Circular Head Settlement Strategy – Land Demand and Natural Hazard Assessment

Circular Head Council

24 | 11 | 2023

SGS Economics & Planning

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OFFICES IN CANBERRA, HOBART, MELBOURNE, AND SYDNEY ON THE COUNTRY OF THE NGAMBRI/NGUNNAWAL/NGARIGO, MUWININA, WURUNDJERI, AND GADIGAL PEOPLES.

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APPENDICES

Executive summary

SGS was tasked to project future demand for residential, commercial and industrial uses in the municipality. These projections will inform the settlement strategy preparation. SGS also reviewed natural hazards with a focus on where and how these natural hazards may impact on land use. The natural hazard assessment takes into account changes due to evolving climate change impacts. This assessment will also inform the settlement strategy as it seeks to accommodate (sensitive) land uses away from exposure to natural perils.

Housing Demand Projections

Demand for residential land and housing is driven by expected changes in population and demographic characteristics. The SGS Housing Demand Model utilises ABS Census data to understand demographic characteristics as well as Treasury Tasmania population projections to understand the historical and projected demand for dwellings in Circular Head and surrounding areas.

Major findings include:

- The population of Circular Head has grown over the last five years (from 2016 to 2021), at a higher pace than before.
- Based on the recent population growth and the latest projections by the Centre of Population, the high growth scenario is the most likely one, at this point in time.
- However, with the population ageing, the Tasmanian Treasury projects a drop in population, even under the high growth scenario.
- At the same time, the average household size is projected to continue to decrease, resulting in additional demand for housing even if the population was to decrease.
- The roll-out of major renewable energy projects in the region will likely attract additional workers and their households to the region.
- The total demand for additional housing is 348 dwellings by 2041 (or 8.7 per cent of the current housing stock) under the high scenario and assuming the attraction of additional worker households. This is equal to an extra 17 dwellings on average per annum. This projection excludes any housing demand generated by the short stay sector.
- Under the medium scenario, the demand for housing would drop. This drop excludes any housing demand generated by the short stay sector.
- Currently, most households occupy free standing dwellings. If that was to continue, our demand model shows by far, most future demand will continue to be for separate dwellings. However, with housing affordability deteriorating as it is, we may likely see a change towards more demand for semi-detached housing and apartments/units.
- Renting in Circular Head is becoming more difficult: the vacancy rates are low and rents are becoming less affordable. Some of the housing stock has been transferred to short stay, and this may continue to occur in the future.

The three scenarios modelled were based off Treasury Tasmania's population projections for Circular Head, looking at the medium and high growth projections. The third scenario modelled added the demand relating to future workers employed in the renewable energy sector in the event that Circular Head becomes a hub for the industry with projects such as Marinus Link and wind farm constructions taking off. This is the scenario where Circular Head becomes a renewable powerhouse, discussed in the following section. Rounded figures presenting the main result of the analysis are presented in Table A.

TABLE A: HOUSING DEMAND BY DWELLING TYPE IN CIRCULAR HEAD, 2021-2041

Scenario	Housing type	2021	2041	Change
Medium	Low density	3,790	3,480	-310
	Medium, high and other	230	160	-70
	Total	**4,020**	**3,640**	**-380**
High	Low density	3,790	4,010	220
	Medium, high and other	230	180	-50
	Total	**4,020**	**4,190**	**170**
High + renewable powerhouse	Low density	3,790	4,180	390
	Medium, high and other	230	190	-40
	Total	**4,020**	**4,370**	**350**

Source: SGS Economics & Planning

Commercial and Industrial Floorspace Projections

Demand for commercial and industrial floorspace is primarily driven by economic growth. Our modelling provides employment projections under a low (Business as Usual) and a high (Renewable Powerhouse) scenario, and then uses these employment projections to estimate future demand for commercial and industrial floorspace (also referred to as employment floorspace). As other wind farms at the site did not reveal employment growth data for analysis, SGS used the Renewable Powerhouse scenario for the demand analysis. Therefore, the actual demand growth may be underestimated.

The employment floorspace demand for two scenarios have been considered in the analysis:

- A "business as usual" (BAU) scenario; which assumes the economy will continue to evolve in line with observed changes over the last five years of ABS Censuses; and
- A "Renewable Powerhouse" (RP) scenario in which major renewable energy and infrastructure projects, including the Marinus Link project, are assumed to boost employment in the region.

Under the BAU scenario, some of Circular Head's major industries including agriculture, forestry and fishing as well as the accommodation and food services industries are expected to experience large increases in employment over the next 20 years, whilst there is expected to be a fall in manufacturing and retail jobs. Overall, this will lead to 180 net additional jobs to 2041, and this will likely lead to an increase in floorspace demand of approximately 29,000 sqm, the majority being commercial.

With the RP scenario, a very significant increase in jobs related to the development of renewable energy projects and infrastructure is expected and these are mostly contained in the construction industry. A significant share of these jobs is assumed to be fulfilled by workers from outside the region due to the quantity of the jobs relative to the local labour pool, and due to specialised skills. The

additional jobs in the community will generate additional spending and flow-on effects to other industries. These sectors include manufacturing, wholesale trade, accommodation and food services, other services, and health care and social assistance. Overall, the RP scenario will result in 460 net additional jobs, which is over double the increase in jobs in the BAU scenario to 2042. The net demand for floorspace is about 36,000 sqm. The development of renewable energy projects and infrastructure will drive a peak in employment, which will drop again once the projects move into their operational stage. Peak employment is expected prior to around 2027, with a peak employment of 1,100 jobs.

Rounded figures outlining the main results of the analysis are presented in Table B below

TABLE B: COMMERCIAL AND INDUSTRIAL FLOORSPACE DEMAND IN CIRCULAR HEAD, 2022-2042

Scenario	Broad Industry	Total Employment change	Total floorspace demand (sqm)
Business-as-Usual	Commercial	430	35,000
	Industrial	-190	-6,000
	Total	**180***	**29,000**
Renewable Powerhouse	Commercial	430	35,000
	Industrial	30	1,000
	Total	**460**	**36,000**

Source: SGS Economics & Planning (rounded)
* excludes changes in Inadequately described industries

Natural hazards in a changing climate

Natural hazards can have an impact on existing land uses and should also be taken into account when planning for future growth. Some natural hazards are typically not very location-specific, such as drought, extreme rainfall and extreme heat (they are specific to a region rather than a particular zone of a few hundred metres). Other natural hazards such as erosion, inundation, river and stormwater flooding and bushfires are often very location-specific. With climate change, many natural hazards will increase in frequency and severity. To inform current and future land use patterns, it is therefore important to better understand location-specific natural hazards and how they expose land uses to risks at present and in the future as climate change exacerbates.

The natural hazard assessment, using a variety of data sources, shows several locations are exposed to existing and evolving erosion, flood and bushfire risks. The hot spots include locations within or close to low-lying areas exposed to erosion and inundation: Smithton (low-lying industrial and residential areas close to the river), Marrawah, Stanley (the highway towards Stanley especially), and lower Arthur River are exposed to erosion and inundation risks. With respect to bushfires, Hellyer, Crayfish Creek and Edgcumbe Beach are in high-risk areas. The combined assessment of all environmental risk profile to 2050 of each main town is summarised in the table below. Of these Stanley presents a high risk due to flooding, bushfires, and coastal erosion. Note that although there are some risk areas along Hellyer, Crayfish Creek, most of the residential areas are at low risk and the high risk areas are generally isolated from the immediate shoreline.

TABLE C: SUMMARY OF ENVIORNMENTAL HAZARDS TO 2050

Area	Environmental Hazards	Risk level 2050	Implications for growth and development
Smithton	Coastal erosion, flooding, drought, and sea level rise	Medium	Further growth can occur in areas with low risk.
Stanley	Flooding, bushfire, coastal erosion and sea level rise	High	Improve infrastructure and buildings to make them more resilient.
Marrawah	Flooding	Low	Further growth can occur in areas with low risk.
Hellyer	Bushfire, coastal erosion	Medium to High	Zoning for the development of green space or other features that contribute to hazard mitigation.
Crayfish Creek	Bushfire, coastal erosion	Low to Medium	Further growth can occur in areas with low risk.
Edgcumbe Beach	Bushfire, coastal erosion	Medium	There are already houses along Edgecumbe beach in bushfire hazard codes. Further development should be within safety from bushfire.
Arthur River	Flooding, drought	Low	Further growth can occur in areas with low risk.

Source: SGS Economics & Planning (2023)

- In terms of settlement planning, it is recommended to avoid development in areas at risk especially in relation to sensitive uses, and/or;
- Allow development in areas at risk only if appropriate measures have taken to reduce the risk exposure to acceptable levels, and
- Ensure infrastructure and services that service a wider area are not exposed to unacceptable levels of risk. The highway to Stanley is a priority for further investigation.

1 Introduction

SGS was commissioned by ERA, as a sub-consultant, to prepare a settlement strategy that allows Circular Head to appropriately plan to accommodate future growth and development in the region. The development of this strategy comes after a decade of barriers to strategic planning, during which the municipality had adopted the Circular Head Interim Planning Scheme 2013. While growth has been fairly minimal during that time, the settlement strategy is being adopted not only to plan for growth, but to facilitate and stimulate it.

This growth is most likely to be a product of the North West region of Tasmania's comparative advantage in renewable energy production. As one of the windiest places in the world, and with vast open space available, Circular Head is an ideal location for wind farm projects, such as the one proposed at Robbins Island. The Marinus Link is a major renewable energy infrastructure project that would link Tasmania and Victoria via an underground transmission line. The energy production plant for this facility would be in North West Tasmania, and especially during its construction, would require the importation of labour to the region, some of which would be expected to be permanent additions to the Circular Head labour force.

Turning Circular Head into a renewable energy hub and facilitating population growth through the establishment of a new industry in the region would be a boon for the region. It would require the development of a range of housing types to accommodate new workers and families in the major townships of Smithton and Stanley. This requires a settlement strategy that positions Circular Head Council to be able to make decisions proactively, rather than reacting to growth, which could potentially stymy it.

2 Residential demand analysis

In this section, SGS uses ABS Census data and Treasury Tasmania projections to understand the historical and projected trends in population growth and dwelling demand in Circular Head and the surrounding areas.

Circular Head is not only less populous than the north-west LGAs of Burnie and Waratah-Wynyard but has also experienced slower population growth over the past five years. Similar to the rest of North West Tasmania, its population is also projected to fall over the next 20 years.

Dwelling growth has also fallen recently and is unequal across the different townships, remaining strongest in Stanley. Despite this slowing in growth, there is some evidence that the low vacancy rates and the many visitors to the area may be putting the region at risk of rental market failure due to lack of housing supply in the future. Whilst dwelling demand is expected to fall under a medium population growth scenario, under a high population growth scenario, total dwellings demanded is expected to peak in 2036 at 4,214, with the demand for separate houses largely driving this growth.

2.1 Past changes

Population growth

TABLE 1: POPULATION GROWTH IN NORTH WEST TASMANIA FROM 2011-21

	2011	2016	2021	AAGR 2011-16	AAGR 2016-21	AAGR 2011-21
Circular Head	7,977	7,926	8,117	-0.13%	0.48%	0.17%
Waratah-Wynyard	13,708	13,578	14,300	-0.19%	1.04%	0.42%
Burnie	19,239	18,895	19,918	-0.36%	1.06%	0.35%

Source: ABS Census 2011, 2016, 2021

All three LGAs experienced declines in population between the 2011 and 2016 censuses, but experienced growth between the 2016 and 2021 censuses. Circular Head has the slowest population growth after experiencing a less severe decline, while Burnie, the most populous, and Waratah-Wynyard had broadly similar growth trends to one another. Circular Head's population is concentrated in Smithton and Stanley, with the rest of the population dispersed around the other districts.

TABLE 2: POPULATION GROWTH IN CIRCULAR HEAD FROM 2011-21

	2011	2016	2021	AAGR 2011-16	AAGR 2016-21	AAGR 2011-21
Smithton	3,240	3,275	3,282	0.22%	0.04%	0.13%
Stanley	481	476	504	-0.21%	1.15%	0.47%
Forest*	590	482	464	-3.96%	-0.76%	-2.37%
Irishtown	287	301	307	0.96%	0.40%	0.68%
Edith Creek*	303	141	116	-14.19%	-3.83%	-9.15%
Arthur River**	371	57	32	-4.16%	2.83%	-0.72%
Marrawah		131	152			
Woolnorth***		112	161			
Hellyer**	302	173	189	0.00%	1.29%	0.64%
Crayfish Creek		75	68			
Edgcumbe Beach		54	65			
Rest of LGA	3,583	3,573	3,664	-0.06%	0.50%	0.22%

Source: ABS Census 2011, 2016, 2021

* In 2016, Forest and Edith Creek had their boundaries redrawn to exclude previously included land, hence their populations fell

** In 2016, Arthur River was split into Arthur River, Marrawah and Woolnorth, and Hellyer was split into Hellyer, Crayfish Creek and Edgcumbe Beach under the ABS state suburbs and localities classifications.

***Woolnorth's entire site is privately owned and the population is primarily composed of workers.

Dwelling growth

In contrast to population growth trends, Circular Head has maintained steady dwelling growth over the period 2011-2021. Table 4 disaggregates the total number of dwellings in Circular Head to the township level. Notable among these is Stanley, which shows the highest rate of dwelling growth of all Circular Head areas, due to the town's increased reputation as a food and wine destination and the picturesque fishing village atmosphere, including its unique rounded headland and historic buildings bringing continued tourism growth. As with population growth, Table 3 shows that Circular Head had the slowest dwelling growth rate among the three councils, however, it experienced the most rapid growth between 2016 and 2021.

TABLE 3: ALL PRIVATE DWELLINGS GROWTH FROM 2011-21

	2011	2016	2021	AAGR 2011-16	AAGR 2016-21	AAGR 2011-21
Circular Head	3,814	3,818	4,037	0.02%	1.12%	0.57%
Waratah-Wynyard	6,244	6,599	6,895	1.11%	0.88%	1.00%
Burnie	8,622	8,864	9,236	0.56%	0.83%	0.69%

Source: ABS Census 2011, 2016, 2021

TABLE 4: DWELLING GROWTH IN CIRCULAR HEAD FROM 2011-21

	2011	2016	2021	AAGR 2011-16	AAGR 2016-21	AAGR 2011-21
Smithton	1,462	1,507	1,569	0.61%	0.81%	0.71%
Stanley	255	270	301	1.15%	2.20%	1.67%
Forest*	258	194	204	-5.54%	1.01%	-2.32%
Irishtown	122	123	131	0.16%	1.27%	0.71%
Edith Creek*	114	56	48	-13.25%	-3.04%	-8.29%
Arthur River**	270	75	80	-2.99%	0.17%	-1.42%
Marrawah		101	91			
Woolnorth***		56	63			
Hellyer**	232	125	121	-0.97%	1.75%	0.38%
Crayfish Creek		58	75			
Edgcumbe Beach		38	45			
Rest of LGA	1,595	1,588	1,692	-0.09%	1.28%	0.59%

Source: ABS Census 2011, 2016, 2021

* In 2016, Forest and Edith Creek had their boundaries redrawn to exclude previously included land, hence the count of dwellings fell

** In 2016, Arthur River was split into Arthur River, Marrawah and Woolnorth, and Hellyer was split into Hellyer, Crayfish Creek and Edgcumbe Beach under the ABS state suburbs and localities classifications.

***Woolnorth's entire site is privately owned and the population is primarily composed of workers.

Dwelling distribution

According the 2021 Census, there were 4,037 dwellings in Circular Head, with much of the development concentrated in the largest township of Smithton. There is likely a significant number of dwellings in remote areas that are not part of established settlements. Given the spatial distribution of housing in Circular Head, it is not unexpected that the predominant dwelling structure in the municipality is separate houses, the least dense form of housing. The housing profile of Circular Head is detailed in Table 5 below.

TABLE 5: CIRCULAR HEAD HOUSING PROFILE, 2021

Dwelling type	Separate House	Semi-detached	Flat or apartment	Other	Total
Number of dwellings	3,790	146	38	90	4,064
% of total dwellings	93.3%	3.6%	0.9%	2.2%	100%

Source: ABS Census 2021

There is a relatively low proportion of renters in Circular Head, with 17 per cent of households occupied by renters. This is significantly lower than the 26.4 per cent state-wide average and 30.6 per cent national average. Home ownership is substantial in the region, with over half of dwellings owned or mortgaged. Perhaps due to limited competition or data limitations, the official rental market in Circular Head has remained relatively healthy while much of the rest of Tasmania has suffered from

deteriorating rental affordability and historically low vacancy rates (It is important to note that rental affordability is presented for the region as a whole and does not reflect a more detailed breakdown of housing affordability by geographic location and income group). Circular Head was rated as "acceptable" on the SGS Rental Affordability Index[1] with a score of 139, meaning that the average rental household spent 22 per cent of their income on rent.

Despite the relative affordability of renting in Circular Head, the region does still suffer from many of the same symptoms that have caused a rental market failure in other parts of the state, and the country. There is a historically low vacancy rate of 0.27 per cent in Circular Head, which is lower than state-wide vacancy rate of 0.62 per cent.[2] Nevertheless, while the median rent for houses in Tasmania is $470 per week, it is $340 in Circular Head. Although Circular head's housing affordability levels are better than Tasmania's levels, housing affordability levels in 2022 have deteriorated compared to 2019. This represents an increasing number of people in the area who are unable to afford housing.

The proliferation of short-term rental properties in the private rental market has exacerbated the rental affordability crisis. According to AirDNA, there are 126 short-term rental listings in Circular Head, with most of them in Stanley, and otherwise along the municipality's northern shoreline, including Smithton. This is 18.3 per cent as a proportion of Circular Head's rented dwellings as shown in Table 6. Further encroachment into the private rental market by short-term rental listings has the potential to price out residents if landlords can profit more off visitors than long term renters.

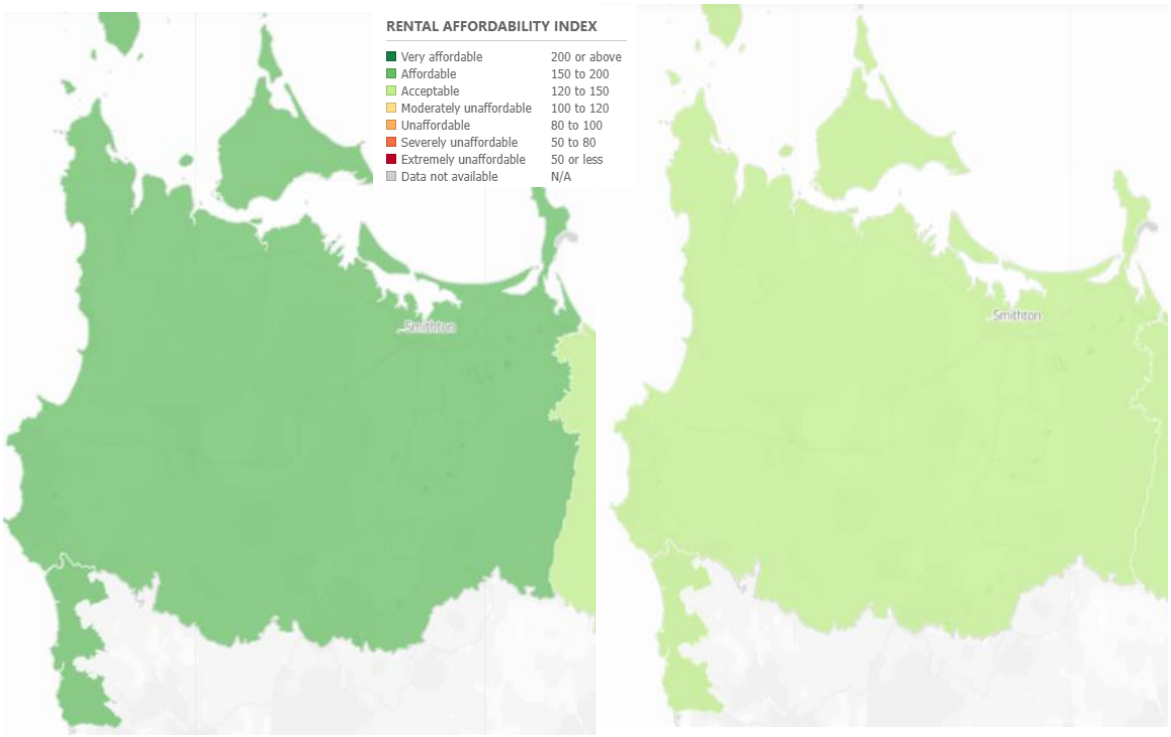
TABLE 6: CIRCULAR HEAD HOUSING TENURE, 2021

Tenure type	Owned outright	Owned with mortgage	Rented	Other	Not stated/ applicable	Total
Number of dwellings	1,155	982	690	200	1,037	4,064
% of total dwellings	28.4%	24.2%	17.0%	4.9%	25.5%	100%

Source: ABS Census 2021

[1] https://sgsep.com.au/projects/rental-affordability-index
[2] https://www.realestateinvestar.com.au/Property/tasmania/circular+head

FIGURE 1: RENTAL AFFORDABILITY IN CIRCULAR HEAD IN 2019, COMPARED TO 2022



From left to right are 2019 and 2022.

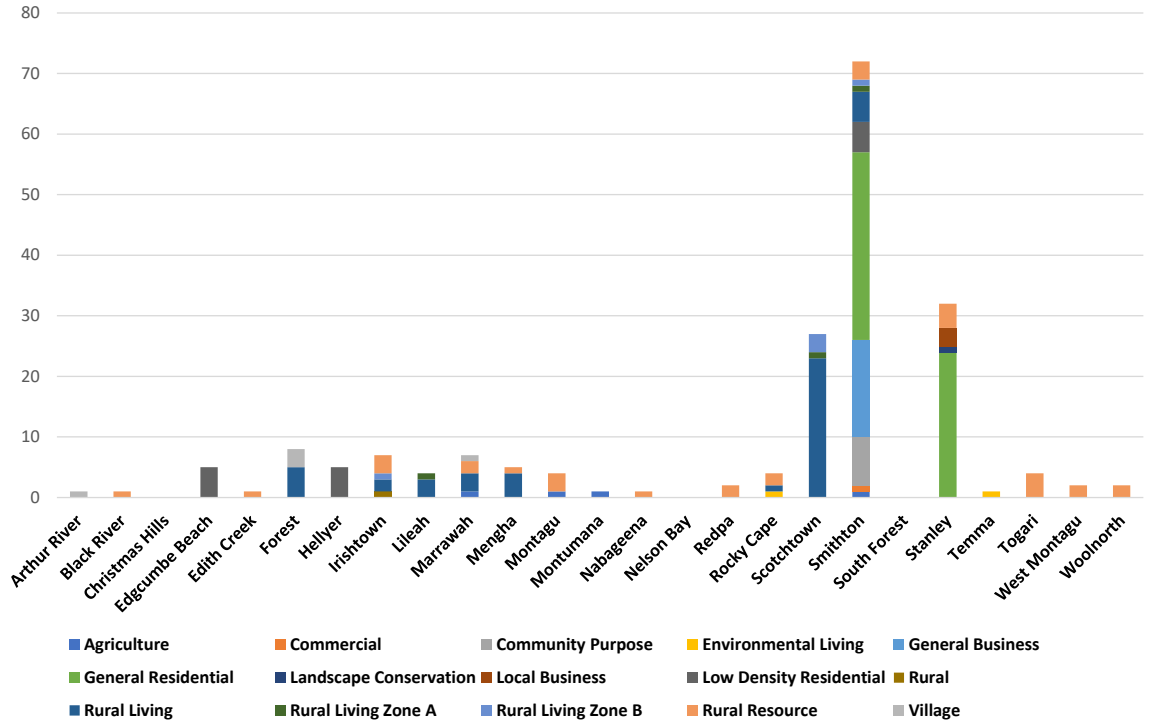
Source: SGS Economics & Planning (2022)

As Figure 1 shows, while rental affordability still falls into the acceptable range, the region appears to be declining in affordability from the pre-COVID rental market. In 2019, the region scored 157 on the rental affordability index (RAI), in the affordable range, which is equivalent to a household spending 19 per cent of their weekly income on rent. In 2022, the RAI score declined to 139 in 2022, which is equivalent to spending 22 per cent of weekly income on rent.

Dwelling growth

Circular Head's dwelling applications and construction completions over the past decade (2013-2023) have been concentrated in Smithton (72), Stanley (32), and Scotchtown (27) (Figure 3, Figure 4). Broadly, there are more dwellings being approved outside of the general residential zone than within. In this time, there have been 196 net additional dwellings added in Circular Head. 55 of these dwellings were in the General Residential zone, predominantly in Smithton and Stanley. The next most common zones for new dwellings was in the Rural Living Zone (including Rural Living Zones A and B), where there were 54. The majority of these were located in Scotchtown, with others dispersed among the smaller settlements. The spatial distribution of the additional dwellings by zone is presented in Figure 2 below.

FIGURE 2: NET ADDITIONAL DWELLINGS IN CIRCULAR HEAD BY ZONE (2013-2023)

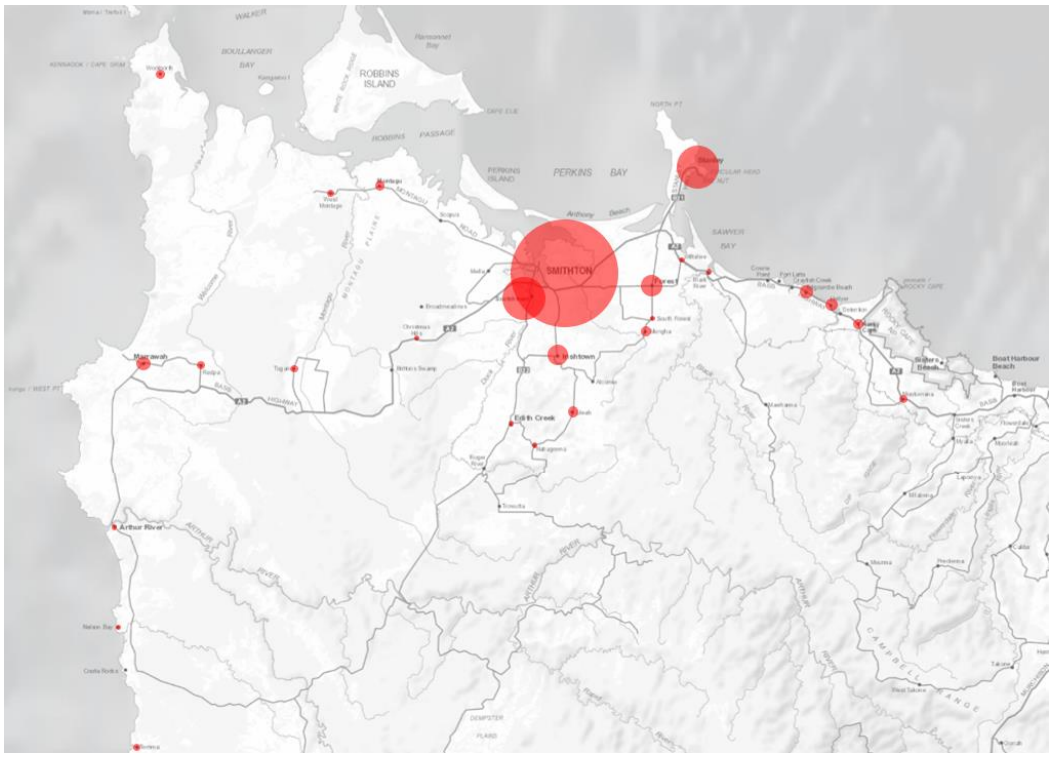


Source: Circular Head Council

In February 2023, there was one dwelling approved in Circular Head. August through to October 2022 saw 35 dwelling approvals while there were none in November or December 2022.[3]

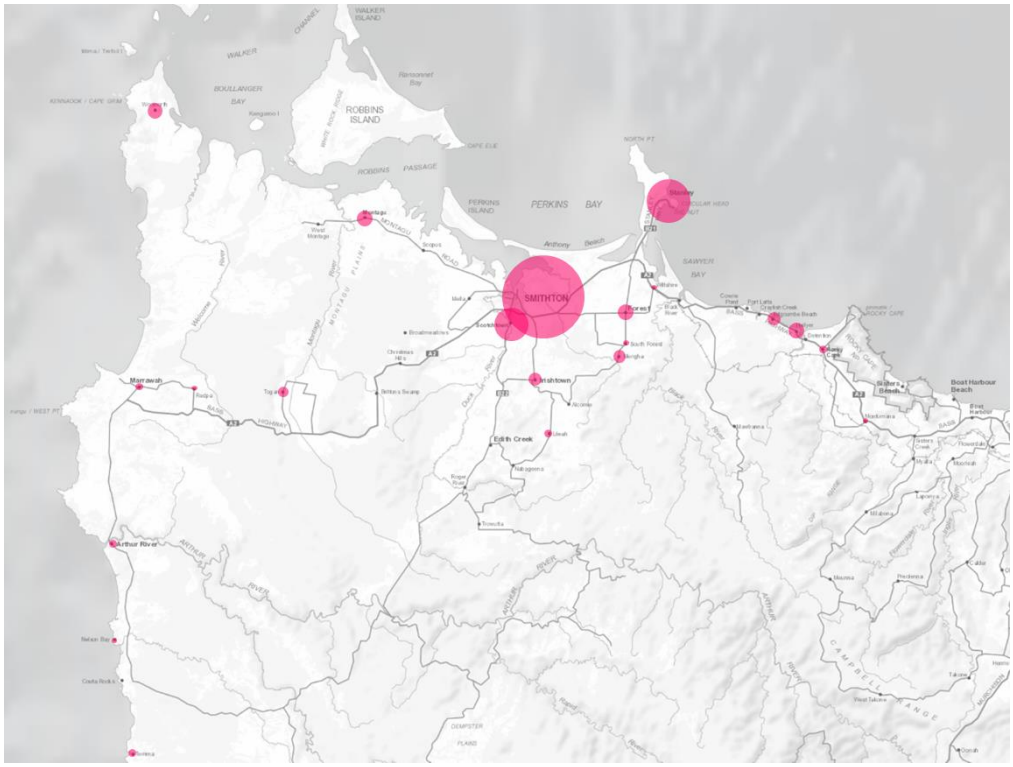
[3] Circular Head Council. Dwellings Data 2012-2022.

FIGURE 3: DWELLING PLANNING APPROVALS IN CIRCULAR HEAD, 2012-22



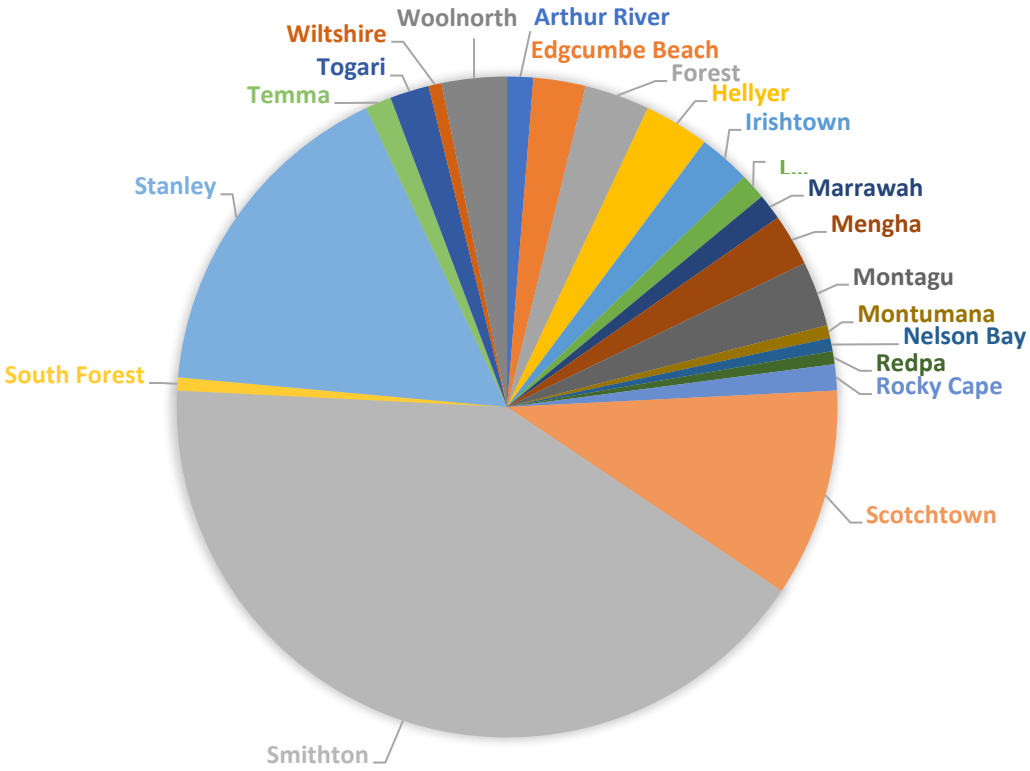
Source: Circular Head Council (accessed 2023)

FIGURE 4: DWELLING COMPLETIONS IN CIRCULAR HEAD, 2012-22



Source: Circular Head Council (accessed 2023)

FIGURE 5: DWELLING APPROVALS IN CIRCULAR HEAD BY LOCATION, 2012-22



Source: Circular Head Council (accessed 2023)

Over the past decade (2012-2022), approved dwellings have been concentrated in Smithton, Stanley, Scotchtown, and Woolnorth. Housing increases in Stanley have mostly been from before 2019, while the growth in dwellings approval from 2020 onwards has been led by Smithton, Scotchtown and Forest.

2.2 Population projections

In 2022, Treasury Tasmania released rebased population projections,[4] updating their previous projections from 2019, in light of faster than expected population growth highlighted by the release of the 2021 Census.

TABLE 7: PROJECTED POPULATION GROWTH IN NORTH WEST TASMANIA FROM 2021-41, HIGH SCENARIO

	2021	2026	2031	2036	2041	AAGR 2021-41
Circular Head	8,335	8,371	8,367	8,315	8,197	-0.08%
Waratah-Wynyard	14,641	14,725	14,656	14,369	13,943	-0.24%
Burnie	20,441	19,255	20,776	20,923	20,991	0.13%

Source: Treasury Tasmania (2022)

[4] https://www.treasury.tas.gov.au/economy/economic-data/2019-population-projections-for-tasmania-and-its-local-government-areas

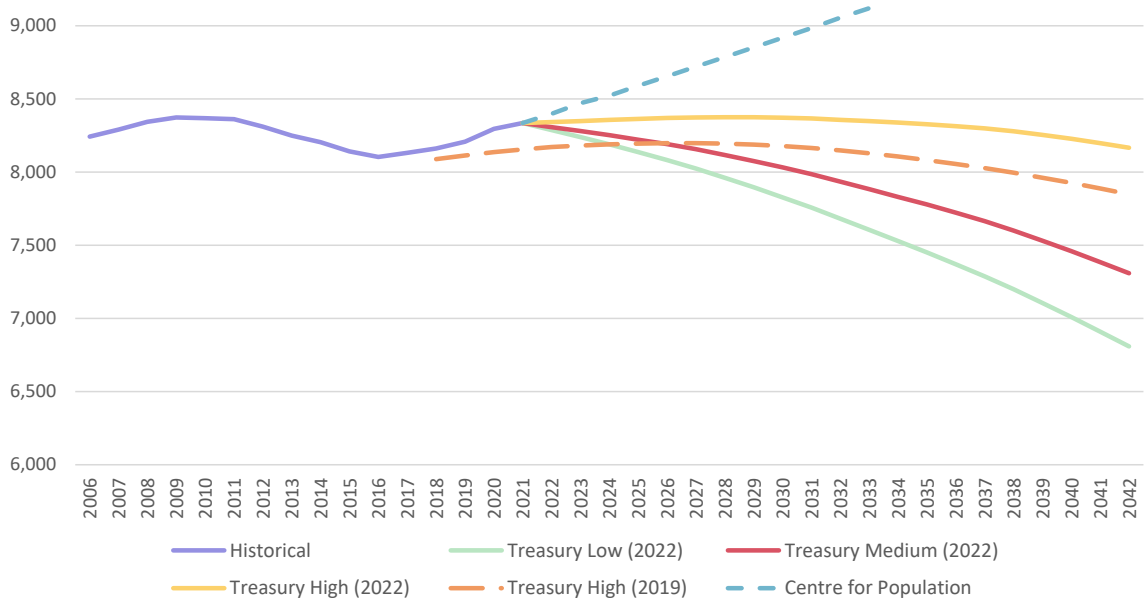
TABLE 8: PROJECTED POPULATION GROWTH IN NORTH WEST TASMANIA FROM 2021-41, MEDIUM SCENARIO

	2021	2026	2031	2036	2041	AAGR 2021-41
Circular Head	8,335	8,190	7,986	7,722	7,384	-0.60%
Waratah-Wynyard	14,641	14,506	14,177	13,613	12,901	-0.63%
Burnie	20,441	19,946	19,375	18,748	18,033	-0.62%

Source: Treasury Tasmania (2022)

In both scenarios, the populations of all three north-western LGAs are projected to decline over the next 20 years.

FIGURE 6: HISTORICAL AND PROJECTED POPULATION OF CIRCULAR HEAD



Source: Treasury Tasmania (2022); Centre for Population (2022)

As Figure 6 shows, in all scenarios modelled by Treasury Tasmania, the population is expected to fall below the current level. The scenario in Figure 6 not modelled by Treasury Tasmania is a disaggregated projection from the Centre for Population,[5] which projects that the population of the Rest of Tasmania, that is, excluding Greater Hobart, will grow at an average annual growth rate of 0.76 per cent over the next 11 years to 2033.

Forestry was traditionally a major economic driver in the area, providing jobs and contributing to the local economy. The demise of forestry between 2010 and 2014 was also a significant factor in the population decline in Circular Head during this period.

The rise of renewable energy and agriculture can attract new residents and retain existing ones by creating jobs and driving economic development. They contribute to the economic resilience of the area, provide employment opportunities, and improve the overall quality of life. By promoting sustainable practices and industries, communities can create a positive environment that fosters growth, innovation and social well-being.

[5] https://population.gov.au/data-and-forecasts/projections

As the Centre for Population Scenario assumes the growth rate of the wider state, this projection diverges from those of Treasury Tasmania, continuing and increasing the growth more in line with what was experienced in Circular Head between the last two censuses.

TABLE 9: POPULATION PROJECTIONS FOR CIRCULAR HEAD, 2021-41

Scenario		2021	2023	2031	2041
Treasury Tasmania	Low	8,335	8,239	7,757	6,909
	Medium	8,335	8,280	7,986	7,384
	High	8,335	8,349	8,367	8,197
Centre for Population		8,355	8,471	8,985	Not modelled
Treasury Tasmania High (2019)		8,155	8,182	8,164	7,888

Source: Treasury Tasmania (2022); Centre for Population (2022)

TABLE 10: POPULATION PROJECTIONS GROWTH RATES FOR CIRCULAR HEAD, 2021-41

Scenario		AAGR 2021-31	AAGR 2031-41	AAGR 2021-41
Treasury Tasmania	Low	-0.72%	-1.15%	-0.93%
	Medium	-0.43%	-0.78%	-0.60%
	High	0.04%	-0.21%	-0.08%
Centre for Population		0.75%		Not modelled
Treasury Tasmania High (2019)		0.01%	-0.34%	-0.17%

Source: Treasury Tasmania (2022); Centre for Population (2022)

2.3 Household demand

Housing demand model

The growth in demand for housing associated with temporary workers is typically subject to a high degree of uncertainty. Some studies assess this by conducting surveys or interviews with workers, employers, and local stakeholders to gather first-hand information about their accommodation needs. This includes asking about their preferences, length of stay, desired amenities, and any challenges they face in finding suitable short-term accommodations. This type of research is costly in terms of labour and time, so SGS uses desktop research including demographics, employment data, and industry reports to assess the demand for short-term worker accommodations. Based on these hypothetical considerations, SGS considers the high growth scenario to be more reliable and is used to analyse changes in housing demand in Circular Head.

SGS's housing demand model produces an estimate of number of dwellings needed by type and size to house the future community in a given area. The model synthesises population projections, local demographic trends and local trends in the revealed housing preferences for different household types (i.e., what proportion of households live in each kind of dwelling).

Description of the model

Typical dwelling projections do not take into account the diversity of housing needs, or preferences for different housing types. This means that projections generally estimate the total amount of housing that must be accommodated in an area but provide little guidance on what this means in terms of the need for *different housing types*.

Housing strategies often discuss the need for increased housing diversity or draw broad conclusions like the need for more smaller dwelling in response to the increasing prevalence of small one, two or three person households in society, rather than larger families. However, unless the need for diversity can be quantified, it provides little concrete guidance for strategic planning.

By contrast, SGS's model calculates demand for dwellings broken down into the ABS categories of:

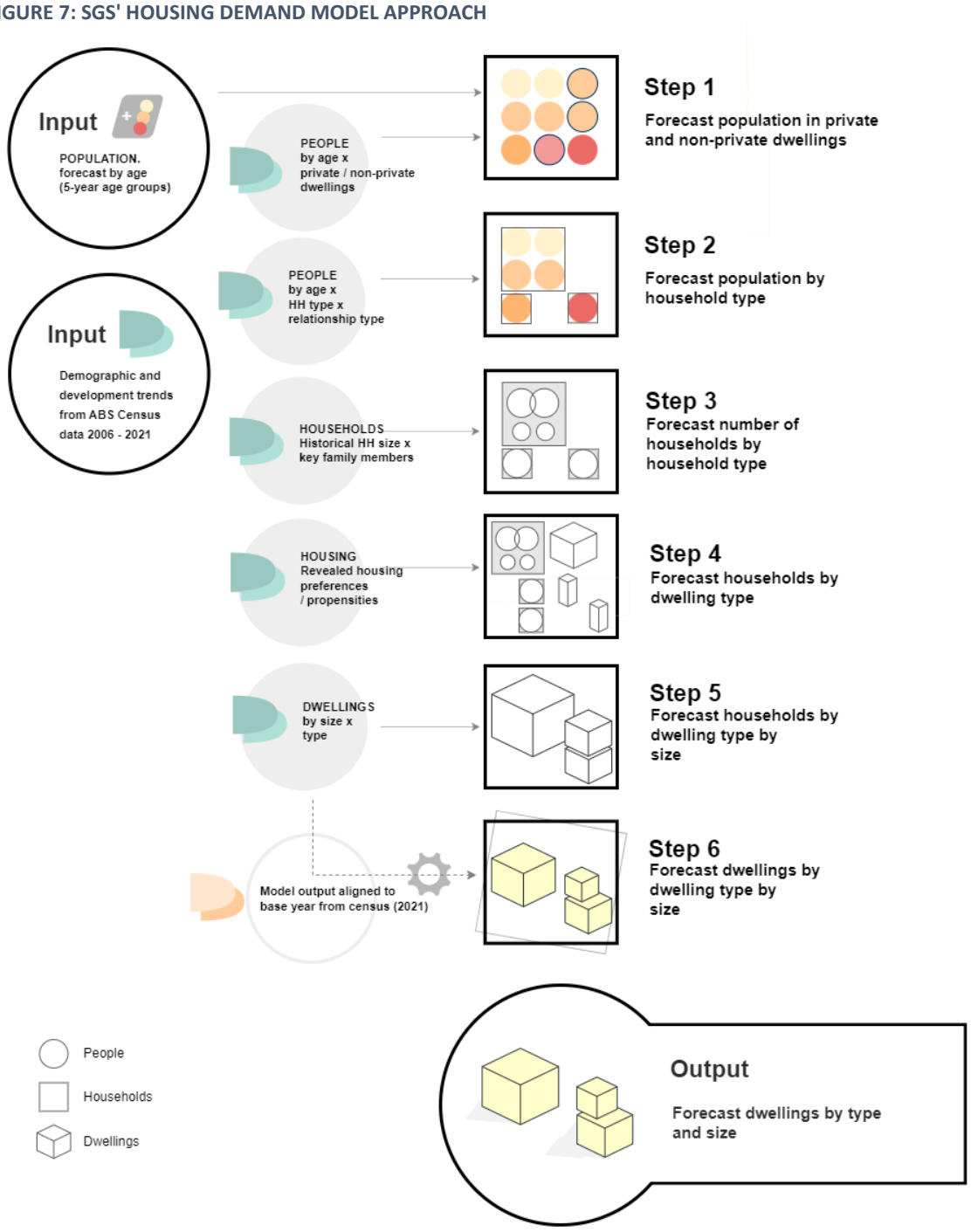
- Separate house, meaning a dwelling which is not attached to any other dwelling.
- Medium density dwellings include attached dwellings (such as semi-detached, terraced houses and townhouses), as well as two storey apartments buildings.
- Higher density dwellings, which are flats and apartment buildings with three or more storeys.
- Other dwellings including caravans and cabins, improvised dwellings (for example sheds, tents or humpies), houseboats and flats attached to shops.

Underlying demand by dwelling size (measured by number of bedrooms) is also calculated, which informs planning for housing mix. As well as quantifying housing demand, this model provides information about local living arrangements and demographics, including forecasts of household composition and average household size.

Model approach

The structure of the model is summarised in Figure 7 below.

FIGURE 7: SGS' HOUSING DEMAND MODEL APPROACH



Source: SGS Economics & Planning (2022)

Overview

Population by age groups is translated into *family members* using trends observed in the 2006 to 2021 ABS Census. This captures gradual changes in the formation of families (for example, an increase in lone person households and more complex family structures in general) and shifts in population demographics (such as an ageing population).

Family members are then translated into *households by family type*. Finally, *households by family type* are translated into underlying *demand for dwellings* by structure type based on trends evident in the 1996 to 2016 ABS Census. This approach captures changes in implied consumer preferences such as a shift in preference towards higher density forms as households' trade-off dwelling size for higher accessibility and amenity.

Adjusting demand results

It is also possible to adjust the model results to account for the fact that the built supply (as revealed) might not match with changing (stated) household preferences. These adjustments would account for any failures in the local development market, local strategic planning aspirations and emerging shifts in housing preferences that are not visible in historical census data.

Ideally, the adjustments would be based on a survey of housing preferences, but in the absence of this, there is an evolving information base on shifting preferences which could be utilised in the absence of primary preferences data (SGS has conducted this type of preferences surveying in recent studies for several NSW local governments). Typically, survey results show that there is latent demand for more compact, medium density housing forms including terraces, townhouses and semi-detached dwelling types. Engagement with local real estate and development professionals or market data analysis can also be used.

Housing categories

Dwellings are categorised into four types which are based on definitions used by the Australian Bureau of Statistics (ABS) in the Census and other data sources which are outlined in the description of the model section.

Another common categorisation of housing type is between separate houses; attached dwellings (in which each dwelling shares one or more walls with another and no dwelling is above another); and apartments (which share vertical as well as horizontal walls). In this report, one and two storey attached dwellings have been combined with apartments to generate the medium density category due to the similarity in these development forms and the associated discrepancies in the Australian Bureau of Statistics data categorisations between different census periods.

The above refers only to *private dwellings*, in which individual households occupy self-contained dwellings which do not share bathrooms, kitchens or similar. The City of Moonee Valley also contains *non-private dwellings* which includes student accommodation, aged care facilities and various other dormitory style or not self-contained housing forms. This distinction refers to the living arrangements in dwellings rather than their ownership, and so social housing, while mostly owned by the government, would be counted in the categories listed above as long as each dwelling is self-contained.

Granny flats and other similar forms of secondary dwelling (for example tiny houses on a property containing a larger house) are inconsistently classified in the ABS Census. They are sometimes counted as separate houses, or in some cases may be counted as part of the primary dwelling.

Household types

The following household types have been used in this report, aligning with those used in the ABS Census:

- Couple family with children means a family with two adults and one or more children.

- Couple family without children means a couple in a long term-relationship without children. This includes both young couples and older couples whose children have moved out. In housing demand results, couple families without children are split into people aged 0-44 and 45+.
- One parent family means one parent living with one or more children.
- Other family includes other kinds of households containing related people living together, such as siblings living together.
- Multi-family household means two or more families (from the categories above) living together in the same dwelling.
- Lone person household means a single person living by themselves.
- Group household means two or more unrelated people living together, for example a sharehouse.
- Other non-classifiable household means a household which does not fall into the above categories, or for which insufficient information was available in the ABS Census to accurately categorise the household.

As defined by the ABS, and in this report, a family can have unrelated people living with them. For example, a couple sharing a dwelling with another person would count as a couple family with children rather than a group household.

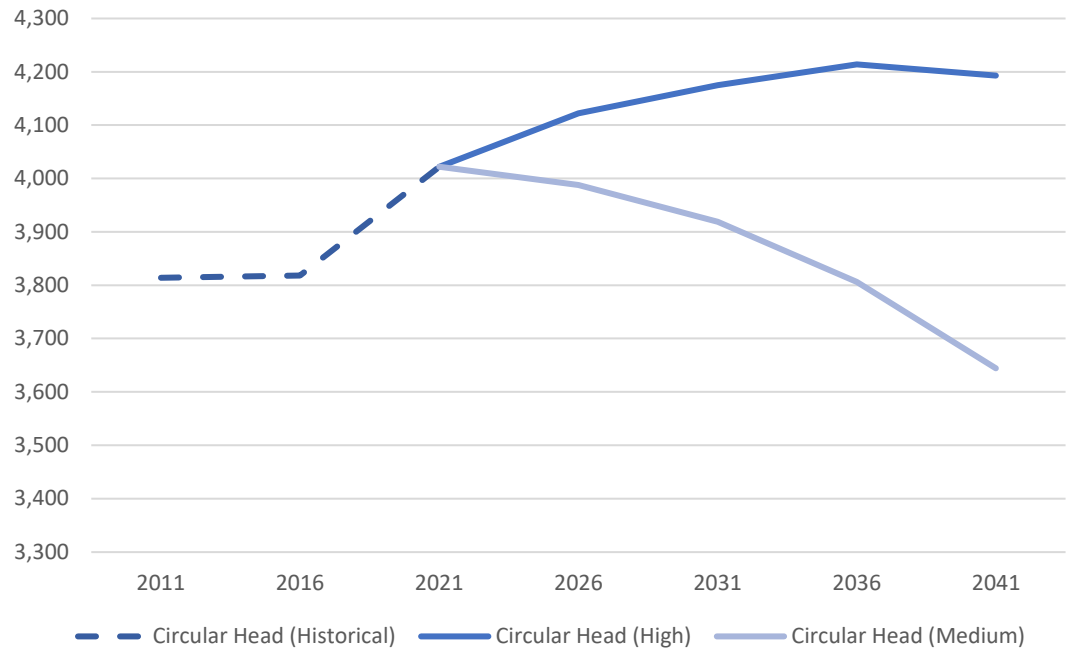
Total change

Business as Usual: Under the high population growth scenario, the projected demand for dwellings in Circular Head is expected to grow by 171, from 4,022 in 2021 to 4,193 in 2041. However, in 2036, dwelling demand is expected to peak at 4,214, 192 higher than in 2021. Under a medium population growth scenario, dwelling demand is projected to decline from 2021 onwards, falling to 3,644, 378 fewer dwellings than in 2021.

For Burnie and Waratah-Wynyard, only the high scenario was modelled. In Burnie, this modelling projected an increase of 110 dwellings in 2041 than in 2021, reaching 9,353 dwellings. In Waratah-Wynyard, there is similarly modest growth in dwelling demand, increasing by 38, from 6,864 in 2021 to 6,902 in 2041. However, dwelling demand is projected to peak in 2031 at 7,068, 204 more than in 2021. A comparison of the growth in each region and scenario is shown in below.

Renewable Powerhouse: Under this scenario, Circular Head is assumed to follow the same population growth trend as in the high population growth scenario, with the addition of workers attracted to the new industry heralded by the Marinus Link and other renewable energy projects in the region. By 2041, dwelling demand is expected to grow by 348, to 4,370, an additional 173 dwellings on top of the high growth projection in the BAU scenario. This is equivalent to 8.7% of Circular Head's current endowment of housing, and equals 17 additional dwellings per year.

FIGURE 8: HISTORICAL AND PROJECTED FUTURE DWELLINGS IN CIRCULAR HEAD, 2011-2041



Source: ABS Census 2021[6]

Change by type

TABLE 11: PROJECTED DWELLING DEMAND GROWTH IN CIRCULAR HEAD, HIGH GROWTH SCENARIO

Dwelling type	2021	2026	2031	2036	2041	Change	AAGR
Attached dwelling	155	92	104	115	123	-32	-1.1%
High density	37	55	28	23	22	-15	-2.6%
Other	39	39	40	39	39	0	0.0%
Separate house	3,791	3,936	4,003	4,037	4,009	218	0.3%
Total	4,022	4,122	4,175	4,214	4,193	171	0.2%

Source: SGS Economics & Planning (2023)

[6] https://abs.gov.au/census/find-census-data/quickstats/2021/LGA61210

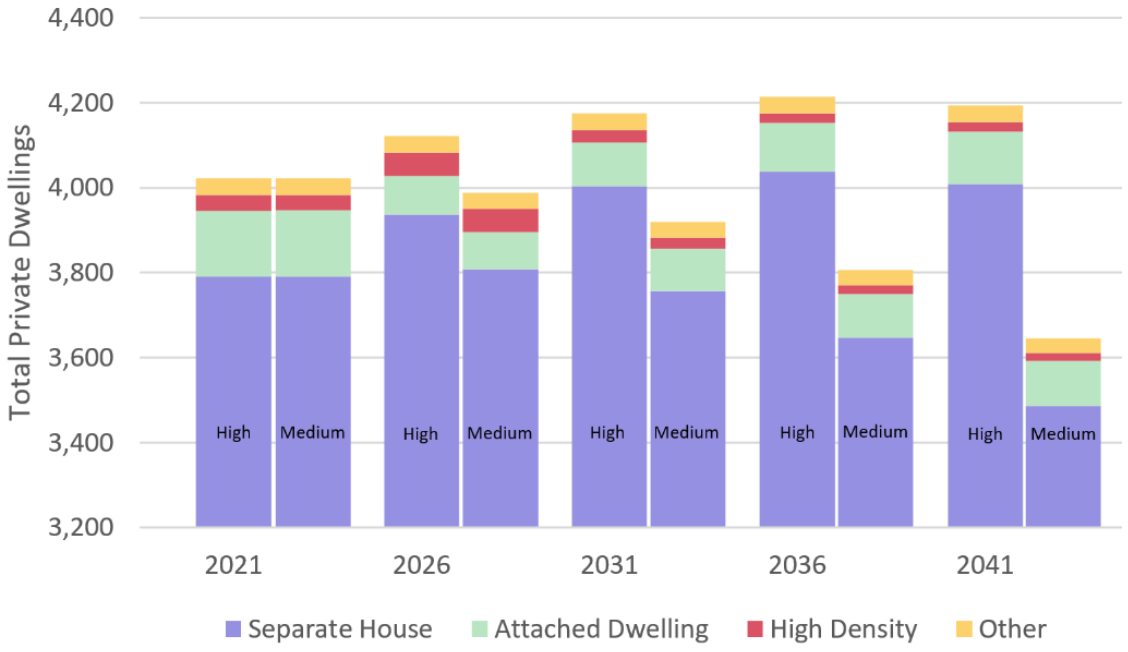
TABLE 12: PROJECTED DWELLING DEMAND GROWTH IN CIRCULAR HEAD, MEDIUM GROWTH SCENARIO

Dwelling type	2021	2026	2031	2036	2041	Change	AAGR
Attached dwelling	155	89	99	104	107	-48	-1.8%
High density	37	54	27	21	19	-18	-3.3%
Other	39	38	37	36	34	-5	-0.7%
Separate house	3,791	3,807	3,756	3,645	3,484	-307	-0.4%
Total	4,022	3,988	3,919	3,806	3,644	-378	-0.5%

Source: SGS Economics & Planning (2023)

According to ABS records, there were 4,037 total private dwellings in Circular Head on the night of 2021 Census. However, the community profile generated by the ABS for the same Census reported only 3,717 total private dwellings.[7] This indicates that there may have been additional people who do not meet the standard of Circular Head being their place of usual residence in the municipality, on Census night. For comparison, while the 2021 Census reports that there were 9,236 total private dwellings in Burnie, the community profile reports 8,857. Likewise, the population numbers on Census night in Circular Head are higher than that reported in the community profile – 8,117 compared to 7,193. It is important to note that the Community Profile is based on data for usual residence and does not include visitors and usual residents who were temporarily absent on Census night. Therefore, the actual number of private residences and population in Circular Head may be higher than that reported in the Community Profile.

FIGURE 9: CHANGE IN DWELLINGS BY TYPE IN CIRCULAR HEAD IN TWO GROWTH SCENARIOS, 2021-2041



Source: SGS Economics & Planning (2023)

While there were very few medium and high-density dwellings in Circular Head to begin with, in both medium and high population growth scenarios, the share of dwellings made up by those types of

[7] https://www.abs.gov.au/census/find-census-data/community-profiles/2021/LGA61210

housing is projected to diminish, as are the actual numbers of them. This will make the housing profile of the municipality highly homogenous, and could potentially exacerbate housing and rental affordability issues, with a lack of availability of more affordable, higher density dwellings.

TABLE 13: PROJECTED DWELLING DEMAND GROWTH IN BURNIE, HIGH GROWTH SCENARIO

Dwelling type	2021	2026	2031	2036	2041	Change	AAGR
Attached dwelling	798	868	954	1,037	1,114	316	1.7%
High density	200	132	130	128	126	-74	-2.3%
Other	37	37	37	36	36	-1	-0.1%
Separate house	8,208	8,222	8,152	8,119	8,077	-131	-0.1%
Total	9,243	9,259	9,273	9,320	9,353	110	0.1%

Source: SGS Economics & Planning (2023)

TABLE 14: PROJECTED DWELLING DEMAND GROWTH IN WARATAH-WYNYARD, HIGH GROWTH SCENARIO

Dwelling type	2021	2026	2031	2036	2041	Change	AAGR
Attached dwelling	441	512	523	526	520	79	0.8%
High density	21	14	14	13	12	-9	-2.8%
Other	53	53	53	52	50	-3	-0.3%
Separate house	6,349	6,401	6,478	6,468	6,320	-29	0.0%
Total	6,864	6,980	7,068	7,059	6,902	38	0.0%

Source: SGS Economics & Planning (2023)

Change by size (number of bedrooms)

TABLE 15: PROJECTED DWELLING DEMAND GROWTH IN CIRCULAR HEAD, HIGH GROWTH SCENARIO

Dwelling size	2021	2026	2031	2036	2041	Change	AAGR
0 bedrooms	20	17	17	17	18	-2	-0.5%
1 bedroom	162	177	179	187	196	34	1.0%
2 bedrooms	688	710	749	791	822	134	0.9%
3 bedrooms	2,193	2,179	2,126	2,057	1,957	-236	-0.6%
4 bedrooms	786	848	896	938	966	180	1.0%
5+ bedrooms	173	191	208	223	235	62	1.5%

Source: SGS Economics & Planning (2023)

TABLE 16: PROJECTED DWELLING DEMAND GROWTH IN CIRCULAR HEAD, MEDIUM GROWTH SCENARIO

Dwelling size	2021	2026	2031	2036	2041	Change	AAGR
0 bedrooms	20	16	16	15	15	-5	-1.4%
1 bedroom	162	172	168	170	170	8	0.2%
2 bedrooms	688	688	704	715	714	26	0.2%
3 bedrooms	2,193	2,108	1,995	1,858	1,701	-492	-1.3%
4 bedrooms	786	820	841	847	839	53	0.3%
5+ bedrooms	173	185	195	202	204	31	0.8%

Source: SGS Economics & Planning (2023)

TABLE 17: PROJECTED DWELLING DEMAND GROWTH IN BURNIE, HIGH GROWTH SCENARIO

Dwelling size	2021	2026	2031	2036	2041	Change	AAGR
0 bedrooms	57	41	45	45	45	-12	-1.2%
1 bedroom	394	459	516	556	593	199	2.1%
2 bedrooms	1,727	1,828	1,915	2,012	2,104	377	1.0%
3 bedrooms	5,135	4,933	4,723	4,546	4,368	-767	-0.8%
4 bedrooms	1,597	1,641	1,694	1,756	1,816	219	0.6%
5+ bedrooms	334	358	380	404	426	92	1.2%

Source: SGS Economics & Planning (2023)

TABLE 18: PROJECTED DWELLING DEMAND GROWTH IN WARATAH-WYNYARD, HIGH GROWTH SCENARIO

Dwelling size	2021	2026	2031	2036	2041	Change	AAGR
0 bedrooms	33	34	38	38	38	5	0.7%
1 bedroom	315	370	386	387	383	68	1.0%
2 bedrooms	1,402	1,564	1,689	1,796	1,824	422	1.3%
3 bedrooms	3,603	3,448	3,340	3,192	3,002	-601	-0.9%
4 bedrooms	1,252	1,278	1,306	1,319	1,313	61	0.2%
5+ bedrooms	259	287	309	328	342	83	1.4%

Source: SGS Economics & Planning (2023)

3 Commercial and Industrial floorspace demand analysis

Circular Head has a diverse economy that includes dairy, beef, agriculture, and fishing. The municipality is also home to one of Australia's largest wind farms, Woolnorth, and the nation's only air pollution baseline station, Cape Grim.[8] The dairy industry is a traditional strength of Circular Head's agriculture, with more than 100 dairy farms producing approximately 10 per cent of Tasmania's milk supply. The dairy industry and beef industry, which are important economic drivers, will continue to provide employment. Circular Head's manufacturing sector is focused on the wind farm industry, which employs more than 40 people and generates enough electricity to 9 per cent of Tasmania's electricity needs.[9]

Circular Head's agricultural sector is exploring new opportunities for the circular economy and waste management, such as using biomaterials to return nutrients to the soil or upgrading waste to energy.[10] Circular Head is also home to important Aboriginal and colonial cultural and heritage sites, such as the Hayfield Historic Site. Tourism has been a growth sector for Circular Head with various initiatives and strategies to promote and develop the area as a must-see destination.[11] The circular economy is an important business opportunity that can support the development of new industries and jobs in the region.[12] The Council is also committed to supporting the circular economy and waste management, aiming to reduce waste and greenhouse gas emissions through reuse, recycling and responsible manufacturing.

This section analyses the floorspace requirements for the workforce of Circular Head into the future. It also considers potential structural changes to the economy from the potential development of the Marinus Link and the impacts this may have on commercial and industrial land capacity in the region.

Industrial floorspace contains agriculture, forestry and fishing, mining, construction, electricity, gas, water and waste services. Commercial floorspace includes retail, office and other commercial (non-industrial) floorspace. Demand for this will be primarily population-driven, and partially driven by overall economic growth.

The analysis considers:

- current occupied commercial floorspace: distinguish between retail and other use categories – council data needed;
- employment projections by industry – SGS, based on historic patterns and with consideration of known economic changes in key sectors;

[8] https://rediscovertasmania.com.au/circular-head/
[9] https://woolnorthrenewables.com.au/about/
[10] CEAT (2021). Agriculture and the Circular Economy. https://ceat.org.au/agriculture-and-the-circular-economy/
[11] Hodgman, W. (2017) Growing Circular Head Tourism. https://www.premier.tas.gov.au/releases/growing_circular_head_tourism
[12] CSIRO. Circular Economy and Waste Management. https://www.csiro.au/en/research/environmental-impacts/sustainability/Circular-Economy

- apply floorspace to employment ratios to estimate future demand.

The upgrade of the Spirit of Tasmania ferry could be one of the major projects affecting tourism demand and supply in Circular Head, which is expected to increase in size by 30 per cent, carrying more passengers and vehicles across the Bass Strait.[13] The new ferry is scheduled to begin operations in 2023, which could boost visitor numbers and spending in Tasmania, especially in areas like Circular Head that offer coastal and natural experiences in areas like The Nut State Reserve[14]. Other projects that could improve tourism potential include a Regional Tourism Strategy, the recent move of the Circular Head Heritage Centre[15] and the Church Street Precinct Master Plan[16].

According to Tourism Tasmania, Circular Head received 113,000 visitors in 2019-20, a 4 per cent increase over the previous year. However, due to the COVID-19 pandemic, visitor numbers for the March 2020 quarter were down 28 per cent compared to the same period in 2019. The average length of stay was 2.5 nights and the average spend per visitor was $348. Circular Head's primary visitors were from intrastate (54 per cent), interstate (43 per cent) and international (3 per cent). The primary types of accommodations used by visitors were caravan parks/campgrounds (32 per cent), hotels/motels/resorts (25 per cent), and private accommodations (22 per cent). The main activities done by visitors were eating at restaurants/cafes (66 per cent), going to the beach (49 per cent), visiting national parks/reserves (45 per cent), and visiting historical/heritage buildings/sites (40 per cent). Tourism development primarily generates short-term commercial lodging growth, and this growth is difficult to translate into robust land demand projections, so SGS did not include it in the floor space demand projections.

3.1 Calculating future floorspace demand

SGS follows a three-step process when calculating employment floorspace demand:

1. Calculate future employment (number of jobs) by ANZSIC Division;[17]
2. Convert employment to floorspace using a defined floor area ratio (FAR) by industry; and
3. Bundle the divisions according to categories of provision.

Two scenarios have been considered to calculate the future requirements for Circular Head using this process. One scenario involves the completion of the Marinus Link positioning Circular Head as renewable powerhouse, while the other is a "business as usual" scenario, where the Marinus Link does not have an impact on future employment in the region.

Scenario A – Business as usual

1. Calculating future employment

Circular Head's major industries include agriculture, dairy production, quality beef production, forestry and timber production, commercial fisheries and aquaculture, manufacturing, vegetable processing, tourism, and iron ore pelletizing. According to ABS 2021 Census data, dairy cattle farming (13.7 per

[13] Spirit of Tasmania. https://www.spiritoftasmania.com.au/
[14] https://www.circularhead.tas.gov.au/__data/assets/pdf_file/0023/453290/tourism_advantage_web.pdf
[15] https://circularheadheritagecentre.com.au/about/
[16] https://www.circularhead.tas.gov.au/our-council/current-projects/church-street-precinct-master-plan
[17] https://www.abs.gov.au/ausstats/abs@.nsf/0/20C5B5A4F46DF95BCA25711F00146D75?opendocument

cent) provides the most employment in Circular Head, followed by meat processing (5.0 per cent) and beef cattle farming (4.1 per cent).[18]

As shown in Table 19, under the "business as usual" scenario, these agricultural and farming industries as well as the accommodation and food services industries are expected to see the greatest increases in employment, with 100 new jobs in each industry being added over the next 20 years. In contrast, there is expected to be a large fall in the number of manufacturing jobs, and a moderate fall in retail jobs over this period. Overall, industries in the municipality other than agriculture and farming are expected to continue to decay, with manufacturing in particular lacking new growth drivers. Employment growth in the commercial sector will be stimulated by tourism from the area's natural beauty and cultural heritage, while an ageing demographic will lead to increased demand for health care and social assistance in the future.

TABLE 19: EMPLOYMENT BY INDUSTRY IN CIRCULAR HEAD IN 2022 AND 2042 (SCENARIO A)

Industry	2022*	2042*	Change in employment*
Agriculture, Forestry and Fishing	880	980	100
Mining	90	80	-10
Manufacturing	560	310	-250
Electricity, Gas, Water and Waste Services	20	10	-10
Construction	200	180	-20
Wholesale Trade	120	200	80
Retail Trade	270	190	-80
Accommodation and Food Services	250	350	100
Transport, Postal and Warehousing	130	140	10
Information Media and Telecommunications	10	30	20
Financial and Insurance Services^	20	20	-
Rental, Hiring and Real Estate Services^	20	20	-
Professional, Scientific and Technical Services	80	90	10
Administrative and Support Services	70	100	30
Public Administration and Safety	110	140	30
Education and Training	280	360	80
Health Care and Social Assistance	250	330	80
Arts and Recreation Services^	20	30	10
Other Services	140	200	60

[18] ABS: Circular Head 2021 Census All persons QuickStats. https://abs.gov.au/census/find-census-data/quickstats/2021/LGA61210

Inadequately described or not stated	120	60	-60
Total Employment	**3,640**	**3,820**	**180**

Source: SGS Economics & Planning (2023)

* Rounded to nearest 10.

^ Whilst 2016 and 2021 data was used to draw out the annual average growth rate (AAGR) for most industries, the *Financial and Insurance Services* and *Rental, Hiring and Real Estate Services* industry projections were calculated using the 2021 job share since applying the AAGR results in negative projections and it is expected that the LGA will require a certain level of jobs to be maintained to service the its basic needs. Additionally, the *Arts and Recreation Services* projections were calculated using 2011 and 2021 Census data to minimise biases caused by rapid growth in this sector following the relaxing of COVID-19 restrictions.

2. Convert employment to floorspace using a defined floor area ratio (FAR) by industry

TABLE 20: FLOOR AREA RATIO BY ANZSIC INDUSTRY (SCENARIO A)

Industry	Floorspace (sqm) per unit of employment	Change in employment* (2022-42)	Total change in floorspace demand (sqm)
Agriculture, Forestry and Fishing	28	100	2,800
Mining	28	-10	-280
Manufacturing	29	-250	-7,250
Electricity, Gas, Water and Waste Services	30	-10	-300
Construction	33	-20	-660
Wholesale Trade	63	80	5,040
Retail Trade	39	-80	-3,120
Accommodation and Food Services	150	100	15,000
Transport, Postal and Warehousing	60	10	600
Information Media and Telecommunications	39	20	780
Financial and Insurance Services	26	-	-
Rental, Hiring and Real Estate Services	68	-	-
Professional, Scientific and Technical Services	26	10	260
Administrative and Support Services	27	30	810
Public Administration and Safety	33	30	990
Education and Training	80	80	6,400
Health Care and Social Assistance	35	80	2,800
Arts and Recreation Services	85	10	850
Other Services	75	60	4,500
Inadequately described or not stated	-	-60	-
Total Employment		180	**29,220**

Source: SGS Economics & Planning (2023)
* Rounded to nearest 10.

3. *Bundle the divisions according to categories or provision*

TABLE 21: COMMERCIAL AND INDUSTRIAL FLOORSPACE DEMAND (SQM) IN CIRCULAR HEAD (SCENARIO A)

	Total Employment change	Total floorspace demand (sqm)
Commercial	430	34,910
Industrial	-190	-5,690
Total	240*	29,220

Source: SGS Economics & Planning (2023)
* Excludes changes in inadequately described industries.

Scenario B – Renewable Powerhouse

Previous analysis conducted by SGS predicted that during the construction phase of Marinus Link, the high voltage direct current electricity connector between Tasmania and Victoria (2025-2029), 1,603 jobs would be injected into North West Tasmania's economy. During the operation phase, (2030 onwards), it is expected to contribute an average of 15 jobs per annum to North West Tasmania's economy, totalling 600 jobs in electricity generation over the period 2030 – 2050. Table 22 below shows the current levels of employment in those industries, as well as the proportion of North West Tasmania's total employment in those industries. Table 23 shows the proportion of the labour force in each municipality, taken up by the Marinus Link related industries.

TABLE 22: NORTH WEST TASMANIAN EMPLOYMENT IN MARINUS LINK RELATED INDUSTRIES

	Electricity, Gas, Waste & Water Services	Construction
Burnie	566 (46.4%)	60 (47.6%)
Circular Head	200 (16.4%)	16 (12.7%)
Waratah-Wynyard	454 (37.2%)	50 (39.7%)

Source: ABS Census 2021

TABLE 23: NORTH WEST TASMANIAN EMPLOYMENT IN MARINUS LINK-RELATED INDUSTRIES AS A PROPORTION OF THE LABOUR FORCE

	Electricity, Gas, Waste & Water Services	Construction
Burnie	6.5%	0.7%
Circular Head	5.5%	0.4%
Waratah-Wynyard	7.8%	0.9%

Source: ABS Census 2021

Circular Head has a relative underrepresentation of workers employed in the industries that will be hired for in the scenario that the Marinus Link makes the North West region a renewable powerhouse, whereby other windfarms and renewable projects are enabled. The flow on-effects modelled for Marinus link are considered to be a reasonable proxy for these future employment opportunities. This

scenario has been modelled as above, with the addition of a proportional increase in employment in the Construction and Electricity, Gas, Waste and Water Services sectors, in line with the percentages in Table 22.

TABLE 24: UPLIFTS BY SECTOR IN SCENARIO B COMPARED TO A, IN TOTAL AND FOR CIRCULAR HEAD

Industry	Change 2022-42	Weighted for CH
Agriculture, Forestry and Fishing	220	55
Mining	9	2
Manufacturing	203	51
Electricity, Gas, Water and Waste Services	69	17
Construction	391	98
Total Employment	**555**	**139**

Source: SGS Economics & Planning (2023)

1. Calculating future employment

The total employment change in Scenario B includes the uplifts to sectors as shown in Table 24.

TABLE 25: EMPLOYMENT BY INDUSTRY IN CIRCULAR HEAD IN 2022 AND 2042 (SCENARIO B)

Industry	2022*	2042*	Change in employment*
Agriculture, Forestry and Fishing	880	1,030	150
Mining	90	90	0
Manufacturing	560	360	-200
Electricity, Gas, Water and Waste Services	20	20	10
Construction	200	280	80
Wholesale Trade	120	200	90
Retail Trade	270	190	-80
Accommodation and Food Services	250	350	100
Transport, Postal and Warehousing	130	140	10
Information Media and Telecommunications	10	30	20
Financial and Insurance Services^	20	20	0
Rental, Hiring and Real Estate Services^	20	20	0
Professional, Scientific and Technical Services	80	90	10
Administrative and Support Services	70	100	30
Public Administration and Safety	110	140	30
Education and Training	280	360	90

Industry	2022*	2042*	Change in employment*
Health Care and Social Assistance	260	330	70
Arts and Recreation Services^	20	30	10
Other Services	140	200	60
Inadequately described or not stated	120	120	0
Total Employment	**3,630**	**4,090**	**460**

Source: SGS Economics & Planning (2023)

* Rounded to nearest 10.

^ Whilst 2016 and 2021 data was used to draw out the annual average growth rate (AAGR) for most industries, the *Financial and Insurance Services* and *Rental, Hiring and Real Estate Services* industry projections were calculated using the 2021 job share since applying the AAGR results in negative projections, and it is expected that the LGA will require a certain level of jobs to be maintained to service its basic needs. Additionally, the *Arts and Recreation Services* projections were calculated using 2011 and 2021 Census data to minimise biases caused by rapid growth in this sector following the relaxing of COVID-19 restrictions.

2. Convert employment to floorspace using a defined floor area ratio (FAR) by industry

TABLE 26: FLOOR AREA RATIO BY ANZSIC INDUSTRY (SCENARIO B)

Industry	Floorspace (sqm) per unit of employment	Change in employment* (2022-42)	Total change in floorspace demand (sqm)
Agriculture, Forestry and Fishing	28	150	4,200
Mining	28	0	0
Manufacturing	29	-200	-5,800
Electricity, Gas, Water and Waste Services	30	0	0
Construction	33	80	2,640
Wholesale Trade	63	90	5,040
Retail Trade	39	-80	-3,120
Accommodation and Food Services	150	100	15,000
Transport, Postal and Warehousing	60	10	600
Information Media and Telecommunications	39	20	780
Financial and Insurance Services	26	0	0
Rental, Hiring and Real Estate Services	68	0	0
Professional, Scientific and Technical Services	26	10	260
Administrative and Support Services	27	30	810
Public Administration and Safety	33	30	990
Education and Training	80	90	6,400
Health Care and Social Assistance	35	70	2,800

Arts and Recreation Services	85	10	850
Other Services	75	60	4,500
Inadequately described or not stated	-	0	0
Total Employment		**460**	**35,950**

Source: SGS Economics & Planning (2023)
* Rounded to nearest 10.

3. Bundle the divisions according to categories or provision

TABLE 27: COMMERCIAL AND INDUSTRIAL FLOORSPACE DEMAND (SQM) IN CIRCULAR HEAD (SCENARIO B)

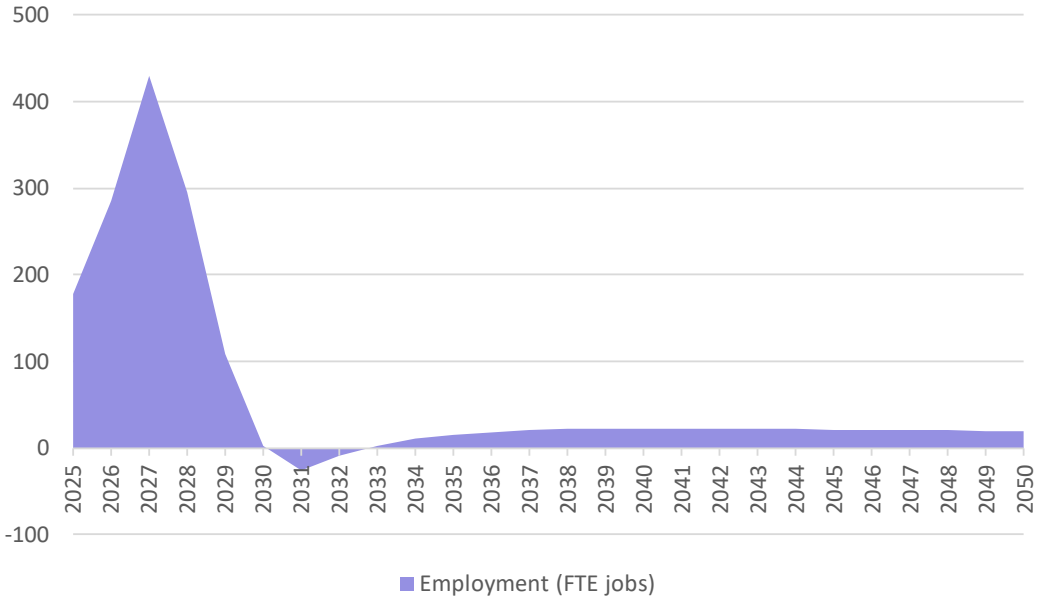
	Total Employment change	Total floorspace demand (sqm)
Commercial	430	35,000
Industrial	30	1,000
Total	**460***	**36,000**

Source: SGS Economics & Planning (2023)
* Excludes changes in inadequately described industries.

As the Marinus Link project is expected to induce a non-linear change in jobs, with the largest increase occurring during the five years of construction, SGS has also conducted this analysis for two other time periods to understand the evolution of changes in jobs over the next 20 years.

Table 28 shows the changes to employment expected over a period of 5, 10 and 20 years from 2022, under the renewable powerhouse scenario. It demonstrates that the peak employment occurs well before 2042 and is much higher than the permanent employment uplift until 2042. This is also reiterated by Figure 10. The Marinus Link project is expected to create a large demand for construction workers (1,220 FTE jobs between 2025 and 2050). This may cause competing demands employment in the agriculture, forestry and fishing industry as it competes with the need for construction workers. However, once construction is completed, the Project is expected to support job growth in these industries. The Project is also expected to create jobs in wholesale trade (200 FTE jobs between 2022 and 2050), accommodation and food services (200), other services (180), health care and social assistance (170), and professional services (130).

FIGURE 10: FTE GENERATED BY CONSTRUCTION AND OPERATION IN NORTH WEST TASMANIA



Source: SGS Economics & Planning (2023); Centre for Policy Studies

TABLE 28: EMPLOYMENT BY INDUSTRY IN CIRCULAR HEAD IN 2027, 2032 AND 2042 (SCENARIO B)

Industry	Change from 2022-2027	Change from 2022-2032	Change from 2022-2042 (Permanent)
Agriculture, Forestry and Fishing	-60	0	150
Mining	0	0	0
Manufacturing	-10	0	-200
Electricity, Gas, Water and Waste Services	10	10	10
Construction	360	540	80
Wholesale Trade	50	60	80
Retail Trade	80	110	-100
Accommodation and Food Services	40	50	90
Transport, Postal and Warehousing	30	40	0
Information Media and Telecommunications	10	10	10
Financial and Insurance Services^	0	0	0
Rental, Hiring and Real Estate Services^	0	0	-10
Professional, Scientific and Technical Services	40	60	20
Administrative and Support Services	20	30	40
Public Administration and Safety	10	20	30
Education and Training	20	30	80
Health Care and Social Assistance	60	70	40
Arts and Recreation Services^	10	20	0
Other Services	40	60	60
Inadequately described or not stated	0	0	0
Total Employment	**690**	**1,090**	**380**

Source: SGS Economics & Planning (2023)

* Rounded to nearest 10.

^ Whilst 2016 and 2021 data was used to draw out the annual average growth rate (AAGR) for most industries, the Financial and Insurance Services and Rental, Hiring and Real Estate Services industry projections were calculated using the 2021 job share since applying the AAGR results in negative projections, and it is expected that the LGA will require a certain level of jobs to be maintained to service its basic needs. Additionally, the Arts and Recreation Services projections were calculated using 2011 and 2021 Census data to minimise biases caused by rapid growth in this sector following the relaxing of COVID-19 restrictions.

TABLE 29: FLOOR AREA RATIO BY ANZSIC INDUSTRY IN 2027, 2032 AND 2042 (SCENARIO B)

Industry	Total change in floorspace demand (sqm) 2022-2027	Total change in floorspace demand (sqm) 2022-2032	Total change in floorspace demand (sqm) 2022-2042
Agriculture, Forestry and Fishing	-1,120	0	4,200
Mining	-280	-280	0
Manufacturing	-2,030	0	-5,800
Electricity, Gas, Water and Waste Services	0	300	0
Construction	11,550	17,820	2,640
Wholesale Trade	3,780	3,150	5,040
Retail Trade	2,340	3,900	-3,120
Accommodation and Food Services	9,000	7,500	15,000
Transport, Postal and Warehousing	1,800	2,400	600
Information Media and Telecommunications	390	390	780
Financial and Insurance Services	0	0	0
Rental, Hiring and Real Estate Services	0	0	0
Professional, Scientific and Technical Services	1,040	1,560	260
Administrative and Support Services	810	810	810
Public Administration and Safety	660	660	990
Education and Training	3,200	1,600	6,400
Health Care and Social Assistance	2,800	2,450	2,800
Arts and Recreation Services	1,700	1,700	850
Other Services	3,750	3,750	4,500
Inadequately described or not stated	0	0	0
Total Employment	**39,390**	**47,710**	**35,950**

Source: SGS Economics & Planning (2023)

* Rounded to nearest 10.

TABLE 30: COMMERCIAL AND INDUSTRIAL FLOORSPACE DEMAND IN 2027, 2032 AND 2042 (SCENARIO B)

	Total floorspace demand (sqm) 2022-2027	Total floorspace demand (sqm) 2022-2032	Total floorspace demand (sqm) 2022-2042
Commercial	31,270	29,870	34,910
Industrial	8,120	17,840	1,040
Total	**39,390**	**47,710**	**35,950**

Source: SGS Economics & Planning (2023)

* Excludes changes in inadequately described industries.

Peak employment is projected to occur within the next ten years, and in fact, floorspace demand over the next five years will be greater than the permanent demand in the long term, that is – to 2042. This comes as Marinus Link and other renewable projects bring in a temporary workforce, especially during the construction phase, which is why there is such a large demand for industrial floorspace between 2022-32, which significantly dwindles to 2042. Demand for commercial floorspace is relatively stable across the periods.

In addition, there are acute workforce needs in Circular Head in the short term. The Circular Head Workforce Planning Study finds that the Circular Head region could use an additional 300-400 workers immediately or over the next three years.[19]

3.2 Summary

Commercial floorspace

The commercial floorspace demand for two scenarios has been considered in this analysis: one "Renewable Powerhouse" scenario in which the Marinus Link project is likely to boost employment in the region, and a "business as usual" (BAU) scenario. The RP scenario in this report contains an Economic Impact Assessment (EIA) for Marinus Link, which estimates that the value added to the economy by the construction and operation of Marinus Link creates significant employment in a variety of local and state industries, including construction, professional services, retail, manufacturing, and accommodation and food services. The model was conducted by the Centre for Policy Studies (CoPS) at the University of Victoria, Melbourne.

Under the "business as usual" scenario, the Accommodation and Food Services and Education and Training industries are expected to experience large increases in employment over the next 20 years, whilst there is expected to be a fall in retail jobs. Overall, there is expected to be 430 new jobs in commercial industries added over this period, equivalent to an increase in floorspace demand of 34,910 sqm.

In the "Renewable Powerhouse" scenario, the industries that would see a major change in employment are the industrial ones. However, the project is expected to create even more jobs over the long-term, supporting growth in indirectly related industries, in the commercial sector such as accommodation and food services, and in health care and social assistance. Overall, the Renewable Powerhouse scenario will result in 430 additional jobs in commercial industries between 2025 and 2042 and require an additional 34,910 sqm of floorspace compared to BAU. Renewable energy projects could inject a new economic growth engine into Circular Head.

Industrial floorspace

As above, the same two scenarios have been assessed.

In the BAU scenario, one of Circular Head's major industries; Agriculture, Forestry and Fishing is expected to experience a large increase in employment. Growth in the traditionally dominant

[19] https://www.circularhead.tas.gov.au/__data/assets/pdf_file/0020/1109207/CH-Workforce-Planning-Study-Volume-1-Report-FINAL.pdf

agricultural sector may come from the development of circular economies, as demand for food and how it is produced evolves to become more sustainable. However, it would be undercut by contractions in other industrial sectors, especially manufacturing, which is projected to nearly halve over the next two decades under this scenario. Overall, the industrial sector is projected to demand 190 fewer jobs by 2042 than currently, equivalent to a decrease of 5,690 sqm of required floorspace.

Together with commercial demand, this scenario leads to an overall increase in employment of 240 (including in inadequately described industries), and an additional floorspace demand of 29,220 sqm.

Under the “Renewable Powerhouse” scenario, a large increase in construction jobs is expected during the initial few years of the project, which may lower employment in the agricultural industries as these sectors compete for workers. Overall, the industrial sector is projected to grow by 30 jobs by 2042 and require an additional 1,040 sqm of employment floorspace. While this is a modest increase, compared to the decline in the industrial sectors in the BAU scenario, it reflects a more significant impact in industrial floorspace demand in this scenario. Moreover, the peak employment demand for industrial sectors is expected to occur before 2042, during the construction phase of the Marinus Link and other proposed renewable energy projects. Between 2022 and 2032, the construction sector alone is expected to grow by 540 jobs, relating to about 18,000 sqm of industrial floorspace demand, before contracting again to 2042. Whereas in the BAU scenario, the Manufacturing industry was projected to shrink. If North West Tasmania becomes a hub for renewable energy production, wind farm development may be a new industry that enters the region, providing jobs in the manufacturing and energy generation sectors.

The development and introduction of new industries to the region would not only have a direct impact on the sectors which directly contribute to employment. It would also influence demand in sectors such as retail and accommodation.

Together with commercial demand, this leads to an increase in employment of 460 (including inadequately described industries), equivalent to additional floorspace demand of 35,950 sqm.

4 Environmental values, natural values, and hazard assessment

Natural hazard events are increasing and becoming more severe, due to the impacts of worsening climate change. Circular Head is exposed to risks such as stormwater flood events, river flooding, bushfires and increasingly, extreme heat events. While Tasmania is one of the few locations in the country with fairly good data on climate change (Climate Future of Tasmania), there is still limited data available to better understand the risk exposure of our communities. SGS applied Climatics and LIST data to assess the impact of Circular Head rainfall, flooding, bushfire, coastal hazards, and extreme sea level rise on both agriculture and natural assets in response to historical records of climate hazards provided by the Council. The data from Climatics was used to recalibrate risk exposure in the community and identify climate hot spots. In addition, from this recalibrated present-day, forward projections is established. As part of the analysis there had also been consideration of the Tasmanian Flood Mapping Project (by SES), which has modelled the impacts of climate change on flooding at Duck River and Arthur River. This data was used to perform risk exposure and climate hotspot overlap analysis for the community. SGS also included several irreplaceable cultural, heritage and natural assets in the climate change risk assessment for Circular Head. These include the Tarkine Wilderness Area, Rocky Cape National Park, Arthur River, the historic town of Stanley, and Aboriginal heritage.

4.1 Temperature

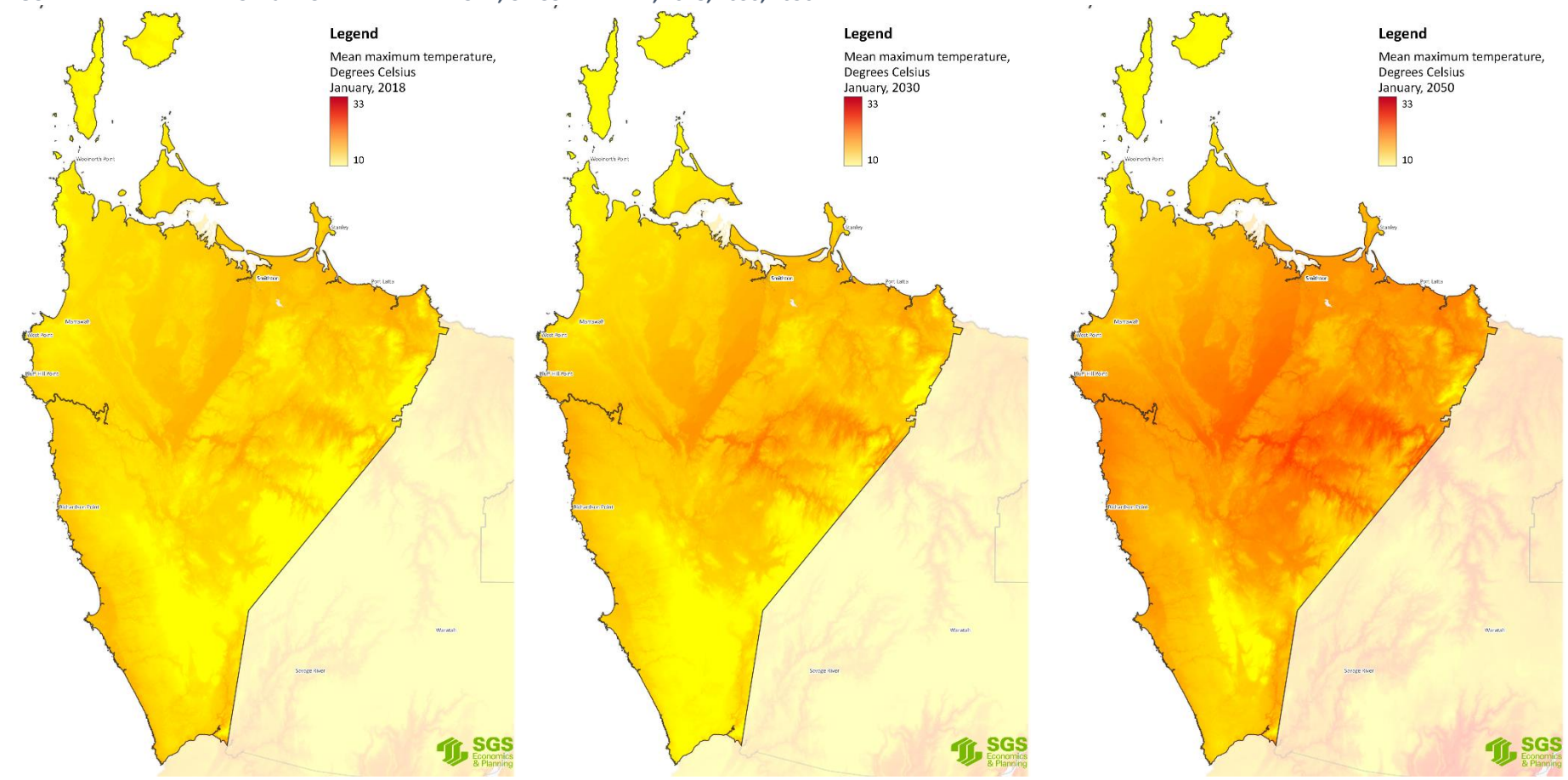
Like the rest of Tasmania, Circular Head is expected to see an increase in average temperatures, leading to more frequent and severe heat waves. This will have implications for human health, agriculture, water resources and native ecosystems.

- Under the higher emissions scenario, the city is expected to experience an average temperature increase of 2.6 to 3.3°C throughout the 21st century. The increase in daily minimum temperature is projected to be slightly higher than the daily maximum temperature and have similar temperature variations across the seasons. The projected change for the entire century is 1.3 to 2.0°C under the low emissions scenario.
- The projected change in mean temperature is similar to the rest of Tasmania but is lower than the global average and significantly lower than northern Australia and many parts of the world, particularly the northern hemisphere continents and the Arctic.

Figure 11 below presents historical (2018) and projected future mean maximum temperatures in January, selected at the peak of summer. The 2030 and 2050 maximum temperature maps are projections based off the RCP 8.5 scenario.[20] The progressive darkening of the maps is indicative of rising maximum temperatures in January throughout the three time periods. By 2050, mean maximum temperatures in parts of Circular Head will reach 30 °C under this high emissions scenario. The current average daily maximum temperature through January is 20°C in Smithton.

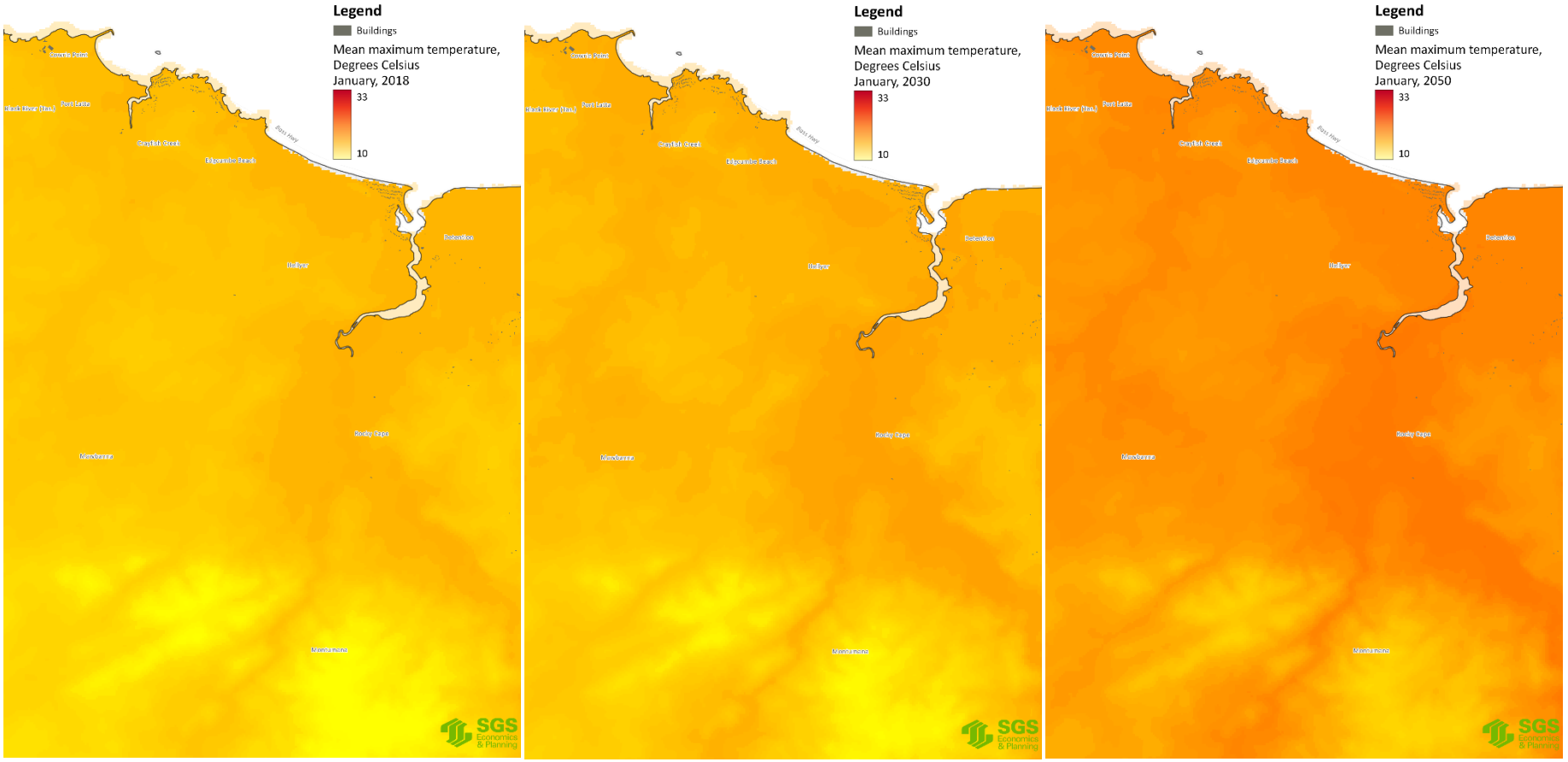
[20] https://nrmdatalibrary.dpipwe.tas.gov.au/FactSheets/WfW/ListMapUserNotes/Inventory_DCM_Tas.pdf

FIGURE 11: MEAN MAXIMUM JANUARY TEMPERATURE, CIRCULAR HEAD, 2018, 2030, 2050



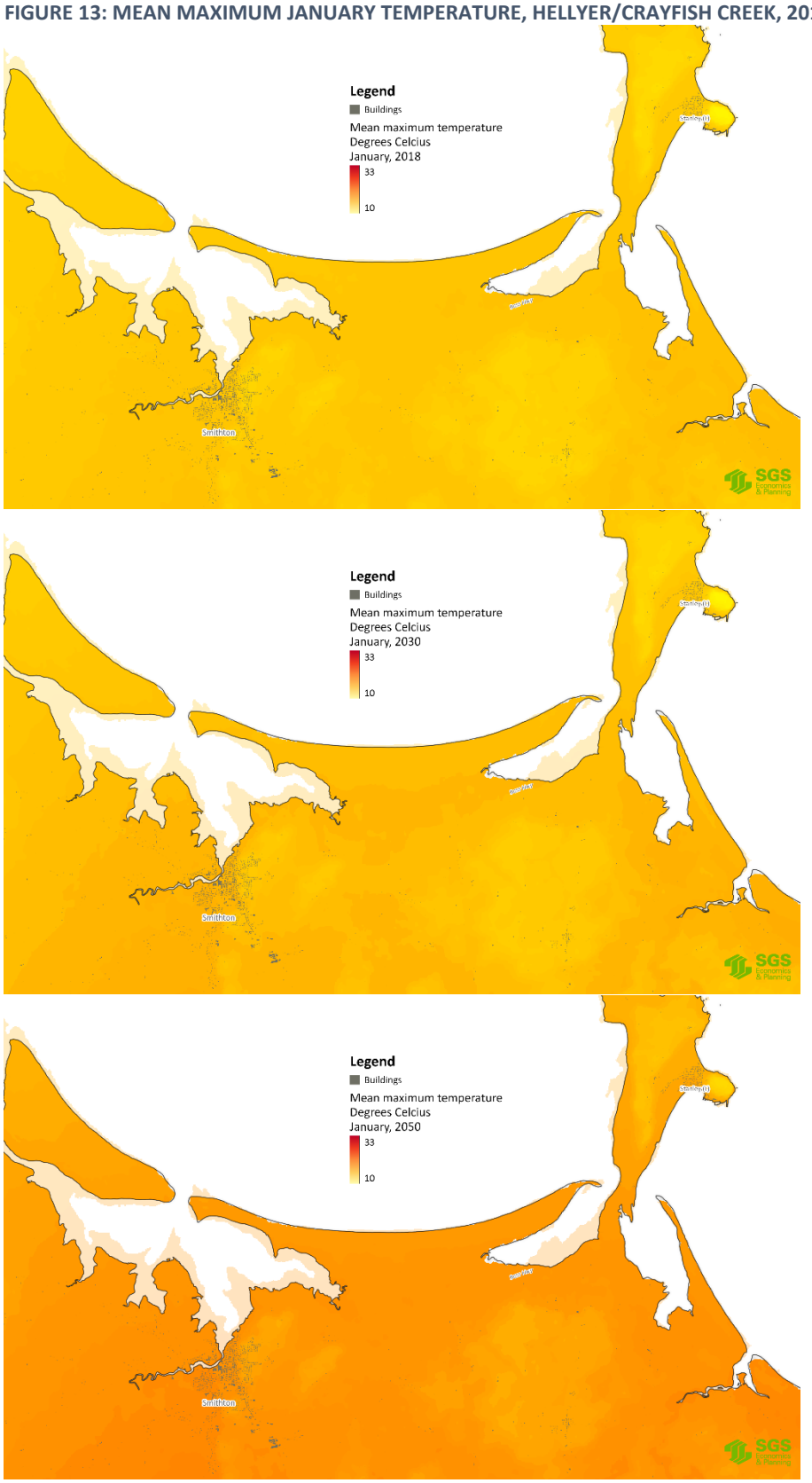
Source: TheLIST; Department of Natural Resources and Environment (accessed 2023)

FIGURE 12: MEAN MAXIMUM JANUARY TEMPERATURE, HELLYER/CRAYFISH CREEK, 2018, 2030, 2050



Source: SGS Economics & Planning (2023); theLIST (accessed 2023)

FIGURE 13: MEAN MAXIMUM JANUARY TEMPERATURE, HELLYER/CRAYFISH CREEK, 2018, 2030, 2050



Source: SGS Economics & Planning (2023); theLIST (accessed 2023)

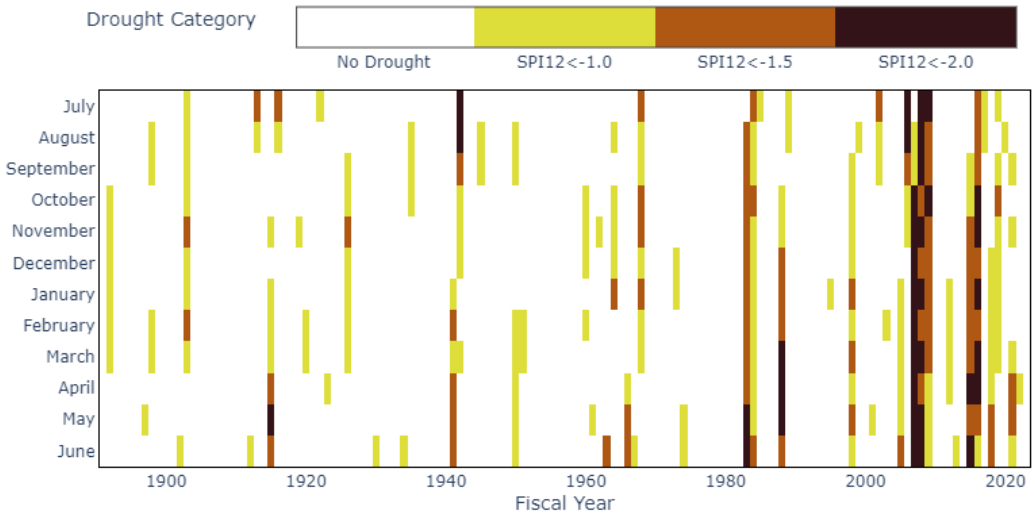
As presented in Figure 12 and Figure 13, much of the urban settled areas in Circular Head, particularly Smithton and Stanley, are on coastal areas where the temperature is expected to rise higher than in more inland, higher altitude areas.

4.2 Rainfall

Average rainfall in Circular Head has been declining since the mid-1970s, and there has been a lack of very wet years, with this decline being strongest in Autumn. The "big dry" drought of 1995-2009 exacerbated this decline. Rainfall in the last two years has generally been above average.[21]

Circular Head experienced its longest drought on record – 27 months – from October 2006 to December 2008. The frequency and severity of droughts have been on an upward trajectory since the 1960's. From 1961 to 1990, 13.67 months per decade were spent in drought conditions. Since 1991, 29.15 months per decade – almost a quarter – have been spent in drought conditions. This trend is shown in Figure 14 below. According to Climatics forecasts, the drought in Circular Head will intensify, unlike other areas of North West Tasmania. Most areas including Smithton, Marrawah and Arthur River will see an increase in moderate, severe, extreme drought months, with Smithton having a moderate risk of 17.8 additional drought months over the next decade. Some central areas may see an increase in drought of 25.8 months. In contrast, drought conditions in Crayfish and Hellyer will ease slightly. This trend in frequency is depicted in Figure 15, which demonstrates that most of the region has been experiencing droughts more often in the recent past. Smithton, Arthur River, and central locations in Circular Head are all at extreme risk of moderate to extreme drought according to Climatics risk assessment shown in Figure 15. In fact, in the last two decades, 28 months have been spent in severe drought conditions, while in the century prior, 8 months were endured in the same conditions.

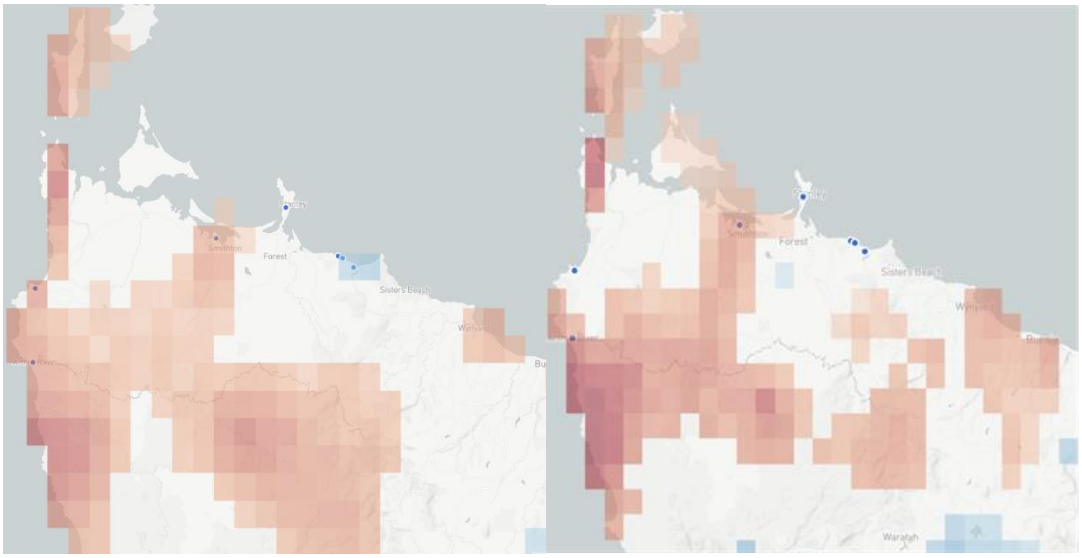
FIGURE 14: FREQUENCY OF DROUGHTS IN DROUGHT PRONE AREAS IN CIRCULAR HEAD



[21]Michael Grose. Local climate profile: Circular Head Municipality. https://www.dpac.tas.gov.au/__data/assets/pdf_file/0011/24122/Circular_Head.pdf

Source: Climatics (accessed 2023)

FIGURE 15: DROUGHT TREND IN FREQUENCY IN CIRCULAR HEAD



Drought, Bushfire	Trend in Frequency Result					
	Significantly Negative	Marginally Negative	No Clear Trend / No Trend	Marginally Positive	Significantly Positive	Significantly Positive + Δ rate>12
Risk Score	**Low**	**Low**	**Low**	**Medium**	**High**	**Extreme**

Note: Left is moderate risk of drought map, right is severe risk of drought map from Climatics. Red indicates a positive trend in frequency of droughts, while blue indicates areas where droughts are becoming less common.

Source: Climatics (accessed 2023)

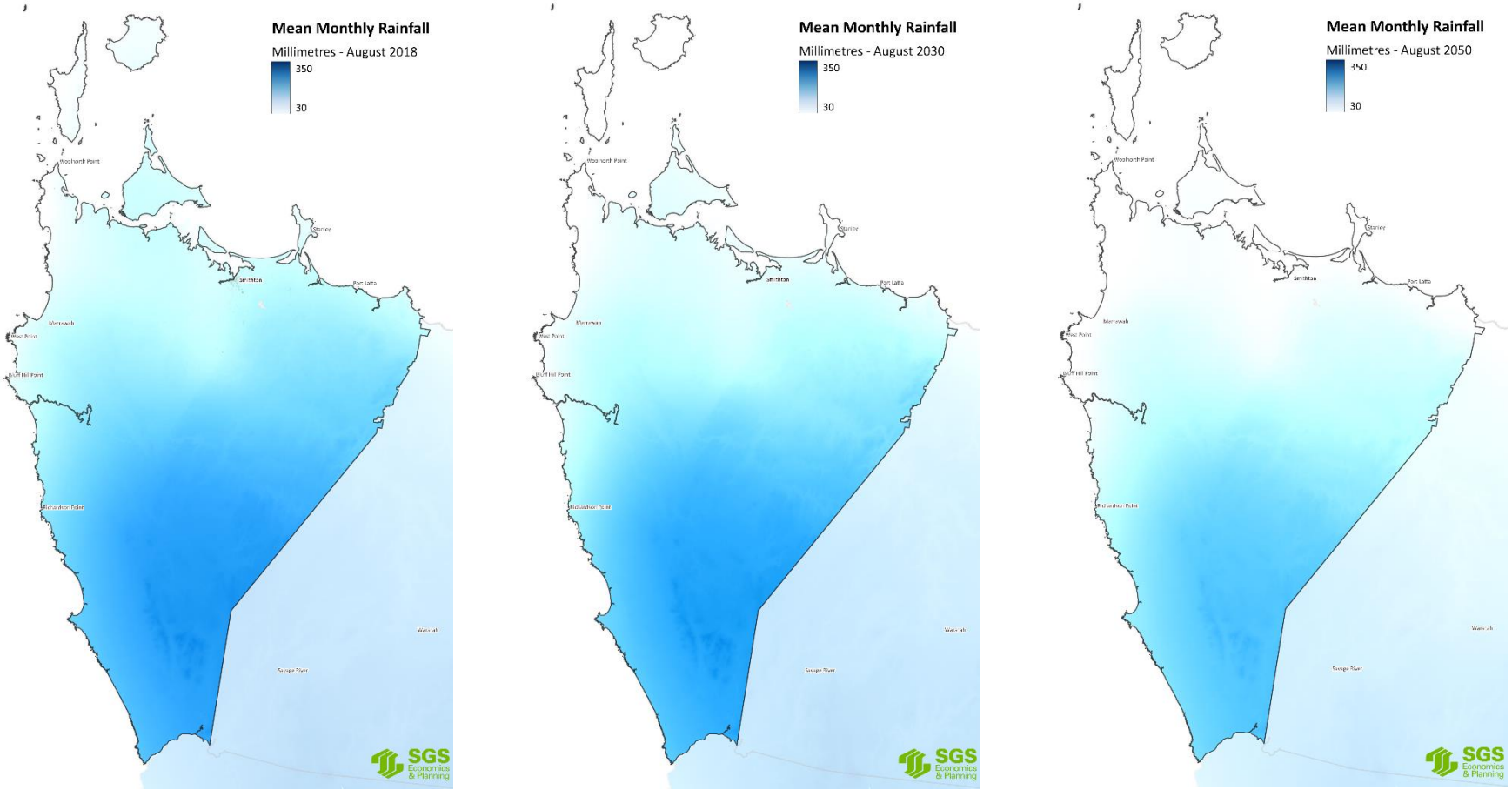
Figure 16 below indicates average rainfall in August – Tasmania's wettest month – historically (2018) and projections for 2030 and 2050 which are based off the RCP 8.5 scenario, as above. Rainfall in August at Circular Head (the wettest month in Tasmania) is expected to continue to decline in 2030 and 2050 based on the RCP8.5 scenario projections, which assumes high levels of greenhouse gas emissions.[22] Climate change is likely to lead to more intense rainfall events at Circular Head. This means a greater risk of heavy rainfall, which could lead to flooding and erosion. The region will also experience longer periods of drought interspersed with more intense rainfall events, which could have significant impacts on agriculture, water resources, and natural ecosystems.

The Climate Futures for Tasmania project model suggests that the region is likely to experience more rainfall in the winter and less in the summer, which could have implications for water storage and irrigation practices.[23]

22 https://web.archive.org/web/20150406012906/http://www.dpac.tas.gov.au/__data/assets/pdf_file/0019/134209/CFT_Summary_-_General_Climate_Impacts.pdf

23 https://recfit.tas.gov.au/what_are_the_projected_impacts_for_tasmania

FIGURE 16: MEAN MONTHLY (AUGUST) RAINFALL IN CIRCULAR HEAD, 2018, 2030, 2050



Source: TheLIST; Department of Natural Resources and Environment (accessed 2023)

Circular Head is one of the drier regions in Tasmania, especially the coastal areas which are illustrated by a lighter blue in Figure 16.

4.3 Flooding

The major rivers in Circular Head are the Detention River, Black River, Duck River, Montague River, Welcome River and Arthur River. The Arthur River is the largest and longest river in Circular Head. It originates in the Waratah-Wynyard municipal district on Mount Bischoff and flows westward into the Southern Ocean. Areas along the Arthur and Duck rivers may be at risk of river flooding during heavy rains. Climate change is expected to lead to an increase in the intensity and variability of precipitation events. This may bring about more frequent and severe flooding as storm events may inundate local drainage systems and cause rivers to overflow their banks. Low-lying coastal areas, such as Smithton, Marrawah and Stanley, may be affected by storm surge and coastal flooding according to a report from TAS State Emergency Service presenting the results of a flood modelling study conducted in the Arthur River catchment.[24] The report notes that the lower Arthur River and its tributaries are particularly vulnerable to flooding and that low-lying areas can be inundated during major flood events. It also identifies several flood-prone areas within the Circular Head Council area, including the towns of Smithton and Stanley.

The June 2016 flooding event in northern Tasmania was a major disaster causing widespread damage in several cities. This extreme weather event highlighted the vulnerability of a wide range of infrastructure, property and agriculture to heavy rainfall and flooding. The devastating loss of 310 livestock from the Arthur River dairy farm at Circular Head is a clear example of the impact of flooding on the agricultural sector.[25] Accurate flood modelling and risk assessment can help communities and local authorities better prepare for and mitigate the impacts of future floods.

As sea levels rise, the coastal areas of Circular Head may experience more frequent and severe storm surges, resulting in an increased risk of coastal flooding. When storm surges coincide with heavy rainfall events, they can exacerbate river flooding because higher sea levels can impede water flow out to sea. In addition to increasing the risk of storm surges, sea level rises can lead to gradual inundation of low-lying coastal areas, resulting in more frequent flooding during high tide or heavy rainfall events.

Warmer temperatures and more intense rainfall events can lead to higher runoff rates, resulting in increased soil erosion and sedimentation in rivers and streams. This can reduce the capacity of rivers and drainage systems, making them more susceptible to flooding.

Based on the Climatics Flood Watch Alert record regarding rainfall amounts and potentially affected catchments, the Arthur River, Northwest and Central Coast River catchments may be at greater risk of flooding during high rainfall weather conditions. Low-lying areas near these water bodies and poor drainage systems are more likely to experience flooding. Areas adjacent to rainfall-affected rivers and catchments on the other hand may be more susceptible to flooding due to moderate rainfall, wet catchments, and rapid river response.

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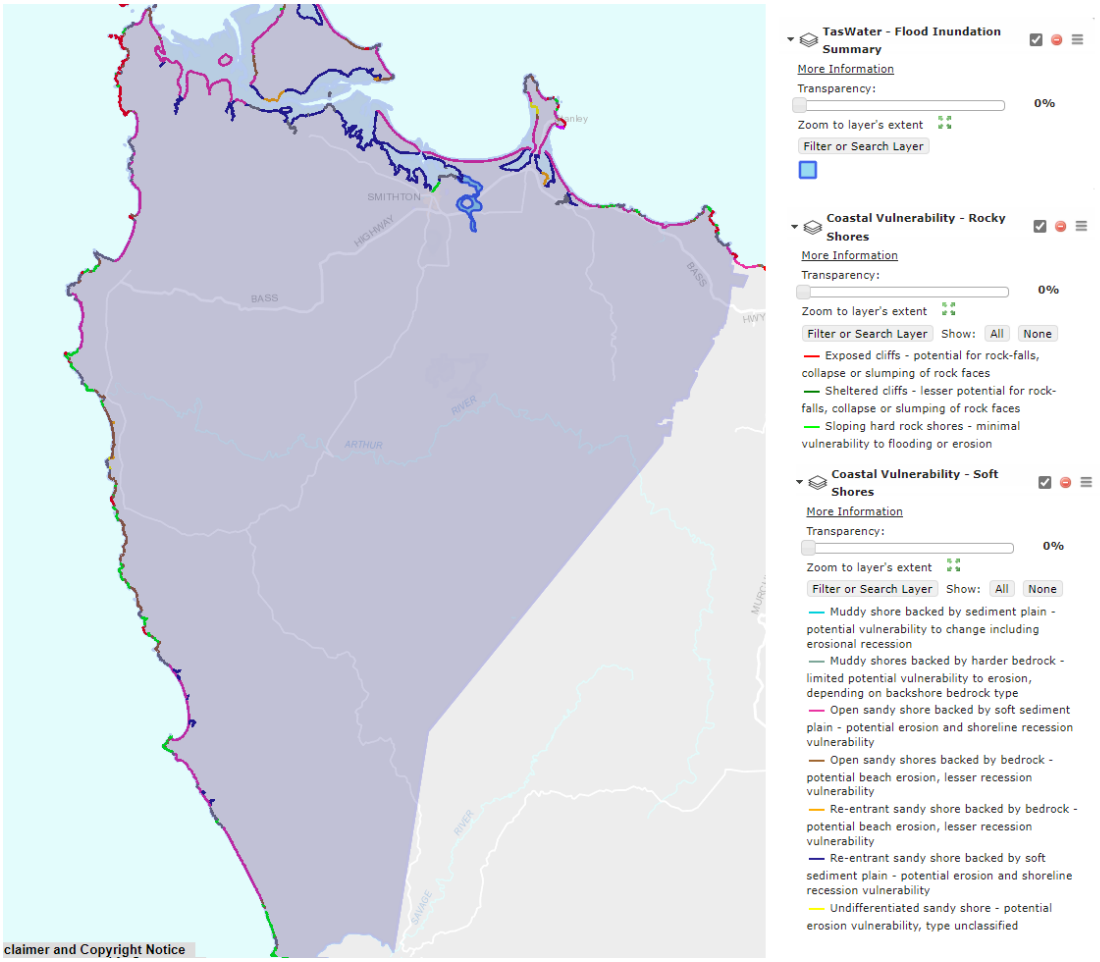
[24] Arthur Study Area Design Flood Modelling Report. Tasmanian Government, Department of Premier and Cabinet, Hobart, Tasmania. August 2022. Retrieved from https://d2kpbjo3hey01t.cloudfront.net/uploads/2022/08/Arthur-study-area-design-flood-modelling-report-August-2022.pdf

[25] Western Municipal Combined Area Emergency Management Committee. (2020). Western Emergency Management Plan. Issue 2.

Smithton, Circular Head's largest township, lies along the Duck River, which flows into Duck Bay, though it originates about 17 km southeast, near Nabageena, at an elevation of about 200 metres. It traverses undulating hills as it zig-zags towards Smithton, and as a result of the surrounding topography, low-lying agricultural areas along its banks are prone to flooding.[26] Arthur River is the largest river in the municipality, traversing it from east to west, and emptying into the Indian Ocean. According to Climatics, most of Circular Head is at low risk of flooding including the township of Arthur River. However, inland, along Arthur River, at the Kanunnah Bridge, the risk of flooding is extreme. A one in 20-year flood event at this site would reach a depth of 1.5 metres, while parts of the surrounds (within 100 metres) would reach a flood depth 3.7 metres. However, this site is within the Trowutta Regional Reserve, in a Landscape Conservation Zone, meaning that development is likely to be insignificant if anything.

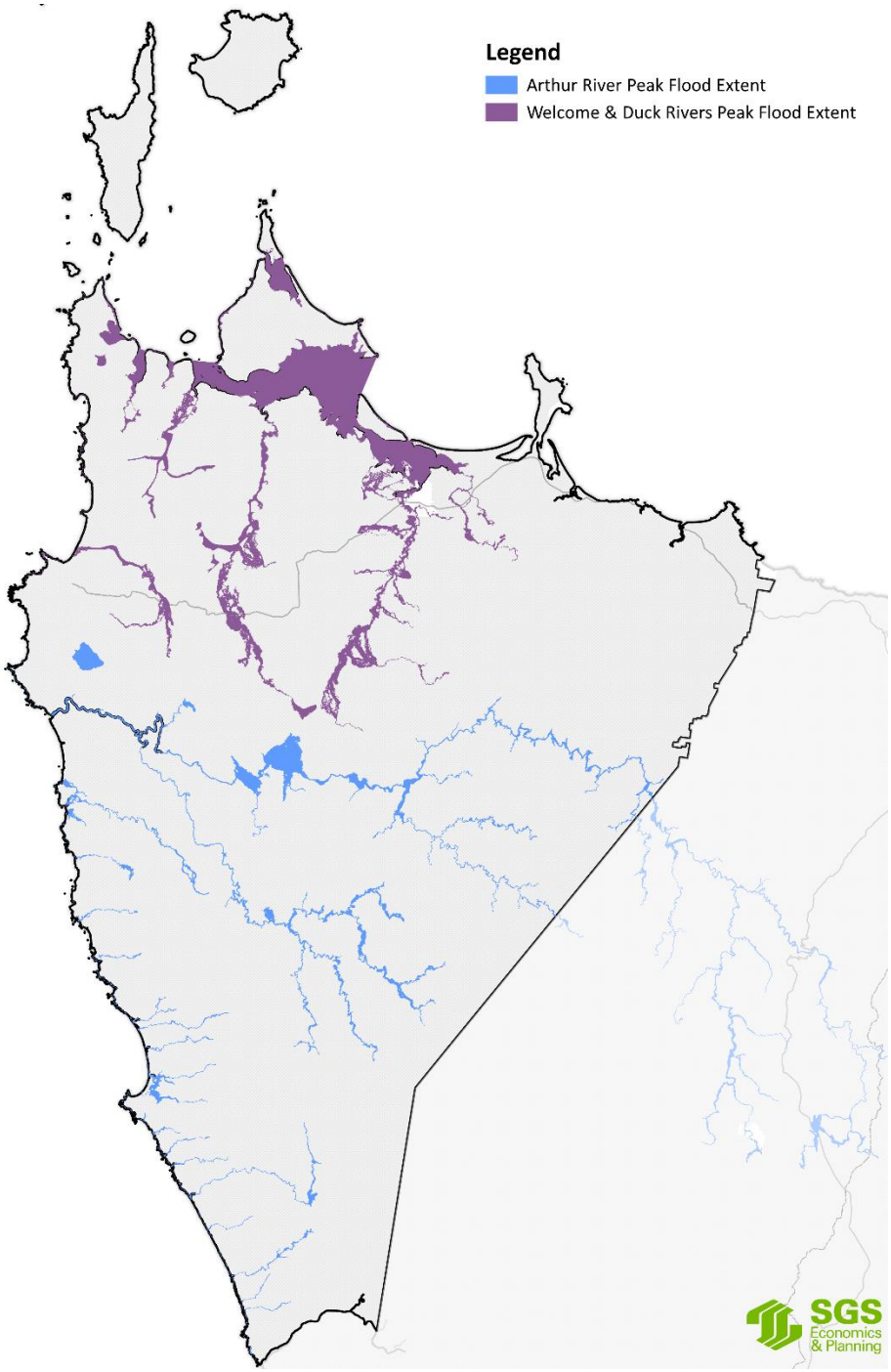
FIGURE 17: COASTAL VULNERABILITY AND FLOOD INUNDATION SUMMARY IN CIRCULAR HEAD



Source: Circular Head Council (accessed 2023)

[26] https://nre.tas.gov.au/Documents/Duck-River-SOR-Executive-Summary.pdf

FIGURE 18: WELCOME RIVER, DUCK RIVER AND ARTHUR RIVER PEAK FLOOD EXTENTS



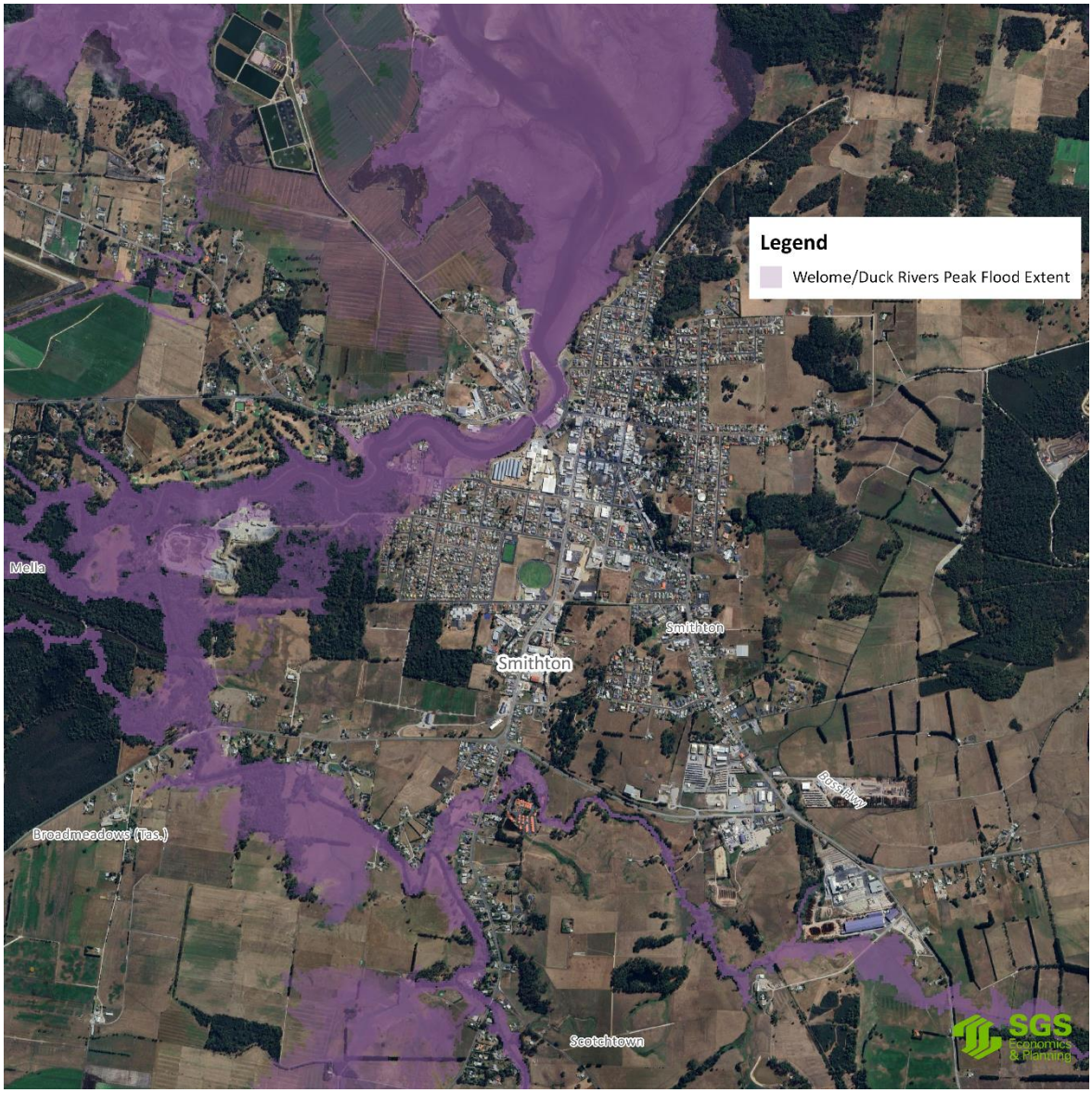
Source: Circular Head Council (accessed 2023)

Figure 18 shows the peak flood extents of two of Circular Head's major river systems. The Welcome and Duck Rivers in the north have peak flood extents that cover some of the more populated, urbanised areas, along the north coast, while the Arthur River flood extent covers state and forest reserves and some agricultural land around Marrawah and Redpa, as well as in central Circular Head, around Trowutta. As described above, during periods of heavy rainfall, the probability that these rivers would break their banks and threaten communities and/or agricultural land rises. A primary concern would be

the cutting off of transport routes due to flooding occurring on highways. This could threaten the fairly remote local communities along the municipality's east coast, including Arthur River.

As Figure 19 demonstrates, the peak flood extent of the Duck River, which flows into the Duck Bay at Smithton, threatens residential land in the municipality's largest township, as well as agricultural land on the outskirts.

FIGURE 19: DUCK RIVER FLOOD EXTENT AT SMITHTON



Source: SGS Economics and Planning (2023)

4.4 Bushfire

Circular Head has a history of bushfires that have impacted the region over the years, with some of the most significant events occurring in 2013, 2016, and 2019. The region's risk of bushfires is influenced by its landscape, climate conditions, and human activity in rural areas. As a region with dense vegetation,

forested areas, and agricultural land, Circular Head is susceptible to bushfires, especially during dry and hot seasons. Given the trend in drought frequency, the conditions that lead to dry forest floors that are especially susceptible to burning put the region at greater risk.

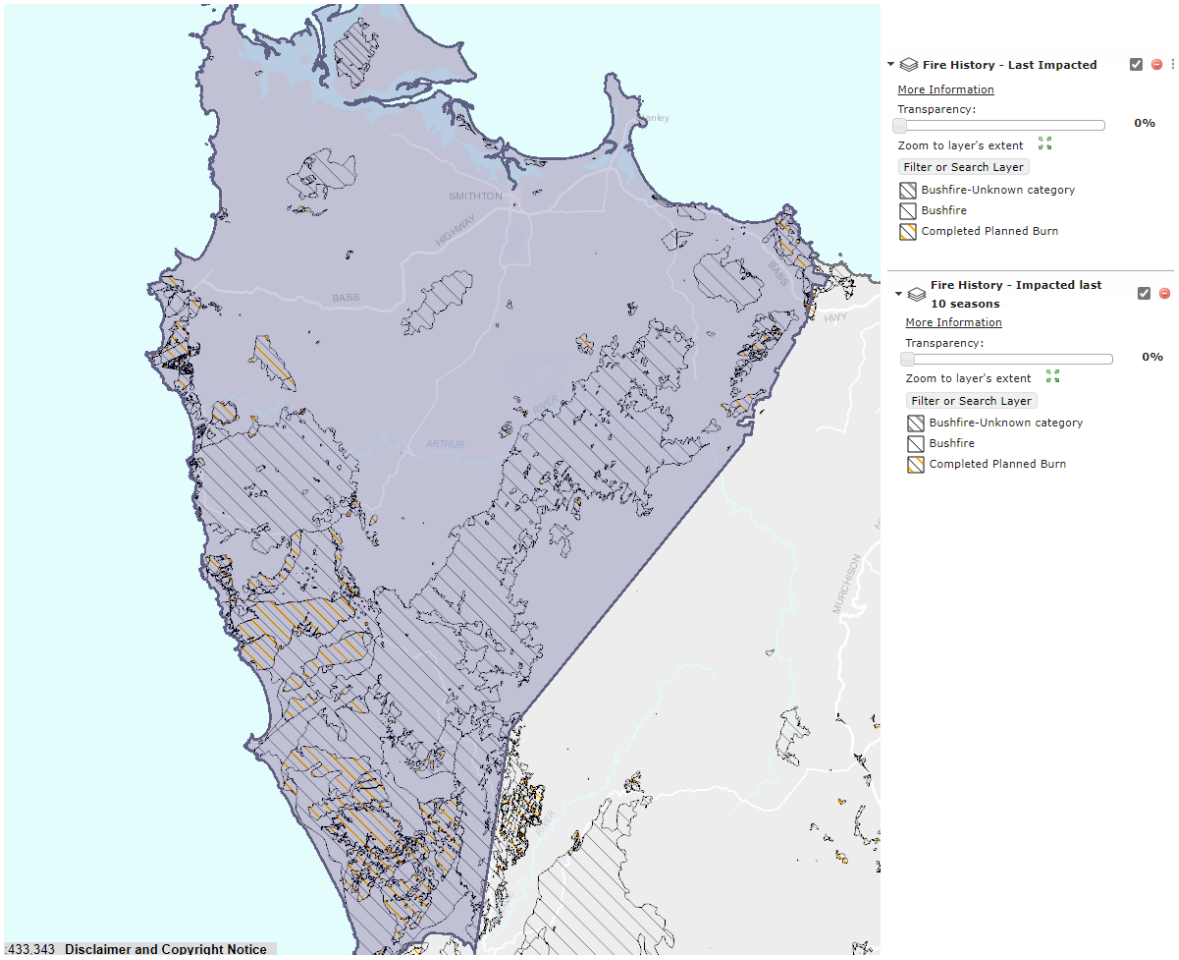
According to the Tasmanian Planning Scheme – Circular Head and Climatics analysis, there are many areas in Circular Head that are considered bushfire prone, with the exception of urbanised areas like Smithton, Stanley and Marrawah. However, even in these areas, some residential areas may still be at risk of direct bushfire damage due to their proximity to wildland vegetation. Hellyer, Crayfish Creek and Edgcumbe Beach are among the high-risk areas with an annual incidence of 12.26% of bushfire events and 14.53% in the eastern part of Hellyer.

The January 2019 bushfire in Circular Head was a significant event, burning large areas of land and impacting forestry assets, beehives, and some pasture and fencing.[27] As climate change continues to cause drier and hotter summers and more frequent droughts, bushfire-prone areas in Circular Head are likely to experience increased risk and potential damage in the future.

Circular Head's bushfire annual exceedance probability (AEP)[28] is subject to fluctuations depending on climate conditions and other factors. The region's risk of drought and extreme heatwaves, as well as its likelihood of experiencing high fire danger on the Fire Danger Index, contribute to its overall bushfire risk assessment. By monitoring these factors and understanding the trends in bushfire frequency and severity, communities in Circular Head can better prepare for and mitigate the risk of future bushfire events.

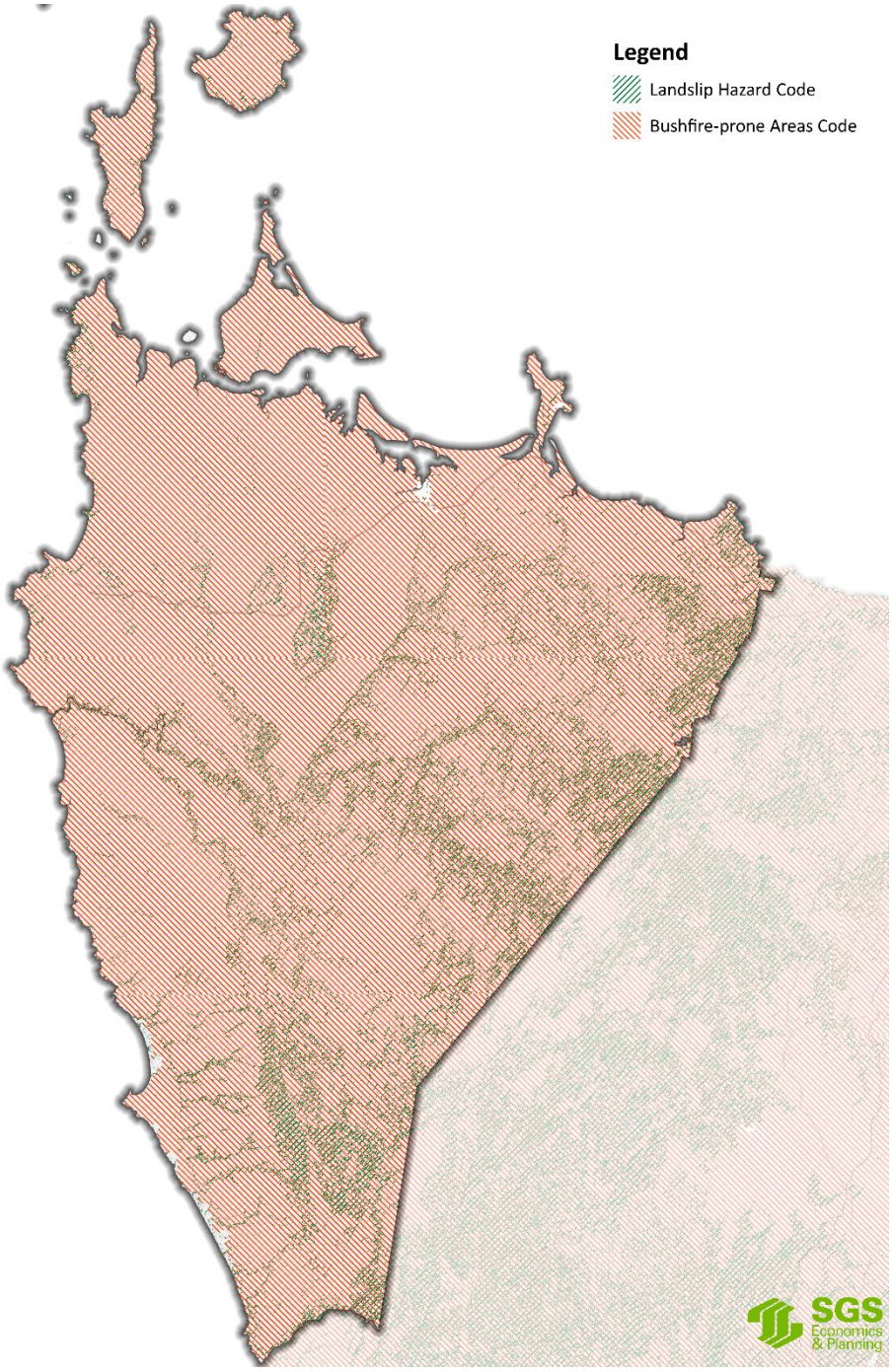
[27] Western Municipal Combined Area Emergency Management Committee. (2020). Western Emergency Management Plan. Issue 2.
[28] Annual exceedance probability refers to the likelihood that an event, in this case, a bushfire, will occur within a period of one year

FIGURE 20: BUSHFIRE MANAGEMENT OVERLAYS IN CIRCULAR HEAD



Source: Circular Head Council (accessed 2023)

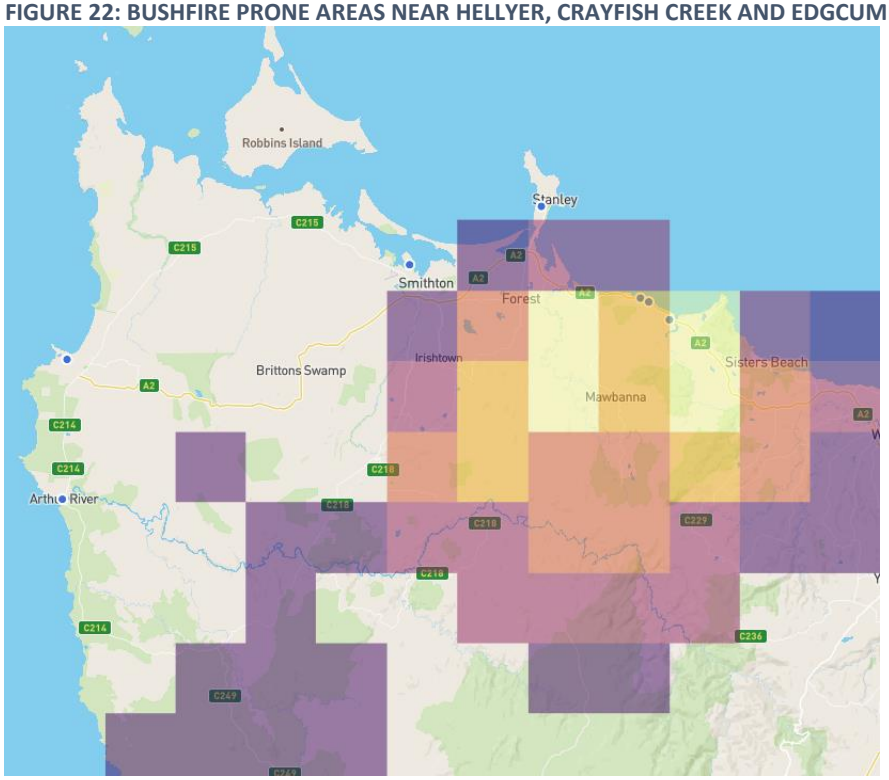
FIGURE 21: BUSHFIRE AND LANDSLIP HAZARD CODES IN CIRCULAR HEAD



Source: Tasmanian Planning Code Overlay (accessed 2023)

Almost the entirety of the municipal area, excluding the urban, built-up area of Smithton and some coastal areas in the south, is covered by a Bushfire Prone Area Code overlay. Bushfires can greatly increase the risk of landslides especially after rain, due to the accumulation of burnt debris from forested areas. Trees and their roots help prevent landslides by absorbing rainwater and holding the forest floor together. The loss of plants after bushfires means the devastation caused by landslides would increase.

FIGURE 22: BUSHFIRE PRONE AREAS NEAR HELLYER, CRAYFISH CREEK AND EDGCUMBE BEACH



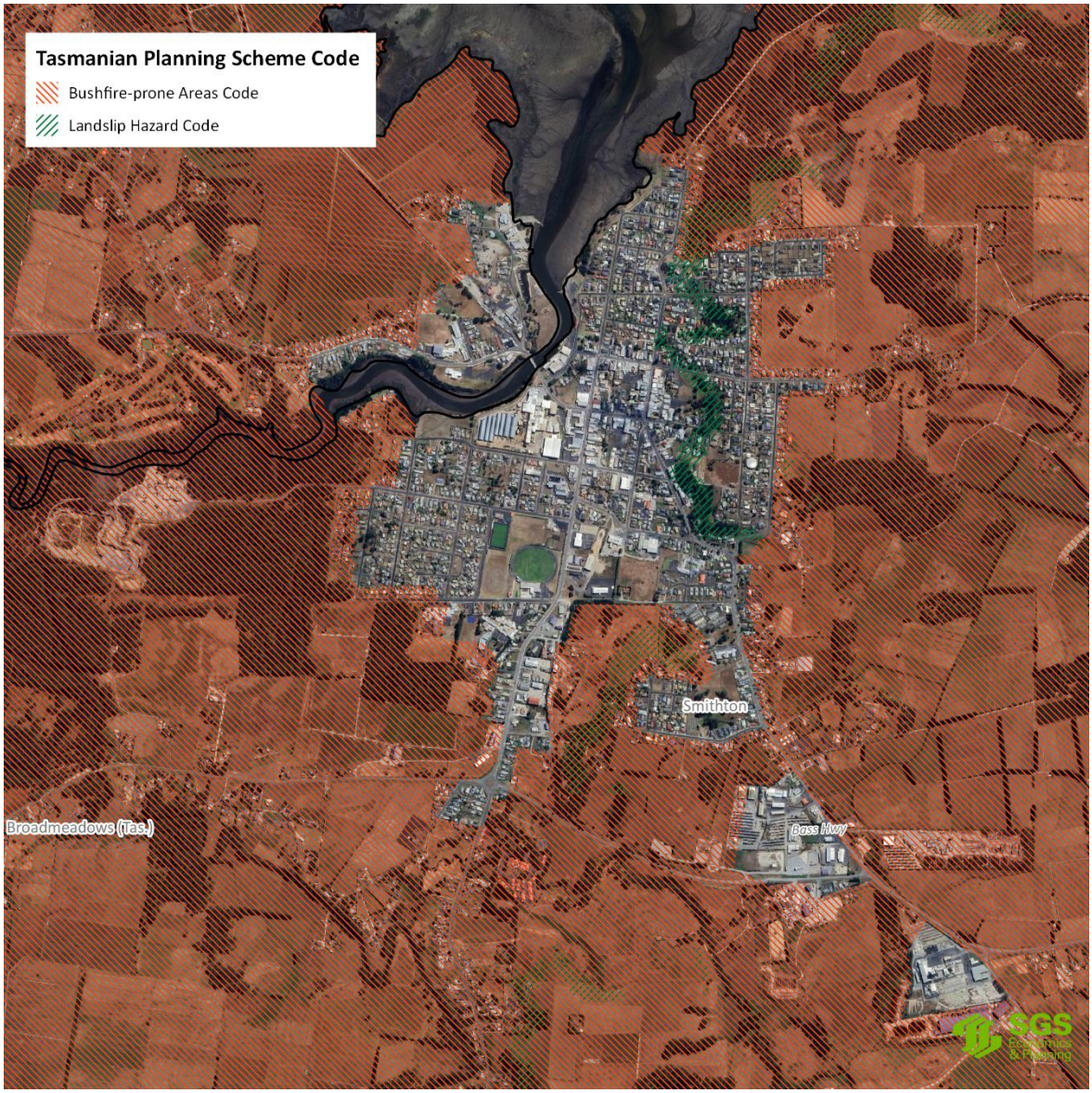
Source: Climatics (accessed 2023)

FIGURE 23: BUSHFIRE RISK MANAGEMENT PLANS RISK REGISTER - HUMAN SETTLEMENT AREAS

Source: theLIST map (accessed 2023)

* Risk level from 1 -32, with 1 being high, 32 being low.

FIGURE 24: BUSHFIRE PRONE AREAS IN SMITHTON



Source: theLIST, Tasmanian Planning Scheme (accessed 2023)

As the largest, most urbanised settlement in the municipality, most of the residential land in Smithton is at least one street in from adjacent bushland and farmland, and therefore protected from bushfire hazard overlays. However, the outer layer of residential land is at risk, as it is almost all agricultural land surrounding the settlement. As a coastal town, it would rely on the Bass Highway as an exit route, as well as a critical route for emergency services in the event of a bushfire in this region. Even though most residences may be safe, a bushfire may cut off the town from the rest of the state.

FIGURE 25: BUSHFIRE PRONE AREAS IN STANLEY

Source: theLIST, Tasmanian Planning Scheme (accessed 2023)

Stanley is a smaller settlement, and similarly, has an outer layer of residential land that is not protected from adjacent farmland in the event of a bushfire. It is more isolated than Smithton and in such an event, the region would be inaccessible due to the narrow neck north of which it sits, likely being engulfed. Considering the situation during the Black Summer bushfires in Victoria, where residents of the town of Mallacoota, on the states western tip, were forced to seek shelter from the bushfire on the beach, a similar situation is foreseeable in Stanley in the event of a catastrophic bushfire, given that the beach would be the only safe respite from the surrounding bushfire prone area.

FIGURE 26: BUSHFIRE PRONE AREAS IN CRAYFISH CREEK

Source: theLIST, Tasmanian Planning Scheme (accessed 2023)

In Crayfish Creek, only some of the western-side residences are protected from the Bushfire Prone Areas Code, with much of the settlement surrounded by forest or grassland, which is susceptible to burning. While the Bass highway bisects the settlement, separating residential from forested areas, the settlement is not very urbanised, and much of the housing is only one street in from bushland, meaning it is not sufficiently protected.

FIGURE 27: BUSHFIRE PRONE AREAS IN HELLYER

Source: theLIST, Tasmanian Planning Scheme (accessed 2023)

Like Crayfish Creek, Hellyer has a small portion of beach-adjacent housing that is one or more streets separated from the nearby bushland. However, on the outskirts of the settlement, as well as further south, along the banks of the Detention River, there are residential areas that are covered by bushfire hazard overlays. Even if these residences are protected from a potential bushfire, they are still at significant risk from such an event, given that they both would effectively be cut off from the rest of the state by only having a single road out of town.

4.5 Coastal hazards

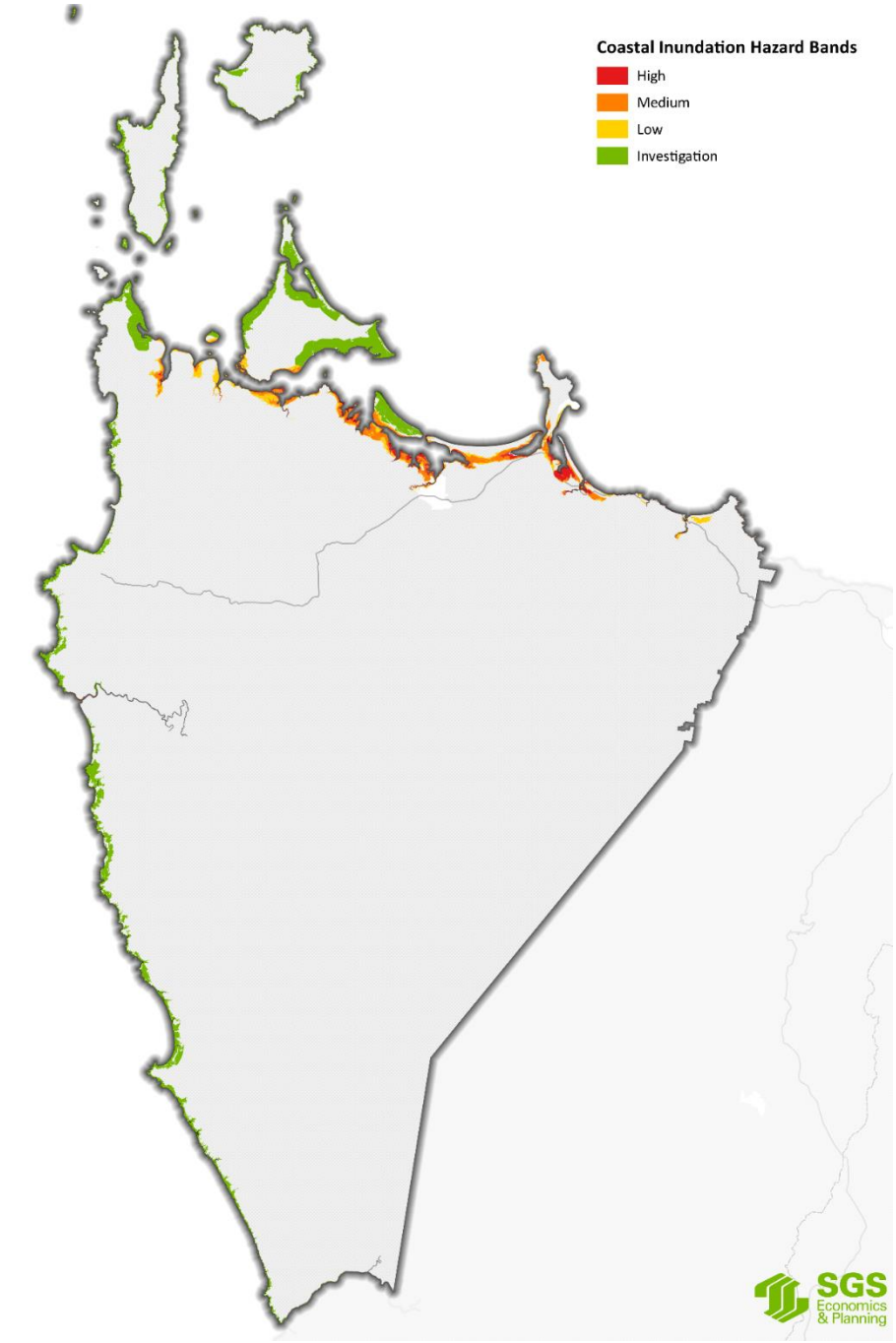
Circular Head has one of the longest shorelines of any municipal area in Tasmania and its topographic features are different from the rest of the state. Most of the land is low-lying coastal zone with higher areas of undulation in Mengha, Lileah and Trowutta.

The extensive intertidal sands of Duck Bay are not marine or coastal sediments, but rather relict sands of Pleistocene age that are being eroded and permanently lost to the tidal channels that divide the sands. With continued sea level rise and deeper water depths, some of the intertidal zone may eventually have some accommodation, but given the large tidal range of Duck Bay, this will probably only occur after further significant sea level rise. Shoreline erosion has apparently released sand and finer sediments, some of which may be reabsorbed by vegetation along those saline shores that are still accreting, yet ebb currents can be expected to move much of the loose sediment into the tidal channel, where the sand fraction will settle and gradually move down the channel into the sand troughs of Bass Strait. Given that very little sand is likely to be moved back into the intertidal zone from the deeper tidal channels by flood tidal currents, the extensive intertidal sands of Duck Bay are an area of exposure and continued erosion.[29]

Mapping of coastal erosion susceptibility zones used to define hazard zones in Tasmania indicates that areas along Cape Woolnorth could be affected by 0.2m sea level rise resulting in 10m of shoreline recession by 2050 and 0.8m SLR resulting in 40m of shoreline recession by 2100.[30] The slope of this shoreline at the mouth of the Welcome River is eroding into old Pleistocene wind and sand deposits. This site experiences the largest tidal range in Tasmania at about 3m but is completely sheltered from swell waves behind Robins Island and Woolnorth Point.

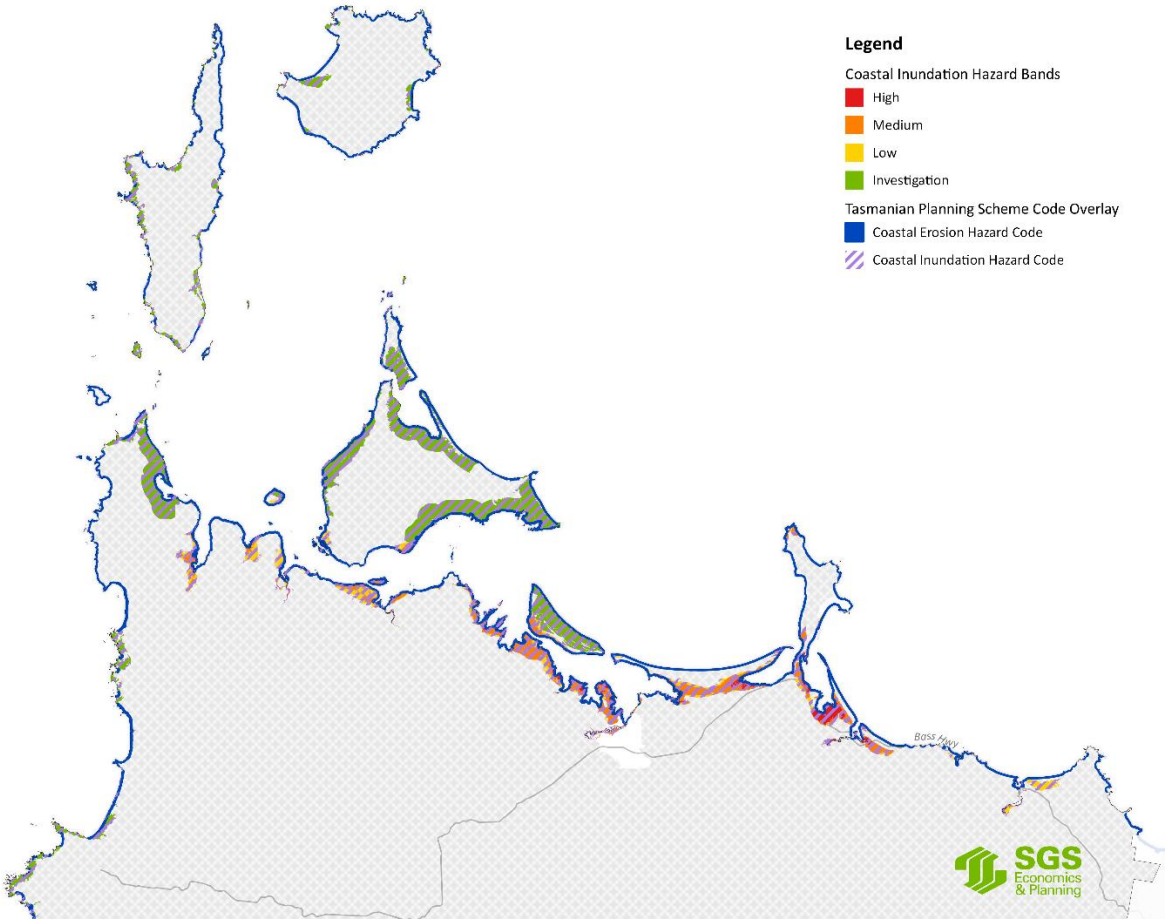
[29] Sharples, C. E. (2020). *Identifying attributable physical effects of contemporary climate change-driven sea-level rise on soft coastal landforms* (Doctoral dissertation, University of Tasmania).
[30] Sharples, C., Walford, H & Roberts, L. (2013). Coastal erosion susceptibility zone mapping for hazard band definition in Tasmania

FIGURE 28: COASTAL INUNDATION HAZARD BANDS FOR CIRCULAR HEAD



Source: theLIST Coastal Inundation Hazard Bands (2016)

FIGURE 29: COASTAL HAZARDS OVERLAYED WITH PLANNING SCHEME CODES

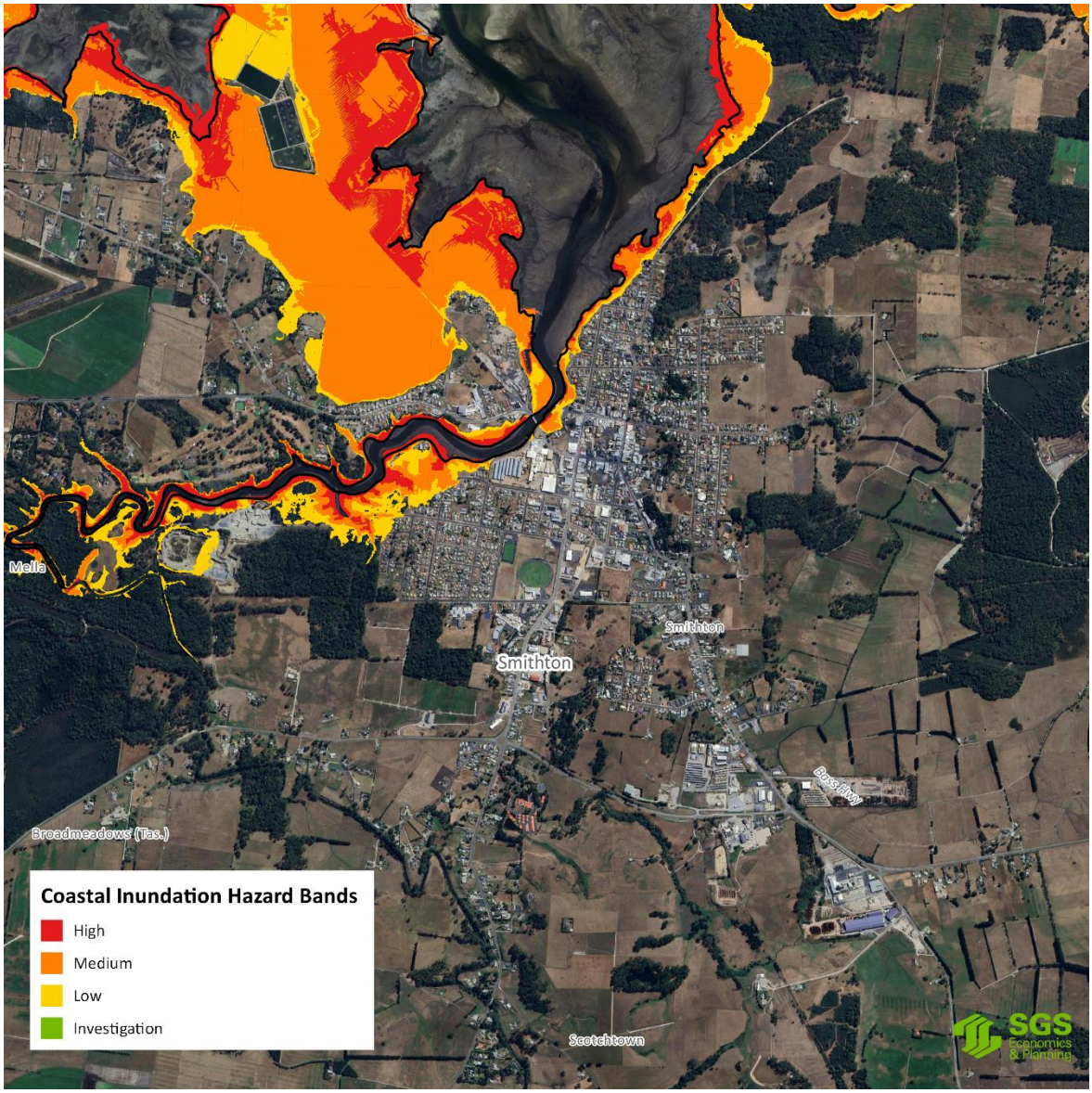


Source: theLIST Coastal Inundation Hazard Bands, Tasmanian Planning Code Overlay (accessed 2023)

Almost all of Circular Head's vast coast is covered by a Coastal Erosion Hazard Code, while much of the municipality's north coast is covered by a Coastal Inundation Hazard Code. Erosion refers to the loss of land and/or beach along a shoreline from changing ocean conditions, whereas inundation refers to the flooding of low-lying coastal areas along ocean waters. Given that much of Circular Head's population lives along the coastline, these risks threaten the population centres of the municipality.

The figures below are of the different hazard bans regarding coastal inundation. The high-risk band indicates an area that is vulnerable to sea-level rise by 2050 from the mean high tide. The medium-risk band indicates an area that is vulnerable to a one in 100-year storm event in 2050, while the low-risk band indicates an area that is vulnerable to a one in 100-year storm in 2100. Investigation areas are those that are within 1 km of the coast in non-LiDAR mapped areas.

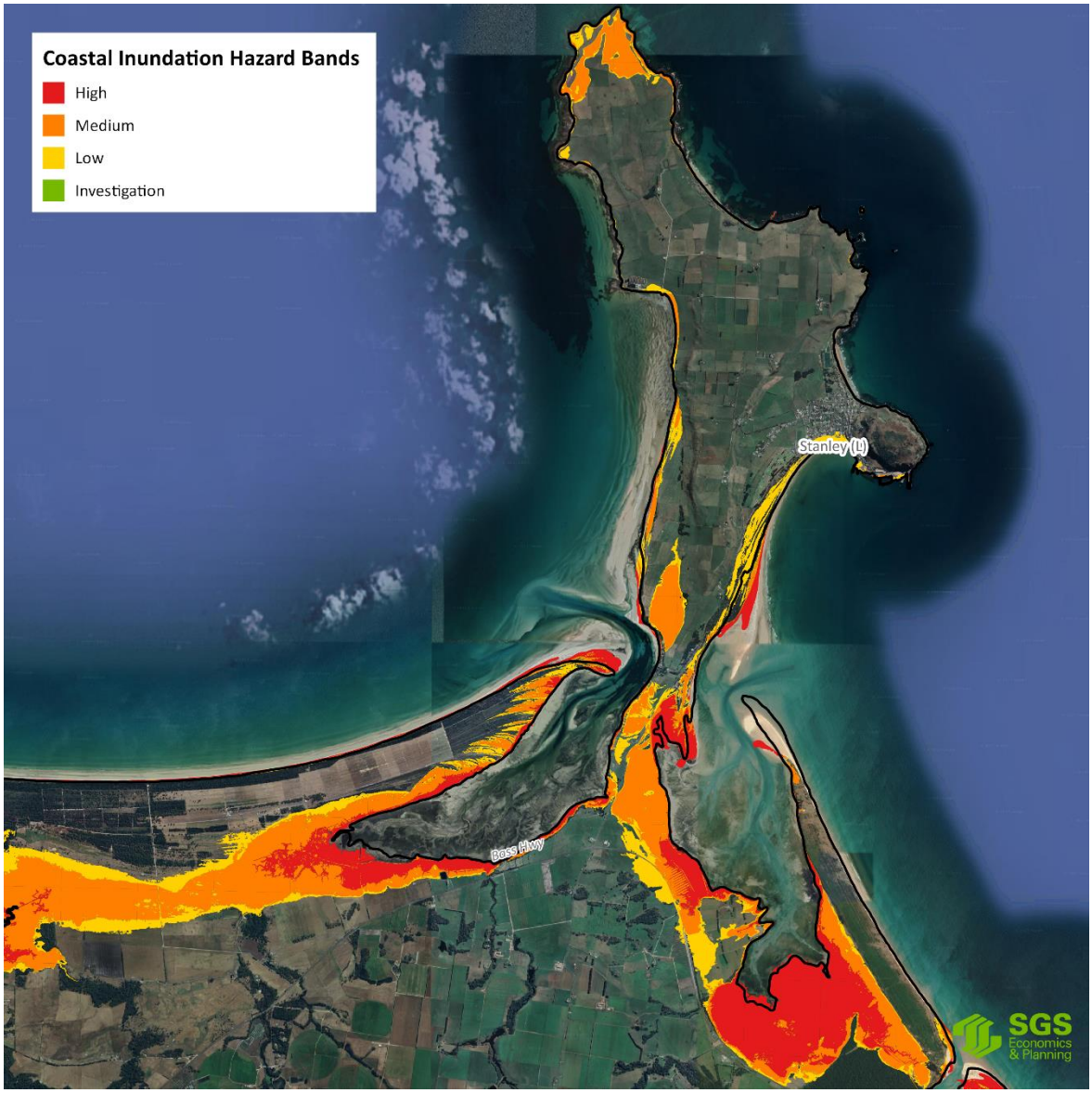
FIGURE 30: COASTAL INUNDATION HAZARD BANDS AT SMITHTON



Source: SGS Economics and Planning; theLIST (accessed 2023)

Some residential properties adjacent to Duck River are at high and medium risk of coastal inundation, putting them in danger by 2050. There is also significant agricultural land in the north, to the west of Duck Bay, that is at risk by 2050. These risk areas indicate not only where existing residential and agricultural land should be protected and the risks mitigated, but also where development of new residential land should be avoided.

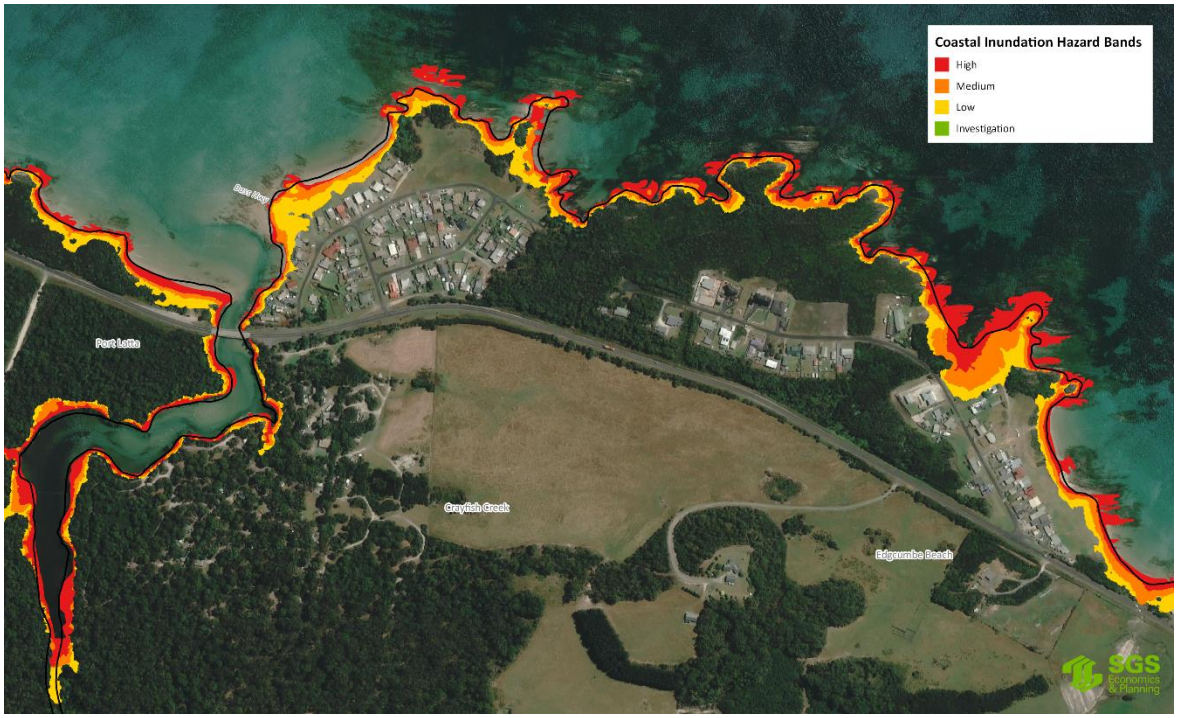
FIGURE 31: COASTAL INUNDATION HAZARD BANDS AT STANLEY



Source: SGS Economics and Planning; theLIST (accessed 2023)

While the residential land in Stanley is generally at low risk, at worst, the concern for the township, given that is located north of a slim neck of land, is that the Stanley Highway could be entirely inundated, as it is covered by high and medium risk hazard bands. This would effectively cut off the township from Smithton and indeed the rest of the state. A significant proportion of agricultural land to the south of the Seven Mile Beach is also at high and medium risk from coastal inundation.

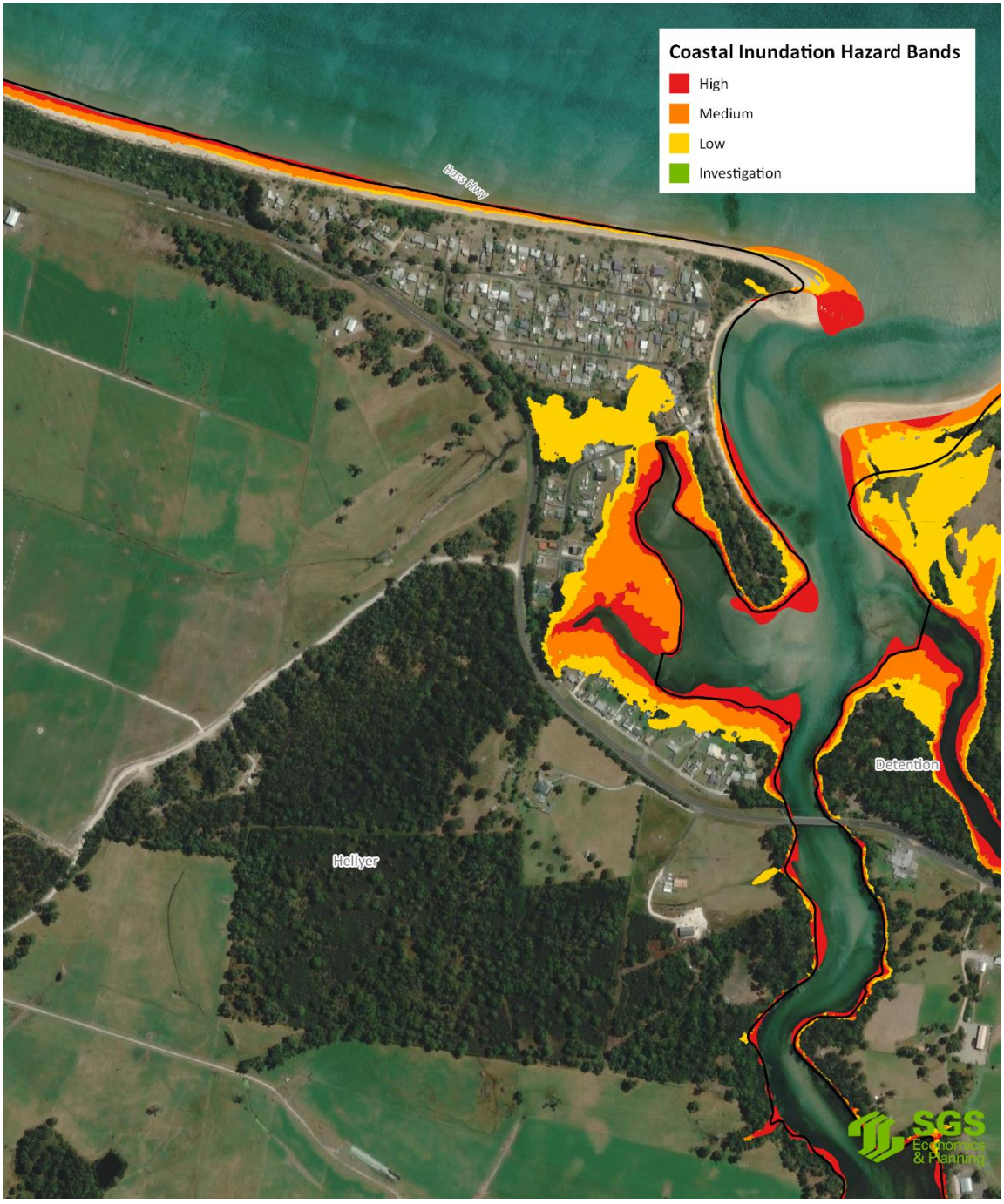
FIGURE 32: COASTAL INUNDATION HAZARD BANDS AT CRAYFISH CREEK



Source: SGS Economics and Planning; theLIST (accessed 2023)

Unsurprisingly for Crayfish Creek, which is located right on the coast, there are coastal inundation risk areas along the shoreline. There are also risk areas along the Crayfish Creek for which the town is named. Mostly, the residential land is at low risk, with high risk areas generally isolated to the direct shoreline.

FIGURE 33: COASTAL INUNDATION HAZARDS BANDS AT HELLYER



Source: SGS Economics and Planning; theLIST (accessed 2023)

For Hellyer, the risk areas along its northern coastline are quite limited, and do not encroach on the residential land adjacent to it. However, along Detention River, areas of significant risk threaten residential property that overlook it, rather than the Seven Mile Beach.

As ocean levels rise due climate change, high tide will encroach further into land along Circular Head's north coast, and by 2100, under the RCP 8.5 scenario, the median sea level rise is predicted to be 0.84 metres. The impact for Circular Head is shown in the Extreme Sea level events section below.

4.6 Extreme sea level events

Tasmania's coastal areas may experience the effects of sea level rise, including increased risk of coastal flooding and erosion. This could result in damage to infrastructure, loss of coastal habitat, and displacement of coastal communities. The ocean around Tasmania is likely to continue to warm and acidify, affecting marine ecosystems and species, including those important to commercial and recreational fisheries.

Extreme sea level events are influenced by several factors, including sea level rise, storm surge, and coastal geomorphology. Climate change is expected to impact these factors, potentially increasing the frequency and intensity of extreme sea level events in coastal areas such as Circular Head.

FIGURE 34: 2100 FUTURE HIGH TIDE (+0.84M), SMITHTON, STANLEY, HELLYER

Source: Coastal Risk Australia (accessed 2023)

Global sea levels are rising due to the thermal expansion of seawater and the melting of ice sheets and glaciers. Sea level rise will contribute to an increase in the frequency of extreme sea level events, as higher baseline water levels make storm surges and high tides more likely to cause inundation and flooding. Coastal areas, especially the agricultural regions in the northwest of Smithton, would be largely inundated in the event of sea level rise of this magnitude, under the RCP 8.5 scenario. Low-lying areas adjacent to the Duck River would also be inundated at high tide under this scenario, including residential and urban areas, such as the TasTAFE Smithton campus. Figure 35 highlights certain areas that should be avoided for development, specifically, the northside of Montagu Road either side of Pelican Point Road.

Even in areas that are not necessarily at risk of coastal inundation, the risk of saltwater intrusion into freshwater resources is a concern, as the ocean water encroaches further into the riverways. This can affect the quality and availability of drinking water, particularly in Smithton. Local economies that are especially reliant on coastal tourism, particularly Stanley's, are at risk from sea level rise too, even though not at risk of inundation. The disruption of transport networks, such as the Stanley Highway between Smithton and Stanley would essentially block off the town from the rest of state, and the thing stretch of land that connect them could potentially be entirely inundated in a scenario such as the one in Figure 35 below.

FIGURE 35: 2100 FUTURE HIGH TIDE (+0.84M) IN SMITHTON

Source: Coastal Risk Australia (accessed 2023)

Climate change is expected to increase the intensity of storms and cyclones in some regions. More intense storms can lead to higher storm surges, which are temporary rises in sea level caused by strong winds and low pressure. The risk of coastal flooding and extreme sea level events increases when storm surges coincide with high tides or heavy rainfall. Instances of storm surge can lead to higher tides than the predicted 0.84 metre rise by 2100, so sites at higher ground and further inland that are not shown to be impacted Figure 35 could be affected.

The effects of climate change, such as sea level rise, changing wave patterns, and more Intense storms, can alter the geomorphology of coastlines, leading to increased erosion and changes in coastal defences. This could make the Circular Head area more vulnerable to extreme sea level events.

4.7 Agricultural Impact

The fertile soil of the Circular Head, combined with the gentle terrain, supports more than 30 per cent of Tasmania's dairy farms. Circular Head has less than 2 per cent of Tasmania's population, but

accounts for more than 12 per cent of the state's annual agricultural production and contributes nearly $100 million to the economy each year.[31]

Forestry plantations and agricultural land dominate Circular Head and, along with aquaculture, provide the main employment and income for the municipality. It is Tasmania's largest dairy and premium beef producing region. Other industries include fishing,[32] oyster and abalone farming, tourism, the processing of many fresh produce products including vegetables, meat and milk, as well as raw material products including timber, and the major iron ore pellet plant at Port Rata.[33]

Climate change will present challenges to Circular Head and Tasmanian agriculture, including shifts in the growing season, reduced water availability, increased risk of pests and diseases, and potential declines in crop and livestock productivity. The frequency and intensity of extreme weather events, such as storms, floods and bushfires, are expected to increase, which will disrupt agricultural activities, and cause loss of livestock.

Rising temperatures may lead to a longer growing season that may benefit some crops, but warmer temperatures may also increase the risk of heat stress to crops and livestock. Some crops may require more irrigation due to increased evapotranspiration. Some areas of Circular Head may become more suitable for different crop varieties or agricultural practices due to increased temperatures and changes in precipitation.

According to Climate Futures for Tasmania projection,[34] changes in precipitation patterns and potential reductions in annual precipitation, particularly in the eastern and northern parts of Tasmania, could affect irrigation water availability and impact crop yields. More frequent and severe droughts could make the agricultural sector in Circular Head even worse. At the same time, increased temperatures and changes in rainfall patterns could lead to increased pests and diseases affecting crops and livestock, potentially leading to reduced productivity and increased management costs.

To mitigate the effects of climate change on Circular Head's agricultural sector and increase its resilience, several strategies can be pursued, which are explored in Table 31 below. Using Priorities have been assigned based on the potential consequences of failure to adopt these strategies.

[31] Circular Head Council Annual Report. (2022). https://www.circularhead.tas.gov.au/__data/assets/pdf_file/0029/1218818/DRAFT-2021-22-Annual-Report.pdf

[32] Bennett, L. (2021). Farmer investment group fights to save family farms as big corporations buy Tasmanian land. https://www.abc.net.au/news/2021-11-27/tasmanian-farmers-fight-corporate-and-foreign-ownership-of-farms/100652678

[33] Circular Head Regional Economic Development Working Group. (2018). https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0014/166100/CHREDWG_Final_Report_January_2018_FINAL.pdf

[34] https://recfit.tas.gov.au/what_are_the_projected_impacts_for_tasmania

TABLE 31: CIRCULAR HEAD AGRICULTURE ADAPTATION STRATEGY AND PRIORITY LEVEL

Adaptation	Strategy	Priority
Diversification	Diversify crop varieties or livestock breeds to better adapt to changing climate conditions. This can include selecting drought- or heat-tolerant crop varieties and livestock breeds.	High
Water management	The adoption of more efficient irrigation systems and water conservation techniques can help optimise water use and reduce the potential impact of water scarcity.	High
Sustainable land management	Implementing practices such as conservation tillage, cover cropping, and agroforestry can help improve soil health, increase water retention, reduce erosion, and make agricultural systems more resilient to climate change.	High
Pest and disease management	Regular monitoring and integrated pest management strategies can help farmers manage the risks posed by pests and diseases under changing climate conditions.	Medium
Climate-smart agriculture	Adopting climate-smart agricultural practices, such as precision farming and using weather and climate information in decision-making, can help farmers adapt to and mitigate the impacts of climate change.	Medium
Research and Development	Investing in agricultural research and development can help identify new crop varieties and farming methods better suited to changing climate conditions, ultimately supporting the long-term sustainability and resilience of Circular Head's agricultural sector.	Medium

Source: SGS Economics & Planning (2023) using previous frameworks[35][36]

4.8 Local community issues and challenges

The Western Emergency Management Plan, Issue 2 (2020) provides an overview of the key risks and hazards faced by the North West TAS region, including natural disasters, infrastructure failures, and public health emergencies. It also identifies the roles and responsibilities of emergency services, government agencies, and community organizations in responding to and managing emergencies. The western portion of the Northwest Coast is vulnerable to power supply failures, with periodic power supply losses during a range of weather conditions and limited redundancy in the transmission network. This is particularly true for the Circular Head Council, as there is one transmission line serving the area.[37]

[35] George, D.A., Clewett, J.F., Lloyd, D., McKellar, R., Tan, P.L., Howden, M., Rickards, L., Ugalde, D. and Barlow, S., 2019. Research priorities and best practices for managing climate risk and climate change adaptation in Australian agriculture. *Australasian Journal of Environmental Management*, *26*(1), pp.6-24.

[36] https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0009/349227/CSIRO_-_Submission_Action_Plan.pdf

[37] Western Municipal Combined Area Emergency Management Committee. (2020). Western Emergency Management Plan

Circular Head has experienced some major emergencies, including power outages, the decline of the logging industry and the 2016 floods. Instead of immediate recovery, these emergencies have had a noticeable impact on the municipality's economy, infrastructure and community (Table 32).

TABLE 32: SIGNIFICANT EMERGENCIES IN CIRCULAR HEAD[38]

2009-2010 Two major Power Failures Circular Head	Damage caused by severe weather resulted in black outs throughout the municipality. Debris from trees, powers poles and damaged lines resulted in some outlying areas (mainly farms and rural residences) being without power for up to 40 hours or more. This had a significant impact on industry and farming operations.
2010-2014 Forestry Demise	The Tasmanian Forestry Agreement resulted in the demise of the once integral logging industry in Circular Head. Logging and transport contractors were offered limited funds from 2010 Forestry Peace Deal Fund to exit the industry. The logging and milling industries operate at a greatly reduced rate, and much of the heavy and earthmoving equipment once based in the area is no longer available.
June 2016 Flooding	The northern municipalities of Tasmanian experienced significant flooding around 6 June 2016 because of a significant rain event, which also impacted much of Southern Australia. Damage in several municipal areas across the north exceeded $5 million per municipality. Extensive infrastructure damage occurred, including the loss of three bridges in the Waratah-Wynyard Municipality. Flooding of 20 homes occurred. A dairy farm at Arthur River in Circular Head lost 310 animals in the flooding. Within Burnie extensive inundation of businesses on River Road occurred, resulting in significant impacts on businesses and business activity and consequential financial loss. Infrastructure damage for Burnie was moderate, however, it did impact community activities for a period.

Source: SGS Economics & Planning

According to the summary of historical natural hazard events within the municipality, a review of literature and natural hazards assessment, the local impacts and risk levels are evaluated and listed in Table 33. Circular Head's local economy, particularly coastal tourism, is challenged by these hazards, and infrastructure, such as roads, bridges, and communication networks, can be extensively damaged. Other issues of concern include saltwater intrusion into freshwater sources, affecting the quality of drinking water, and the immediate and long-term health risks associated with extreme weather conditions. The environment also faces potential damage, including soil erosion, vegetation loss, and water pollution.

[38] Western Municipal Combined Area Emergency Management Committee. (2020). Western Emergency Management Plan

TABLE 33: CIRCULAR HEAD LOCAL IMPACT OF NATURE HAZARDS AND RISK LEVEL

Local impact	Related hazard	Prone areas	Risk Level
Property damage	Bushfire, flooding, sea level rise	Farms and buildings near the coast or in low-lying areas along the Duck and Montagu Rivers might be vulnerable to this risk.	Medium to high
Agriculture	Drought, extreme temperatures, flooding, storms, and extreme weather, change in rainfall patterns. Shifts in the growing season, reduced water availability, increased risk of pests and diseases, and potential declines in crop and livestock productivity.	Farms along the Arthur River or in valleys where water may accumulate during heavy rainfall. Lands that are near forests or bushland, or those with a high amount of dry vegetation, are at a higher risk of bushfire.	Low to medium
Economic impact	Destruction of properties, infrastructure, and natural resources can lead to economic losses for businesses, industries, and the overall community.	Local economies that are especially reliant on coastal tourism, particularly Stanley's, are at risk of sea level rise.	Medium
Coastal erosion	Coastal hazards	Almost all Circular Head's extensive shore is covered by the Coastal Erosion Hazard Code, while most of the city's north shore is covered by the Coastal Inundation Hazard Code.	Medium
Infrastructure damage	Bushfire, flooding, and storms can lead to extensive damage to roads, bridges, power lines, and communication networks.	N/A	Medium
Disruption of transportation	Bushfire, flooding, extreme sea level rise	Sea level rise in the RCP scenario could lead to disruptions in the municipal transportation network, such as the Stanley Highway between Smithton and Stanley, which would essentially block the town from the rest of the state.	Medium
Saltwater intrusion	Storm surge, big rainfall. Rising sea levels and coastal hazards due to climate change can lead to saltwater intrusion into freshwater sources and agricultural lands.	Rising sea levels due to climate change may cause further saltwater intrusion into rivers. This could affect the quality and availability of drinking water, especially in Smithton.	Medium to high
Health and safety risks	Extreme hot or cold weather, bushfire, flooding can pose immediate risks to the safety of residents and emergency responders, as well as longer-term health concerns related to air quality, water contamination, and mental health stressors.	N/A	Low to medium
Environmental impact	Flooding, bushfires, and coastal hazards can result in long-lasting damage to the natural environment, including soil erosion, loss of vegetation, harm to wildlife habitats, and water pollution.	Low-lying coastal areas, agricultural lands	Low to medium

Source: SGS Economics & Planning (2023)

TABLE 34: SUMMARY OF ENVIORNMENTAL HAZARDS TO 2050

Area	Environmental Hazards	Risk level 2050	Implications for growth and development
Smithton	Coastal erosion, flooding, drought, and sea level rise	Medium	Further growth can occur in areas with low risk.
Stanley	Flooding, bushfire, coastal erosion and sea level rise	High	Improve infrastructure and buildings to make them more resilient.
Marrawah	Flooding	Low	Further growth can occur in areas with low risk.
Hellyer	Bushfire, coastal erosion	Medium to High	Zoning for the development of green space or other features that contribute to hazard mitigation.
Crayfish Creek	Bushfire, coastal erosion	Low to Medium	Further growth can occur in areas with low risk.
Edgcumbe Beach	Bushfire, coastal erosion	Medium	Further growth can occur in areas with low risk.
Arthur River	Flooding, drought	Low	Further growth can occur in areas with low risk.

Source: SGS Economics & Planning (2023)

Appendix A: Employment Floor Area Ratios

The calculation of floorspace comprises five main data sources:

Trends and changes in floorspace ratios

Floorspace per job is likely to change in the future in response to multiple changing trends in the way people work. These trends include:

- Increases in the number of people working from home or remotely (including because of trends established during COVID-19), resulting in lower average use of floorspace per worker as firms assume a proportion of their workforce will work from home each day.
- General increases over time in the density of office use, particularly in valuable real estate markets. This has also been somewhat offset by decreases in floorspace ratios due to the need for high quality offices space, more social distancing, and more collaborative and purposeful spaces (i.e., additional meeting rooms, AV pods, etc).
- Automation, which can both increase and decrease the number of employees needed in generally blue-collar workspaces, due to either more intensive (semi-office) type environments and less labour intensive but capital and space intensive facilities (i.e., a data centre or automated distribution facility).
- Changes in the broad industry profile and nature and composition of businesses within an industry.

Given the multiple (in some cases competing) trends and the long period over which forecasts are being considered, it is difficult to forecast on an industry-specific basis NFA per job ratios out to 2041. This difficulty is compounded by different trends working in different directions, and the uncertainty related to the long-term impacts of the COVID-19 pandemic. For the sake of simplicity, NFA per job ratios have generally been held constant to 2041.

Standard job floorspace ratios

To capture this variation, SGS developed a five-scale NFA per job range for each of the 37 industries modelled for use within a defined area. These are shown in Table 35 below.

TABLE 35: NET FLOOR AREA (SQM) PER JOB FOR EACH INDUSTRY CATEGORY

Industry	Low	Low-med	Medium	Med-high	High
Agriculture, Forestry and Fishing	19	22	24	27	29
Mining	19	22	24	27	29
Manufacturing Class 1 to 7	37	40	43	45	48
Electricity, Gas, Water and Waste Services	17	21	26	30	34
Construction	23	26	30	33	36
Wholesale Trade	37	46	54	63	71
Retail Trade	28	31	34	36	39
Food and Beverage Services	23	25	28	30	32
Accommodation	273	325	377	428	480
Warehousing and Storage Services	31	37	43	49	55
Road, Rail and Water Transport	31	37	43	49	55
Air and Space Transport	31	37	43	49	55
Other Transport	31	37	43	49	55
Information Media and Telecommunications	25	30	34	39	43
Financial and Insurance Services	19	21	24	26	28
Rental and Hiring Services (except Real Estate)	48	55	62	68	75
Property Operators and Real Estate Services	20	21	22	23	24
Professional, Scientific and Technical Services	21	23	25	26	28
Administrative and Support Services	21	23	25	27	29
Public Administration	25	28	31	33	36
Defence	25	28	31	33	36
Public Order, Safety and Regulatory Services	25	28	31	33	36
Tertiary Education	78	82	86	90	94
Other Education	45	51	57	62	68
School Education	45	51	57	62	68
Residential Care and Social Assistance Activities	25	27	30	32	34
Hospitals	21	22	23	24	25
Medical and Other Health Care Services	25	27	30	32	34
Arts and Recreation Services	46	59	72	85	98
Repair and Maintenance	37	40	43	45	48
Personal and Other Services	36	50	64	77	91

Source: SGS Economics & Planning (2022); based on desktop review

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