged with DPE aquaculture and Council if issues are identified.

In 2012 the Southern Rivers Catchment River Authority together with oyster famers, Council and other key stakeholders developed the Wapengo Waterway and Foreshore Management Plan 2012 (FMP). This plan identified 4 key issues for consideration:

- Boating access - No formal boat launching and parking – leading to erosion and damage to saltmarsh. Two informal access points, east and west side of lake adjacent to oyster sheds, mix of Council and crown land (leased my oyster farmers).
- Public toilet facilities – lack of
- Boating behaviour - impacts on oyster leases and environment, clash of competing uses
- Sustainable fishing practices
- Determination following development of the Wapengo Waterway and Foreshore Management Plan (2012) was that an increase in facilities was not wanted by NPWS or oyster farmers as it would lead to increase and users which is not sustainable.

Outcome of the FMP was that access and infrastructure was suitable for current usage levels and type.

<u>Management</u>

Historically many improvements have been made in the catchment through engagement with landholders and works on private land such as riparian vegetation protection or rehabilitation; road sealing and drainage improvements; and weed control.

Wapengo Catchment and Habitat Protection project involved establishment of a working group of relevant agencies including Council, forestry, LALCs, oyster farmers, local residents, Bega Cheese and targeted hotspots. Series of works done including installation of fencing (9 km), riparian revegetation and protection (80 hectares), road improvements (2 km) and protection of aboriginal heritage sites through bank stabilisation.

More recently additional works have been completed by LLS via the Marine Estate funding including two road and track improvement projects, two bank stabilisation sites, one riparian restoration site.

There has been a high success rate of works completed in this region, Council will continue to support oyster farmers and SCWO in the process of EMS development and work with LLS where possible to assist with works. Councils love our lakes program to support broader education regarding healthy waterways.

Existing Studies and management plans

- Monitoring Evaluation and Reporting Water Quality Report (2012 – 2013)
- Wapengo Lake EMS (2010) (SCRMA)
- Wapengo and Waterway foreshore Management Plan DRAFT (2012)
- Rapid Catchment Assessment (2006) SCRMA

Middle

Middle Lagoon is located within the Mimosa Rocks National Park and is classified as a semi mature, saline coastal lagoon, it is intermittently open to the ocean. A large portion of the catchment is forested (72%) although some sections are highly disturbed due to previous forestry operations. Higher up in the catchment along the two main tributaries, Sandy Creek and Booths Creek there is private properties with land cleared for agricultural purposes.

Water management issues include natural and man-made erosion, intensive land-use and unsealed roads which can all affect water quality via increased sediment and nutrients. Middle lagoon is not subject to regular and/or significant tidal flushing, water quality of the lagoon is more sensitive to catchment inputs compared to permanently open, well flushed estuaries therefore is more vulnerable to catchment disturbance.

Water quality sampling undertaken in 2010-2013 indicated moderate levels of nutrients with mean Nitrogen and Phosphorus levels generally exceeding guideline limits with seasonal algal blooms common (Elgin 2016). The entrance tends to be closed to the ocean a majority of the time with the lake having a highly variable salinity regime with waters ranging from brackish to marine conditions.

Issues

High priority issues identified in the Rapid catchment assessment include:

- Access and usage related issues on NPWS land. (vehicle and boat launching)
- Road and stormwater runoff issues
- Damage to riparian vegetation and bank erosion associated with stock access
- Artificial opening of the entrance

Management

Many of the actions have been addressed by Council, LLS and NPWS and include road sealing (BVSC); installation of gates (NPWS) and; revegetation and fencing on private properties. A barrier to completion of works has been unwillingness of some land holders to participate in rehabilitation projects.

Existing Studies and Management Plans

- Monitoring Evaluation and Reporting Water Quality Report (2012 – 2013)
- Rapid Catchment Assessment – Middle Lagoon (2016)

Nelson Lagoon

Nelson Lagoon is located north of Tathra within the Mimosa Rocks National Park. The estuary is a shallow, saline, coastal lagoon classified as a semi-mature (referring to its stage of infilling), wave-dominated, barrier estuary (Roy et al. 2001). Nelson Lagoon is largely surrounded by National Park (92%) with a few rural residential properties around the edge of the Lake and Nelsons Creek, which is the primary tributary. Less than 1% of the catchment has been cleared for agricultural grazing or rural residential uses (Elgin 2016) The entrance is permanently open and tidally influenced due to the rocky headland on the northern side of the mouth (Elgin 2016). These characteristics result in marine conditions which support extensive mangrove habitat which is not observed in many of BVSC's estuaries which function as ICOLL's.

Due to the close vicinity of the estuary to Tathra, pristine conditions and facilities provided within Mimosa Rocks NP this location is a popular tourist spot for swimming, snorkelling,

kayaking, hiking and fishing. There are unregulated formal tracks to the back of the estuary with multiple informal boat and kayak launching locations within the National Park which pose a risk in terms of sedimentation, loss of riparian vegetation and damage to aboriginal heritage.

Issues

Issues identified in the Rapid Catchment Assessment relate to stock access, degradation of riparian vegetation, reduces bank stability, sediment input from road runoff and informal access.

Management

Many actions identified in the Rapid Catchment Assessment have been completed on private land via LLS and NPWS land with road sealing, installation of fencing and riparian restoration projects undertaken within the catchment.

Existing Studies and Management Plans

- Monitoring Evaluation and Reporting Water Quality Report (2012 – 2013)
- Rapid Catchment Assessment – Nelsons Lagoon (2016)

Bega River

The Bega River estuary is located to the north of Tathra and is classified as a mature, wave dominated, barrier estuary (Fraser 2008, Roy et al. 2001). The entrance is intermittently open and closed to the ocean and is manually opened by Council in line with an entrance management policy to reduce inundation impacts near the entrance. Bega River has a large catchment which incorporates the townships and villages of Kalaru, Bega, Bemboka, Candelo, Brogo and Wolumla. The total catchment area includes the sub-catchments of its main tributaries which are the Brogo River and Upper Brogo in the north and Bemboka River, Tantawangalo Creek, Sandy Creek, Candelo Creek and Wolumla Creek in the south

The estuary consists of a main riverine channel and a number of shallow backwaters including Horseshoe Lagoon, Blackfellows Lagoon, Zecks Lagoon, Chinnock Lagoon, Kangaroo Swamp, Racecourse Creek, Black Ada Swamp and Mogareeka wetland (Elgin 2014). In an open state, tidal influence extends to approximately 11 km upstream to a narrow channel referred to as Bottleneck Reach (near Jellat Jellat flats).

Approximately 57% of the total catchment is forested which includes Tanja State Forest and sections of National park (Bournda NP and South East Forests NP). The lowlands and foothills contain the townships with a large portion of land cleared for agricultural purposes, largely for dairy farming.

The estuary is highly used for recreational purposes for boating, recreational fishing, paddling, swimming and walking. There are two formal boat ramps within the Bega River at Mogareeka and Blackfellows Lagoon. Informal camping is a popular activity along the banks in the lower reaches.

The sand spit on the southern side of the entrance area of the Bega River is a key shorebird breeding site within the Bega Valley with a high success rate.

Further development is approved within this catchment with subdivisions underway at Kalaru and Thompsons River Estate. As part of the Thompsons subdivisions BVSC has obtained a section of foreshore reserve around this site and is currently undertaking riparian restoration works in line with a LLS bank stabilisation project.

Brogo dam is located in the upper regions of the catchment and supplies water to Quaama, Cobargo, Bermagui, Beauty Point, Fairhaven, Wallaga Lake and Wallaga Lake Heights.

Issues

Key issues identified in The Bega River Estuary Management Plan (2011) include:

- Impacts of agriculture – water extraction, clearing of native vegetation, degradation of riparian, bank erosion and other natural areas and pollutants in runoff (sediment, nutrients, pathogens)
- Sewerage treatment and the impacts of holiday populations causing sewerage system failure, leakage and failure of onsite sewerage systems.
- Population growth and urban development
- Climate change

Additional issues raised by the community through the consultation process included demand for entrance management, odours related to STP, lack of public access to foreshore, recreational user conflicts with fishing waste and water-skiing activity and lack of water quality data.

Recent incidents since the EMP which have impacted the catchment include two bushfires, March 2018 (Tathra) and January 2020 bushfires (largely upper catchment).

Management

Many of the actions have been completed through on ground works, changes to the LEP and zoning and completion of additional studies or plans. Council has adopted an entrance management policy for Bega River and completed a flood study, risk management study and plan and developed a Bega and Brogo Rivers Flood Warning System. Upgrades of the two boat ramps (Mogareeka and Blackfellows Lagoon) have been completed via NSW Boating Now funding. NPWS via a shorebird coordinator have worked hard to protect and preserve shorebird habitat through supporting shorebird volunteers with monitoring, installation of signage and temporary fencing and educational programs. NPWS also conducted fox control programs at Mogareeka.

BRAWL has completed extensive work around Bega including revegetation, weed control, installation of interpretive signage, erosion control and development and maintenance of recreational areas including walking tracks and parks along the foreshore.

Bega Cheese Environmental Management System Project was undertaken by Bega Cheese with support from SCRMA, BVSN and DPI. The project initially involved 20 dairy farms but was expanded in 2006 to include all interested dairy farmers in the region. On farm projects to a total expenditure of around $10 million have included dairy effluent management plans and upgrades, riparian and wetland fencing and alternative watering points, dairy laneway upgrades, stream crossing upgrades, farm soil nutrient mapping, whole farm plan development along with training and field days. This partnership base approach has been a key factor to success with the project well received by farmers contributing $3.40 for each grant dollar (BVSC 2008).

Existing studies and Management Plans

- Flood inundation map Bega and Brogo Rivers at Bega Valley Shire Council Water Resources Commission NSW (1980)
- Tathra Sewerage Augmentation Environmental Impact Statement (1997)
- Bega River Estuary Sediment Study (1999)
- Independent Inquiry into the Bega River System (Healthy Rivers Commission) (2000)
- Bega River Estuary – Data Review (2004)
- Bega River Estuary Processes Study (2006)
- Bega River Estuary Management Plan – Estuary Processes (2006)
- MHL / DNR Bega River Tidal Data Collection Sept 2002, Feb 2005 and Nov 2005-Aug 2006 Report MHL1460 (2007)
- Bega River Estuary Management Plan (2007)
- Bega River Estuary Management Plan – Implementation Summary Plan (2011)
- Monitoring Evaluation and Reporting Water Quality Report (2012 – 2013)
- Bega and Brogo Rivers Flood Study (2014)
- Review of Environmental Factors for The Artificial Opening of Bega River (2016)
- Bega River Entrance Management Policy DRAFT (2016)
- Bega and Brogo Rivers Floodplain Risk Management Study and Plan
- Coastal Lakes - Independent Inquiry into Coastal Lakes (2002)

Wallagoot

Wallagoot Lake is situated within Bournda National Park between the towns of Merimbula and Tathra. It is a saline coastal lagoon classified more broadly as a wave dominated intermittently open estuary (Roy et al. 2001) which is subject to prolonged periods of closure. The lake is one of the largest estuaries in the BVSC region with a waterway size of 3.91km^2, however it has a relatively small catchment area of 26.59 km^2 (Fraser 2008). The main tributary in Moncks Creek which is located on the western foreshore. The lake has an expansive central basin with depths ranging from 4-5 on the western side with a maximum depth of 10.5 metres recorded at the eastern end of the basin, adjacent to the marine tidal delta (Elgin 2014).

Land uses within the catchment include light agricultural grazing, low density residential and recreational uses with 68% National Park or Nature Reserve. In water sampling undertaken by Council in 2012-2013 Wallagoot received an overall score of 4.5 (very good) with seagrass and saltmarsh also in good condition. Risk of stratification in Wonboyn due to the depth with low dissolved oxygen in bottom waters. In 2019 there was a fish kill with water sampling indicating it was a result of the waters 'turning' post rainfall.

Wallagoot contains extensive seagrass beds covering 19% of the estuary area (Creese et al. 2009) with saltmarsh fringing the edge of the estuary (3%) (Creese et al. 2009). The invasive green alga *Caulerpa taxifolia* was identified in Wallagoot lake in 2007 in Scotts Bay however was under control via rapid response by NSW DPI and Wallagoot Landcare group with monitoring ongoing. Wallagoot Boat Club and public boat ramp are situation on the northern side of the lake, professional fishing occurs on Wallagoot lake over a six-month fishing season.

High recreational usage for paddling, sailing swimming, fishing, walking and camping popular activities within the national park with provision of facilities including a boat ramp, amenities and sailing club. Housing is located around the lake foreshore in the northern side of the lake, agricultural areas to the west and a campground in the south east corner. Bournda Environmental Education Centre runs school programs and education events on and around the Lake.

Issues

An Estuary Management Plan was developed in 2012 and identified the following issues:

- Development pressures
- Invasive species (Caulerpa, fire weed, rabbits)
- Agriculture – stock access, loss of riparian vegetation & bank erosion
- Climate change
- Lack of data – water quality, biodiversity, vegetation
- Reduction in biodiversity (rec & commercial fish species)
- Increased jellyfish populations
- Entrance management -access

Existing studies and Management Plans

- Review of Environmental Factors for The Artificial Opening of Wallagoot Lake – Review of Environmental Factors (2016)
- Wallagoot Entrance Management Policy (2016)
- Estuary Management Plan for Wallagoot Lake and Bournda Lagoon (2012)
- Estuary Health Monitoring Report Series (2010-2013)
- Bournda National Park and Bournda Nature Reserve Plan of Management (2014)

Bournda Lagoon

The Bournda Lagoon is a generally closed lagoon, the catchment is 71% with some rural residential properties and land cleared for agricultural purposes. Bournda Lagoon has a large catchment and small lake volume therefore is more vulnerable to catchment input. The area is mainly used for recreational and educational activities with walking tracks through the national park and high environmental values due to its largely unimpacted nature. The largely untouched vegetation provides habitat for an array of rare, threatened species including the yellow-bellied glider, Potoroo, Powerful Owl and Hooded Plover. Sandy Creek contains small patches of littoral rainforest. Bournda is a key location for aboriginal heritage sites with 26

sites identified. It is listed as a sensitive coastal lake under Schedule 1 of the Resilience and Hazards SEPP (2021) – this means the whole catchment is mapped as coastal environment area.

In the State of Catchments Report (2010) rated the pressures in the catchment as very low (4.6) with threats stemming from cleared land, sediment and nutrient inputs. There is a history of macro-algal blooms in drought periods. A draft plan was prepared by Bournda Environmental and Education Centre in 2012 with the intention to provide justification for a combined estuary management plan for Bournda and Wallagoot.

Issues

Main issue for the lagoon is catchment runoff from agricultural land and associated nutrient inputs and sedimentation form unsealed roads. Actions for issues identified in the NP PoM relevant to Bournda Lagoon include weed and pest control, preparation of a fire management plan, trail maintenance, relocate sandy beach creek track, and development of an aboriginal heritage management strategy.

Management

Bournda Lagoon was previously a licensed eel and prawn fishing however has been limited or restricted since due to the environmental impacts and clash with recreational usage.

Existing Studies and Management Plans

- Estuary Management Plan for Wallagoot Lake and Bournda Lagoon DRAFT (2012)
- Bournda National Park and Bournda Nature Reserve Plan of Management (2014)

Back Lake

Back Lake is a small coastal lagoon located on the outskirts of Merimbula which is intermittently open and closed to the ocean. The main tributary is Merimbula Creek with the catchment largely vegetated with a mix of residential, National Park (South East Forest NP, Yurramie NP and Bournda NP) with some rural residential land cleared for agriculture. Despite

development there some riparian vegetation along a majority of the riverbank. Seagrass meadows cover approximately 68% of the estuary area (Webb, McKeown & Associates, 1997).

The lower sections of the lake are surrounded by urban development with housing located in Merimbula and Berrambool and the Mirador subdivision under development on the northern side. A recreational complex is located at the lower end with walking tracks around the edges of the lake. The entrance area is a popular swimming spot when the entrance is open with other recreational activities including fishing and kayaking.

Yellow Pinch Dam, located in the upper region of the catchment, is an off-stream dam with a capacity of 3,000 mega litres. Water is pumped into Yellow Pinch dam from Tantawangalo and supplies water to Merimbula, Tura Beach, Pambula Beach, Pambula and 70 rural properties downstream of Yellow Pinch Dam.

Issues

Issues identified in previous plans include:

- Over development
- Sediment inputs and lack of compliance around building sites
- Nutrient input via stormwater runoff
- Loss of riparian vegetation
- Logging activities

Recent issues since the last report include increased sediment inputs from development sites; weed intrusion from urban areas; illegal clearing and vegetation vandalism and; community dissatisfaction with entrance management and trigger levels.

Management

Heavy rainfall events have resulted sediment runoff from the Mirador development, Council have worked closely with the developer to improve sediment an erosion controls on site and conduct more frequent compliance checks. Lessons learnt through this development can be carried into conditions on future developments.

Effort has been put into Merimbula Creek with a community clean up day, weed control and revegetation however for greater success engagement with surrounding land holders and the community is required along with improved compliance.

An Entrance Management Policy for Back Lake was adopted in 2016.

Existing studies & management plans

- Merimbula Lake and Back Lake Compendium of Data Report (1994)
- Merimbula Lake and Back Lake Estuary Processes Study (1995)
- Merimbula Lake and Back Lakes Estuary Management Study and Plan (1997)
- MHL / DIPNR Merimbula Lake, Pambula Lake and Back Lagoon Tidal Data Collection Sept-Nov 2003 Report MHL1290 (2004)
- Coastal Lakes Sustainability Assessments – Merimbula and Back Lakes Pilot Study (2006)
- Back Lake Sustainability Assessment (2009)
- Back lake Sustainability Assessment and Management Strategy (Unknown)
- Back Lake Entrance Management Policy (2016)
- Review of Environmental Factors for The Artificial Opening of Back Lake (2016)
- Back Lake Entrance Management Policy (2016)
- Merimbula and Back Lake Flood Study (2017)

Merimbula Lake

Merimbula Lake is classified as a wave dominated barrier estuary (Roy et al. 2001) and is permanently open to the ocean with the entrance channel trained along the rocky shoreline of Long Point. The lake consists of a deep basin known as 'Top Lake' towards the west which connects to the ocean via an expansive marine tidal delta (Elgin 2014) and a small backwater area known as Golf Course Lake towards the south. The primary inflows are Boggy Creek and Bald Hills Creek which enter from the north west and southwest shores respectively. The catchment is largely vegetated (75%) with 21.5% cleared for agriculture and 5.4% urban development (NLWRA 2001). The town centre is located at the lower end of the estuary with small sections of the upper catchment Yurramie State Forest and National Park.

As a permanently open estuary Merimbula Lake supports seagrass meadows (30%), mangroves (11%), saltmarsh (10%) and intertidal sand/mud flats (Creese et al. 2009). It is one of only three estuaries in the Bega Valley which contains *Posidonia australis* (strapweed) along with *Zostera muelleri* (eelgrass) and *Halophila ovalis* (paddleweed). AS with most estuaries Merimbula Lake contains aboriginal heritage sites and artefacts including shell middens which are often located along the foreshore.

Due to its central location and relatively pristine condition Merimbula Lake is a popular spot for recreational usage for boating, fishing, swimming and kayaking. A boardwalk and pathways are present around large sections of the lake with two boat launching facilities (both at Top Lake) and multiple cafes. Small commercial vessels also operate out of Merimbula for whale watching and fishing charters. Oyster farming occurs throughout the lake with 125.8 hectares designated as priority oyster aquaculture (OISAS 2006).

Other key uses and infrastructure around the lake include the Merimbula Airport, Pambula-Merimbula Gold Course and Merimbula STP of which water reuse occurs on the golf course.

<u>Issues</u>

- Over development

- Sediment inputs and lack of compliance around building sites
- Nutrient input via stormwater runoff
- Loss of riparian vegetation
- Logging activities
- Conflict between waterway users during peak times
- Commercial pressures for the development of recreational boating facilities
- Bank erosion
- Visual impact of oyster leases
- Low lying infrastructure

Management

Some actions of previous management plans have been achieved through updates to LEP and zoning; upgrade to boat ramps via NSW Boating Now Program; improvements to recreational assets, installation of interpretive signage around the foreshore and community engagement and education activities via Love our Lakes. LLS have also had success with works on private properties including fencing out cattle, riparian restoration and weed control.

Entrance instability is a new issue since the last study with successive large swell events eroding the southern end of Merimbula Main beach impacting the channel and placing a large amount of sediment offshore in the boating channel. This has caused some issues for both commercial and recreational boat uses and resulting in relocation of channel markers.

Existing studies and Management Plans

- Merimbula Lake Tourist Centre Environmental Study Report Volume 1 – Environmental Planning Report David Grogan Planning Services (1982)
- Merimbula Lake Tourist Centre Environmental Study Report Volume 2 – Engineering Design Report David Grogan Planning Services (1982)
- Merimbula Creek Flood Study Reid Street Crossing (1986)
- Merimbula Lake and Back Lake Compendium of Data Report (1994)
- Merimbula Lake and Back Lake Estuary Processes Study (1995)
- Merimbula Lake and Back Lakes Estuary Management Study and Plan (1997)
- MHL / DIPNR Merimbula Lake, Pambula Lake and Back Lagoon Tidal Data Collection Sept-Nov 2003 Report MHL1290 (2004)
- Coastal Lakes Sustainability Assessments – Merimbula and Back Lakes Pilot Study (2006)
- Merimbula Lake Sustainability Assessment and Management Study (2009)
- Merimbula Bay Deep Water Survey (2009)
- 21 Beach Street Merimbula, Coastal Engineering Assessment (2010)[1]
- Monitoring Evaluation and Reporting Water Quality Report (2010 – 2013)
- Merimbula and Back Lake Flood Study (2017)
- Merimbula Lake Oyster Growers Environmental Management System (SCRMA 2011)

[1] Confidential planning assessment report.

Pambula River

Pambula River is situated south of the Pambula township and is best classified as a wave dominated, drowned river valley due to the topography and geology of the steep slopes which confine the entrance (Elgin 2014). The relatively deep inlet, up to 12m in sections, is 4km long and connects to a central sand mud basin known as Broadwater with depths between 4-6m (Elgin 2014). The catchment is 80% forested with 14% used for grazing and 3% is urban/rural (Cardno 2011). Ben Boyd National Park encompasses most of the lower reaches with urban development and agricultural land focused along the two main tributaries, Yowaka and Pambula River.

Being permanently open to the ocean and exhibiting predominantly marine conditions the lake supports communities of seagrass meadows (15%), mangroves (12%) and saltmarsh (7%) (Creese et al 2009). Pambula River is one of only 3 estuaries within the Bega Valley which supports large meadows of *Posidonia australis* (with Merimbula Lake and Bermagui River) (Elgin 2014).

Its location in close proximity to the town centre of Merimbula and Pambula result in high recreational usage for boating, fishing and swimming and is used commercial for oyster farming. Access to the lake is well provided on both the north side (BVSC) and south side (NPWS) with formal parking and access tracks to mile beaches and walking tracks along either side. On the western side of the lake at Broadwater there is a public boat ramp facility. Oaklands Farm located along the Pambula River has been a site of STP water reuse since 2013 with the landholder also participating in Willow control projects.

The Estuary Processes Study (2011) concluded the estuary was in good condition however some ecosystem indicators showed a worsening trend due to human activities in the catchment.

Panboola Wetlands is a key environmental site located along Pambula River at the bottom of the Pambula township. Pambula Wetlands and Heritage Project Inc. manages 82 hectares of

land which was largely donated with some Crown Land. Extensive rehabilitation works have been undertaken on this site through grant funding and community participation for the purpose of nature conservation and resting habitat for wildlife. As well as conservation, the area is popular for recreation with a network of walking tracks and interpretive signage throughout the wetland, some of which dogs are permitted.

Issues

SCRMA completed a Pambula Catchment Rehabilitation Plan (2012) which identified site specific issues along the Pambula and Yowaka Rivers and subcatchments to guide future works. This report characterised conditions of major streams, recommended management actions and identified priority reaches to target for future works based on recovery potential and socio-economic values. Issues highlighted in this study include geomorphic condition, riparian condition and weed intrusion, all of which were prevalent along the upper reaches mostly on private land.

Actions in Pambula CZMP were related to terrestrial weeds, bank stabilisation and rehab, riparian protection (fencing) and restoration, rationalisation of access, community engagement and education (private residents and industry), protection of aboriginal heritage sites, storm water management and improved recreational opportunities. There is minimal Council land around Pambula Estuary, actions were largely related to LLS and NPWS. Actions have largely been completed or are ongoing projects within the catchment.

Management

Successful projects in the catchment include Panboola Wetlands and ongoing works with land holders. Major issue for completion of actions in this catchment is landholder engagement, with most issues located on private land along Pambula and Yowaka Rivers, cooperation and input by land holders is required to complete actions.

There is a strong drive within the local community with Pambula village collectively going ‘plastic free’ and active community and land care group. Ongoing education and engagement with local residents and businesses is key for this location.

Council has current grant for bank stabilisation, revegetation and weed control along key sites on the Yowaka and Pambula Rivers. There is minimal Council land around Pambula Estuary, actions were largely related to LLS and NPWS. Actions have largely been completed or are ongoing projects within the catchment.

Existing studies and Management Plans

- Pambula River Data Assessment Study (1990)
- Character and Sources of Sediment to Pambula Lake (1994)
- MHL / DIPNR Merimbula Lake, Pambula Lake and Back Lagoon Tidal Data Collection Sept-Nov 2003 Report MHL1290 (2004)
- Pambula Lake Estuary – Data Compilation Study (2008)
- Pambula River Estuary Processes Study (2012)
- Pambula Lake Coastal Zone Management Plan (2015)
- Pambula Catchment Rehabilitation Plan (2012) (SCRMA)

Lake Curalo

Lake Curalo is located at the southern end of the Shire in Eden and is a semi-mature, saline coastal lagoon that is intermittently closed or open to the ocean (Fraser 2008). The primary inflow into the lake is via Palestine Creek with two ephemeral streams, Freshwater Creek and an unnamed creek that drain into Curalo from the West (Elgon 2016). Wave action is the dominant force in the estuary with a large barrier dune enclosing the central basin (Roy et al. 2001). This combined with other factors including rainfall, small catchment size and limited freshwater inflows result in the lake often being closed to the ocean. Council manually opens the entrance as per the Lake Curalo Entrance Opening Policy to limit inundation impacts of keys assets and infrastructure. The lower catchment is largely urban and rural residential land in the town of Eden with the upper sections incorporating Nullica State Forest and a section of Ben Boyd National Park.

Curalo Lagoon contains sections of seagrass, sections of saltmarsh and intertidal mud flats which are a key habitat for wader and shorebird species of which 33 species have been recorded at Curalo including four protected species (BVSC 2002).

The walkway and boardwalk exist around the foreshore however community consultation has identified the need for better access and improvements for all abilities and prams.

<u>Issues</u>

Key issues identified in the previous Estuary Management Study and Plan include:

- Potential sources of nutrients (stormwater, septic, sediment, commercial/industry)
- Impacts of foreshore usage (golf course reuse, sports grounds, agriculture, unsealed roads/drainage lines)
- Entrance management
- Flood risk
- Odour
- Lack of public land around the lake

- Degradation of riparian vegetation
- Estuary health
- Lack of public access and recreational facilities around the lake
- Lack of knowledge and educational resources around the lake (local and tourism benefit)
- Development

Recent issues which identified by the community include bushfire threat, increased illegal clearing and lack of recreational access and usage of the lake. Given the long period of closure up until the lake was opened in July 2020 community concern for the health of the lake was heightened and dissatisfaction with the amenity and odour. This has resulted in increased queries regarding sedimentation and odour and options to reduce this. Extensive housing development on the northern side of the lake has also caused concern.

Management

Works have involved Love our Lakes educational program, improvements to recreational facilities (walking track/board walk and signage), update to planning documents DCP and LEP and development of an entrance management policy. Although some works have been undertaken in Lake Curalo since the development of the EMS the overall objectives of many of the actions has not been met.

Existing studies and Management Plans

- Lake Curalo Data Compilation Study (1997)
- Lake Curalo Estuary Processes Study (2002)
- Lake Curalo Estuary Management Study and Plan (2002)
- Lake Curalo Sediment Study (2007)
- Monitoring Evaluation and Reporting Water Quality Report (2012 – 2013)
- Review of Environmental Factors for The Artificial Opening of Curalo Lake (2016)
- Curalo Lake Entrance Management Policy (2016)
- Eden, Twofold Bay and Towamba River Flood Study (2020)
- Proposed Dredging of Lake Curalo, Eden – Environmental Impact Statement (1988)

Shadrachs Creek

Shadrachs Creek is a small coastal creek which runs into Twofold Bay adjacent to a caravan park and is frequently closed. The catchment is largely Nullica State Forest, part rural residential and part Eden residential area. No data was collected regarding Shadrachs creek for the state of the catchment reports.

The creek is utilised recreational for fishing and swimming activities with a caravan park located adjacent to the creek. A rock wall has been constructed in front on the caravan park backing the beach.

Issues

Based on land uses potential issues include sediment inputs from forestry activities and unsealed roads, nutrient inputs form agricultural areas and loss of riparian habitat although. This area is susceptible to coastal hazards including overtopping and inundation with the caravan park low lying in the gulley with no dune buffer present.

Management

This area was significantly impacted by the January 2020 fires and will be included in catchment recovery plans to be developed. Initial erosion and sediment controls will be done across the catchment followed by revegetation and weed control as needed.

This area has also been covered in the recent Eden, Twofold Bay and Towamba River Flood Study (2020).

Existing studies and Management Plans

- Eden, Twofold Bay and Towamba River Flood Study (2020)

Nullica

Nullica River is located on the western side of Twofold Bay and has a predominantly open entrance. It is situated in a large catchment mostly made up of Nullica State Forest with sections of rural residential private land along the lower reaches of the river with some land cleared for agricultural purposes. The two main tributaries are Nullica River and Leos Creek.

Access to the river is provided near the entrance with the River popular for recreational fishing and is recognised as a declared recreational fishing haven.

The Nullica catchment was heavily impacted by fires in January 2020 with 93% of the catchment burnt.

Issues

Potential issues within the catchment include erosion from unsealed roads and clearing of riparian vegetation and stock access to waterways. Historical land usage has led to sedimentation of the river. The State of the Catchment Report (2010) assessed Nullica River to have a low to very low pressure rating (4.9) based on land usage.

Management

Council currently has a grant to undertake sediment and erosion controls, weed control and revegetation to reduce bushfire related impacts to the waterway.

Existing studies and management plans

- Eden, Twofold Bay and Towamba River Flood Study (2020)
- MER Program sampling (2011)
- State of Catchments Report (2010)

Boydtown Creek

Located in Twofold Bay Boydtown Creek is a small coastal creek with a small catchment area. There has been significant clearing undertaken in the lower catchment for the development of a caravan park and subdivision. The catchment also contains rural residential land and cleared sections for agricultural purposes. The State of Catchments report (2010) assigned Boydtwon Creek a low to very low-pressure rating (4.3), no condition score was provided due to lack of data.

Issues

- Illegal opening of the entrance
- Sediment runoff from unsealed roads and subdivision site
- Loss of riparian vegetation and habitat

The bushfires in January 2020 burnt 58% of the Boydtown catchment so there is greater potential for erosion from steep surrounding slopes and nutrient input into the creek.

Management

This site has historic development approvals with some works undertaken as part of this. Future approvals for this site will align with current legislation and seek to have better environmental outcomes.

Existing studies and management plans

- Eden, Twofold Bay and Towamba River Flood Study (2020)
- State of Catchments Report 2010

Towamba River

Towamba River is a permanently open wave dominated barrier estuary situated at the southern end of Twofold Bay and is a declared recreational fishing haven. It has a fairly large catchment with 5 tributaries including Pericoe Creek, Wog Wog River, Mid Towamba River, Jingo Creek, Stony Creek. The catchment consists of a mix of State Forest, National Park (Mount Imlay NP) and rural residential land with private properties situated along the foreshore for the length of the Towamba River. Councils water supply for the southern area is drawn from Towamba River bore field at Kiah.

Issues

Based on land usage potential issues within the catchment include:

- Sediment input from forestry activities and unsealed roads
- Stock access leading to bank instability and loss of riparian vegetation
- Potential impacts on water quality from private septics and agricultural runoff
- Unregulated clearing and vegetation vandalism due to lack of compliance/oversight

This catchment was impacted in the Jan 2020 fires and with impacts to be addressed via the fire recovery grant with works including water quality monitoring, sediment and erosion controls and revegetation. Since the fire there has been continued clearing of vegetation, burnt and unburnt.

Existing studies and Management Plans

- Eden, Twofold Bay and Towamba River Flood Study (2020)
- Davidson Whaling Station Historic Site Plan of Management

Fisheries Creek

Fisheries Creek is located on the south eastern edge of Twofold Bay and has an intermittently closed entrance. East Boyd Sate Forest makes up a majority of the catchment, Eden Aboriginal Lands Council owns land to the west of the Creek with the Eden Chip Mill located on the eastern side. There is limited data on the state of this creek however in the State of Catchment Report (2010) the pressure indicator for the creek was scored a 5 which is deemed very low risk from factors including population, nutrient input, cleared land and disturbed habitat.

Potential future uses of the site when it is linked to the Bundian Way include formalised camping area.

This region was impacted in the January 2020 fires and will be included as part of the fire recovery grant for works including sediment and erosion controls and revegetation.

Issues

Through consultation and site visit with LALC (March 2021) a range of issues were identified

- informal access and camping - lock is frequently cut and additional four wheel drive tracks made
- Difficulty with compliance - LALC have insufficient resources and low priority for police
- Illegal dumping of waste,
- European green crab and other marine pests via ballast -previous management program by LALC & with funding
- Vehicle damage to saltmarsh - LALC seeking to fence off access to this area
- Persisting beach scarp and loss of dune from 2016 east coast low

Post fire issues include weed intrusion (Arum Lily) and loss of dune vegetation.

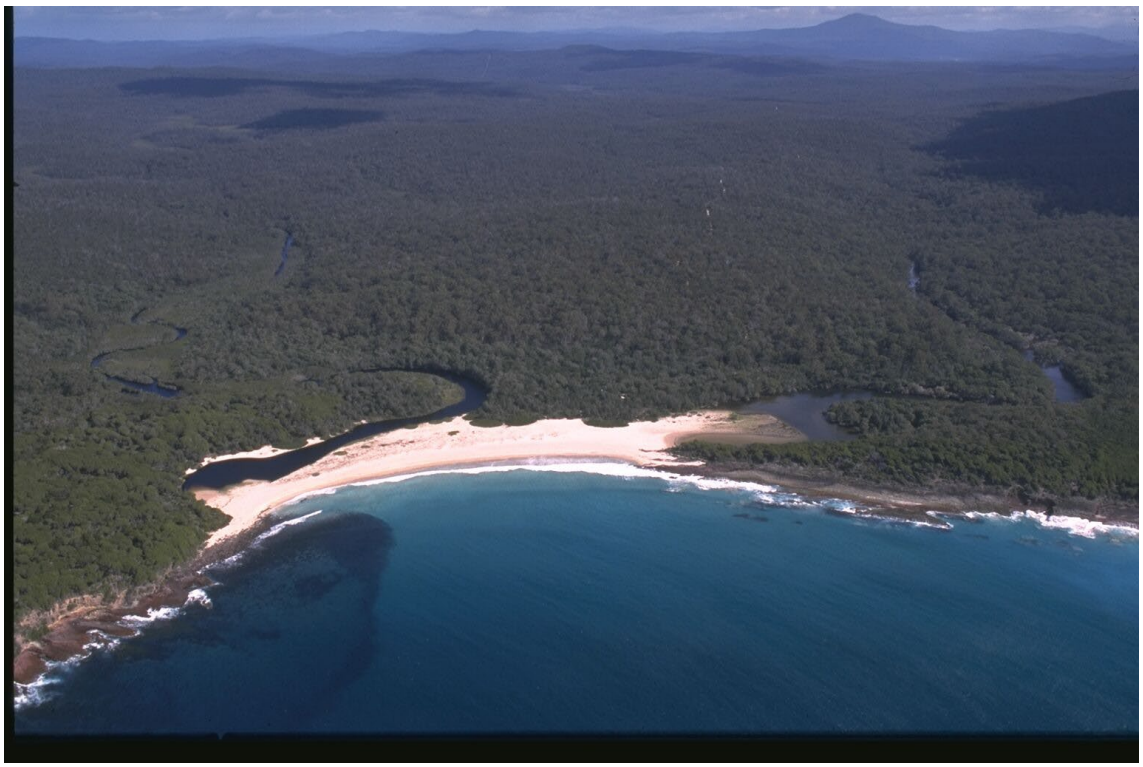
Management

Land Council try to restrict access (with the help of NPWS) and weed management program. Illegal access to the site continues to be an ongoing issue. Due to the remoteness of the site compliance is difficult.

Existing studies and Management Plans

nil

Woodburn and Saltwater Creek



Woodburn and Saltwater Creek are both located within the same bay in the middle of the Ben Boyd National Park south of Twofold Bay. These saline coastal lagoons are intermittently closed to the ocean. Saltwater Creek campground is located at the back of the beach and is a popular area for camping, recreational fishing, surfing and walking with the Light to Light Walk running along this section of coastline from Green Cape in the south to Ben Boyd Tower in the North.

Issues & Management

Minor issues may relate to recreational usage with campgrounds situated behind the beach.

Existing Studies and Management Plans

- Ben Boyd National Park and Bell Bird Creek Nature Reserve Plan of Management (NPWS)

Wonboyn

Wonboyn River is located at the southern end of the Bega Valley in Disaster Bay in a largely vegetated catchment consisting of Ben Boyd National Park, Nadgee Nature Reserve with large portion State Forest (East Boyd, Timbillica and Nadgee). The small village of Wonboyn is located on the western edge of the lake which includes rural residential lots with small areas cleared. There is a small number of properties scattered upstream and along the northern foreshore of the lake and holiday cabins. Many of the properties on the lake have jetties and boat sheds and hold Crown Leases for this usage.

Wonboyn River is a youthful wave dominated barrier estuary (Roy et al. 2001) which consists of a shallow inlet channel which opens into a broad and deep basin approximately 3.5km from the ocean (Elgin 2015). The tidal inlet is shallow and characterised by shifting sand shoals with a predominantly open entrance which is trained along the northern side of Bay Cliff. The constrained entrance results in a reduced tidal range, approximately 10-15% less than the ocean (WBM 2001) and longer flushing time than other riverine estuaries in the Bega Valley taking 66.4 days (Roper et al. 2011).

The large catchment consists of five subcatchments; Bull Creek, Stevens Creek, Watergums Creek, an un-named creek and Narrabarba Creek (incl. Ludwigs Creek) which is the largest covering approximately 54% of the total catchment area (Elgin 2015).

Oyster aquaculture is a key industry in Wonboyn with 52.8ha of the estuary designated priority oyster aquaculture area (OISAS 2014). The lake is a popular tourist destination with many people travelling to the area to access Ben Boyd National Park and utilise the lake and beaches for fishing, surfing, boating and kayaking.

Issues

Wonboyn EMS identifies improvement to oyster industry operations to reduce environmental impacts, also highlights other issues within the catchment. High risk external factors noted in the EMS were recreational boat activity (wake and interaction with leases), uses of

chemicals/pesticides in the catchment (only occurs in 7.8% of catchment), deterioration of water quality due to agricultural runoff, unsealed roads, camping close to waterway, forestry activities, acid sulphate soils and changes in hydrological processes (entrance closures).

Ongoing issues relate to lack of recreational access and infrastructure around the lake. There are sites of informal access on the northern side with ATV access onto the beach and dogs within the national park impacting dune vegetation and shorebirds. Climate change issues and changes in rainfall and opening periods, adaptation to infrastructure (note shellfish doc. being developed to address this).

Initial attempts in 2015-2017 to develop at Entrance Management Policy for Wonboyn Lake were unsuccessful with oyster farmers requesting consideration of water quality triggers. As a lake which has historically been open a majority of the time there was strong community dissatisfaction related to extended periods of entrance closures. Following extensive stakeholder and community consultation an Entrance Management Policy for Wonboyn Lake was endorsed by Council in June 2021. Other issues include sedimentation of the mouth and erosion of the foreshore at North Wonboyn.

Impacts from 2020 bushfire are severe in the Wonboyn catchment with 90% burnt, fortunately much of the immediate foreshore vegetation remains intact. Successive large rainfall events in this catchment has mobilised sediment and debris which has impacted bridges and poses an ongoing threat to water quality.

Management

Many of the actions from the previous plan have been implemented including:

- Rezoning through LEP
- Installation of channel markers within the estuary
- Improvement to NPWS directional and informational signage
- Upgrade of Myrtle Cove boat ramp
- Sealing of Wonboyn and Nadgee Road
- Storm and wastewater management plan developed

Existing studies and Management Plans

- Wonboyn River Tidal Data Collection (1997-98)
- Wonboyn Lake Vibrocore Summary (1999)
- Wonboyn Lake Estuary Management Study (2002)
- Wonboyn Lake Estuary Management Plan (2003)
- Stormwater, Septic and Waste Leachate Management Plan: Wonboyn Lake (2005)
- Wonboyn Lake Oyster Growers – Environmental Management System (SCRMA 2011)
- North Wonboyn Foreshore Protection Study (2015)
- Wonboyn River Estuary- Environmental Monitoring in coastal lakes and lagoons of the Bega Valley Shire Council region (2015)
- Review of Environmental Factors for The Artificial Opening of Wonboyn Lake DRAFT (2016)
- Wonboyn Lake Entrance Management Policy DRAFT (2016)
- Wonboyn Estuary: Northern Foreshore Erosion Assessment and Protection Plan (2017)
- North Wonboyn NSW Foreshore Protection Study (2015)
- Review of Environmental Factors – Low Water Level Artificial Opening of Wonboyn Lake to mitigate Post-Bushfire Water Quality Impacts (Elgin 2020)

- Preliminary Investigation of Wonboyn Entrance Opening and Potential Bushfire Water Quality Impacts- Stage 1: Initial Assessment of reverse entrance opening for spring tides 6-14th February 2020 (MHL 2020)
- Preliminary Investigation of Wonboyn Entrance Opening and Potential Bushfire Water Quality Impacts- Stage 2: 2D Hydraulic Model Investigation of Entrance Channel Dredging (MHL 2020)
- DPIE Post Bushfire Water Sampling (DPIE EES 2021)
- Wonboyn Lake Environmental Management System (2011) (SCRMA)
- Ben Boyd National Park and Bell Bird Creek Nature Reserve Plan of Management (NPWS)

Nadgee Lake, Nadgee River, Table Creek/Little River and Merrica River

Nadgee Lake

These four estuaries are located within the Nadgee Nature Reserve at the southern end of the Bega Valley between Wonboyn Lake and the Victorian border encompassing 20,671 ha. The reserve is the sole declared wilderness area in NSW of high conservation value for both flora and fauna supporting a series of threatened and biologically significant species (NPWS 2003). Aboriginal sites of significance have been identified and are a high priority for protection and preservation. The estuaries and coastline are some are the most isolated beaches and undisturbed catchments in NSW and is a key site for scientific reference sites. Under the DPE-EES MER program, Nadgee Lake is sampled each year as a reference site for water quality impacts. Nadgee Lake is listed as a sensitive coastal lake under schedule 1 of the Resilience and Hazards SEPP meaning the whole catchment is mapped as coastal environment area.

This area managed by NPWS under the Nadgee Nature Reserve Plan of Management (2003) which states “The wilderness area will be managed to protect its natural heritage and value for solitude and self-reliant recreation by such measures as minimising vehicle tracks and limiting the amount of use”. The region supports low key visitor usage for activities including walking, picnicking, beach and lake recreation however protection of natural values has priority over

recreation. The only disturbance within this zone is related to historical usage for agriculture purposes and forestry including road access and a homestead.

Actions and policies developed in the Plan of Management include eradication of weeds and introduced species as required throughout the reserve, protection of aboriginal cultural sites and fire management.

This region was significantly impacted by the fires in Jan 2020 (mention burn scar mapping). Bega Valley Shire Council along with Eurobodalla and Shoalhaven City Councils has obtained grant funding for a regional assessment of fire impacts and development of an implementation plan to guide recovery works over the next 3 - 10 years.

Issues & Management

Minor issues include weeds (arum lily) and pests including deer.

Existing Studies and Management Plans

- Nadgee Nature Reserve Plan of Management (2003)

Nadgee River

Merrica River

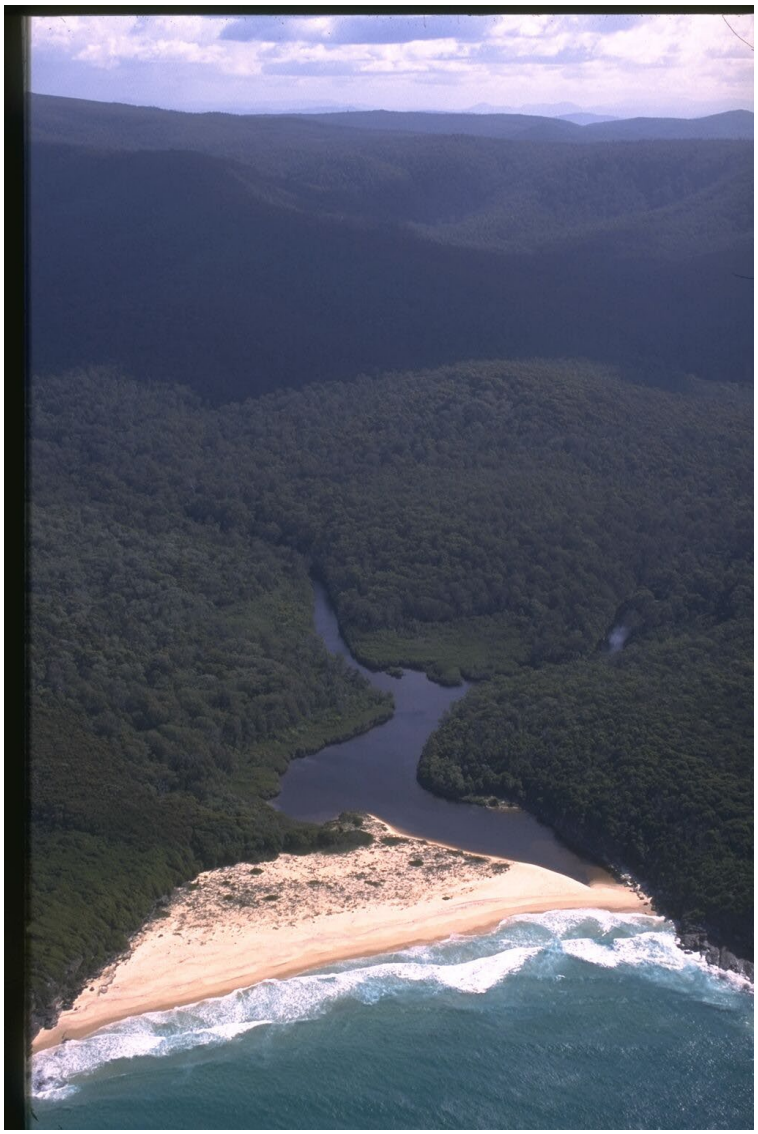


Table Creek