



# IDENTIFICATION OF FUEL MANAGEMENT LOCATIONS AND RISK REDUCTION POTENTIAL

## Mechanical Fuel Load Reduction Utilisation project

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Version	Release history	Date
1.0	Initial release of document	14/12/2021



**Australian Government**  
 Department of Industry, Science,  
 Energy and Resources

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 Centres Program

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**Publisher:**

Bushfire and Natural Hazards CRC

December 2021

Citation: Jeanneau A, Zecchin A, van Delden H, McNaught T & Maier H (2021) Identification of fuel management locations and risk reduction potential, Bushfire and Natural Hazards CRC, Melbourne.

Cover: Schlerophyll forest. Source: commons.wikimedia.org



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## **ACKNOWLEDGMENTS**

The project team at the University of Adelaide and the Research Institute for Knowledge Systems would like to thank our end-users in Western Australia and South Australia; your insight and contributions were invaluable.

We would also like to thank everyone within the Bushfire & Natural Hazards CRC Office who have supported this work in multiple ways from funding, contracting, and business development.



## EXECUTIVE SUMMARY

Planned burning is one of the most utilised fuel management activities, but the safe and effective application of this method is likely to be hindered by climate change (e.g. shrinking and shifting windows of opportunity) and potential adverse societal outcomes (e.g. smoke impact, risk of fire escape). For this reason, fire managers need access to detailed information to help them make informed decisions and select a fuel management strategy that is compatible with a range of factors.

This project explored the use of experts' knowledge and the UNHaRMED Decision Support System (DSS) framework (an integrated spatio-temporal model for analysing natural hazard risk within urban and rural environments) to identify areas where fuel management activities should be conducted within the study area and identify future bushfire risk reduction potential at identified hotspots.

The discussions with end-users resulted in the selection of five major areas to focus on for this study (i.e. Gingin, Kalamunda, Mundaring and Margaret River). The level of bushfire risk simulated in UNHaRMED for a baseline period indicated a good agreement with the perceived levels of bushfire risk at the rural-urban interface identified by the relevant bushfire management agencies. This observation therefore suggests that UNHaRMED is suitable for identifying areas of emerging risk under different climate change scenarios.

This research also highlighted that areas where fuel management activities are currently conducted in Gingin, Kalamunda, Mundaring and Margaret River overlap with areas of high bushfire risk modelled in UNHaRMED (rural-urban interface). This suggests that UNHaRMED is suitable for assessing the impact of fuel load mitigation activities at the rural-urban interface in WA.

The next step will be to run UNHaRMED simulations involving a range of future climate and population growth scenarios with and without fuel management activities (M2). This will then enable us to identify how bushfire risk changes for each scenario, where management activities are desirable, and where potential risk reduction will be possible (irrespective of management type) (D2).



## 1. INTRODUCTION

This milestone aims to identify areas where fuel management activities should be conducted within the study area and identify future bushfire risk reduction potential at identified hotspots.





## 2. METHOD

We consulted end-users to identify key areas of emerging bushfire risk in Western Australia. We organised a brainstorming session on 15 January 2020 with representatives from the Department of Fire and Emergency Services (DFES) and the Department of Planning, Lands and Heritage (DPLH) [**Error! Reference source not found.**]. We also exchanged emails with Mike Meinema from the Department of Biodiversity, Conservation and Attractions (DBCA) to confirm the location of key areas of interest for this case study.

We consulted Bushfire Risk Management Plans (BRM Plan) from the key areas of interest to compare the extent of current fire mitigation activities and the UNHaRMED bushfire risk outputs. Under the *State Hazard Plan for Fire*, an integrated BRM Plan is required for local government areas with significant bushfire risk. BRM Plans are strategic documents that identify assets at risk from bushfire and their priority for treatment. The treatment schedule sets out a broad program of coordinated multi-agency treatments to address the BRM Plan's risks. Government agencies and other land managers responsible for implementing treatments participate in developing the BRM Plan to ensure treatment strategies are collaborative and efficient, regardless of land tenure. This treatment schedule can be accessed through the WA Bushfire Risk Management System (BRMS) and will soon be accessible through the Shared Land Information Platform (SLIP). On this system, registered users can look at a range of fire mitigation activities planned or conducted within WA (e.g. chemical work, mechanical work, grazing, planned burning, fire track maintenance, firebreak maintenance). They can also filter the results based on the status of the work (e.g. planned for a specific financial year and agreed; planned for a specific financial year but not conducted yet (overdue); work completed in one particular financial year). One of the main limitations of this system is that there is limited information regarding when the funding was agreed and received. This context is important as local governments may not have received funding to undertake all the work at once and may have achieved their target activities over a longer period. Here, we only selected the mitigation activities occurring within the key areas of emerging bushfire risk for this milestone.

We then used the UNHaRMED framework to estimate where bushfires could be expected to occur for a baseline period (UNHaRMED bushfire likelihood). The outputs were compared with the BRM Plans from the end-user selected target regions to see if they aligned with the modelled bushfire hotspots and the location of fuel load reduction measures conducted in these regions.

To assess the extent of current fuel load reduction activities, we used the BRMS shapefiles to estimate the average and total length of road-side treatments and the average and total surface treated. The treatment schedule results were summarised for each fuel load reduction activity and financial year and grouped by Local Governments (LGs).



### 3. RESULTS

#### 3.1 SELECTION OF KEY AREAS FOR FUEL MANAGEMENT AND RISK REDUCTION POTENTIAL

The end-users agreed that any region located on the fringe of larger towns/cities with a mix of residential and rural landscape (rural-urban interface) would be considered an emerging bushfire risk in the future. For instance, recent variations in climatic factors have had the most significant influence on the use of planned burning for bushfire mitigation at this interface. There would also be greater detrimental outcomes in the event of a fire escape in such regions, and there is a higher probability that smoke will negatively impact neighbours.

The rural-urban interface is also ecologically important as it often hosts known Threatened Ecological Communities (TECs) and priority plant/animal species. The presence of TECs may limit the potential range of mitigation options available and requires an additional level of planning and reporting. In WA, fire mitigation planning is based on the consideration of TECs, social acceptability, seasonality, resourcing and cost. The weighting of these factors depends on regional specificities and may influence the potential to apply a range of mitigation activities.

THE DISCUSSIONS WITH END-USERS RESULTED IN THE SELECTION OF FIVE MAJOR AREAS TO FOCUS ON FOR THIS STUDY. THIS SELECTION WAS BASED ON LOCAL KNOWLEDGE AND INFORMATION PRESENTED IN LOCAL BRM PLANS. THE FIVE TARGET AREAS FOR FUEL MANAGEMENT AND RISK REDUCTION POTENTIAL ARE THE GINGIN REGION, TWO REGIONS IN THE PERTH HILLS (KALAMUNDA AND MUNDARING), MARGARET RIVER AND THE JERRAMUGUP (BREMER BAY) REGION (

Figure 1 and Figure 2).

THE BASELINE BUSHFIRE LIKELIHOOD OBTAINED USING UNHARMED FOR THE FOUR SELECTED REGIONS IT COVERS (I.E. GINGIN, KALAMUNDA, MUNDARING AND MARGARET RIVER) IS GENERALLY MODERATE OR HIGH, INCLUDING THE MAJORITY OF THE GINGIN, KALAMUNDA AND





MUNDARING REGIONS AND SOME OF THE COASTAL FRINGES OF MARGARET RIVER (

FIGURE 1). FIGURE 2 PRESENTS THE BUSHFIRE RISK IN SOUTH-WEST WA, EXPRESSED AS AN AVERAGE ANNUAL LOSS (AAL, IN AUD), WHICH REPRESENTS A COMBINATION OF BUSHFIRE LIKELIHOOD (

Figure 1) and the presence of assets at risk of being damaged by bushfires. These results indicate good agreement between the level of bushfire risk simulated in UNHaRMED (AAL) and the perceived levels of bushfire risk at the rural-urban interface identified by the relevant bushfire management agencies, suggesting that UNHaRMED is suitable for identifying areas of emerging risk under different climate change scenarios. Figure 2 also indicated that current mitigation activities in Gingin, Perth Hills and Margaret River areas are conducted in the vicinity of high-value assets at risk of bushfires simulated in UNHaRMED (indicated by high AAL values). This suggests that UNHaRMED is suitable for assessing the impact of fuel load mitigation activities at the rural-urban interface in WA.



Other LGs, such as Serpentine/Jarrahdale and Rockingham (South of Perth), and Wanneroo, Joondalup (North of Perth), where UNHaRMED predicted a high bushfire risk (Figure 2), were also identified as areas of high bushfire risk during discussions with end-users. However, to keep the case-study areas to a manageable number, it was decided to exclude these areas from the present study.

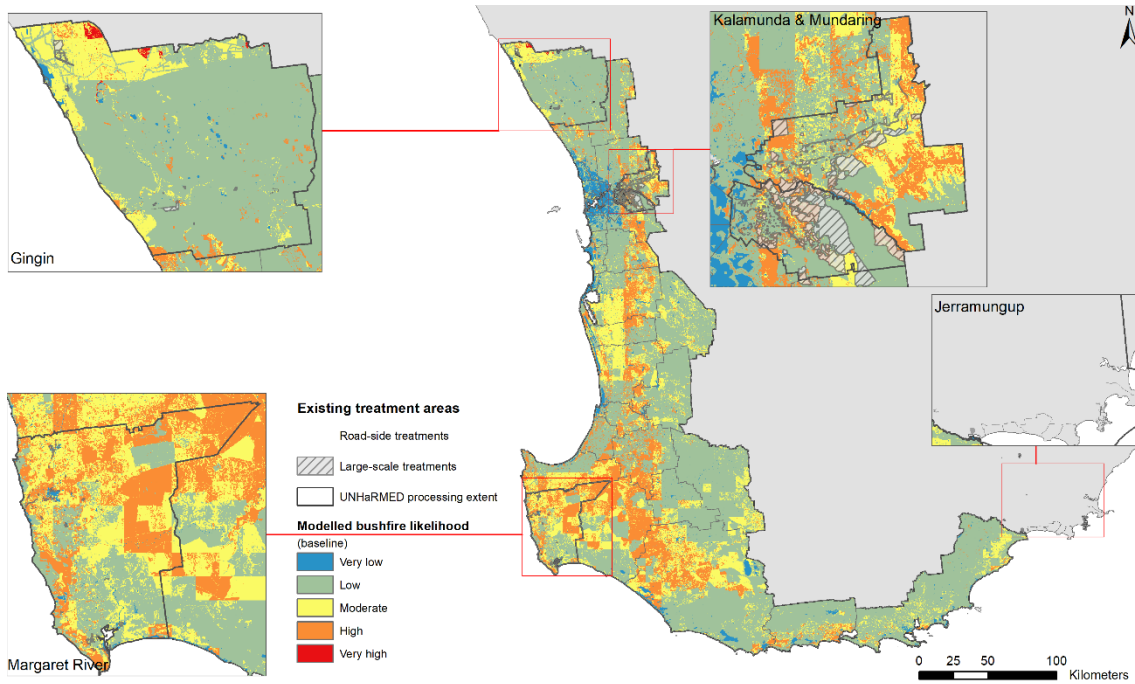


FIGURE 1. MODELLED BUSHFIRE LIKELIHOOD PRODUCED BY UNHARMED (BASELINE PERIOD), WITH A CLOSE-UP ON KEY TARGET AREAS DEFINED BY END-USERS. THE BUSHFIRE LIKELIHOOD REPRESENTS WHERE BUSHFIRES ARE LIKELY TO OCCUR IN THE LANDSCAPE. NOTE THAT THE JERRAMUNGUP REGION IS CURRENTLY OUTSIDE OF THE UNHARMED PROCESSING EXTENT.

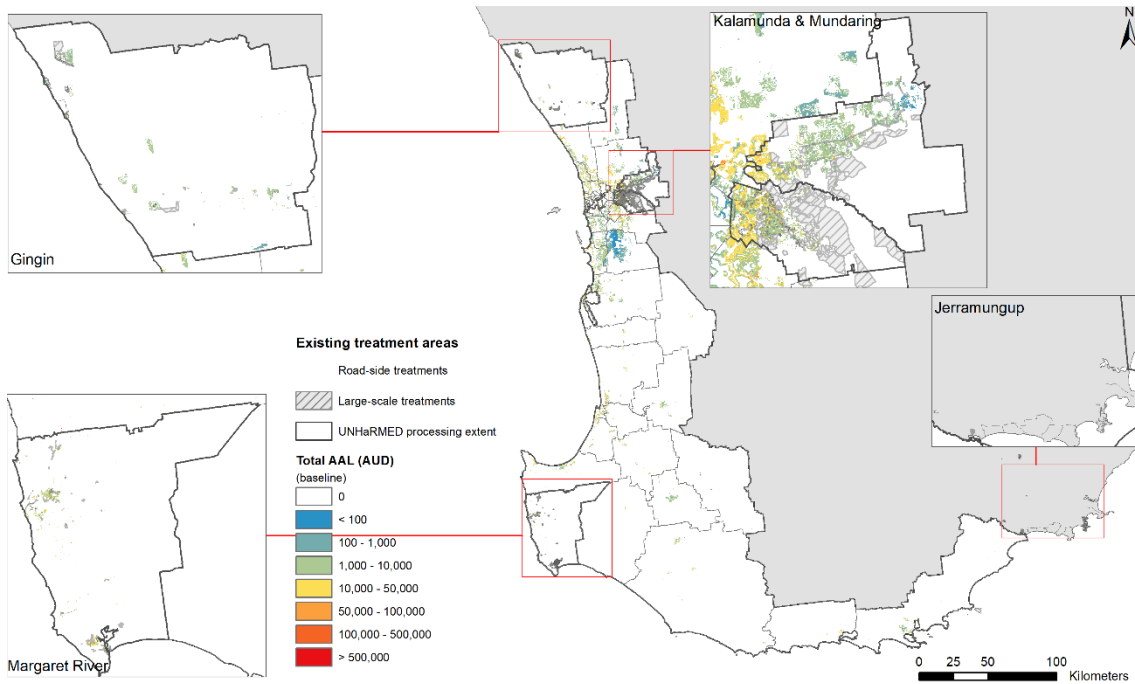


FIGURE 2. EXISTING FUEL MANAGEMENT ACTIVITIES WITHIN THE KEY TARGET AREAS DEFINED BY END-USERS OVERLAYED ON THE MODELLED AVERAGE ANNUAL LOSS (AUD) PRODUCED BY UNHARMED (BASELINE PERIOD). THE AAL REPRESENTS THE POTENTIAL IMPACT OF BUSHFIRES ON ASSETS.



### 3.2 CURRENT FUEL MITIGATION ACTIVITIES IN THE TARGET REGIONS

Table 1 presents a summary of the average and total length of road-side treatments, as well as the average and total surface treated for each fuel load reduction activity and financial year, and grouped by LGs, extracted from the WA BRMS treatment schedule.

Generally, planned burning is the most frequently used fuel mitigation treatment in all the target regions, representing up to 1,500 ha of the land treated in Mundaring in 2019-2020 (Table 1). Regarding road-side activities, chemical and mechanical works are the most frequently used for all the LGs, followed by firebreaks and fire track maintenance. Grazing is not actively applied in the target regions, except for Gingin, where grazing activities were planned in 2018 but not conducted yet.

This table also highlights that fuel load mitigation activities are spread across several financial periods and that not all of the regions are able to conduct the works planned (i.e. overdue classes). Planned burning appears to be the activity that is the most difficult to conduct, followed by the installation of fire breaks or fire access [**Error! Reference source not found.**]. The main limiting factors to conduct these activities seem to be linked to unfavourable seasonal conditions, lack of resources (e.g. availability of Bush Fire Brigades or funding), environment approvals and community concerns [**Error! Reference source not found.**].



TABLE 1. AMOUNT OF AREA/LENGTH TREATED FOR EACH LOCAL GOVERNMENT, TREATMENT TYPE AND FINANCIAL YEAR. NOTE THAT THE "OVERDUE" TREATMENTS REFER TO TREATMENTS PLANNED IN A PREVIOUS FINANCIAL YEAR BUT THAT HAVE NOT BEEN CONDUCTED YET.

LG	Financial Year	Treatment type	Average length treated <sup>(1)</sup> (m)	Total length treated (m)	Average surface treated <sup>(1)</sup> (ha)	Total surface treated (ha)
Margaret River	Overdue	Mechanical Works	2822	11287	1.03	18.58
		Planned Burning	-	-	4.09	49.07
		Fire Access Road/Track(s)	-	-	0.05	0.05
	2021-2022	Mechanical Works	1683	6732	1.96	39.21
		Planned Burning	-	-	2.70	91.77
		Fire Access Road/Track(s)	-	-	0.24	0.24
	2020-2021	Mechanical Works	-	-	0.84	2.52
		Planned Burning (planned)	-	-	4.53	36.20
		Planned Burning (completed)	-	-	3.06	6.12
	2019-2020	Mechanical Works	808	808	1.07	13.88
		Planned Burning	-	-	2.70	8.10
		Fire Access Road/Track(s)	730	730	-	-
	2018-2019	Mechanical Works	2506	5012	1.54	20.08
		Planned Burning	-	-	3.62	10.87
		Firebreak(s)	-	-	1.18	2.36

<sup>(1)</sup> Denotes average area/length per treatment.



TABLE 1 (CONTINUED). AMOUNT OF AREA/LENGTH TREATED FOR EACH LOCAL GOVERNMENT, TREATMENT TYPE AND FINANCIAL YEAR. NOTE THAT THE "OVERDUE" TREATMENTS REFER TO TREATMENTS PLANNED IN A PREVIOUS FINANCIAL YEAR BUT THAT HAVE NOT BEEN CONDUCTED YET.

LG	Financial Year	Treatment type	Average length treated <sup>(1)</sup> (m)	Total length treated (m)	Average surface treated <sup>(1)</sup> (ha)	Total surface treated (ha)
Margaret River (continued)	2017-2018	Mechanical Works	-	-	1.28	10.23
		Planned Burning	-	-	5.30	21.19
		Fire Access Road/Track(s)	-	-	0.26	0.26
	Before 2017	Planned Burning	-	-	3.55	17.73
Gingin	Overdue	Chemical Works	1635	8177	3.41	6.83
		Grazing	-	-	42.81	42.81
		Mechanical Works	1268	22824	0.29	4.59
		Planned Burning	-	-	32.54	1204.08
		Fire Access Road/Track(s)	760	9126	0.05	0.23
		Firebreak(s)	1064	18084	-	-
	2021-2022	Planned Burning	-	-	0.90	0.90
	2020-2021	Chemical Works (planned)	5007	5007	-	-
		Mechanical Works (planned)	2372	11859	-	-
		Planned Burning (planned)	-	-	7.54	75.4
	2019-2020	Chemical Works	2332	6996	0.41	1.65
		Mechanical Works	2266	13595	0.34	1.70
		Planned Burning	-	-	9.60	38.38
		Firebreak(s)	1866	7465	-	-

<sup>(1)</sup> Denotes average area/length per treatment.



TABLE 1 (CONTINUED). AMOUNT OF AREA/LENGTH TREATED FOR EACH LOCAL GOVERNMENT, TREATMENT TYPE AND FINANCIAL YEAR. NOTE THAT THE "OVERDUE" TREATMENTS REFER TO TREATMENTS PLANNED IN A PREVIOUS FINANCIAL YEAR BUT THAT HAVE NOT BEEN CONDUCTED YET.

LG	Financial Year	Treatment type	Average length treated <sup>(1)</sup> (m)	Total length treated (m)	Average surface treated <sup>(1)</sup> (ha)	Total surface treated (ha)
Gingin (continued)	2018-2019	Chemical Works	660	3961	0.30	0.91
		Mechanical Works	838	8377	0.55	1.66
		Fire Access Road/Track(s)	417	835	-	-
	Before 2017	Mechanical Works	720	1439	-	-
		Firebreak(s)	266	266	-	-
Jerramungup	Overdue	Chemical Works	-	-	1.32	3.96
		Mechanical Works	554	554	0.55	15.28
		Planned Burning	-	-	26.06	469.00
		Fire Access Road/Track(s)	865	1730	1.22	10.97
		Firebreak(s)	-	-	3.27	6.55
	2021-2022	Mechanical Works	-	-	0.22	0.22
		Planned Burning	-	-	5.26	5.26
	2020-2021	Chemical Works (planned)	1402	33643	1.24	7.44
		Mechanical Works (planned)	3887	132162	0.74	16.95
		Planned Burning (planned)	-	-	27.18	353.38
		Fire Access Road/Track(s) (planned)	-	-	0.46	0.46

<sup>(1)</sup> Denotes average area/length per treatment.





TABLE 1 (CONTINUED). AMOUNT OF AREA/LENGTH TREATED FOR EACH LOCAL GOVERNMENT, TREATMENT TYPE AND FINANCIAL YEAR. NOTE THAT THE "OVERDUE" TREATMENTS REFER TO TREATMENTS PLANNED IN A PREVIOUS FINANCIAL YEAR BUT THAT HAVE NOT BEEN CONDUCTED YET.

LG	Financial Year	Treatment type	Average length treated <sup>(1)</sup> (m)	Total length treated (m)	Average surface treated <sup>(1)</sup> (ha)	Total surface treated (ha)
Jerramungup (continued)	2019-2020	Chemical Works	1630	42391	0.54	2.15
		Mechanical Works	1506	33131	0.82	3.26
		Fire Access Road/Track(s)	–	–	0.002	0.002
	2018-2019	Chemical Works	1392	20882	1.06	11.62
		Mechanical Works	1808	27120	0.95	19.06
		Fire Access Road/Track(s)	1459	1459	0.81	4.07
		Firebreak(s)	–	–	0.55	0.55
	2017-2018	Chemical Works	1585	17430	1.00	3.00
		Mechanical Works	1350	24303	2.57	30.87
		Planned Burning	–	–	14.92	29.85
		Fire Access Road/Track(s)	676	2027	0.98	12.68
	Before 2017	Mechanical Works	–	–	0.32	3.23
		Planned Burning	–	–	2.61	5.23
Firebreak(s)		–	–	0.35	0.35	
Kalamunda	Overdue	Chemical Works	–	–	0.21	0.21
		Mechanical Works	66	66	0.48	105.6
		Planned Burning	–	–	21.82	1527.39
		Firebreak(s)	550	70968	0.20	1.19

<sup>(1)</sup> Denotes average area/length per treatment.



TABLE 1 (CONTINUED). AMOUNT OF AREA/LENGTH TREATED FOR EACH LOCAL GOVERNMENT, TREATMENT TYPE AND FINANCIAL YEAR. NOTE THAT THE "OVERDUE" TREATMENTS REFER TO TREATMENTS PLANNED IN A PREVIOUS FINANCIAL YEAR BUT THAT HAVE NOT BEEN CONDUCTED YET.

LG	Financial Year	Treatment type	Average length treated <sup>(1)</sup> (m)	Total length treated (m)	Average surface treated <sup>(1)</sup> (ha)	Total surface treated (ha)
Kalamunda (continued)	2021-2022	Mechanical Works	-	-	0.39	1.57
		Planned Burning	-	-	59.06	9154.44
		Firebreak(s)	612	1225	-	-
	2020-2021	Planned Burning (planned)	-	-	0.50	4.52
	2018-2019	Mechanical Works	-	-	0.21	0.21
		Planned Burning	-	-	81.82	1227.27
		Firebreak(s)	426	853	-	-
	2017-2018	Planned Burning	-	-	61.57	492.58
Before 2017	Planned Burning	-	-	2.74	49.25	
Mundaring	Overdue	Mechanical Works	-	-	0.57	2.29
		Planned Burning	-	-	157.13	628.51
		Fire Access Road/Track(s)	-	-	48.36	48.36
		Firebreak(s)	-	-	0.06	0.06
	2021-2022	Chemical Works	-	-	13.69	27.38
		Mechanical Works	-	-	4.12	37.08
		Planned Burning	-	-	105.08	1471.09
		Fire Access Road/Track(s)	-	-	64.11	256.45
		Firebreak(s)	-	-	35.18	70.36

<sup>(1)</sup> Denotes average area/length per treatment.



TABLE 1 (CONTINUED). AMOUNT OF AREA/LENGTH TREATED FOR EACH LOCAL GOVERNMENT, TREATMENT TYPE AND FINANCIAL YEAR. NOTE THAT THE "OVERDUE" TREATMENTS REFER TO TREATMENTS PLANNED IN A PREVIOUS FINANCIAL YEAR BUT THAT HAVE NOT BEEN CONDUCTED YET.

LG	Financial Year	Treatment type	Average length treated <sup>(1)</sup> (m)	Total length treated (m)	Average surface treated <sup>(1)</sup> (ha)	Total surface treated (ha)
Mundaring (continued)	2020-2021	Mechanical Works	-	-	1.94	9.69
		Planned Burning (planned)	-	-	12.17	60.85
		Planned Burning (completed)	-	-	29.95	119.79
		Fire Access Road/Track(s) (planned)	-	-	99.24	99.24
		Fire Access Road/Track(s) (completed)	-	-	6.95	20.85
		Firebreak(s)	-	-	0.40	0.40
	2019-2020	Chemical Works	-	-	6.53	39.20
		Mechanical Works	-	-	12.92	142.14
		Planned Burning	-	-	158.09	1580.86
		Fire Access Road/Track(s)	-	-	219.52	439.05
		Firebreak(s)	-	-	17.97	125.76
	2018-2019	Mechanical Works	-	-	15.87	158.73
		Planned Burning	-	-	62.39	561.55
		Fire Access Road/Track(s)	-	-	10.33	41.32
		Firebreak(s)	-	-	2.80	8.40

<sup>(1)</sup> Denotes average area/length per treatment.



## 4. FUTURE WORK

The next step will be to run UNHaRMED simulations involving a range of future climate and population growth scenarios with and without fuel management activities (M2). We will then identify how bushfire risk changes for each scenario, where management activities are desirable, and where potential risk reduction is possible (irrespective of management type) (D2).



## TEAM MEMBERS

### RESEARCH TEAM

Prof Holger Maier (University of Adelaide): Lead Researcher

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Dr Aaron Zecchin (University of Adelaide): Key Researcher

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Roel Vanhout: UNHaRMED software development, conceptual development

### END-USERS

End-user organisation	End-user representative
Department for Fire and Emergency Services (DFES)	Tim McNaught
Department for Environment and Water (DEW)	Mike Wouters Simeon Telfer
Tasmanian Fire Services (TFS)	Louise Mendel



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