DECEMBER 2021

DEPARTMENT OF PLANNING, INDUSTRY AND ENVIRONMENT

TECHNICAL STUDY REPORT

ENGINEERING – INFRASTRUCTURE

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GLOSSARY

Distribution Network	Distribution systems operate at a lower voltage than transmission systems and deliver power from the transmission network to households and businesses
Energy Consumption	The amount of energy consumed in an hour is usually expressed as kilowatt-hours (kWh) or megawatt-hours (MWh). 1 MWh = 1,000 kWh
Forecast Load	Future asset loading patterns
Generator	An organisation that produces electricity. Power can be generated from various sources, e.g. coal fired power plants, gas-fired power plants, wind farms
Investigation Area	The investigation area for the Snowy Mountains SAP, encompassing an area of 72,211 ha including Jindabyne and the Alpine Resorts of Kosciuszko National Park.
Load	The amount of electrical power that is drawn from the network
Monero Ngarigo	Aboriginal linguistic group who traditionally occupied the eastern side of the Kosciuszko plateau and further north towards the Murrumbidgee River. The traditional custodians of the Snowy Mountains are the Monero Ngarigo people.
Maximum Transformer Delivery Power	Usually expressed in megavolt-ampere (MVA)
Power	Watts (W), usually expressed in kilowatts (kW) and megawatts (MW). 1 MW = 1,000 kW = 1 million W
Snowy Mountains	The highest mountain range on the continent of mainland Australia, located in southern New South Wales and part of the larger Australian Alps and Great Dividing Range. The mountain range experiences large natural snowfalls every winter.
Special Activation Precinct	A Special Activation Precinct is a dedicated area in a regional location identified by the NSW Government to become a thriving business hub to create jobs, attract business and investors, support local industries and fuel economic development.
Substation	A set of electrical equipment used to step high voltage electricity down to a lower voltage. Lower voltages are used to deliver power safely to small businesses and residential consumers.
Terminal Substation	This asset will usually represent the boundary of ownership between one Network Service Provider and another. It is the point where electricity leaves a transmission network and enters a distribution network. Typically, a terminal substation will transform voltage down from transmission level voltages to sub transmission level voltages.
Transformer	A power transformer is used to change the voltages from one level to another. Different voltages are used for generation, high voltage transmission and local distribution the power transformer steps the voltage up or down before attaching to similar equipment and exiting the substation.
Transmission line	A high voltage power line running at 500 kV, 330 kV, 220 kV or 132 kV. The high voltage allows delivery of bulk power over long distances with minimal power loss.
Voltage	Can be thought of as the “pressure” that forces current to flow in a wire like the way in which pressure forces water to flow in a pipe. The higher the pressure the greater the flow. Voltage is measured in Volts and has the symbol “V”.

ABBREVIATIONS

ACT	Australian Capital Territory
ADWF	Average Dry Weather Flow
AGWR	Australian Guidelines for Water Recycling
CBD	Central Business District
DAPR	Distribution Planning Report
DBYD	Dial Before You Dig
DN	Nominal Diameter
DPC	Department of Premier and Cabinet
DPIE	Department of Planning, Industry and Environment
DRNSW	Department of Regional New South Wales
EbD	Enquiry by Design
EPA	Environment Protection Authority
EPL	Environment Protection License
FOGO	Food Organics and Green Organics
FTE	Full-Time Equivalent
HPGTPs	High Pressure Gas Transmission Pipelines
HNSW	Heritage New South Wales
HV	High-Voltage
KNP	Kosciuszko National Park
KNP POM	Kosciuszko National Park Plan of Management
kV	Kilo Volts
LGA	Local Government Area
LV	Low-Voltage
LRV	Log Reduction Value
MAOP	Maximum Allowable Operating Pressure
ML	Measurement Length
MVA	Mega Volt-Ampere
MW	Mega Watt
NPWS	National Parks and Wildlife Service
NSW	New South Wales

PDD	Peak Day Demand
PJ	Petajoule
PV	Photovoltaic
RAP	Registered Aboriginal Party
RGDC	Regional Growth NSW Development Corporation
SAP	Special Activation Precinct
SEPP	State Environmental Planning Policy
SMRC	Snowy Monaro Regional Council
SPS	Sewerage Pump Station
STP	Sewerage Treatment Plant (also WWTP)
STS	Sub-Transmission Substation
TAPR	Transmission Planning Report
TfNSW	Transport for New South Wales
TL	Transmission Line
TS	Terminal Substation
TX	Transformer
VIC	Victoria
WAL	Water Allocation License
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant (also STP)
ZS	Distribution Zone Substation

EXECUTIVE SUMMARY

Through the Snowy Mountains Special Activation Precinct project, a new Master Plan for the Snowy Mountains will be created. The Master Plan focuses on:

- increasing year-round tourism to grow the regional economy
- creating year-round employment opportunities
- investing in the region's infrastructure to meet the growing needs of residents, seasonal works and temporary visitors, and
- attracting more visitors to the region from Australia and the world, transforming the Snowies into Australia's Alpine Capital.

The Snowy Mountains SAP will continue to focus on Jindabyne (including East Jindabyne and Tyrolean Village) but also look at Kosciuszko National Park and alpine resorts (Thredbo, Perisher and Charlotte Pass) and the major transport corridors of Alpine Way and Kosciuszko Road.

WSP has been engaged to develop the engineering packages for the Snowy Mountains Special Activation Precinct master plan. This infrastructure report studies existing infrastructure networks and makes recommendations to upgrade or construct new services to meet the master planning needs of the area.

In doing so, the structure plans were reviewed to understand the proposed development areas, types, and densities so new infrastructure could be developed. In addition, permanent populations and visitor growth forecasts were analysed to assess the impact of the increasing demand on critical infrastructure including sewer treatment plans, water intake location and electrical substations.

WSP engaged with multiple stakeholders over the course of the delivery including utility authorities, Snowy Monaro Regional Council (SMRC), Regional Growth NSW Development Corporation, NSW Department of Industry, Planning and Environment, NSW National Parks and Wildlife Service, Perisher and Thredbo ski resorts and other local chalets and lodges. The information used to develop this technical study is both from existing system data and information, or anecdotally through the experience of the infrastructure operators and other stakeholders listed.

The process identified the below summary of key findings:

- The Jindabyne potable water treatment facilities are currently inadequate and require investment to upgrade the water intake and filtration points and provide a central water treatment facility.
- The Jindabyne sewer treatment plant does not have capacity to service additional flows from population growth in Jindabyne and will require expansion.
- The Thredbo and Perisher ski resorts have capacity in the existing sewer treatment, water treatment, and power substation facilities to meet the demands of current bed limits. An increase in these bed limits would require the upgrade or expansion of these resort facilities.
- The Thredbo and Perisher ski resorts have fibre telecommunications connections that have been negotiated with service providers in the past. Smaller resorts along Alpine Way and Kosciuszko Road are mostly reliant on inconsistent coverage by telecommunications towers or private satellite connections.
- Growth areas proposed in the Structure Plan have resulted in the requirement to upgrade, expand or construct new power, water, telecommunications and electrical infrastructure to service the areas.

A full list of infrastructure upgrade recommendations can be found in the Conclusion and Recommendations sections of the report.

1 INTRODUCTION

Special Activation Precincts (SAPs) are dedicated areas in regional NSW identified by the NSW Government to become thriving hubs. The SAP program facilitates job creation and economic development in these areas through infrastructure investment, streamlining planning approvals and investor attraction.

The SAP program adopts a collaborative and integrated whole-of-government approach, bringing together the local Council and a range of other relevant State and local agencies.

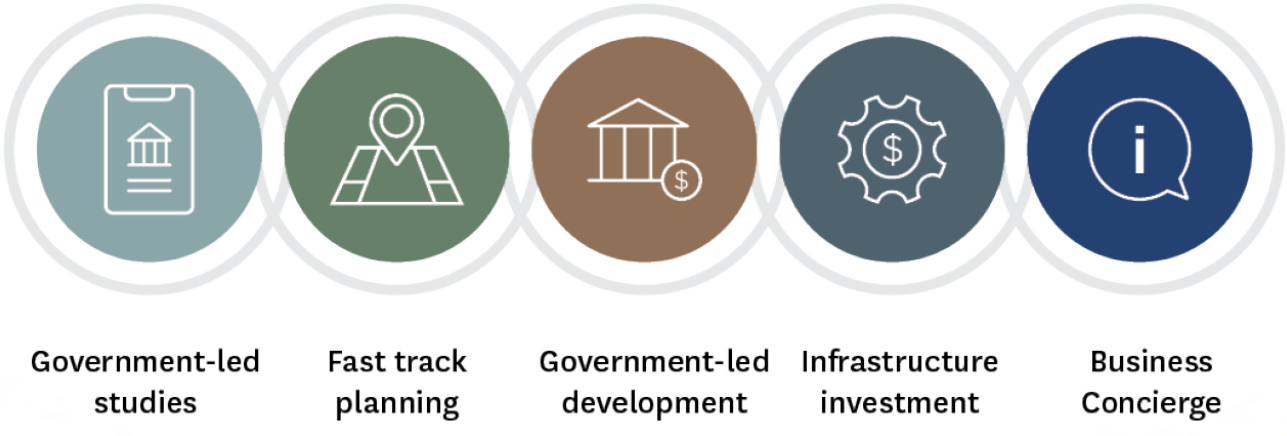
SAPs are unique to regional NSW. By focusing on planning and investment, their goal is to stimulate economic development and create jobs in line with the competitive advantages and economic strengths of a region.

On 15 November 2019, the NSW Government announced its commitment to investigating the Snowy Mountains SAP, to revitalise the Snowy Mountains into a year-round destination and Australia's Alpine Capital, with Jindabyne at its heart. The Snowy Mountains SAP is being delivered through the $4.2-billion Snowy Hydro Legacy Fund.

Different components of each SAP are led by different teams within the NSW Government:

- The **Department of Regional NSW** assesses potential locations for inclusion in the program and considers government investment for essential infrastructure to service the SAPs.
- The **NSW Department of Planning, Industry and Environment** (the Department) is responsible for the planning of SAPs. The Department leads the master planning process, including community and stakeholder engagement, the technical studies required to inform the preparation of a master plan and development of the simplified planning framework for each Precinct.
- The **Regional Growth NSW Development Corporation** (Regional Growth NSW) is responsible for delivering and implementing Special Activation Precincts. This includes attracting investment, providing support to businesses, developing enabling infrastructure, and creating strategic partnerships to foster education, training and collaboration opportunities.

The five core pillars of the Special Activation Precincts are:



The planning framework for each Special Activation Precinct includes three key parts:

State Environmental Planning Policy (Activation Precincts) 2020	Special Activation Precinct Master Plans	Special Activation Precinct Delivery Plans

— Identifies each Special Activation Precinct.
— Requires that an Activation Precinct Certificate be sought prior to a development application or complying development certificate being issued, to ensure the development is consistent with the Master Plan and Delivery Plan.
— Provides zoning and land use controls for each Precinct.
— Identifies Exempt and Complying Development pathways for certain development.
	— Made by the NSW Department of Planning, Industry and Environment and approved by the Minister.
	— Identifies the Vision, Aspirations and Principles for the Precinct.
	— Provides more detailed land use controls where required.
	— Identifies Performance Criteria at a Precinct-scale for amenity, environmental performance and infrastructure provision.
	— Identifies the matters to be addressed as part of the Delivery Plan.
		— Prepared by Regional Growth NSW and approved by the Planning Secretary.
		— Identifies site-level development controls.
		— Provides detailed strategies and plans for:
		  — Aboriginal cultural heritage
		  — environmental protection and management
		  — protection of amenity
		  — infrastructure and services
		  — staging
		  — provides procedures for ongoing monitoring and reporting.

1.1 MASTER PLANNING

The master planning process for the SAPs adopts an evidenced based approach to determining the best outcome for the precincts. It is designed to ultimately provide a clear pathway for the right types of future development, in the right locations.

The process involves the engagement of a range of technical experts to investigate the study area and prepare technical studies (such as this report) to demonstrate their findings. Each of the technical studies are specifically designed and scoped for each SAP and tailored to the needs of the study area.

Importantly, the master planning process for the Snowy Mountains SAP will build on work already undertaken for portions of the study area as part of the Go Jindabyne master plan.

To achieve integrated and balanced planning outcomes, technical experts and other stakeholders work together at a series of enquiry by design workshops throughout the master planning process. At these workshops, opportunities and constraints are discussed and assessed to inform how the precinct should be shaped. This includes the evaluation of matters such as environmental impacts and benefits, transport opportunities, infrastructure capabilities, stormwater, economic viability and many others. These workshops are designed to give technical experts and decision makers a chance to ensure the identified vision, aspirations and principals for the precinct are guiding the outcomes.

The technical reports will ultimately inform the development of planning controls for the Snowy Mountains SAP to guide the precincts development. These controls will be contained in the master plan, Special Activation Precincts SEPP and delivery plan and will relate to important matters such as amenity, environmental performance and infrastructure provision.

Throughout the planning process, community, stakeholder and industry consultation takes place. Ongoing consultation provides an opportunity for community members and landowners to contribute and help shape the vision for the project.

1.1 SNOWY MOUNTAINS SAP

The Snowy Mountains region is one of Australia's most iconic natural environments. In addition to hosting some of Australia's premier alpine destinations, the Snowy Mountains is home to over 35,000 people and Australia's highest peak, Mount Kosciuszko. The traditional custodians of the Snowy Mountains are the Monero Ngarigo people, in connection with the Walgalu, Ngunnawal and Bidhawal people.

The Snowy Mountains are located in the south east of NSW. This region forms the northern part of the Australian Alps which extends south into Victoria. Predominantly the region is accessed from Canberra which is located approximately 150 kilometres to the north. To the south and west of this region is the sparsely populated high country. The township of Jindabyne situated on Lake Jindabyne provides a hub for the region, with opportunities for tourism and facilities supporting the regional catchment.

Jindabyne is located 175 km south of Canberra and 60 km south-west of Cooma. Jindabyne has evolved into the gateway to the Snowy Mountains and currently services 1.4 million visitors each year who travel to the region to enjoy its unique tourism and recreational offerings (Destination NSW, June 2020 report). There are approximately 35,500 residents of the Snowy Mountains, of which 3,500 residents live in Jindabyne (including Kalkite, East Jindabyne and Tyrolean Village).

Portions of the Snowy Mountains are within Kosciuszko National Park. Kosciuszko National Park is the central segment of the Australian Alps Bioregion containing the highest mountains in Australia and is the largest national park in NSW (NSW National Parks and Wildlife Service, 2006). The park possesses exceptional diversity of alpine plant communities, containing threatened ecological communities (TECs) and providing habitat for a number of rare and threatened species (NSW National Parks and Wildlife Service, 2006). The park contains most of the alpine endemic species found on the Australian mainland (NSW National Parks and Wildlife Service, 2006).

The Snowy Mountains region is home to the Monero Ngarigo people, the tribal homeland stretches from the western slopes of the coastal ranges to the eastern side of the Kosciuszko plateau and further north. Included in the Ngarigo land is the peak of Mount Kosciuszko and the Snowy Ranges. European settlers accessed the region in 1823, and between the late 1830s to 1957 the Monaro highland region was grazing by cattle and sheep. The original town of Jindabyne was settled in the 1840s on the banks of the Snowy River where the main river crossing took place. A bridge was constructed over the river in 1893, contributing to the success of the town. In 1949 the Snowy Mountains Scheme was introduced which consisted of plans to dam and divert water from the Snowy River. By 1964 the dam had created Lake Jindabyne and the township relocated to where it is today. The old town disappeared under Lake Jindabyne in 1967. Although losing much of its built heritage, Jindabyne, as we know it today, was rebuilt and has continued to steadily grow leveraging its tourist and agricultural offerings (Ozark Environment and Heritage, 2020).

Today, the Snowy Mountains region plays a crucial role within the regional and state economy, with its local population swelling with an additional 1.4 million international and domestic visitors each year (Destination NSW, June 2020 report). The region's unique natural environment allows locals and visitors to participate in a diverse array of recreational activities year-round, with many visitors still experiencing the region through the peak winter season.

Priorities for the Snowy Mountains SAP are to capitalise on the unique cultural and environmental attributes which attract 1.4 million visitors annually to the region, revitalise the Snowy Mountains into a year-round destination, and reaffirm Australia's Alpine Capital (Destination NSW, June 2020 report). The revitalisation is to focus on year-round adventure and eco-tourism, improving regional transport connectivity, shifting towards a carbon neutral region, increasing the lifestyle and wellbeing activities on offer, and supporting Jindabyne's growth as Australia's national winter sports training base.

1.2 STUDY AREA

The Snowy Mountains SAP Investigation Area encompasses 72,211 hectare (ha) of land and within this study area are several key areas called "development opportunity areas":

- Jindabyne growth opportunity areas: parcels of land located primarily to the south and west of the existing Jindabyne township, but also at East Jindabyne
- Jindabyne centre opportunity areas: areas within the existing town of Jindabyne
- Tourism opportunity areas: areas both near the town of Jindabyne and in the Kosciuszko National Park.

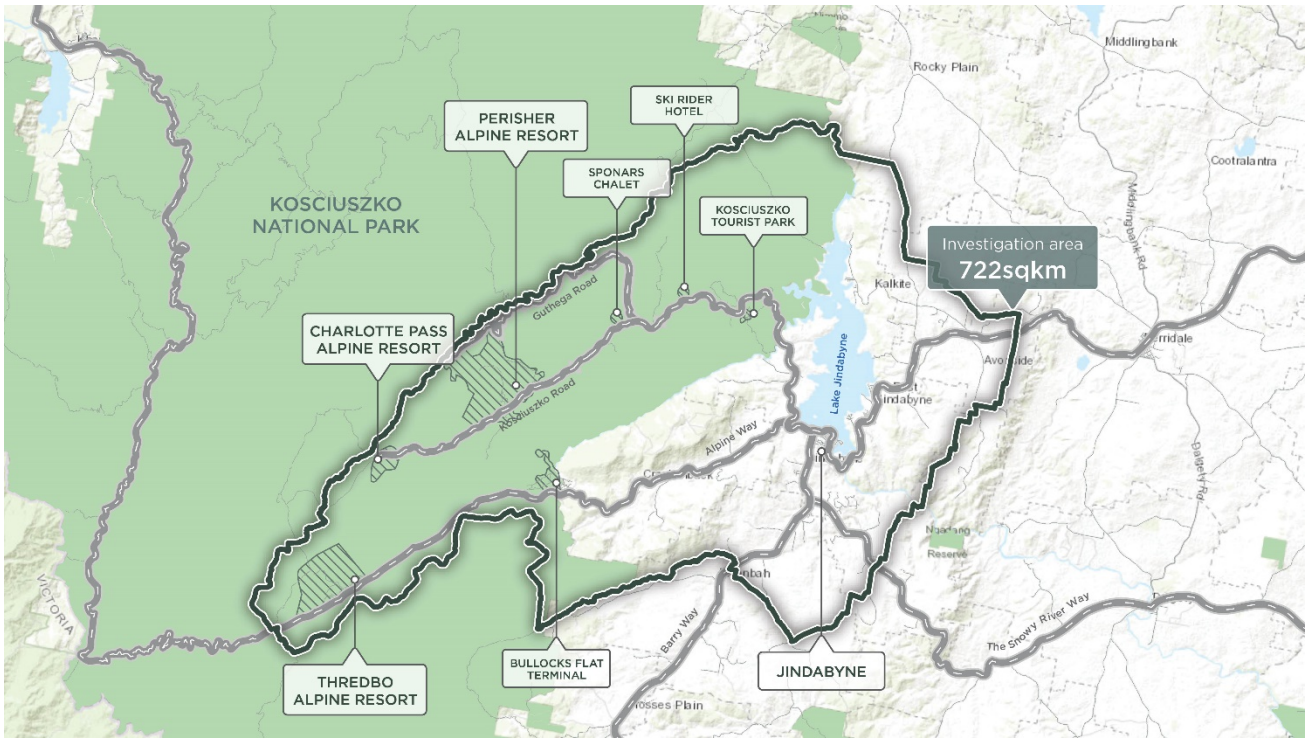


Figure 1.1 Study area

1.2 PURPOSE OF THIS REPORT

This Technical Study will form part of the Engineering Package for the Snowy Mountains Special Activation Precinct (SAP). The report will fist provide a context analysis to understand the existing circumstances of the area including opportunities and constraints. A case study analysis is then demonstrated to draw ideas and best practices from similar regions around the world. The report will then analyse the existing infrastructure parameters in the region, assess the growth analysis and make recommendations to upgrade or construct new infrastructure assets to meet the service demands of such growth.

This Technical Study has been prepared through collaboration with the NSW Government, Snowy Monaro Regional Council (SMRC), National Parks and Wildlife Services (NPWS) and other stakeholders including representatives from the Alpine Resorts.

The recommendations from this report will combine with other technical studies in the disciplines of engineering, planning, environment, economics and legislation to inform the Master Planning for the Snowy Mountains SAP.

2 CONTEXT ANALYSIS

2.1 PURPOSE

The Context Analysis provides a comprehensive overview of existing studies and data, and relevant policies, standards and guidelines which are crucial to preparing the Infrastructure Technical Study for the Snowy Mountains SAP. The Context Analysis will review all available data sources, including but not limited to documents contained within the Snowy Mountains SAP Library. This report builds on technical and local area knowledge to provide a snapshot of the existing context, opportunities and constraints within the Snowy Mountains study area.

2.2 BACKGROUND INFORMATION

The following background information has been reviewed and summarised in this report:

Table 2.1 Background information

POLICY AND PLANNING CONTEXT	Future Transport Strategy 2056
	Southeast and Tablelands Regional Plan
	Snowy Monaro Regional Council Destination Management Plan
	Kosciuszko National Park Plan of Management
EXISTING STUDIES	Go Jindabyne Utilities and Servicing Strategy
	Creel Bay Kosciuszko National Park, Preliminary Master Plan, Tract, September 2016
	SAP Regional Airport Pre-Feasibility Assessment (DPC – July 2019)
	Alpine Resorts – Kosciuszko National Park Development Control Plan 2019
	Snowy River Shire Council Integrated Water Cycle Management Detail Strategy Study
	Carrying Capacity in the Alpine Resorts of Kosciuszko National Park: Background Paper, February 2016
MODELS	There are no known models used in this stage of the project
DATA	Publicly available information is used in generating this report. A reference is stated in corresponding sections of the report
STANDARDS AND GUIDELINES	There are no known standards applied in this stage of the project

2.3 SNOWY MOUNTAINS CONTEXT

2.3.1 VISION STATEMENT AND STRATEGIC ALIGMENT

The vision that will guide the aspirations and outcomes for which the Snowy Mountains SAP precinct is expected to achieve, was developed collaboratively by the NSW Government, SMRC, Destination Southern NSW, Tourism Snowy Mountains, and feedback from public consultation.

The vision is:

> ***"The Snowy Mountains are the rooftop of Australia where unspoiled alpine landscape meets a dramatic climate that is unfound elsewhere on the continent. This is Australia's high country where visitors are drawn to our everchanging seasons, and with them, endless opportunities to experience the great outdoors. The rich Culture and authentic character of our region is sawn through the patchwork of local experiences that inspire exploration and provoke adventure.***
>
> ***Our Future is environmentally resilient. We live sustainably and in harmony with our environment, powered by clean energy, offsetting our impacts, and maintaining our country town way of life, while remembering that the pristine landscape of Kosciuszko National Park is what brings our guests here to begin with.***
>
> ***Our future is economically strong. We invest in our growing year-round visitor economy and leverage our strengths in sport, environment, and hospitality to foster a visitor experience that is world-class, provide four-season employment, and empower our youth to gain the skills they'll need to lead our growing region into tomorrow.***
>
> ***Our future is socially inclusive. We support the needs of our local residents, seasonal workers, and returning visitors with infrastructure, connection, and services that will guarantee that the Snowies are a healthy, accessible, adventurous, and sustainable place to live, work, and play forever more."***

It was also supported by five aspirations to make the Snowy Mountains SAP stand out from other regional growth locations, by emphasising Snowy Mountains' competitive strengths with a focus on areas which the Snowy Mountains SAP will target for investment or attention. They included:

1. Adventure and Ecotourism
2. Sport and Education
3. Sustainability and Wellness
4. Design and Culture
5. Infrastructure and Connections.

To align the purpose of the Infrastructure and Services Plan to the Snowy Mountains SAP vision and aspirations, the following considerations will be incorporated:

Table 2.2 Strategic alignment to achieve aspiration statements

1	— Elimination of existing telecommunication blackspots will facilitate safer navigation of back country activities such as hiking, biking and skiing in addition to enhancing emergency response capabilities. — To manage infrastructure issues experienced in the alpine resorts in Kosciuszko National Park.
2	— Ensuring the planned and future sporting and education facilities have access to year-round reliable infrastructure supporting their multi-functional demands.
3	— A holistic investigation into "green" network enhancement will be conducted with the wastewater, renewable energy, flooding and water quality teams to pursue future ready environmentally sensitive solutions. — Reduction in pollutant discharge into National Park waterways from wastewater during peak months.
4	— Infrastructure improvements to have limited impact to the visual aspects of the snowy mountain region and increasing tourism amenity throughout the region.
5	— Balance between peak and off-peak season demands and protecting existing and planned infrastructure from the impacts of extreme weather on infrastructure network integrity and efficiency. — Upgrades to the existing 4G network to 5G networks building resilience and reliability of coverage.

2.3.2 REGIONAL CONTEXT

For the South East and Tablelands region the NSW Department of Planning and Environment have documented their 2036 gaols and directions for the region. For the Snowy Mountains SAP Engineering Infrastructure context the relevant directions include:

- Goal 1: A connected and prosperous economy
  - Direction 3: Develop the Snowy Mountains into Australia's premier year-round alpine destination
  - Direction 6: Position the region as a hub of renewable energy excellence.
- Goal 2: A diverse environment interconnected by biodiversity corridors
  - Direction 18: Secure water resources.
- Goal 4: Environmentally sustainable housing choices
  - Direction 26: Coordinate infrastructure and water supply in a cross-border setting.

2.4 THE STUDY AREA

For the purposes of preparing the infrastructure context report the Snowy Mountains SAP study area has been split up into smaller segments based on factors such as terrain, natural boundaries, land use and background reports. For each area the report has:

- aligned with relevant strategy and policies
- outlined how the area is serviced by existing infrastructure
- identified any current, committed or planned infrastructure projects
- investigated the strengths, weaknesses, opportunities and constraints in each area.

Figure 2.1 shows the segments the Snowy Mountains SAP study area was considered in undertaking the context review. The areas include Jindabyne, Creel Bay, North Lake Jindabyne, Alpine Way, Resorts and Ski Slopes, Kosciuszko National Park and Selwyn Resort.

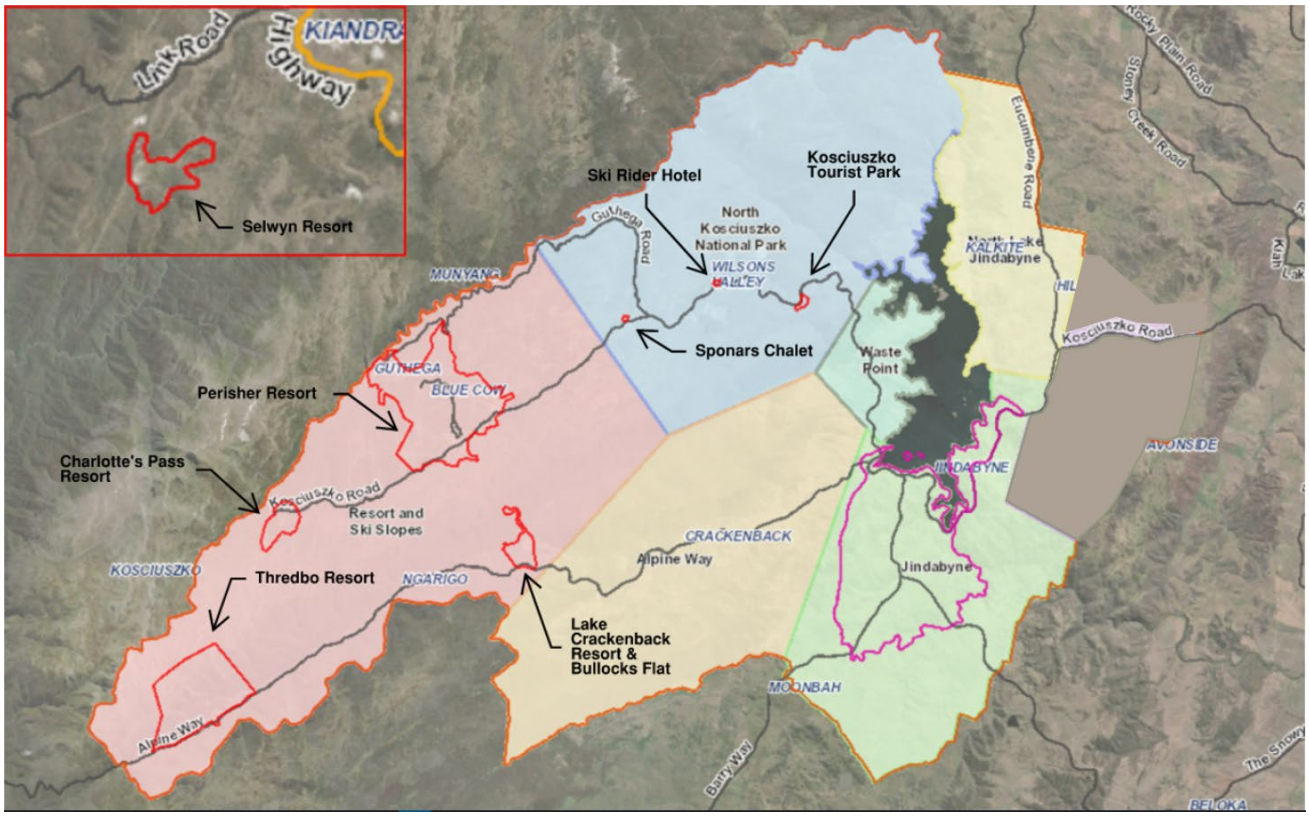


Figure 2.1 Context report sub-areas

2.5 JINDABYNE

2.5.1 DESCRIPTION OF AREA

The Jindabyne investigation area covers the areas delineated in the Figure 2.2 below. It is bounded by the surrounding settlements of Adaminaby, Berridale, Cooma and Dalgety which lie in the wider Snowy Mountains region.

As a gateway to the Snowy Mountains, Jindabyne is a sought-after tourist destination which brings about seasonal population changes, attracting over 1.3 million visitors in different times of year with peaks during the winter. Jindabyne is comprised of low to medium density residential, commercial usage and major open spaces with main population located within Jindabyne, East Jindabyne and South of Jindabyne. Based on the Go Jindabyne Utilities and Servicing Strategy Report created in July 2019, these urban centres are currently well serviced and are expected to experience significant population and demographic changes.

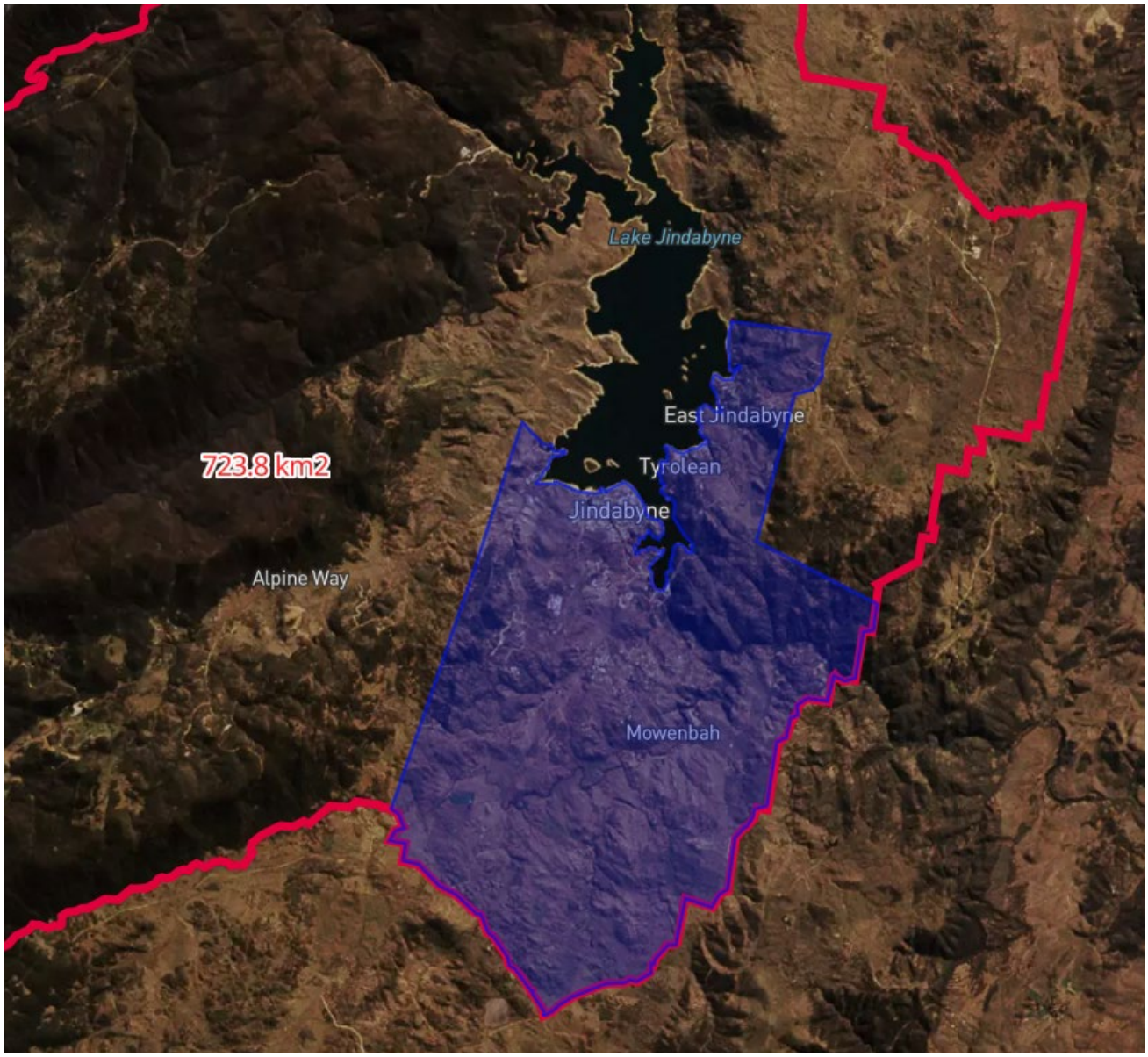


Figure 2.2 Jindabyne sub-area

Based on desktop analysis, the study area has the following existing utility services:

- Water Supply: provided by the SMRC primarily through intakes from Lake Jindabyne.
- Wastewater: provided by the SMRC. Effluent is treated through a single sewerage treatment plants in the Jindabyne area. Discharge from Jindabyne Sewer Treatment Plant is to Cobbin Creek.
- Electrical: provided by Essential Energy with zone substations in Jindabyne, Jindabyne East and a 1 MW hydro generator at Jindabyne Dam.
- Waste disposal: Provided by SMRC at Jindabyne Regional Waste Management Facility.
- Gas: serviced by APA Group (Origin Energy) with a small number of LPG gas mains.
- Data and Communications: serviced by NBN, Telstra, Vodafone and Optus.

The Jindabyne Regional Waste Management Facility is a landfill located within the Snowy Mountains SAP area and there is one transfer station at Berridale which is along the eastern boarder of the investigation area. The Jindabyne land fill processed approx. 13,000 tonnes of waste of which 19 tonnes is recovered as compost and approximately 1500 tonnes is processed off site for lawful recovery, such as batteries and commingled recyclables.

2.5.2 INFRASTRUCTURE PROJECTS/STRATEGIC PLANS

To ensure current capacity issues are addressed and to meet future growth demands in the study area, the following items have been identified as potential infrastructure upgrades based on the Go Jindabyne Utilities and Servicing Strategy Report (2010):

- Water Supply: Upgrade works for Jindabyne Intake WPS, upgrade for Reservoirs (East Jindabyne Kunama, East Jindabyne, Jindabyne High Zone, Low Zone, Barry Way and High Country), upgrade for Water Pumping Stations (East Jindabyne, Jindabyne Low Zone, High Zone, and High Country), construction of new potable water mains in growth areas to service new developments in Jindabyne, East Jindabyne and South of Jindabyne, and renewal of the water extraction license as required to meet growth in development. Further improvements may include rainwater harvesting and recycled water.
- Wastewater: Upgrade of capacity constrained pump stations, and construction of new sewer mains in Jindabyne, East Jindabyne and South of Jindabyne growth areas. Further improvements may include expansion of existing recycled water network for irrigation of sports fields, golf courses and park land; and grey water re-use strategies.
- Electrical: New 11 kV feeder routes to support the proposed new developments; and new kiosk substations to service new development. Further improvements may include community solar schemes combined with battery storage, localised microgrids, building orientation, electric car charging, centralised heat extraction system, geothermal heating, smart metering, or glazing options to improve thermal comfort and reduce heating and cooling loads.
- Data and Communications: Improvements to data and communication connection coverage through 5G technologies and roll out of a public WIFI network.

2.5.3 SWOC

A summary of the identified strengths, weaknesses, constrains and opportunities based on the desktop review is summarised in Table 2.3.

Table 2.3 Jindabyne area utility SWOC analysis

STRENGTHS	WEAKNESSES
1 There is availability of existing waste facilities within Jindabyne sub area including a land fill site and waste transfer station at Jindabyne. This infrastructure provides options for waste disposal growth. 2 Availability of water from Lake Jindabyne and the Snowy Mountains region provides a consistent and reliable source of water to the town.	1 Lack of a coordinated view of infrastructure requirements to meet the anticipated demands for the sustainable growth of the Jindabyne region. 2 Existing communication network cannot be scaled up and down to meet peak demands. 3 Activation of current waterfront is restrained by the limited pedestrian access and lighting. 4 Current electrical supply is not well protected from harsh weather conditions. 5 Existing water treatment within Jindabyne is inadequate to serve the existing population that still are required to boil water after heavy rain event.
OPPORTUNITIES	**CONSTRAINTS**
1 Public WIFI, CCTV and adjustable lighting services to accommodate the redevelopment of public space. This approach to "Smart" technology aligns with the Australian Government Smart Cities Platform. 2 Supplement Jindabyne waterfront boardwalks and main town pedestrian routes with a multi-function lighting network. 3 Renewable energy opportunities from Waste generation. 4 Review and upgrade of exiting licencing to increase the supply. 5 Upgrade of existing utility infrastructure to accommodate future population demands. This infrastructure includes substations and power supply networks, water treatment plants, sewer treatment plants and water and wastewater reticulation networks.	1 Risk of missing opportunity to obtain funding from the Snowy 2.0 legacy fund to provide necessary capital investment in infrastructure, as per the Snowy Mountains SAP intent. 2 Peak demand during winter months of 5:1 ratio limit carrying capacity of communication network. 3 Without adequate access and lighting to the waterfront the area will remain inactivated and unusable as multifunctional area. 4 Water licencing limits the maximum extraction to supply the area.

2.6 CREEL BAY (FORMALLY WASTE POINT)

2.6.1 DESCRIPTION OF AREA

The Creel Bay area of this investigation covers the western foreshore of lake Jindabyne. The study area, Figure 2.3, includes Creel Bay, Gaden Trout Hatchery and the Thredbo River.

The Creel Bay area contains residential and accommodation houses, National Parks and Wildlife Service (NPWS) Lake Jindabyne Works Depot and a Research Centre. A Preliminary Master Plan was created in September 2016 explored future possibilities for area of Creel Bay. Based on this report the area is supplied by:

- Water Supply: Provided by Snowy Hydro; treatment and distribution operated by NPWS.
- Sewerage: Provided by NPWS by Septic system treated by a shares absorption field.
- Electrical: Provided by Essential Energy supplies a 11 kV overhead system.
- Gas: There is no gas supply in the area.
- Communication: Provided Telstra have underground cables servicing the area.

The Creel Bay Kosciuszko National Park, Preliminary Master Plan (2016) report recommends upgrades to improve quality and reliability of water supply, upgrades to the capacity substations. This will involve upgrades on both reticulation and sources.

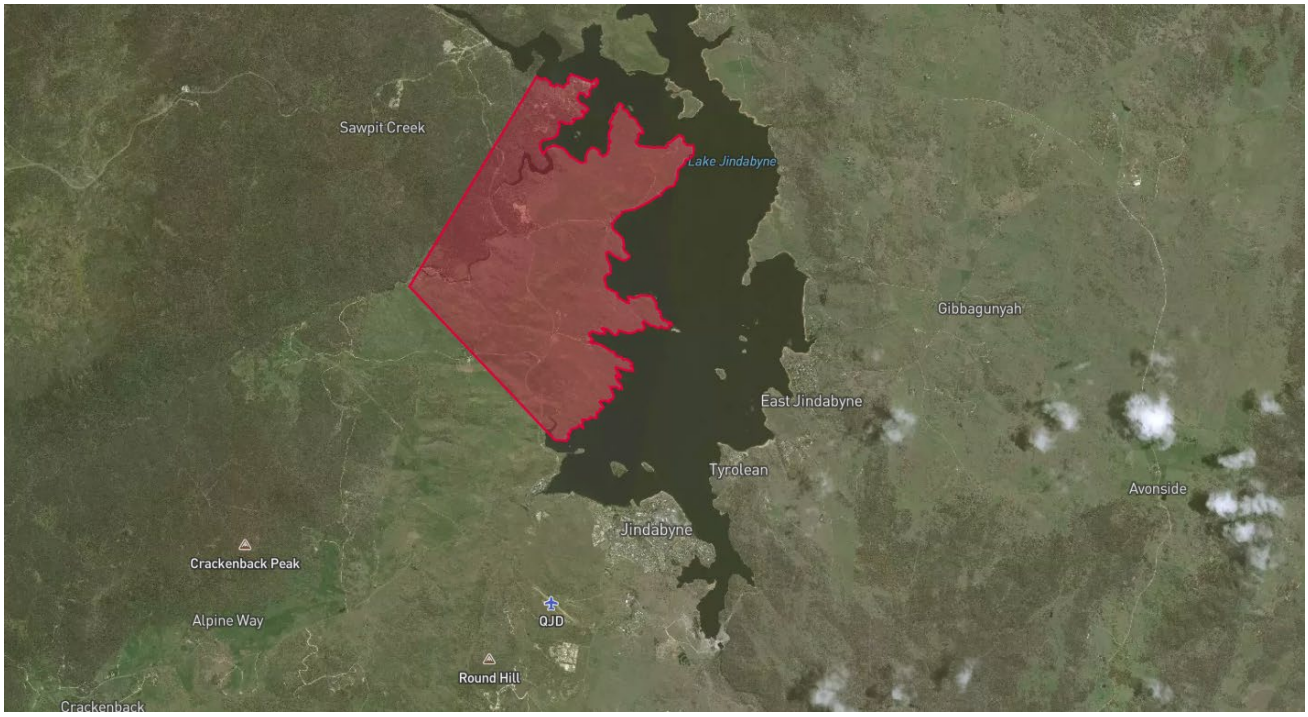


Figure 2.3 Creel Bay study area

2.6.2 SWOC

A summary of the identified strengths, weaknesses, constrains and opportunities based on the desktop review is summarised in Table 2.4.

Table 2.4 Creel Bay area utility SWOC analysis

STRENGTHS	WEAKNESSES
1 Current water supply is from the Snowy Hydro connection. Expansion in this area would not contribute to the Jindabyne intake limits.	**1** Current infrastructure is at capacity or not suitable for any large development. **2** The substation servicing the body of the village is insufficient to meet peak demand of properties fitted with reverse cycle air-conditioning and will need upgrading.
OPPORTUNITIES	**CONSTRAINTS**
1 Upgrades to infrastructure supporting Creel Bay can be developed further to also service growth opportunities in West Jindabyne foreshore and visa-versa. Thus maximising the usage and servicing potential from the capital investment.	**1** Any redevelopment scenario will require upgrades to existing infrastructure. **2** 132 kV transmission line passing through this area may inhibit any future development or subdivision.

2.7 NORTH LAKE JINDABYNE

2.7.1 DESCRIPTION OF AREA

The North Lake Jindabyne study area, Figure 2.4, extends from the North Eastern banks of the Jindabyne Lake to Snowy Mountains SAP investigation boundary. This area is based around the suburb of Kalkite.

Based on desktop analysis the area is supplied by:

- Water Supply: provided by SMRC which sources its water from Lake Jindabyne.
- Sewerage: provided by SMRC with a sewerage treatment scheme servicing Kalkite.
- Electrical: provided by Essential Energy has a distribution network of zone substation, ground substation and underground cabling.
- Gas: There is no gas supply in the area. WSP is continuously engaging relevant authorities to confirm presence of all relevant utility infrastructure and will update the documentations as required.
- Communication: is provided by Telstra, NBN and Optus with a combination of underground and cellular towers.

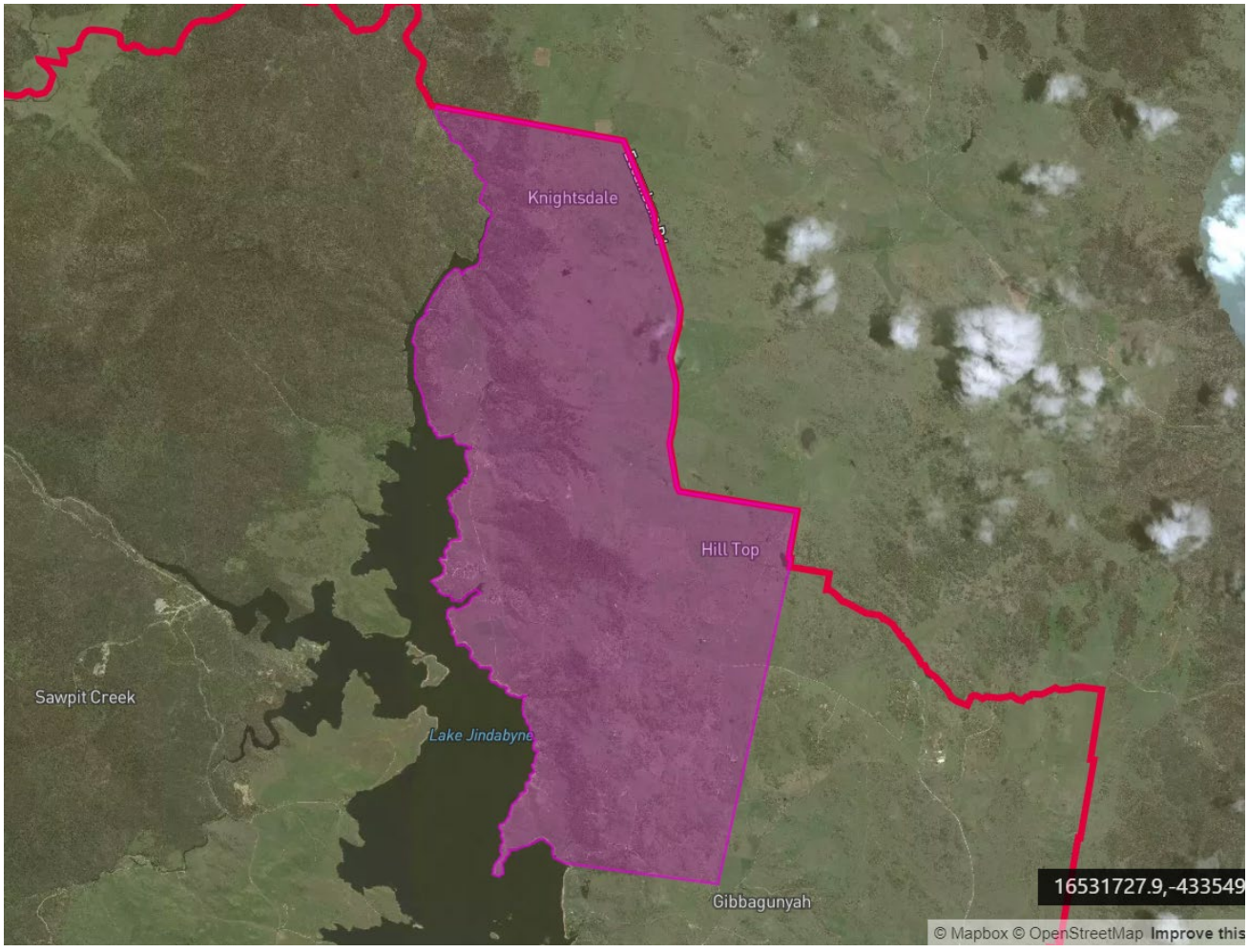


Figure 2.4 North Lake Jindabyne study area

2.7.2 INFRASTRUCTURE PROJECTS/STRATEGIC PLANS

To ensure current capacity issues are addressed and to meet future growth demands in the study area, the following items have been identified as potential infrastructure upgrades:

- The Canberra Region Joint Organisation identified a project to upgrade the Kalkite Sewerage System within their Water and Wastewater Prospectus (October 2018), further investigation is required to understand the status of this project.

2.7.3 SWOC

A summary of the identified strengths, weaknesses, constrains and opportunities based on the desktop review is summarised in Table 2.5.

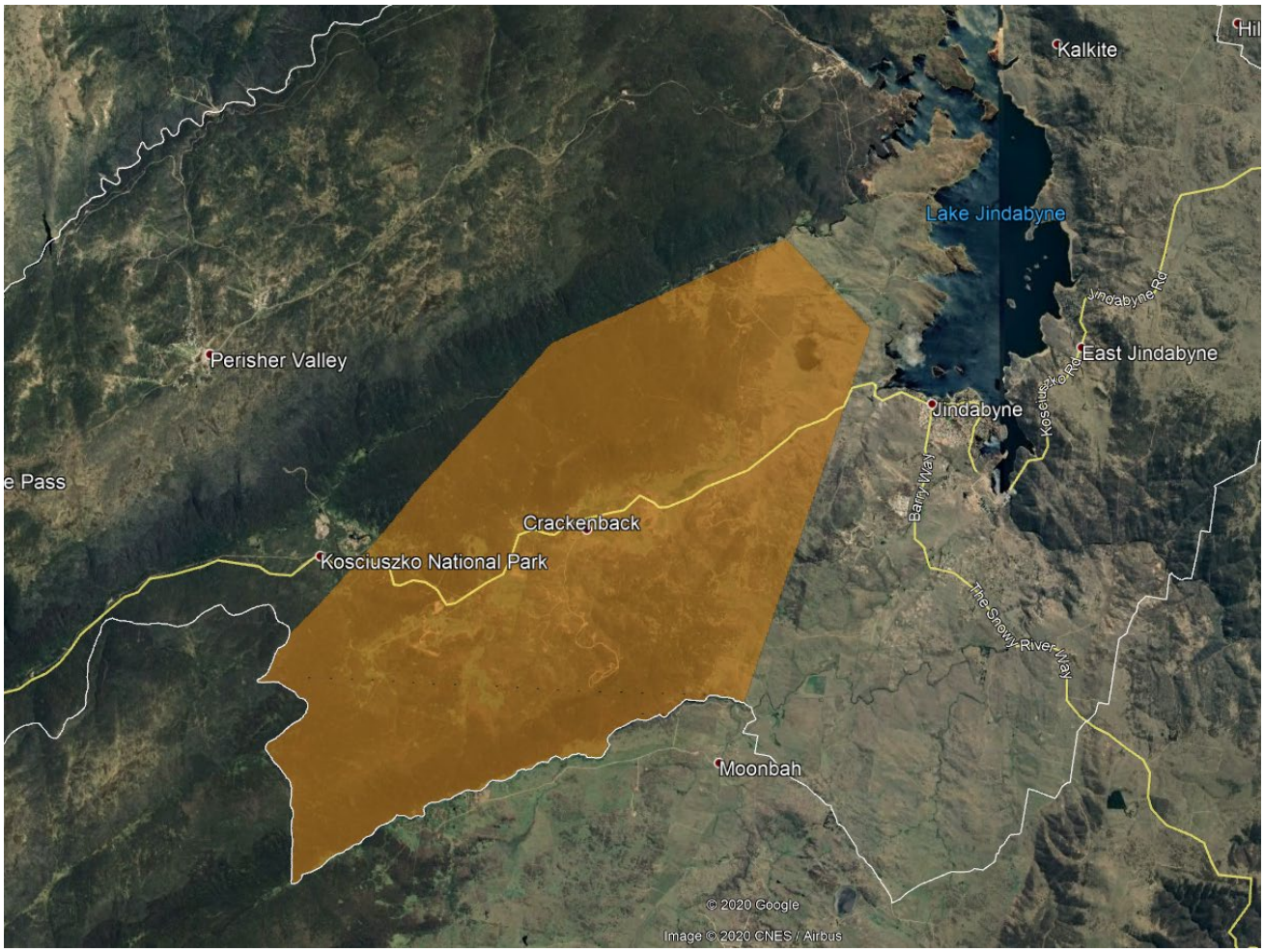
Table 2.5 North Lake area utility SWOC analysis

STRENGTHS	**WEAKNESSES**
1 The areas currently inhabited are well serviced with power and communications.	**1** Kalkite Sewerage Pump station requires upgrading. **2** Potential high risk to drinking water quality due to Kalkite Water Supply Scheme supplying unfiltered water from an unprotected catchment as potable supply.
OPPORTUNITIES	**CONSTRAINTS**
1 Upgrade to the Kalkite Sewerage treatment system to support growth in Kalkite. **2** Improve water treatment system at Kalkite to add water filtration system and pump upgrades.	**1** Sewer effluent is dispersed to evaporation ponds and not monitored by the EPA. Growth in this area would require a review of EPA licencing agreements to confirm discharge limits, and an upgrade to the sewer treatment system.

2.8 ALPINE WAY

2.8.1 DESCRIPTION OF AREA

The Alpine Way sub-area is situated in the southern portion of the Snowy Mountains SAP study as shown in Figure 2.5. It is considered as the gateway to Jindabyne which then converges to Kosciuszko Road, south of Lake Jindabyne.



Source: WSP Create (GIS Application)

Figure 2.5 Alpine Way sub-area

The Alpine Way area contains Lake Crackenback Resort, residential and accommodation houses, mostly along Alpine Way and a distillery. Desktop investigation suggests the area is supplied by:

- Water Supply: Private onsite water supplies.
- Sewerage: Private sewer treatments, typical septic tanks.
- Electrical: provided by Essential Energy supplied by a 11 kV overhead system.
- Gas: There is no known gas supply in the area. WSP is continuously engaging relevant authorities to confirm presence of all relevant utility infrastructure and will update the documentations as required.
- Data and Communications: provided by Telstra with underground cables servicing the area with NBN and Optus providing several towers.
- Waste Disposal: Provided by the SMRC which is then handled by Jindabyne Landfill.

2.8.2 SWOC

A summary of the identified strengths, weaknesses, constrains and opportunities based on the desktop review is summarised in Table 2.6.

Table 2.6 Alpine Way area utility SWOC analysis

STRENGTHS	WEAKNESSES
1 Availability of utility corridor (Alpine Way) for network upgrades to support infrastructure required.	1 Minimal presence of water, gas and sewer distribution infrastructures.
OPPORTUNITIES	**CONSTRAINTS**
1 Proposed networks could be plan for long term future growth in the area.	1 Any redevelopment scenario will require upgrades to existing infrastructure.

2.9 RESORTS AND SKI SLOPES

2.9.1 DESCRIPTION OF AREA

The alpine resort areas of Charlotte Pass, Thredbo, Selwyn and Perisher Range occupy less than 1% of Kosciuszko National Park but are the most popular visitor destinations.

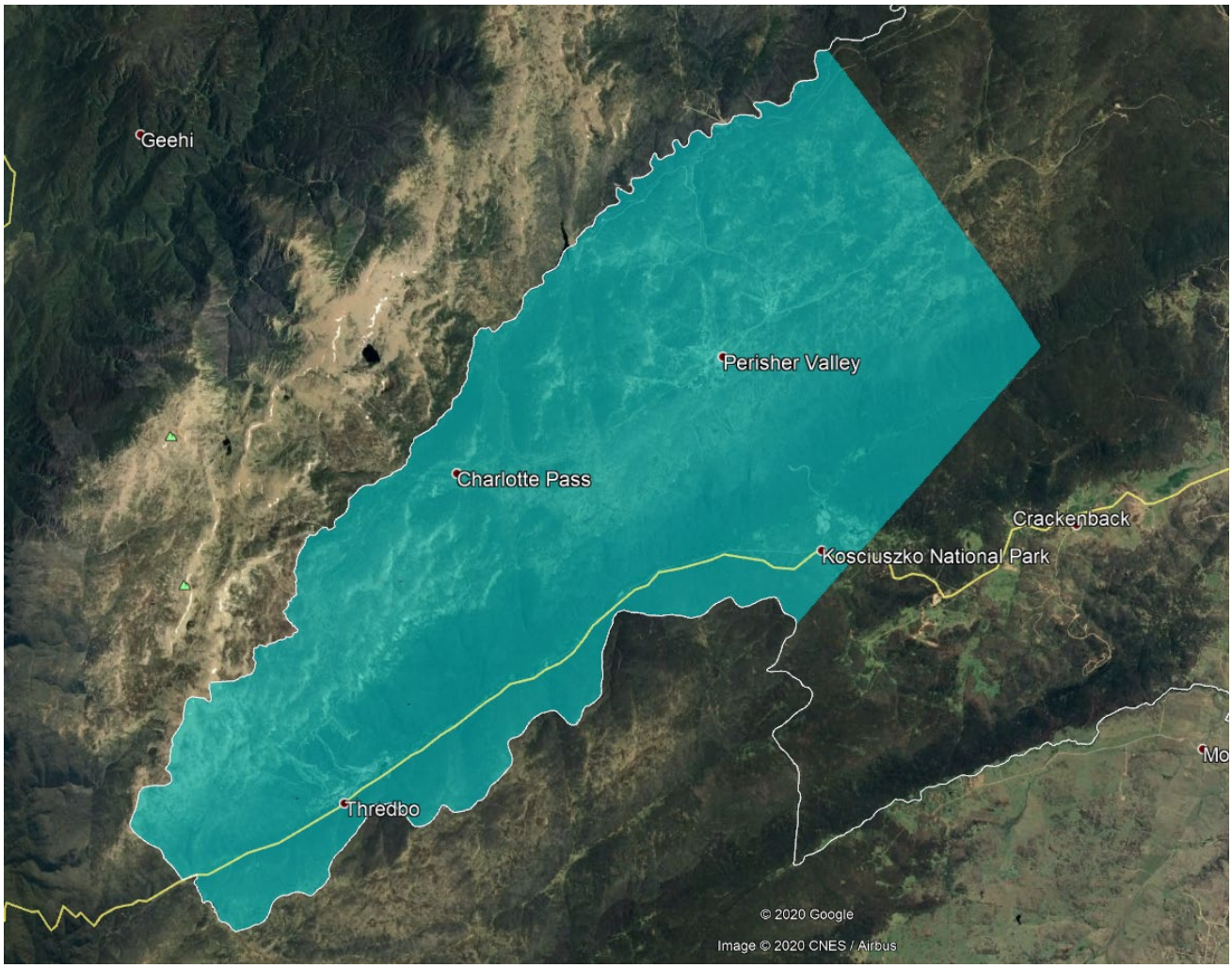


Figure 2.6 Context report sub-areas

Based on desktop analysis, the study area has the following existing utility services:

- Water Supply: provided by National Parks and Wildlife Services (NPWS) to each resort by a number of separate dams, weirs, reservoirs, and pumping stations.
- Wastewater: National Parks and Wildlife Services (NPWS) operates the Perisher Valley STP that treats effluents collected from Perisher Valley, Smiggin Holes and Guthega and discharges to Perisher Creek. There are other separate STP's systems at Thredbo, Charlotte Pass, and Bullocks Flat.
- Electrical: provided by Essential Energy with an underground distribution network.
- Waste disposal: each resort collects and stores its own refuse prior to removal and recycling at the regional refuse processing centre.
- Gas: some areas serviced by Elgas with LPG via onsite tanks a small number of gas mains.
- Data and Communications: serviced by Telstra, Vodaphone and Optus.

2.9.2 SWOC

A summary of the identified strengths, weaknesses, constrains and opportunities based on the desktop review is summarised in Table 2.7.

Table 2.7 Resort and Ski slope area utility SWOC analysis

STRENGTHS	**WEAKNESSES**
1 4G Coverage is available for most parts of the inhabited areas of the Snowy Mountains. **2** The circular economy connection between waste water and electrical generation will create flexibility to scale up and down product to meet demands.	**1** Existing communication networks is unreliable and at capacity during peak periods. **2** The cold weather impacts the biological treatment process and pollutants have been found in the local creeks where sewer is being discharged at Perisher, Thredbo and Charlotte Pass. **3** Large seasonal variations in demand and load. **4** The terrain makes it difficult and costly to run underground services.
OPPORTUNITIES	**CONSTRAINTS**
1 Create opportunities for 5G telecommunication upgrade to a more robust and reliable network. **2** Leverage Regional Digital Connectivity program. **3** Opportunity for energy from wastewater recovery and power generation. **4** Upgrade of sewerage treatment facilities for ski resorts to accommodate growth above the current carrying capacity of the resorts.	**1** There are a number of communication blackspots. **2** Current sewerage treatment facilities are already approaching capacity in the winter months with the influx of more visitors each year. **3** The topographical mountainous terrain of the area.

2.10 NORTH KOSCIUSZKO NATIONAL PARK WITHIN SNOWY MOUNTAINS SAP BOUNDARY

2.10.1 DESCRIPTION OF AREA

The Kosciuszko National Park area of this investigation covers the northern area of the Snowy Mountains SAP investigation area, Figure 2.7. This area is predominately national park with accommodation spotted along Kosciuszko Road. Based on desktop analysis the area is supplied by:

- Water Supply: Water in Sawpit Creek precinct is provided by National Parks and Wildlife Services (NPWS) from Sawpit Creek. It undergoes ultraviolet disinfection prior to distribution through the reticulation network. Sponars Chalet and Ski Rider resorts have their water supplies.
- Wastewater: NPWS operates the sewage treatment plant at Sawpit Creek which treats all wastewater from the Kosciuszko Mountain Retreat tourist park. Sponars Chalet and Ski Rider resorts have their own treatment systems.
- Electrical: Essential Energy supplies an underground distribution network. There is a TransGrid 132 kV Transmission lines passing through the area to Jindabyne Substation.
- Gas: There is no gas supply in the area.
- Communication: Telstra have underground cables servicing the area.

Based from the available information at this stage it is identified that there are no current proposed plans upgrades to the existing infrastructure in the area.

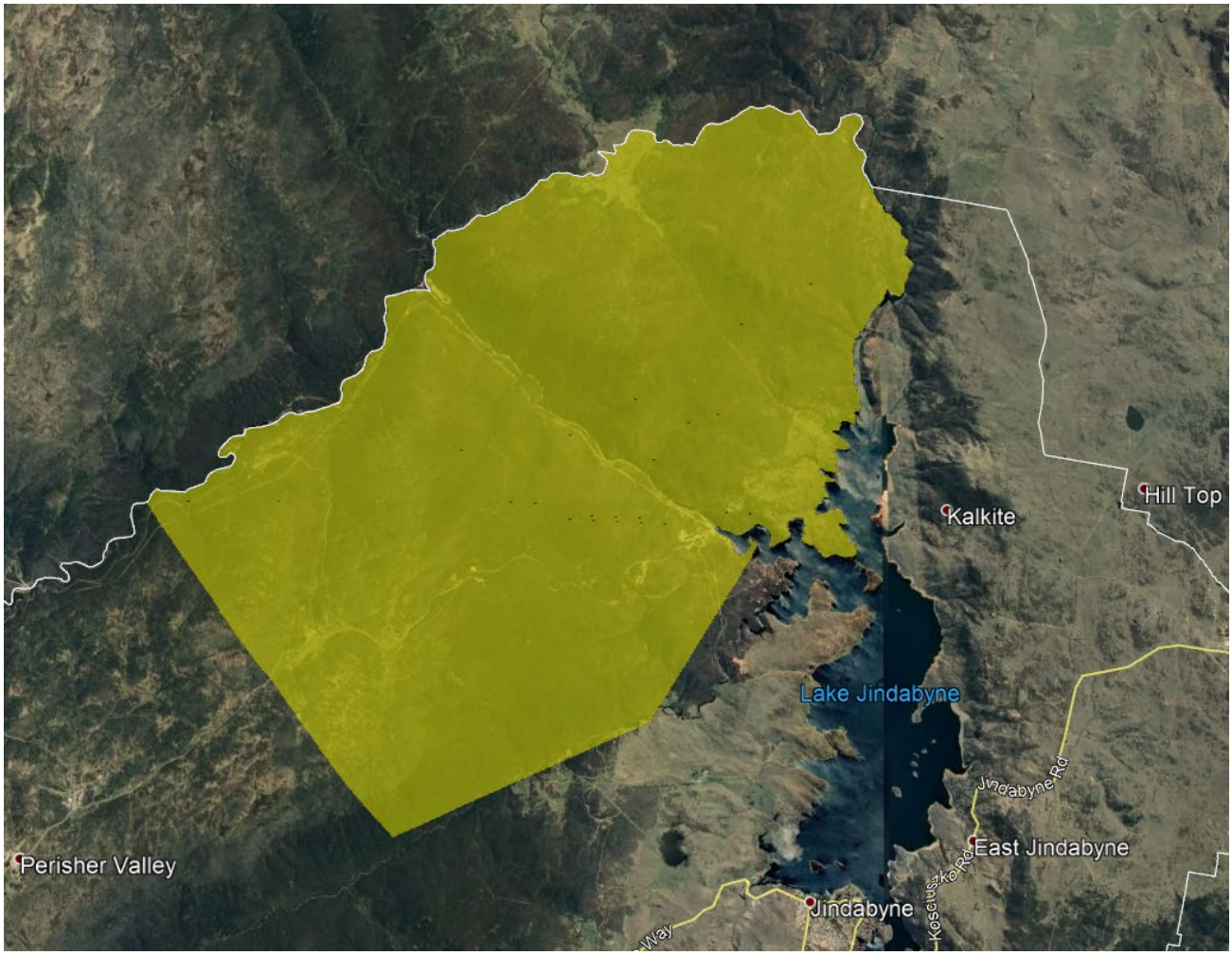


Figure 2.7 Kosciuszko National Park study area

2.10.2 SWOC

A summary of the identified strengths, weaknesses, constrains and opportunities based on the desktop review is summarised in Table 2.8.

Table 2.8 Kosciuszko National Park utility SWOC analysis

STRENGTHS	**WEAKNESSES**
1 Use access points and already cleared areas (i.e. fire trails or hiking tracks) to service the area.	**1** No existing infrastructure outside accommodation along Kosciuszko Road. **2** Large seasonal variations in demand and load. **3** Having small, separate disconnected systems between accommodation locations.
OPPORTUNITIES	**CONSTRAINTS**
1 Existing infrastructure along Kosciuszko Road can be upgraded as backbone to service the area where decentralisation cannot be achieved. **2** Implementation of non-intrusive infrastructure that blends in with the environment.	**1** Location is predominately mountainous and national park which is uninhabited. **2** Environmental protection within National Park Land restricts the footprint of proposed developments.

2.11 SELWYN

2.11.1 DESCRIPTION OF AREA

The Selwyn Snow Resort is an area of 203 ha located approx. 40 km north of the main Snowy Mountains SAP investigation area. This site is leased to the Mount Selwyn Snowfields Proprietary Limited who operate the ski lifts and a ski school providing a low-cost option for skiing and snow activities. Based on desktop analysis the area is supplied by:

- Water supply and Wastewater services are operated by Selwyn Snowfields Pty Ltd.
- Electrical: Essential Energy supplies an underground distribution network.
- Gas: Kleenheat provides LPG bulk storage tank.
- Communication: Telstra have overhead and underground cables and cellular towers servicing the area.

Based from the available information at this stage it is identified that there are no current proposed plans upgrades to the existing infrastructure in the area.

Figure 2.8 Selwyn study area

2.11.2 SWOC

A summary of the identified strengths, weaknesses, constrains and opportunities based on the desktop review is summarised in Table 2.9.

Table 2.9 Selwyn utility SWOC analysis

STRENGTHS	**WEAKNESSES**
1 Three-mile dam has accessible water approx. 2.5 km from investigation area.	**1** The resort will require access to additional water for snow-making to remain viable.
OPPORTUNITIES	**CONSTRAINTS**
1 Permit water to be drawn from Three Mile Dam for snow-making purposes.	**1** Snow making is constrained by the current supply of water.

3 CASE STUDIES

Selected comparable alpine tourist towns that have similar characteristics to Jindabyne and the Snowy Mountains have been identified and analysed to draw ideas and best practices. The themes of the selected towns included:

- seasonal towns, where the population grows significantly and most of the economic activity happens in parts of the year and tied to seasonal activities
- settlement and development in sensitive environments
- waterfront towns and cities, drawing lessons about connecting town centres to the waterfront and ideas for temporary and permanent activation in flood prone areas
- core elements of success for year-round alpine tourism towns and regions, and how they address international competitiveness, seasonal economies, liveability for residents and amenity for visitors.

The ideas and best practices that can be drawn from each of these towns with respect to infrastructure is documented below.

3.1 QUEENSTOWN

Queenstown is located on the South Island of New Zealand on the edge of Lake Wakatipu. Lake Wakatipu is a glacial lake and drained through the Frankton Arm and into the Kawarau River to the east of the town of Queenstown.

Currently the town of Queenstown is experiencing a significant pinch in public capacity within the main town centre and the road network connecting all areas to the airport. The primary residential area is across the Shotover River to the east of the airport and the primary working/industrial area, with one bridge over the river connecting the two. As a result of having one primary access route between the two areas, traffic congestion has increased with population growth. Similarly, the public transport system density is not able to cater for the higher volumes of people living and travelling within the area.

Queenstown is now planning on the following to improve the current situation:

- Transport planning to give priority to public transport, walking and cycling around the city centre.
- Land use zoning to be more multipurpose, leaving less need to travel to different areas.
- Adjusting road corridors to accommodate high capacity public transport (more buses, light rails).
- 3000 additional hotel rooms to become available.
- Construct a bypass around the residential area into town.
- Installing a Gondola that will connect the airport to the town centre:
  - appears to be fairly cost effective to install relative to road widenings in the mountainous surroundings.
- Creating off road cycling tracks and network that will provide safe travel paths for children to cycle to school.

As this increase in population and population growth is expected, sustainable energy technologies have been introduced in the area to offset the increased energy and material consumption. The following are examples of successful recycling/renewable energy operations in Queenstown:

- Coronet Peak has been utilising their greywater to melt ice on the deck for customer safety.
- Coronet Peak's snowmaking system uses 95% recycled water sourced from high-altitude water storage.
- Reservoirs at 1200 m above sea level keeps the water at about 0C, at least 20% more energy efficient than from other sources.
- Material recycling centres have been constructed and utilised in the nearby town of Wanaka.
- Hotels and resorts in Queenstown running off 100% recycled water and have introduced a number of other sustainable measures.

Currently infrastructure that is in place has provided some addition access to travel up to the mountains. Gondolas with bike holders allow access into the mountains throughout the winter and summer seasons, keeping tourist numbers high all year round. Skyline Enterprises have played a big part installing and running the Gondola systems in Queenstown and around the world. As of recently, developers and private entities have been collaborating for recent developments and future planning. Some of the challenges involved are listed below:

- Infrastructure network has been adhoc as required to cater for the ongoing growth as a result of focus on extending the network rather than maintaining. This has caused environmental and reliability issues with sewer discharges and leaking pipes.
- The mountainous surroundings of Queenstown have left restricted area for growth and development.
- The mountainous surroundings also leaving the town vulnerable to landslides and earthquake repercussions.
- Remarkables ski field reaching capacity.
- Balancing local population satisfaction with tourist attraction and accommodation.

Lessons learnt from Queenstown for the Snowy Mountains SAP:

- Any developments must be carried out with future expansion in mind.
- Development of hotels/resorts operation of sustainable practices has proven to be a big tourist attraction.
- Operations in the mountains can introduce greywater water recycling operations to reduce water and energy consumption.
- Gondolas providing access to mountain biking tracks in the summer has maintained tourist numbers into the summer months.
- Energy efficient snow making systems can be used to efficiently produce snow from water reservoirs at high altitudes.
- Traffic developments are to prioritise increasing public transport density, cycling and walking traffic to reduce number of private cars on the road.

3.2 LAKE TAUPO

Lake Taupo is located on the North Island of New Zealand, near New Zealand's largest ski fields and has several towns situated on the Lake's edge. Recently Taupo has experienced a significant increase in number of visitors to the town, especially during the summer months. This is despite the development of an Eastern arterial road on the outskirts of town.

One of the primary access routes into the Taupo town is the Number 1 Highway, between Wellington and Auckland. This is a single lane carriageway along the edge of the lake that is constantly needing remediation works due to erosion. Traffic into Taupo from Wellington has often been very frustrating for visitors as a result of heavy traffic delays during remediation.

Some examples of measures taken in anticipation of further increased visitor volumes are listed below:

- 4.5G network has been rolled out across Taupo in the past three years by the network provider Spark, in an attempt to increase network capability for an increased population. Mobile data consumption in Taupo had increased 200% between 2016–2017.
- Taupo has experienced bigger hotel companies being built. Sustainability measures and policies enforced on these hotels have been crucial in mitigating any offset to the environment caused by increased tourism.
- Dedicated recycling stations have been established around Taupo to encourage minimisation of waste.
- No hotels or developments in the main skiing area as it is located in the national park.
- Airport only hosts propeller planes.
- Gondola up to the main ski area of Taupo in the Tonagariro National Park:
  - capital cost of $25million for 1.6 km
  - improves trip into the mountains during Summer and Winter.

Taupo is a rich source for renewable energy generation for the entire country. Seven geothermal power stations including the historic Wairakei geothermal power station are located around the Taupo area, contributing to NZ's 17% of electricity generation coming from geothermal sources. The lake itself was dammed so that it could be used to generate hydro-electric power. The Aratiatia Dam is located 13 km upstream from Taupo and serves the listed purposes below:

- One of nine hydro plants along the Waikato river that produce approximately 10% of New Zealand's electricity.
- Serves as one of Taupo's largest tourist attractions, benefitting local private companies such as Rapids Jet.
- Multi-million dollar upgrade to the hydro station is expected to boost the local economy with additional people living, working and renting within the town.

Lessons learnt from Taupo for the Snowy Mountains SAP:

- Network providers anticipating increased volume of visitors and hence greater demand on the mobile data network, resulting in upgrade of network.
- Sustainability policies imposed on new and existing hotel developments to offset increased energy and material consumption.
- Gondola infrastructure increasing foot traffic into the mountains year round.
- Possibility for renewable energy infrastructure to become tourist attractions and opportunities for local companies.

3.3 JACKSON HOLE

Jackson Hole is located in the Snake River Valley, Wyoming USA, with the main towns of Teton Village or Jackson. Airports are a primary method of travel into the valley, with buses readily available to transport passengers between the two towns. Current ambitions for the towns transport are listed below:

- Airports are restricting number of flights into town to reduce noise pollution into the valley.
- 100% electric bus population in the valley by 2020.

In an effort to reduce water pollution into the Snake River as a by-product of the residential and tourist population, Jackson Hole has installed a Wastewater Treatment Plant at a capital cost of approximately USD$12,000,000. Recently an Energy efficient mixer project has been installed at the Treatment Plant to reduce the energy consumed to run the operation:

- Renewable energy for the plant is generated on site through a 246-panel solar farm.
- Gridbee Mixer units were installed in 4 treatment ponds and as a result showed a 70% increase in efficiency for the treatment process, including propane and electricity. Has saved 915,300 kWh's (https://vimeo.com/189826588) of energy used after the first full year of operation.
- Town of Jackson was able to reduce energy consumed by 4.5 million kWh per year (approx. 300 households).
- Reducing energy consumption of the plant in some instances has come at a cost to quality of the water recycled. Finding an acceptable balance has been a debatable point between locals and plant owners since the outset.
- A long term issue is the volume of unregulated nutrients such as phosphorus and nitrogen flowing from the power plant into the Snake River. Regulators are in the process of developing numeric standards for these facilities.

With future population growth in mind, the Wastewater Treatment Plant has been designed to be easily upgraded. Recent upgrades and instalments to the power plant have been funded by taxpayers, non-profit organisations (Teton County Wastewater Funds) and private Utility companies (Lower Valley Energy). Further sustainability measures include constructing a three story green house that serves to increase farm to table style cooking in local houses and restaurants, which has become a tourist attraction since opening.

Lessons learnt from Jackson Hole for the Snowy Mountains SAP:

- Waste water treatment comes at a cost of increased energy consumption. This can however be offset through energy saving instalments and drawing energy from alternate renewable energy sources (e.g. solar panels).
- Developments must be made with future expansion in mind.
- Potential for electric public transport to be primary mode of transport between two ski resorts reduce emissions within the National Park.
- Including facilities on buses for mountain bikes can encourage access to the mountains throughout the summer months.

(https://www.jhnewsandguide.com/news/environmental/with-jackson-hole-s-sewage-a-treatment-tradeoff/article_61b8916c-c48e-5b6a-81ed-4a5027c44db0.html)

3.4 LAKE PLACID

Lake Placid is described as 802 ha lake located in Essex County in the Town of North Elba in New York State. The area has become a very popular tourist destination during the summer and winter months, resulting in a highly developed and attractive area. Until the 2002 Salt Lake Winter games, Lake Placid was known as the winter sports hub, leaving behind a large volume of skiing based infrastructure and highly developed lake front. However, recent growth in population has required infrastructure such as the water and sewer networks to be upgraded.

The Whiteface ski field has adapted to the high numbers of visitors throughout the year by committing to becoming 100% operational off renewable energies. A significant volume of this energy comes from a 2.6 MW solar plant based in NY, providing energy to power the resort ski lifts and snow making programs. This solar plant has been owned operated by the commercial company Borrego Solar. An additional source of energy used by Whiteface is propane, used primarily as a heat source throughout the ski field.

Lessons learnt from Lake Placid for the Snowy Mountains SAP:

- Sewer and water networks constructed in an alpine regions should not only be planned for the winter season, but also consider the future population growth that winter activities bring to the region over the long term.

3.5 WHISTLER

Whistler is a town north of Vancouver, British Columbia, that's home to Whistler Blackcomb, one of the largest ski resorts in North America and sits within the Alta Creek valley. Known for its wide range of facilities for activities, Whistler has become a hub throughout the Winter and Summer months.

The primary source of infrastructure within the region stemmed from holding the 2010 Winter Olympics. With a significant increase in visitors expected, Whistler successfully implemented a private public partnership to establish wireless internet access throughout the resort.

During the upgrade/maintenance of existing assets, property owners have been given the opportunity to have overhead assets undergrounded at the same time. This proved to be a cost-efficient way for property owners to underground their nearby assets.

Lessons learnt from Whistler for the Snowy Mountains SAP:

- Successful wireless internet networks around the town should be considered when expecting larger volumes of visitors/residents. Wireless networks increase connectivity between visitors and the resorts improving communications, access to information and safety alerts.
- Opportunities to underground assets as part of upgrade/maintenance works should be considered as this can create cost efficiencies
- Providing a wide range of access to activities in Summer will help to encourage visitors all year round.

3.6 BANFF

The town of Banff is located with the Rockies National Park which is listed as a UNESCO site. Gondolas are in operation to the surrounding areas, ultimately encouraging visitors to visit year-round and increasing access to these areas.

Current practices in place to maintain the current environment in Banff are listed below:

- National park has regulated growth in development, restricting number of new housing and hotels in the area.
- Free bus rides come with the purchase of a 3-day ski pass, promoting the use of public transport.

As well as the above, Banff Uses a N-Viro biosolids waste recycling process at its wastewater treatment plant to manage its organics waste streams of biosolids from commercial and residential kitchens. N-Viro harvests essential nutrients from organic waste such as biosolids and turns it into a marketable product that can be used in landscaping and agriculture.

Lessons learnt from Banff for the Snowy Mountains SAP:

- Waste water treatment is to be considered if expecting increased volumes of people within the area. If feasible due to the increase in volume, waste biosolids can be treated and converted to a marketable product to improve the circular economy and provide review streams for the asset owners.
- National park restrictions on development or development areas is crucial to ensure the surrounding environment is not lost to housing. However this simultaneously restricts the number of residents.
- Gondola infrastructure can assist in encouraging visitors on a year round basis

3.7 ZERMATT

Zermatt is located in Valais, Switzerland, in a valley with the Triftbach stream flowing through the centre of town. 70% of Zermatt's energy is produced by the city's hydro power plant including powering the iconic Zermatt "Red Trains", used to transport visitors to additional areas of the Zermatt mountainous surroundings.

Since the 1970's, public buses and electric cars have primarily occupied the streets of Zermatt with the acceptation of petrol cars used for medical use. This leaves Zermatt mainly accessible by train.

One of Switzerland's largest mobile network companies, Swisscom, has been ranked among the top three providers in Europe. This is partly due to its successful 5G roll out to 90% of Switzerland, with every one of Switzerland's communities having access to the network by 2021. This includes the town of Zermatt which currently has its fibre optic network expansion under construction. By 2025, it is expected the fibre optic coverage will be doubled to around 60% of homes and businesses. CHF 1.6 billion has been invested in the roll out of the 5G network every year to ensure adequate network coverage to a growing population.

Lessons learnt from Zermatt for the Snowy Mountains SAP:

- Leaving the town primarily accessible by train has left little to no congestion on the streets of Zermatt town.
- Utilising the hydro power plants facilities have significantly reduced the town's energy consumption. Areas with access to consistent water supply should consider hydro power infrastructure or procurement of electricity from existing hydro power generation.

4 EXISTING SERVICES

The assessment provided in this report is based on available information including previous assessment reports and input from the respective infrastructure authorities/asset owners.

All required, or potentially required, upgrade projects noted in this report will require detailed engineering planning and investigations to support any business case or commitment of investment.

Key previous studies/information sources relied on (in absence of available data/analysis able to be used for this study):

- Go Jindabyne Services Report (AECOM, 2019)
- Water and Wastewater Prospectus (CRJO, 2018)
- Jindabyne Sewerage Scheme (MWH, 2010)
- Perisher STP Capacity and Robustness Review (Simmonds & Bristow, 2018)
- Perisher Range Resorts Infrastructure Services Strategy (NPWS, 2002)
- SRSC Integrated Water Cycle Management Scheme (Hydro Science, 2012)
- Meetings and correspondence with SMRC
- Discussions with private system owners and operators (continuing).

4.1 INFRASTRUCTURE – REGIONAL AND LOCAL ANALYSIS

This desktop analysis seeks to understand the capacity and availability of utility infrastructure and services both within the Snowy Mountains SAP Study area and its adjacent wider regions, depending on the supply of services. It has been based on information and spatial data received from the Department of Planning, Industry and Environment (DPIE), SMRC, National Parks and Wildlife Services (NPWS), utility providers and discussion with the Snowy Mountains SAP Study area stakeholders. The infrastructure and services assessed include:

- water, wastewater and stormwater
- electricity and gas
- telecommunications and internet services; and
- waste and resources recovery.

As a general disclaimer. It is noted that the utilities information shown in these plans have been compiled from multiple sources of information. The information within this report and any drawings produced are never to be used for the purpose of locating services. WSP shall not be liable for any loss or damage caused using the utilities/services information shown on these drawings.

This analysis focuses on assessing the remaining available capacity of existing infrastructure located in the Snowy Mountains SAP Study area.

4.2 WATER, WASTEWATER AND STORMWATER

There are multiple water and wastewater infrastructure systems currently in place to service the Snowy Mountains region. This infrastructure is operated and maintained by different groups, including:

- SMRC
- National Parks and Wildlife Service (NPWS); and
- multiple private owners such as ski resorts and hotels.

The key identified water systems of the study area are shown in Figure 4.1 and a summary of the region's water infrastructure is provided in Table 4.1. These systems supply potable water to the resort facilities unless noted otherwise (i.e. for snowmaking).

The key identified wastewater systems of the study area are shown in Figure 15 and a summary of the region's water infrastructure is provided in Table 4.1.

Overall the information provided has been in the form of anecdotal advice from operators or site representatives. Formal studies and reports have been sighted for Jindabyne systems and Perisher Valley STP only.

4.2.1.1 WATER INFRASTRUCTURE

EXISTING WATER INFRASTRUCTURE

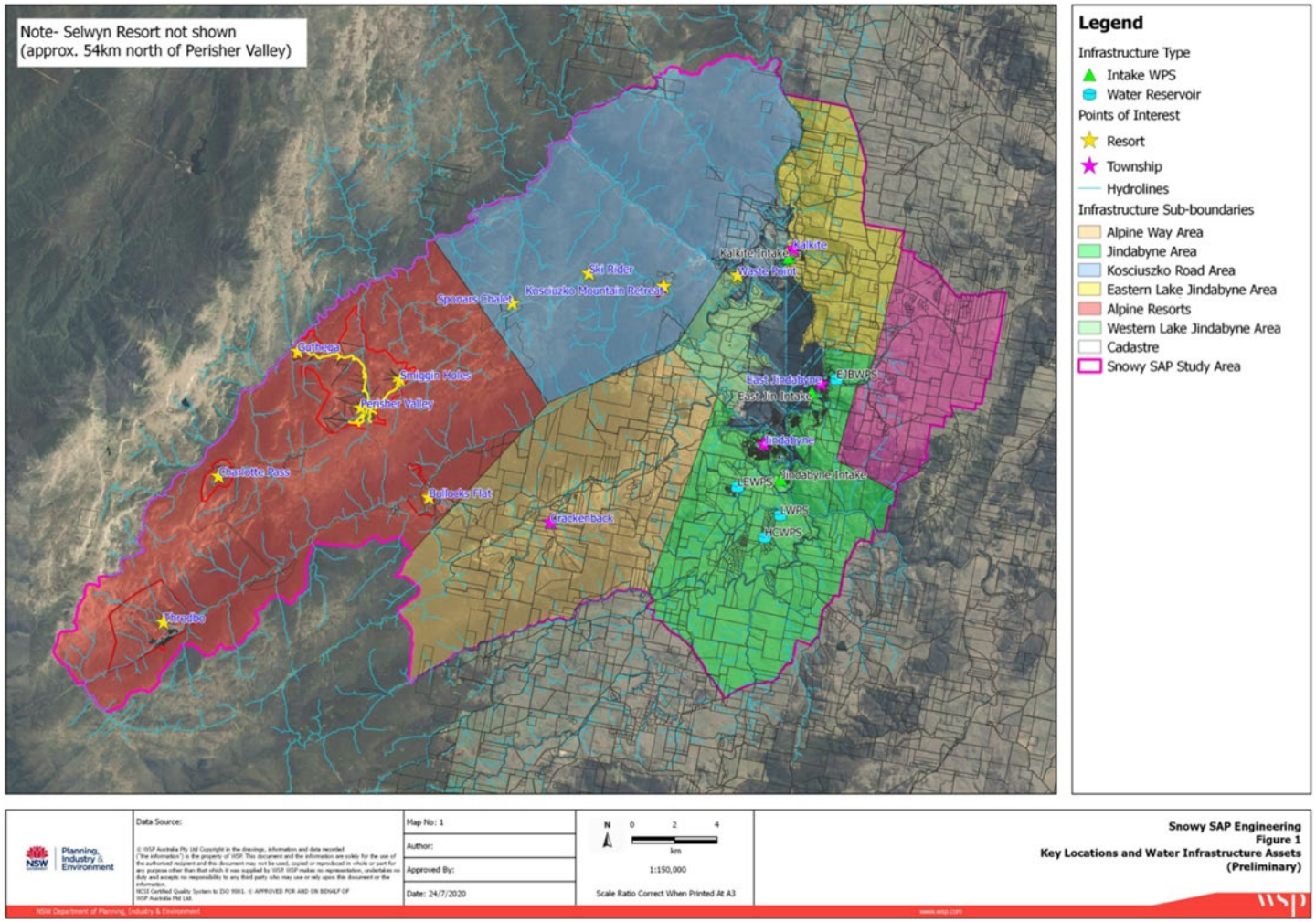


Figure 4.1 Water infrastructure summary map

Table 4.1 Water infrastructure summary

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/CAPACITY ITEMS OF NOTE
ASSETS OWNED BY SMRC See Figure 4.2 below which provides an overview of these systems and their respective service areas				
Jindabyne	Draws water from Lake Jindabyne Extraction limit is 577 ML a year under current Water Licence.	Chlorine disinfection and fluoridation. SMRC are currently commencing a project to add secondary filtration to improve management of water quality risks.	The water supply system servicing Jindabyne comprises of 10 reservoirs, three booster pumps and an Intake WPS. The intake extraction license capacity is 8.6 ML/day.	Current extraction is approx. 518 ML/year (SMRC advice). Asset performance unknown. Treatment capacity details not sighted.
Jindabyne East	Draws water from Lake Jindabyne Also supplies the town of Berridale which is beyond the Snowy Mountains SAP Study area to the East. Extraction limit is 467 ML a year under current Water Licence.	Chlorine disinfection and fluoridation. Currently no primary filtration. SMRC are currently undergoing a project to add filtration to improve management of water quality risks in Jindabyne.	Comprises four reservoirs, and Intake WPS and a pump station and pipeline system transferring water to Berridale (outside of the Snowy Mountains SAP Study area). An additional booster pump station also supplies Kunama Reservoir. The intake extraction license capacity is 8.6 ML/day.	Current extraction is approx. 249 ML/year (SMRC advice). Asset performance unknown. Treatment capacity details not sighted.
Kalkite	Draws water from Lake Jindabyne Extraction limit is 78 ML a year under current Water Licence.	Chlorine disinfection and no primary filtration. SMRC are currently undergoing a project to add primary filtration to improve management of water quality risks.	Comprises an Intake WPS and a balance tank, two reservoirs and a pump station. The intake extraction license capacity is 1 ML/day.	Current extraction is approx. 17 ML/year (SMRC advice). Asset performance unknown. Treatment capacity details not sighted.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/CAPACITY ITEMS OF NOTE
NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) See Figure 4.3 below which provides an overview of these systems and their respective service areas				
Perisher Valley	Water sourced from Rock Creek under Water Allocation License (WAL) 10WA119556 & WAL 38550. Extraction limit is 160 ML/year.	UV Disinfection Periodic chlorination of reticulation system Anecdotal advice is that the operator has had discussions with NSW Health regarding additional filtration previously, but all parties have agreed that the current level of treatment is adequate.	Relatively simple and small scale networks including weir, off-stream storage, pump station and service reservoirs (2 x 700 kL), and reticulation mains. Both reservoirs at same height on opposite sides of valley. Reservoir is a critical asset (all water is supplied through it), whereas Reservoir 2 is often taken offline.	Current extraction is approx. 121 ML/year (DPI license data). Detailed asset performance unknown. Current network configuration has limited flexibility/resilience, as Reservoir 1 cannot be bypassed/isolated and the system operated with Reservoir 2. Treatment capacity details not sighted.
Smiggin Holes	Water sourced from Piper's Creek under WAL 119564 Extraction limit is 45 ML a year.	UV Disinfection.	Relatively simple and small scale network including weir, pump station, service reservoirs (2 x 200 kL), and reticulation mains. Link main exists between Smiggin Holes and Perisher systems, which enables supply to the Smiggin Holes system to be supplemented from the larger Perisher system if required during peak demand periods.	Current extraction is approx. 20 ML/year (DPI license data). The supplementary supply from Perisher into Smiggin Holes has not been required to operate. Asset performance unknown. Treatment capacity details not sighted.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/CAPACITY ITEMS OF NOTE
Guthega	Water sourced from Farm Creek under WAL 38564 Extraction limit is 25 ML a year.	UV Disinfection.	Relatively simple and small scale network including weir, service reservoirs (2 x 80 kL), and reticulation mains.	Current extraction is approx. 7 ML/year (DPI license data). Asset performance unknown. Treatment capacity details not sighted.
Kosciuszko Mountain Retreat resort and tourist park	Water sourced from Sawpit Creek under License WAL 38557 Extraction limit is 12 ML a year.	UV Disinfection.	Relatively simple and small scale networks including weir, service reservoirs (2 x 100 kL) and reticulation mains.	Current extraction is approx. 5 ML/year (DPI license data). Asset performance unknown. Treatment capacity details not sighted.
Western Lake Jindabyne Area	Water sourced from Lake Jindabyne as part of Snowy Hydro Scheme – formal supply agreement unknown.	Filtration and UV Disinfection.	Relatively simple and small scale networks including service reservoirs (1 x 23 kL, 1 x 100 kL) and reticulation mains.	No details sighted Treatment capacity details not sighted.
PRIVATE SYSTEMS Figure 4.1 above provides an overview of these system locations and Figure 4.4 shows the location private resorts around Sawpit Creek				
The Blue Cow Resort	Water sourced from Perisher Creek under WAL 10 SL 55290 and 10 AL 119557. Extraction limit is 5 ML a year. Extraction licence historically held by NPWS but more recently has been transferred to Perisher Blue Pty Ltd.	UV Disinfection (based on anecdotal advice only).	Small system servicing a single resort building.	Current extraction is approx. 3.5 ML/year (DPI license data). Asset performance unknown. Treatment capacity details not sighted.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/CAPACITY ITEMS OF NOTE
Kosciuszko Thredbo	System operated by Kosciuszko Thredbo Pty Ltd. Water sourced from Merritts Creek under WAL41294 and WAL39986. The entitlement under WAL41294 is currently subject to negotiations between Kosciuszko Thredbo Pty Ltd and WaterNSW/DPI/NRAR. Extraction limit is 41 ML a year for domestic purposes.	Coarse screen filtration at intakes and UV Disinfection post storage/ pre village water mains.	Raw water sourced from High Noon dam located on Merritts Creek. Network infrastructure includes 185 kL storage total (two reservoirs) at Merrits Creek and 200 kL storage total at Alpine Way (two reservoirs). System designed for approved bed limit (4820 beds).	Current extraction is approx. 367 ML/year (DPI license data). This significantly exceeds the license allocation. Asset performance unknown. Treatment capacity details not sighted.
Charlotte Pass	Operated by Charlotte Pass Snow Resort Pty Ltd. Water sourced from Upper Snowy River under WAL41294. Extraction limit is 16 ML.	UV Disinfection (based on anecdotal advice only). Source understood to be unreliable in summer (based on anecdotal advice only).	Small system servicing a hotel and 11 visitor lodges. Understood to have no reservoir storage, hence system operation relies on storage in the weir/river (based on anecdotal advice only).	No details sighted. Asset performance unknown. Understood to have limited reliability due to lack of reservoir storage and source reliability Treatment capacity details not sighted.
Bullocks Flat	Operated by Perisher Blue Pty Ltd. System services ski tube terminal and car park area. Water sourced from Thredbo River under Water Licences 10SL45363 and 10AL119673. Extraction limit is 28 ML a year.	UV Disinfection (based on anecdotal advice only).	Small system servicing ski tube terminal and car park area and Bullock Flats STP.	Current extraction is approx. 15 ML/year (DPI license data). Asset performance.unknown. Treatment capacity details not sighted.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/CAPACITY ITEMS OF NOTE
Sponars Chalet	Operated by Ski Sponars Pty Ltd. Water sourced from Rainbow Lake.	UV Disinfection only (i.e. no chlorine disinfection).	Small system servicing a hotel. System consists of gravity mains and service reservoir.	No details sighted. Asset performance unknown. Treatment capacity details not sighted.
Ski Rider	System services Ski Rider Resort (Motel accommodation). Operated by resort owner/s. Water is sourced from sawpit creek (WAL 10FL055357) via weir. 339 bed limit under current lease. Lease expires 2025, at which point owner would look to extend it and (desirably) increase bed numbers. In the past they have operated up to 385 beds. Resort not open in summer – operates late June to September typically.	UV treatment, otherwise periodic manual chlorine disinfection of system.	Holding tanks and no significant retic (services resort only).	No details sighted. Asset performance unknown. Treatment capacity details not sighted.
Selwyn Snow Resort	Operated by Selwyn Snowfields Pty Ltd. Water sourced from Clear Creek under WAL39347. Extraction limit is 50 ML a year for domestic use. Water used for snowmaking sourced from Clear Creek and Three Mile dam when required (license arrangements unknown).	UV Disinfection (based on anecdotal advice only).	Small system servicing a resort area.	Current extraction is approx. 44 ML/year (DPI license data). Asset performance unknown. Treatment capacity details not sighted.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/CAPACITY ITEMS OF NOTE
Lake Crackenback	Water sourced from Thredbo River and Little Thredbo River under two licenses – license details unknown. Unlimited water from the supply area. Almost exclusively used for chalets and apartments domestic use, with some potable water used for irrigation of golf course (greens only) during summer. Golf course irrigation water is primarily recycled water sourced from the Lake Crackenback STP.	Memco package WTP system, approximately 30 years old. Details of the specific treatment process included in this WTP have not been sighted. Has its own water system and sewerage system.	Gravity supply within the resort. Lake Crackenback has 1000 bed development approval. The water infrastructure was designed to meet this requirement.	No current issues with water availability, treatment plant capacity or asset performance (based on initial discussion with asset owner).
Island Bend	No water supply at this site.	N/A	N/A	N/A
Thredbo Rangers Station	Rain water capture with a 2000 litre storage tank. There had previously been a licence to extract water from the creek, however this has not been used in many years.	UV disinfection at site. It is unsure if the facility is in an operational state. Upgrades were made to the buildings 10 years ago but there has been little maintenance or use since then.	Electric pressure pump.	Facilities require testing to understand the condition and operational capacity.

Water used for snowmaking has been included for context regarding general quantities of water used. Table 4.2 provides a summary of availabe information regarding snowmaking water usagewithin the study area. It is noted there is some discrepency between these data sources.

Refer to the separate report "Climate Change Impacts on the Kosciuszko National Park Carrying Capacity and Artificial Snowmaking at NSW Alpine Resorts" for detailed analsyis of current and future snowmking operations, including water usage implications.

Table 4.2 Availabe information regarding snowmaking

LICENCE NAME/ NUMBER	ANNUAL EXTRACTION LIMIT (ML)[1]	ANNUAL AVERAGE USAGE RECORDED BY DPIE (2016-2019) (ML)[1]	ESTIMATED USAGE PROVIDED BY ALPINE RESORT (ML)
Perisher			
Snowmaking Pump Station 3 (10 SL 57228/WAL 38553)	137	120	unknown
Smiggin Creek/snowmaking (10 SL 57193)	50	15	unknown
Perisher Range Aqueduct (10 SL 57220)	710	315	unknown
Total	**897**	**450**	**790**[2]
Thredbo			
Snowmaking pumping plant (WAL 39982)	260	250	unknown
Diversion channel snowmaking (WAL 41189)	345	Not provided/unknown	unknown
Total	**605 ML**	**250 ML**	**290 ML**[3]
Grand total	**1502 ML**	**700 ML**	**1080 ML**

(1) Alpine resorts' water extraction/access licenses and usage (2016–2019) data provided by DPIE

(2) Indicative annual water usage for snowmaking provided by Perisher alpine resort for a typical year (refer above carrying capcaity report for source details)

(3) Annual average water usage for snowmaking provided by Thredbo alpine resorts for financial years 2017/2018 and 2018/2019 (refer above carrying capcaity report for source details)

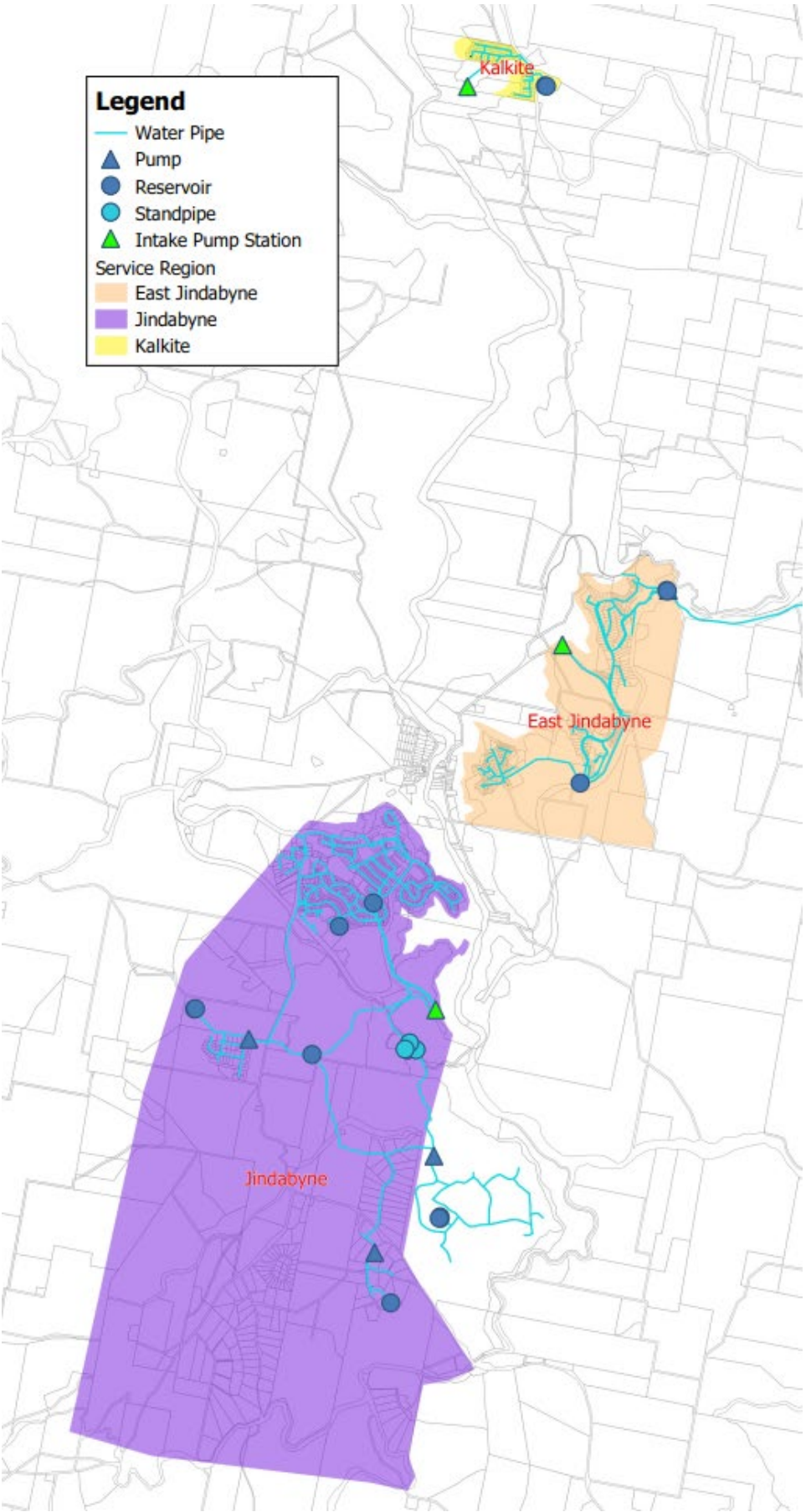


Figure 4.2 SMRC water supply systems serviced areas/overview

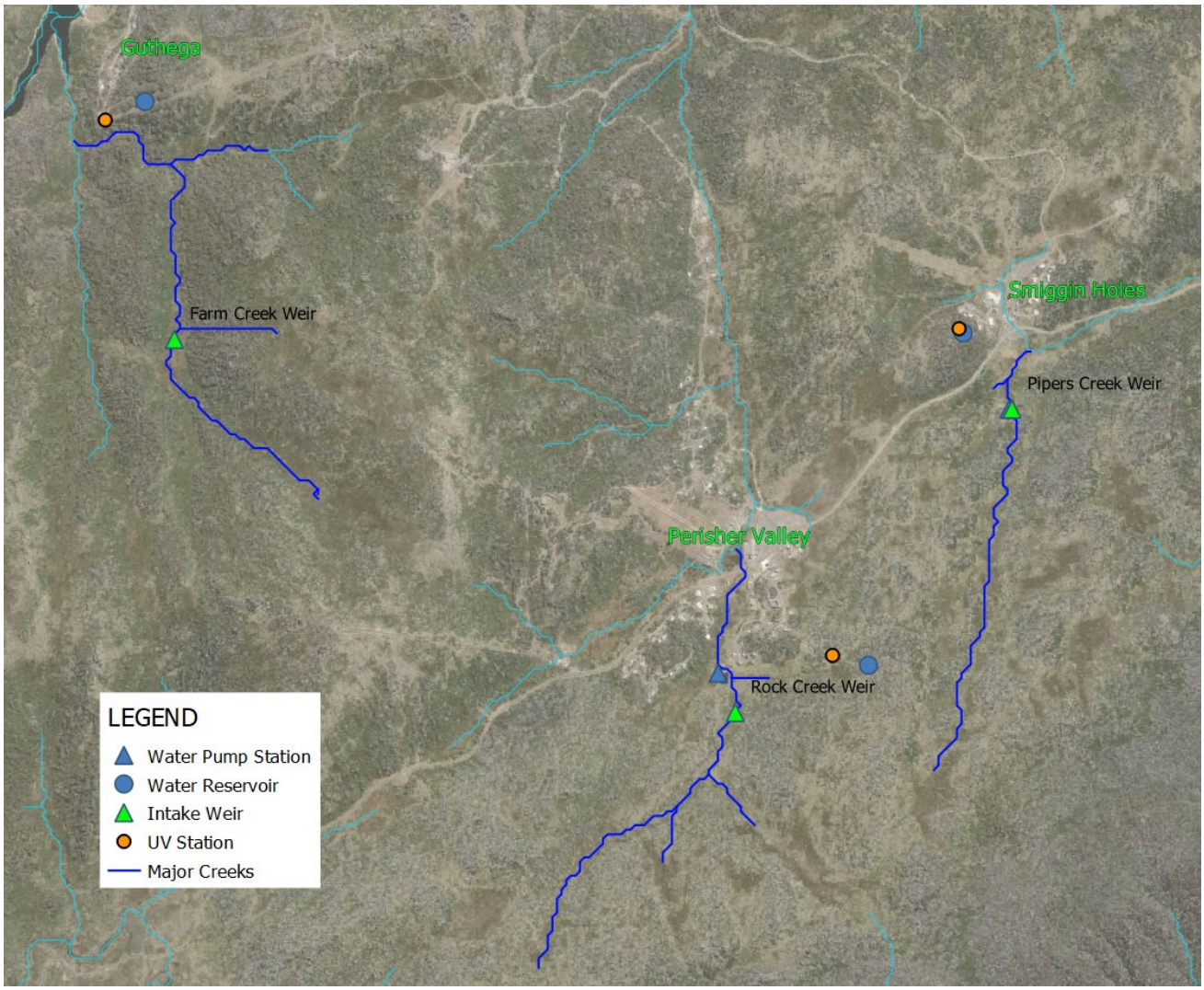


Figure 4.3 NPWS water supply systems overview at Perisher Valley

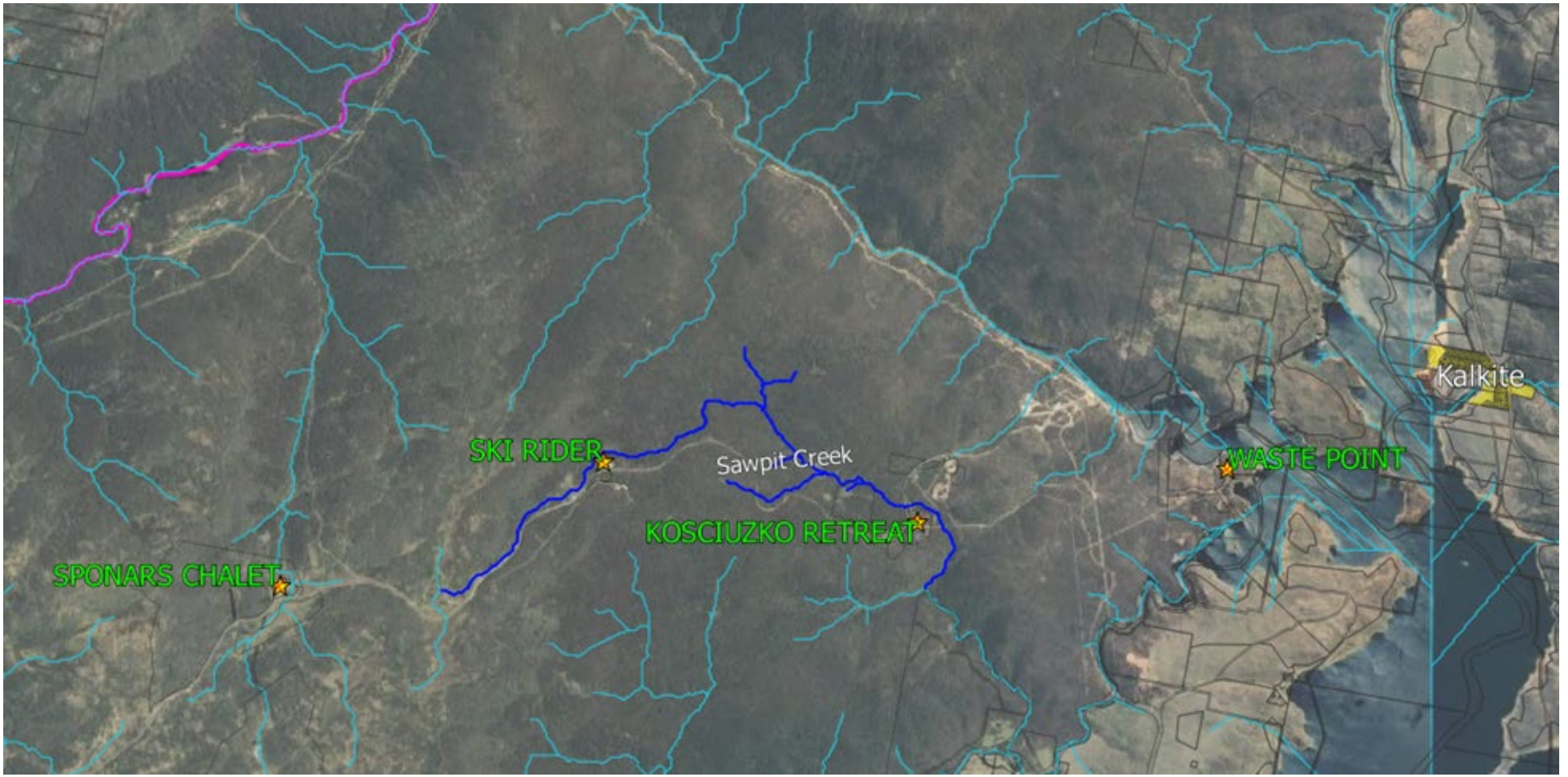


Figure 4.4 Locations of Sawpit Creek in relation to Kosciuszko Retreat and Ski Rider resorts

4.2.1.2 WASTEWATER INFRASTRUCTURE

EXISTING WASTEWATER INFRASTRUCTURE

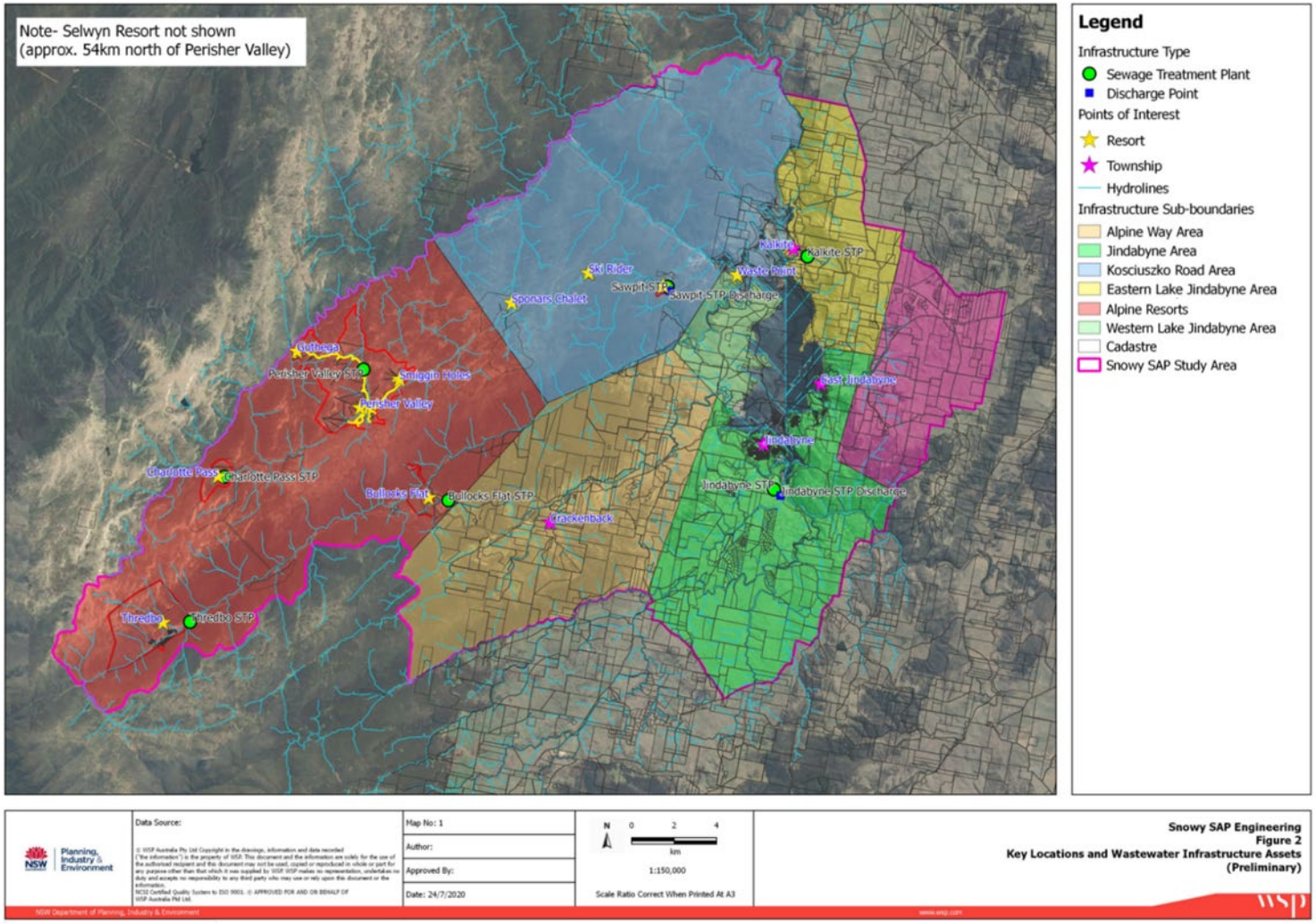


Figure 4.5 Wastewater infrastructure summary map

Table 4.3 Wastewater infrastructure summary

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
ASSETS OWNED BY SMRC See Figure 4.6 to Figure 4.8 below which provide an overview of these systems and their respective service areas					
Jindabyne	— Servicing Jindabyne and East Jindabyne catchments. — Discharge to Cobbin Creek under EPA License No. 773, discharge limit is 2,000 kL/d.	— IDEA process discharging to a pond system which includes 6 maturation ponds. Further details of the existing treatment system have not been sighted. — Original capacity of 8,000 EP (1,920 kL/d). — Limited process upgrades undertaken in recent years to improve performance.	— Includes 7 SPS in Jindabyne and 9 SPS in East Jindabyne. In total, 5 of these SPS discharge directly to the STP via common rising main systems. — Some SPS include emergency storage structures to manage overflow risks. — Reticulation system consists of conventional gravity sewerage. — Contains approx. 50 km of sewers and covers an area of 780 hectares.	— STP is beyond capacity in peak months. Sufficient for residential population but for tourist population in winter it needs temporary measures. Council is in the process of looking at design for upgraded facilities such as broader reticulation systems around Jindabyne.	During 2017–2020 report period there were 142 non-compliances with EPL: — 13 instances of phosphorous limit exceedance — 5 instances of total nitrogen exceedance — 2 instances of ammonia level exceedance — 2 instances of pH limit exceedance — 8 instances of Faecal coliform limit exceedance — 4 instances of concentration limits exceeded — 108 instances of daily discharge limit exceeded.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
Kalkite	— Servicing a limited area within Kalkite township with over 120 connections. — Not licenced under OEH Environmental Protection Licence.	— Pasveer channel plant. Further details of the existing treatment system have not been sighted. — Effluent disposal is via evaporation pond. — System design capacity is 1,000 EP.	— Includes three small SPS. — Reticulation system consists of conventional gravity sewerage.	Issues noted in 2014 Snowy River Shire Council *Integrated Water Cycle Management Detailed Strategy Study* report include: — Kalkite STP civil components have poor asset condition, mechanical and electrical components renewal replacement overdue — 20% of the Pasveer ditch civil works (panels) need replacement — All mechanical and electrical systems need replacement — It is unclear if the evaporation ponds are operating adequately — Council have been considering possible augmentation or relocation of this STP.	N/A (effluent discharged to evaporation pond, not monitored by EPA).

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) See Figure 4.9 to Figure 4.12 below which provide an overview of these systems/locations					
Perisher Valley	— Servicing Perisher Valley resort, Smiggin Holes, Blue Cow and Guthega resorts. — Discharge to Perisher Creek under EPA Licence No. 1797, discharge limit is 2000 kL/day. — STP and network assets in good condition generally.	IDEA plant which includes: — Inlet step screen with coarse bar screen bypass. — Inlet pumping station. — Inlet splitter box. — 3x Extended Aeration Treatment (EAT) tanks. — Carbon dosing in the form of Liquid Sugar, dosed into the anoxic zone. — pH correction dosing using Soda Ash (Sodium Carbonate). — Phosphorus removal via Aluminium Chlorohydrate (AC) dosing, with dosing directed to both into the inlet splitter box and decant well. — Combined decant channel.	— Includes five SPS and associated rising/gravity mains. — SPS 1 has a balance. Tank. — Sewerage from Blue Cow pumped to Guthega then transferred to Perisher from a wet well with gate/valve control on outlet via gravity flow to Perisher.	— STP is snow bound in winter with access restricted to oversnow vehicles only. — High ammonia loading due to day visitors challenges the treatment process and constrains capacity to around the current loading. — Operational challenges with sludge management at the STP due to snow conditions requiring full season storage. — Long rising main from Blue Cow which would have very high detention time. No odour/septicity issues from this noted to date.	During 2016–2020 report period there were 18 non-compliances with EPL: — 6 instances re: exceedance of concentration limits and overflow from non-licensed points (2016–2017) — 6 instances re: elevated ammonia and total nitrogen levels in 2017 — 4 instances re: phosphorus levels in 2018–2020 — 5 instances of daily discharge limit exceeded.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
		— Effluent catch-pond. — UV Disinfection system. — 2x waste activated sludge (WAS) storage tanks. — Additional dosing of Phosphoric Acid, Urea, Blood and Bone and Di-ammonium Phosphate as necessary during start-up. — Design capacity 2 ML/d for 8000 EP. — To manage winter ramp up in loading, and 18 week feed program is undertaken prior to winter and typically the treatment process is seeded using sludge from the SMRC Jindabyne STP.			

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
		— The STP processes require gas fuelled heating to operate during winter. Treated effluent is heated and returned to either the inlet splitter or directly into the process tanks themselves if additional heating of a specific reactor is needed.. — Biosolids from the STP are land applied on a property near Berridale for soil conditioning — Effluent quality limits include TN 10 and TP 0.3 mg/L limits.			

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
Sawpit Creek	— Servicing the Kosciuszko Mountain Retreat/ Caravan Park and NPWS Education Centre. — Discharge to an absorption trench system under EPA License No. 447.	— Small IDEA plant with single EAT tank, similar process to the Perisher Valley plant (but smaller), based on anecdotal advice from NPWS representative.	— Small and simple network servicing only a local area. — System receives caravan waste from a dump point at Kosciuszko Mountain Retreat.	— Sawpit Creek absorption trench disposal system is nearing the end of its design life and has issues with hydraulic loading in peak winter loading/conditions. — Treatment capacity details not sighted.	During 2016–2019 report period there were 8 non-compliances with EPL: — 1 instance of concentration limit of nitrogen exceeded — 5 instances of total suspended solids exceeded — 2 instances of concentration limit of phosphorus exceeded.
Western Lake Jindabyne Area	— Serviced by individual septic tank systems with common absorption bed system.	— Individual septic tanks. — Effluent is disposed of to an absorption field.	— No details sighted.	— No details sighted. — Asset performance unknown. — Treatment capacity details not sighted.	N/A

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
Thredbo Village	— Servicing Thredbo Village. — Operated by Kosciuszko Thredbo Pty Ltd. — Discharge to Thredbo River, discharge limit is 1610 kL/d.	— Activated sludge plant with pre-treatment, flow equalisation basin, two operating aeration tanks, three maturation ponds, tertiary filtration system and UV disinfection of effluent prior to release to a wetland and subsequently the Thredbo River. — System designed for approved bed limit (4820 beds). — Treated effluent discharge to the Thredbo River under EPA Licence 1599.	— Asset details unknown (however covers a significant site area, so expected to include at least several SPS catchments). — System designed for approved bed limit (4820 beds).	— Asset performance unknown.	During 2016–2020 report period there were 11 non-compliances with EPL: — 2 instances of phosphorous limit exceedance — 2 instances of load limit for suspended solids exceeded — 1 instance of total nitrogen exceedance — 3 instances of daily discharge limit exceeded — 3 instances of concentration limit of nitrogen exceeded. There were no non-compliances during 2019 to 2020.

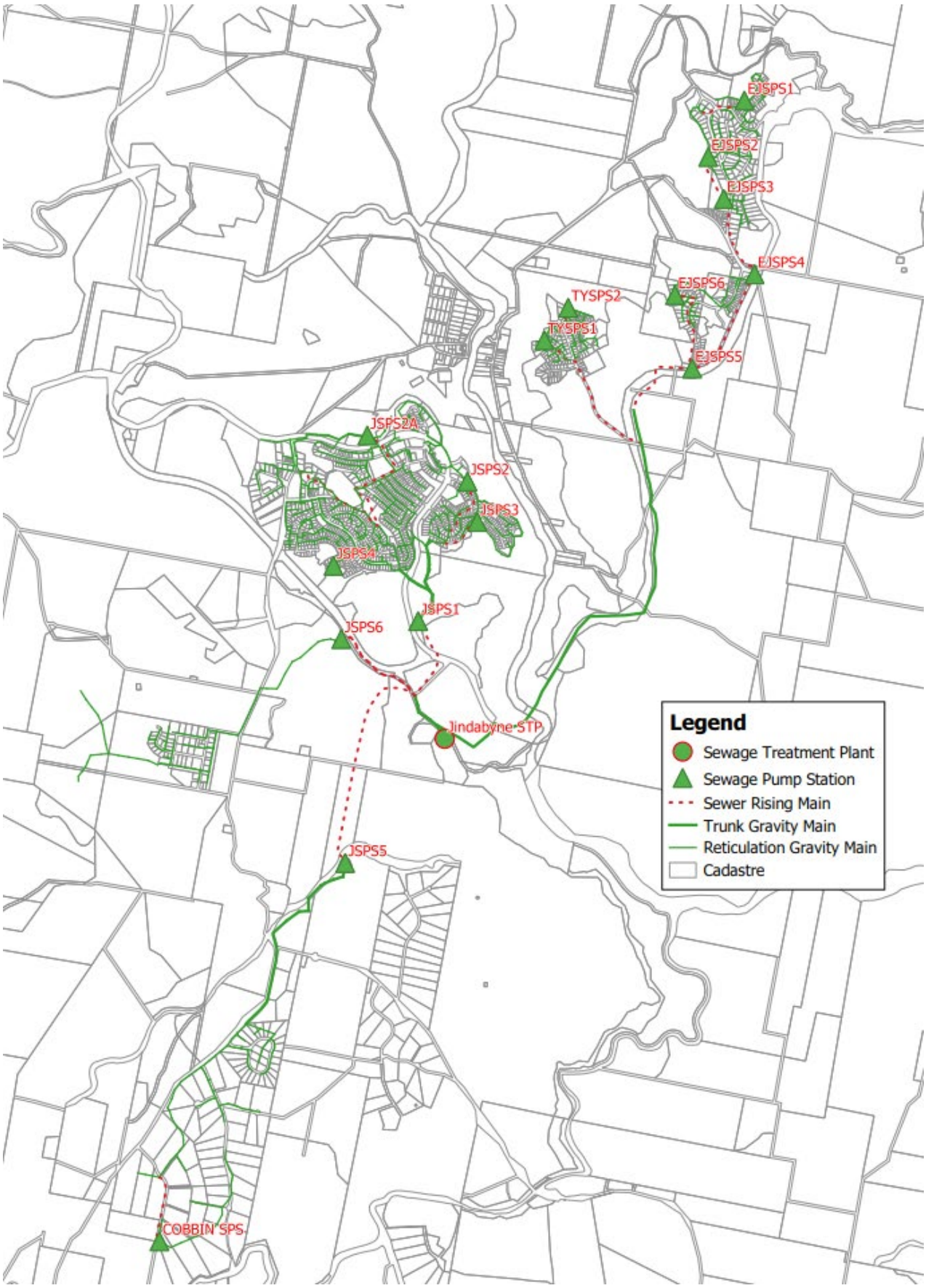
SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
Charlotte Pass	— Servicing Charlotte Pass resort. — Operated by Charlotte Pass Snow Resort Pty Ltd under Licence no. 1591. — Discharge to an intermittent stream joining Spencers Creek, discharge limit is 233 kL/day.	— On-site STP. IDEA system with final UV disinfection. Treatment tanks in series rather than having them in parallel.	— Pumps station feeds the STP from the town.	— STP is snow bound in winter with access restricted to oversnow vehicles only. — No details sighted. — Asset performance unknown. — Similar issues to Perisher Valley with dramatic increase in winter load requiring a careful feed program.	During 2016–2020 report period there were 203 non-compliances with EPL: — 1 instance of pH limit exceedance — 7 instances of faecal coliform concentration limit exceeded — 1 instance of discharge limit exceeded due to major storm event — 1 instance of mishandling of samples, and 3 of unfulfilled monitoring — 1 instance of BOD exceedance — 38 instances of Phosphorus exceedance — 150 instances of Nitrogen/Total Nitrogen exceedance — 1 instance of concentration of suspended solids exceeded.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
Bullocks Flat	— Servicing Bullocks Flat terminal and nearby areas. — Operated by Perisher Blue Pty Ltd under Licence no. 2274. — Discharge to Thredbo River, discharge limit is 3750 kL/day.	— Bullocks Flat STP details unknown (some type of mechanical plant with UV disinfection prior to discharge to holding ponds). — Holding ponds wetland system. — Discharge from holding ponds to Thredbo River.	— No details sighted.	— No details sighted — Asset performance unknown. — Treatment capacity details not sighted.	— A total of 75 non-compliances in relation to various exceedances of concentration limits of water qualities during 2016–2018 report periods. — Nine administrative non-compliances during 2018–2019 report period.
Sponars Chalet	— Servicing Sponars Chalet resort. — Operated by Ski Sponars Pty Ltd under Licence no. 3113. — Discharge to an evaporation pond and monitored at Diggers Creek, discharge limit is 50 kL/day.	— Activated Sludge STP and UV disinfection. — Effluent is discharged to an evaporation pond for evaporation in Summer. Creek discharge is generally not undertaken however monitoring is undertaken at Diggers Creek and the discharge limit is 50 kL/day.	— No details sighted.	— No details sighted. — Asset performance unknown. — Treatment capacity details not sighted.	During 2016–2019 report period there were 7 non-compliances with EPL: — 5 occasions in relation to exceedance of nitrogen or ammonia limits — 1 instance of mishandling of samples — 1 instance of failing to monitoring daily discharge. There were no non-compliances during 2019 to 2020.

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
Ski Rider Resort	— Services Ski Rider resort.	— Small aerobic pond treatment system with storage for effluent (3 ponds with 2.5ML total volume). — Effluent is pumped out every season (or can be pumped out early if required). Also pumped out prior to the season (to maximize available storage). Requires multiple trucks. — Effluent disposal is offsite (i.e. by the pump-out contractor at an STP or to land application outside the National Park) with no discharge occurring on-site.	— No details sighted.	— No details sighted. — Asset performance unknown. — Treatment capacity details not sighted.	N/A
Selwyn Snow Resort	— Services the Selwyn Snow resort.	— Utilising waterless composting toilet system. — Waste water is disposed and treated via a septic system and an absorption trench system.	— No details sighted.	— No details sighted. — Asset performance unknown. — Treatment capacity details not sighted.	N/A

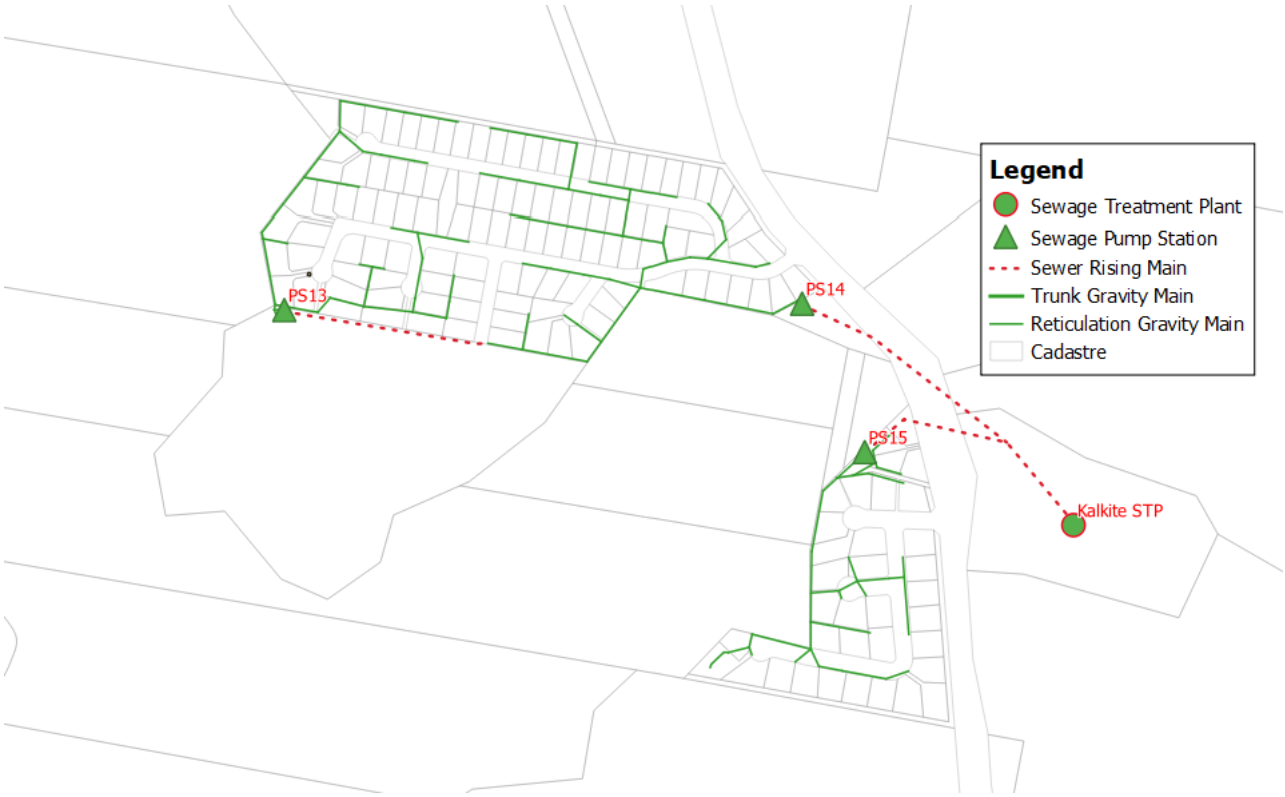
SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
Lake Crackenback	— 830 beds approved by council? Or 1000 and 830 currently installed. — 100 beds yet to be developed by others. — 170 beds still within the approval from council to be developed by this private owner.	— Package plant STP, concrete units under licence (for 900 EP). — 9 ML treated effluent reservoir in the resort and then another larger one in an adjoining block of land. — Spray irrigation goes under the golf course. — Consultant looked after the licencing side. — They do some monitoring quite frequently. — All of the STP effluent is stored during winter, so discharge from the reservoirs is in non-winter time. — Systems is all self-contained onsite.	— Conventional gravity system with no major assets identified.	— No current issues with treatment plant or sewer network capacity or asset performance (based on initial discussion with asset owner).	N/A
Island Bend	— Sealed pump out toilets on site.	NA	NA	NA	NA

SYSTEM	OVERVIEW	TREATMENT INFRASTRUCTURE DETAILS	NETWORK INFRASTRUCTURE DETAILS	PERFORMANCE/ CAPACITY ITEMS OF NOTE	EPL NON-COMPLIANCES
Thredbo Rangers Station	— Concrete septic tank with a brick lined absorption trench on site. It is a historic structure and not suitable for future use of expansion on site.	NA	NA	NA	NA



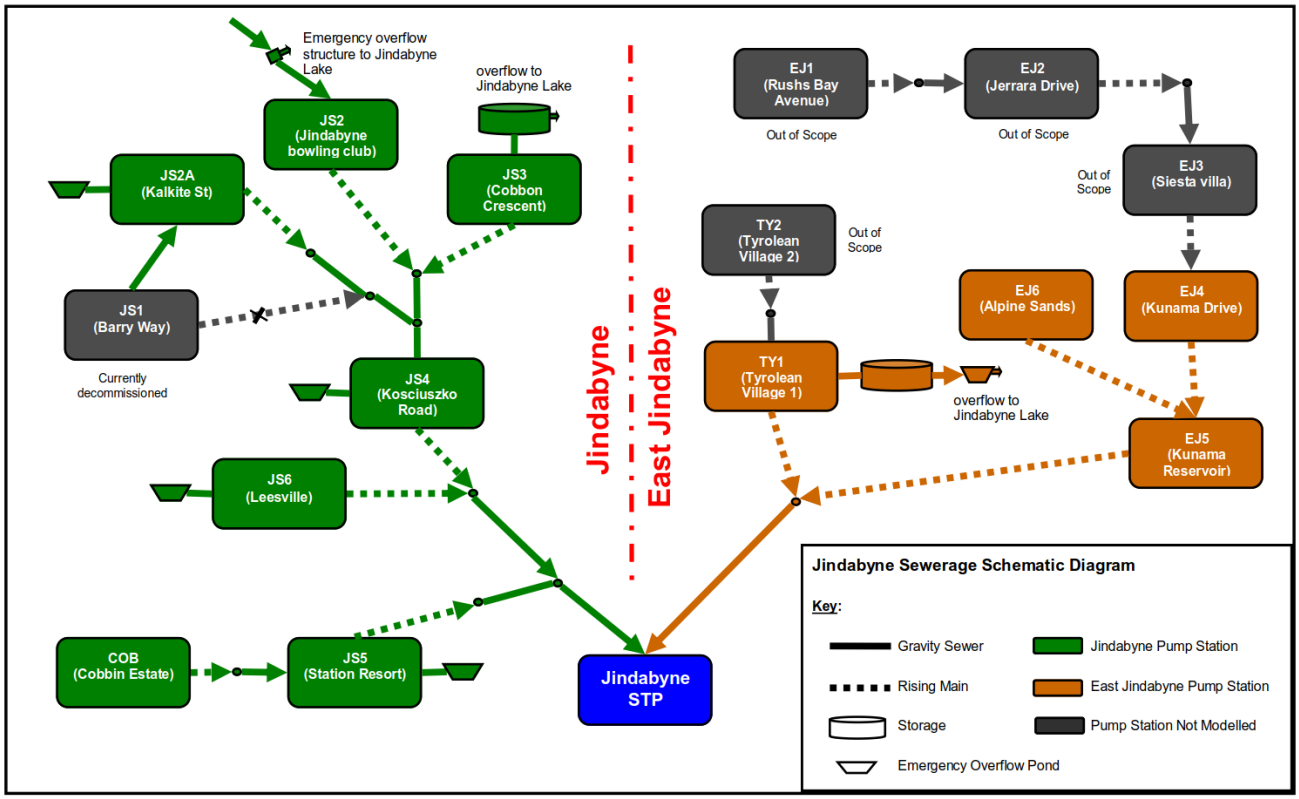
Source: SMRC

Figure 4.6 Jindabyne wastewater system overview/serviced area



Source: SMRC

Figure 4.7 Kalkite wastewater system overview/serviced area



Source: Jindabyne Sewerage Scheme Report, MWH 2010

Figure 4.8 Jindabyne wastewater SPS catchment schematic

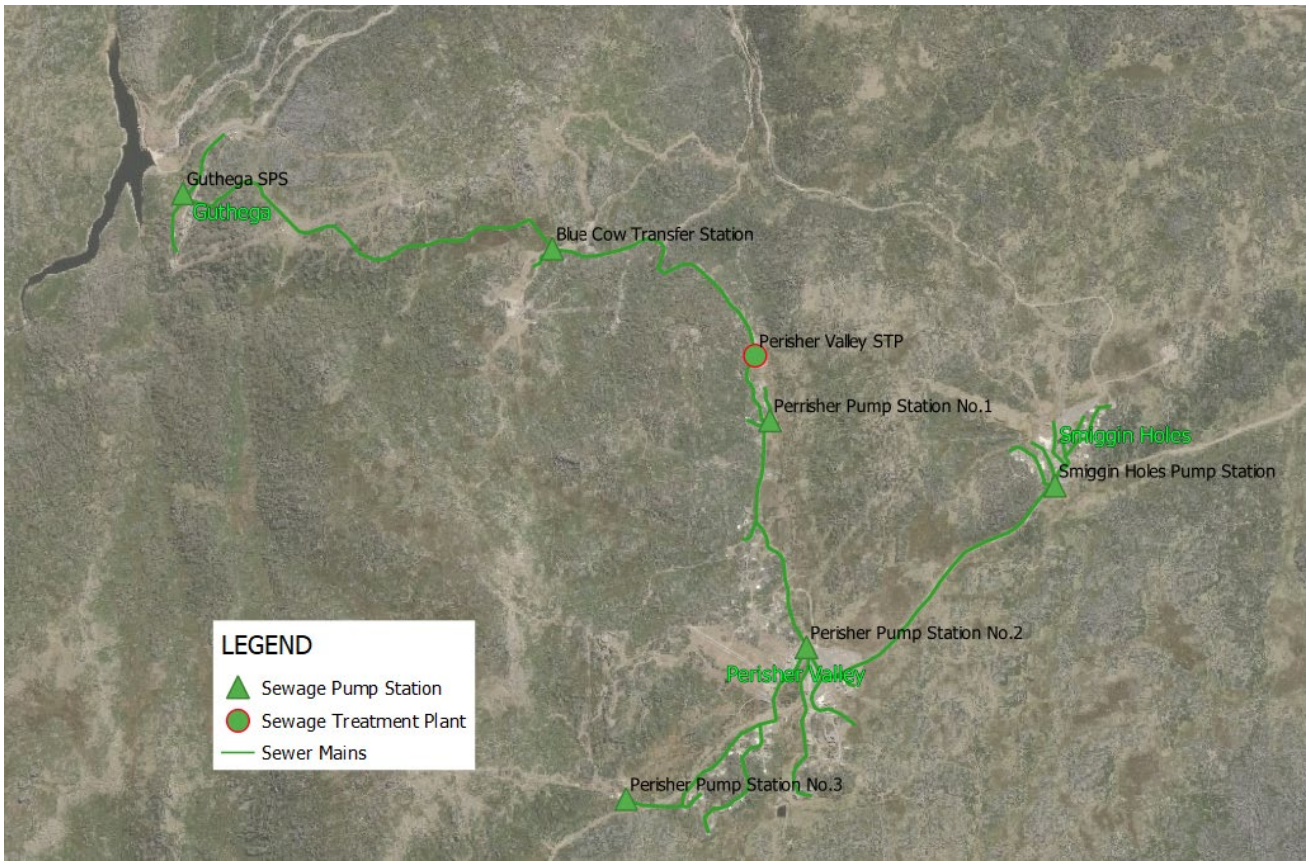


Figure 4.9 Perisher Valley wastewater system overview/serviced area

Figure 4.10 Sawpit Creek STP site

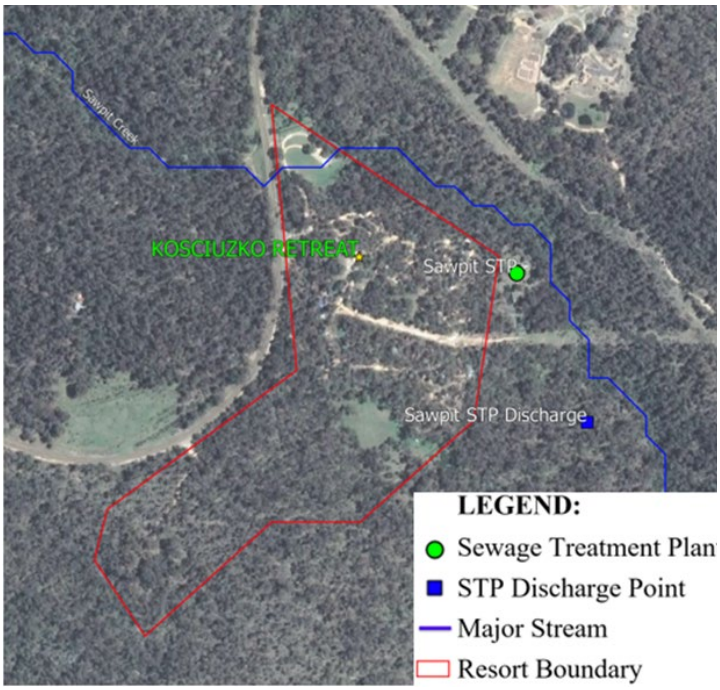


Figure 4.11 Sawpit Creek wastewater system overview

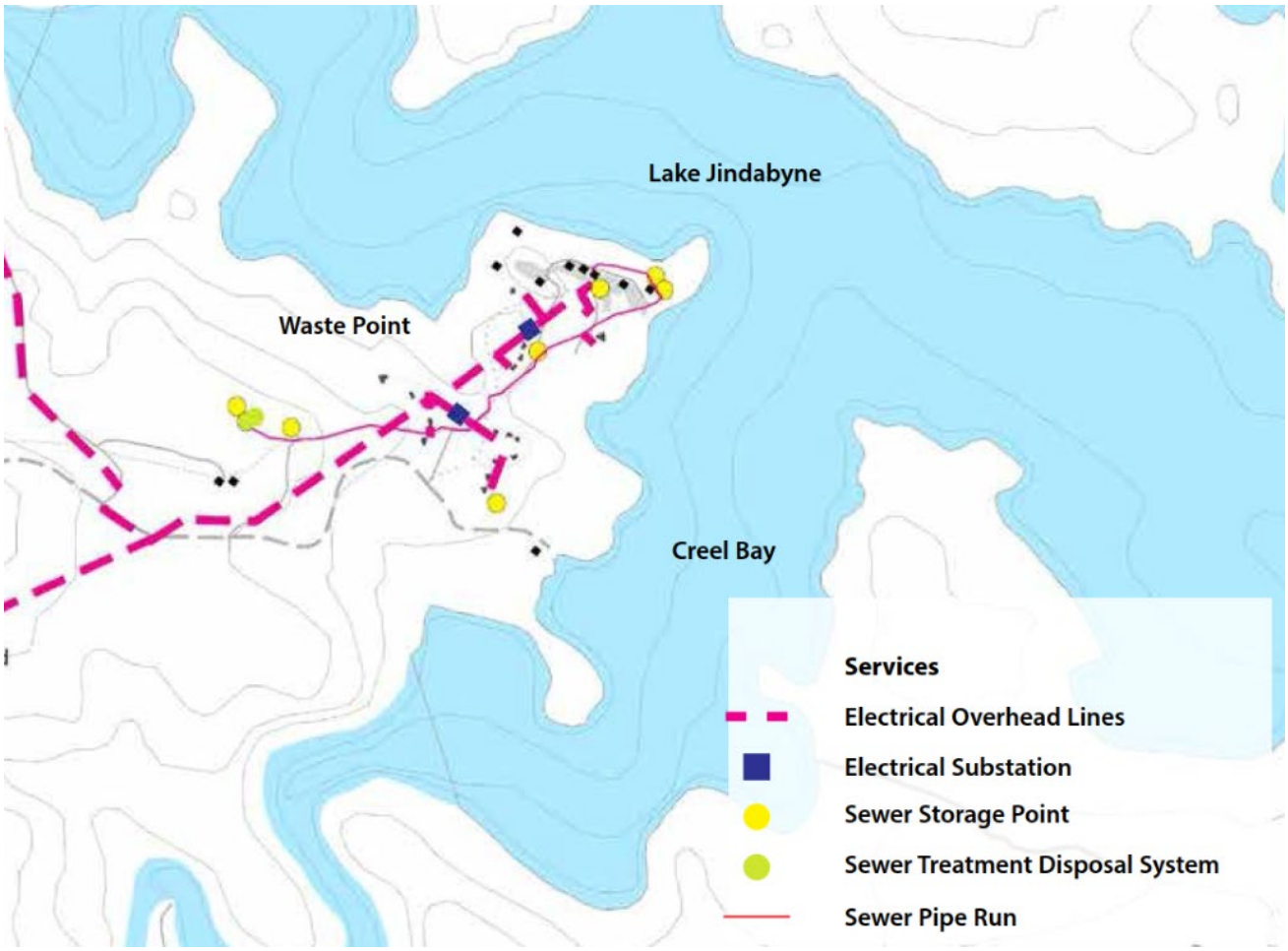


Figure 4.12 Western Lake Jindabyne wastewater system overview

4.3 ELECTRICITY INFRASTRUCTURE

This section of the report considers the existing distribution infrastructure and the available capacity of the distribution network in the vicinity of the Snowy Mountains SAP Study area. The majority of these distributions belong to Essential Energy and Jindabyne pumping station which is a private asset. These substations along with their capacity are outlined in Table 4.4 below.

The existing infrastructure within the study area have been identified based on the information available within the Asset Management Distribution Annual Planning Report (DAPR) 2019 and the interactive map available from the Australian Energy Market Operator (AEMO).

Table 4.4 Distribution substation in the Snowy Mountains SAP region

SUBSTATION STATION NAME	SUBSTATION VOLTAGE LEVEL (kV)	TRANSFORMER MVA CAPACITY (MVA)
Snowy Adit Substation (supplied by Munyang Substation)	132/66/11 kV	1 x 10 MVA 1 x 30 MVA
Jindabyne Substation (supplied by Cooma Substation)	66/33/11 kV	2 x 30 MVA (66/11 kV) 1 x 15 MVA (66/33 kV)
Jindabyne East Substation (supplied by Cooma Substation)	66/11 kV	2 x 10 MVA

SUBSTATION STATION NAME	SUBSTATION VOLTAGE LEVEL (kV)	TRANSFORMER MVA CAPACITY (MVA)
Blue Cow Substation (supplied by Munyang Substation)	33/11 kV	1 x 8 MVA
Smiggin Holes Switching Station	33 kV	-NA-
Perisher (supplied by Munyang Substation)	33/11 kV	2 x 10 MVA
Bullocks Portal (supplied by Munyang Substation)	33/11 kV	1 x 6.25 MVA
Bullocks Flat (supplied by Munyang Substation)	33/11 kV	1 x 6.25 MVA
Thredbo (supplied by Munyang Substation)	33/11 kV	2 x 16 MVA
Jindabyne Pump Station	132 kV	-NA-

The forecast loads for the sub-transmission feeder and STS and ZS servicing the study area have been provided by Essential Energy in the DAPR-2019. Based on this, WSP has estimated available capacity for each of the substations in the Snowy Mountains SAP Study area. These are summarised in Table 4.5 below.

Table 4.5 Distribution substation loading in the Snowy Mountains SAP region

SUBSTATION SWITCHING STATION NAME	INSTALLED CAPACITY (MVA)	AVAILABLE CAPACITY FOR THE YEAR 2021 (MVA)
Snowy Adit Substation (supplied by Munyang Substation)	1 x 10 MVA 1 x 30 MVA	9.9 MVA 17.7 MVA
Jindabyne Substation (supplied by Cooma Substation)	2 x 30 MVA (66/11 kV) 1 x 15 MVA (66/33 kV)	46.6 MVA 13.3 MVA
Jindabyne East Substation (supplied by Cooma Substation)	2 x 10 MVA	15.4 MVA
Blue Cow Substation (supplied by Munyang Substation)	1 x 8 MVA	1.9 MVA
Smiggin Holes Switching Station	-NA-	-NA-
Perisher (supplied by Munyang Substation)	2 x 10 MVA	8.7 MVA
Bullocks Portal (supplied by Munyang Substation)	1 x 6.25 MVA	5.15 MVA
Bullocks Flat (supplied by Munyang Substation)	1 x 6.25 MVA	5.25 MVA
Thredbo (supplied by Munyang Substation)	2 x 16 MVA	17.7 MVA
Jindabyne Pump Station	-NA-	-NA-

From the above table, it is observed that these substations are catered for by either the Munyang or the Cooma substations. The feeder thermal rating (MVA) and the line loading as per the forecast are shown in Figure 4.13 below.

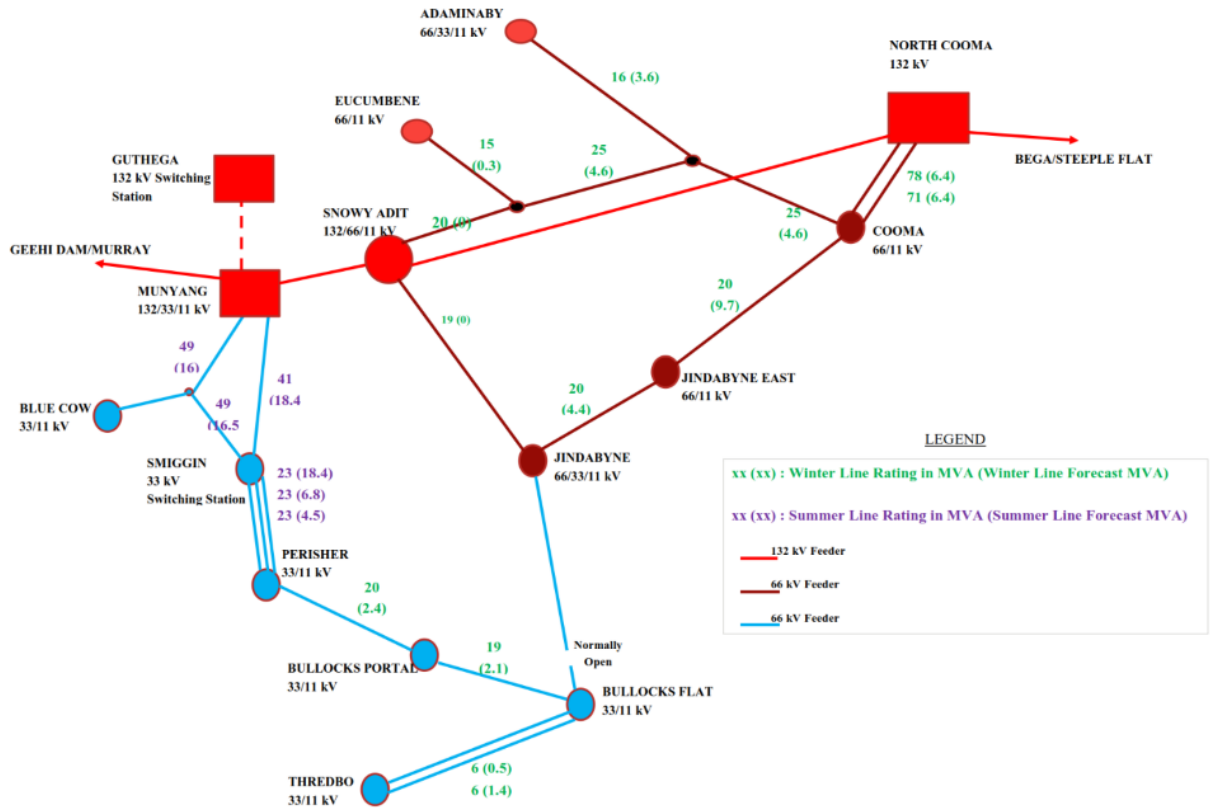


Figure 4.13 Feeder rating and forecasted line loading in MVA

The Renewable Energy Context (WSP, 29/06/2020) report identifies there are three transmission substations within the Snowy Mountains SAP study area.

Table 4.6 Transmission substation in the Snowy Mountains SAP region

SUBSTATION STATION NAME	SUBSTATION VOLTAGE LEVEL (KV)	TRANSFORMER MVA CAPACITY (MVA)
Guthega 132 kV switching station	132 kV	-NA-
Munyang Substation	132/33/11 kV	2 x 60 MVA
Cooma Substation	132/66 kV	2 x 60 MVA

The estimated available capacity for the transmission substations as provided in the Renewable Energy Context report (WSP, 29/06/2020) and shown in the below table.

Table 4.7 Transmission substation loading in the Snowy Mountains SAP region

SUBSTATION SWITCHING STATION NAME	INSTALLED CAPACITY (MVA)	AVAILABLE CAPACITY IN THE YEAR 2021 (MVA)
Guthega 132 kV switching station	-NA-	-NA-
Munyang Substation	120 MVA	87 MVA
Cooma Substation	120 MVA	63 MVA

4.4 GAS INFRASTRUCTURE

The gas servicing the Snowy Mountains SAP Study area is set up as small localised networks in specific areas, such as Perisher and East Jindabyne. Other areas within the Snowy Mountains SAP Study area are distributed by onsite storage tanks or cylinders. The Alpine regions are pipe networks are managed by Elgas while Jindabyne pipeline are maintained by Origin Energy (APA group). All gas supply to the area is LPG.

Elgas has a small depot in Cooma and cylinder swap in Jindabyne, however larger orders, such as Thredbo and Perisher, are trucked from Port Botany in Sydney or alternativity can be brought in from Victoria if required. During winter there are additional cost for clearing snow to access supply tanks that is completed by the property owner or additional charges due to the feed for over snow transport. At Perisher, Elgas have a large storage tank mounted on an over snow trailer that is towed around the resort by a snow groomer.

The nearest supply of natural gas is the Eastern Gas pipeline, owned and operated by Jemena. This pipeline passes through Cooma which is approximately 60 km away. Jemena Gas were consulted with and future extension of this pipeline was discussed; there are currently no plans to extend it past Cooma.

Table 4.8 Gas network summary

AREA	USAGE (LITRES)	OVERVIEW
Perisher	Not Supplied	Small individual networks supplying specific locations in the resort and/or individual onsite storage tanks.
Thredbo Village	729,739 (2018–2019)	Onsite Storage Tank
Charlotte Pass	Not Supplied	Small network supplying the resort
Bullocks Flat	Not Supplied	
Sponars Chalet	Not Supplied	Gas delivery weekly - higher capacity for gas if trucks aren't able to get to resort. Gas for kitchen, commercial laundry and staff quarters for hot water.
Ski Rider Resort	16,339 (2019)	Gas delivery is weekly, however there is a higher capacity on site for gas – if trucks can't get to resort. Gas is used in resort kitchen, commercial laundry and staff quarters for hot water.
Selwyn Snow Resort	Not Supplied	Onsite Storage Tank
Lake Crackenback	Not Supplied	
East Jindabyne	Not Supplied	Small network supplying the residential area south of Willow Bay. Storage tank location at the entrance of the area along Rainbow Drive.

4.5 TELECOMMUNICATIONS AND INTERNET SERVICES

This preliminary analysis draws from publicly available information (DBYDs), information from utility providers as well as team knowledge of the assets within the area.

Information requested from the main telecommunication service providers (namely Telstra, Optus and NBN) in the region, was not forthcoming. WSP were advised by the service providers that commercial in confidence policy restricts their ability to share information on network capacity and speed, in addition to strategic upgrades proposed.

4.5.1 TELECOMMUNICATIONS INFRASTRUCTURE

NBN

NBN is present in study area, servicing the residential and commercial properties within the city centre of Jindabyne with underground fixed line broadband. The surrounding lowland area of Jindabyne are generally serviced by the NBN Fixed Wireless broadband service, although there are areas within the Snowy Mountains SAP Study area receiving little to no coverage. These areas include the alpine and national park region including Perisher, Thredbo and smaller resorts within the National Park. Figure 4.14 illustrates the broadband availability and telecommunications towers around the Snowy Mountains SAP Study area.

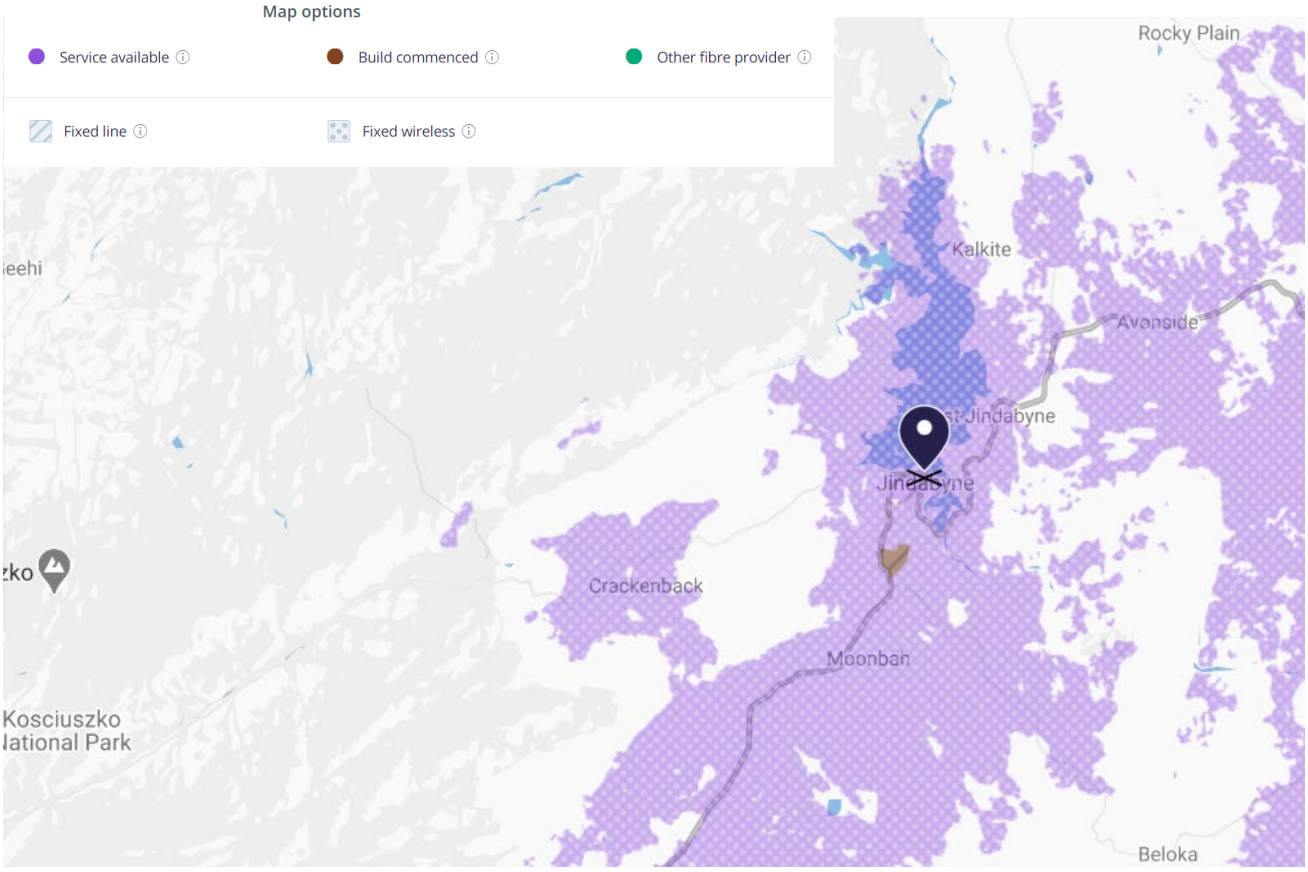


Figure 4.14 NBN coverage map

TELSTRA

Telstra is present in area, servicing the residential and commercial properties, within the city centre of Jindabyne as well as the surrounding areas with fixed line broadband. The surrounds are generally serviced by the by Telstra Fixed Wireless broadband service, although there are areas within the Snowy Mountains SAP Study area receiving little to no coverage. Figure 4.15 and Figure 4.16 illustrate the broadband availability and telecommunications towers around the Snowy Mountains SAP Study area.

Key Assets within the Snowy Mountains SAP Study area include Berridal-Jindabyne High Integrity Data, Canberra-Jindabyne Medium Integrity Data and Jindabyne-Jindabyne South Low Integrity Cable. These cables are the backbone to the Telstra network within Snowy Mountains SAP Study area.

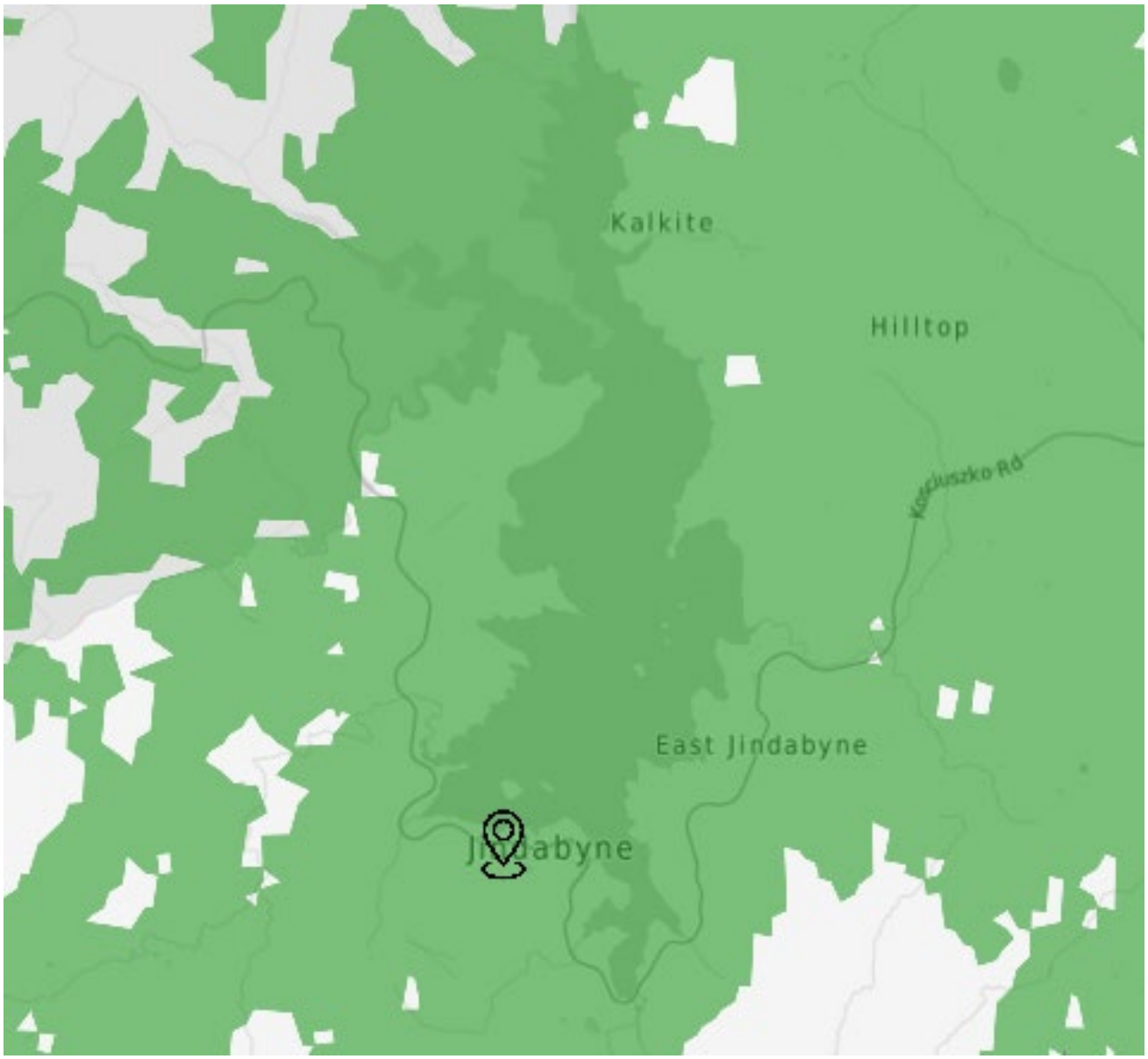


Figure 4.15 Telstra coverage maps

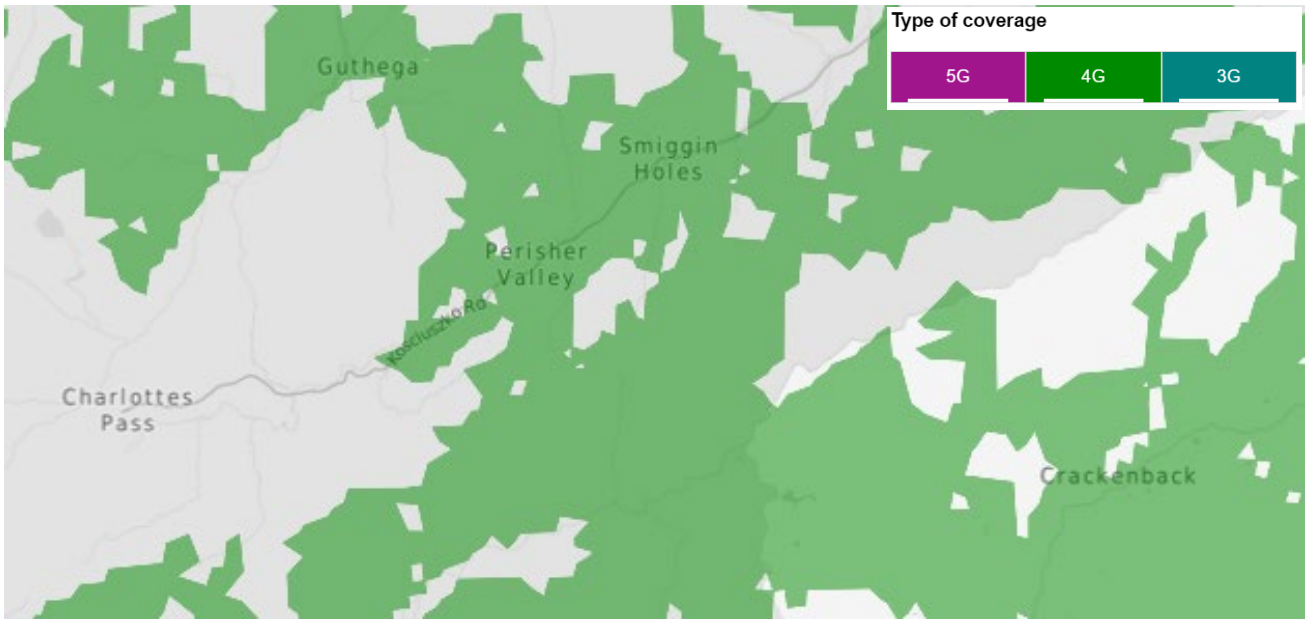


Figure 4.16 Telstra coverage maps

OPTUS

Optus is present in areas surrounding some of their telecommunication towers with fixed line broadband. The Snowy Mountains SAP Study area is generally serviced by Optus Fixed Wireless broadband service, although there are areas within the Snowy Mountains SAP investigation receiving little to no coverage. Figure 4.17 illustrates the broadband availability and telecommunications towers around the Snowy Mountains SAP Study area.

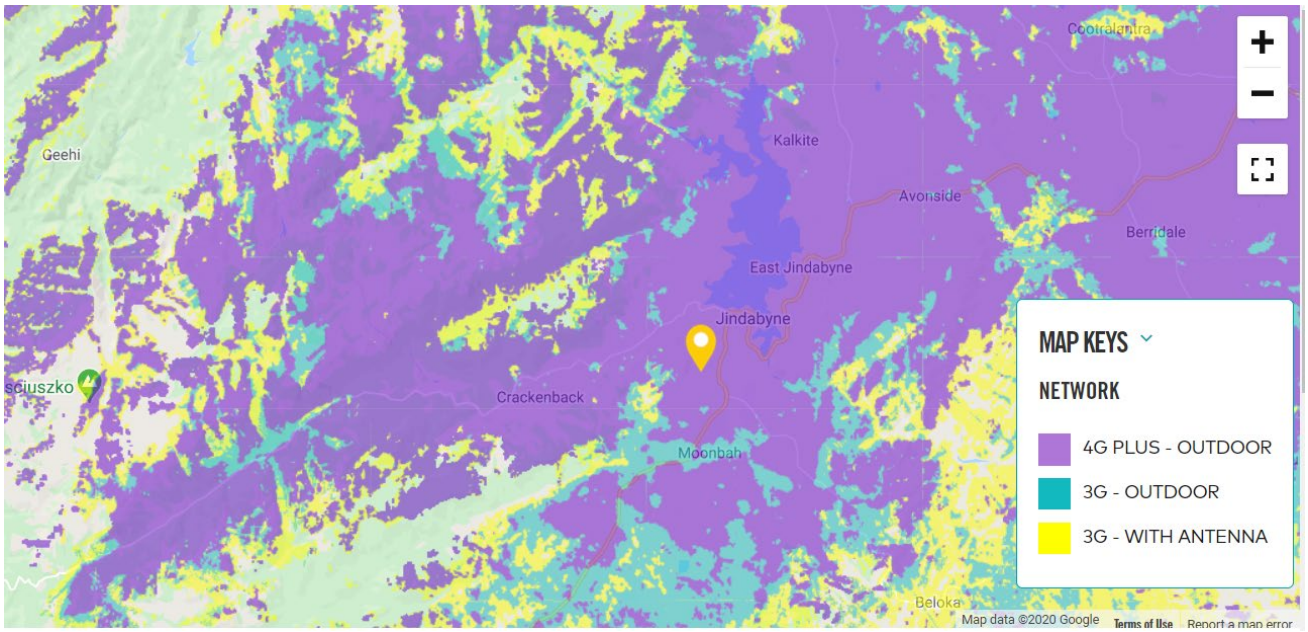


Figure 4.17 Optus coverage map

VODAFONE

Vodafone services the Snowy Mountains SAP study area through Fixed Wireless broadband service, however, there are many areas receiving little to no coverage. Figure 4.18 illustrates the broadband availability in the Snowy Mountains SAP study area.

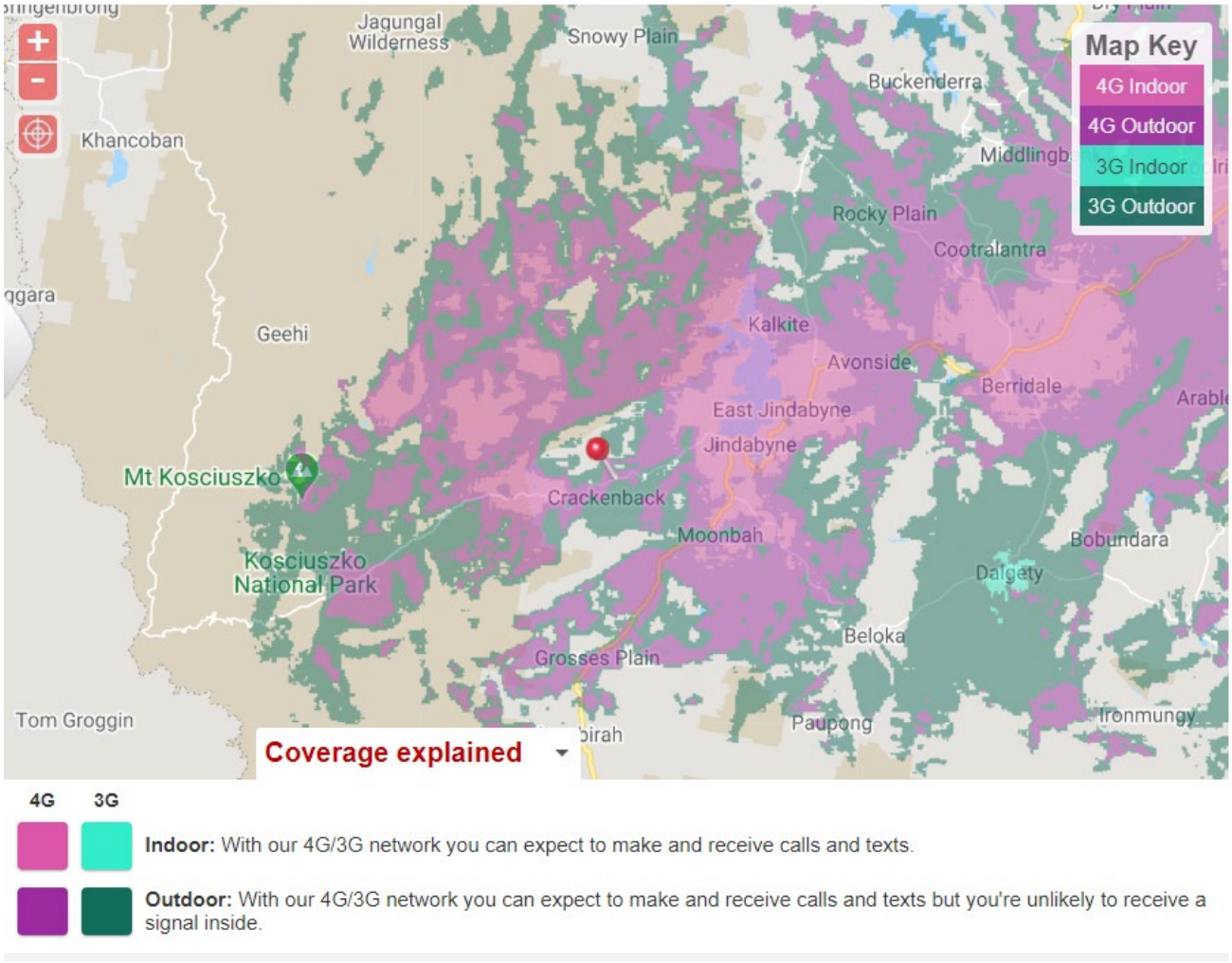


Figure 4.18 Vodafone coverage map

TELECOMMUNICATION TOWERS

Figure 4.19 below illustrates the locations of telecommunications towers and small cells located within the Snowy Mountains SAP Study area. The towers range from 2G networks to 5G.

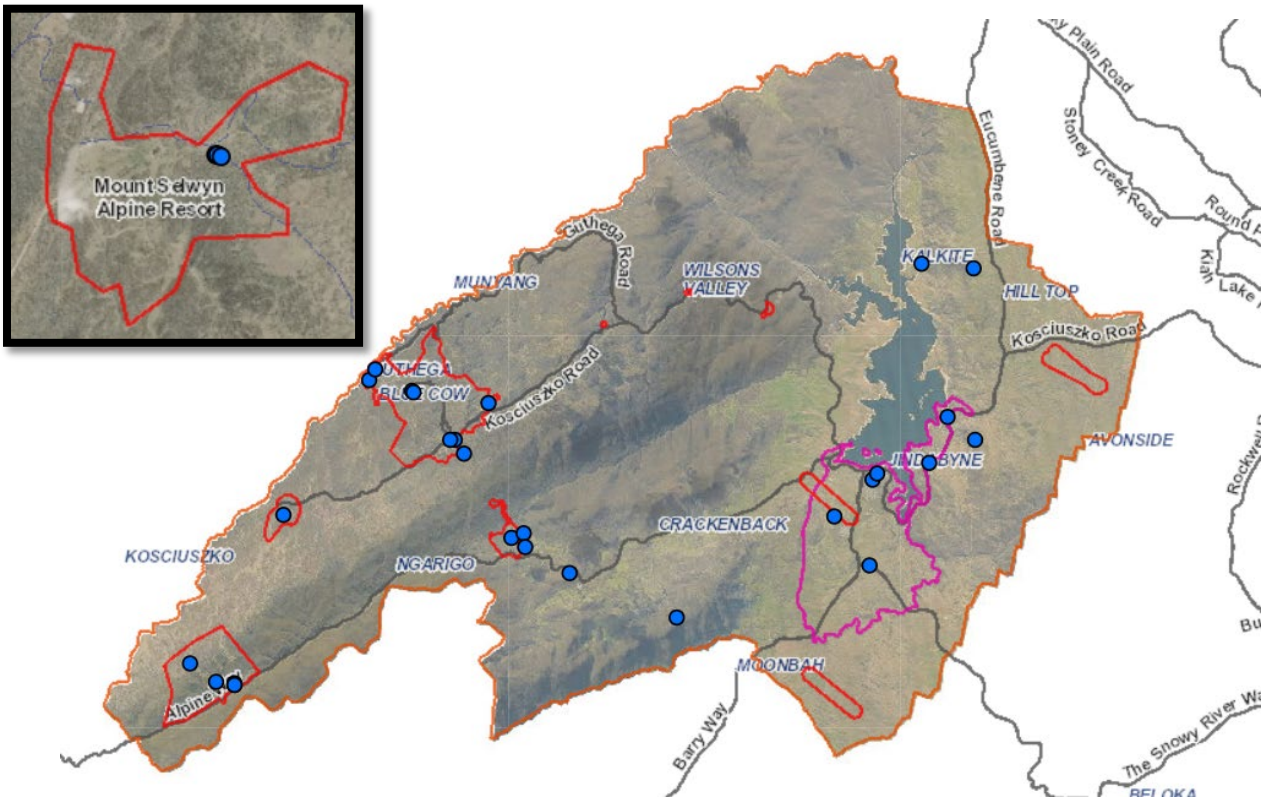


Figure 4.19 Communication tower maps (incl. 3G/4G and 5G)

A number of stakeholders have been consulted in the Snowy Mountains SAP study area to understand their connectivity concerns. Table 4.9 outlines their anecdotal feedback.

Table 4.9 Communication network summary

AREA	STAKEHOLDER FEEDBACK
Perisher	Telstra is planning to install a 4G tower closer to Perisher to improve connectivity in the area. Demand of 4G network is high in winter however connectivity is inconsistent on the mountain. There is fibre connection in Perisher. At Perisher there is a wireless exchange that services surrounding resorts such as Smiggin Holes, Charlotte Pass and the Ski Centre. The fibre connectivity into Perisher is received through an Optus service located through the ski tube with connectivity back to the system at Bullocks Flat. Perisher Village installed this cable with Optus approximately 5 years ago.
Thredbo	The telecommunications connection in Thredbo and along Alpine Way are currently well serviced by existing Fibre cables and Telecommunications towers. Fibre internet connectivity into Thredbo Village is received through a Telstra service located on the overhead Essential Energy transmission poles that bring power into Thredbo.

AREA	STAKEHOLDER FEEDBACK
Sponars Chalet	Telecommunication reliability is unreliable and detrimental to business. There is no NBN or Telstra connection and poor satellite signal. The chalet works with Activate8 Me who operate a satellite on the roof of the chalet. The service charges patrons staying at the property and does not supply fast internet speed. There is a Telstra copper cable along Kosciuszko Road that bypasses the chalet to which Sponars are not currently connected.
Ski Rider Resort	Telcom communication is terrible and detrimental to business. No NBN or poor satellite signal. Wireless is not reliable enough. Few other options but very expensive.
Jindabyne	Jindabyne and surrounding villages (Tyroleane, East Jindabyne etc) are well serviced by Telstra and NBN fibre connectivity.

(1) Jindabyne Utilities and Servicing Strategy

4.6 WASTE AND RESOURCES RECOVERY

4.6.1 OPERATIONS AND FACILITIES

SMRC have developed a draft waste management strategy. This was issued on the 22 July 2020. The report covers the SMRC area including Bombala, Berridale, Michelago, Cooma and Jindabyne. The report identified that Jindabyne landfill has limited air space available within its existing landfill cell. Snowy Monaro Council considered the following options to address the limited life of the landfill:

1. A second lift above the existing cell. This cell would provide additional capacity to the existing location of the landfill cell.
2. A new cell within the quarry area which lies adjacent to the existing land fill site. It is noted that this option may present a more cost-effective solution with respect to air space gained. The space provides a larger land fill site compared to Option 1.
3. Expansion of the transfer station area and consolidation of land fill sites in Cooma. The current transfer station sorts and recycles various materials including wood, steel, garden waste, paper and cardboard. The expansion of the site is recommended to include the transfer of general waste to Cooma and cease landfill operations at Jindabyne.

On 11 January 2021, WSP were informed by the Project Manager from SMRC that a recommendation will be made to not proceed with the landfill expansion in Jindabyne and to consolidate the SMRC landfill assets in Cooma (Option 3). A recommendation will also be made to invest in landfill gas capture technologies to reduce greenhouse gas emissions.

On 23 November 2021, WSP conducted a second meeting with the SMRC waste management team to further discuss and gain clarity around the waste management strategy. During this discussion, SMRC provided their current strategies on converting the existing Jindabyne landfill to a transfer station. The current considerations for this project from SMRC are as follows:

- Investigation of the landfill site has concluded that the existing site cannot be re-purposed for a transfer station due to unsatisfactory gas, settlement issues and the likely existence of asbestos contaminated land. SMRC are currently investigating other sites in the vicinity to design and construct the transfer station which may require property acquisition.
- The transfer station site should have appropriate access to cater for B Double vehicles. This will reduce transporting costs for the facility in future.

- SMRC have revisited their capacity calculation and estimate the current Jindabyne landfill will reach capacity circa March/June 2023. The council is investigating temporary expansion of the current landfill site to accommodate waste until the new transfer station is operational. SMRC are currently conducting an on-site survey to confirm the available capacity of the landfill site and confirm the area of temporary expansion.
- Cooma landfill site, including waste transfer from Jindabyne, has 20 years of capacity at the current configuration. There is no planned expansion, and new land acquisitions would be required after the 20 year period.
- An Environmental Licence Variation will be required for Cooma to take the transferred waste from Jindabyne. It is expected that the EPA will ask for increase of environmental controls such as increased lining and future lining requirements.

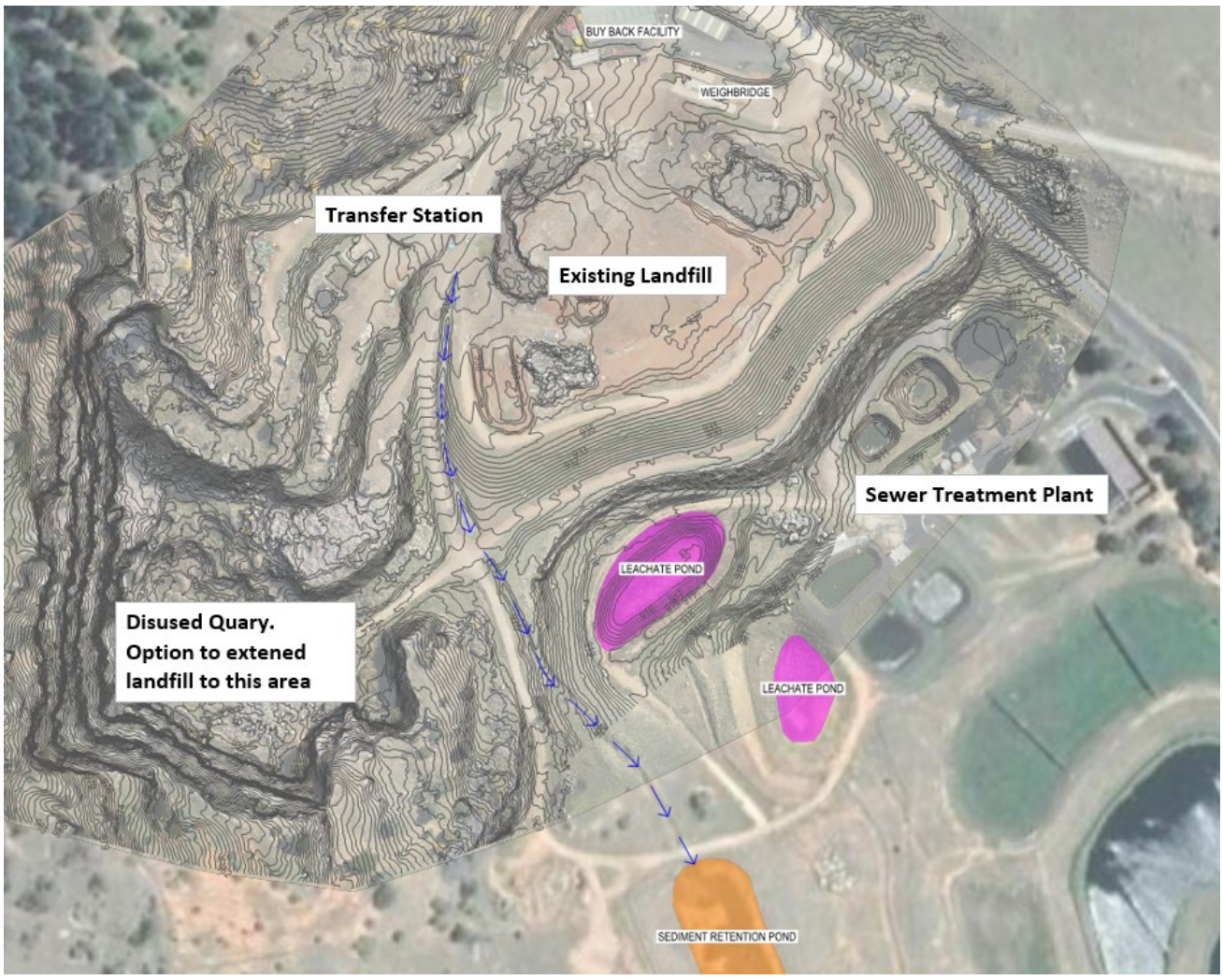


Figure 4.20 Expansion of landfill to quarry – SMRG Jindabyne Regional Waste Management Facility Basis of Design Report. New Landfill Cell

The current site licence, EPL 20060, allows for the following waste and quantities shown in Figure 4.21.

Waste type	Quantity/limit	Activity
Liquid waste	n/a	Storage
General solid waste (non-putrescible)	5,000 tonnes/annum 2,500 tonnes	Landfill disposal Storage
General solid waste (putrescible)	7,000 tonnes/annum	Landfill disposal
Hazardous wastes	5,000 tonnes	Storage
Special waste (Asbestos) (Tyres)	500 tonnes/annum 50 tonnes/ annum or 5000 tyres	 Accepted (Not stored) Stored

Figure 4.21 Jindabyne licenced incoming waste quantities and types – Jindabyne Regional Waste Management Facility, Basis of Design Report, New Landfill Cell (July 2020)

The quantity of waste received and diverted from the Jindabyne Landfill are shown in Figure 4.22.

Reporting period	Waste received (tonnes)	Waste diverted (transport from site) (tonnes)
2018-2019	TBC	TBC
2017-2018	14,232	1,335
2016-2017	11,717	2,033
2015-2016	12,365	1,344
2014-2015	10,021	2,407
2013-2014	11,753	1,233

Figure 4.22 Jindabyne waste quantities – Jindabyne Regional Waste Management Facility, Basis of Design Report, New Landfill Cell (July 2020)

The resorts and accommodation waste are typically serviced through a private waste collection company. It has been assumed that waste operators transport to the nearest landfill (Jindabyne), however at this stage it is unclear on where each operator transport the waste.

4.6.2 CIRCULAR ECONOMY PRINCIPALS

Current incentives currently implemented in the Snowy Mountain SAP study area include:

- From the NPWS STPs, such as Charlotte Pass and Thredbo, waste sludge is being transported and land applied in Berridale; previously dewatered ending up in Jindabyne or Cooma landfill sites and now is being contracted to local waste management in conjunction with a polymer and applying it to land in Berridale. Reports and nutrient testing are occurring as per due process.
- Currently SMRC re-use the green waste taken to landfills as compost.
- A separate organics waste stream (predominantly kitchen waste) is collected in Perisher Valley and Smiggin Holes during winter with the product processed at Sawpit Creek to produce a compost product that is utilised in rehabilitation projects within park.
- From their Draft Waste Strategy, SMRC are considering the capture of glass for use as a sand or gravel replacement in council construction projects.
- SMRC have noted they will look to do more in the town of Jindabyne concerning circular economy principals including clean cardboard recycling, materials recovery and hard plastic recovery, and re-use of construction and demolition waste in local projects. Re-use of construction and demolition waste needs to consider the likelihood of asbestos material.

4.7 STORMWATER INFRASTRUCTURE

Stormwater infrastructure within the Snowy Mountains SAP area consists of a large network of pits and pipes, connecting local catchment areas to waterways to purge untreated stormwater water. At the outlet to streams, there are efforts to capture pollutant materials such as garbage waste or large debris such as rocks that could cause additional erosion. Beyond the urban areas, many of the roads do not include kerbs and gutters and stormwater runoff simply flows off the edge of the road, into the nearest overland flow path and creek.

The Ski Resorts in the Upper Snow Catchment – Stormwater Management plan (Storm Consulting, 2000) identified the stormwater infrastructure to include:

- Sealed roads – including culverts and bridges and table drains and kerb and gutter piped drainage
- piped stormwater systems
- unsealed roads – including table drains, flow diversion banks
- hydrocarbon interceptors; and
- sediment traps.

The following resorts have indicated that they are currently capturing stormwater for use on their property:

- Lake Crackenback
    - small scale recycling of stormwater within Chalets
    - recycled water/treated wastewater effluent used for Lake Crackenback Golf Course irrigation.

The below image outlines the main drainage pits and pits capturing rainwater within the Jindabyne area and indicates discharge points to local water courses and Lake Jindabyne (Figure 4.23).

Stormwater management varies for the ski resorts. These are summarized below:

- For Thredbo, the main roads and river crossings include kerbs and pits, however, there are several roads in Thredbo without kerb and gutters.
- At Perisher, stormwater drainage appears to include roll kerb gutters to collect stormwater runoff in some areas. But many of the roads do not include formal kerbs and gutters including the car park which allows stormwater runoff to drain directly into the nearest watercourse.
- A “Stormceptor” has been installed in the corner of the Perisher carpark. This device has a capacity of 26,000 litres, catching runoff from the car park and allows for suspended solids to be filtered before water enters the creek. Monitoring of turbidity was tested above and below the “Stormceptor” during 2014 and 2015. Initial monitoring indicates a reduction in turbidity during low flow. (OEH 2017).

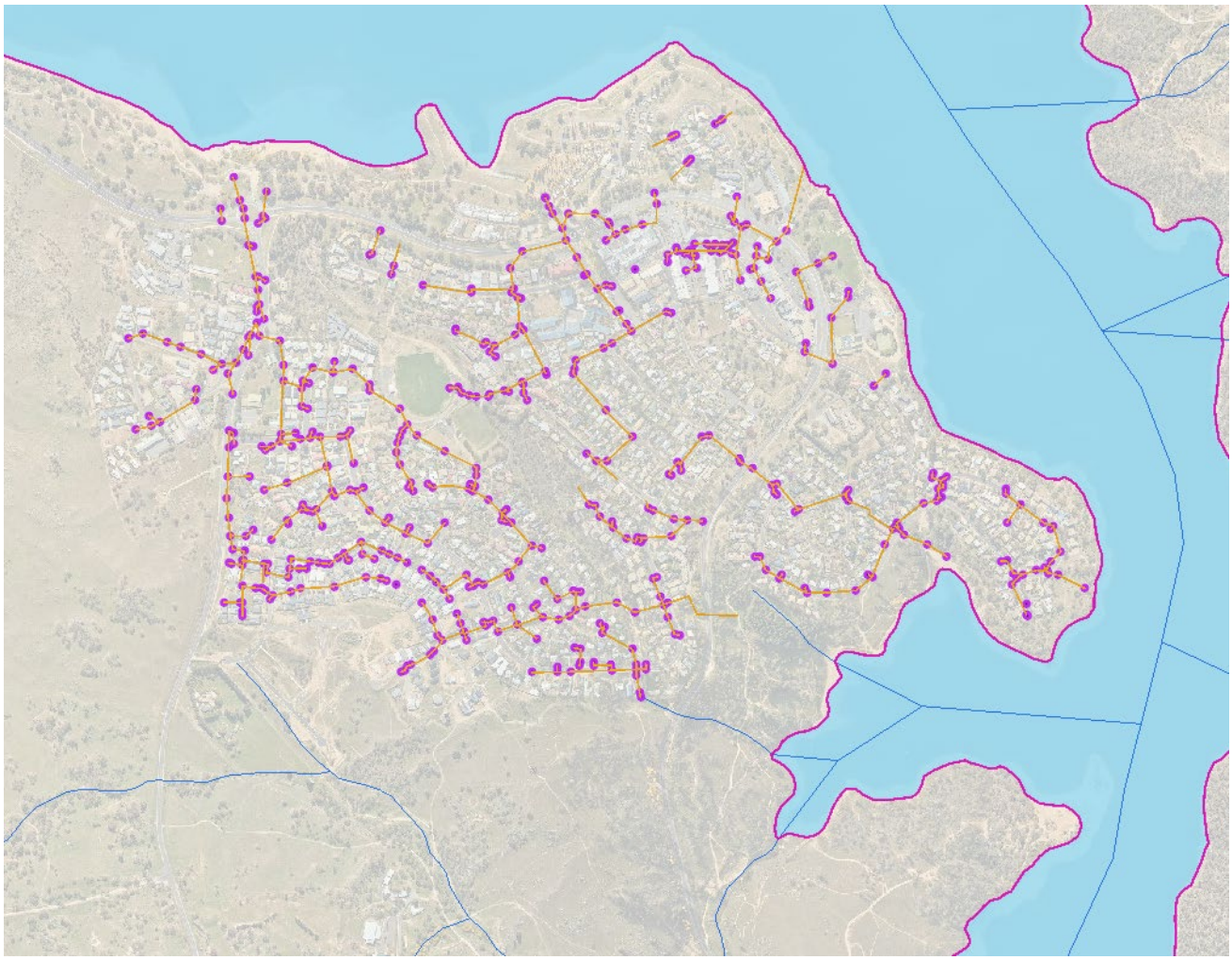


Figure 4.23 Existing stormwater network

Stormwater management plans prepared for the alpine villages of Thredbo and Perisher indicate that stormwater quality has been poor, and management of stormwater runoff is crucial to maintaining the pristine nature of the downstream waterways. A study by the Cooperative Research Centre for Freshwater Ecology identified potential sources of stormwater pollution from the Perisher Resort Car Park to be:

1. salt from de-icing activities – particularly in winter
2. sediment runoff from dirt roads – suspended solids and overflows of silt traps
3. oil, trace metals from parking areas – trace metals are greatest in winter
4. rubbish (gross pollutants).

The above potential issues are relevant to all off the road areas within the National Park, and this is further detailed in the Flooding Technical Study.

In reference to flooding, the flood modelling in the Flooding Technical Study Report indicates the waterways are largely incised and flooding is generally confined to narrow floodplains, which means, the narrow floodplain widths are unlikely to pose any constraints on future development and water storage of ponding will not be required. Reference should be made to the Flooding Technical Study Report for a detailed review on the existing flooding cases in the Snowy Mountains SAP area. These are summarised below:

- In Thredbo, study concluded that some access roads were susceptible to inundation in regular events and additional culverts would be required to minimise the effects of flooding.
- In Perisher, the study concluded that the Sewage Pumping Station No. 2 may be inundated in a 1% AEP event and several of the over snow bridges would be overtopped for all events modelled.

5 CURRENT AND FUTURE DEMAND

Figure 5.1 below shows the proposed structure plan for the Jindabyne study are. The structure plan was developed out of the master planning workshops, and includes the eight focus areas below:

- Growth Area 1 – Town Centre
- Growth Area 2 – South East Jindabyne
- Growth Area 3 – South West Jindabyne
- Growth Area 4 – East Lake Jindabyne
- Growth Area 5 – Rabbits Corner
- Growth Area 6 – Industrial Site, South Jindabyne
- Sports and Recreation site
- West Lake Jindabyne.

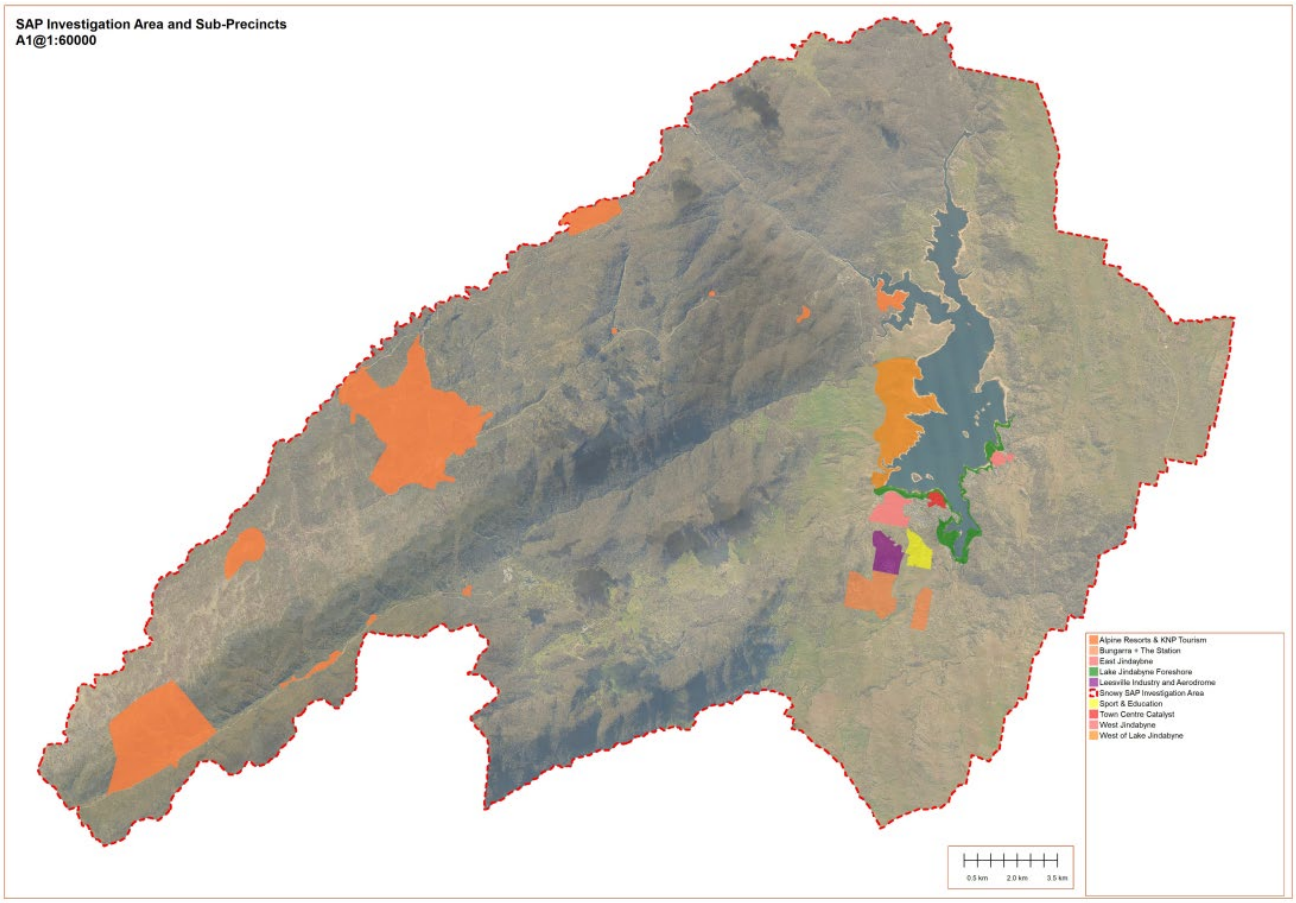


Figure 5.1 Snowy Mountains SAP structure plan (Jensen+)

In the Alpine Regions, there are 11 areas of focus:

1 Charlotte Pass
2 Guthega
3 Island Bend
4 Perisher
5 Ski Rider Motel
6 Sponars Chalet
7 Thredbo Resort East
8 Thredbo Resort West
9 Thredbo Rangers Station
10 Smiggin Holes Resort
11 Bullocks Flat.

Refer to Appendix A for the detailed structure plan details of the above sites.

The following assumptions have been made within this report. Refer to the appendices for assumptions specific to each discipline.

- WSP have used publicly available information as well as limited stakeholder inputs for this technical report. It assumes that the initial findings in the report may change depending on the result of future planned consultation with the relevant stakeholders.
- The permanent population and workforce growth captured in the provided data occurs within Jindabyne-Berridale SA2. The areas are serviced by the common asset owners mentioned within this report (Essential, SMRC). i.e. there is no growth indicated in rural (private) areas.
- Population growth has been estimated from the final structure plan and supporting data (Jensen Plus, received 12 January 2021 and 14 January 2021) and spread across the six growth areas identified in the structure plan. No demand growth within Jindabyne/East Jindabyne has been assigned to the Copper Tom development, MTB Park or proposed West Lake Jindabyne tourist development on the western side of Lake Jindabyne.
- There is no permanent population growth in the Alpine Regions (only over night and day visitors).
- For overnight visitors (which have been broken down into Jindabyne/Thredbo/Perisher areas for the peak month of August), visitor numbers are averaged across the month evenly (i.e. number of concurrent visitors = number of visitor nights/31 days.
- For both Perisher and Thredbo, visitor numbers will exceed the current bed limits in 2021 and 2025, respectively, and then rise to approximately 170% and 160%, respectively, of the current bed limits by 2039 (the peak year in visitation, before it declines).
- Aside from Perisher and Thredbo (as above), it is assumed there will be no increase in current bed limits at any other alpine reports/accommodation (as no details have been provided to consider).

As only the total numbers of day trip visitors within August have been provided, it is assumed that 20% of these figures would occur concurrently on weekends within August, which would be the peak times (this figure assumes day trip visitors are mostly during weekends and spend both days of the weekend at these resorts). It is noted that peak water demand occurs in summer, which is typical of Australian communities and is a result of increased outdoor water use in systems which predominately supply residential customers. SMRC's daily water extraction data confirms this is indeed the case in Jindabyne, despite the increased seasonal worker population and visitors seen during winter months.

Conversely, peak sewage flows occur during winter as a result of both the increased population visitation as well as wet-weather inflow and infiltration to the network during winter months. SMRC's daily Jindabyne STP inflow data clearly shows this is the case in Jindabyne.

5.1 WATER, WASTEWATER AND STORMWATER

Projected population and visitor growth within the Snowy Mountains SAP study area has been provided by the Structure Planning Consultant, Jensen Plus, for the period 2020 to 2061. The population growth consists of permanent residents and seasonal workforce, as shown in Figure 5.2.

Population growth information for areas outside of Jindabyne/East Jindabyne is not available.

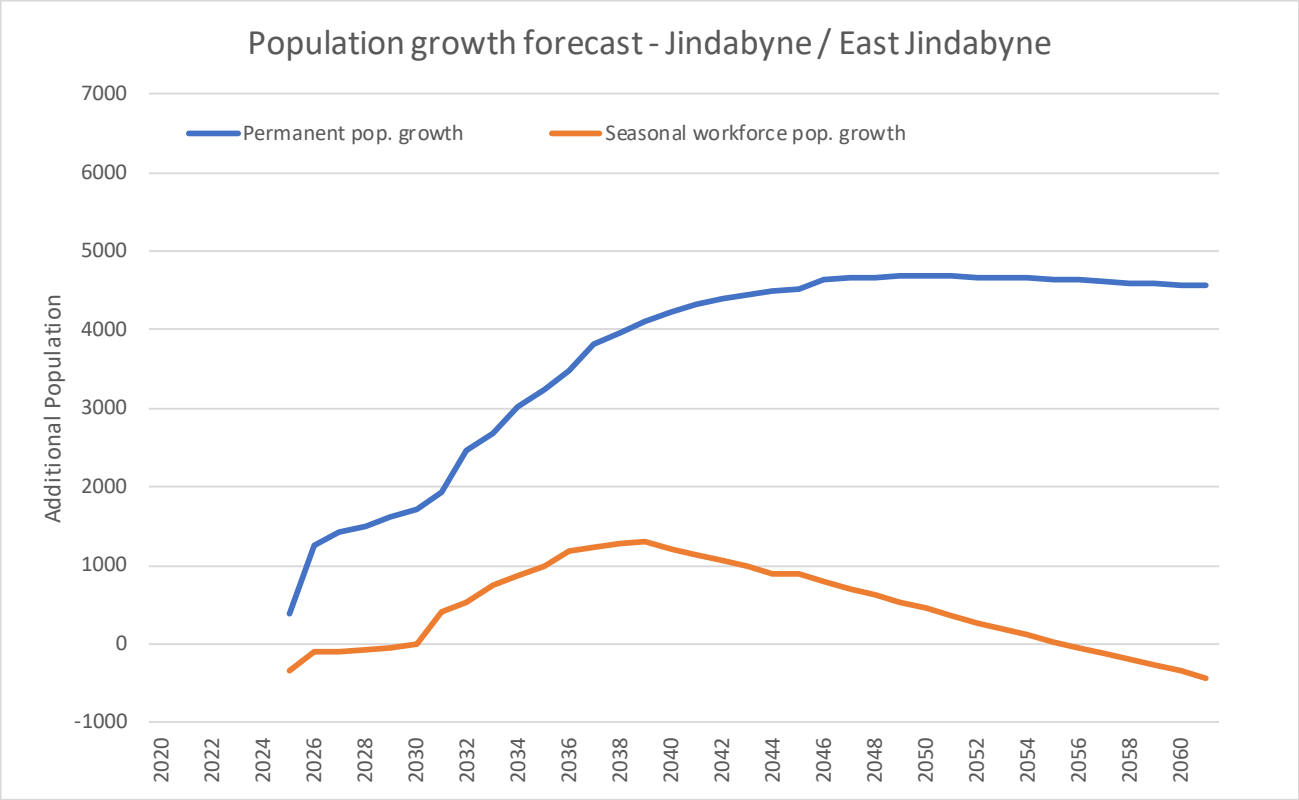


Figure 5.2 Adopted population growth

Projected growth in visitation has been provided by the Master Planning Consultant for the Snowy Mountains SAP study area overall and then, for the peak month of August only, broken down into Jindabyne, Perisher and Thredbo locations. Refer to Figure 5.3 for the forecast overnight visitor nights during the peak month of August. Projected day-visitor growth data has also been provided for Thredbo and Perisher only.

No other visitor growth information is available (i.e. for any other alpine resorts).

Figure 5.3 shows the visitor numbers are expected to peak in the year 2039 before declining.

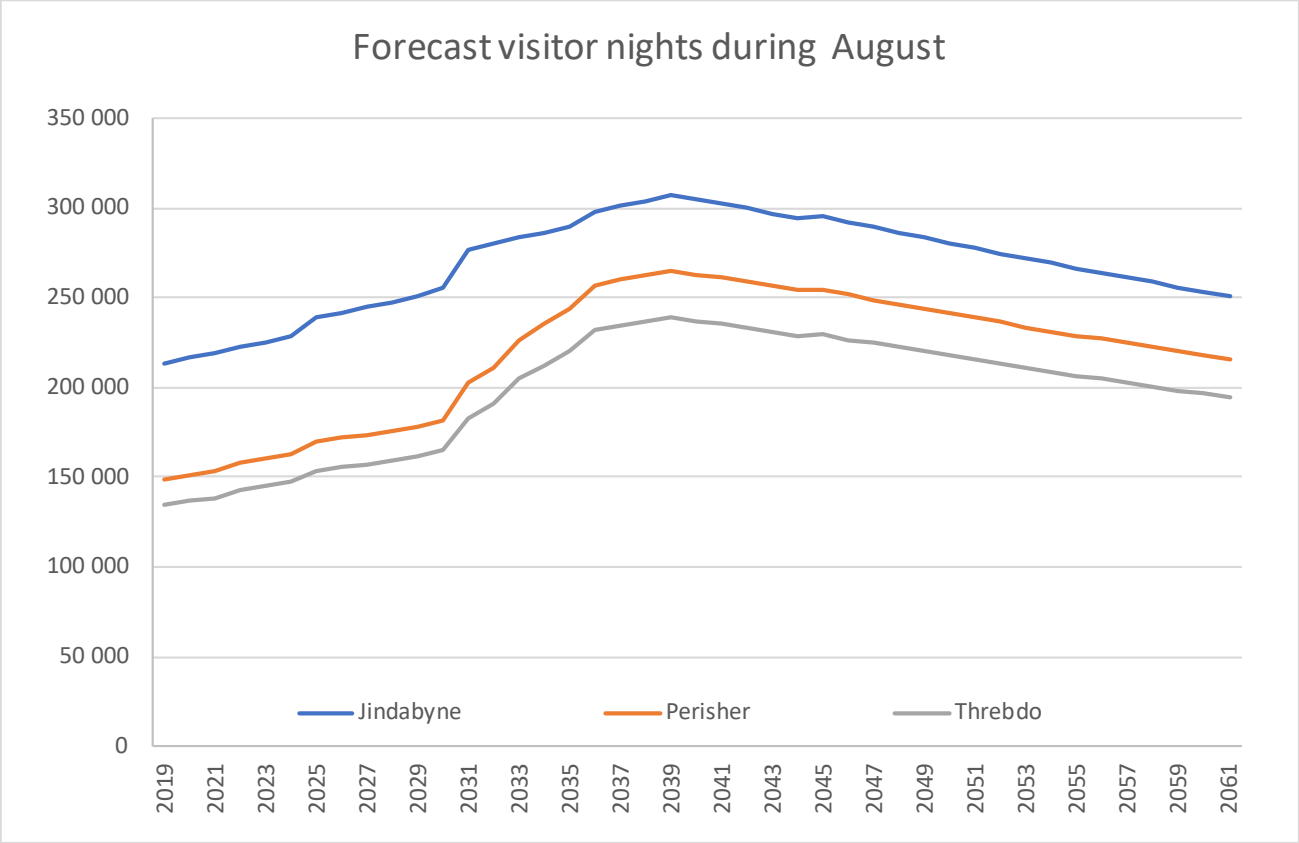


Figure 5.3 Adopted overnight visitor growth (visitor nights)

Future water and wastewater demands have been developed based on these forecast growth inputs. Refer to Appendix C for a detailed list of assumptions and methodology for demand estimation. In general, the approach has been taken to adopt existing demands as a baseline, where this information is available, and then add estimated additional demand for the population/visitation growth components only.

5.1.1 WATER INFRASTRUCTURE

Current demand information for the SMRC, NPWS and private systems is summarised in Table 5.1, Table 5.2 and Table 5.3, respectively.

Table 5.1 Summary of existing water demand for SMRC systems

INTAKE	EXTRACTION LIMIT (ML/YEAR)	CURRENT ANNUAL USAGE (ML)[1]	INTAKE LICENSE CAPACITY (ML/DAY)[1]	PEAK DAY DEMAND (ML/DAY)
Jindabyne	577	518	8.6	4.0[2]
East Jindabyne	467	249	8.6	3.0[2]
Kalkite	78	17	1.0	0.1[3]
TOTAL	**1122**	**784**	**18.2**	**7.1**

(1) As per SMRC advice and documentation

(2) As agreed with SMRC based on the IWCM Strategy (2012) – actual extraction data for 2018/2019 was reviewed and found to be lower than these figures, however this data is not considered sufficiently reliable due to the limited time period available and data gaps/integrity due to the manual recording method

(3) Estimated from annual volume based on an assumed peak day factor of 2.5, due to absence of other available information

Current annual extraction and peak demand for the various NPWS water supply systems is summarised in Table 5.2. This is within the capacity of these existing extraction licenses and key infrastructure assets.

Table 5.2 Summary of existing water demand for NPWS systems

SYSTEM	EXTRACTION LIMIT (ML/YEAR)	2018–2019 ANNUAL USAGE[1] (ML)	INTAKE CAPACITY (KL/DAY)	PEAK DAY DEMAND (KL/DAY)[2]
Perisher Valley	160	120.9	Unknown	352.6
Smiggin Holes	45	19.6	Unknown	101.6
Guthega	25	7.2	Unknown	33
Kosciuszko Tourist Park	12	4.9	Unknown	Unknown
Western Lake Jindabyne Area	No formal agreement with provider Snowy Hydro	Not metered	Unknown	Unknown

(1) Sourced from DPI Water Licence data

(2) Order of magnitude estimate based on all beds filled and a peak usage of 100 L/bed/day.

Current annual extraction and usage for the various private water supply systems is summarised in Table 5.3.

Table 5.3 Summary of existing water demand for private systems

SYSTEM	EXTRACTION LIMIT (ML/YEAR)	2018–2019 ANNUAL USAGE[1] (ML)	PEAK DAY DEMAND (KL/DAY)[2]
Blue Cow	5	3.5	2.5
Thredbo Village	41	over 367	481
Charlotte Pass	16	no record	60.7
Bullocks Flat	28	15	4
Sponars Chalet	no licence, water sourced from a lake nearby	no record	Unknown
Ski Rider	unknown	unknown	Unknown
Selwyn Snow(50)	50	44	5

(1) Sourced from DPI Water Licence data

(2) Order of magnitude estimate based on all beds filled and a peak usage of 100 L/bed/day.

Future annual and peak day demand for SMRC's Jindabyne/East Jindabyne/Kalkite systems (combined) developed from the master planning inputs are summarised in Figure 5.4 and Figure 5.5, respectively. This represents an increase in annual demand of approximately 75% and an increase in peak day demand of approximately 50%, compared to current levels occurring over the next 30 years.

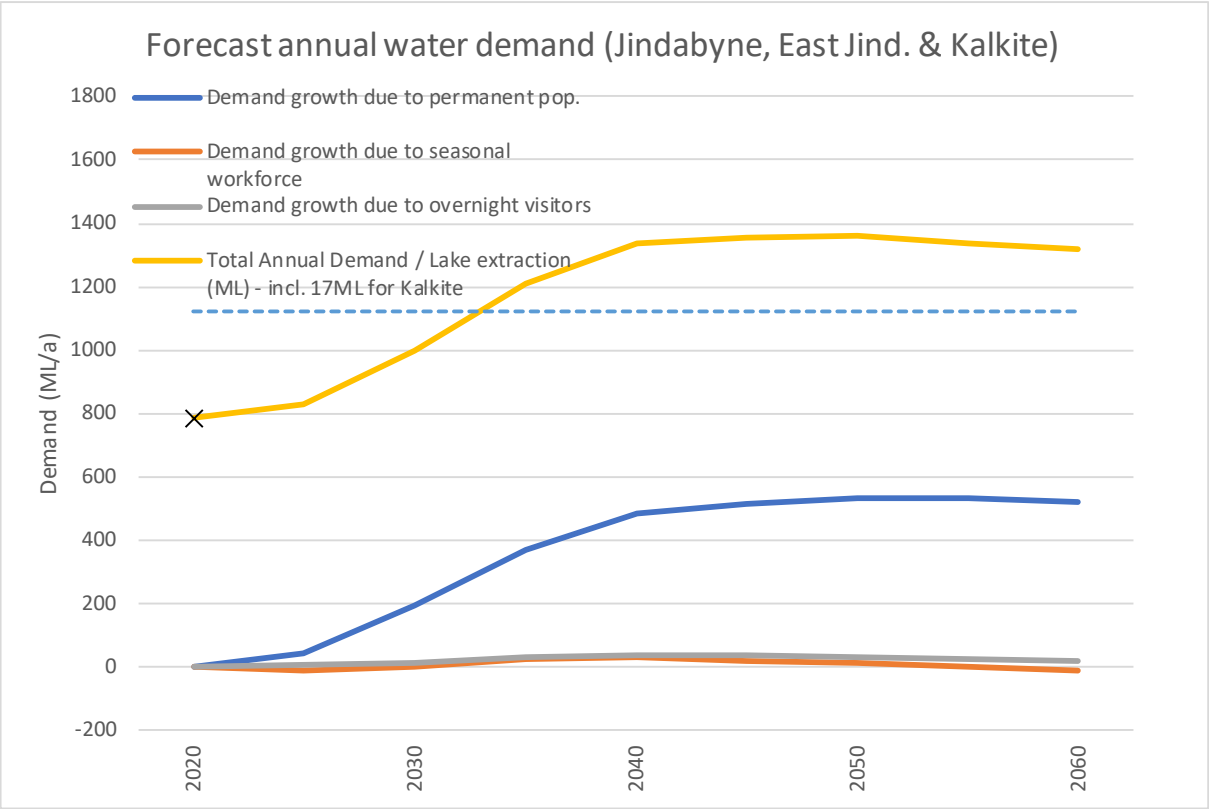
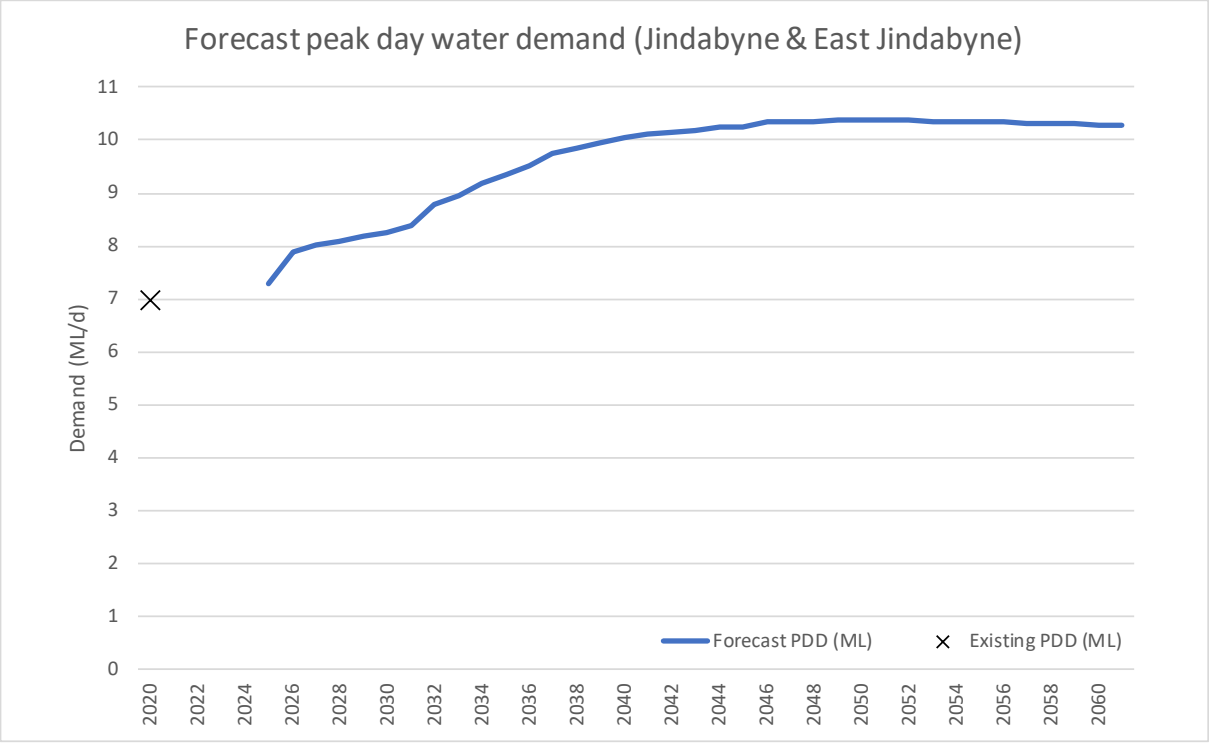


Figure 5.4 Adopted future annual water demand (Jindabyne)



Note for Figure 5.5: Despite significant increased winter visitation and seasonal workforce, the peak demand period is expected to remain during summer (based on the assumption that typical residential consumption due to outdoor water use is at least double the average consumption). Therefore, the increase in peak day demand is based on only on the permanent population growth is not as significant as the increase in annual demand (which considers seasonal population/visitors).

Figure 5.5 Adopted future peak day water demand (Jindabyne)

Refer to Appendix C for a detailed list of assumptions and methodology for demand estimation.

Water demand for the proposed West Lake Jindabyne resort development on the western side of Lake Jindabyne is estimated to be 16 Equivalent Tenements resulting in approximately 3.9 ML annual demand and approximately 25 kL peak day demand (which would occur in summer). This does not allow for any potential landscaping or open space irrigation demands (which are potentially substantial given the proposed development includes a new golf course).

For growth in Jindabyne and East Jindabyne, the additional demand has been distributed across the six identified growth areas proportionately by ET growth estimated from the structure plans and visitation inputs. Minor developments such as Copper Tom and West Lake Jindabyne tourist development areas have been excluded from this demand allocation as they are not considered as critical areas in the structure plan. The Mountain Bike Park has also been excluded as it is assumed that this area will not be connected to the local water network.

The adopted growth areas are shown in Figure 5.6, with indicative demand figures presented in Table 5.4.

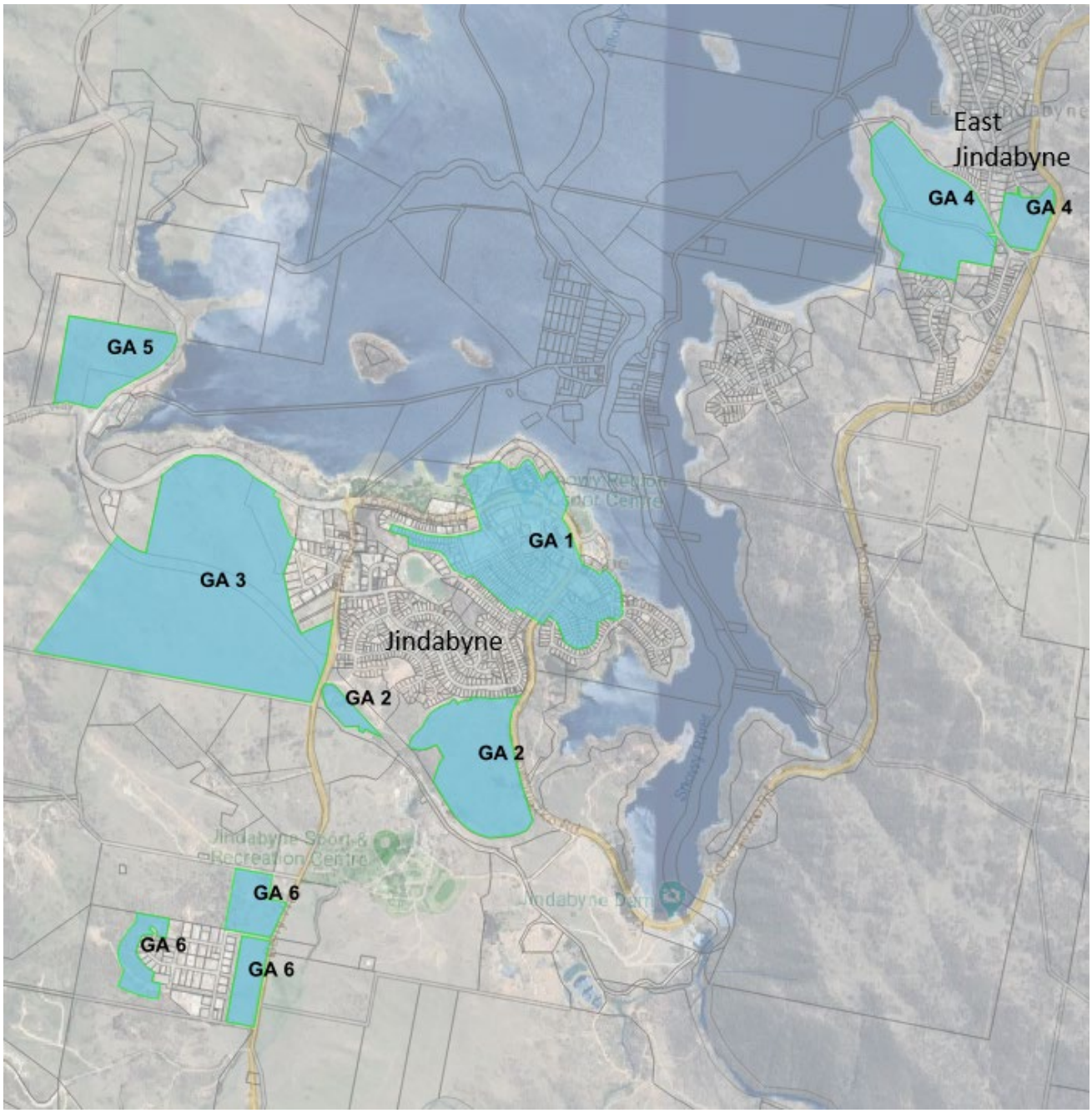


Figure 5.6 Adopted growth areas in Jindabyne/East Jindabyne

Table 5.4 provides a breakdown of the maximum additional peak day demand, which occurs in 2051.

Table 5.4 Breakdown of maximum future (2051) additional peak day water demand within Jindabyne and East Jindabyne

AREA LABEL	ADDITIONAL EQUIVALENT TENEMENTS (ET)	ADDITIONAL PDD, 2046 (kL/DAY)
GA 1	928	1.07
GA 2	258	0.30
GA 3	1076	1.24
GA 4	360	0.41
GA 5	84	0.10
GA 6	252	0.29
Other	577	-
TOTAL	3535	3.40

The forecast additional water demand during the peak August period for the Perisher Valley Reports (in total) and Thredbo is shown in Figure 5.7 and Figure 5.8 respectively. As the current demand during the peak period is unknown, the total future demand is not able to be estimated.

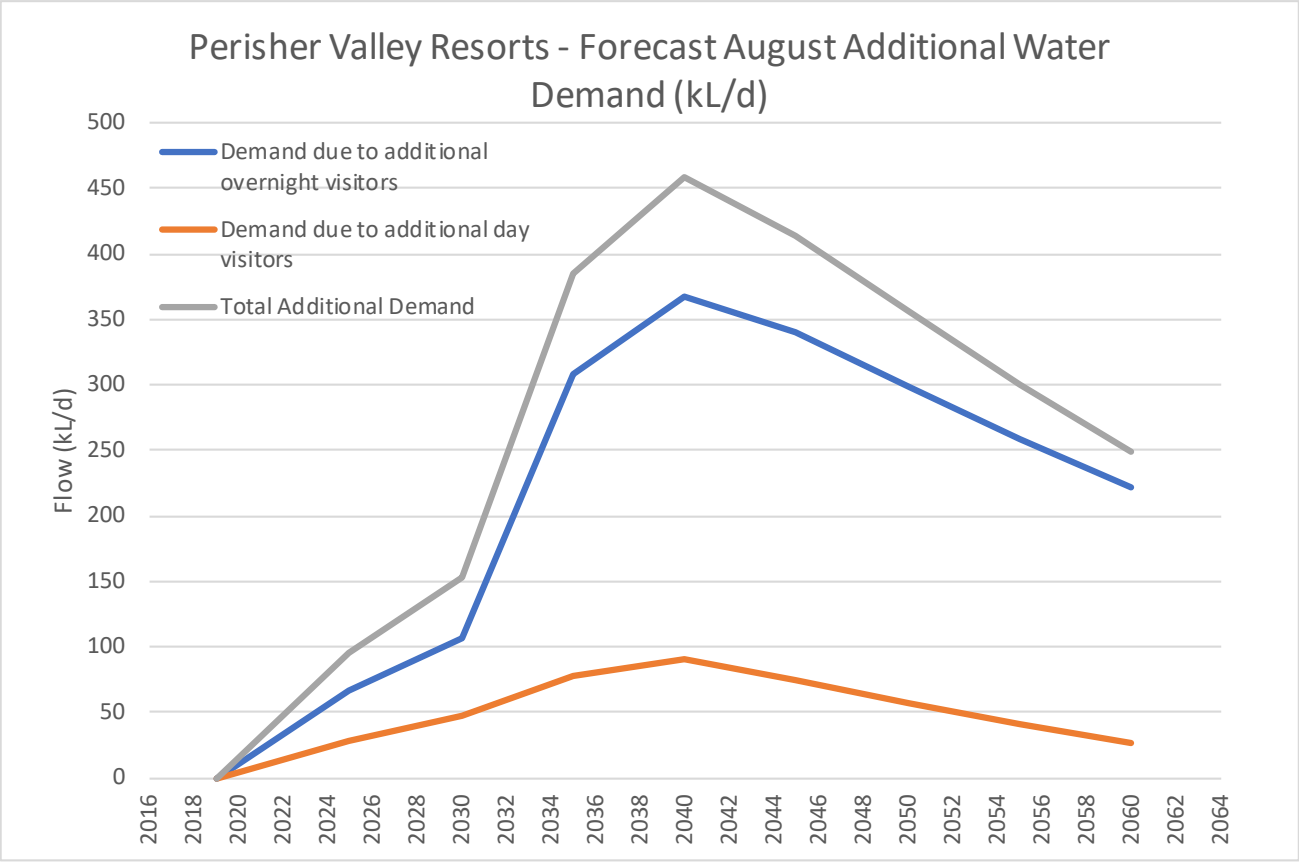


Figure 5.7 Adopted future additional water demand in Perisher during peak season (August)

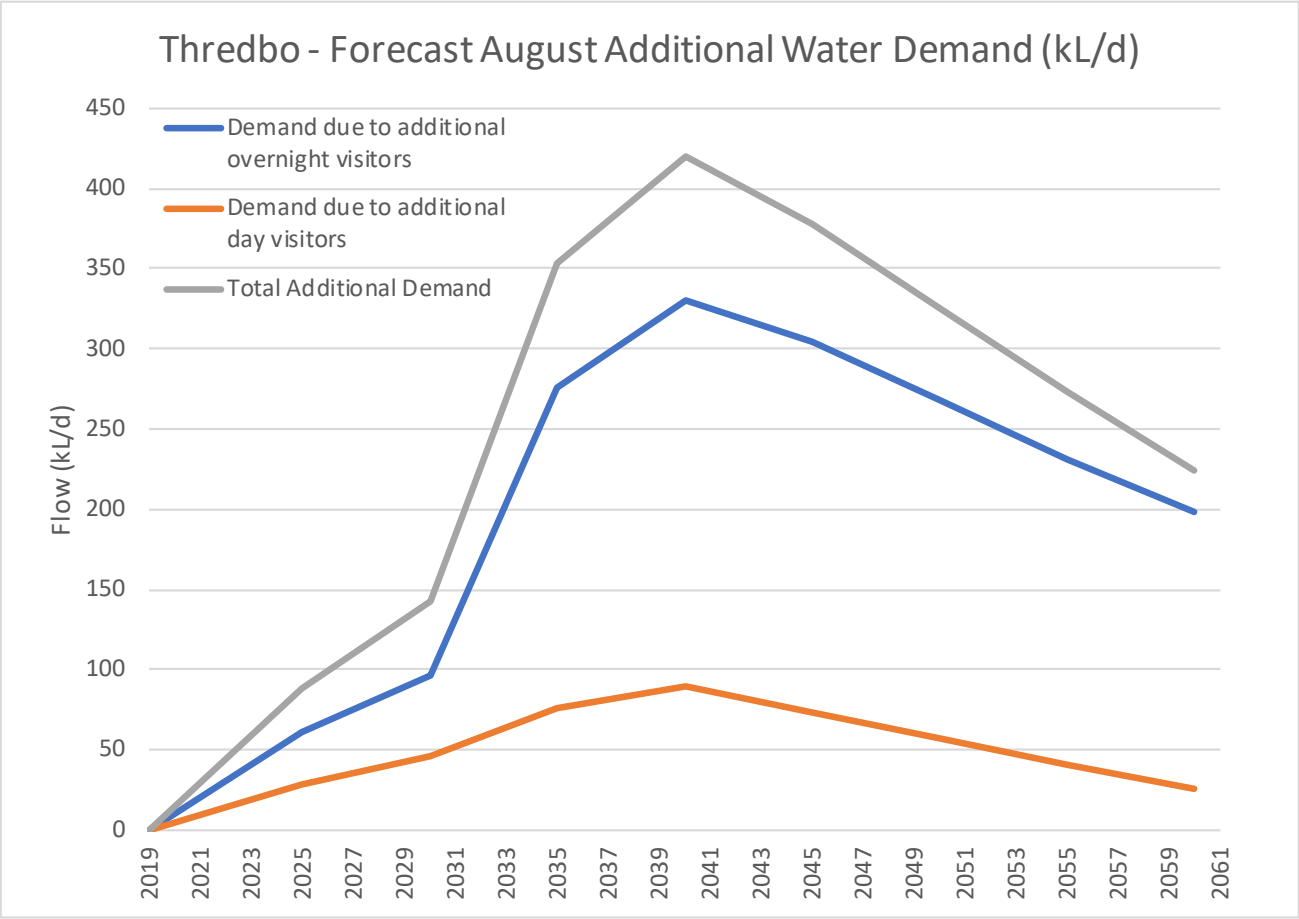


Figure 5.8 Adopted future additional water demand in Thredbo during peak season (August)

Refer to Appendix C for a detailed list of assumptions and methodology for demand estimation. The key assumption for these estimates is the adopted demand rate for overnight visitors of 100 L/d. This assumption requires investigation to enable more reliable infrastructure assessment and planning. Daily recording of flow data at these resorts is required to enable this investigation.

The adopted visitation growth for Perisher and Thredbo is significant, increasing to approx. 170% and 160% respectively of current bed limits over the next 20 years and hence the additional water demand for this is significant. Day visitors are expected to have a relatively minor impact on overall daily demand however could result in increased instantaneous peaks.

Annual demand for Perisher and Thredbo will also significantly increase, however is difficult to quantify from the available peak season visitation forecast data only.

Snowmaking demand at various resorts is also expected to increase due to climate change and business requirements for the resorts, refer to the separate SAP Study Report Kosciuszko National Park Carrying Capacity Review for detailed information regarding future snowmaking considerations.

5.1.2 WASTEWATER INFRASTRUCTURE

Across the study area, peak wastewater loading occurs in winter due to the high seasonal population and visitation to the region, but also due to stormwater inflow and groundwater infiltration to reticulation systems. In alpine areas, inflow and infiltration due to snow melt can also result in elevated wastewater loading. Loading data for the Perisher Valley STP, presented in the Perisher Valley STP Capacity and Robustness Review, Simmonds and Bristow (2018), indicates elevated loading for this system occurs until around October each year.

Current wastewater loading information for the various SMRC and NPWS systems is summarised in Table 5.5 and Table 5.6. Loading data is not available for the smaller private systems.

Table 5.5 Summary of existing wastewater loading for SMRC systems

SCHEME	EXISTING AVERAGE FLOW	EXISTING PEAK DAILY FLOW	DISCHARGE CAPACITY
Jindabyne	931 kL/day (2018/2019 annual daily average)	1950 kL/day (2018/2019 daily peak at Jindabyne STP)	20.5 L/s 2,000 kL/d (license limit)
Kalkite	214 EP (as of 2016 population)	-Unknown	1000 EP[1]

(1) Actual operational capacity is likely to be less than this design capacity due to issues with the current evaporation disposal system (based on anecdotal advice from SMRC, this is struggling to cope with existing loading and is difficult)

Table 5.6 Summary of existing wastewater loading for NPWS systems

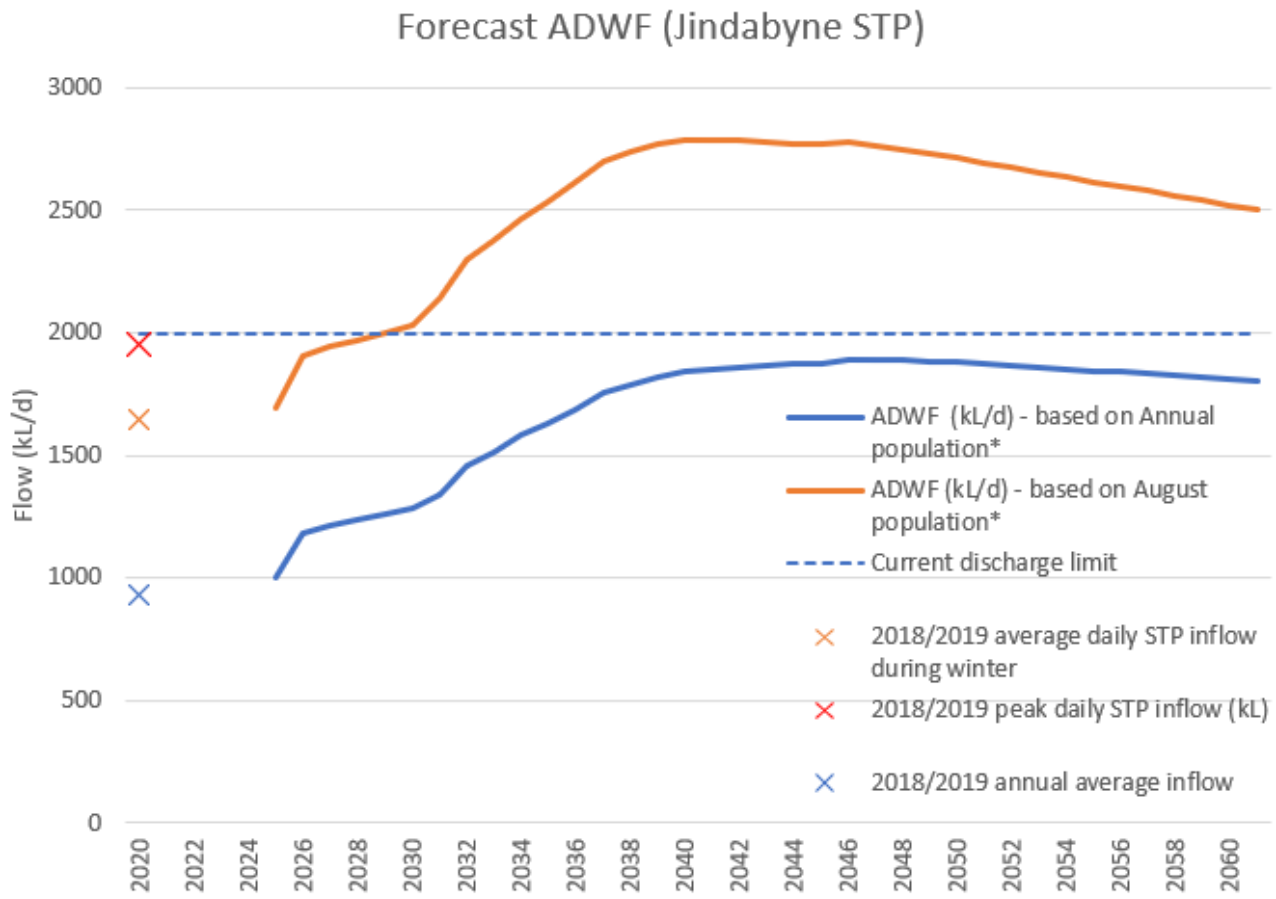
SCHEME	EXISTING PEAK DAILY FLOW	DISCHARGE LICENSE LIMIT
Perisher Valley	1200 kL/day[1]	2000 kL/day
Sawpit Creek	-Unknown	70 kL/day
Creel Bay	-Unknown	-N/A

(1) As advised by NPWS

Future Average Dry Weather Flow (ADWF) for SMRC's combined Jindabyne/East Jindabyne wastewater system estimated from the master planning inputs are summarised in Figure 5.9. This has been estimated based on both the peak August population and the annual average population.

The increase in ADWF based on annual average population is approximate 105% by 2046.

Additional wet-weather flow components are highly system specific and influenced by reticulation asset design, condition and depth in relation to groundwater. This is not possible to accurately estimate in the long-term future due to unknown asset conditions/asset-management strategies and unknown details of the reticulation systems servicing new growth areas. Based on the current ratio of peak to average daily inflow to Jindabyne STP (based on inflow data supplied by SMRC) of 2.1, the peak daily inflow in 2046 could be estimated to be 4,000 kL (as an order of magnitude estimate).



*Note for Figure 5.9 – only the growth component of these figures is technically an ADWF. The baseline flows (indicated by marks at year 2020) represents average daily flow for the noted periods however these figures does not specifically exclude wet-weather inflows during these periods. Refer to Figure 6.5 for a detailed record of daily flow, which can be used to modify these baseline figures if required.

Figure 5.9 Adopted future Jindabyne STP wastewater inflow

Wastewater demand for the new resort development on the western side of Lake Jindabyne is estimated to be 16 Equivalent Tenements resulting in an ADWF of 12 kL/d (based on assumed annual average occupancy of 50%) and ADWF of 21 kL/d (based on full occupancy during winter).

As for water demand, the additional sewer ADWF has been distributed across the six major growth areas proportionately by ET growth estimated from the structure plans and visitation inputs, as shown in Figure 5.6 in the previous section. These figures are summarised in Table 5.7 below.

Table 5.7 Breakdown maximum future (2046) sewer ADWF within Jindabyne and East Jindabyne

AREA LABEL	ADDITIONAL EQUIVALENT TENEMENTS (ET)	ADDITIONAL ADWF – AUGUST POPULATION, 2046 (kL/d)
GA 1	928	358
GA 2	258	99
GA 3	1076	415
GA 4	360	139
GA 5	84	32
GA 6	252	97
Other	577	-
TOTAL	3535	1140

It is noted that the maximum additional demand/loading for water and wastewater for the Jindabyne/East Jindabyne growth areas is predicted to occur in different years (2051 and 2040, respectively). This is because peak water demand is based only on permanent population whilst peak wastewater loading also considers the seasonal workforce and visitor contribution. This approach is based on the assumption that the peak water demand will continue to occur in summer (i.e. outside of the winter tourist season) as opposed to peak sewage loading which will continue to occur during winter.

The forecast additional wastewater flow during the peak August period for the Perisher Valley Reports (in total) and Thredbo is shown in Figure 5.10 and Figure 5.11, respectively. For Thredbo, as the current flow during the peak period is unknown, the total future flow is not able to be estimated.

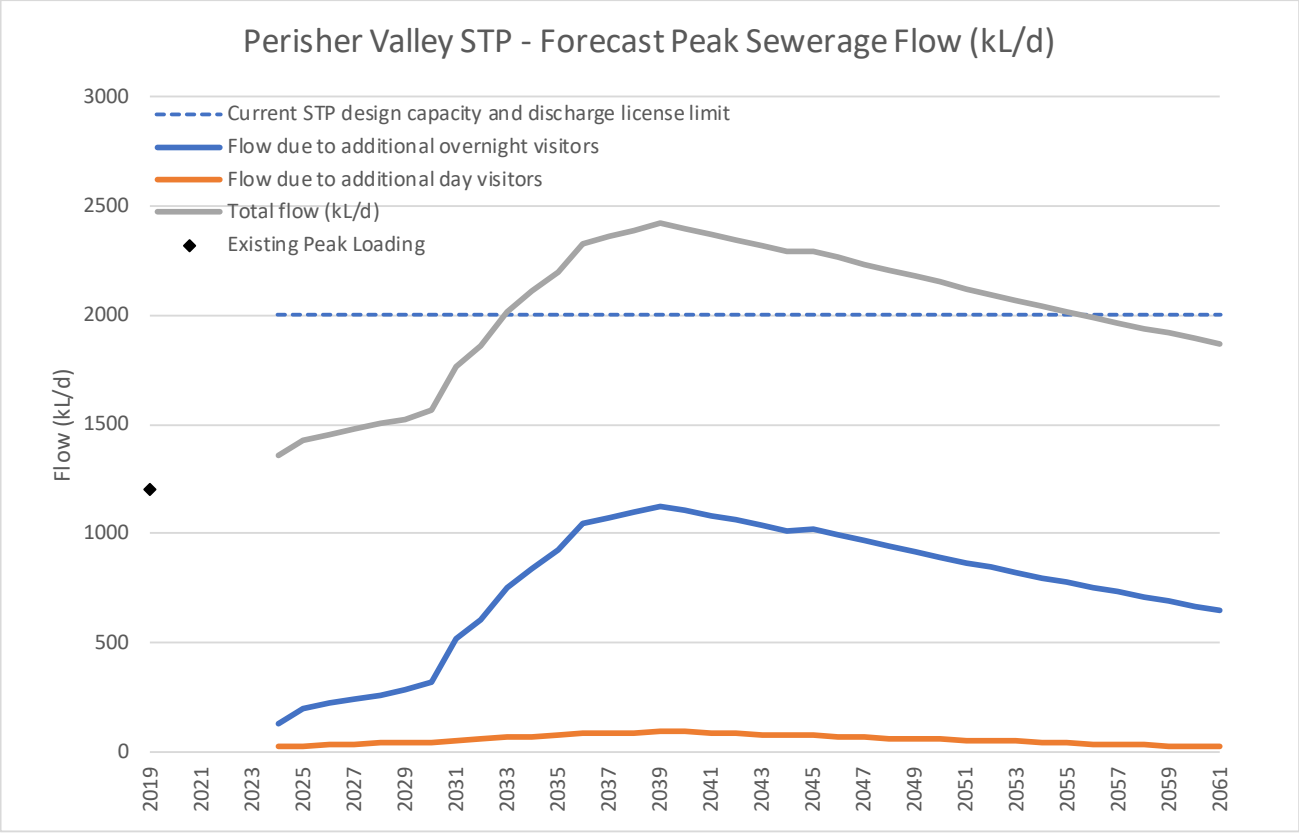


Figure 5.10 Adopted future sewerage flow at Perisher Valley STP

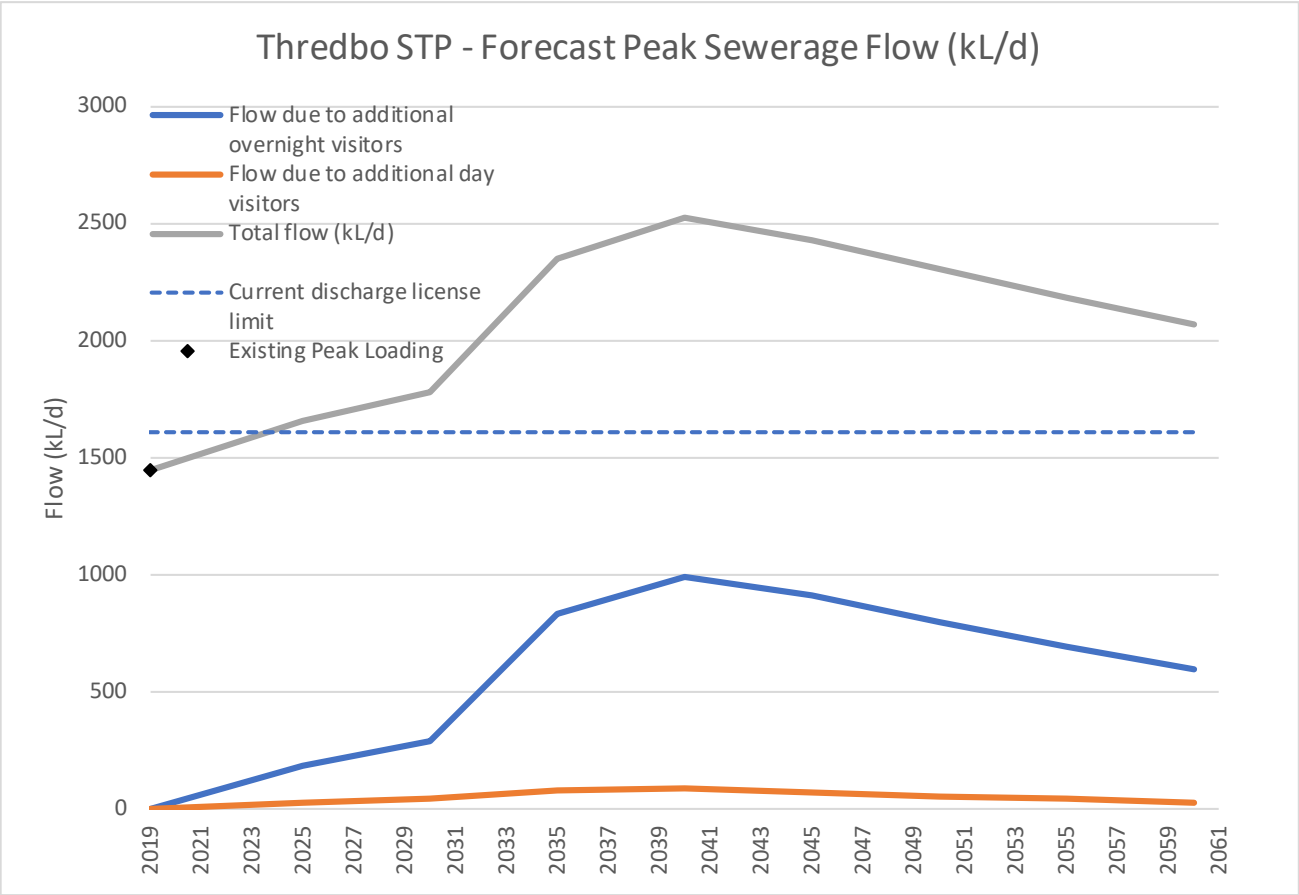


Figure 5.11 Adopted future additional sewage flow at Thredbo STP

Refer to Appendix C for a detailed list of assumptions and methodology for demand estimation. The key assumption for the below estimates is the adopted flow generation rate for overnight visitors of 300 L/d. This is the figure adopted in the 2018 Perisher Valley STP Capacity and Robustness Review. Whist this figure is higher than the water demand rate adopted in the previous section, it is intended to include wet-weather components which may be significant during winter at these sites. This assumption requires detailed investigation to enable more reliable infrastructure assessment and planning including wet weather flow analysis.

The adopted visitation growth for Perisher and Thredbo is significant, increasing to approx. 170% and 160% respectively of current bed limits over the next 20 years and hence the additional wastewater flows will be significant. Day visitors are expected to have a relatively minor impact on overall flow, although may impact wastewater influent quality characteristics such as ammonia loading (based on operational experience with Perisher STP during busy visitation periods).

5.2 ELECTRICITY AND GAS SUPPLY

5.2.1 ELECTRICITY INFRASTRUCTURE

5.2.1.1 CURRENT DEMAND

Current demand information of the Essential Energy system is outlined in Table 5.8.

Table 5.8 Electrical demand calculations and projections for South Jindabyne

SUBSTATION SWITCHING STATION NAME	INSTALLED CAPACITY (MVA)	CURRENT DEMAND (MVA)
Snowy Adit Substation (supplied by Munyang Substation)	1 x 10 MVA 1 x 30 MVA	0.1 MVA 12.3 MVA
Jindabyne Substation (supplied by Cooma Substation)	2 x 30 MVA (66/11 kV) 1 x 15 MVA (66/33 kV)	13.4 MVA 1.7 MVA
Jindabyne East Substation (supplied by Cooma Substation)	2 x 10 MVA	4.6 MVA
Blue Cow Substation (supplied by Munyang Substation)	1 x 8 MVA	6.1 MVA
Perisher (supplied by Munyang Substation)	2 x 10 MVA	11.3 MVA
Bullocks Portal (supplied by Munyang Substation)	1 x 6.25 MVA	1.1 MVA
Bullocks Flat (supplied by Munyang Substation)	1 x 6.25 MVA	5.25 MVA
Thredbo (supplied by Munyang Substation)	2 x 16 MVA	12.3 MVA

5.2.1.2 FUTURE DEMAND

The developable areas under the Snowy Mountains SAP Structure Plans were used to determine future electricity demand. The land areas reviewed were those identified as growth areas for new accommodate growth of permanent population and tourism. These areas are present in Appendix A – Snowy Mountains SAP Structure Plans and represented in the table below. Note the below methodology and assumptions used to determine these future demands.

- Land type allocation. Documentation supplied to WSP (200604 Snowy Structure Plans 20.12.17 and 210323 P2520 Snowy Mountains SAP Structure Plan Yield Analysis) identifies the land use breakdown of residential, commercial, industrial etc. These documents were referenced in the calculations of future electricity demands. WSP have made assumptions based of the information supplied and also verbal indication of potential developments at these sights given by Jensen Plus.
- Ratio of built area to land use. WSP have made conservative assumptions on the ratio of land that will be building footprint within the growth areas, compared to vacant land required for roads, yards and reserve.
- Assumed hours of operation for industrial and commercial properties are 12 hours a day, while for residential properties is 10 hours a day.

- Future Demand for existing substations. WSP have used Essential Energy's data (Asset Management Distribution Annual Planning Report 2020) in determining the power demand forecast for each substation within the Snowy Mountains SAP study area.

Refer to Appendix B Future Electrical Demand Spreadsheet for the detailed draft calculation spreadsheet and assumptions.

Table 5.9 Electrical demand calculations and projections for Thredbo Substation

STRUCTURE PLAN LOCATION	NET DEVELOPABLE AREA (HA)	BUILT AREA ESTIMATE (m^2)	ADDITIONAL LOAD DEMAND ESTIMATES (MVA)	AVAILABLE CAPACITY AT SUPPLYING SUBSTATION
Charlotte Pass	8.03	41,160	21.98	Thredbo Substation: 17.70 MVA
Thredbo Ranger Station	0.50	2,500		
Thredbo Village	87.26	437,320		

Table 5.10 Electrical demand calculations and projections for Perisher Substation

STRUCTURE PLAN LOCATION	NET DEVELOPABLE AREA (HA)	BUILT AREA ESTIMATE (m^2)	ADDITIONAL LOAD DEMAND ESTIMATES (MVA)	AVAILABLE CAPACITY AT SUPPLYING SUBSTATION
Perisher Village	55.97	281,187	14.085	Perisher Substation: 8.70 MVA
Smiggin Holes Resort	5.25	26,850		

Table 5.11 Electrical demand calculations and projections for East Jindabyne

STRUCTURE PLAN LOCATION	NET DEVELOPABLE AREA (HA)	BUILT AREA ESTIMATE (m^2)	ADDITIONAL LOAD DEMAND ESTIMATES (MVA)	AVAILABLE CAPACITY AT SUPPLYING SUBSTATION
Green Field – East Jindabyne (Growth Area 4)	34.29	171,435	7.828	East Jindabyne Substation: 15.4 MVA

Table 5.12 Electrical demand calculations and projections for Snowy Adit

LOCATION	NET DEVELOPABLE AREA (HA)	BUILT AREA ESTIMATE (m^2)	ADDITIONAL LOAD DEMAND ESTIMATES (MVA)	AVAILABLE CAPACITY AT SUPPLYING SUBSTATION
Sponars Chalet	3.70	18,725	1.20	Snowy Adit Substation: 9.90 MVA
Ski Rider Motel	0.00	0		
Guthega	0.00	0		
Kosi Tourist Park	0.50	2,500		
Island Bend/Thredbo Diggings/Ngarigo	1.00	5,000		

Table 5.13 Electrical demand calculations and projections for Bullocks Flat

LOCATION	NET DEVELOPABLE AREA (HA)	BUILT AREA ESTIMATE (m^2)	ADDITIONAL LOAD DEMAND ESTIMATES (MVA)	AVAILABLE CAPACITY AT SUPPLYING SUBSTATION
Bullocks Flat	10.40	51,975	2.37	Bullocks Flat Substation: 5.3 MVA

Table 5.14 Electrical demand calculations and projections for Jindabyne

LOCATION	NET DEVELOPABLE AREA (HA)	BUILT AREA ESTIMATE (m^2)	ADDITIONAL LOAD DEMAND ESTIMATES (MVA)	AVAILABLE CAPACITY AT SUPPLYING SUBSTATION
West of Lake Jindabyne	9.20	46,000	106.075	Jindabyne Substation: 59.90 MVA
Town Centre	220.38	1,117,143		
Inner Suburbs Infill	102.22	511,100		
Leesville Industry (Growth Area 6)	16.82	84,100		
Green Field – South Jindabyne (Growth Area 2)	14.66	73,300		
Green Field – West Jindabyne (Growth Area 3)	72.19	360,943		
Green Field – Lake Jindabyne Village/Rabbits Corner (Growth Area 5)	15.71	78,525		
Greenfield – South Jindabyne Growth Area 2	2.03	10,150		
Creel Bay	1.14	5,700		

5.2.2 GAS INFRASTRUCTURE

Future demand has not been calculated for this report. Future demand calculations are generally done when there is a network available to accommodate the supply of additional gas. In the case of the Jindabyne and alpine regions, there is no existing Jemena gas network to review existing demand and impacts of future demands.

From discussions with Elgas, Cooma branch, the supply system is well established in the area and has the ability to be scaled up or down supply to the Snowy Mountains SAP region depending on demand through scheduling of deliveries any upgrades within the private assets. New development areas in the Snowy Mountains SAP region have the opportunity to install modular LPG gas supplies and have them serviced by Elgas, similar to the existing cases in the alpine resort and East Jindabyne.

5.3 WASTE AND RECOVERY RESOURCS

5.3.1 OPERATIONS AND FACILITIES

Figure 5.12 below summarises the projected composition of annual waste calculated on the incoming waste composition data with an assumed 5% growth rate. These calculations and assumptions are to be verified in the next stage of the investigation based on the definition of the key site developments scope, type, area scale and timeline of growth as an outcome of the Snowy Mountains SAP Master Plan.

These calculations do not take into consideration the increase waste material from construction of large construction activities. For example, the Southern Connector Route project and other major projects that are an outcome of the Snowy Mountains SAP Structure Plan. SMCR have expressed that major projects could increase the cost of construction and demolition (C&D) waste recovery and may have to be sent to Canberra for disposal if Jindabyne cannot account for this increase in waste.

Soil disposal and construction material costs need to consider escalation to the current cost due to unplanned increase in waste disposal. Increasing the soil waste from projects as an outcome of the Structure Plan will increase the cost of disposal.

Year	Annual waste received (tonnes)	Key category breakdown (tonnes)	
2018 (NSW EPA WARR data)	14,232	Biosolids or manures	968
		Bricks or concrete	1,059
		Commingled recyclables	1,060
		Mixed waste	4,622
		VENM	5,740
2030 (projected)	25,559	Biosolids or manures	1,739
		Bricks or concrete	1,902
		Commingled recyclables	1,903
		Mixed waste	8,301
		VENM	10,309
2040 (projected)	41,633	Biosolids or manures	2,832
		Bricks or concrete	3,099
		Commingled recyclables	3,100
		Mixed waste	13,522
		VENM	16,792
2050 (projected)	67,815	Biosolids or manures	4,614
		Bricks or concrete	5,047
		Commingled recyclables	5,050
		Mixed waste	22,026
		VENM	27,352

Figure 5.12 Jindabyne projected annual waste composition – Jindabyne Regional Waste Management Facility, Basis of Design Report, New Landfill Cell (July 2020)

6 EXTENSION, UPGRADE AND NEW INFRASTRUCTURE

6.1 WATER, WASTEWATER AND STORMWATER

Planning and growth scenarios for the Snowy Mountains SAP Study were developed by Jensen Plus (structure planning consultant). The Snowy Mountains SAP Structure Plan represented the proposed growth areas to align with inputs of the stakeholders. Refer to Appendix A for the detailed structure plan.

6.1.1 WATER INFRASTRUCTURE

6.1.1.1 WEST LAKE JINDABYNE RESORT

The resort development on the western side of Lake Jindabyne requires extension of the Jindabyne potable water network by approximately 3 km (from proposed growth area GA5, otherwise approx. 6 km if required to connect from the existing network). Given this development is likely to have high maximum instantaneous demands, significant fire protection requirements and require good service reliability, it is proposed that the development include a small private storage reservoir (i.e. 50 kL or similar). This would allow the new connecting water main size to be minimised and will also minimise hydraulic impacts on the existing Jindabyne reticulation network. Figure 6.1 provides an overview of this concept.

Detailed servicing requirements would need to be developed with SMRC based on detailed information about the proposed development.

An alternative servicing strategy would be to install a stand-alone/private water source (i.e. Lake offtake) and treatment system for this development. The feasibility of this alternative has not been investigated and it has not been adopted for the Snowy Mountains SAP Structure Plan.

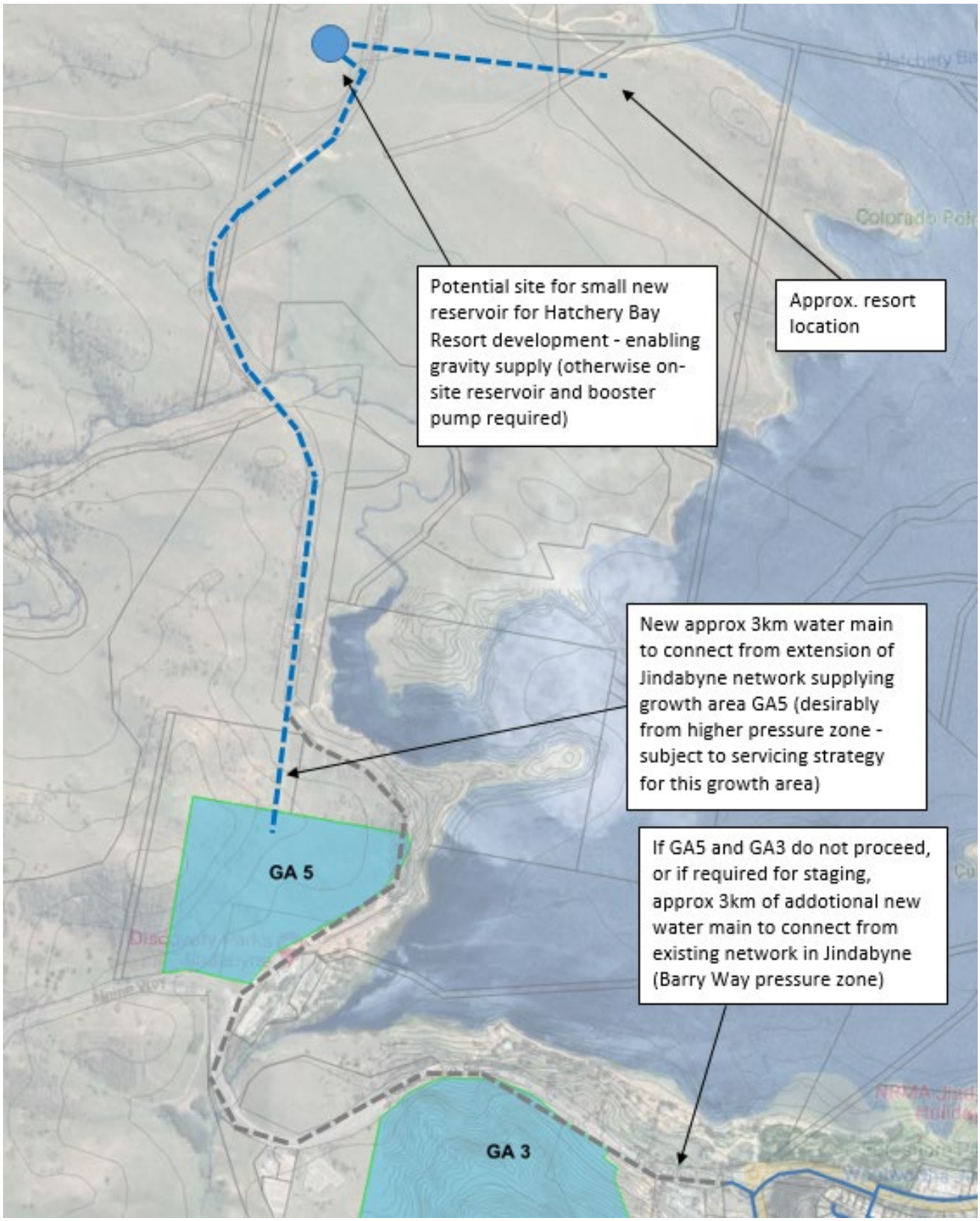


Figure 6.1 West Lake Jindabyne resort development – water servicing concept plan

6.1.1.2 JINDABYNE

SOURCE AND TREATMENT

SMRC are currently undertaking a scoping study for a WTP upgrade project which will provide secondary filtration at Jindabyne, East Jindabyne and Kalkite intakes or, alternatively, rationalisation of the separate intakes to a central location in Jindabyne. In addition to a new filtration process, the WTP upgrades may also include reconfiguration of the disinfection process, monitoring and control upgrades and associated site works. The scoping study will identify a preferred strategy to develop the project for funding commitment and delivery, planned in the next few years. SMRC do not currently have approved funding to delivery this project. The proposed locations for a rationalized WTP are illustrated in Figure 6.2.

This strategy (and any infrastructure required to be delivered or upgraded as part of this strategy) should consider the future average annual and peak day demands for the Snowy Mountains SAP development, approx. 1,367 ML/a and 10.3 ML/d respectively by 2046.

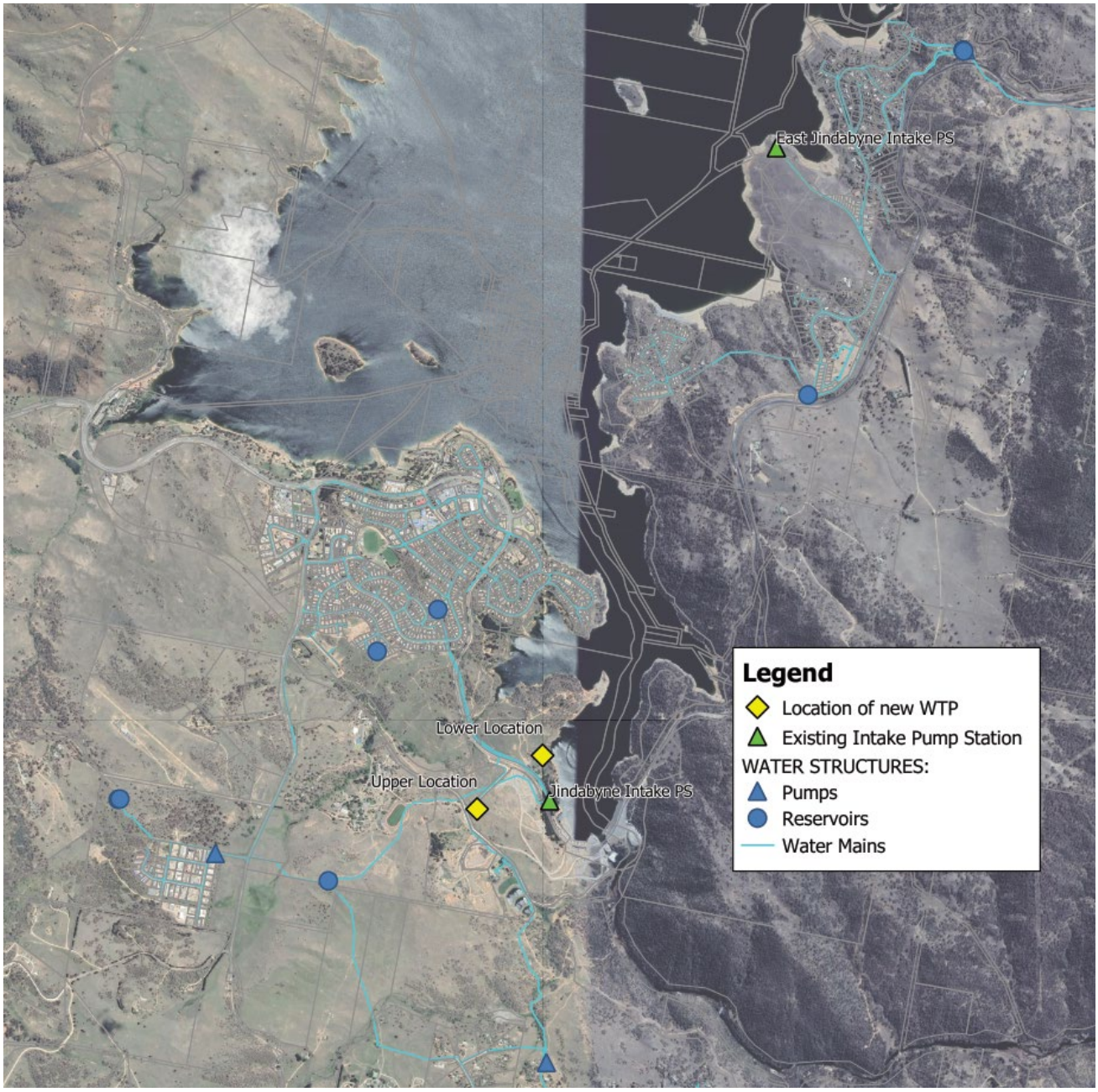


Figure 6.2 Proposed locations for a rationalised Jindabyne WTP

The existing Jindabyne annual extraction license allocation of 577 ML is already approx. 90% utilized and will be exceeded in the short term due to the proposed Snowy Mountains SAP development. There is significant excess allocation for the East Jindabyne and Kalkite systems which could be transferred to Jindabyne or modified to enable the three existing sites to be managed under a single overall allocation. If this is done, the overall allocation will be enough until 2032.

SMRC's updated IWCM strategy and the proposed update of the Regional Water Strategy (DPIE Water) will need to consider whether the required additional allocation can be obtained (i.e. an additional 245 ML/yr to meet the forecast 2046 demand of 1,367 ML/yr). Sufficient water efficiency, demand management and drought management strategies may need to be demonstrated to obtain additional allocation. Improvements in flow metering and demand data collection are required to support this type of future planning and should be implemented as part of the water filtration upgrade project in the short term.

NETWORK

Due to the high-level nature of the master planning inputs available, and as an existing hydraulic model is not available, network servicing requirements have only been developed at a high-level. Figure 6.3 shows the proposed servicing strategy for the identified growth areas in Jindabyne and East Jindabyne, based on the elevation which can be serviced via existing pressure zones. A summary of these elevations is provided in Table 6.1.

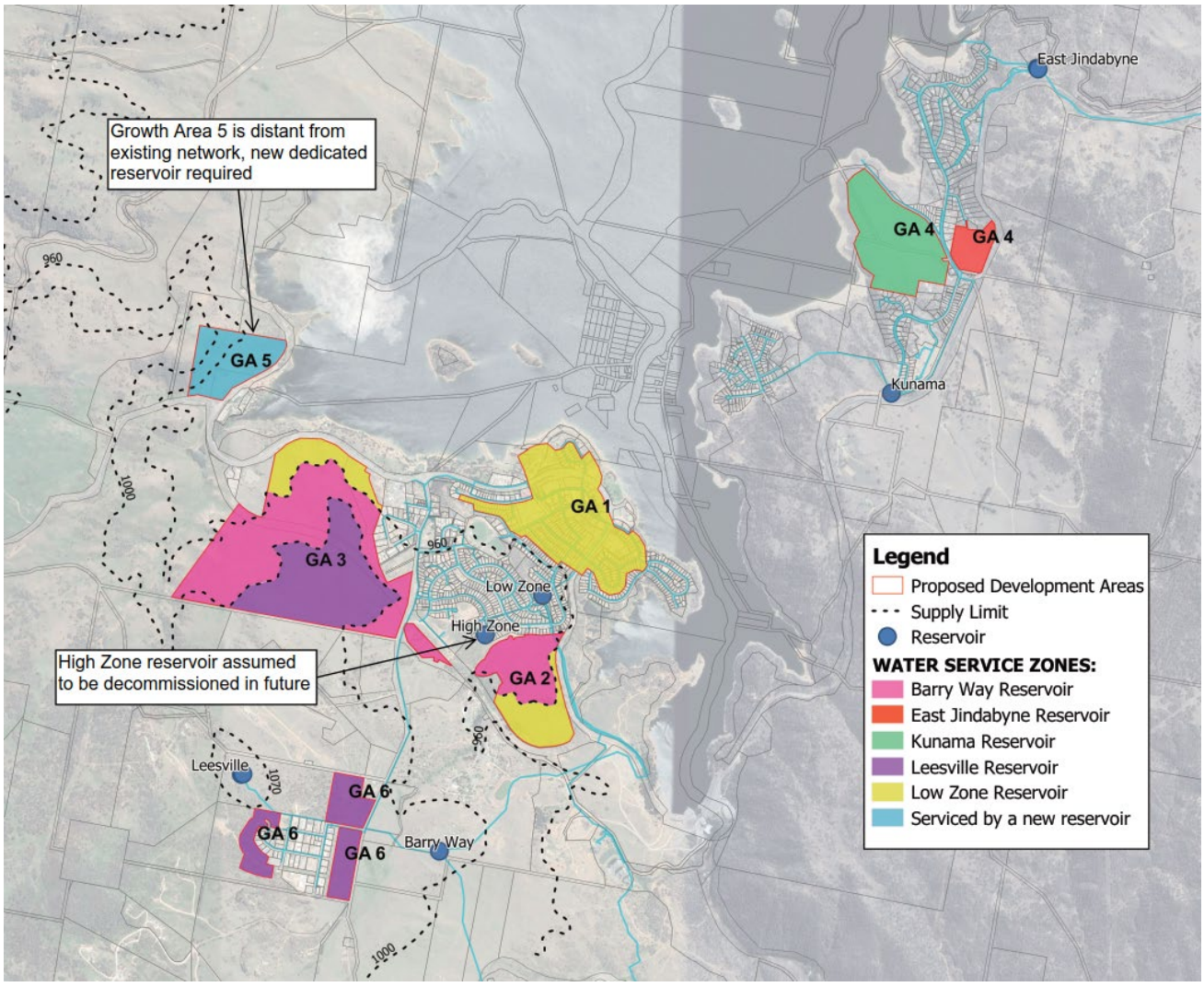


Figure 6.3 Water servicing high-level concept for proposed Snowy Mountains SAP development areas

Table 6.1 Reservoir levels and adopted indicative servicing limits

RESERVOIR	TOP WATER LEVEL (mAHD)[1]	INDICATIVE SERVICE LIMIT (mAHD)[2]
Leesville	1092.0	1070
Barry Way	1030.6	1000
High Zone	N/A	N/A
Low Zone	987.7	960
Kunama	10004	N/A
East Jindabyne	1004.0	N/A

(1) TWL taken from available SMRC input data

(2) This level represents the highest elevation land which can be serviced from the respective reservoir. This is an indicative figure based on SMRC planning documents and reservoir TWL only

It is assumed that the existing High Zone Reservoir is to be removed from service in future, as per the proposed SMRC project identified in CRJO 2018, with this area rezoned to Barry Way Reservoir zone.

As shown in Figure 6.5, the proposed growth areas in Jindabyne and East Jindabyne are located within and lower than the supply limits of existing pressure zones. With the exception of growth area GA5, the proposed growth areas can all be serviced via existing reservoirs. The conceptual servicing strategy for the growth areas shown in Figure 6.5 has been developed based on the following considerations:

- Growth area GA5 is relatively distant from the existing infrastructure and varies significantly in elevation (920 to 120 mAHD). It is recommended to service the area by a new dedicated reservoir and a pump station at some location and as a minimum, two pressure zones are required within this area.
- Growth area also GA3 varies in elevation significantly (920 to 1040 mAHD), thus requiring servicing from multiple pressure zones. The higher elevation part is assumed to be serviced via Leesville Reservoir, which will require a new approx. 1.5 km linking main. An alternative strategy would be to install a new pump station and reservoir at approximately 1060 mAHD – note this would require locating the reservoir close to the existing aerodrome runway.
- Growth areas GA2 and the remainder of GA3 can be serviced from Barry Way zone and the Jindabyne Low Zone via extension and upgrade of existing water mains. If desired to avoid additional reticulation works, the small part of GA3 at lower elevation could alternatively be serviced from Barry Way zone (i.e. rather than Jindabyne Low Zone) zone with a pressure reduction valve(s) to avoid excessive service pressure.
- Growth area GA1 is all below 960 mAHD elevation and can be serviced from the Low Zone reservoir via extension of existing water mains. As above, if desired to maintain existing zone boundary locations and avoid additional reticulation works, some parts of GA1 could alternatively be serviced from Barry Way zone (i.e. rather than Jindabyne Low Zone) zone.
- Growth area G4 is between 920 and 965 mAHD elevation and can be serviced from the two existing reservoirs in East Jindabyne. In line with Council's existing pressure zone boundaries, the small eastern part of GA4 is proposed to be serviced via East Jindabyne Reservoir with the larger western part serviced via Kunama reservoir.

In addition to the above items, upgrade of existing assets is expected to be required where impacted by significant greenfield growth. This may include:

- upgrade to and extension of the reticulation network in central Jindabyne within the Low Zone and Barry Way zones
- upgrades to the Low Zone, Barry Way, Leesville, Kunama and East Jindabyne reservoirs
- upgrade to pump stations supplying Low Zone, Barry Way, Leesville, Kunama and East Jindabyne Reservoirs.

These upgrades have not been investigated in detail or quantified at this stage. An assessment of reservoir storage capacity has not been possible with the available input information. Detailed planning investigations are required to confirm the above strategy and infrastructure needs.

In addition, upgrades to the following assets have been previously identified in the Go Jindabyne Study, 2019 to address asset condition issues:

- Jindabyne Water System:
  - Jindabyne Water Intake pump station
  - Jindabyne Low Zone WPS
  - Barry Way WPS
  - Lakewood Estate WPS
  - High Country Estate WPS
  - Leesville WPS.
- East Jindabyne:
  - East Jindabyne WPS
  - Kunama reservoir roof
  - East Jindabyne reservoir roof.

Significant investigations are required including building a network hydraulic model to develop a holistic planning strategy for the Jindabyne and East Jindabyne water network. This strategy should define the extent and staging of upgrades to cater for growth and should also consider asset condition issues and renewals.

6.1.1.3 THREDBO

TREATMENT AND SOURCE

An upgrade to the existing water treatment plant will be required to increase the capacity from an approximate PDD of 481 kl/d to supply a future (up to 2039) total demand (existing and future) of 911 kl/d. Investigations for the new treatment plant will need to identify the treatment process, ascertain the condition of the existing plant and whether it is feasible (practically and economically) to use the existing plant into the future or whether a totally new facility is required. The ability for the stream to recharge should also be considered as the current study has not included a review of the hydrogeology.

NETWORK

Thredbo Village have noted that they maintain the water and sewer network throughout the village. Since inception, all of the water network has been upgraded or replaced and is consistently maintained by Thredbo Village.

Given the proposed substantial level of growth (equivalent to more than double the existing bed count), significant infrastructure upgrades are expected to be required. These upgrades have not been investigated in detail due to limited available information regarding existing peak demands and existing asset capacity.

6.1.1.4 PERISHER VALLEY

TREATMENT AND SOURCE

An upgrade to the existing water treatment system will be required to increase the capacity of the plant from an approximate PDD of 352.6 to supply a future (up to 2039) demand of 821.6 kl/d. Investigations for the new treatment plant will need to identify the treatment process, ascertain the condition of the existing plant and whether it is feasible (practically and economically) to use the existing plant into the future or whether a totally new facility is required. The ability for the stream to recharge should also be considered as the current study has not included a review of the hydrogeology.

From our initial investigations we note that the Perisher site has the following existing challenges which will have to considered during design:

- Biosolids cannot be removed during the winter months, requiring storage onsite. The existing system is at capacity resulting in occasional odour issues towards the end of the season.
- The existing site is extremely constrained with no space available for expansion next to the existing STP.
- Wastewater requires heating in winter to achieve treatment objectives in winter, currently LPG is used for this process.

NETWORK

Recent upgrades to pipework have taken place in Perisher of the last 20 years as road have been upgraded. Where National Parks re-built and sealed roads throughout the resort, the aging water network was also replaced. The older network infrastructure is in the area of the resort adjacent to Perisher Creek, were the latest upgrades took place between 1980 and 2000. Refer to E, for a marked-up map identifying the Perisher water and wastewater network.

In respect to the flow of water, currently all water passes through Reservoir 1, which cannot be isolated or bypassed. Reservoir 2 is filled from Reservoir 1 via balancing through the reticulation (as they are at similar elevation). A new dedicated water main to enable Reservoir 2 to be operated independently if Reservoir 1 is bypassed or isolated is recommended. This will significantly enhance network resilience and operational flexibility.

Given the proposed substantial level of growth (equivalent to more than double the existing bed count), significant infrastructure upgrades are expected to be required. These upgrades have not been investigated in detail due to limited available information regarding existing peak demands and existing asset capacity.

Significant investigations are required including investigation of actual demands, developing site-specific planning criteria including firefighting requirements, building a network hydraulic model and capacity assessment are required to confirm the network servicing strategy and upgrade requirements at Thredbo and Perisher.

6.1.1.5 OTHER

Selwyn Snow Resort has suffered damage in the recent 2019/2020 summer bushfires, including to water supply infrastructure. Upgrades are required to address these issues. Anecdotally from initial discussions with alpine resort stakeholders, there may be some remaining sections of asbestos cement (AC) water mains at alpine resorts which will require replacement over coming years to maintain the integrity of these reticulation networks.

No other upgrade requirements have been identified based on available information.

Generally, from initial discussions with alpine resort stakeholders, it appears water infrastructure at many of these sites has been designed to specifically cater for the approved maximum number of beds. On this basis, capacity upgrades may only be required if additional beds were approved in the future (or significant other uses).

It is understood (based on anecdotal information only) that Charlotte Pass has no reservoir storage and relies on storage in the weir/river source, which is unreliable in summer. It is recommended that a new storage reservoir is installed to enable the expansion of Charlotte Pass in both Winter and Summer season. However assessment of the current infrastructure configuration and future requirements (which has not been possible in this technical study) is required to progress this project.

6.1.2 WASTEWATER INFRASTRUCTURE

6.1.2.1 WEST LAKE JINDABYNE RESORT

The proposed resort development on the western side of Lake Jindabyne is proposed to have its own dedicated Sewerage Pump Station (SPS) and approximately 3-km rising main SMRC's Jindabyne network (at the extended network to service the GA5 growth area, if no new Snowy Mountains SAP development occurs in GA5 and GA3, an additional approximately 3-km of rising main would be required to reach the existing network at the intersection of Barry Way and Kosciuszko Road). Figure 6.4 shows an overview of these assets. These assets could be owned and maintained by the developer to suit their specific needs, or alternatively by SMRC.

Additional network capacity upgrades may be required downstream to support the servicing of the resort development, which requires detailed hydraulic analysis to assess. These upgrades are likely also required to support other development within the areas proposed immediately to the west of Jindabyne. For the Snowy Mountains SAP and resort development planning, it would be desirable to minimize the peak inflows to the resort SPS and hence the required discharge flowrate, Options to achieve this include designing the resort wastewater reticulation such that wet-weather inflow and infiltration can be avoided/minimized or provision of buffering storage at the SPS site.

The specific servicing requirements would need to be developed with SMRC based on more detailed information of the proposed development.

An alternative servicing strategy is to install a stand-along/private STP at this site with all treated effluent to be re-used for irrigation of the proposed new golf course at this site. Refer to Section 6.1.3.2 for further details. This is an attractive option (providing a new golf course is developed) however the feasibility of this system has not been investigated as part of this technical study.

The conveyance of sewage to the Jindabyne network (as described above and shown in Figure 6.4) has been adopted for the Snowy Mountains SAP Master Plan.

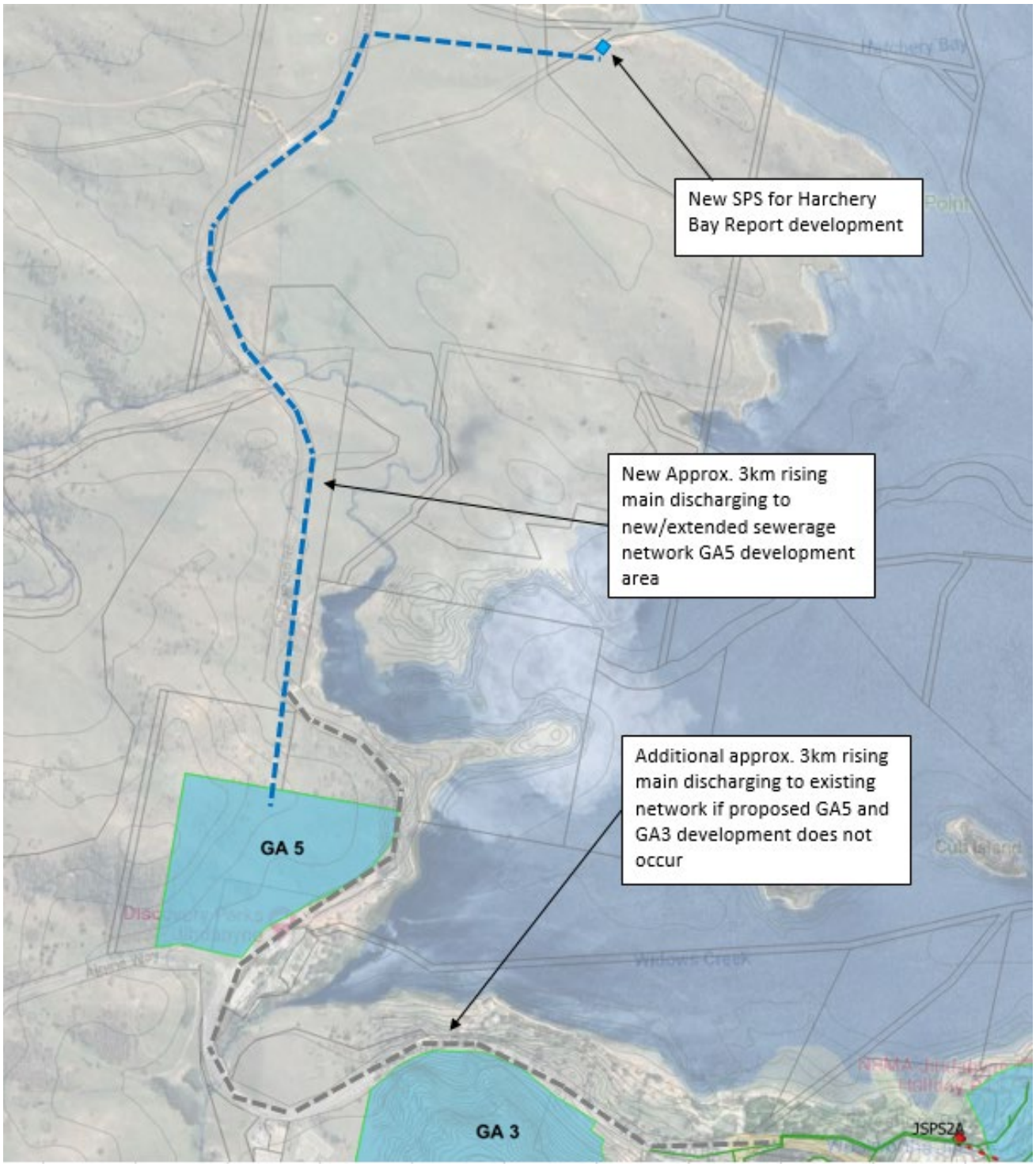


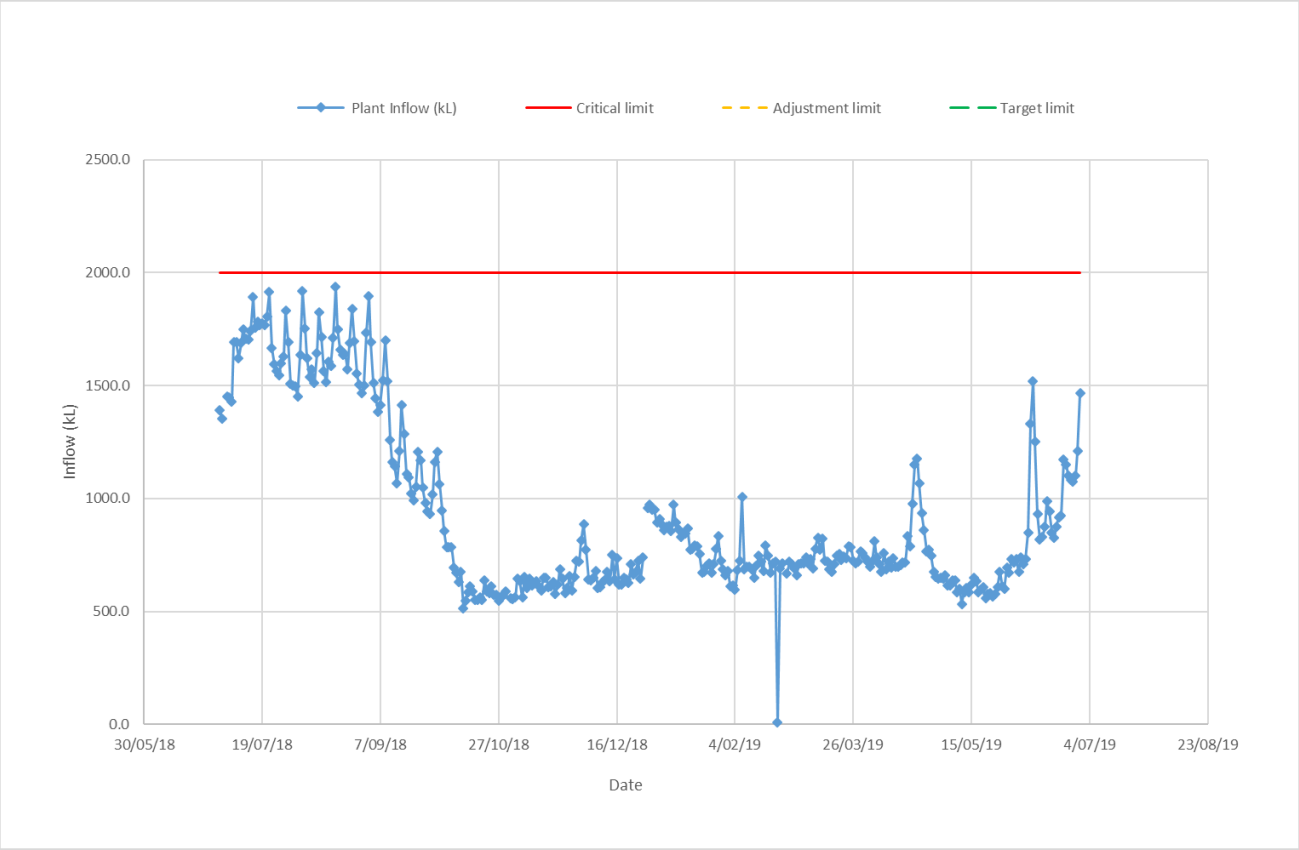
Figure 6.4 West of Lake Jindabyne Resort wastewater servicing

6.1.2.2 JINDABYNE

PLANT CAPACITY

The Jindabyne STP (designed for 8,000 EP at 2 ML/d ADWF) is currently reaching its maximum capacity (2 ML/d) during the winter season, as illustrated in Figure 6.5. Due to the high levels of tourism in the winter months, the Jindabyne STP can receive flows in the range of 2 to 4 times those received during the "off" tourist season. The fluctuation in flow at the plant is not a new a trend; similar influent flow trends have been noted in the last major process review for the plant, documented in the Concept Design Report for the Jindabyne Wastewater Treatment Plant (WWTP) (NSW Public Works 2010). Refer to SMRC for this document.

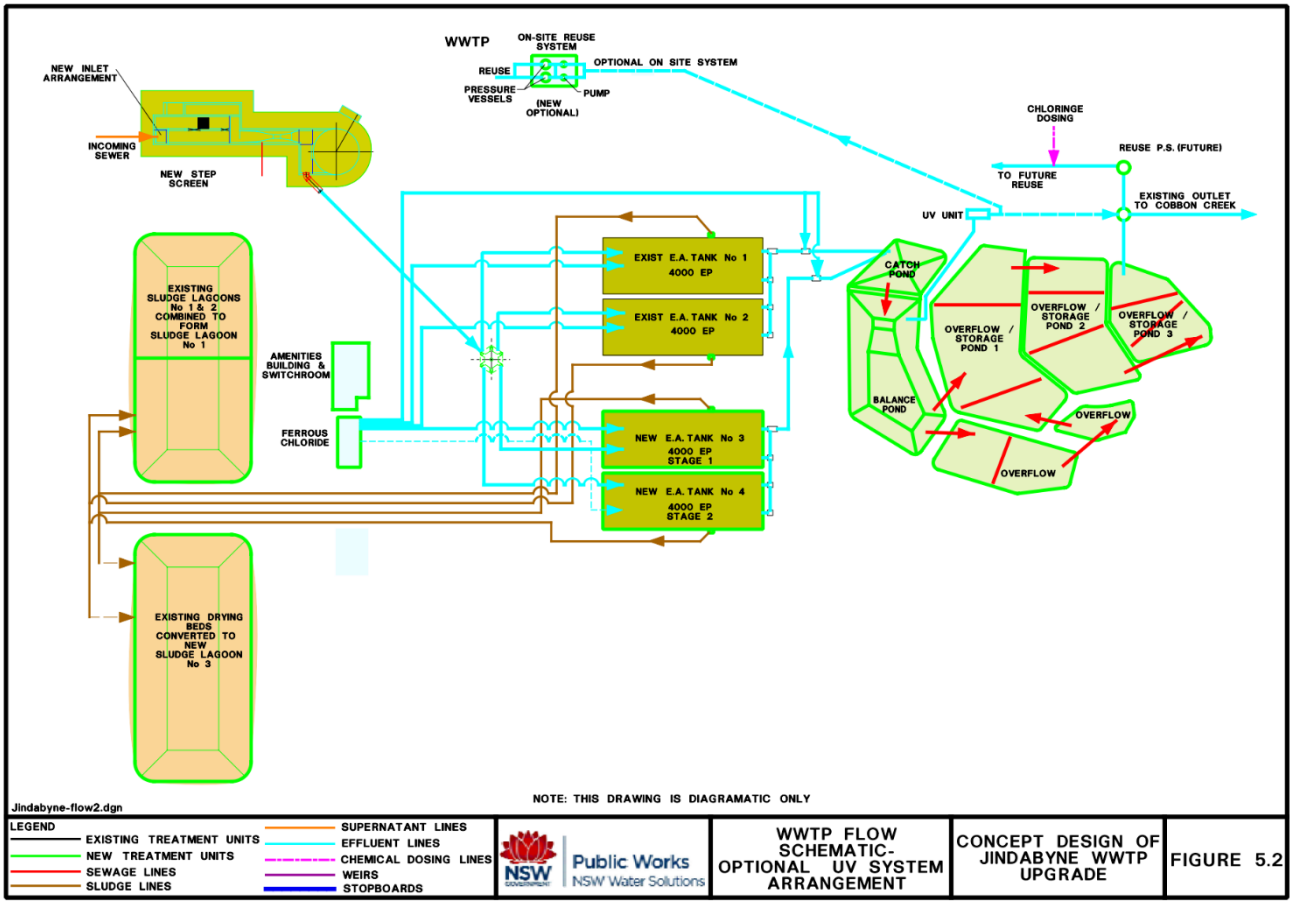
While the existing plant will require a capacity upgrade to effectively service current winter flows, it will certainly require an imminent upgrade to service the projected wastewater flows generated by the Snowy Mountains SAP development. The wastewater flows projected in the Snowy Mountains SAP increase rapidly over the first 20 years of growth in the region. The existing plant could not accommodate this growth, especially given that most of the growth is based on increased winter tourist populations in the area which is the very time of year the existing plant is at risk of surpassing its current capacity.



(Data Source: influent flows to the Jindabyne STP provided by SMRC)

Figure 6.5 Jindabyne STP Inflows (2018–2019)

The Snowy Mountains SAP development is forecast to result in substantially higher flows to the STP with the largest overall increase in flow occurring around 2040 and resulting in an ADWF of approximately 2.6 ML/d (based on August population flows). That said, this calculation has been completed on purely theoretical values and not considering the current influent flows into the plant as illustrated in Figure 6.5, therefore it is suggested that the future projected flows be validated based on actual wastewater generation rates per a review of existing plant loading data. Moreover, plant upgrades are typically undertaken well before a plant reaches its rated capacity. It is not atypical to plan upgrades for the time when a facility is projected to reach approximately 85% of its rated capacity for instance (in this case being in the year 2025). Upgrades and license amendments should be based on a robust long-term strategy considering potential changes to treatment requirements and staging. The existing concept design provides a modular staged approach to the expansion of the existing STP as illustrated in Figure 6.5. In consultation with SMRC, the latter indicated that they did not have any objections to the proposed upgrade plans as presented in the Concept Design for the Jindabyne STP (NSW Public Works 2010), but that they have simply not acted on all the recommendations made in the report thus far. SMRC recognises that an expansion to the plant will be required in the next few years.



Source: NSW Public Works, Concept Design Report for Jindabyne WWTP (2010)

Figure 6.6 Proposed upgrades to Jindabyne STP in Concept Design Report

The proposed upgrades in the concept design provides a staged phasing of upgrades to support growth and equivalent projected wastewater flows as summarised in Table 6.2. Note that based on the projected flow, the highest ADWF for the catchment is projected to be 2.6 ML/d, meaning the Stage 2 expansion will be required within the planning outlook. This does present an opportunity to have the option of accommodating additional growth beyond the projections currently planned in the region. That is, there are no land constraints in terms of being able to increase capacity at the existing plant which provides flexibility in growth without increasing operational and maintenance complexity for council (i.e. adding an additional treatment plant in the region).

Table 6.2 Proposed expansion phasing in Jindabyne STP (based on 2010 Concept Design)

PLANT EXPANSION STAGE	EQUIVALENT POPULATION SERVICED	EQUIVALENT ADWF (ML/D)[1]	TIMING OF EXPANSION BASED ON PLANNED GROWTH IN SNOWY MOUNTAINS SAP
Existing Jindabyne STP	8,000	2 ML/d	N/a
Stage 1 Expansion	12,000	3 ML/d	2020–2025
Stage 2 Expansion	16,000	4 ML/d	N/a[2]

(1) Approximate ADWF, based on an assumed wastewater generation of 240 L/cap/day (used as a basis in the Concept Design report).

(2) Stage 2 may not be required based on the growth projected in the Snowy Mountains SAP, so long as the basis of design in the concept design is still valid. If actual per capita wastewater flows are greater than 240 L/cap/day, Stage 2 will be required.

TREATMENT CAPABILITY

The current effluent quality limits (90th percentile and maximums) for the Jindabyne STP are summarised in Table 6.3. These limits are based on the existing Environment Protection Licence (EPL) for the facility (Licence No. 773).

Table 6.3 Jindabyne STP effluent quality limits

PARAMETER	QUALITY (90%ILE)
Biochemical Oxygen Demand (BOD_5)	10 mg/L
Total Suspended Solids (SS)	15 mg/L
Ammonia	2 mg/L
Total Nitrogen (TN)	10 mg/L
Total Phosphorus (TP)	0.3 mg/L
Oil and Grease	2 mg/L
Faecal Coliforms (FC)	200/100 mL
pH	6.5–8.5

In general, the limits above could be achieved using the currently chosen IDEA technology, however, performance of any treatment system can be impacted during periods of cold weather and ability to achieve ammonia limits could be compromised. Moreover, the significant increase in wastewater generation during the winter months may also be contributing to process upsets. This is supported by several non-compliances with respect to the Jindabyne STP's effluent limits that have been reported in the past 10 years. The concept design report noted several non-compliances in relation to BOD, Total Suspended Solids (TSS), TN, pH; based on a review of data between 2008 and 2009. Since the completion of the concept design report, SMRC have implemented several of the Stage 1 upgrades at the plant per the concept design report to aid with the system's performance and process monitoring, including:

- new chemical dosing facilities, including a ferric system which is to double dose coagulant within the system
- new dissolved oxygen (DO) monitors and pH meters
- a new step screen within the existing inlet works.

Based on a current high-level review of plant performance data and non-compliance reporting provided by SMRC, it is evident that the Jindabyne STP process is still not meeting its effluent limits consistently.

During 2017–2020 report period there were 142 non-compliances, notably, the following:

- 13 instances of phosphorous limit exceedance
- 5 instances of total nitrogen exceedance
- 2 instances of ammonia level exceedance
- 2 instances of pH limit exceedance
- 8 instances of Faecal coliform limit exceedance
- 4 instances of concentration limits exceeded
- 108 instances of daily discharge limit exceeded.

Note that most of the non-compliances recorded in the last 3 years are related to the plant's flow exceeding its capacity; thereby reinforcing the need for a plant upgrade (or consideration of an overflow tank to manage peak flows). Regarding the non-compliances related to effluent quality, it is understood based on the previous process review, included in the 2010 Concept Design Report, some of these issues arise due to the IDEA tanks being overloaded in the winter months without the provision of additional aeration capacity, and due to low temperatures. Additionally, algae growth in the ponds contribute to high pH and high suspended solids. SMRC has noted in conversation that plant performance is most impacted during the winter months. This is not surprising given the increase load on the system and the lower temperature of the wastewater during this period. The factors contributing to the quality non-compliances noted above require more in-depth investigation through a detailed process review in order to ascertain the root causes of each non-compliance. There are often "ripple effects" that can occur in a system such as a STP since a slight change to one process element can impact on another. The added stark variations in flow and temperature in the system also complicates the complexity of our understanding of the system.

NEXT STEPS ON VALIDATING JINDABYNE STP EXPANSION PLANS

While SMRC currently have an existing Concept Design which they have been referring to, to plan plant upgrades, it is recommended that the following steps are taken to validate the specific pathway for planning further upgrades to the existing plant:

- Validating the process is adequate through a detailed process review and detailed Biowin modelling under a range of operating conditions. Such a study should include the following:
  - an analysis of influent water quality through wastewater characterisation in summer and winter periods to ascertain any changes to the types of uses in the system (i.e. understanding if there is an increase in trade waste entering the system)
  - an analysis of the treatment performance for each stage of the plant, to identify route cause to current non-compliance issues (and to validate that the current planned process is adequate for the future)
  - development of upgraded Biowin model (to validate that the existing process issues are not caused due to the process being inadequate)
  - an analysis of the mechanisms for mitigating against overflow events in the short and long term
  - determine the upgrades that are required to support existing system deficiencies
  - an analysis of the extent of the flow peaks in the system. Flows into the system appear highly variable and there is a risk of having rain on snow melt type scenarios which exacerbate inflow and infiltration in the system (when can them impact on treatment performance).
- Once a process review is undertaken, to update the concept design for the system, outlining the stages of implementation.

NETWORK

Due to the high-level nature of the master planning inputs available, and as an existing network hydraulic model is not available, network servicing requirements have only been developed at a high-level. Figure 6.7 and Figure 6.8 show the proposed servicing strategy for the identified growth areas in Jindabyne and East Jindabyne respectively, based on topography and existing network assets. Potential layout of new gravity sewers (excluding local reticulation) is shown in blue lines to assist understanding.

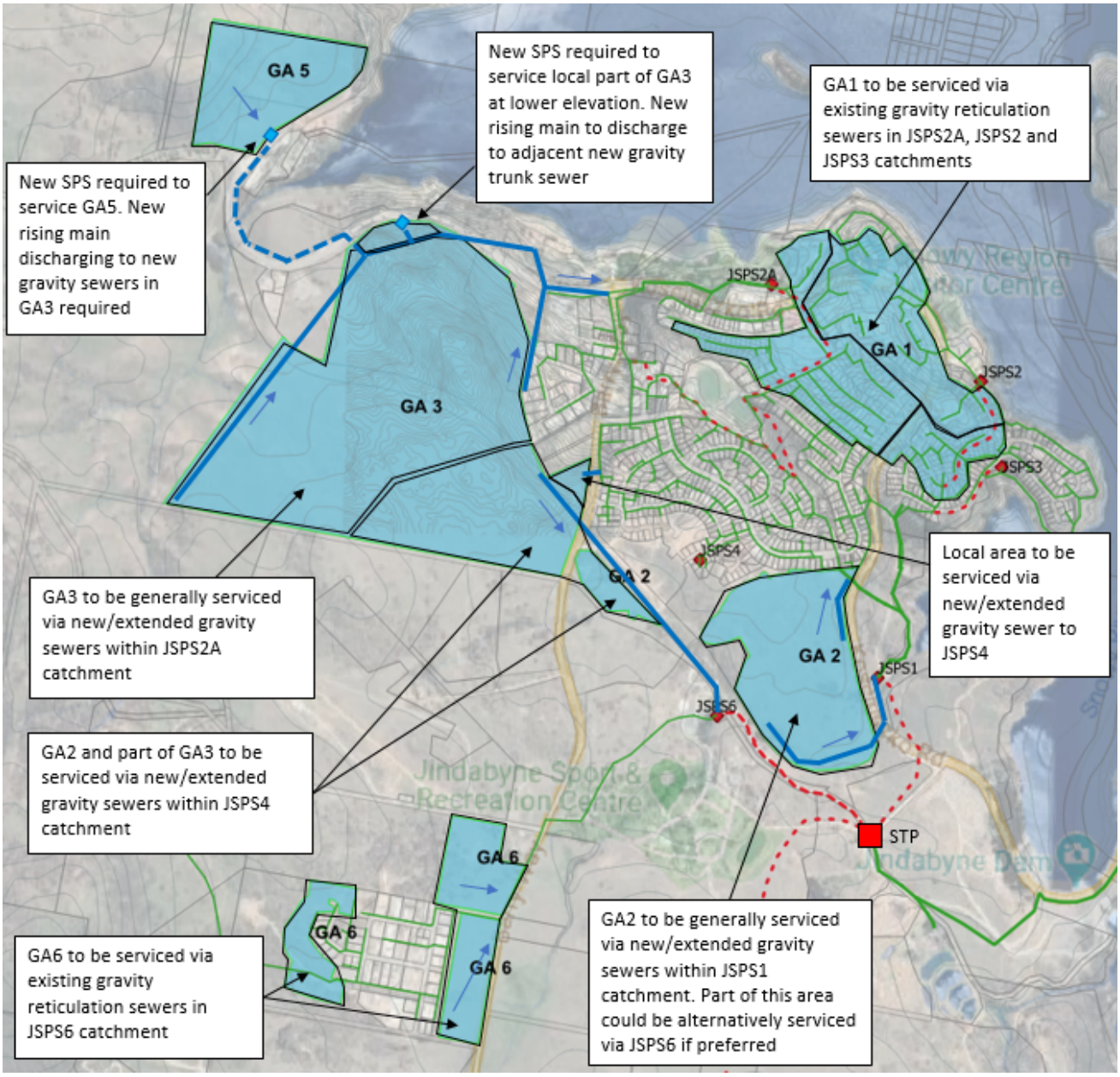


Figure 6.7 Jindabyne wastewater network servicing – high-level strategy

As shown in Figure 6.7, the proposed growth areas in Jindabyne are located within and adjacent various existing sewerage catchments. With the exception of growth area GA5 and a local area at lower elevation within GA3, the proposed growth areas can all be serviced via gravity to existing SPS. This will generally require new/extended gravity sewers, except within growth area GA1 which is proposed to be infill type development with an existing serviced area.

In addition to new gravity mains to extend the network into the greenfield growth areas shown in Figure 6.7, significant upgrades to existing network assets including SPS, rising mains and trunk gravity mains associated with the following catchments are expected to be required:

- JSPS2A (formerly JSPS1)
- JSPS6.

Although not servicing significant greenfield growth areas, upgrades to infrastructure in JSPS2, JSPS2A and JSPS4 catchments are potentially also required subject to specific development details and existing available capacity.

These upgrades have not been investigated in detail or quantified at this stage. In absence of further investigation, it should be assumed that complete replacement of the above impacted existing assets may be required.

In addition to the above, various network upgrades were identified in the 2019 Go Jindabyne Study to address existing capacity and asset condition issues in the Jindabyne network (including at JSPS3, JSPS4 and JSPS5). SMRC have also advised anecdotally of significant asset condition issue within the Jindabyne wastewater reticulation generally.

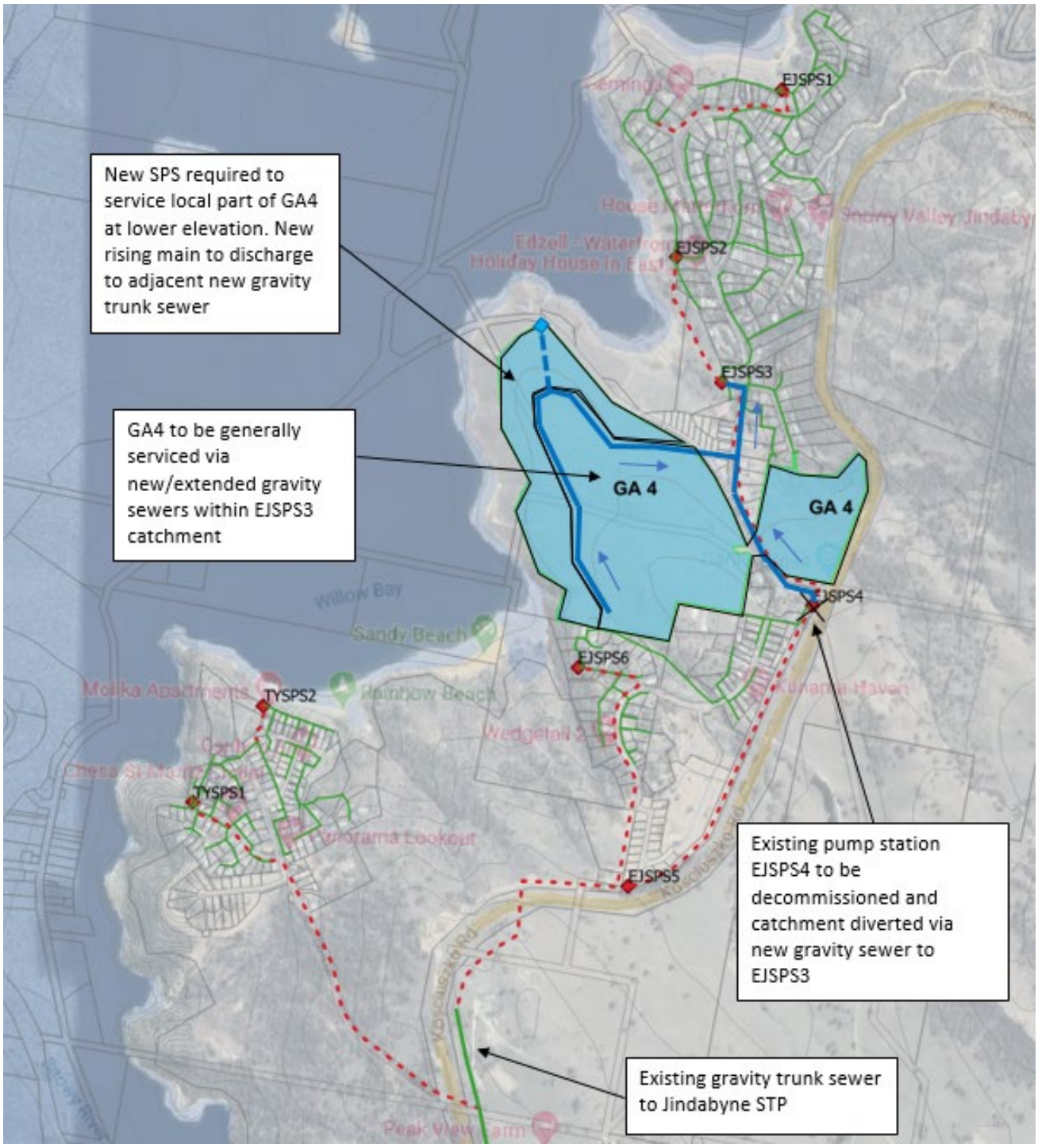


Figure 6.8 East Jindabyne wastewater network servicing – high-level strategy

As shown in Figure 6.8, all growth areas in East Jindabyne are proposed to be serviced via the EJSPS3 catchment either via gravity (generally) or via a new SPS catchment located near the Lake. An existing SMRC planning strategy documented in the Jindabyne Sewerage Scheme Report (2016, Stantec) to decommission JSPS4 and divert this catchment via gravity into JSPS3 appears to be feasible and has been adopted. This strategy aligns with the proposed servicing of the identified Snowy Mountains SAP growth areas via JSPS3, as potential impacts and upgrades to the existing network will be limited to this single SPS and associated assets.

For the East Jindabyne network, in addition to new gravity mains to extend the network into the greenfield growth areas shown in Figure 6.8, significant upgrades to existing network assets including SPS, rising mains and trunk gravity mains associated with the following catchments are expected to be required:

- EJSPS3
- EJSPS5
- Trunk gravity mains discharging to STP.

These upgrades have not been investigated in detail or quantified. In absence of further investigation, it should be assumed that complete replacement of these assets may be required.

In addition to the above, upgrades were identified in the 2019 Go Jindabyne Study to address existing overflow storage requirements at EJSPS5.

6.1.2.3 THREDBO

TREATMENT AND EFFLUENT DISPOSAL

Significant growth is proposed at Thredbo and, although current flows are not known, the current discharge license limit of 1610 kL day and STP capacity will certainly be exceeded due to the Snowy Mountains SAP development.

NETWORK

Given the proposed substantial level of growth (equivalent to approx. 60% increase above the existing bed limit), significant infrastructure upgrades are expected to be required. These upgrades have not been investigated in detail due to limited available information regarding existing flows and existing asset capacity.

This investigation requires flow monitoring/data recording/analysis to identify peak demands, site inspection, development of appropriate site specific planning criteria and hydraulic analysis. Depending on reticulation network complexity, building a hydraulic model may be required.

6.1.2.4 PERISHER, BLUE COW, SMIGGIN HOLES AND GUTHEGA

TREATMENT AND EFFLUENT DISPOSAL

Significant growth is proposed at Perisher beyond the current discharge license limit and STP capacity of 2000 kL day. Based on the 2018 Perisher Valley STP Capacity and Robustness Review, this STP cannot currently achieve its design capacity and will likely require upgrades to accommodate any significant growth. Undertaking upgrades at the current site will be quite challenging as there is limited free space adjacent on the site to construct an expansion (the land around the site slopes down). There is an opportunity to potentially site some infrastructure near Pumping Station 1, located just a few 100 meters away from the existing STP. A technical and cost feasibility of the options will have to be undertaken to ascertain the best path forward for the upgrades.

Blue Cow, Smiggin Holes and Guthega reports are serviced by Perisher STP so any growth at these locations will impact this facility.

NETWORK

Given the proposed substantial level of growth (equivalent to approx. 70% increase above the existing bed limit), significant infrastructure upgrades are expected to be required. These upgrades have not been investigated in detail due to limited available information regarding existing flows and existing asset capacity.

As for Thredbo this investigation requires flow monitoring/data recording/analysis to identify peak demands, site inspection, development of appropriate site specific planning criteria and hydraulic analysis. Depending on reticulation network complexity, building a hydraulic model may be required.

6.1.2.5 OTHER

No information regarding growth in other areas has been provided as part of the master planning inputs to enable consideration in this study. Some upgrades due to existing condition and performance issues should still be expected including:

- Sawpit Creek absorption trench disposal system does not perform adequately in peak winter loading/conditions and requires either a new discharge to be created direct to Sawpit Creek (subject to EPA approval) or, alternatively, replacement/modification of the absorption trench system
- upgrades at three SPS in Kalkite (as identified in the CRJO Water and Wastewater Prospectus, 2018) as well as potential upgrades to the STP and effluent disposal system, (to address existing performance issues)
- repairs/restoration of wastewater facilities at Selwyn Snow Resort in response to bushfire damage during the 2019/2020 summer
- Charlotte Pass sewer treatment plant is noted as aging infrastructure which inhibits the efficient operations of the plant on occasion. The sewer treatment plant requires a further assessment on its condition to determine the required upgrades or replacement
- Ski Rider Motel has been identified in the structure plan as having potential expansion. Currently, there is not sewerage treatment facility and discharge on site. Sewerage is stored on site and pumped out incrementally to and transported to Jindabyne STP by truck. If expansion of the hotel were to happen, an onsite sewer treatment facility would need to be investigated.

Generally, from initial discussion with alpine resort stakeholders, it appears wastewater infrastructure at many of these sites has been designed to specifically cater for the approved maximum number of beds. On this basis, capacity upgrades may only be required if additional beds were allowed in future (or significant other loads added to these systems).

6.1.3 RECYCLED WATER OPPORTUNITIES

6.1.3.1 JINDABYNE STP

The Jindabyne STP does not supply any recycled water and discharges approximately 646 ML/year to Cobbin Creek. Cobbin Creek is considered a sensitive receiving water, therefore implementing water recycling offer the opportunity to reduce environmental impacts. Since the existing treatment facility is located adjacent to much of the future growth areas for the Snowy Mountains SAP, there are expected to be opportunities to reuse effluent by both existing and future developments. Implementing water recycling would result in the following overall benefits within the community and environment:

- substituting existing potable water demand which would otherwise be met by using more WTP's
- supporting additional development (or additional water usage for existing sites), particularly for water-intensive land-uses, which otherwise may not be appropriate to supply with potable water
- reducing the nutrient load discharged to Cobbin Creek.

A review was undertaken to ascertain potential users for the recycled water system. Since most of the planned growth in Jindabyne will be made up of residential development, the review focused on existing irrigated playing fields and public open space. The potential water demands for these sites has also been estimated at an order-of-magnitude level. Table 6.4 provides a summary of these sites and Figure 6.9 and Figure 6.10 provide an overview of their location and extent.

Table 6.4 Summary of identified potential recycled water irrigation sites in Jindabyne

LOCATION	ESTIMATED IRRIGATION AREA (HA)	ESTIMATED IRRIGATION DEMAND (ML/YEAR)[1]	APPROX. DISTANCE FROM JINDABYNE STP (km)
Jindabyne Sports and Recreation Centre – playing fields	1.0	1.0 to 4.9	0.8
Jindabyne Sports and Recreation Centre – landscaping	1.2	1.2 to 6	0.9
JJ Connors Oval (Park Road)	1.4	1.4 to 7	2.4
Soccer field (Park Road)	0.65	6.5 to 3.3	2.4
Snowy Mountains Grammar School – playing fields	0.13	0.13 to 0.7	2.8

(1) Based on an assumed annual irrigation rate of 1–5 ML/ha (order of magnitude). This rate is highly site-specific and depends on turf type, desired turf quality, climate and irrigation practices

Considering the locations and volumes which can be used, the Jindabyne Sports and Recreation Centre presents the most feasible opportunity for economical water recycling from the identified sites. This provides the opportunity for up to 2–10 ML/year of recycled water irrigation (i.e. and equivalent reduction in potable water demand and treated wastewater effluent discharge to Cobbin Creek), based on the assumed irrigation demand rate of 1–5 ML/ha. Although not captured in the above site identification exercise, this precinct is also identified for further development of additional sports facilities and accommodation in the final Snowy Mountains SAP structure plan – which could enable additional recycled water volume to be used. This requires further investigation of these sites to develop more accurate irrigation requirements.

The above potential recycled water volumes are relatively minor in proportion to the total annual volume of treated wastewater effluent discharged from Jindabyne STP, less than 5% of the current estimated volume (646 ML). Hence this opportunity is limited by available irrigation areas and therefore implementing a recycle water system on this basis would not be economically feasible. A scheme would benefit from development of significant additional playing fields and irrigated open space in the vicinity of the sports and recreation centre. A golf course (if developed) would provide significant area and opportunity.

Other opportunities are to supply recycled water for uses such as SMRC-managed tree watering and landscaping irrigation within the Jindabyne town centre or future residential developments close to the STP site. These uses are expected to result in limited additional demand however. When consulting with SMRC, they did note this same limitation; that there is currently a lack of potential recycled water users in the area. Moreover, they noted that the readily available source water for the potable drinking water system also does not contribute towards the need for a recycled water system.

Irrigation of proposed landscaping in lakefront areas with recycled water would present significant drinking water quality risks (due to the lake being the drinking water source) and is not considered a feasible option. Likewise, supply of recycled water to residential customers via a “third-pipe” reticulation system for private garden irrigation and toilet flushing is not considered feasible in a small development/regional context as these end-uses introduce significant additional public health risks which are will be onerous for SMRC to manage.

Figure 6.9 Irrigated sites for recycled water opportunities in central Jindabyne

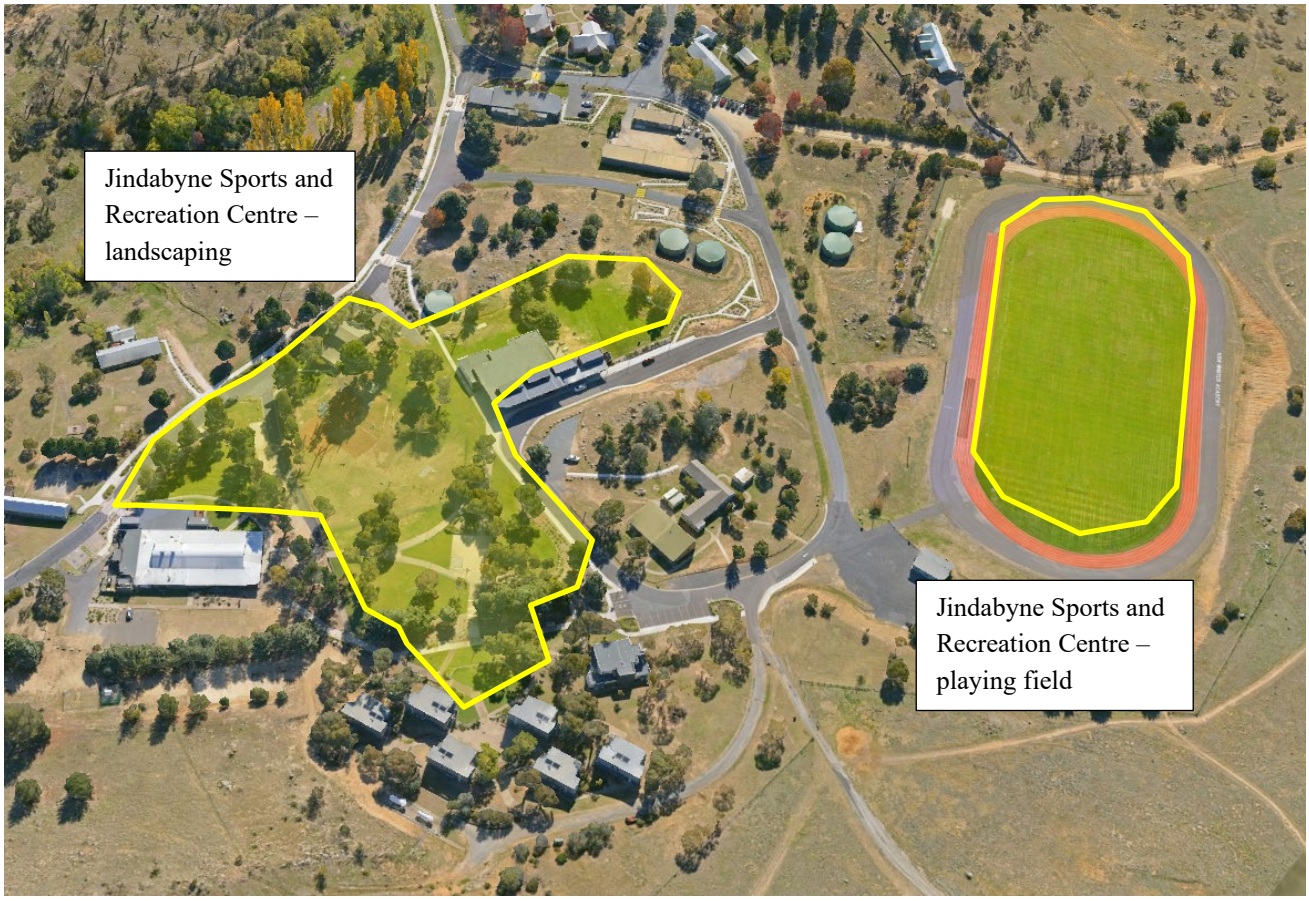


Figure 6.10 Irrigated sites for recycled water opportunities at Jindabyne Sports and Recreational Centre

WATER QUALITY REQUIREMENTS

The performance reliability of the existing Jindabyne STP, and the quality of effluent water it produces, must also be considered in conjunction with the types of proposed recycled water uses. The following section provides the context regarding the guidelines for planning and implementing recycled water systems in NSW and how these apply to the case for a recycled water system at the Jindabyne STP.

WATER RECYCLE GUIDELINES

The two predominant guidelines relevant to planning and implementing recycled water schemes in NSW are the NSW Guidelines for Recycled Water Management Systems and the Australian Guidelines for Water Recycling (AGWR). These two guidelines are commonly referenced for best practices in terms of the frameworks used to plan for recycled water systems, although there are other guidelines that inform specific elements of planning such systems. For instance, the EPA's guidelines titled Environmental Guidelines: Use of Effluent by Irrigation provides guidance on the monitoring of irrigation end points, to monitor the efficacy of the treatment system used.

The development of recycled water schemes in NSW is predominantly guided by the NSW Guidelines for Recycled Water Management Systems since it follows the framework outlines in the AGWR and therefore the use of the state guidelines satisfies the federal guidelines. The state guidelines, like the federal guidelines, recommend a health-based performance target assessment for managing pathogen risk when evaluating a recycle scheme. In addition to the health-based target performance assessment, the state guidelines offer a framework for completing a Recycled Water Management System (RWMS) which satisfies the legislative requirements in NSW (notably s60 of the *Local Government Act 1993 (LGA)* or s292 of the NSW *Water Management Act 2000 (WMA)*). Therefore, when assessing the recycled water schemes in NSW, both the state and federal guidelines are relevant.

The guidelines recommend a health-based performance target for achieving microbial and pathogen quality in recycled water. The assessment used for determining the indicative health risk is based on calculating the Log Reduction Value (LRV) for a treatment and recycle water system and comparing it to the target LRV for the intended use of the recycled water. To put it plainly, your system and management practices must meet or exceed the target LRV (see Equation 1). While there is a certain level of pathogen risk associated with each type of use, it must be demonstrated that this pathogen risk can be mitigated through either the extent of treatment in the system and/or end use management systems to protect end users and the public.

Equation 1 Target LRV – (Treatment System LRV + Management System LRV) ≤ 0

The NSW Guidelines for Recycled Water Management Systems lists the LRV and quality targets for the proposed recycled water uses in Snowy are summarised in Table 6.5.

Table 6.5 Log reduction and quality targets for current recycled water uses in Jindabyne

TYPE OF RECYCLE WATER USE	LRV[1] TARGET (VIRUS/ PROTOZOA/BACTERIA)	QUALITY TARGETS
Municipal use — open spaces, sports grounds, golf courses, trees, shrubs, public gardens, dust suppression or unrestricted access and application	5.2/3.7/4.0	Refer to AGWR

(1) LRV's are used in used in reference to the physical–chemical treatment of water to remove, kill, or inactivate microorganisms such as bacteria, protozoa and viruses (1-log removal = 90% reduction in density of the target organism, 2-log removal = 99% reduction, 3-log removal = 99.9% reduction, etc).

To determine the actual LRV's for a treatment process and management practices, a calculation has to be made using the indicative values provided in Tables 8 and 9 of the NSW Guideline for Recycled Water Management Systems.

Prior to establishing a recycled water system using effluent from the Jindabyne STP, SMRC will have to undertake a health-based target approach, in line with the NSW Guidelines for Recycled Water Management Systems when considering supply of recycled water to potential users. As the LRV targets within this guideline are more conservative than those of the AGWR, the numbers summarised in the former should be used.

SUITABILITY OF EXISTING JINDABYNE STP EFFLUENT WATER FOR PROPOSED RECYCLED WATER USES

For illustrative purposes, an indicative HBT assessment has been completed and summarised in Table 6.6, based on the use of recycled water for municipal irrigation purposes. Note that this is indicative only as it has been completed without consultation with potential end users and stakeholders which would be involved in the planning stages of the system. The results indicate first and foremost that there would be a deficit in the system's capacity to mitigate against risk of viruses. Moreover, it is important to note that the assessment supposes that the existing treatment system reliably and consistently produces effluent to the quality required, which is not currently the case for the Jindabyne STP (and recommendations have been made to further investigate this matter). The results of the assessment are in line with the Concept Design Report for the Jindabyne STP. In the report, a recommendation was made to make provisions for tertiary filtration as well as UV disinfection (and possible further chlorine disinfection for certain users such as golf courses). An assessment of the sizing of the recycled water storage pond would also be required to provide balancing for recycled scheme. The addition of these additional process steps, in addition to the rectification of existing process deficiencies, would appear provide the overall treatment necessary to use effluent from the plant as a recycled water source for the proposed end users noted in this report.

Table 6.6 Health-based target assessment for municipal uses of recycled water from Jindabyne STP

	LOG REDUCTION VALUES			EFFLUENT QUALITY PARAMETERS
	Virus	Bacteria	Protozoa	
Log Reduction Value (LRV) Targets (NSW Guidelines)	5.2	4.0	3.7	To be determined on case-by-case basis depending on technologies. Could include turbidity criteria for filtration, disinfectant Ct or dose (UV) E. coli.
Secondary Treatment	0.5	1.0	0.5	
Lagoon Storage	1.0	1.0	1.0	
Deficit (Based on NSW Guidelines)	**3.7**	**2.0**	**2.2**	
Additional Log Claim for Implementation of Management Controls				
No public access during irrigation	2.0	2.0	2.0	
Withholding periods for irrigation of parks/sports grounds (1–4 hours)	1.0	1.0	1.0	
Deficit with Additional Log Removal Claims (Based on NSW Guidelines)	**0.7**	**-1.0**	**-0.8**	

While there is a pathway for making a recycled water system at the Jindabyne STP viable, it will need a more detailed assessment of potential users, including stakeholder consultation, to ascertain the economic viability of such a scheme and the appropriate treatment standard. The upgrades proposed at the plant would require a capital investment to implement that otherwise wouldn't be necessary. The scale of uptake of recycled water should be investigated in more detail as well as considerations regarding end user agreements and usage pricing structures.

6.1.3.2 WEST LAKE JINDABYNE RESORT DEVELOPMENT

As discussed in Section 6.1.2.1, this new develop could potentially be serviced via a new dedicated STP and all treated effluent used for irrigation of the proposed new golf course at this site. A lined pond/lagoon for seasonal storage of treated effluent would be required (i.e. to balance peak effluent generation in winter with peak irrigation demand in summer). This is an attractive option (providing a new golf course is developed) however the feasibility of this system has not been investigated as part of this technical study.

6.1.3.3 RECYCLED WATER FOR SNOW PRODUCTION: PERISHER AND THREDBO

A review for the potential to utilise recycled water for snow making has been undertaken. Per the Climate Change Impact report (WSP 2020), one of the deliverables within the current assessment of the Snowy Mountains SAP, has been noted that climate change will impact on the volumes of natural snowfall in the Snowy Mountains SAP region. In other words, to maintain the recreational amenities for snow making, greater volumes of artificial snow will be required, beyond the levels currently being produced at resorts in the region. Therefore, water consumption for snow making will likely only increase in future. In consultation with Snowy Mountains SAP stakeholders, some stakeholders have expressed interest in considering the use of recycled water for snowmaking.

Like the assessment for the viability of a recycled water system using effluent from Jindabyne STP, the below assessment also includes considerations regarding the regulatory framework for planning and approving such as a system as well as its overall feasibility and water quality requirements.

WATER RECYCLE GUIDELINES

Since the Perisher and Thredbo STP's are privately owned systems (they are owned and operated by non-council entities), the approval of a recycled treatment scheme downstream of these plants would be regulated under the Water Industry Competition Act (WICA) and not under DPIE like council owned systems. Whereas the details regarding licencing (mostly notably the organisation that will licence the system) will change under these two scenarios, the process by which a proponent is to plan for a recycled water system with regarding to planning the infrastructure itself remains the same. WICA, which falls under regulation by the Independent Pricing and Regulatory Tribunal (IPART), requires that a risk framework is used, such as the one in the AGWR which is explained in the discussion regarding recycled water from Jindabyne STP above.

Prior to planning and implementing a recycled water system either at the Perisher STP or Thredbo STP, NPWS would have to undertake a health-based target assessment. The complicated factor in doing such an assessment in this instance is that snow making is not a common recycled water use in Australia and is not one of the defined end uses listed in the AGWR. In other words, ascertaining the LRV associated with this end use would require some additional work and likely some consultation with the scheme regulator (IPART) and other key stakeholders such as NSW Health and EPA. For this reason, an indicative HBT assessment has not been completed in this report. What is important to note, however, is that the treatment capability of the plants would have to be highly reliable and consistent if the recycled water is to be used for snow making as there are no end use management controls that could be applied in this scenario. Skiers would have direct contact with the snow and therefore the water used would have to be of a high-quality water, likely requiring tertiary treatment. Moreover, due to the nature of the proposed use, the treatment process is likely to required higher level of redundancy for key systems to ensure the likelihood of pathogen breach through the system is minimised.

The lack of a streamlined approach for implementing a recycled water system for snow making should not deter proponents from further investigating the feasibility of a such a scheme. There are two known examples of recycled water schemes used for snow making in Australia. Both are in Victoria and include the system at Mt Buller and Mount Hotham. There is an opportunity to learn from the planning process used to plan and implement these two systems; however, it should be noted that based on this proposed use, the proponent of a recycle water scheme used for snow making would have to provide evidence of detailed verification, validation and monitoring requirements and that these would have to be negotiated with the EPA and NSW Health. Also, the lead time for commissioning and using such a system is likely to be long to ensure adequacy of treatment (through ongoing monitoring and validation) before enabling the water to be used for snow making. While such a scheme is possible and has been implemented in Australia, the level of investment required (capital, operational and maintenance) is likely to exceed that needed for a recycled water scheme for alternate uses such as crop irrigation. There is a possibility that requirements like those for direct potable reuse would apply.

FEASIBILITY OF A RECYCLE WATER SYSTEM FOR SNOW MAKING AT PERISHER STP AND THREDBO STP

As summarised in the Climate Change Impact Report, the data reviewed for volumes of water used in snow making is quite variable and needs to be confirmed. This is important to note as it can skew the assessment summarised below. Nonetheless, for the purpose of this report, Table 6.7 summarises the amounts of water used for snow making at the two largest ski resorts, per two different sets of data.

Table 6.7 Annual water usage for snow making

SYSTEM NAME	ANNUAL AVERAGE WATER USAGE FOR SNOW MAKING RECORDED BY DPIE (2016–2019) (ML/A)	ESTIMATED WATER USAGE FOR SNOW MAKING, PROVIDED BY ALPINE RESORT (ML/A)
Perisher Area Total	450	790[1]
Thredbo Area Total	250	290[2]
Grand Total	700	1080

(1) Indicative annual water usage for snowmaking provided by Perisher alpine resort for a typical year (Perisher Resort, pers. comm. 20 August)

(2) Annual average water usage for snowmaking provided by Thredbo alpine resorts for financial years 2017/2018 and 2018/2019 (Thredbo Resort, pers. comm. 16 August 2020).

Since the ski season is typically from June to October at these resorts, the amount of water used for snow making has been compared to a daily use for this duration of years, resulting in the flowrates summarised in Table 6.8. Compared against the maximum production rates for the existing Perisher STP and Thredbo STP as presented in the table below, the volumes of water used to make snow that could be offset by recycle water streams are not insignificant. Again, this type of assessment would have to be confirmed with vetted numbers as the reliability of the data provided is unclear (the ranges of water volumes are quite variable).

Table 6.8 Daily water usage for snow making

SYSTEM NAME	ANNUAL AVERAGE WATER USAGE FOR SNOW MAKING RECORDED BY DPIE (2016–2019) (ML/d)	ESTIMATED WATER USAGE FOR SNOW MAKING, PROVIDED BY ALPINE RESORT (ML/d)	RELATED STP CAPACITY/ MAXIMUM AVAILABLE WATER FOR REUSE (ML/d)	PERCENTAGE OF WATER CURRENTLY USED FOR SNOW MAKING OFFSET BY RECYCLE WATER STREAM	PERCENTAGE OF WATER CURRENTLY USED FOR SNOW MAKING OFFSET BY RECYCLE WATER STREAM
Perisher Area Total	3.0	5.2	2.0	68%	38%
Thredbo Area Total	1.6	1.9	1.6	98%	84%

Based on assessing the extent to which a recycled water stream could offset existing potable water use for snow making, there appears to be a significant benefit. That said, there would be a need for a significant amount of piped infrastructure to accommodate such a system. While the rates provided in Table 6.7 and Table 6.8 have been totalised by resort area to simplify the assessment, there are several snow making areas within both the Perisher and Thredbo areas (3 and 2, respectively). In other words, infrastructure would have to be implemented to supply the recycled water to the various areas. A detailed investigation outlining the amount of piped infrastructure would be required to understand the cost impact for such a scheme.

The systems' governance is also an important factor to investigate, which will require more detailed consultation with the entities that operate the systems as they are the owners and operators of the existing STP's in question and would therefore have to support such a plan and fund the infrastructure required to implement the reuse scheme for snow making.

6.1.4 STORMWATER INFRASTRUCTURE

6.1.4.1 JINDABYNE

Increased developed land and population will result in an increase of stormwater runoff into Lake Jindabyne. While the Lake has enough storage to absorb the stormwater runoff and not be affected by sediment and nutrient laden runoff, there is still potential for poor stormwater practices to affect the aesthetics of Lake Jindabyne. Future development needs to manage stormwater runoff to ensure all surface water that reach the lake is clean such that it enhances uses of the lake for fishing, water sports and recreational uses on the foreshore.

The Department of Planning, Industry and Environment has put together a series of aspirations for the Snowy Mountains SAP. The following are relevant to flooding and water quality, and recommendations in Jindabyne have been proposed to align with these aspirations:

SUSTAINABILITY AND WELLNESS – THROUGH GREEN INFRASTRUCTURE

Future development needs to consider the entire water cycle through minimising hard surfaces and encouraging stormwater runoff to infiltrate and be treated through Water Sensitive Urban Design (WSUD) measures that mimic the natural filtration and storage processes of the hydrologic cycle. This may include:

- planting of vegetation adjacent to new roads and footpath such as garden beds and small shrubs. Increased planting assists in water pollution capture of run off, and minimises velocities of minor flood events to prevent scouring of water ways and reduce the volume of water the flood zones from a large influx to a gradual increase over time
- using open grass channels in areas instead of pit and pipe networks. The channels benefit from increased vegetation as mentioned above, and also minimise the construction impact on environment and reduce capital cost.

DESIGN AND CULTURE – LAKE JINDABYNE AND ITS WATERFRONT

Ensure future development of the waterfront considers stormwater runoff and overland flow path connections to the Lake. Poor stormwater quality draining into the Lake will detract from use of the area around the stormwater connections and mismanaged overland flow paths may erode land at the foreshore reducing use of the land. The varying Lake levels will also need to be considered when designing waterfront amenities. Proposed infrastructure to accommodate these design principles include:

- construction of appropriate new stormwater pit and pipe networks are the location of lakeside developments with outfalls to the lake. Locations and extend of new buildings and other developments will be determined at the enquiry by design workshops
- construct floating wetlands. Floating wetlands consist of rafts of vegetation that float on the surface of the water and the roots grow into the water and absorb nutrients and other dissolved substances thus removing them from the water. These could be considered as a treatment solution at stormwater outlets from the urban areas around Lake Jindabyne which the advantage that they can rise and fall as the Lake changes levels and potentially move horizontally to account for the change in the Lake edge.

INFRASTRUCTURE AND CONNECTIONS – ACCESSIBILITY

Ensure future transport networks are designed to meet future rainfall climate conditions, consider at source treatment of stormwater and design the transport networks to be free from regular flooding and the risk understood for extreme flood events. Proposed infrastructure to accommodate these design principles include:

- stormwater capture for new developments and households. Council has the opportunity upon reviewing development applications, to do with the Snowy Mountains SAP or otherwise, to promote and require an applicable amount of onsite water retention and recycling
- appropriate stormwater pits and pipes to capture increase run off from new road areas. It is noted that the location of the southern connector route that bypasses Jindabyne falls away approximately 40 meters in each direction towards creeks at the North and South connection point to Kosciuszko Road. The southern part of the route also runs along the existing Lee Creek location. Due to the topography of the land, this part of the route will act as a natural flow route for water, and as such require appropriate pipe sizing to replace the existing creek.

During construction of the Southern Connector Route, temporary basins will be necessary at both ends of the site for water capture and quality management prior to discharge to water ways, and for the re-use of dust suppression on site. It is proposed that these temporary basins be transitioned to permanent that collect water in rain events and facilitate the slow release of water to the water ways and Jindabyne Lake.

The below image shows a high-level stormwater strategy for the Southern Connector Route.

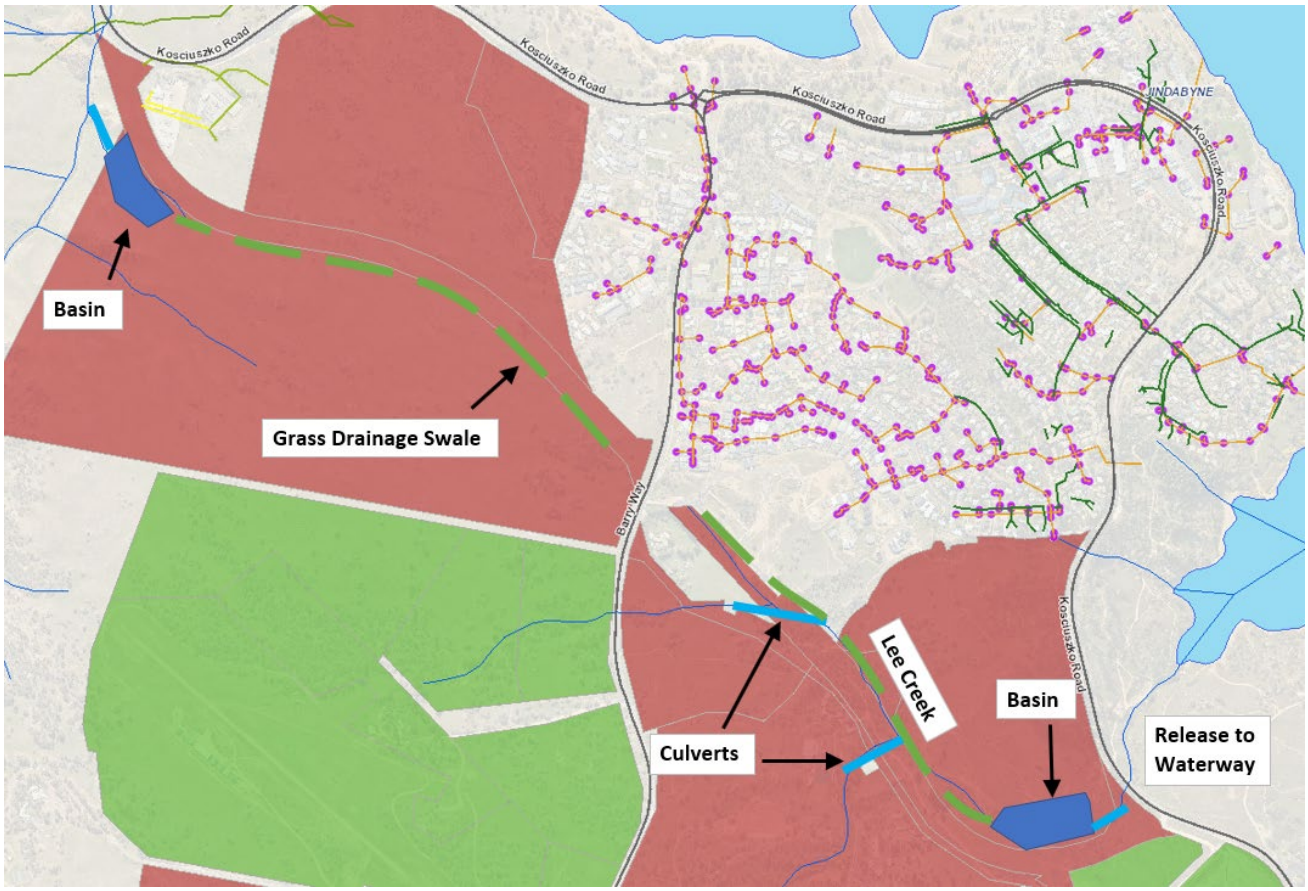


Figure 6.11 Southern connector route

6.1.4.2 ALPINE RESORTS

The below proposals are considered appropriate to accommodate existing concerns within the national park:

- sealing of internal roads within and between the alpine resorts. There is a current program to seal internal roads with concrete to reduce erosion of the roads, reduce sediment deposits into the stormwater streams and improve water quality. Concrete is considered the better material compared with asphalt as it withstands snow clearing operations better. It is proposed to review this program to accommodate infrastructure plans and funding where required
- review locations in the resorts where the road does not have a kerb and gutter against high overland flow areas. It is proposed to develop a program that develops the construction of kerb and gutter on these roads to direct flows into the existing stormwater catchment system, reduce land erosion and sediment infiltration into water ways. Where required, additional stormwater pits and pipes are proposed to capture overland flows and direct it into water ways or existing pipe networks.

6.1.5 OPPORTUNITIES FOR PRIVATISATION OF WASTEWATER TREATMENT FACILITIES

The privatization of wastewater treatment facilities has been increasing over the past several decades. A primary driver behind this is public pressure on local governments to reduce spending, but also the present opportunity for private investment to drive innovation in process and technology.

Advocates of privatization maintain that financial and operational concerns will be alleviated with a move to private investment and operation. This approach is desirable where several similar systems can be combined under a single contract to achieve consistent performance outcomes. It is also beneficial for small systems where the resort/asset owner may not have the personnel to manage these systems effectively. Additional pros typically include:

Cost Efficiency – Private industry is widely perceived as more cost conscious than government organisations. For example, companies that own and operates a series of wastewater treatment facilities have higher buying power for supplies and resources, as supply chain negotiations include several facilities. Furthermore, engineering resources that may be only partially used at one facility, may be able to be amortized across multiple facilities.

Best Practices – A company with an engineering group operating and maintain multiple facilities will identify best practices that can be scaled across multiple sites. A factor of business growth is to innovate, and it could be argued that businesses would operate in the most efficient manner to increase profitability and drive technological development.

Some companies that currently own and operate waste treatment plants include:

- Triloty. Triloty are an Australian company that provide a range of services including design and construction, asset management operations and management and other consulting services for water and wastewater infrastructure.
- UGL offer similar services to those listed above. UGL are a much larger company, spanning Australia, New Zealand and Asia and is and owned by parent company CIMIC Group.

The Snowy Mountains SAP study area already contains a number of private wastewater treatment facilities and experience of actual performance and level of record-keeping for these systems is varied and in some cases poor (as evident from the limited information available for this study). Any future private systems need to be established and managed with robust controls in place to ensure a high standard of performance monitoring and reporting to avoid future issues.

6.2 ELECTRICITY AND GAS SUPPLY

6.2.1 ELECTRICITY INFRASTRUCTURE

Planning and growth scenarios for the Snowy Mountains structure plans were developed by Jensen Plus (master planning consultant). The Snowy Mountains SAP Strategic Master Plan represented the proposed growth areas to align with inputs of the stakeholders. The growth numbers and areas of development are included in the final Structure Plan, Appendix A.

The final strategic plan and detailed network study of the Essential Energy system will be required to validate the proposals in this report and identify additional upgrade requirements.

6.2.1.1 SUBSTATION UPGRADES

The below table summarises the capacity upgrades required for the existing substations to support the proposed growth areas under the new structure plan.

Table 6.9 Summary of substation upgrades required

SUBSTATION	AVAILABLE CAPACITY (MVA)	ADDITIONAL DEMAND (MVA)	UPGRADES REQUIRED TO SUPPORT STRUCTURE PLAN GROWTH
Jindabyne East	15.4	7.83	No upgrades required
Jindabyne	59.9	106.08	51 MVA
Thredbo	17.7	21.98	5 MVA
Perisher	8.7	14.09	6 MVA
Snowy Adit	9.9	1.20	No upgrades required
Bullocks Flat	5.3	2.37	No upgrades required

JINDABYNE EAST SUBSTATION

The demand calculations for the growth areas in East Jindabyne has identified that additional 7.83 MVA is required to service future developments within the area.

Connection to the new development areas could be made off the existing 11 kV feeders, however capacity in these feeders in unknown and so it is likely that a new feeder will be required to supplement the area.

The current capacity of the substation is 15.4 MVA, and as such will not require an upgrade as the power demand forecast for this area is well within the current capacity of the substation. It is therefore recommended that only 11 kVfeeder reticulations to development areas will be required.

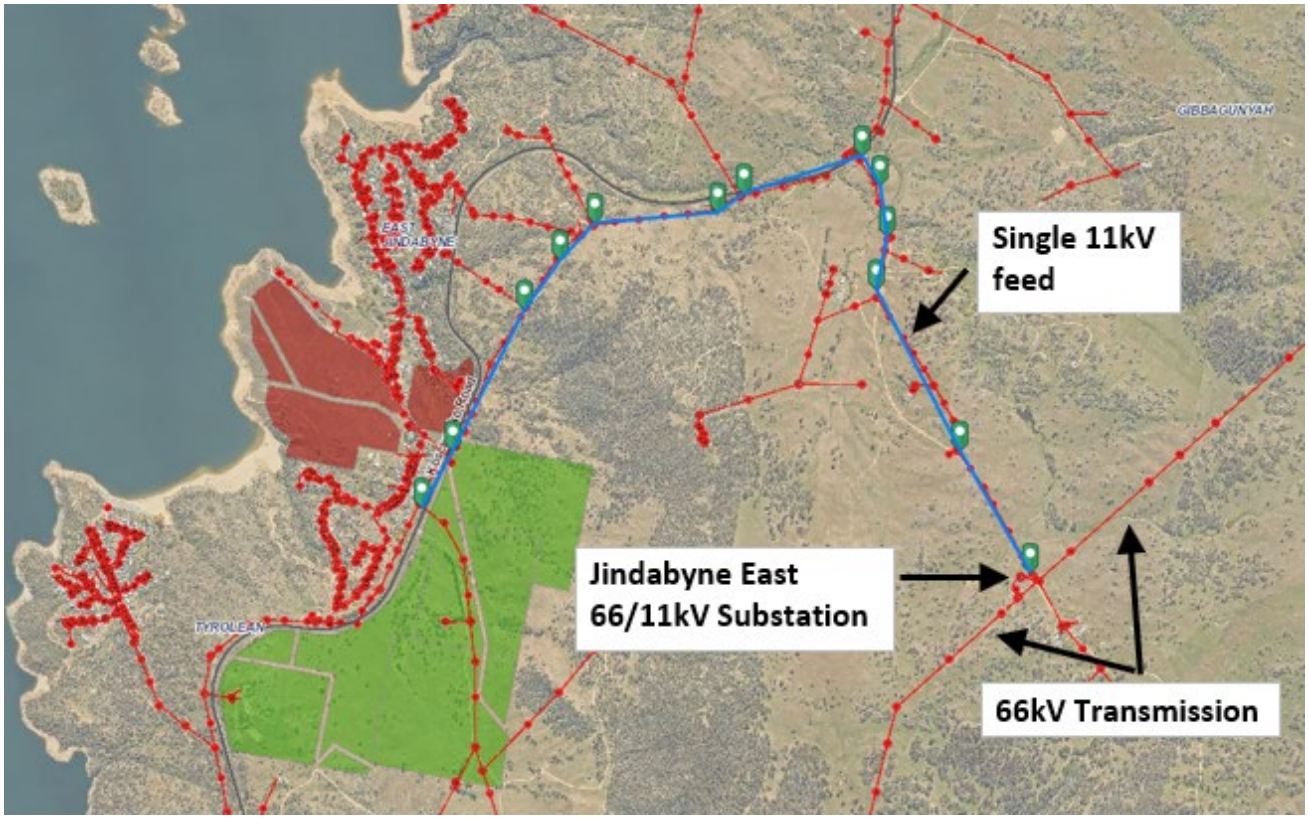


Figure 6.12 Power supply to East Jindabyne

It is noted that the additional 7.83 MVA for Jindabyne East is fed from the 66 kV transmission lines from Cooma substation, and Jindabyne substation. These lines are not radial feeders and so power supply from each substation will vary with demand and capacity in the system. To better understand the network, a detailed analysis needs to be conducted to understand the following:

- current power flow direction in transmission lines
- technical parameters of the feeders including cable type, size age
- cable resistance
- detailed review of existing network capacity against final Snowy Mountains SAP demands.

There is the potential that the additional demands in the Snowy Mountains SAP area will require an upgrade of the existing 66 kV feeder from Cooma to accommodate a higher carrying capacity conductor or duplicate the conductor. This conductor (overhead cable) could either be installed on the existing towers or on new towers. The final development proposals, load requirements and detailed analysis of the existing system is required to determine if this work is required.

JINDABYNE SUBSTATION – SUPPLYING SOUTH, CENTRAL, WEST LAKE JINDABYNE ,TOWN CENTRE, CREEL BAY AND LEESVILLE INDUSTRY

The demand calculations for the growth areas in under Jindabyne considered that 106.08 MVA is required to service the new residential (greenfield and inner suburban fill), town centre developments, and industrial growth in Leesville. The current available capacity of Jindabyne substation is at 59.90 MVA and therefore is deemed insufficient to cater the new growth areas under the Snowy Mountains SAP structure plan. To accommodate this, the below network upgrades will be required:

- New 11 kV feeders from the existing distribution system to the locations of proposed growth areas. New reticulation will likely be required as the capacity of these distribution feeders are unknown at this stage.
- With the new demand requirements, the Jindabyne substation will be at 100% capacity and so additional 60 MVA capacity transformer upgrade will be required to enable spare capacity in the system.
- Relocation of two existing 11 kV overhead lines will be required to accommodate construction of the new Southern Connector Route (this will need to be investigated further as the design of the road develops).

As there is already a distribution network in Jindabyne, it is likely that the required reticulation will mostly from the existing networks to the new development areas. The capacity of these existing feeder needs to be verified by Essential Energy as the design progresses. If there is insufficient capacity in this 11 kV line, then a new feeder will be required.

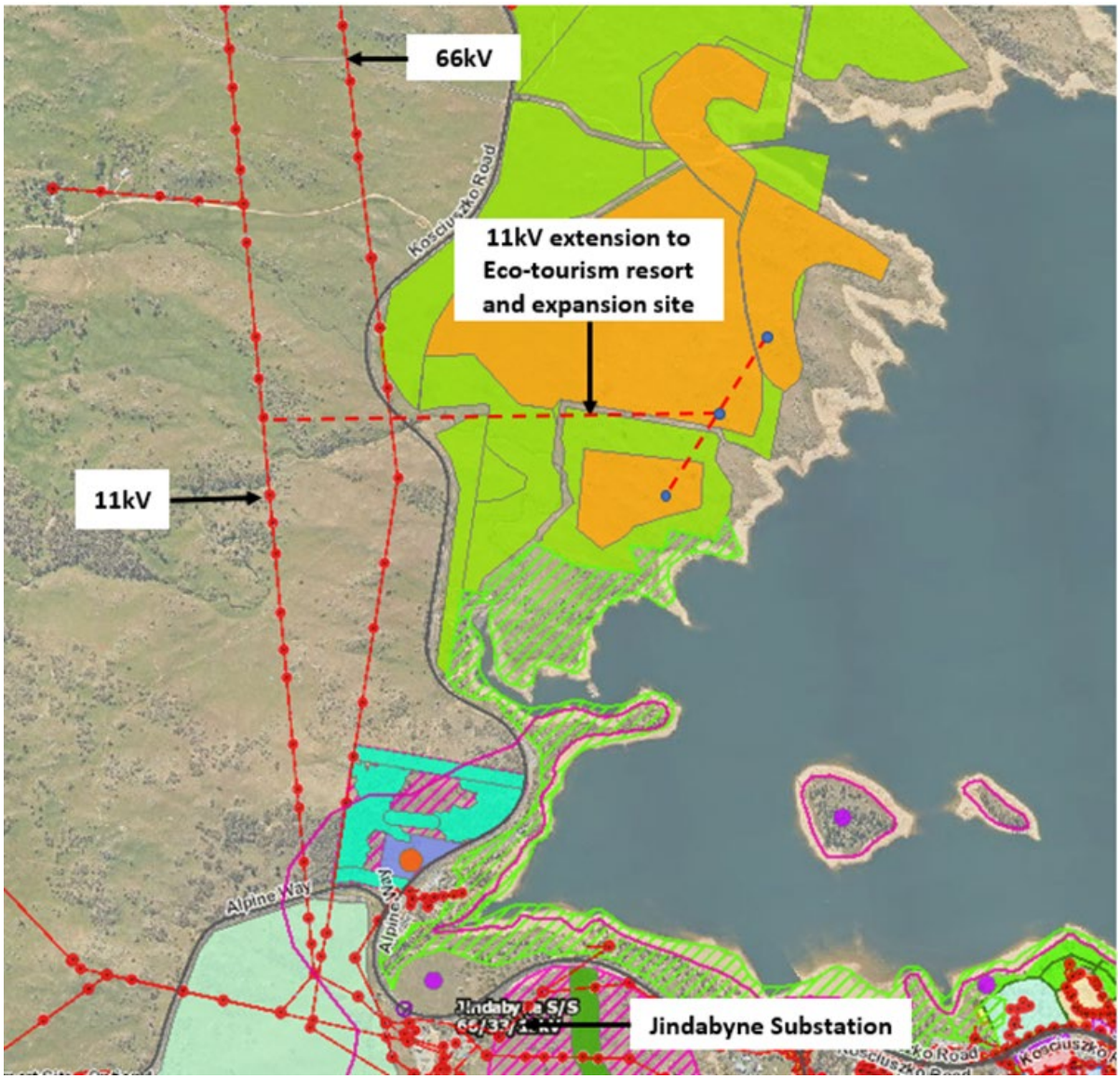


Figure 6.13 Power supply to West Jindabyne

THREDBO SUBSTATION

New developments in Charlotte Pass and Thredbo Village are expected to grow as noted in the Snowy Mountains SAP structure plan yield analysis supplied by Jensen Plus. The existing substation at Thredbo currently has 17.7 MVA spare capacity while demand calculations considered that an additional 21.98 MVA is required to service future developments within the area. Therefore, a 5 MVA capacity upgrade to the distribution transformer is required to cater the growth areas.

New 11 kV reticulation will likely be required to the new growth areas as the capacity of these distribution feeders are unknown at this stage.

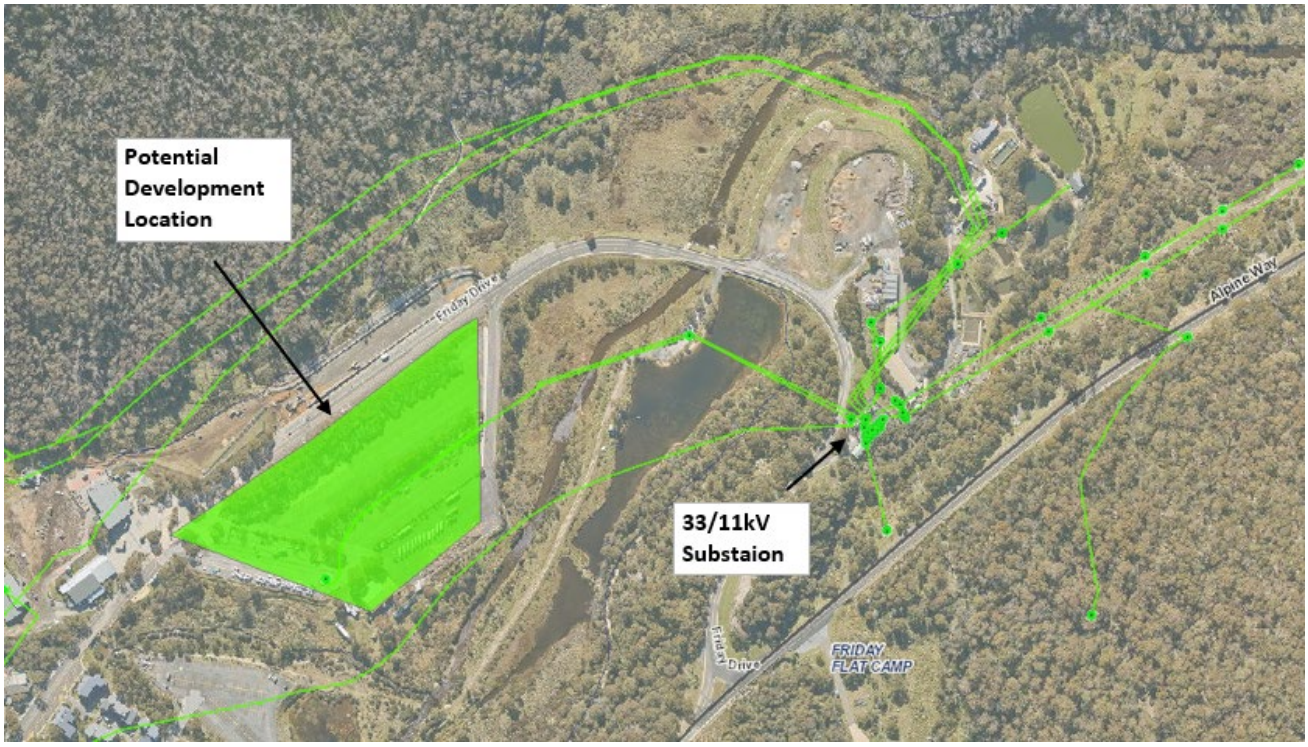


Figure 6.14 Thredbo electrical proposals

6.2.1.2 PERISHER

Visitation numbers in Perisher and Smiggin Holes Resort is expected to significantly grow as noted in the Snowy Mountains SAP structure plan yield analysis supplied by Jensen Plus. The demand calculations considered that and additional 14.09 MVA is required to service future developments within the area.

The current capacity of the substation is 8.70 MVA, and as such will require an upgrade to accommodate the additional demand. Upgrades to the system include:

- additional 6 MVA transformer. Note, the existing substation is underground within a rock structure. The expansion of this substation to accommodate a new transformer will require additional space at this location
- potential new 11 kV feeders to the development site of the car park in Perisher. It may be possible to connect power to this development from the existing network in this area, however capacity in the 11 kV feeder will need to be confirmed by Essential Energy. Similarly, 11 kV feeders are already available within the Smiggin Holes Resort area and as such, it may be possible to connect power to these locations from the proposed growth areas
- the existing switchgear in the substation requires replacement by September 2022 as it reaches the end of its economic life.

Capacity in the feeder to the substation has been reviewed and no upgrade of the feeder will be required to service the additional load.

It is noted that the SCADA, Network Control and Protection Systems replacement is required by June 2024 due to asset age and asset failure. This has been communicated by Perisher resort.

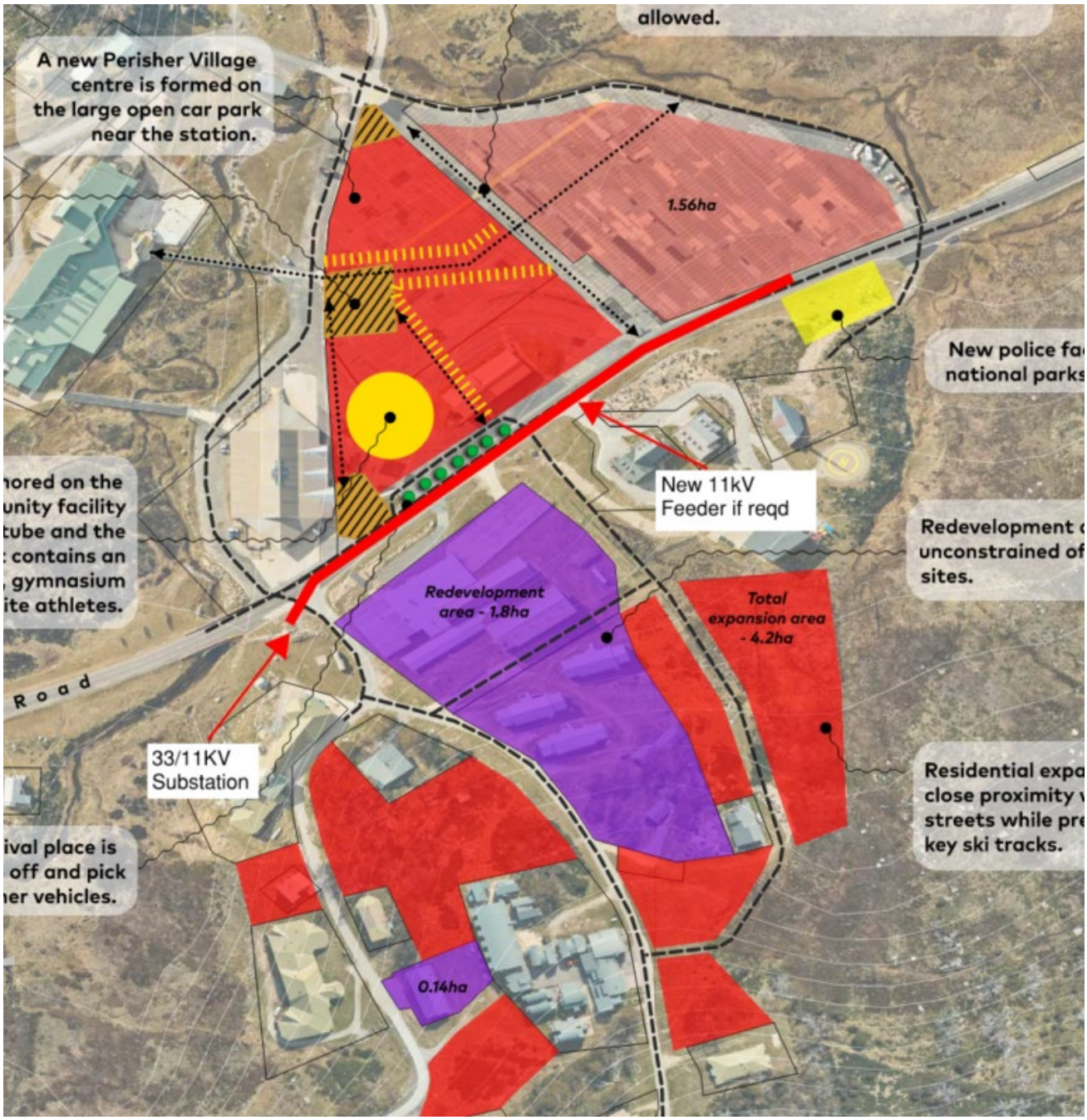


Figure 6.15 Perisher electrical proposals

SNOWY ADIT SUBSTATION

The demand calculations for the Snowy Adit substation includes the re-development areas under Sponars Chalet, Kosi Tourist Park and Island Bend. It has been identified that additional 1.20 MVA is required to support the future developments in the area.

The current available capacity of Snowy Adit substation is 9.90 MVA which is enough cater the new growth areas under the Snowy Mountains SAP structure plan. Therefore, no upgrade is required in the substation.

BULLOCKS FLAT SUBSTATION

There is a forecasted residential growth in the Bullocks Flat as noted in the Snowy Mountains SAP structure plan yield analysis supplied by Jensen Plus. This growth has been assessed and has identified that an additional 2.37 MVA is required to service future developments in the area. The current available capacity of Bullocks Flat substation is 5.30 MVA which is well within the future demand. Based on this information, it is recommended that there is no upgrade required for Bullock Flat substation.

6.2.1.3 OTHER/NETWORKS

Details on the condition and remaining life of the existing electrical reticulation infrastructure are unknown. The asset owner, Essential Energy, is responsible for operating and maintaining the upgrade of existing infrastructure to ensure it continues to meet its service requirements. It is not proposed that the Snowy Mountains SAP project provide input to the upgrade of assets under poor condition or at the end of their life, as this process is typical of the asset owners.

It is noted that the existing capacity in the distribution and reticulation networks are unknown. A detailed network study and connection process through Essential Energy is required to completely understand the existing demand circumstances on the distributions and reticulation networks (11 kV and LV). Upgrades to buildings and properties in the centre of Jindabyne and areas that are already serviced with power, may require the further upgrade of feeders to that area, and the installation of local pad mount substations. These requirements will not be known until specific developments are proposed and applications to connect are made through Essential Energy.

6.2.2 GAS INFRASTRUCTURE

As stated previously, the gas supply can be scaled up or down with minimal changes to the network. There are currently no planned upgrades for the area.

It is not economically feasible to create any large networks or to connect to the nearest natural gas supply.

Table 6.10 Gas infrastructure considerations for potential Snowy Mountains SAP developments

GAS INFRASTRUCTURE	STRENGTH	WEAKNESS	OPPORTUNITY	CONSTRAINTS
Hydrogen Blend	The water consumption of the largest electrolyser is less than 1% of the forecast demand of Jindabyne and is therefore a relatively small component of the overall water consumption of the town.	Relatively small amounts of hydrogen (10–15% by volume) can be added to natural gas. A complete displacement of natural gas with hydrogen would require an upgrade of the existing appliances because of the different energy content and other characteristics.	The renewable technical report identifies the opportunity to generate hydrogen using the excess power generated from Jindabyne town's distribution Solar PV generation. The investigation explores 3 sizes of hydrogen plants that have the potential hydrogen production of 162–1079 kg/day. Potential uses of this hydrogen include Hydrogen powered vehicles and blending hydrogen with natural gas.	As there is no large gas distribution network within or near the Snowy Mountains SAP the blended gas would likely be distributed in gas cylinders via truck to the resorts and residential areas.

GAS INFRASTRUCTURE	STRENGTH	WEAKNESS	OPPORTUNITY	CONSTRAINTS
Connection to Jemena HPGTP's (Eastern Gas Pipeline)	No expected source upgrade is required to support the Snowy Mountains SAP demands.	The nearest gas line is approx. 65 km from Jindabyne. A City Gate, which is a substation that distributes gas from the high-pressure gas main to the distribution network, will be required.	Establish connection between Eastern Gas Pipeline and Hydrogen Plant would provide a large supply to blend hydrogen. Construction of the gas pipeline is assumed at $1,500 a meter.	Typically, the provision of gas infrastructure is not based on future demand analysis rather on a requirement basis, therefore there may be a reluctance from the service provider to invest in gas distribution infrastructure until development and customers are in place.

6.3 TELECOMMUNICATIONS AND INTERNET SERVICES

6.3.1 TELECOMMUNICATIONS INFRASTRUCTURE

An increase in demand for data and call services in the Snowy Mountains SAP Study area will place additional loading on the existing mobile communications infrastructure in and around Snowy Mountains SAP Study area. Generally, it will fall to the individual telecommunication carriers to accommodate an increased demand for services by either upgrading existing facilities or by building new base stations should they be required. This is typically a reactive process on the carrier's behalf, with increased demand being placed on facilities triggering a process of either upgrade or infill to accommodate the new load. The upgrading of existing facilities in the area would depend on a range of factors including tenure, structural capacity, coverage objective of a carrier and the level of demand being placed on the network at the time.

CURRENT PLANNED UPGRADES:

NBN – NBN are currently extending fixed line broadband from Jindabyne to service northern area of Moonbah rural residential area. NBN have confirmed that that they have no current plans to extend services up to the Alpine resorts.

Telstra – There is a small cell planned to be installed south of the Snowy Mountains SAP Study area at Moonbah, Mountain View Road. This is not expected to improve any connectivity within the Snowy Mountains SAP Study area.

Regional Digital Connectivity Program – Leveraging digital connectivity program will be investigated during the progression of this report.

For condensed developments and existing areas with high user density 5G technologies would be suitable to improve speed and reliability. Radio waves proposed for 5G are highly impacted by Water droplets (Fog, Rain and Snow), urban furniture and trees, it also will have difficulty to penetrate building. Therefore, for majority of the Snowy Mountains SAP area a fibre connection will provide the most suitable connectivity source.

6.3.1.1 JINDABYNE

Through the Gig State Program, a backhaul can be funded and provide improved internet speed and reliability. Based on discussion with regional growth and development the initial POC Gig State Program is unlikely to provide connection in the current project stage, however the final (based on early stages) proposed statewide Gig State rollout area would assist in providing a backhaul connectivity to the Snowy Mountains SAP investigation area.

EAST JINDABYNE

There are Telstra backbones installed along Kosciuszko Road that could be used as a connection point and extend to provide internal reticular within the development. During the early stages of the development planning a telecommunication company to access connection and design any internal reticulation, typical all communications infrastructure is to be installed within road corridor. Allow a minimum of six months' notice before service connections are required.

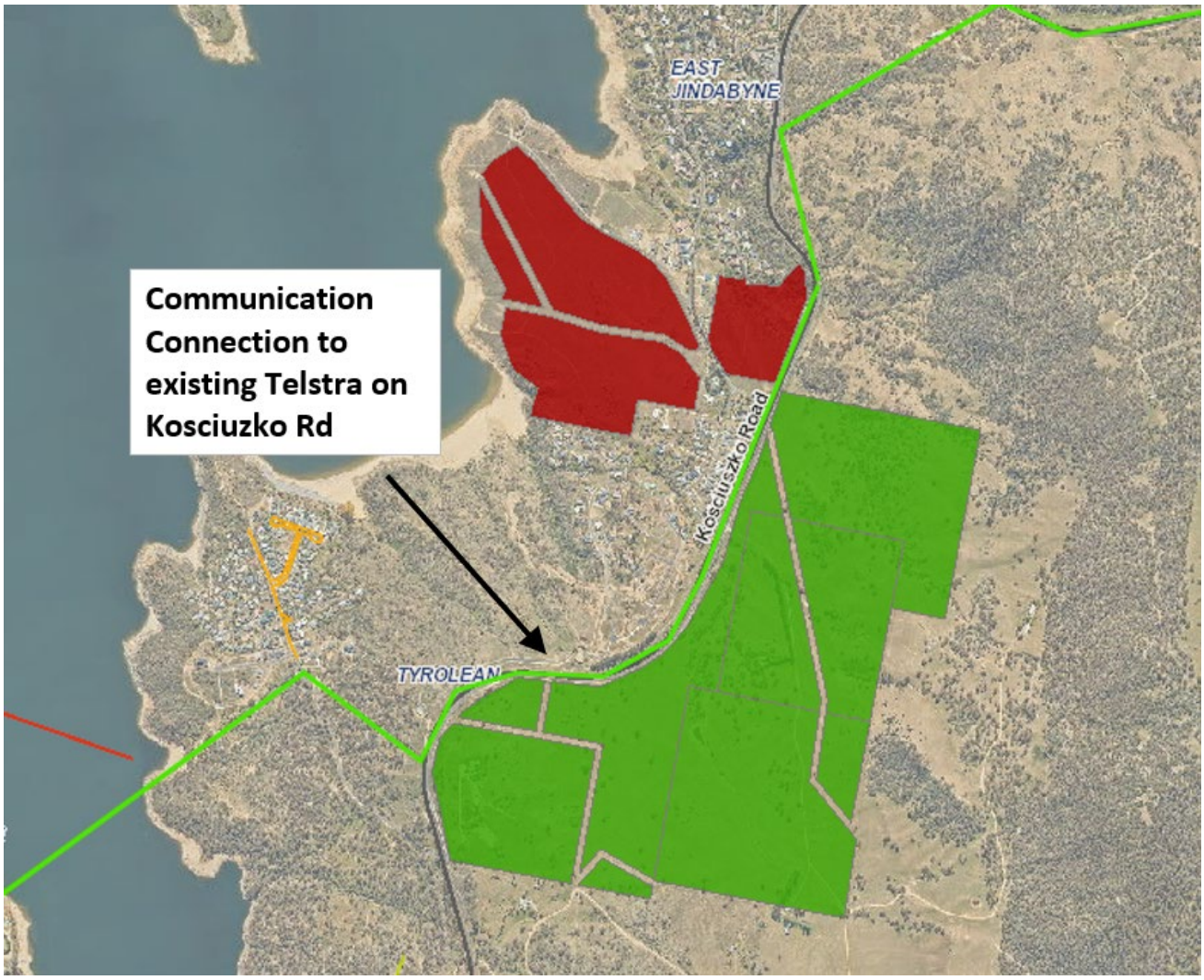


Figure 6.16 Telecommunication connection in East Jindabyne

WEST JINDABYNE

To services the future developments along the West Jindabyne it is proposed, in Figure 6.17, to install a new service connection to the telecommunication exchange in Jindabyne. The construction of this fibre connection should be completed in conjunction with other utilities connection, such as water, and road improvement works wherever possible to reduce delays and cost.

There is an option to connect to the existing network in green at the top of the hill West of the development area. Telstra are required to confirm capacity in this conduit and advise if this is feasible. The worst-case project for a lead in fibre is shown in Figure 6.17.

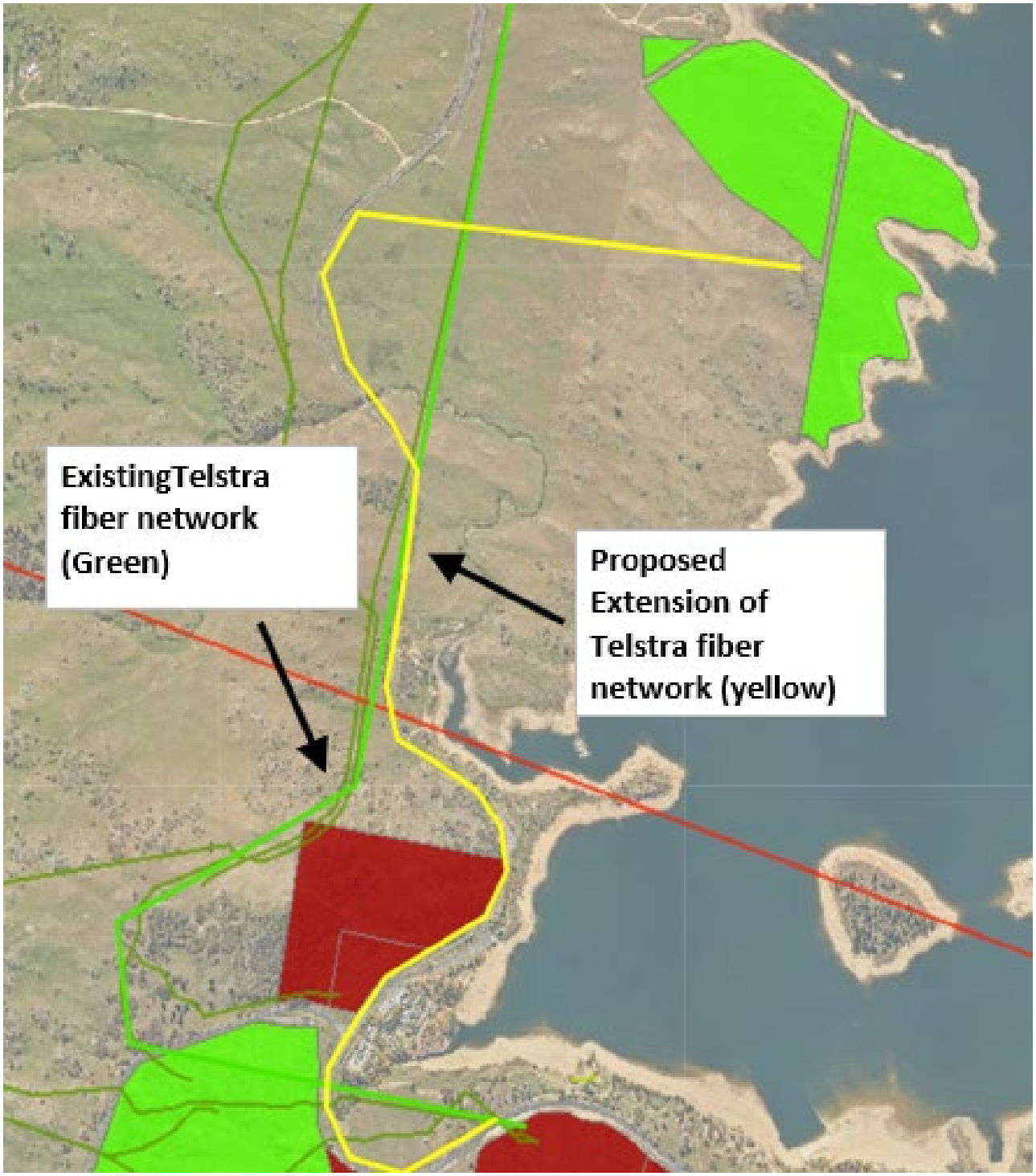


Figure 6.17 Telecommunication connection in West Jindabyne

SOUTH/CENTRAL JINDABYNE

There are NBN and Telstra backbones installed along Barry Way and Alpine way that could be used as a connection point to install internal reticular within the development. During the early stages of the development planning a telecommunication company to access connection and design any internal reticulation, typical all communications infrastructure is to be installed within road corridor. Allow a minimum of six months' notice before service connections are required.

6.3.1.2 THREDBO

Thredbo Village have no plans or current requirements to expand or extend their service. Proposed developments as part of the Master Plan would require connection to the existing service in Thredbo, and minor extensions of the network at the village would be required to achieve connectivity.

6.3.1.3 PERISHER

There are currently no plans or requirements to expand the service in Perisher. Proposed developments part of the Master Plan would require connection to the existing service in Perisher, and minor extensions of the network at the village would be required to achieve connectivity.

6.3.1.4 RESORTS ALONG KOSCIUSZKO ROAD

Fibre cables from Jindabyne along Kosciuszko Road create connectivity points for resorts, businesses and residents. Existing Telstra DBYD show a fibre connection from Jindabyne to Ski Riders where there is a Pair Gain System (PGS). There are redundant copper cables that continue to Sponars Chalet, however from consultation with the owners of the resort, they are not connected. For Sponars Chalet to achieve connectivity, an application should be made through Telstra for extension of their cabling through the existing conduit network which terminates just past the property.

6.3.1.5 LAZAR TELECOMMUNICATIONS – TRANSCELESTIAL

WSP attended a meeting with Transcelestial Technologies to understand their product offering and potential benefits to the Snowy Mountains SAP developments. The start-up produces high bandwidth, wireless laser communication devices for telecommunication transmittal. After connection is made to an existing fibre connection, the device transmits telecommunication signals to another, which enables internet connectivity of hard to reach places as an alternative to cable connection.

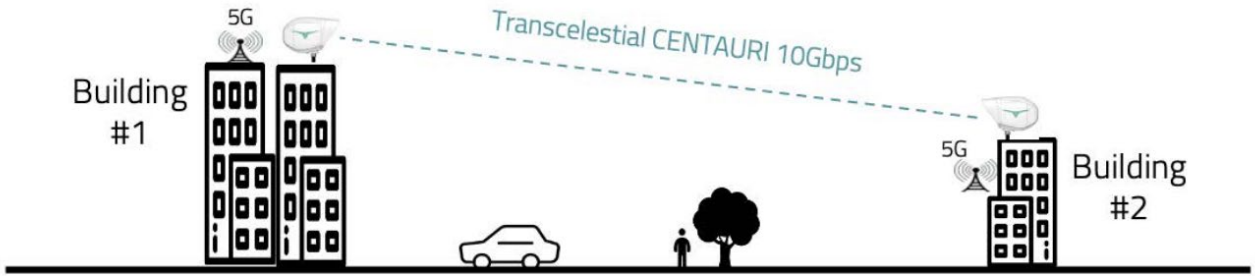


Figure 6.18 Transcelestial connectivity diagram

WSP have completed the below analysis of the product for further review and discuss at the Enquiry by Design Workshops.

Table 6.11 Transcelestial SWOC analysis

STRENGTH	WEAKNESS	OPPORTUNITY	CONSTRAINTS
Transfers internet connection over large distances without the need for conduits or cables, saving on capital cost of internet connectivity.	Connectivity requires direct line of site between devices. Multiple devices needed to patch signal between to Alpine regions.	Potential to provide connectivity from fibre connections in the road reserve, to large residences along roadways. E.g. Internet connectivity of the Eco-resort on the West side of Jindabyne Lake could be provided with this device.	This product is not yet operational in Australia. Trial versions are taking place in the Northern Territory.
Converts fibre connection, to laser signal, then to a wireless signal at the receiving end which can be used for public WiFi or for connection of a residence.	Connectivity may be impeded by poor weather, including snow and heavy rainfall.	Provision of internet connectivity to regional sites, such as camping spots, nature reserves or cafes located away from existing services.	The device would need to be reviewed from a security standpoint, and ensure it meet Australian regulation as an approved product.
Devices can be powered from a solar cell if placed in regional areas.	The receival device cannot convert signal back to a fibre connection, only to a wireless connection. The device would be beneficial for public WiFi, but not specifically for patching length between two fibre connections.	Extension of the public WiFi system proposed in the town centre to the areas of Kalkite or East Jindabyne.	The product is non-standard and ongoing maintenance would be restricted as the business is in the start-up phase in Australia.
The units can be monitored remotely to measure productivity.	The product only has a 10 yr lifespan, and at risk of damage from weather events or theft within this period.	The devices can transmit to a mobile device like a car or temporary platform. This could be utilised for public WiFi at events or festivals.	Ownership of the device and the internet connection from the supply point is private. Ownership, maintenance and operational cost need to be determined. Transcelestial provide the product and ongoing technical support of the device, but do not own the service or operation of the internet.

6.3.2 SMART INFRASTRUCTURE OPPORTUNITIES

Developing Jindabyne carries the opportunity to integrate smart technology in line with the NSW Government Smart Places Strategy. Embedded smart technology helps to capture information on the asset itself, or local environment. The data is analysed to help people and governments to make better, evidence-based decisions about how to improve the productivity, liveability and resilience of cities, towns and communities.

When developing and operating infrastructure with connectivity, it is important to also understand and apply implementation that is aligned with government policy. The NSW Government Smart Infrastructure Policy establishes the minimum requirements for smart technology to be embedded in all new and upgraded infrastructure. It is a foundational element of the Smart Places Strategy as it ensures the NSW Government can plan, design, build and operate connected communities that:

- are better placed to meet growing demand due to population growth (i.e. increased capacity and minimising service failure)
- produce, analyse and securely share infrastructure data to improve liveability, productivity and sustainability
- get the best return on the Government's infrastructure commitment.

The policy covers requirements including: Cyber Security, Privacy, Data and Intelligence, Application and Hosting, Connectivity and Sensors. All the requirements combined play a role in interoperability and the development of Smart Infrastructure.

6.3.2.1 PUBLIC WIFI

As Jindabyne focuses on tourism and increased permanent population, personal connectivity will be essential to provide the level of experience desired by tourists in their day-to-day activities. A community WiFi system provides the below strengths and opportunities:

- free connectivity for tourists and day-trippers in town
- provides instant information to tourists about the region, connecting them to experiences
- provides means of data collection for the council to better understand tourism movements, demands, how often they visit and where they go.

Some means of providing public WiFi include:

1. Easyweb Digital. Easyweb Digital are an Australian, Melbourne based company that provide community WiFi servicers by designing, commissioning and maintaining community WIFI systems. Easyweb are a licensed internet carrier and maintain an internet system that provides ongoing 24hr support and pre-emptive system maintenance through remote monitoring capability. Some case studies of where this infrastructure has been installed include:
    a. City of Darwin Public Spaces WiFi project (2016). From Smith Street Mall in the CBD to the Nightcliff Aquatic Centre, 7 km to the North, Easyweb's WiFi system keeps Darwin visitors and residents connected and engaged, and Darwin city informed on network usage. WIFI points could be house on the proposed multi-function poles throughout the Jindabyne township and waterfront areas.
    b. Watarrka National Park (2015). In March 2015, Easyweb Digital commissioned for Tourism NT a Public WIFI hotspot at the Watarrka National Park. Internet access is provided by a satellite connection. Power is provided by a solar power system backed with batteries to ensure uptime. This system could be duplicated in spots throughout the Kosciuszko National Park, providing internet access to campers and trekkers.

2 iiNet. iiNet are an Australian internet service provider. iiNet have the capability to design, supply and mange public WIFI services on a large scale. Notable projects include:

   a Canberra WiFi. Named as Digital Canberra, the iiNet role out of WIFI stations was Australia's largest public WiFi project.

   b Vic Free WiFi. The iiNet WiFi coverage in Victoria has a combined coverage zone of over 600,000 square metres across Melbourne, Ballarat and Bendigo CBDs.

3 Air Telstra. Telstra's Aire Telstra WiFi services are mostly recognisable by their bright pink telephone booths or bright pink signage and boxes seen around Australia's capital cities. The hotspot booths and points are free for usage for existing Telstra customers, but can come at a cost for non-Telstra customers.

6.3.2.2 MULTI-FUNCTION POLES

Multi-function poles are a product that provide capability of housing multiple devices that serve different infrastructure or aesthetic purposes. Generally owned by the council, the poles allow multiple asset owners to utilise the same pole and fix a range of devices. These may include:

- Lighting. Generally owned by council who would also the pole
- CCTV cameras
- WiFi signal points
- Speakers
- Power points – utilised for maintenance activities or powering additional temporary lights
- Traffic Control Signals (TCS). Owned and operated by RMS
- Flags or banners. Owned by council or can be rented to for advertisement
- Fixings to string hanging banners or lights between poles
- Signage. Electrical and non-electrical. Owned by RMS or the local road authority.

The below image also shows additional services that can be established on a multi-function pole.

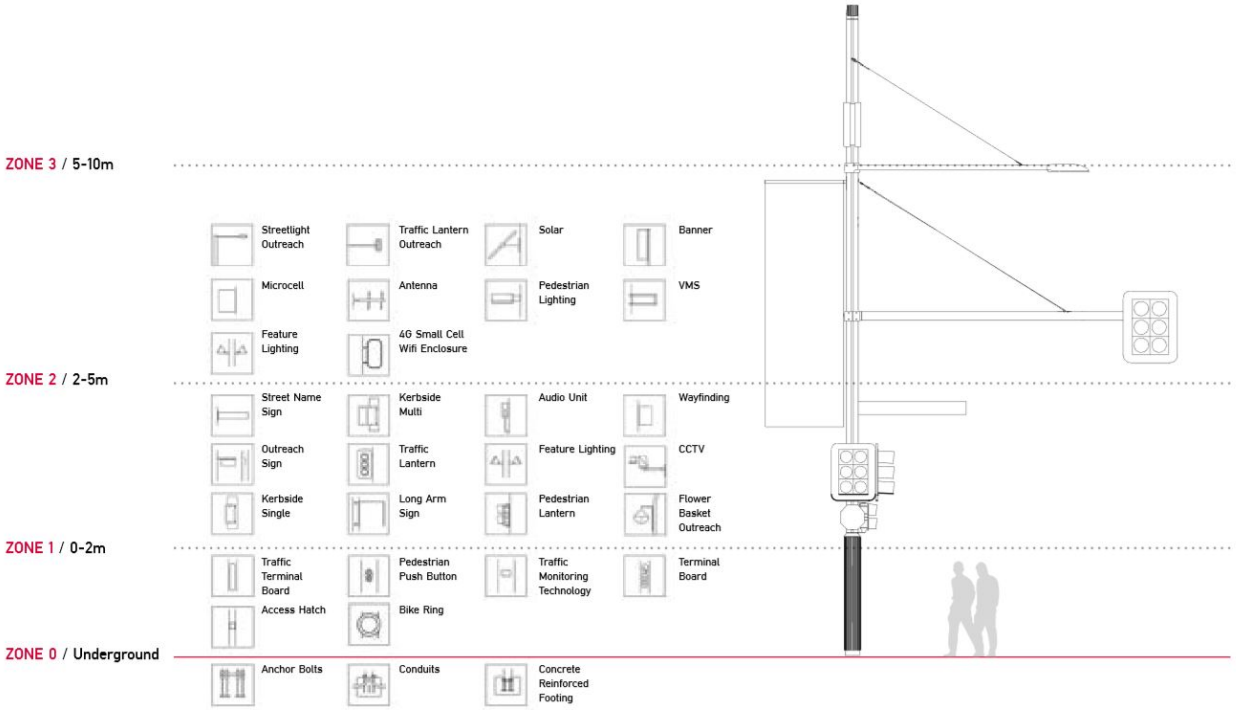


Figure 6.19 Multi-Function Pole – https://hub-group.com/multi-function-poles/

The multi-function pole network would be owned by council and require its own conduit network that supplies power and communications connection to each pole. Power to the council owned network, would be supplied by connection/s to the Essential Energy network, and telecommunications would be a private connection from a Telstra or NBN services already within Jindabyne.

Establishing a network such as this would enable SMRC to establish a smart infrastructure system that aligns with the NSW Government Smart Places Strategy, which could potentially increase funding opportunities for such infrastructure.

Providers of such multi-function poles include HUB. Some case studies of their application are listed below:

- Canberra City Centre. Pole were provided to supply lighting and a provision of shelter at pedestrian waiting areas

Figure 6.20 Canberra MFP https://hub-group.com/multi-function-poles/

– Wollongong Crown Street Mall. Poles provided a hanging laminar design between locations

Figure 6.21 Wollongong MFP https://hub-group.com/multi-function-poles/

- Sydney Light Rail. Multi-function poles held lights, traffic control lights, and flags. The conduit network also allowed provision for additional electrical and communications cables that would be used to power and service additional devices that could be attached to the poles in future by City of Sydney Council

Figure 6.22 Sydney MFP https://hub-group.com/multi-function-poles/

6.3.2.3 SMART LIGHTING

It is proposed to implement smart lighting systems throughout Jindabyne and the new Snowy Mountains SAP development areas. Smart lighting refers to the use of sensors to adjust lighting levels as conditions change. That is, when there is no activity on the road on in a pedestrian area, the lights would luminate at a low level and increase with brightness as activity increases. The lighting can also be adjusted for weather events such as heavy rainfall or snow. The benefits of smart lighting include:

- increased life span of luminaries
- limitation of light pollution
- reduction in energy consumption.

Within the town centre multi-function pole area, lighting would be owned and managed by the council. Outside of the town center, where multi-function poles are not required or cease to add value, Essential Energy will retain ownership and responsibility of the street lighting. The poles used will be as per the Essential Energy Standards, as they will not take ownership or control of non-standard products of approved materials. Essential Energy currently have no standard for multi-function poles, so all new lighting poles will be for lights only. As an organization initiative, Essential Energy are trailing their own smart lighting which could be implemented across the roads and develops within the Snowy Mountains SAP. The initiatives include:

- LED Technology. All new streetlights would be equipped with LED luminaires. The technology reduced energy consumption and increases life span. Essential Energy is working closely with Councils across its footprint, and has started the transformation of streetlighting, with almost 20% of lights already converted to LED. Essential Energy is working with councils, with a target of 90% of lights to be LED by 2024.
- Smart Controls. Essential Energy are investigating and trialing technologies that include lighting control to manage lighting levels via sensors as explained above.

6.4 WASTE AND RESOURCES RECOVERY

6.4.1 WASTE TRANSFER FACILITIES

As noted in section 4.6, SMRC have recommended an expansion of the transfer station area in Jindabyne and consolidation of land fill sites in Cooma to accommodate future growth. The expansion of the Jindabyne transfer station and consolidation at Cooma will need to consider the growth of waste into the future as noted in section 5.3.

SMRC are basing the transfer station layout on Albury Waste Management Centre, which includes an eight metre high shed. The existing Jindabyne land fill site has been assessed as inadequate due to gas and settlement issues, asbestos cells and footing likely to impact landfill cell and cap. As a result, the SMRC are in discussion to secure a more suitable site. The new facility needs to have an appropriate service road into the area to accept B-doubles. Considering this, any new road designs will reduce the future transport cost at the facility.

Due to the relatively short period until Jindabyne reaches capacity and the time it will take for a new transfer station to be constructed, a temporary expansion of the existing Jindabyne site will be required to facilitate a short term transfer station.

6.4.2 WASTEWATER TREATMENT FOR ENERGY PRODUCTION

An increasing trend in wastewater treatment across the world includes the anaerobic digestion of sludge to produce for energy production. Wastewater collected from the sewerage system will typically contain solids which can be collected and digested from sludge to produce biogas. Biogas can then be used directly to electricity and heat. Alternatively, the biogas can be further processed into biomethane, which can potentially be added to the natural gas grid.

Sludge wasted at the Jindabyne STP is currently collected within the on-site lagoons and dewatered using a dewatering unit, producing Grade B biosolids. The biosolids are then applied to the neighbouring landfill as a soil conditioner. Currently, there is no existing infrastructure in place to digest the sludge anaerobically in order to recover energy (biogas) from the digestion process.

That said, the Jindabyne STP, the largest wastewater treatment facility within the area, is currently rated at a capacity of 2 ML/d. The proposed upgrade to the plant based on growth per the Snowy Mountains SAP study requires a facility rated at 3 ML/d. This scale of treatment is unfortunately not suited for energy recovery from digestion. From experience, the treatment scale required to affect an adequate enough of biogas to make an energy recover system feasible is at about 30 ML/d, and the ideal range is 50 ML/d or greater. Even if combining the sludge from multiple plants in the region, the combined volumes do not add up to near this range.

Utilisation of these resources for small scale application is unlikely to be cost effective.

It is noted that the burning of biogas produces greenhouse gasses such are carbon dioxide. To sustainably produce electricity from waste a carbon capture system would be recommended in conjunction with power generation.

Refer to the below SWOC analysis of this infrastructure for further considerations:

Table 6.12 Biogas SWOC analysis

STRENGTH	WEAKNESS	OPPORTUNITY	CONSTRAINTS
Largest commodities produced in the Snowy Monaro region are from livestock products. Several wastewater treatment facilities in the Snowy Mountains SAP.	Distance from the Snowy Mountains SAP and livestock selling centre (Cooma). Domestic, commercial and municipal waste quantities likely insufficient for reliable supply. Utilisation of domestic waste and wastewater for small scale application is unlikely to be cost effective. Current practice is to leave livestock waste on field.	Approximately 117,600–863,800 m^3 of biogas per year could potentially be produced from livestock residue within the region. Potential electricity generation ~151 MWh_e/Year from organic domestic waste. Indicative size of energy generation plants for Snowy Mountains SAP wastewater treatment facilities in the order of 100kW_e.	Transportation of livestock waste from Comma to Snowy Mountains SAP is likely to be prohibitive. Recycling practices already in place by the resorts, compete for use of organic waste. Future recycling and waste management practices further limiting resource availability. Development of hydrogen production may reduce demand for biogas.

6.5 GONDOLA INFRASTRUCTURE REQUIREMENTS

RGDC have presented an infrastructure proposal to the Snowy Mountains SAP consortium which proposes the future construction of a gondola system. The gondola would connect Jindabyne to areas of the alpine resorts and be an option for transport and also a tourist attraction to the area.

Certain inputs on the proposed route, length, station locations and operating requirements are still unknown at this stage.

It is likely that additional substations and transmission feeders will need upgrade to accommodate the power demand of the gondola system. Water supply will also be required to accommodate amenities and firefighting capabilities. Telecommunication systems would also be required to operate and monitor the network.

Considerations into supporting infrastructure requirements for the gondola system have not been considered in this report.

7 KOSCIUSZKO NATIONAL PARK PLAN OF MANAGEMENT

This Kosciuszko National Park Plan of Management has been prepared to provide a framework to guide the long-term management of the broad range of values contained in the park. It contains a suite of actions to be undertaken by the NSW National Parks and Wildlife Service and other organisations to protect and conserve the values of the park.
The plan of management has been reviewed for its infrastructure recommendations which are summarised below.

7.1 SUMMARY OF CURRENT PLAN

1. NPWS and private alpine resort owners operate various water and wastewater infrastructure systems within the KNP area.
2. These systems are regulated by NRAR water allocation licenses (with annual limit) and EPA wastewater discharge licenses (with annual and/or daily limit).
3. An understanding of infrastructure for each system been obtained, primarily though discussion with asset owners.
4. In general, water and wastewater infrastructure has been designed around the approved bed limits for these facilities.
5. A number of these systems have minimal water treatment (UV disinfection typically) due to the protected nature of their surface water catchments (i.e. alpine creeks).
6. Some additional risks relating to operation of wastewater systems in these areas exist. These include difficulty to identify and respond to pipeline failures/environmental spill incidents during winter and also relating to potentially sensitive receiving environments.
7. A number of wastewater treatment systems experience operational challenges due to the extreme seasonal loading differences.

7.2 RECOMMENDATIONS

The proposed Snowy Mountains SAP development (based on current master planning inputs) will significantly exceed current bed limits at Perisher Valley and Thredbo, requiring infrastructure upgrades and wastewater discharge allowances under their respective EPA licenses. Additional water allocation may also be required under their respective licenses; however, this has not been able to be confirmed from the available information. Refer to the section in this report, and the Conclusions and Recommendations section for the current proposed scope of upgrades required.

8 CONCLUSION AND RECOMMENDATIONS

Based on the work undertaken and described in the previous sections of this report, a summary of infrastructure recommendations has been prepared. These are outlined in Table 8.1.

Table 8.1 Proposed infrastructure recommendations

LOCATION	RECOMMENDATIONS
East Jindabyne	Water: — WTP upgrades are required immediately to manage existing water quality risks. Snowy Monaro Regional Council are currently undertaking a scoping study to develop requirements for this project, which are expected to include addition of a filtration process and may also include reconfiguration of the disinfection process, new monitoring and control equipment and associated site works. Based on the outcomes of the scoping study, this project will require subsequent development and funding to deliver. — In the medium term (by 2033), additional overall allocation will also be required. These requirements should be investigated and addressed in Snowy Monaro Regional Council's next IWCM Strategy and DPIE's next update to the Regional Water Strategy. — Significant upgrades to existing network assets in both pressure zones (East Jindabyne and Kunama) may be required including reservoirs, booster pumps and reticulation mains. — A hydraulic model must be built to determine the extent and staging of network upgrades required, as noted above. Wastewater: — Decommission the existing pump station EJSPS4 and divert this catchment to EJSPS3 via a new gravity main, which will also service the new Snowy Mountains SAP growth areas. — Upgrades (complete replacement assumed) to two SPS (EJSPS5 and EJSPS3), their rising mains and the trunk gravity sewer discharging to the STP are required. — Detailed planning investigation is required to develop a holistic network planning strategy and develop these upgrade requirements and staging. Electrical: — 4.8 km of new 11 kV feeder from substation may be required if capacity in the existing feeder cannot accommodate the additional loads. — If there is sufficient load in the existing feeders, then extension can be made off this service to power the expanding development sites in East Jindabyne. — A model must be built and analysed to determine the amount of capacity in the existing feeders and determine the extent of upgrade as note above. — No foreseen substation upgrades required to support new growth. Gas: — No upgrades have been proposed. Consolation with gas providers will be required to plan for increase in demand as population and visitation increases. Telecommunications: — Fibre connection to nearest telecommunication backbone along Kosciuszko Road.

LOCATION	RECOMMENDATIONS
	Stormwater: — Network to accommodate required drainage for new development and discharge to waterways. — Vegetated areas adjacent to roads and paths, including open grass swales. — Stormwater tank requirements for new developments.
Western Lake Jindabyne Sub-Precinct	Water: — Approximately 3 km of new water main from the existing Jindabyne network is required to service the new development area on Rabbits Corner. — An additional 3 km (approx.) would also be required to extend from Rabbits Corner to the proposed resort development site (total 6 km of new lead in main required). — A dedicated reservoir to meet the specific needs of the development is recommended near the proposed resort. — The servicing strategy will need to be developed with Snowy Monaro Regional Council based on further detail of the proposed development. As part of this, the feasibility of the alternative strategy to install a new private/stand-alone source (lake offtake) and treatment system should be considered – however this approach is potentially inconsistent with the proposed Snowy Monaro Regional Council strategy to enhance the robustness of water treatment/water quality risk management. Wastewater: — New sewer pump station is required at the resort development site. — Approximately 3 km rising main is required to extend from the existing gravity network in Jindabyne to service the new development area on Rabbits Corner. — An additional 3 km (approx.) would also be required to extend from Rabbits Corner to the new resort development (total 6 km of sewer rising main). — An alternative strategy to develop a private/stand-alone wastewater treatment system with effluent reuse for irrigation of the proposed golf course at the resort site has been identified. — The servicing strategy will need to be developed with Snowy Monaro Regional Council based on further details of the proposed development. Electrical: — This area is supplied by the main Jindabyne substation. 1.5 km of 11 kV are required to extend from the nearest feeder to the location of the resort and golf course. — 175 m of 11 kV extension is required to Rabbits corner (Area GA5). Gas: — No upgrades have been proposed. Consolation with gas providers will be required to plan for increase in demand as population and visitation increases. Telecommunications: — Fibre connection back to Jindabyne telecommunication exchange. Stormwater: — Network to accommodate required drainage for new development and discharge to waterways. — Vegetated areas adjacent to roads and paths, including open grass swales. — Stormwater tank requirements for new developments.

LOCATION	RECOMMENDATIONS
Central/South Jindabyne	Water: — WTP upgrades are required immediately to manage existing water quality risks. Snowy Monaro Regional Council are currently undertaking a scoping study to develop requirements for this project, which are expected to include addition of a filtration process and may also include reconfiguration of the disinfection process, new monitoring and control equipment and associated site works. The study is considering the implementation of the works at two possible sites. Based on the outcomes of the scoping study, this project will require subsequent development and funding to deliver. — Amendment of Snowy Monaro Regional Council's three water extraction license allocations from Lake Jindabyne is required immediately to enable available capacity at East Jindabyne and Kalkite to be used for the Jindabyne offtake. — In the medium term (by 2033), additional overall allocation will also be required. These requirements should be investigated and addressed in Snowy Monaro Regional Council's next IWCM Strategy and DPIE's next update to the Regional Water Strategy. — Significant upgrades to existing network assets in three pressure zones (Leesville, Barry Way and Jindabyne Low Zone) may be required including reservoirs, booster pumps and reticulation mains This assumes that the existing High Zone reservoir is to be decommissioned as per existing Snowy Monaro Regional Council planning. — A new reservoir and pump station that are supplied from the existing Jindabyne network will be required to service the proposed growth area to the north-west of the existing town. Wastewater: — The Jindabyne STP will require significant upgrades and amendment to effluent discharge license arrangements to cater for the proposed growth. — An existing Concept Design for the Jindabyne STP exists, and the design provides the required future capacity based on growth planned in Jindabyne through the current study. Refer to Snowy Monaro Regional Council for this document. — The basis of the design for the Jindabyne STP needs to be verified by completing a detailed process review and better defining the peak influent wastewater flows to better define the hydraulic loading on the plant. — Two new SPS are required as well as significant gravity network extensions to service the proposed greenfield growth areas. In addition, significant upgrades (complete replacement assumed) to three SPS (JSPS2A, JSPS1 and JSPS6), their rising mains and the receiving trunk gravity sewers are required. Some upgrades may potentially also be required at JSPS2, JSPS3 and JSPS4 and associated assets. — Detailed planning investigation is required to develop a holistic network planning strategy and develop the above upgrade requirements and staging. Recycled Water: — A recycled water treatment facility located at Jindabyne STP would be required to implement a recycle scheme using the STP's effluent (if desired). — Additional investigation is required to validate the economic feasibility of a recycled water scheme in Jindabyne. Based on the current study, there are limited opportunities available for recycled water use, which provides marginal offsets for effluent discharged to the receiving waters and overall potable water use.

LOCATION	RECOMMENDATIONS
	Waste: — Design and construction of a new waste transfer station area in Jindabyne and consolidation of land fill sites in Cooma is recommended to accommodate future growth an align with SMRC waste handling strategy. Electrical: — New 11 kV feeders from the existing distribution system to the locations of proposed growth areas. — A new 1x51 MVA transformer will be required to enable spare capacity in the system at the Jindabyne substation. — Relocation of two existing 11 kV overhead lines will be required to accommodate construction of the new Southern Connector Route. — The 66 kV and 33 kV transmission lines that feed in and out of the substation will need to be assessed as part of the concept design works for the Southern Connector Route and the Gondola. These assets may have to be relocated based on the concept design of these developments. Gas: — No upgrades have been proposed. Consolation with gas providers will be required to plan for increase in demand as population and visitation increases. Telecommunications: — There are existing network services in the areas. Extension of NBN and Telstra network is required into the proposed development areas. Stormwater: — Grass swale and network work required to accommodate drainage required for the Southern connector route. — 2x basins at either end of the Southern Connector route. — Network to accommodate required drainage for new development and discharge to waterways. — Vegetated areas adjacent to roads and paths, including open grass swales. — Stormwater tank requirements for new developments. Smart Infrastructure Opportunities including: — Multi-function pole network — Public WiFi — CCTV — Sensors (Parking and pedestrian) — Smart Lighting.

LOCATION	RECOMMENDATIONS
Thredbo	Water: — An upgrade to the existing water source extraction license and treatment system will be required to increase capacity from the current extraction limit of 112 kL/d to suit the maximum demand of 450 kL/d which is required in 2038. — Significant network upgrades will also be required to extend the network services to the new development areas within Thredbo. Wastewater: — Major upgrade (assumed complete replacement) of the existing STP and amendment of effluent discharge license arrangements is required to cater for the proposed level of growth. Investigation is required to understand the required timing for this this upgrade and possible staging. — Significant network upgrades will also be required (subject to further investigation). Recycled Water: — Water consumption used for snow making may be offset through recycled water from the Thredbo STP. Electrical: — Additional 1x5 MVA transformer to provide capacity for future demands. — New 11 kV reticulation will likely be required to the new growth areas as the capacity of these distribution feeders are unknown at this stage. Gas: — No upgrades have been proposed. Telecommunications — No upgrades have been proposed. Stormwater: — Sealing of unsealed roads with concrete pavement. — Develop plan to increase the amount of kerbed road, and construct piped drainage system.

LOCATION	RECOMMENDATIONS
Perisher	Water: — Upgrade existing water source extraction license and treatment system to increase capacity from the current extraction limit of 438 kL/d to suit the maximum demand of 500 kL/d which is required in 2038. — Significant network upgrades will also be required to extend the network services to the new development areas within Perisher. — A new dedicated main to enable independent filling of Reservoir 2 with Reservoir 1 isolated/bypassed is required, to enhance network resilience and operational flexibility. Wastewater: — Major upgrade of the existing STP and amendment of effluent discharge license arrangements is required to cater for the proposed level of growth. Given that the current site is constrained, as possible solution would be to intensify the process, by converting the existing plant to a membrane bioreactor (MBR) process. If intensification is not feasible, an alternative option would be to implement a new STP to service the total flow at an alternate nearby location. — Upgrades to the solid stream containment at the STP would also be recommended as soon as possible as the current biosolids storage location is not accessible during winter months and therefore creates odour issues as biosolids cannot be removed for long durations of time. — Investigation is required to understand the required timing for this this upgrade and possible staging and location (the current site does not have a lot of available land to increase the plant's footprint). — Significant network upgrades will also be required (subject to further investigation). Recycled Water: — Water consumption used for snow making may be offset through recycled water from the Perisher STP. This would require a detailed investigation to define the amount of storage and pipe required to distribute the water, as well as extensive work and consultation with key stakeholders to work through the risk mitigation framework. — Consultation with NPWS (the owner and operator of the Perisher STP) will be required to ascertain their interest in owning and operating such a scheme as well as third party funding opportunities to enable the implementation of such a scheme. Electrical: — Additional 1x6 MVA transformer to provide capacity for future demands. — Expansion of substation to accommodate a new transformer. — Potential new 11 kV feeder to the development site of the car park. — Relocation of 11 kV line at car park to accommodate development proposal or location of solar farm. — Replacement of existing switchgear in the substation by September 2022. Gas: — No upgrades have been proposed. Telecommunications: — Extension of Fibre cables from Jindabyne to Perisher creating connectivity points for resorts, businesses and residents along Kosciuszko Road.

LOCATION	RECOMMENDATIONS
	Stormwater: — Sealing of unsealed roads with concrete pavement. — Develop plan to increase the amount of kerbed road, and construct piped drainage system.
Other Areas	Water: — WTP upgrades are required immediately to manage existing water quality risks. Snowy Monaro Regional Council are currently undertaking a scoping study to develop requirements for this project, which are expected to include addition of a filtration process and may also include reconfiguration of the disinfection process, new monitoring and control equipment and associated site works. The study is considering the implementation of the works at two possible sites. Based on the outcomes of the scoping study, this project will require subsequent development and funding to deliver. — Charlotte Pass requires additional water storage and treatment facilities to accommodate future expansion, and increased summer usage. Wastewater: — Kalkite SPS effluent disposal system requires upgrade to address existing performance and capacity issues. Investigation is required to develop practical options for this project with Snowy Monaro Regional Council and regulators. — Sawpit Creek STP effluent disposal system requires upgrade or modification to address existing performance and capacity issues. — Selwyn Snow Resort requires repair works to address bushfire damage to assets during 2019/2020 summer. — Charlotte Pass sewer treatment plant requires upgrade address existing performance and condition issues. Electrical: — A detailed analysis of the Essential Energy reticulation network is required to understand existing capacity in 11 kV feeders, and LV lines. Technical inputs to cable condition, cable specifications, and system load analysis will be required to specify any additional network upgrades. — No substation upgrades have been proposed for Snowy Adit and Bullocks Flat as the expected growth can be covered by existing capacities. Gas: — No upgrades have been proposed. Telecommunications: — Fibre connection to be established throughout the Snowy Mountains SAP area targeted towards growth areas. Stormwater: — Sealing of unsealed roads with concrete pavement in Alpine precincts to reduce sediment run off to waterways. — Develop plan to increase the amount of kerbed road, and construct piped drainage system or vegetated road side to reduce sediment run off and improve water quality in the Kosciuszko National Park.

9 LIMITATIONS

This Report is provided by WSP Australia Pty Limited (*WSP*) for Planning NSW(*Client*) in response to specific instructions from the Client and in accordance with WSP's proposal dated 18 March 2020 and agreement with the Client dated 19 May 2020 (*Agreement*).

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APPENDIX A

200928 P2520 SNOWY MOUNTAINS SAP STRUCTURE PLANS

Appendix documents (The Snowy Mountains SAP Structure Plan) have been removed due to the large size, please refer to the overall Snowy Mountains SAP Structure Plan, March 2021 instead

APPENDIX B

ELECTRICAL ASSUMPTIONS AND CALCULATIONS

ELECTRICAL ASSUMPTIONS AND CALCULATIONS

The following general assumptions were made to enable demand estimation from the limited detail of master planning inputs available. It is assumed that:

- power factor 0.9 has been used
- development type split (residential/commercial etc) has been assumed as per the spreadsheet.

Industrial	0.5	250	12
Residential	0.5	150	10
Commercial	1	200	12

Snowy SAP Structure Plan - Calculations & Assumption for Future Power Demand_210323 Structure Plan

Structure Plan Locations	Description	Type	Total land Area (m2)	Total land Area (ha)	% Portion of land area assigned to each sub land use	Ratio of Built Area to Land Use Area (m2)	Built Area Estimate (m2)	Energy Intensity (Building) (kWh/m2/yr)/ Built Area	Energy Consumption Estimates for Built Area (kWh/yr)	Energy Consumption Estimates (MWh/yr)	No of Hrs operation	Power Factor	Average Load Demand Estimates (MVA)	Average Load Demand Estimates (MVA)	Substation/Source	Net Developable Area (M2)	Net Developable Area (Ha)	Built Area Estimate (m2)
Charlotte Pass	CP 1 northern gateway	Commercial	1080	0.1080	100%	100%	1,080	200	216,000	216.00	12	0.9	0.05479452	1.88964992	Thredbo	80310.0	8.0310	41160.0
	CP1 eastern dev area	Residential	21600	2.1600	100%	50%	10,800	150	1,620,000	1,620.00	10	0.9	0.49315068					
	CP3 west of creek	Commercial	330	0.0330	100%	100%	330	200	66,000	66.00	12	0.9	0.01674277					
	CP3 west of creek	Residential	17550	1.7550	100%	50%	8,775	150	1,316,250	1,316.25	10	0.9	0.40068493					
	CP4 southern infill site	Commercial	120	0.0120	100%	100%	120	200	24,000	24.00	12	0.9	0.00608828					
	CP4 southern infill site	Residential	10800	1.0800	100%	50%	5,400	150	810,000	810.00	10	0.9	0.24657534					
	CP2	Residential	9450	0.9450	100%	50%	4,725	150	708,750	708.75	10	0.9	0.21575342					
	Renewal/expansion existing buildings around Charlotte Pass	Commercial	480	0.0480	100%	100%	480	200	96,000	96.00	12	0.9	0.02435312					
	Renewal/expansion existing buildings around Charlotte Pass	Residential	18900	1.8900	100%	50%	9,450	150	1,417,500	1,417.50	10	0.9	0.43150685					
Perisher Village	PV1 (Car park west)	Commercial	1734	0.1734	100%	100%	1,734	200	346,800	346.80	12	0.9	0.08797565	12.85309488	Perisher	559712.00000000	55.9712	281187.00000000
	PV1 (Car park west)	Residential	233550	23.3550	100%	50%	116,775	150	17,516,250	17,516.25	10	0.9	5.33219178					
	PV1b (Car Park East)	Commercial	928	0.0928	100%	100%	928	200	185,600	185.60	12	0.9	0.04708270					
	PV1b (Car Park East)	Residential	94500	9.4500	100%	50%	47,250	150	7,087,500	7,087.50	10	0.9	2.15753425					
	PV2 new infill sites south	Residential	32000	3.2000	100%	50%	16,000	150	2,400,000	2,400.00	10	0.9	0.73059361					
	PV 3 new infill sites west	Residential	20000	2.0000	100%	50%	10,000	150	1,500,000	1,500.00	10	0.9	0.45662100					
	PV4 new site north	Residential	25000	2.5000	100%	50%	12,500	150	1,875,000	1,875.00	10	0.9	0.57077626					
	Renewal/expansion existing buildings around Perisher	Residential	152000	15.2000	100%	50%	76,000	150	11,400,000	11,400.00	10	0.9	3.47031963					
Smiggens Resort	Gateway (workshop) site	Commercial	1200	0.1200	100%	100%	1,200	200	240,000	240.00	12	0.9	0.06088280	1.23211568	Perisher	52500.00000000	5.2500	26850.00000000
	Gateway (workshop) site - Residential	Residential	51300	5.1300	100%	50%	25,650	150	3,847,500	3,847.50	10	0.9	1.17123288					
	SE corner site	-	0	0.0000	100%	#N/A	0.00	#N/A	#N/A	#N/A	#N/A	0.9						
	Link Road site	-	0	0.0000	100%	#N/A	0.00	#N/A	#N/A	#N/A	#N/A	0.9						
Sponars Chalet	Redevelopment Area	Commercial	500	0.0500	100%	100%	500	200	100,000	100.00	12	0.9	0.02536783	0.85755961	Snowy Adit	36950.00000000	3.6950	18725.00000000
	Redevelopment Area	Residential	36450	3.6450	100%	50%	18,225	150	2,733,750	2,733.75	10	0.9	0.83219178					
	Expansion Area	-	0	0.0000	100%	#N/A	0.00	#N/A	#N/A	#N/A	#N/A	0.9						
Ski Rider Motel	Redevelopment Area	-	0	0.0000	100%	#N/A	0.00	#N/A	#N/A	#N/A	#N/A	0.9	#N/A	0.00000000	Snowy Adit	0.00000000	0.0000	0.00000000
Guthega	New Development	-	0	0.0000	100%	#N/A	0.00	#N/A	#N/A	#N/A	#N/A	0.9	#N/A	0.00000000	Snowy Adit	0.00000000	0.0000	0.00000000
Kosi Tourist Park	Expansion (assume 50 additional cabins/camping)	Residential	5000	0.5000	100%	50%	2,500	150	375,000	375.00	10	0.9	0.11415525	0.11415525	Snowy Adit	5000.00000000	0.5000	2500.00000000
Island Bend/Thredbo Diggings/Ngarigo	New Development (assume 100 additional cabins/camping)	Residential	10000	1.0000	100%	50%	5,000	150	750,000	750.00	10	0.9	0.22831050	0.22831050	Snowy Adit	10000.00000000	1.0000	5000.00000000
Thredbo Ranger Station	New Development (assume 20 room lodge and 30 glamping/cabins)	Residential	5000	0.5000	100%	50%	2,500	150	375,000	375.00	10	0.9	0.11415525	0.11415525	Thredbo	5000.00000000	0.5000	2500.00000000
Thredbo Village	Hotel expansion	Commercial	500	0.0500	100%	100%	500	200	100,000	100.00	12	0.9	0.02536783	19.97927448	Thredbo	872605.00000000	87.2605	437320.00000000
	Hotel expansion	Residential	24300	2.4300	100%	50%	12,150	150	1,822,500	1,822.50	10	0.9	0.55479452					
	North Side Tennis Courts	Commercial	125	0.0125	100%	100%	125	200	25,000	25.00	12	0.9	0.00634196					
	North Side Tennis Courts	Residential	20000	2.0000	100%	50%	10,000	150	1,500,000	1,500.00	10	0.9	0.45662100					
	North Side Hub	Commercial	710	0.0710	100%	100%	710	200	142,000	142.00	12	0.9	0.03602232					
	North Side Hub	Residential	13500	1.3500	100%	50%	6,750	150	1,012,500	1,012.50	10	0.9	0.30821918					
	Lot 768	Commercial	200	0.0200	100%	100%	200	200	40,000	40.00	12	0.9	0.01014713					
	Lot 768	Residential	12150	1.2150	100%	50%	6,075	150	911,250	911.25	10	0.9	0.27739726					
	TV1 Golf course	Residential	64800	6.4800	100%	50%	32,400	150	4,860,000	4,860.00	10	0.9	1.47945205					
	south of Thredbo ck investigation	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
	riverside expansion	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
	TV9	Commercial	500	0.0500	100%	100%	500	200	100,000	100.00	12	0.9	0.02536783					
	TV9	Residential	98820	9.8820	100%	50%	49,410	150	7,411,500	7,411.50	10	0.9	2.25616438					
	TV10	Residential	39000	3.9000	100%	50%	19,500	150	2,925,000	2,925.00	10	0.9	0.89041096					
	TV8	Residential	24000	2.4000	100%	50%	12,000	150	1,800,000	1,800.00	10	0.9	0.54794521					
	TV7	Residential	10000	1.0000	100%	50%	5,000	150	750,000	750.00	10	0.9	0.22831050					
	Renewal/expansion existing buildings around Thredbo Central Village and additional capacity in existing apartment building	Residential	324000	32.4000	100%	50%	162,000	150	24,300,000	24,300.00	10	0.9	7.39726027					
	Additional bed capacity in existing apartments at Central Village, Woodridge, Crackenback Ridge TV2, TV3, TV5, TV6	Residential	240000	24.0000	100%	50%	120,000	150	18,000,000	18,000.00	10	0.9	5.47945205					
Bullocks Flat	New Development	Residential	103950	10.3950	100%	50%	51,975	150	7,796,250	7,796.25	10	0.9	2.37328767	2.37328767	Bullocks Flat	103950.00000000	10.3950	51975.00000000
West of Lake Jindabyne	Integrated Lakeside Resort (Hatchery Ba) Assume resort incl. 250 room hotel 40 villas, 20ha excludes	Residential	11500	1.1500	100%	50%	5,750	150	862,500	862.50	10	0.9	0.26255708	2.10045662	Jindabyne	92000.00000000	9.2000	46000.00000000
	Destination Caravan Park (25 cabins, 60 caravan, 60 camping)	Residential	14500	1.4500	100%	50%	7,250	150	1,087,500	1,087.50	10	0.9	0.33105023					
	Hatchery Bay north (120 owner occupied apartments/villas)	Residential	6000	0.6000	100%	50%	3,000	150	450,000	450.00	10	0.9	0.13698630					
	Small scale tourist accommodation within area	Residential	60000	6.0000	100%	50%	30,000	150	4,500,000	4,500.00	10	0.9	1.36986301					
	MU1 - Jindabyne Waterfront Development	Commercial	10680	1.0680	100%	100%	10,680	200	2,136,000	2,136.00	12	0.9	0.54185693					
	MU1 - Jindabyne Waterfront Development	Residential	534000	53.4000	100%	50%	267,000	150	40,050,000	40,050.00	10	0.9	12.19178082					
	MU2 - Kalkite St car park	Residential	15000	1.5000	100%	50%	7,500	150	1,125,000	1,125.00	10	0.9	0.34246575					
	MU3 - JCS site	Commercial	5938	0.5938	100%	100%	5,938	200	1,187,600	1,187.60	12	0.9	0.30126839					
	MU3 - JCS site	Residential	400950	40.0950	100%	50%	200,475	150	30,071,250	30,071.25	10	0.9	9.15410959					
	MU4 - The Village Church Jindabyne	Residential	43000	4.3000	100%	50%	21,500	150	3,225,000	3,225.00	10	0.9	0.98173516					
	MU5 - Memorial Hall site	Commercial	280	0.0280	100%	100%	280	200	56,000	56.00	12	0.9	0.01420599					
	MU6 - Old Town Centre car park	Commercial	1000	0.1000	100%	100%	1,000	200	200,000	200.00	12	0.9	0.05073567					
	MU7 - Thredbo Tce car parking	Commercial	1000	0.1000	100%	100%	1,000	200	200,000	200.00	12	0.9	0.05073567					
	MU8 - B.P. Inn overflow car parking	Commercial	1200	0.1200	100%	100%	1,200	200	240,000	240.00	12	0.9	0.06088280					
	MU6 - Old Town Centre car park	Residential	67500	6.7500	100%	50%	33,750	150	5,062,500	5,062.50	10	0.9	1.54109589					
	MU7 - Thredbo Tce car parking	Residential	51300	5.1300	100%	50%	25,650	150	3,847,500	3,847.50	10	0.9	1.17123288					
	MU8 - B.P. Inn overflow car parking	Residential	60750	6.0750	100%	50%	30,375	150	4,556,250	4,556.25	10	0.9	1.38698630					
	MU9 - Nuggets Car Park	Commercial	1520	0.1520	100%	100%	1,520	200	304,000	304.00	12	0.9	0.07711821					
	MU10 - additional car park	Commercial	920	0.0920	100%	100%	920	200	184,000	184.00	12	0.9	0.04667681					
	MU11 - Caltex	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
	MU12 - Lake Jindabyne Motel	Commercial	4080	0.4080	100%	100%	4,080	200	816,000	816.00	12	0.9	0.20700152					
	MU13 - car park	Commercial	540	0.0540	100%	100%	540	200	108,000	108.00	12	0.9	0.02739726					
	MU14 - emergency services sites	Commercial	3360	0.3360	100%	100%	3,360	200	672,000	672.00	12	0.9	0.17047184					
	MU9 - Nuggets Car Park	Residential	76950	7.6950	100%	50%	38,475	150	5,771,250	5,771.25	10	0.9	1.75684932					

Town Centre	MU10 - additional car park	Residential	47250	4.7250	100%	50%	23,625	150	3,543,750	3,543.75	10	0.9	1.07876712	51.16593100	Jindabyne	2203768.00000000	220.3768	1117143.00000000
	MU11 - Caltex	Residential	20250	2.0250	100%	50%	10,125	150	1,518,750	1,518.75	10	0.9	0.46232877					
	MU12 - Lake Jindabyne Motel	Residential	20250	2.0250	100%	50%	10,125	150	1,518,750	1,518.75	10	0.9	0.46232877					
	MU13 - car park	Residential	27000	2.7000	100%	50%	13,500	150	2,025,000	2,025.00	10	0.9	0.61643836					
	MU14 - emergency services sites	Residential	170100	17.0100	100%	50%	85,050	150	12,757,500	12,757.50	10	0.9	3.88356164					
	TA1 - Clyde Street	Residential	76950	7.6950	100%	50%	38,475	150	5,771,250	5,771.25	10	0.9	1.75684932					
	TA2 - Clyde Street	Residential	286200	28.6200	100%	50%	143,100	150	21,465,000	21,465.00	10	0.9	6.53424658					
	TA3 - McLure Circuit	Residential	64000	6.4000	100%	50%	32,000	150	4,800,000	4,800.00	10	0.9	1.46118721					
	TA4 - McLure Circuit	Residential	138900	13.8900	100%	50%	69,450	150	10,417,500	10,417.50	10	0.9	3.17123288					
	TA5 - McLure Circuit	Residential	72900	7.2900	100%	50%	36,450	150	5,467,500	5,467.50	10	0.9	1.66438356					
	TC2 - swimming pool site assume 80% site cover, 3 levels, no accommodation	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
	TC5 - Mitre 10 assume 80% site cover, 3 levels, no accommodation	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
	TC6 - Old Town Centre assume 80% site cover, 3 levels, no accommodation	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
	TC1 - nuggets crossing shopping centre assume 80% site cover, 3 levels, no accommodation	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
	TC3 - Gippsland St sites assume 80% site cover, 3 levels, no accommodation	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
	TC4 - Gippsland St sites assume 80% site cover, 3 levels, no accommodation	Commercial	0	0.0000	100%	100%	0.00	200	-	-	12	0.9	0.00000000					
Inner Suburbs Infill	IS1	Residential	36000	3.6000	100%	50%	18,000	150	2,700,000	2,700.00	10	0.9	0.82191781	23.33789954	Jindabyne	1022200.00000000	102.2200	511100.00000000
	IS2	Residential	16000	1.6000	100%	50%	8,000	150	1,200,000	1,200.00	10	0.9	0.36529680					
	IS3	Residential	20000	2.0000	100%	50%	10,000	150	1,500,000	1,500.00	10	0.9	0.45662100					
	IS4	Residential	43000	4.3000	100%	50%	21,500	150	3,225,000	3,225.00	10	0.9	0.98173516					
	IS5	Residential	127000	12.7000	100%	50%	63,500	150	9,525,000	9,525.00	10	0.9	2.89954338					
	IS6	Residential	143000	14.3000	100%	50%	71,500	150	10,725,000	10,725.00	10	0.9	3.26484018					
	IS7	Residential	50000	5.0000	100%	50%	25,000	150	3,750,000	3,750.00	10	0.9	1.14155251					
	IS8	Residential	22000	2.2000	100%	50%	11,000	150	1,650,000	1,650.00	10	0.9	0.50228311					
	IS2a	Residential	67800	6.7800	100%	50%	33,900	150	5,085,000	5,085.00	10	0.9	1.54794521					
	IS3a	Residential	122000	12.2000	100%	50%	61,000	150	9,150,000	9,150.00	10	0.9	2.78538813					
	IS4a	Residential	88320	8.8320	100%	50%	44,160	150	6,624,000	6,624.00	10	0.9	2.01643836					
	IS6a	Residential	14400	1.4400	100%	50%	7,200	150	1,080,000	1,080.00	10	0.9	0.32876712					
	IS6d	Residential	82600	8.2600	100%	50%	41,300	150	6,195,000	6,195.00	10	0.9	1.88584475					
	IS6b	Residential	20160	2.0160	100%	50%	10,080	150	1,512,000	1,512.00	10	0.9	0.46027397					
	IS6c	Residential	66720	6.6720	100%	50%	33,360	150	5,004,000	5,004.00	10	0.9	1.52328767					
	IS8a	Residential	103200	10.3200	100%	50%	51,600	150	7,740,000	7,740.00	10	0.9	2.35616438					
Leesville Industry (Growth Area 6)	Area 6A (assume 50% of the net area is industrial	Industrial	57700	5.7700	100%	50%	28,850	250	7,212,500	7,212.50	12	0.9	1.82965500	5.33358701	Jindabyne	168200.00000000	16.8200	84100.00000000
	Area 6B (assume 50% of the net area is industrial	Industrial	44800	4.4800	100%	50%	22,400	250	5,600,000	5,600.00	12	0.9	1.42059868					
	Area 6C (assume 50% of the net area is industrial	Industrial	65700	6.5700	100%	50%	32,850	250	8,212,500	8,212.50	12	0.9	2.08333333					
Green Field - South Jindabyne (Growth Area 2)	Residential Neighbourhood - Area 2 a, Green Infrastructure OVERLAY, Residential Lifetyle - Larger Suburban Lots OVERLAY	Residential	134600	13.4600	100%	50%	67,300	150	10,095,000	10,095.00	10	0.9	3.07305936	3.34703196	Jindabyne	146600.00000000	14.6600	73300.00000000
	2B - Residential Neighbourhood, Green Infrastructure OVERLAY	Residential	12000	1.2000	100%	50%	6,000	150	900,000	900.00	10	0.9	0.27397260					
Green Field - West Jindabyne (Growth Area 3)	Residential Neighbourhood - Area 3A	Residential	420885	42.0885	100%	50%	210,443	150	31,566,375	31,566.38	10	0.9	9.60924658	16.48139269	Jindabyne	721885.00000000	72.1885	360942.50000000
	Residential lifetyle - Green Ridge OVERLAY	Residential	93000	9.3000	100%	50%	46,500	150	6,975,000	6,975.00	10	0.9	2.12328767					
	Slope 1 in 4	Residential	208000	20.8000	100%	50%	104,000	150	15,600,000	15,600.00	10	0.9	4.74885845					
Green Field - East Jindabyne (Growth Area 4)	Residential Neighbourhood - Area 4A	Residential	124400	12.4400	100%	50%	62,200	150	9,330,000	9,330.00	10	0.9	2.84018265	7.82808219	Jindabyne East	342870.00000000	34.2870	171435.00000000
	Residential Choice - Medium Density Residential/Tourism OVERLAY	Residential	182270	18.2270	100%	50%	91,135	150	13,670,250	13,670.25	10	0.9	4.16141553					
	Residential Neighbourhood - 4B	Residential	19200	1.9200	100%	50%	9,600	150	1,440,000	1,440.00	10	0.9	0.43835616					
	Residential Lifetyle - Larger Suburban Lots OVERLAY	Residential	17000	1.7000	100%	50%	8,500	150	1,275,000	1,275.00	10	0.9	0.38812785					
Green Field - Lake Jindabyne Village / Rabbits Corner (Growth Area 5)	Residential Neighbourhood (tourist accommodation assumed)	Residential	31050	3.1050	100%	50%	15,525	150	2,328,750	2,328.75	10	0.9	0.70890411	3.58561644	Jindabyne	157050.00000000	15.7050	78525.00000000
	Residential Choice - Medium Density Residential/Tourism OVERLAY	Residential	126000	12.6000	100%	50%	63,000	150	9,450,000	9,450.00	10	0.9	2.87671233					
Greenfield - South Jindabyne Growth Area 2	Copper Tom assume 50 bed tourism development (or camp ground/cabins)	Residential	5000	0.5000	100%	50%	2,500	150	375,000	375.00	10	0.9	0.11415525	0.46347032	Jindabyne	20300.00000000	2.0300	10150.00000000
	MTB Park assume nominal 10 dwellings acoommodation at MTB park	Residential	300	0.0300	100%	50%	150	150	22,500	22.50	10	0.9	0.00684932					
	Tourism South Growth Area. assume nominal 100 tourism dwellings across expanded and new tourism zones south of Jindabyne e.g. The Station	Residential	5000	0.5000	100%	50%	2,500	150	375,000	375.00	10	0.9	0.11415525					
	Tourism South Growth Area. assume nominal 50 seasonal workers accommodationm dwellings across expanded and new tourism zones south of Jindabyne e.g. The Station	Residential	2500	0.2500	100%	50%	1,250	150	187,500	187.50	10	0.9	0.05707763					
	Tourism West Growth Area. assume nominal 100 tourism dwellings across expanded and new tourism zones west of Jindabyne e.g. Bungarra Precinct	Residential	5000	0.5000	100%	50%	2,500	150	375,000	375.00	10	0.9	0.11415525					
	Tourism West Growth Area. assume nominal 50 seasonal workers accommodationm dwellings across expanded and new tourism zones west of Jindabyne e.g. Bungarra Precinct	Residential	2500	0.2500	100%	50%	1,250	150	187,500	187.50	10	0.9	0.05707763					
Creel Bay	Cottage conversions (46 cottage numbers from creel bay master plan)	Residential	5200	0.5200	100%	50%	2,600	150	390,000	390.00	10	0.9	0.11872146	0.26027397	Jindabyne	11400	1.1400	5,700
	Powered / unpowered camping sites (62 camp site numbers from creel bay master plan)	Residential	6200	0.6200	100%	50%	3,100	150	465,000	465.00	10	0.9	0.14155251					

References:
Demand projections for Residential and Commercial are based from Wagga Wagga SAP demand projection study. Other values were derived from WSP similar projects such as Showground precinct master planning, Western Sydney Construction Hub planning, and Parkes SAP
Glamping sites are assumed to yield no power demands
Assume 100 sqm per cabin
Assume 30 sqm per hotel (average)
Assume 50 sqm per accomodation

Structure Plan location	Net Developable Area (HA)	BUILT AREA ESTIMATE (M2)	ADDITIONAL LOAD DEMAND ESTIMATES (MVA)	AVAILABLE CAPACITY AT SUPPLYING SUBSTATION
Charlotte Pass	8.03	41160	21.98307965	Thredbo
Thredbo Ranger Station	0.50	2500		
Thredbo Village	87.26	437320		
Perisher Village	55.97	281187	14.08521055	Perisher
Smiggens Resort	5.25	26850		
Sponars Chalet	3.70	18725	1.20002537	Snowy Adit
Ski Rider Motel	0.00	0		
Guthega	0.00	0		
Kosi Tourist Park	0.50	2500		
Island Bend/Thredbo Diggings/Ngarigo	1.00	5000		
Bullocks Flat	10.40	51975	2.37328767	Bullocks Flat
West of Lake Jindabyne	9.20	46000	106.07565956	Jindabyne
Town Centre	220.38	1117143		
Inner Suburbs Infill	102.22	511100		
Leesville Industry (Growth Area 6)	16.82	84100		
Green Field - South Jindabyne (Growth Area 2)	14.66	73300		
Green Field - West Jindabyne (Growth Area 3)	72.19	360943		
Green Field - Lake Jindabyne Village / Rabbits Corner (Growth Area 5)	15.71	78525		
Greenfield - South Jindabyne Growth Area 2	2.03	10150		
Creel Bay	1.14	5700		
Green Field - East Jindabyne (Growth Area 4)	34.29	171435	7.82808219	Jindabyne East

Substation	AVAILABLE CAPACITY (MVA)	Additional Demand (MVA)	Net	Required Additional capacity
Thredbo	17.7	21.98	-4.3	5 MVA
Perisher	8.7	14.09	-5.4	6 MVA
Snowy Adit	9.9	1.20	8.7	No upgrades required
Bullocks Flat	5.3	2.37	2.9	No upgrades required
Jindabyne	59.9	106.08	-46.2	51 MVA
Jindabyne East	15.4	7.83	7.6	No upgrades required

SUBSTATION SWITCHING STATION NAME	AVAILABLE CAPACITY FOR THE YEAR 2021 (MVA	INSTALLED CAPACI
Snowy Adit Substation	9.9 MVA	1 x 10 MVA
(supplied by Munyang Substation)	17.7 MVA	1 x 30 MVA
Jindabyne Substation	46.6 MVA	2 x 30 MVA (66/11 kV)
(supplied by Cooma Substation)	13.3 MVA	1 x 15 MVA (66/33 kV)
Jindabyne East Substation	15.4 MVA	2 x 10 MVA
(supplied by Cooma Substation)		
Blue Cow Substation	1.9 MVA	1 x 8 MVA
(supplied by Munyang Substation)		
Smiggin Switching Station	-NA-	-NA-
Perisher	8.7 MVA	2 x 10 MVA
(supplied by Munyang Substation)		
Bullocks Portal	5.15 MVA	1 x 6.25 MVA
(supplied by Munyang Substation)		
Bullocks Flat	5.25 MVA	1 x 6.25 MVA
(supplied by Munyang Substation)		
Thredbo	17.7 MVA	2 x 16 MVA
(supplied by Munyang Substation)		
Jindabyne Pump Station	-NA-	-NA-

APPENDIX C

WATER AND WASTEWATER ASSUMPTIONS AND CALCULATIONS

WATER AND WASTEWATER ASSUMPTIONS AND CALCULATIONS

The following general assumptions were made to enable demand estimation from the limited detail of master planning inputs available (CIE SAP forecast visitation and population spreadsheet and development areas (PDF and GIS format), as provided January 2021). It is assumed that:

1. The Permanent Population and Workforce growth defined in the provided data is to occur within Jindabyne and East Jindabyne in the areas nominated in the information provided. These areas are assumed to be required to be serviced by the common asset owner (Snowy Monaro Regional Council for water and wastewater). i.e. there is no growth indicated in rural (private) areas.
2. Population growth in terms of Equivalent Tenements (ET) has been estimated as best possible from the provided development and visitation details and based on the Section 64 Determination of EWT Guidelines (2017, NSW Water Directorate).
3. There is no permanent population growth in the Alpine Regions (only over night and day visitors).
4. For overnight visitors (which have been broken down in the information provided into Jindabyne/Thredbo/Perisher areas for the peak month of August), visitors numbers are averaged across the month evenly (i.e. number of concurrent visitors = number of visitor nights/31 days), as maximum concurrent figures have not been provided in the data which is broken down by area.
5. Aside from Perisher and Thredbo (as above), it is assumed there will be no increase in current bed limits at any other alpine reports/accommodation (as no details have been provided to consider).
6. Peak numbers of day trip visitors to Perisher and Thredbo occur on weekends, at 1.6 x the August average number (this factor has been estimated from historical vehicle count data, which provides a reasonable indication – however does not consider visitors arriving via the Ski Tube).
7. Commercial and industrial growth has been factored into the ET estimates (item 2 above) as best possible from the provided inputs to calculate the population growth, the provided 2020 resident population and 2020 seasonal workforce has been subtracted from the future figures. This allows the demand estimates to be based on actual existing demands as a baseline, with the theoretical growth component added on for future years.
8. For overnight visitors, it is assumed there will be 2.3 people per room on average (as demand estimates based on a per room rate, from water industry guidelines). This figure of 2.3 aligns with the provided development/growth inputs.

Refer to the separate PDF (or subsequent pages) for detailed calculations of water and wastewater demands, including assumptions.

SAP Scenario - Jindabyne / East Jindabyne water demand estimate (based on masterplanning inputs 'CIE SAP forecasts visitation and populations' provided 14/01/2021)

Year	2020	2025	2030	2035	2040	2045	2050	2055	2060
Resident population (Jindabyne Berridale SA2)	7 287	7 683	9 009	10 532	11 521	11 811	11 964	11 934	11 866
Seasonal workforce (Jindabyne Berridale SA2)	3 265	2 924	3 264	4 254	4 480	4 146	3 715	3 298	2 915
Peak visitors (Jindabyne Berridale SA2)	18 275	20 365	21 839	27 347	29 170	28 233	26 812	25 449	24 211
Total Population SAP									

Demand growth due to permanent pop.									
Permanent pop. growth	0	396	1 721	3 245	4 234	4 524	4 677	4 646	4 579
ET growth (assumes occupancy rate of 2.1)	0	189	820	1545	2016	2154	2227	2213	2180
Demand Growth (ML/a) (240kL/ET rate)	0	45	197	371	484	517	535	531	523

Demand growth due to seasonal workforce									
Seasonal workforce pop. growth	0	- 341	- 1	989	1 215	881	450	33	- 350
ET growth (during peak season) (assumes occupancy rate of 2.5)	0	-136	0	395	486	352	180	13	-140
Demand Growth (ML/a) (assuming seasonal pop. is present for 3 months on average and 240kL/ET/a rate)	0	-8	0	24	29	21	11	1	-8

Demand growth due to overnight visitors									
August visitor nights (total)	213,330	228,516	250,540	286,543	307,221	294,357	283,458	269,078	256,109
August visitor nights (growth)	-	15,186	37,210	73,213	93,891	81,027	70,128	55,748	42,779
Annual visitor nights growth (based on August being approx 20% of annual)	0	75,931	186,048	366,064	469,453	405,134	350,638	278,739	213,894
August ET growth (0.3 ET/room, 2.3 people per room)	0	64	157	308	395	341	295	235	180
August demand growth (ML/d) - 240kL/ET annual rate	0	0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.1
Annual ET growth (0.3 ET/room, 2.3 people per room)	0	27	66	131	168	145	125	100	76
Demand Growth (ML/a) (240kL/ET rate)	0	6.5	16.0	31.4	40.3	34.7	30.1	23.9	18.3

Total demand growth / demand									
Growth in Annual Demand (ML)	0	44	213	426	553	573	575	556	533
PDD Growth (ML/d) - summer, assuming PD factor of 2.3	0	0.3	1.2	2.3	3.0	3.3	3.4	3.3	3.3
Total Annual Demand / Lake extraction (ML) - incl. 17ML for Kalkite	784	828	997	1210	1337	1357	1359	1340	1317
Total PDD (ML/d) - Jindabyne/East Jindabyne system, excl. Kalkite	7	7.3	8.2	9.3	10.0	10.3	10.368	10.3	10.3

SAP Scenario - Jindabyne / East Jindabyne sewer flow estimate (based on masterplanning inputs 'CIE SAP forecasts visitation and populations' provided 14/01/2021)

Year	2020	2025	2030	2035	2040	2045	2050	2055	2060
Resident population (Jindabyne Berridale SA2)	7 287	7 683	9 009	10 532	11 521	11 811	11 964	11 934	11 866
Seasonal workforce (Jindabyne Berridale SA2)	3 265	2 924	3 264	4 254	4 480	4 146	3 715	3 298	2 915
Peak visitors (Jindabyne Berridale SA2)	18 275	20 365	21 839	27 347	29 170	28 233	26 812	25 449	24 211
Total Population SAP									

Annual ADWF growth due to permanent pop.									
Permanent pop. growth	0	396	1 721	3 245	4 234	4 524	4 677	4 646	4 579
ET growth (assumes occupancy rate of 2.1)	0	189	820	1545	2016	2154	2227	2213	2180
Annual ADWF Growth (kL/d) (395L/ET/day)	0	74	324	610	796	851	880	874	861

Annual ADWF growth due to seasonal workforce									
Seasonal workforce pop. growth	0	- 341	- 1	989	1 215	881	450	33	- 350
ET growth (during peak season) (assumes occupancy rate of 2.5)	0	-136	0	395	486	352	180	13	-140
August DWF Growth (kL/d) (395L/ET/day)		-54	0	156	192	139	71	5	-55
Annual ADWF Growth (kL/d) (395L/ET/day)	0	-13	0	39	48	35	18	1	-14

Annual ADWF growth due to overnight visitors									
August visitor nights (total)	213,330	228,516	250,540	286,543	307 221	294,357	283,458	269,078	256,109
August visitor nights (growth)	-	15,186	37,210	73,213	93,891	81,027	70,128	55,748	42,779
Annual visitor nights growth (based on August being approx 20% of annual)	0	75,931	186,048	366,064	469,453	405,134	350,638	278,739	213,894
August ET growth (0.3 ET/room, 2.3 people per room)	0	64	157	308	395	341	295	235	180
August DWF growth (kL/d) - 395L/ET/d	0	25.2	61.8	121.7	156	134.7	116.6	92.7	71.1
Annual ET growth (0.3 ET/room, 2.3 people per room)	0	27	66	131	168	145	125	100	76
Annual ADWF Growth (kL/d) (395L/ET/d)	0	10.7	26.3	51.7	66	57.2	49.5	39.3	30.2

Total Annual ADWF growth									
Annual population ADWF Growth (kL/d)	0	72	350	701	911	943	947	915	878
August population ADWF Growth (kL/d)	0	46	385	888	1144	1125	1067	972	877
ADWF (kL/d) - based on Annual population*	1645	1716.8	1995.0	2346.1	2555.7	2587.9	2592.0	2559.6	2522.6
ADWF (kL/d) - based on August population*	1645	1691	2030	2533	2789	2770	2712	2617	2522

*1645 kL/d is the winter average day Jindabyne STP inflow in 2018/2019

SAP Scenario - Thredbo and Perisher water demand estimate (based on masterplanning inputs 'CIE SAP forecasts visitation and populations' provided 14/01/2021)

	2019	2025	2030	2035	2040	2045	2050	2055	2060
Jindabyne	No.	No.	No.	No.	No.	No.	No.	No.	No.
Overnight visitors	64 994	72 699	77 995	88 050	92 572	89 769	85 294	81 000	77 124
Day trip visitors	0	0	0	0	0	0	0	0	0
Visitor nights	213 330	238 613	255 903	289 644	304 588	295 454	280 607	266 385	253 593
Perisher									
Overnight visitors	45 369	51 690	55 446	73 281	78 728	76 099	72 300	68 641	65 296
Day trip visitors	12 521	13 922	14 854	16 372	17 052	16 224	15 397	14 590	13 811
Visitor nights	148 913	169 652	181 913	244 383	263 021	254 218	241 420	229 114	217 886
Threbdo									
Overnight visitors	41 074	46 796	50 197	66 114	70 997	68 629	65 203	61 904	58 888
Day trip visitors	12 521	13 922	14 854	16 354	17 030	16 202	15 376	14 571	13 793
Visitor nights	134 816	153 591	164 692	220 466	237 175	229 249	217 708	206 610	196 488

PERISHER

Demand due to additional overnight visitors

August visitor nights (total)	148,913	169,652	181,913	244,383	263,021	254,218	241,420	229,114	217,886
August visitor nights (growth)	-	20,739	33,000	95,470	114,108	105,305	92,507	80,201	68,973
August peak occupancy growth (additional people at once) - assumed average of above figure across month	-	669	1,065	3,080	3,681	3,397	2,984	2,587	2,225
August flow growth (kL/d) - 100L/person/d	0	66.9	106.5	308.0	368.1	339.7	298.4	258.7	222.5

Demand due to additional day visitors

August day visitors - assumes provided figure is the peak number of visitors per day, not the total visitors during August	12,521	13,922	14,854	16,372	17,052	16,224	15,397	14,590	13,811
August day visitors (growth)	-	1,401	2,333	3,851	4,531	3,703	2,876	2,069	1,290
August flow growth from day visitors (kL/d) - assumes 20L/person	-	28	47	77	91	74	58	41	26

Total demand (kL/d)

Total Demand Growth	-	95	153	385	459	414	356	300	248

THREDBO

Flow due to additional overnight visitors

August visitor nights (total)	134,816	153,591	164,692	220,466	237,175	229,249	217,708	206,610	196,488
August visitor nights (growth)	-	18,775	29,876	85,650	102,359	94,433	82,892	71,794	61,672
August peak occupancy growth (additional people at once) - assumed average of above figure across month	-	606	964	2,763	3,302	3,046	2,674	2,316	1,989
August growth (kL/d) - 100L/person/d	0	60.6	96.4	276.3	330.2	304.6	267.4	231.6	198.9

Flow due to additional day visitors

August day visitors - assumes provided figure is the peak number of visitors per day, not the total visitors during August	12,521	13,922	14,854	16,354	17,030	16,202	15,376	14,571	13,793
August day visitors (growth)	-	1,401	2,333	3,833	4,509	3,681	2,855	2,050	1,272
August additional flow from day visitors (kL/d) - assumes 20L/person	-	28	47	77	90	74	57	41	25

Total demand (kL/d)

Total Demand Growth	-	89	143	353	420	378	325	273	224

SAP Scenario - Thredbo and Perisher sewer flow estimate (based on masterplanning inputs 'CIE SAP forecasts visitation and populations' provided 14/01/2021)

	2019	2025	2030	2035	2040	2045	2050	2055	2060
Jindabyne	No.	No.	No.	No.	No.	No.	No.	No.	No.
Overnight visitors	64 994	72 699	77 995	88 050	92 572	89 769	85 294	81 000	77 124
Day trip visitors	0	0	0	0	0	0	0	0	0
Visitor nights	213 330	238 613	255 903	289 644	304 588	295 454	280 607	266 385	253 593
Perisher									
Overnight visitors	45 369	51 690	55 446	73 281	78 728	76 099	72 300	68 641	65 296
Day trip visitors	12 521	13 922	14 854	16 372	17 052	16 224	15 397	14 590	13 811
Visitor nights	148 913	169 652	181 913	244 383	263 021	254 218	241 420	229 114	217 886
Threbdo									
Overnight visitors	41 074	46 796	50 197	66 114	70 997	68 629	65 203	61 904	58 888
Day trip visitors	12 521	13 922	14 854	16 354	17 030	16 202	15 376	14 571	13 793
Visitor nights	134 816	153 591	164 692	220 466	237 175	229 249	217 708	206 610	196 488

PERISHER

Flow due to additional overnight visitors

August visitor nights (total)	148,913	169,652	181,913	244,383	263,021	254,218	241,420	229,114	217,886
August visitor nights (growth)	-	20,739	33,000	95,470	114,108	105,305	92,507	80,201	68,973
August peak occupancy growth (additional people at once) - assumed average of above figure across month	-	669	1,065	3,080	3,681	3,397	2,984	2,587	2,225
August flow growth (kL/d) - 300L/person/d	0	200.7	319.4	923.9	1104.3	1019.1	895.2	776.1	667.5

Flow due to additional day visitors

August day visitors - assumes provided figure is the peak number of visitors per day, not the total visitors during August	12,521	13,922	14,854	16,372	17,052	16,224	15,397	14,590	13,811
August day visitors (growth)	-	1,401	2,333	3,851	4,531	3,703	2,876	2,069	1,290
August flow growth from day visitors (kL/d) - assumes 20L/person	-	28	47	77	91	74	58	41	26

Total flow (kL/d)

Growth	-	229	366	1,001	1,195	1,093	953	818	693
Total flow (kL/d)	1200	1,429	1,566	2,201	2,395	2,293	2,153	2,018	1,893
Current STP design capacity and discharge license limit	2000	2000	2000	2000	2000	2000	2000	2000	2000

THREDBO

Flow due to additional overnight visitors

August visitor nights (total)	134,816	153,591	164,692	220,466	237,175	229,249	217,708	206,610	196,488
August visitor nights (growth)	-	18,775	29,876	85,650	102,359	94,433	82,892	71,794	61,672
August peak occupancy growth (additional people at once) - assumed average of above figure across month	-	606	964	2,763	3,302	3,046	2,674	2,316	1,989
August DWF growth (kL/d) - 300L/person/d	0	181.7	289.1	828.9	990.6	913.9	802.2	694.8	596.8

Flow due to additional day visitors

August day visitors - assumes provided figure is the peak number of visitors per day, not the total visitors during August	12,521	13,922	14,854	16,354	17,030	16,202	15,376	14,571	13,793
August day visitors (growth)	-	1,401	2,333	3,833	4,509	3,681	2,855	2,050	1,272
August additional flow from day visitors (kL/d) - assumes 20L/person	-	28	47	77	90	74	57	41	25

Total ADDITIONAL flow (kL/d)

Growth	-	210	336	906	1,081	987	859	736	622
Current discharge license limit	1610	1610	1610	1610	1610	1610	1610	1610	1610

SAP Scenario - West Jindabyne Resort Development - Water demand and wastewater flow estimate

*based on assumption of 250 beds
*assumes average occupancy is 50% of beds, peak occupancy is 100% of beds
*based on S64 Determination of ET guidelines parameters and SMRC water consumption of 240kL/ET/a

Water demand

rooms at 50% occupancy and with 2.3 beds per room	54.3	
ET (based on 0.3ET per room)	16.3	ET
Demand	3913	kL/a
PDD	24.7	

assumed 2.3 x PDF is reasonble for overall demand at site incl some outdoor use

Sewer

With rooms at 50% occupancy and with 2 beds per room	54.3	at 50% occ
ET (based on 0.3ET per room)	16.3	ET
ADWF (based on 240kL/ET/a wastewater generation - ie 100% of water demand)	10.7	kL/d
With rooms at 100% occupancy and with 2.3 beds per room	108.7	at 100% occ
ET (based on 0.3ET per room)	32.6	ET
ADWF (based on 240kL/ET/a wastewater generation - ie 100% of water demand)	21.4	kL/d

APPENDIX D

SWOC SUMMARIES FROM DRAFT A REPORT

D1 SWOC SUMMARIES FROM DRAFT A REPORT

Identified strengths, weaknesses, opportunities and constraints for water infrastructure within the Snowy Mountains SAP Study area are summarised below. This SWOC analysis was considered in the Draft A version of the report.

Table D.1 Water infrastructure SWOC analysis

STRENGTHS	WEAKNESSES	OPPORTUNITIES	CONSTRAINTS
— SMRC water supply: water intake is sourced directly from Lake Jindabyne, a secure water source year round. — Jindabyne/East Jindabyne water supply system has two intakes and multiple storage reservoirs, providing flexibility for operation and future network augmentation. — Water supply systems for each resort are already established and have existing water allocation licenses which are (for most) adequate for current usage. — Current peak demand for water in alpine areas occurs in winter, which coincides with higher stream flows in the creeks where the water is sourced.	— Relatively high operational costs of the region's water supply systems due to topography of the area and high degree of pumping required. — Various existing asset condition issues within the SMRC systems which have ageing assets. — Increased water extraction during summer periods for the various NPWS and alpine resort water systems could potentially impact environmental flows for the respective source creek systems. — Supply interruptions at the resorts during peak season exacerbated due to the snow cover (i.e. more difficult and time consuming to identify issue and make repairs).	— Transfer spare extraction license capacity from the East Jindabyne water intake to Jindabyne. — Vary the three SMRC water extraction licenses to allow more water to be sourced for Jindabyne system and less for East Jindabyne/Kalkite. — Align the Snowy Mountains SAP study outcomes, initiatives and further studies with SMRC's development of an updated IWCM strategy (currently commencing). — Consider opportunities for recycled water at the Alpine Resorts i.e. Thredbo over its usage allocation.	— SMRC water extraction license for Jindabyne system is approaching its limit. — Topography is steep and sloping, resulting in potential high costs for extending the water network to new areas – in particular areas at higher elevation than existing adjacent networks. — Due to lack of advanced water treatment for the various NPWS and alpine resort water systems, ongoing protection of the water source catchments (various creeks) from certain types of development, land-use and recreational activities is an important part of WQ risk management. — Kosciuszko Thredbo currently has an insufficient water licence allocation, though it is noted this is subject to current negotiations. — Anecdotal advice indicates that SMRC water infrastructure needs significant work to keep up with the current population and winter fluctuations, let alone any possible growth.

Identified strengths, weaknesses, opportunities and constraints for wastewater infrastructure within the Snowy Mountains SAP study area are summarised below. This SWOC analysis was considered in the Draft A version of the report.

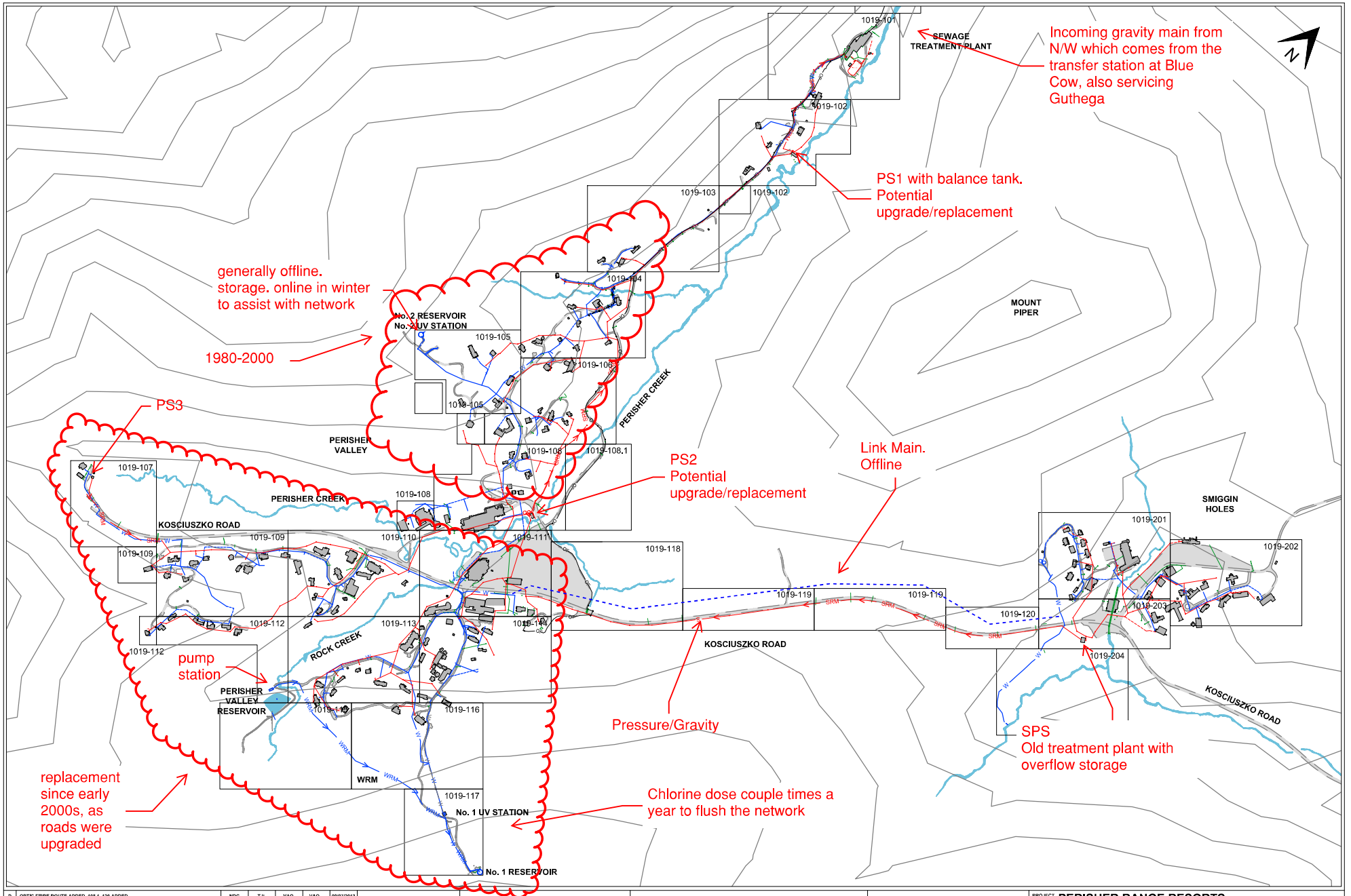
Table D.2 Wastewater infrastructure SWOC analysis

STRENGTHS	WEAKNESSES	OPPORTUNITIES	CONSTRAINTS
— Perisher sewer and sewerage assets are relatively modern and in good condition.	— Poor performance/under capacity of Kalkite STP. — Existing operational/ performance issues with NPWS Sawpit Creek absorption trench effluent disposal system. — Various existing asset condition issues within the SMRC systems which have ageing assets. — Wastewater assets in alpine areas are seasonally covered by snow. Particularly for (pressurized) rising mains, this results in risks of environmental discharges as a failure cannot be readily detected and repaired. — Many of the STP's including Jindabyne, Perisher and private resort systems have a history of licence non-compliances under current loadings.	— Heat energy recovery at Perisher Valley STP to reduce gas heating requirement. — Improve sludge management system Perisher Valley STP. — Align the Snowy Mountains SAP study outcomes, initiatives and further studies with SMRC's development of an updated IWCM strategy (currently commencing). — Remove Sawpit Creek absorption trench system and vary license to allow discharge directly to Sawpit Creek (subject to EPA approval). Otherwise replace/improve absorption trench system. — Single treatment system to service both Bullocks Flat and Lake Crackenback.	— Cobbin Creek EPA discharge license limits for Jindabyne STP (TBC with SMRC). — Limited existing service area of SMRC sewerage networks. — Topography is steep and sloping, resulting in potential high costs for extending the sewerage network to new areas. — Cumulative environmental impacts of on-site wastewater disposal in un-sewered areas may limit future development. — High ammonia loading observed at Perisher Valley STP in periods of high day trip visitation causes operational issues. This is an immediate capacity constraint for the plant to accept increased loads of this type. Additionally, future asset condition or damage from vehicles further increases risks of failures of rising mains and gravity mains. — Thredbo village wastewater systems has aging assets. — Sawpit Creek absorption trench disposal system does not perform adequately in peak winter loading/ conditions.

STRENGTHS	WEAKNESSES	OPPORTUNITIES	CONSTRAINTS
			— Ski Rider Resort has no treated wastewater discharge license and relies on pumping out of effluent, which could constrain future expansion of bed numbers. — Anecdotal advice indicates that SMRC wastewater infrastructure needs significant work to keep up with the current population and winter fluctuations, let alone any possible growth.

APPENDIX E

PERISHER NETWORKS MARK UP



No.	REVISION	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
D	OPTIC FIBRE ROUTE ADDED, 108.1, 120 ADDED	NDC	TJL	VAO	VAO	09/07/2013
C	ADDITION OF RESERVOIRS AND UV STATIONS 1&2, SHEET LAYOUT	N/A	RPW	VAO	VAO	05/04/2012
B	ADDITION OF SEWER RISING MAIN No 3.	N/A	RPW	VAO	VAO	27/02/2012
A	ADDITION OF SEWER RISING MAIN No 2.	N/A	RPW	VAO	VAO	07/12/2011
-	INITIAL ISSUE	N/A	RPW	VAO	VAO	18/03/2011

SCALE IN METRES
0 50 100 200 300
1:5000 SCALE AT A1
1:10000 SCALE AT A3
DO NOT SCALE

NSW GOVERNMENT Environment, Climate Change & Water
National Parks & Wildlife Service

ocre
ecological and resource engineering
po box 181
bermagui nsw 2546
p 02 6494 0239
m 0408 361 612

PROJECT: PERISHER RANGE RESORTS WATER AND SEWERAGE NETWORKS
TITLE: PERISHER VALLEY - KEY PLAN
DRAWING NUMBER: 1019-100
AMENDMENT: D

Date: Friday, 5 July 2013 9:21:07 AM User: Tegan File: C:\1_OCRE\1_Projects\2010\1019\E-Transmittal\1019-000 - 20121102zip\1019-100.dwg

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