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Proposed development - Manyana Beach Estate

Expert Report

Professor David Lindenmayer AO

10 June 2020

Introduction

1. I have been instructed by the Environmental Defenders Office on behalf of the Manyana Matters Environmental Association Inc to provide an expert assessment of the environmental impacts of the proposed residential development at Lot 172 DP 755923 and Lot 823, DP 247285, Manyana, including any impacts of Stage 1, which I am instructed has been issued with a construction certificate.

2. I have been briefed with the following documents, which I have had regard to in providing my opinion:

    a. Information on the original project application and approval from: http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=159.
    b. Flora and Fauna Assessment Proposed Subdivision Lot 172 DP 755923 & Lot 823 DP 247285 Berringer Road and Cunjurong Point Road, Manyana City of Shoalhaven.
    c. Ecoplanning (2019). Flora and Fauna Management Plan, Lot 172 // DP 755923 & Lot 823 DP // 247285, Berringer Road, Cunjurong Point Road and Sunset Strip, Manyana (v. 2.3). Prepared for Precise Planning.
    d. Ecoplanning (2018). Environmental Management Plan Lot 172 // DP 755923, Lot 823 // DP 247285, Berringer Road, Cunjurong Point Road and Sunset Strip, Manyana, NSW. Prepared for Precise Planning Pty Limited, on behalf of Ozy Homes.
    e. A series of images taken from the Department of Planning, Industry and Environment Google Earth Engine Burnt Area Map (GEEBAM) showing the extent and intensity of fires over the 2019/20 summer.
    f. Map – Manyana Fire Extent and Severity, dated 30 May 2020.
    g. Map – BioNet Atlas of NSW Wildlife – Greater Glider, dated 25 May 2020.

3. I have been asked to provide my opinion on whether the development has, will have or is likely to have a significant impact on a listed threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**).

4. I confirm that I have read the Federal Court of Australia Expert Evidence Practice Note (GPN-EXPT) General Practice Note and agree to be bound by it.

General summary of key insights regarding the Greater Glider

5. The Greater Glider is Australia's largest gliding marsupial. Populations of the species in many parts of its distribution have been undergoing significant decline (Smith and Smith 2018) (Lindenmayer and Sato 2018). The species has suffered regional extinction in parts of coastal New South Wales (for example, at Booderee National Park, Jervis Bay Territory) (Lindenmayer et al. 2018). The conservation status of the species has changed in some jurisdictions with populations listed as endangered in parts of New South Wales (https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/nsw-threatened-species-ecological-communities-listed-schedules-20200515.pdf?la=en&hash=621B1E398C79150A3E0098688844585D455445B4).

6. Whilst the Greater Glider is the most detectable of the various species of nocturnal arboreal marsupials (Lindenmayer 2002), it is nevertheless readily missed in spotlighting surveys, even by highly experienced observers (Lindenmayer et al. 2001).

7. The relatively large number of large trees in the development site suggest that the area should be suitable habitat for the species. Indeed, the Greater Glider is dependent on hollow-bearing trees (Gibbons and Lindenmayer 2002) (Lindenmayer et al. 2014) and individual animals need access to cavities in a range of different trees as part of den-swapping behavior (Kehl and Borsboom 1984) (Lindenmayer et al. 2004). It is therefore possible that animals inhabit the Manyana site but have remained undetected.

8. In my view, given the possibility that Greater Gliders inhabit the site, the clearing of the site at Manyana will likely have negative impacts on the persistence of the Greater Glider in the broader area. Animals die in-situ when areas are cleared (Tyndale-Biscoe and Smith 1969). Moreover, in my opinion, clearing of the Manyana development site is highly likely to have significant negative effects on

both the landscape-level persistence of the species in the broader area and also will impair the recovery of the species following the recent fires.

9. Records from various wildlife records databases indicate there have been a number of detections of the Greater Glider on the proposed Manyana development site and in the areas immediately adjacent to the proposed Manyana development site. Animals from these areas may well use the Manyana development site as part of their broader home range, such as for foraging. There is a need for detailed systematic surveys of adjacent areas to the proposed Manyana development site.

10. The presence of the Greater Glider in forests adjacent to the Manyana development site and persistence of unburned areas at the site itself suggest that the Greater Glider may exist as a patchy population in the broader area. That is, its distribution occurs in a series of temporally occupied and temporally unoccupied suitable areas of forest habitat, with the ensemble of patches needed to ensure medium to long-term persistence in a landscape (Hanski 1998, 1999). Such patchy populations have been termed meta-populations (Hanski 1998, 1999) and habitat patches that are unoccupied at a given time can soon after be re-occupied with landscape-level and regional persistence dependent on the maintenance of all patches in an ensemble of patches, especially larger intact patches (Possingham et al. 1994). Considerable work has been done on the persistence of the Greater Glider as a meta-population in other forest environments in Australia (Possingham et al. 1994) (Lindenmayer and Lacy 1995) (McCarthy and Lindenmayer 1999b, McCarthy and Lindenmayer 1999a) (Todd et al. 2016).

11. **The key issue is that all patches of relatively intact forest in the broader landscape including the area that encompasses the Manyana development site will likely be needed to remain intact for persistence of the Greater Glider.** This is especially the case since the extensive wildfires that have occurred in NSW south coast region (see below), including in the broader Lake Conjola/Berringer area (see map produced by Ms 11C(1)(a) dated 30 May 2020 and titled Manyana – Fire Extent and Severity).

12. The Greater Glider is sensitive to the effects of fire (Andrew et al. 2014) and can be lost from burnt areas, including when fire has burnt the surrounding landscape (Berry et al. 2015) (Lindenmayer et al. 2019) (Lindenmayer et al. 2020a).

13. Many populations of the Greater Glider in Victoria and New South Wales have been heavily impacted by the effects of the 2019-2020 wildfires, with large parts of the distribution of the species having been burnt (Department of Environment Land Water and Planning 2020) (Ward and al. 2020). Areas that remain unburned are highly likely to be critical refugia for many species following widespread wildfire (Taylor et al. 2012) (Robinson et al. 2013) including the wildfire which occurred in 2019-2020. Substantial parts of the area surrounding the Manyana development site have been burnt .

14. Unburnt areas within the boundary of an area subject to fire can be important refuges for the Greater Glider. Work on other species elsewhere in eastern Australia has shown that the rate of recovery of species following wildfire is strongly associated with the amount of unburned forest within the footprint of a fire (e.g. (Lindenmayer et al. 2009)).

15. The Greater Glider is at risk of significant decline due to the effects of other kinds of disturbance in the surrounding landscape as found in work conducted in the Tumut area of New South Wales (Lindenmayer et al. 1999) and in the wet forests of Victoria (Lindenmayer et al. 2020a). This includes the impacts of urban development on the ability of the species to persist in adjacent areas – as found in a study in the broader Jervis Bay region in which the Greater Glider had become rare in forests close to human settlements (Villaseñor et al. 2014).

16. Notably, another species of conservation concern, the Yellow-bellied Glider which is listed as vulnerable in NSW ((https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/nsw-threatened-species-ecological-communities-listed-schedules-20200515.pdf?la=en&hash=621B1E398C79150A3E0098688844585D455445B4) (and which may inhabit the forests in the vicinity of the Manyana site and for which there have been relatively recent records), exhibited a significant negative response

to urban development with negative edge effects extending more than 300 metres in the adjacent forest (Villaseñor et al. 2014).

Conclusion

17. The proposed development at Manyana will result in a substantial amount of clearing of relatively intact habitat that remains following extensive wildfires in the surrounding landscape and surrounding region.

18. Clearing of these remaining green and unburnt areas will, in my opinion, likely have a significant negative impact on the persistence of remaining populations of the Greater Glider and potentially also the Yellow-bellied Glider in the region. Therefore, in my opinion, clearing of the Manyana development site is highly likely to have significant negative effects on both the landscape-level persistence of the species in the broader area and also will impair the recovery of the species following the recent fires.

19. In general, landscapes that have been subject to extensive disturbance (such as the landscape around the Manyana site), should not be exposed to yet further disturbance. This is because the cumulative effects of compounding disturbances can drive the losses of disturbance-sensitive species (Lindenmayer et al. 2020b).

20. Populations of the Greater Glider are already under considerable pressure given the extent of fire that has occurred in the region in 2019-2020. It is therefore critical to conserve the limited remaining areas of unburnt refugia to promote the persistence of the Greater Glider and potentially also a wide range of other species of conservation concern in the area (e.g. Yellow-bellied Glider, Glossy Black Cockatoo).

21. Application of the precautionary principle (Deville and Harding 1997) would suggest that intact areas such as that at the Manyana development site should not be cleared given the high value in promoting the persistence of species such as the Greater Glider when such a large part of the surrounding landscape has been disturbed.

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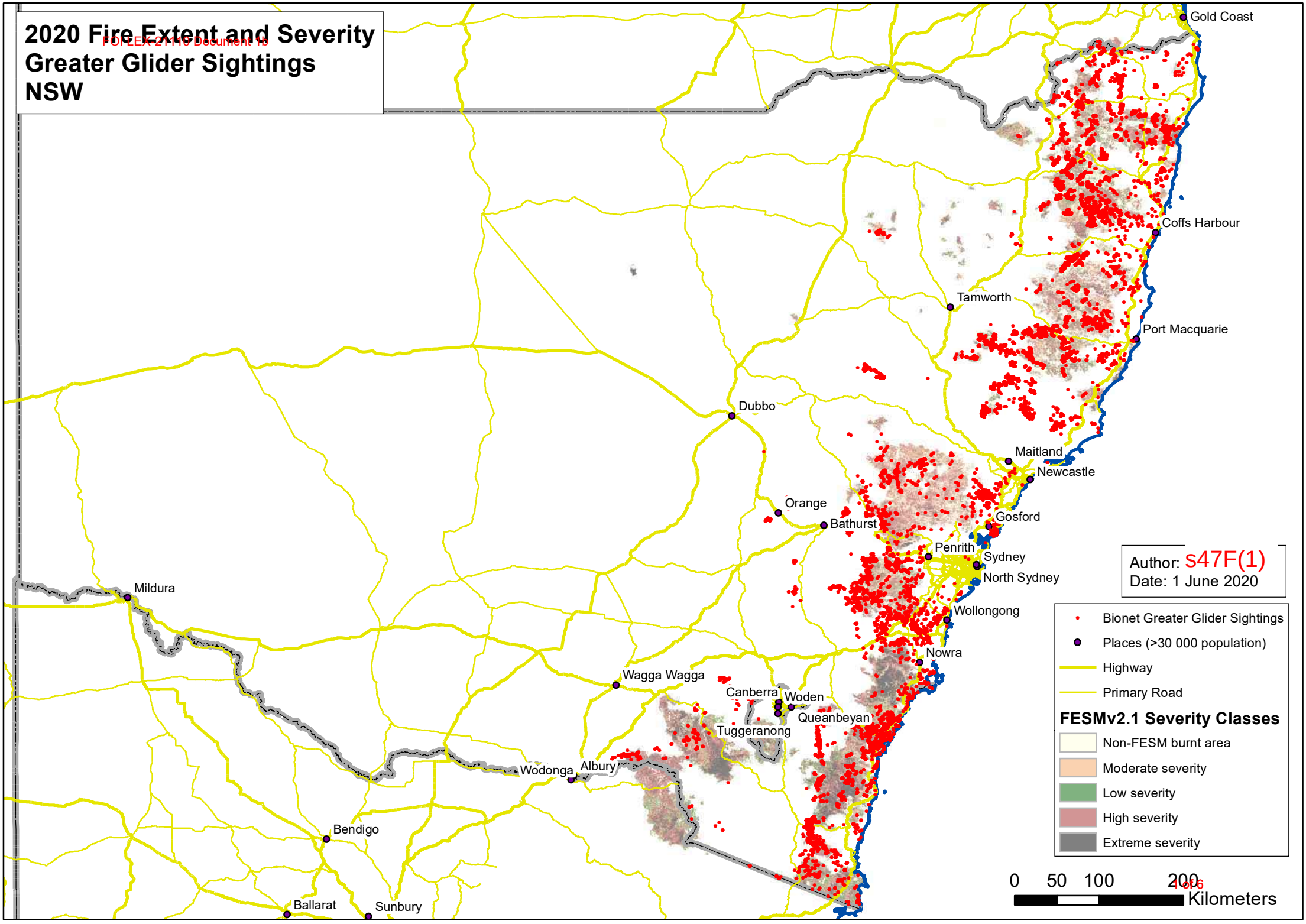
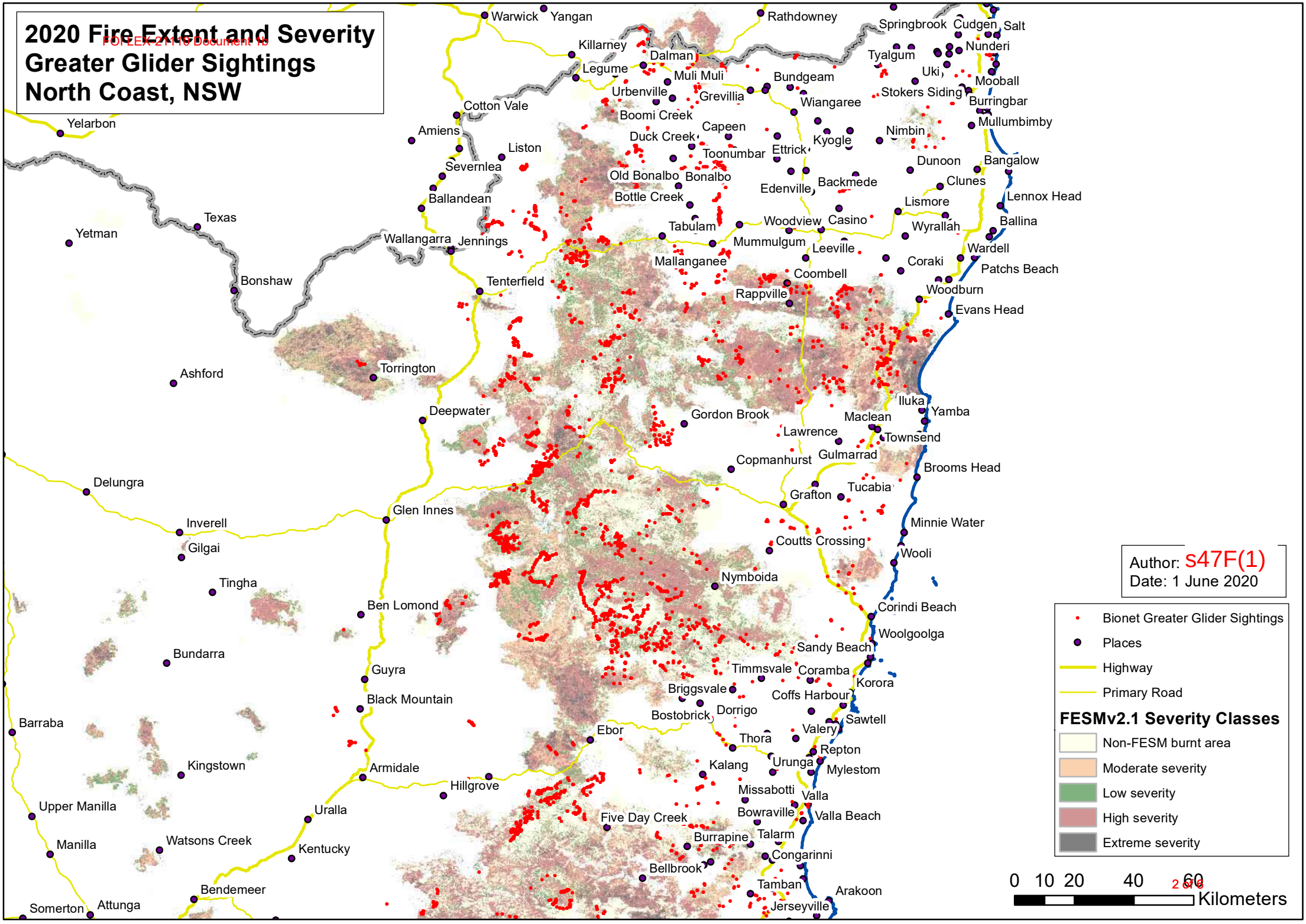
2020 Fire Extent and Severity
Greater Glider Sightings
NSW



2020 Fire Extent and Severity
Greater Glider Sightings
North Coast, NSW



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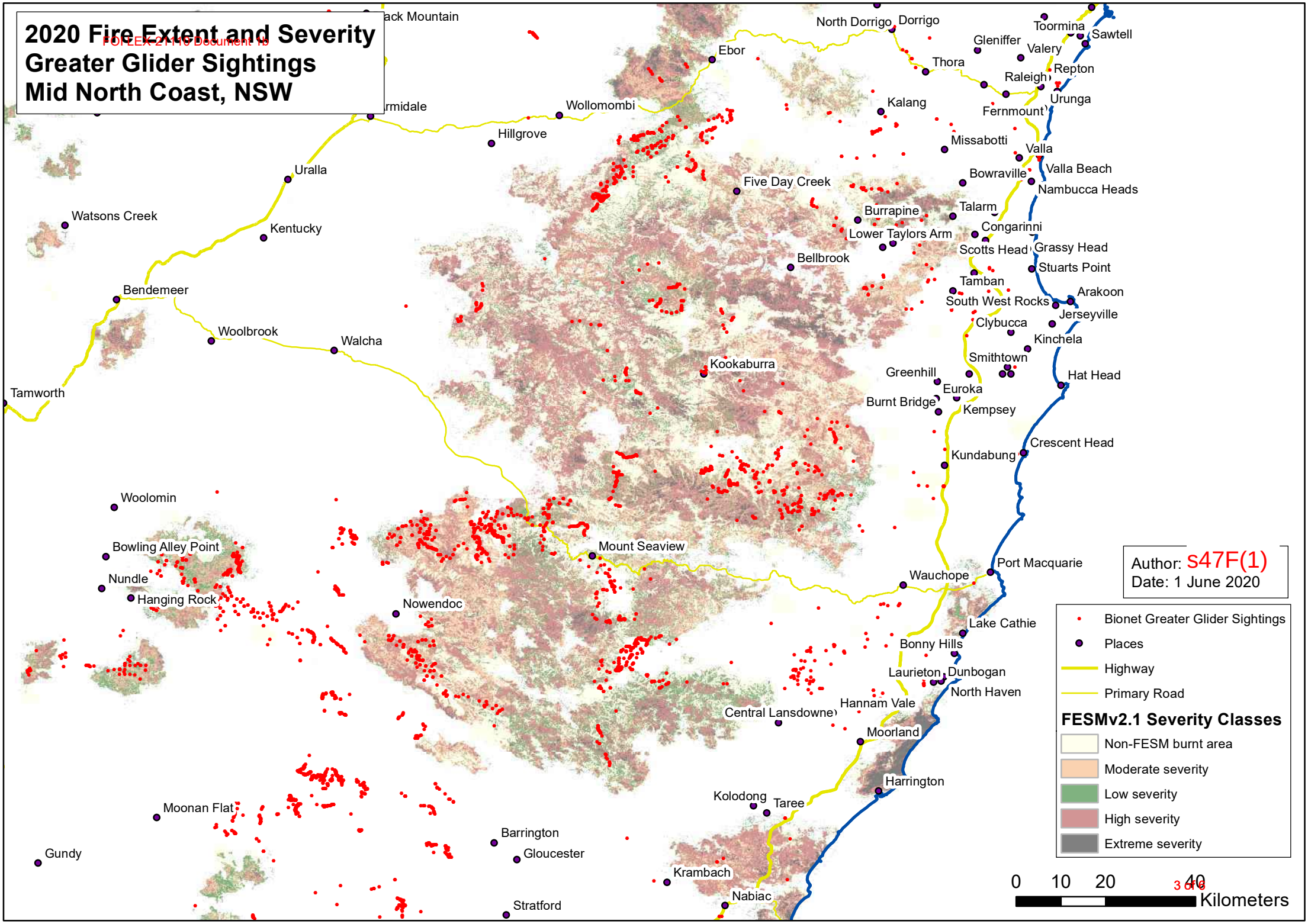
Mid North Coast, NSW



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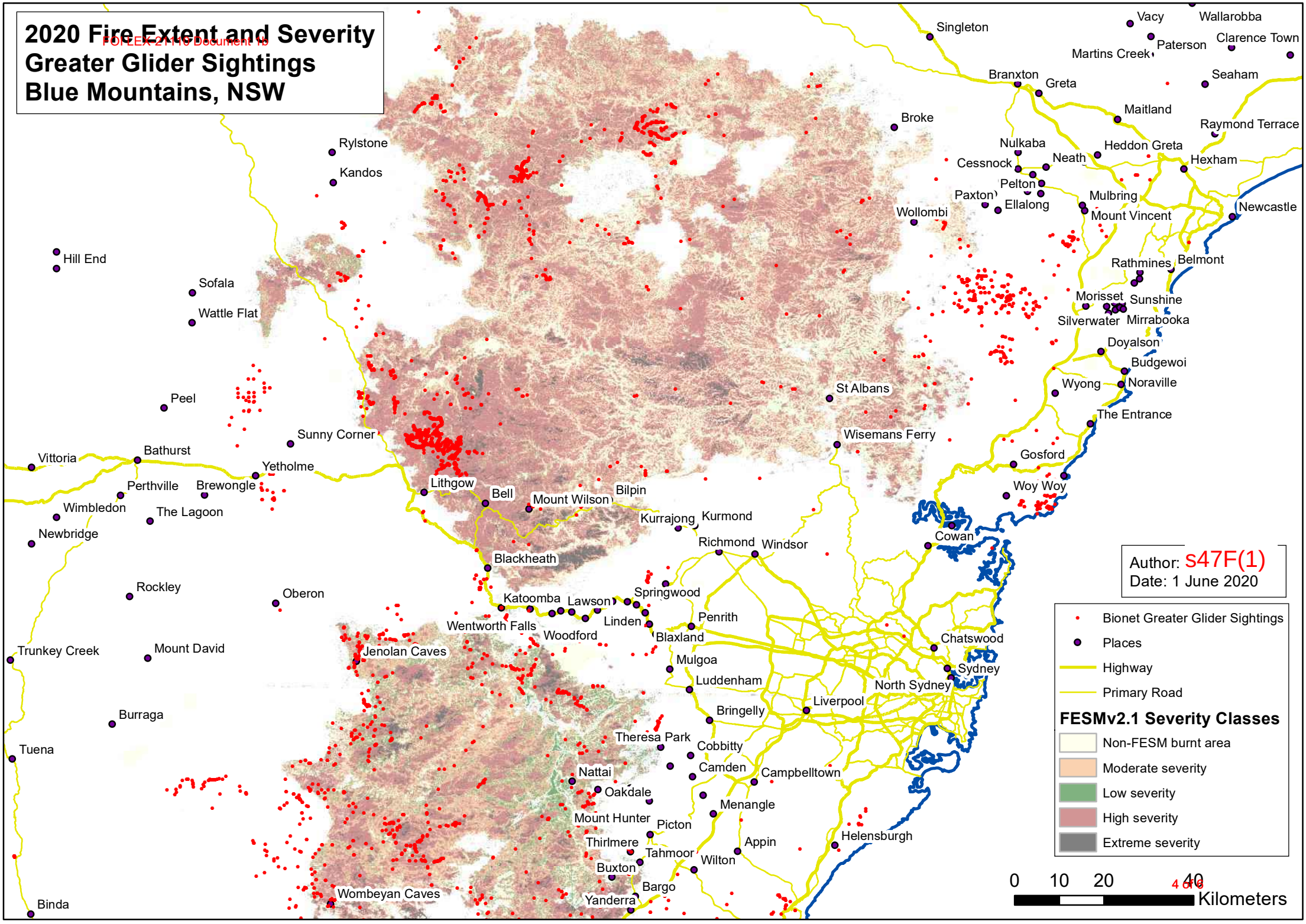
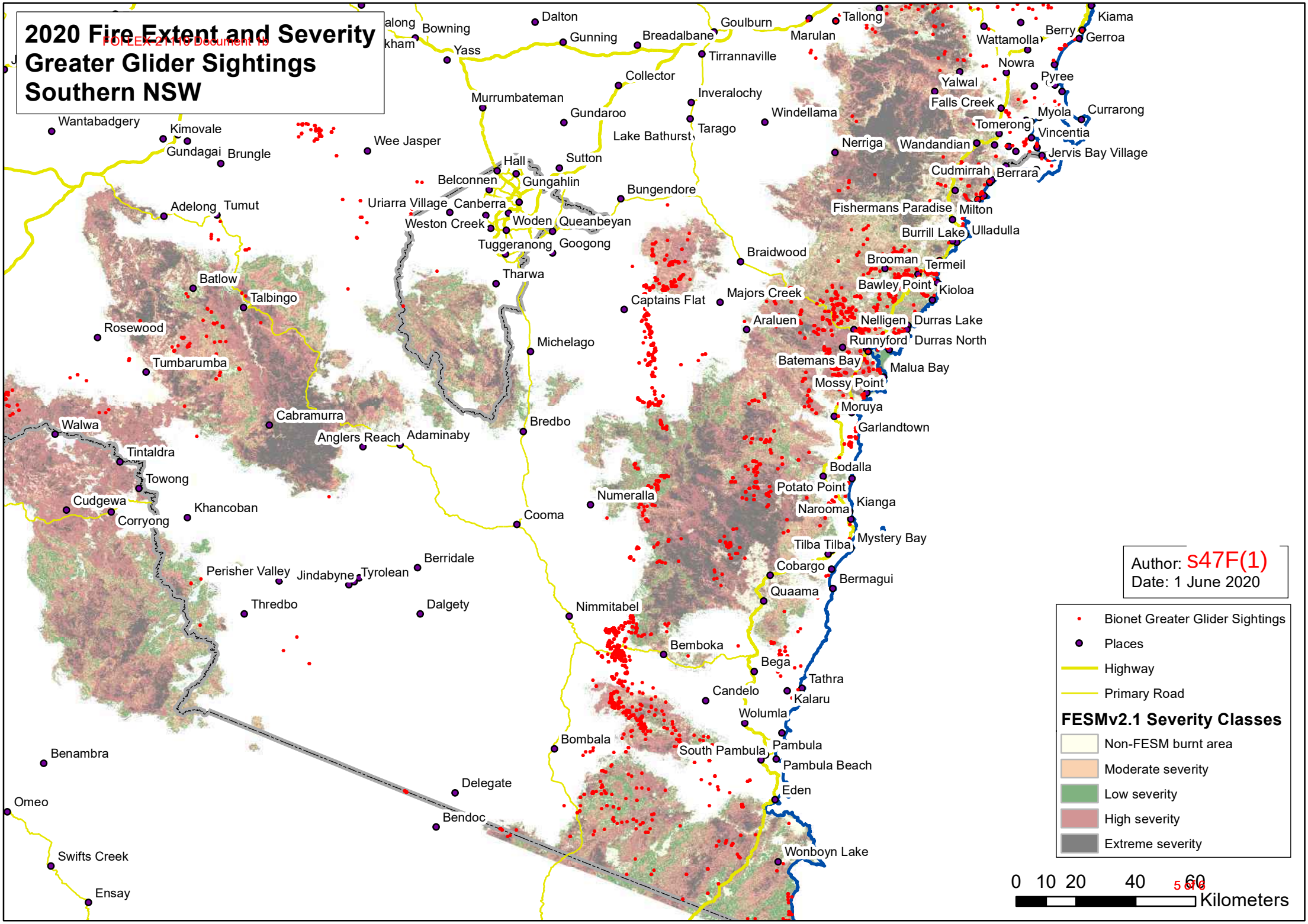
Greater Glider Sightings
Blue Mountains, NSW




2020 Fire Extent and Severity
Greater Glider Sightings
Southern NSW
FOI EE-21-16 Document 16
Author: s47F(1)
Date: 1 June 2020
Bionet Greater Glider Sightings
Places
Highway
Primary Road
FESMv2.1 Severity Classes
Non-FESM burnt area
Moderate severity
Low severity
High severity
Extreme severity
0 10 20 40 60
Kilometers
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Wantabadgery
Kimovale
Gundagai
Brungle
Wee Jasper
Adelong
Tumut
Batlow
Talbingo
Rosewood
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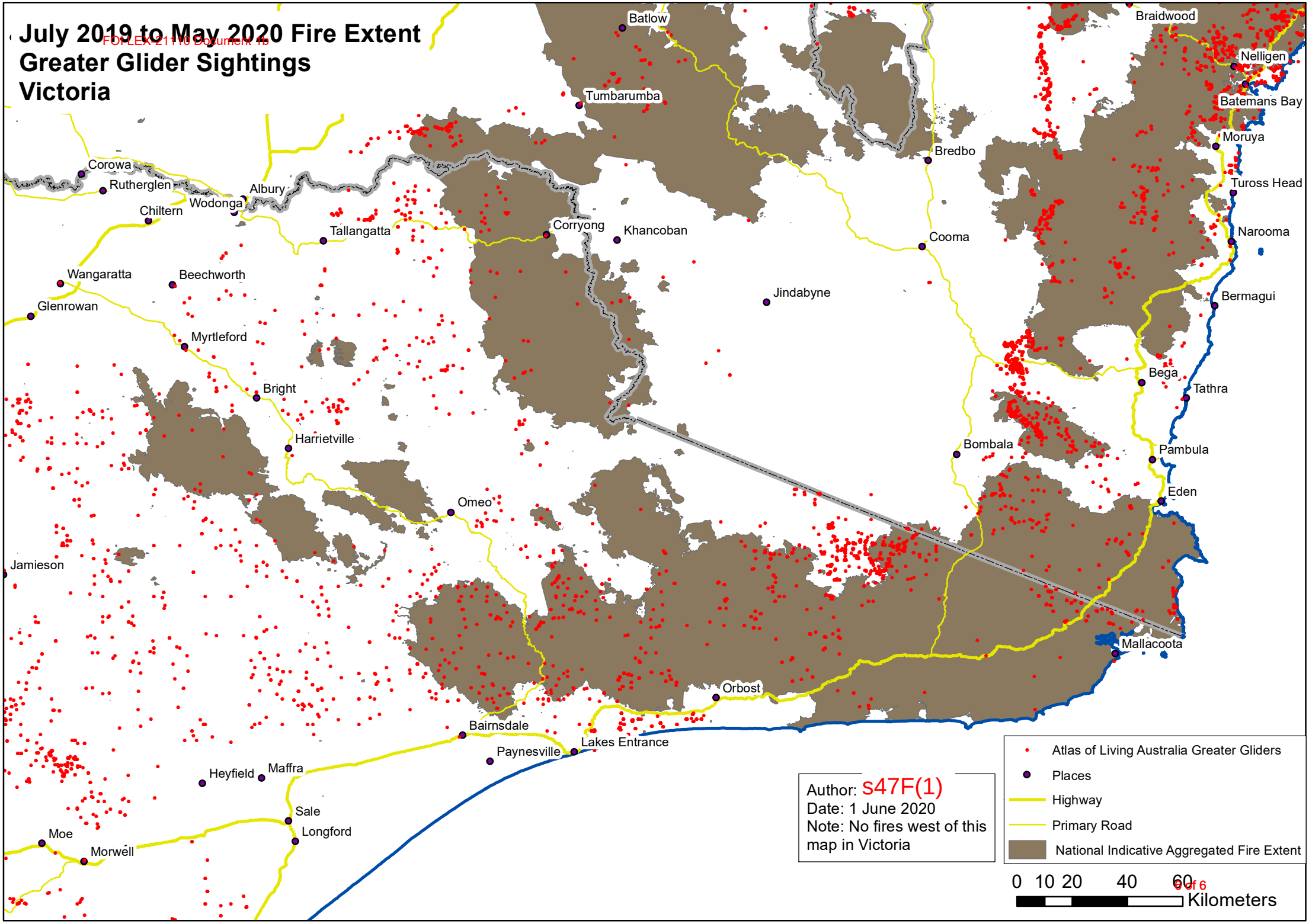
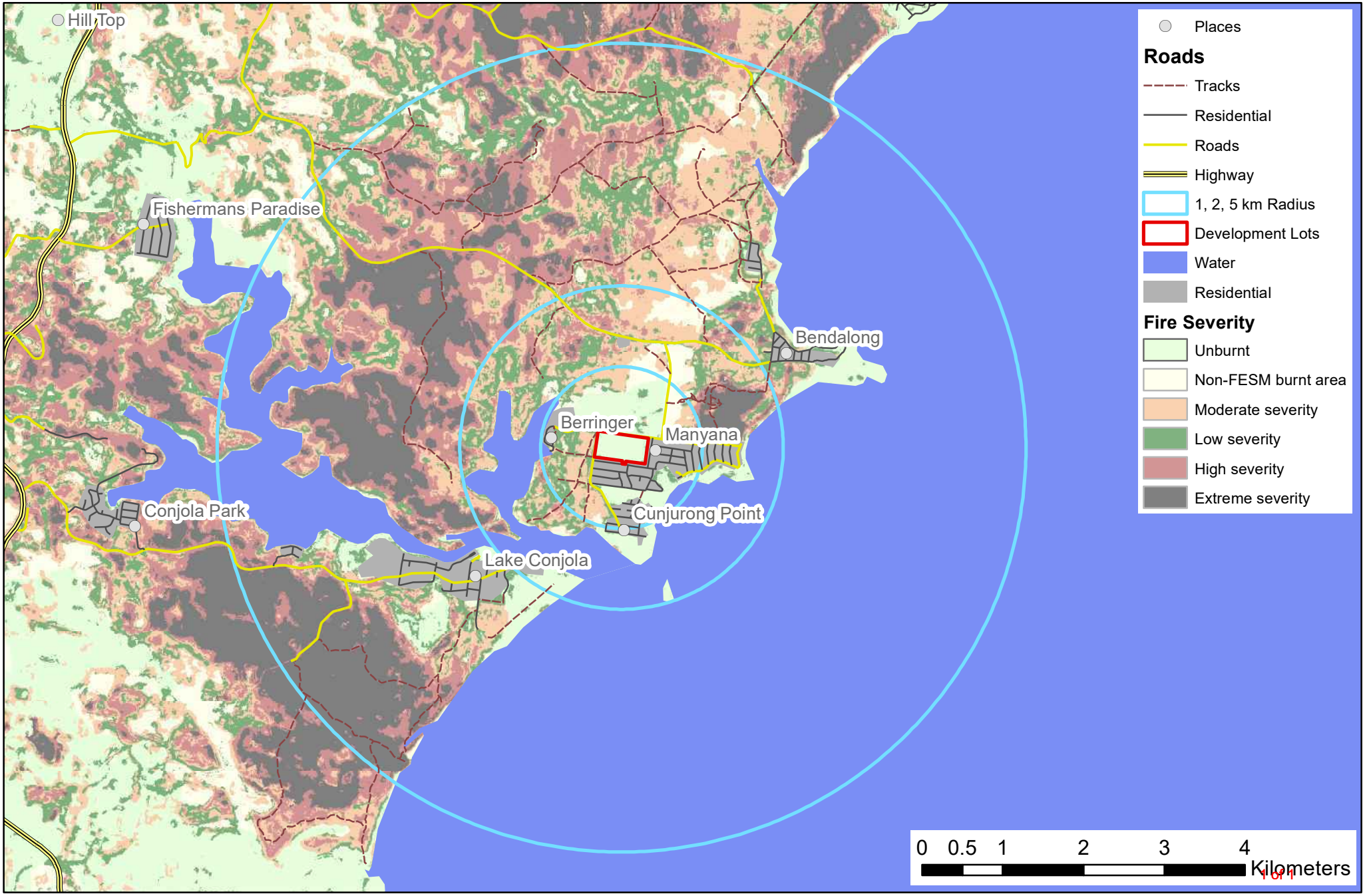
Walwa
Cabramurra
Tintaldra
Towong
Cudgewa
Corryong
Khancoban
Benambra
Omeo
Swifts Creek
Ensay
Perisher Valley
Jindabyne
Tyrolean
Berridale
Thredbo
Dalgety
Delegate
Bendoc
Dalton
Gunning
Yass
Bowning
Murrumbateman
Gundaroo
Collector
Breadalbane
Goulburn
Tirrannaville
Inveralochy
Tarago
Lake Bathurst
Windellama
Marulan
Tallong
Wattamolla
Berry
Kiama
Gerroa
Nowra
Pyree
Yalwal
Falls Creek
Myola
Currarong
Tomerong
Vincentia
Nerriga
Wandandian
Jervis Bay Village
Cudmirrah
Berrara
Fishermans Paradise
Milton
Burrill Lake
Ulladulla
Brooman
Termeil
Bawley Point
Kioloa
Durras Lake
Durras North
Batemans Bay
Malua Bay
Mossy Point
Moruya
Garlandtown
Bodalla
Potato Point
Kianga
Narooma
Mystery Bay
Tilba Tilba
Cobargo
Bermagui
Quaama
Bemboka
Bega
Tathra
Kalaru
Candelo
Wolumla
Pambula
Pambula Beach
South Pambula
Bombala
Eden
Wonboyn Lake
Hall
Sutton
Belconnen
Gungahlin
Bungendore
Uriarra Village
Canberra
Weston Creek
Woden
Queanbeyan
Tuggeranong
Googong
Tharwa
Michelago
Bredbo
Anglers Reach
Adaminaby
Cooma
Numeralla
Nimmitabel
Braidwood
Captains Flat
Majors Creek
Araluen
Nelligen
Runnyford

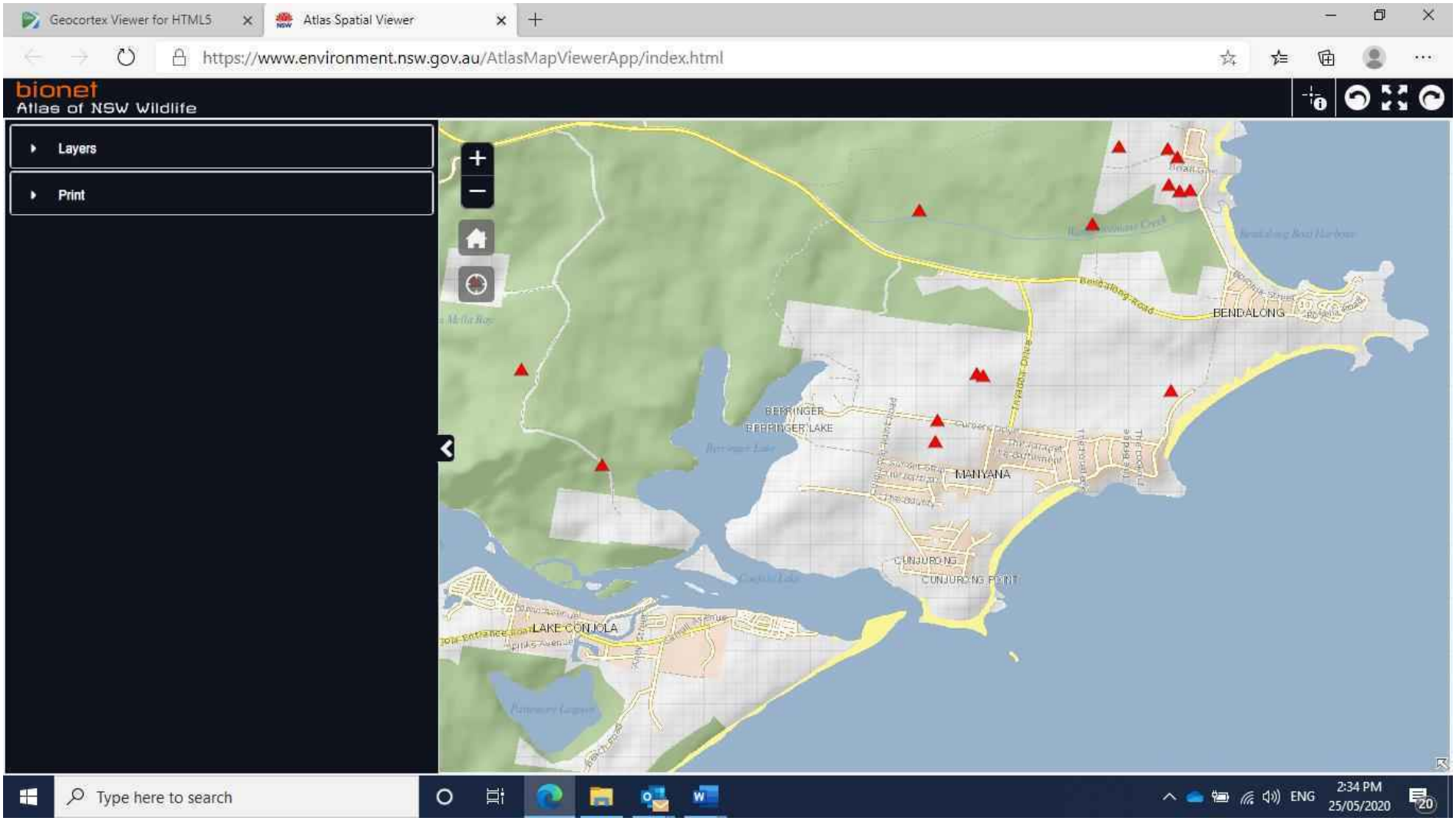
July 2019 to May 2020 Fire Extent
Greater Glider Sightings
Victoria



Manyana
Fire Extent and Severity

Author: s47F(1)
Date: 30 May 2020

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EPBC Act listed species in the Manyana Area, with specific occurrence in the Manyana Beach Estate

Count	Species	Common Name	NSW Status	Commonwealth status	High Priority species following bushfires (Y/N)	Local record
Known to occur in the project area*						
1	*Menura novaehollandiae*	Superb Lyrebird	-	-	Y	Recorded last week by Birdlife Shoalhaven
2	*Lathamus discolo*	Swift Parrot	E	CE	Y	BioNet records + B Ryan pers obs
3	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	-	Y	in EIS and BioNet, and photos on site in the last 2 weeks
4	*Calyptorhynchus lathami*	Glossy Black-cockatoo	V	-	Y	BioNet records and resident in Manyana.
5	*Pycnoptilus floccosus*	Pilot Bird	-	-	Y	BioNet records + B Ryan pers obs
6	*Hirundapus caudacutus*	White-throated Needletail	-	M	Y	BioNet records + B Ryan pers obs
7	*Monarcha melanopsis*	Black-faced Monarch	-	M	Y	BioNet records + B Ryan pers obs.+ EIS
8	*Antechinus mimetes (swainsonii)*	Dusky Antechinus	-	-	Y	BioNet records + B Ryan pers obs.+ EIS
9	*Isoodon obesulus obesulus*	Southern Brown Bandicoot	E	E	Y	BioNet + B Ryan pers obs.
10	*Petauroides volans*	Greater Glider	-	V	Y	EIS + BioNet = BES (crica 2006) across

Count	Species	Common Name	NSW Status	Commonwealth status	High Priority species following bushfires (Y/N)	Local record
						Beringer Road + EMM (circa 2014) east of Inyadda Rd towards Bendalong + recent anecdotal records from community
11	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	Y	BioNet records + B Ryan pers obs.+ EIS
Other species known from the locality:						
1	*Genoplesium vernale*	East Lynne Midge Orchid	V	V	Y	BioNet
2	*Genoplesium baueri*	Bauer's Midge Orchid	E	E	N	BioNet
3	*Baloskion longipes*	Dense Cord-rush	V	V	Y	BioNet
4	*Correa baeuerlenii*	Chef's Cap Correa	V	V	Y	BioNet
5	*Caladenia tessellata*	Thick-lipped Spider-orchid	E	V	Y	BioNet
6	*Cryptostylis hunteriana*	Leafless Tongue-orchid	V	V	Y	BioNet. + B Ryan pers obs.
7	*Cynanchum elegans*	White-flowered Wax Plant	E	E	Y	BioNet
8	*Rhizanthella slateri*	Eastern Underground Orchid	V	V	Y	BioNet
9	*Melaleuca biconvexa*	Biconvex Paperbark	V	V	Y	BioNet
10	*Melaleuca deanei*	Deane's Melaleuca	V	V	Y	BioNet
11	*Prasophyllum affine*	Jervis Bay Leek Orchid	E	E	Y	BioNet
12	*Pterostylis ventricosa*	Halbury Rustyhood	CE	-	Y	BioNet + B Ryan pers obs
13	*Syzygium paniculatum*	Magenta Lilly Pilly	E	V		BioNet

Count	Species	Common Name	NSW Status	Commonwealth status	High Priority species following bushfires (Y/N)	Local record
14	*Thesium australe*	Austral Toadflax, Toadflax	V	V	Y	BioNet
15	*Euastacus guwinus*	Tianjara Crayfish	-	-	Y	BioNet
16	*Litoria littlejohni*	Littlejohn's Tree Frog	V	V	Y	BioNet
17	*Mixophyes balbus*	Stuttering Frog	E	V	Y	BioNet
18	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	Y	BioNet
19	*Litoria aurea*	Green and Golden Bell Frog	E	V	Y	BioNet
20	*Eulamprus tympanum*	Southern Water-skink	-	-	Y	BioNet
21	*Drysdalia rhodogaster*	Mustard-bellied Snake	-	-	Y	BioNet + B Ryan pers obs
22	*Dasyornis brachypterus*	Eastern Bristlebird	E	E	Y	BioNet
23	*Pezoporus wallicus wallicus*	Eastern Ground Parrot	V	-	Y	BioNet
24	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	Y	BioNet
25	*Potorous longipes*	Long-footed Potoroo	CE	E	Y	BioNet
26	*Dasyurus maculatus*	Spotted-tail Quoll	V	E	Y	BioNet
27	*Pseudomys fumeus*	Smoky Mouse	CE	E	Y	BioNet
28	*Petaurus australis*	Yellow-bellied Glider	V	-	Y	BioNet + recrds from BES (crica 2006) in council crown land where the nest boxes have been installed and BES (circa 2006) across Berringer Road. Some records have also made it to BioNet

Count	Species	Common Name	NSW Status	Commonwealth status	High Priority species following bushfires (Y/N)	Local record
29	*Pseudomys novaehollandiae*	New Holland Mouse	-	V	Y	BioNet
30	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	Y	BioNet
31	*Phoniscus papuensis*	Golden-tipped Bat	V	-	Y	BioNet

Key

* Either recorded during the EIS, through BioNet Atlas records or observed in the project area by the author.

Status

V = vulnerable on either/or the NSW BC Act 2016, or Commonwealth EPBC Act 1999
E = Endangered on either/or the NSW BC Act 2016, or Commonwealth EPBC Act 1999
EP = Endangered Population on either/or the NSW BC Act 2016, or Commonwealth EPBC Act 1999
CE = Critically Endangered on either/or the NSW BC Act 2016, or Commonwealth EPBC Act 1999

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Proposed development - Manyana Beach Estate

Expert Report

Professor David Lindenmayer AO

10 June 2020

Introduction

1. I have been instructed by the Environmental Defenders Office on behalf of the Manyana Matters Environmental Association Inc to provide an expert assessment of the environmental impacts of the proposed residential development at Lot 172 DP 755923 and Lot 823, DP 247285, Manyana, including any impacts of Stage 1, which I am instructed has been issued with a construction certificate.

2. I have been briefed with the following documents, which I have had regard to in providing my opinion:

    a. Information on the original project application and approval from: http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=159.
    b. Flora and Fauna Assessment Proposed Subdivision Lot 172 DP 755923 & Lot 823 DP 247285 Berringer Road and Cunjurong Point Road, Manyana City of Shoalhaven.
    c. Ecoplanning (2019). Flora and Fauna Management Plan, Lot 172 // DP 755923 & Lot 823 DP // 247285, Berringer Road, Cunjurong Point Road and Sunset Strip, Manyana (v. 2.3). Prepared for Precise Planning.
    d. Ecoplanning (2018). Environmental Management Plan Lot 172 // DP 755923, Lot 823 // DP 247285, Berringer Road, Cunjurong Point Road and Sunset Strip, Manyana, NSW. Prepared for Precise Planning Pty Limited, on behalf of Ozy Homes.
    e. A series of images taken from the Department of Planning, Industry and Environment Google Earth Engine Burnt Area Map (GEEBAM) showing the extent and intensity of fires over the 2019/20 summer.
    f. Map – Manyana Fire Extent and Severity, dated 30 May 2020.
    g. Map – BioNet Atlas of NSW Wildlife – Greater Glider, dated 25 May 2020.

3. I have been asked to provide my opinion on whether the development has, will have or is likely to have a significant impact on a listed threatened species under the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**).

4. I confirm that I have read the Federal Court of Australia Expert Evidence Practice Note (GPN-EXPT) General Practice Note and agree to be bound by it.

General summary of key insights regarding the Greater Glider

5. The Greater Glider is Australia's largest gliding marsupial. Populations of the species in many parts of its distribution have been undergoing significant decline (Smith and Smith 2018) (Lindenmayer and Sato 2018). The species has suffered regional extinction in parts of coastal New South Wales (for example, at Booderee National Park, Jervis Bay Territory) (Lindenmayer et al. 2018). The conservation status of the species has changed in some jurisdictions with populations listed as endangered in parts of New South Wales (https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/nsw-threatened-species-ecological-communities-listed-schedules-20200515.pdf?la=en&hash=621B1E398C79150A3E0098688844585D455445B4).

6. Whilst the Greater Glider is the most detectable of the various species of nocturnal arboreal marsupials (Lindenmayer 2002), it is nevertheless readily missed in spotlighting surveys, even by highly experienced observers (Lindenmayer et al. 2001).

7. The relatively large number of large trees in the development site suggest that the area should be suitable habitat for the species. Indeed, the Greater Glider is dependent on hollow-bearing trees (Gibbons and Lindenmayer 2002) (Lindenmayer et al. 2014) and individual animals need access to cavities in a range of different trees as part of den-swapping behavior (Kehl and Borsboom 1984) (Lindenmayer et al. 2004). It is therefore possible that animals inhabit the Manyana site but have remained undetected.

8. In my view, given the possibility that Greater Gliders inhabit the site, the clearing of the site at Manyana will likely have negative impacts on the persistence of the Greater Glider in the broader area. Animals die in-situ when areas are cleared (Tyndale-Biscoe and Smith 1969). Moreover, in my opinion, clearing of the Manyana development site is highly likely to have significant negative effects on

both the landscape-level persistence of the species in the broader area and also will impair the recovery of the species following the recent fires.

9. Records from various wildlife records databases indicate there have been a number of detections of the Greater Glider on the proposed Manyana development site and in the areas immediately adjacent to the proposed Manyana development site. Animals from these areas may well use the Manyana development site as part of their broader home range, such as for foraging. There is a need for detailed systematic surveys of adjacent areas to the proposed Manyana development site.

10. The presence of the Greater Glider in forests adjacent to the Manyana development site and persistence of unburned areas at the site itself suggest that the Greater Glider may exist as a patchy population in the broader area. That is, its distribution occurs in a series of temporally occupied and temporally unoccupied suitable areas of forest habitat, with the ensemble of patches needed to ensure medium to long-term persistence in a landscape (Hanski 1998, 1999). Such patchy populations have been termed meta-populations (Hanski 1998, 1999) and habitat patches that are unoccupied at a given time can soon after be re-occupied with landscape-level and regional persistence dependent on the maintenance of all patches in an ensemble of patches, especially larger intact patches (Possingham et al. 1994). Considerable work has been done on the persistence of the Greater Glider as a meta-population in other forest environments in Australia (Possingham et al. 1994) (Lindenmayer and Lacy 1995) (McCarthy and Lindenmayer 1999b, McCarthy and Lindenmayer 1999a) (Todd et al. 2016).

11. **The key issue is that all patches of relatively intact forest in the broader landscape including the area that encompasses the Manyana development site will likely be needed to remain intact for persistence of the Greater Glider.** This is especially the case since the extensive wildfires that have occurred in NSW south coast region (see below), including in the broader Lake Conjola/Berringer area (see map produced by Ms 11C(1)(a) dated 30 May 2020 and titled Manyana – Fire Extent and Severity).

12. The Greater Glider is sensitive to the effects of fire (Andrew et al. 2014) and can be lost from burnt areas, including when fire has burnt the surrounding landscape (Berry et al. 2015) (Lindenmayer et al. 2019) (Lindenmayer et al. 2020a).

13. Many populations of the Greater Glider in Victoria and New South Wales have been heavily impacted by the effects of the 2019-2020 wildfires, with large parts of the distribution of the species having been burnt (Department of Environment Land Water and Planning 2020) (Ward and al. 2020). Areas that remain unburned are highly likely to be critical refugia for many species following widespread wildfire (Taylor et al. 2012) (Robinson et al. 2013) including the wildfire which occurred in 2019-2020. Substantial parts of the area surrounding the Manyana development site have been burnt .

14. Unburnt areas within the boundary of an area subject to fire can be important refuges for the Greater Glider. Work on other species elsewhere in eastern Australia has shown that the rate of recovery of species following wildfire is strongly associated with the amount of unburned forest within the footprint of a fire (e.g. (Lindenmayer et al. 2009)).

15. The Greater Glider is at risk of significant decline due to the effects of other kinds of disturbance in the surrounding landscape as found in work conducted in the Tumut area of New South Wales (Lindenmayer et al. 1999) and in the wet forests of Victoria (Lindenmayer et al. 2020a). This includes the impacts of urban development on the ability of the species to persist in adjacent areas – as found in a study in the broader Jervis Bay region in which the Greater Glider had become rare in forests close to human settlements (Villaseñor et al. 2014).

16. Notably, another species of conservation concern, the Yellow-bellied Glider which is listed as vulnerable in NSW ((https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/nsw-threatened-species-ecological-communities-listed-schedules-20200515.pdf?la=en&hash=621B1E398C79150A3E0098688844585D455445B4) (and which may inhabit the forests in the vicinity of the Manyana site and for which there have been relatively recent records), exhibited a significant negative response

to urban development with negative edge effects extending more than 300 metres in the adjacent forest (Villaseñor et al. 2014).

Conclusion

17. The proposed development at Manyana will result in a substantial amount of clearing of relatively intact habitat that remains following extensive wildfires in the surrounding landscape and surrounding region.

18. Clearing of these remaining green and unburnt areas will, in my opinion, likely have a significant negative impact on the persistence of remaining populations of the Greater Glider and potentially also the Yellow-bellied Glider in the region. Therefore, in my opinion, clearing of the Manyana development site is highly likely to have significant negative effects on both the landscape-level persistence of the species in the broader area and also will impair the recovery of the species following the recent fires.

19. In general, landscapes that have been subject to extensive disturbance (such as the landscape around the Manyana site), should not be exposed to yet further disturbance. This is because the cumulative effects of compounding disturbances can drive the losses of disturbance-sensitive species (Lindenmayer et al. 2020b).

20. Populations of the Greater Glider are already under considerable pressure given the extent of fire that has occurred in the region in 2019-2020. It is therefore critical to conserve the limited remaining areas of unburnt refugia to promote the persistence of the Greater Glider and potentially also a wide range of other species of conservation concern in the area (e.g. Yellow-bellied Glider, Glossy Black Cockatoo).

21. Application of the precautionary principle (Deville and Harding 1997) would suggest that intact areas such as that at the Manyana development site should not be cleared given the high value in promoting the persistence of species such as the Greater Glider when such a large part of the surrounding landscape has been disturbed.

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Lindenmayer, D. B., R. B. Cunningham, C. F. Donnelly, R. D. Incoll, M. L. Pope, C. R. Tribolet, K. L. Viggers, and A. H. Welsh. 2001. How effective is spotlighting for detecting the greater glider (Petauroides volans)? Wildlife Research **28**:105-109.

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Professor David B Lindenmayer, AO

BSc, DipEd, PhD, DSc
FAA, FESA
ARC Laureate Fellow (2013-2018)

Publications Catalogue

Overview

	Number
Books	45
Book chapters	113
Refereed scientific articles (published or in press)	788
Refereed scientific articles (in review)	30
Popular articles, booklets, reports, consultancies, conference papers etc	269
Total	**1246**

Contents

Publications impact

Selection of key publications

Publication and citations	Impact / significance
Lindenmayer DB and Franklin JF. (2002). *Conserving Forest Biodiversity: A Comprehensive Multiscaled Approach*. Island Press, Washington DC. 351 pp. Google Scholar citations: 1865	Widely regarded as the seminal textbook on forest biodiversity. Reviewed as follows *"… pioneering effort to encompass the vast field of knowledge and practice of forest biodiversity conservation"; "Simply put, the book is excellent. I have found few other books that so elegantly blend the practice of natural resources management with the promise of conservation and landscape ecology theory".*
Lindenmayer DB, Foster D, Franklin JF, Hunter M, Noss R, Schmiegelow F and Perry D. (2004). Salvage harvesting policies after natural disturbance. *Science* 303: 1303. Google Scholar citations: 297	This paper discovered the potentially negative effects of a natural disturbance (e.g. wildfire) followed by human disturbance (salvage) logging. It spawned a global interest in, and array of research studies on, salvage logging and inspired the writing of a textbook on the topic of salvage logging (Lindenmayer et al., 2008).
Lindenmayer DB, Hobbs RJ, Likens GE, Krebs C and Banks S. (2011). Newly discovered landscape traps produce regime shifts in wet forests. *Proceedings of the National Academy of Sciences of the USA*, 108, 15887-15891. Google Scholar citations: 220	This paper highlights the discovery of landscape traps. The can develop where interacting natural and human disturbances increase the risk of 'trapping' extensive areas of forest in an early successional stage and preventing them from becoming old growth forest. The work was based on 30+ years of empirical research in the wet Mountain Ash forests of Victoria.
Lindenmayer, DB, and Sato C. (2018). Hidden collapse is driven by fire and logging in a socioecological forest ecosystem. *Proceedings of the National Academy of Sciences*, 115, 5181-86 Google Scholar citations: 11	This paper outlines the discovery that ecosystems can be at elevated risks of collapse due to novel interacting pressures resulting from the over-commitment of resources, recurrent natural disturbances, and losses of keystone structures and biodiversity.
Lindenmayer, DB, Blanchard W, Westgate M, Foster, C, Banks S, Barton, P, Crane, M, Ikin K. and Scheele B. (2019). Novel bird responses to successive, large-scale, landscape transformations. *Ecological Monographs*, 89, e01362. Google Scholar citations: 2	In this very recently published article, we discovered that biodiversity responds not only to recent changes in land use but also past land use transformations (such as partial land clearing) that took place more than a century ago. There also can be novel interactions between present and past forms of land use transformation, indicating that species that currently persist in human-modified environments may be maladapted to new forms of land use change. This work is based on a 21-year, 30 000 ha landscape experiment in southern New South Wales documenting the effects of plantation established in semi-cleared agricultural land.
Lindenmayer, DB, Laurance WF and Franklin JF. (2012). Global decline in large old trees. *Science*, 338, 1305-1306. Google Scholar citations: 300	This paper highlighted, for the first time, that large old trees are at particular risk of decline in many ecosystems globally due to a range of factors. The paper led to further articles in *Biological Reviews*, *Trends in Ecology and Evolution,* and *Conservation Letters* (Lindenmayer & Laurance, 2016; 2017, Lindenmayer et al., 2014).
Lindenmayer DB, Lane, P, Crane, M, Florance, D, Foster, C, Ikin, K, Michael, D, Sato, C, Scheele, B, and Westgate, M (2019). Weather effects on birds of different size are mediated by long-term climate and vegetation type in endangered temperate woodlands. *Global Change Biology*, 25, 675-685. Google Scholar citations: 2	In this recently published paper, we discovered that the effects on biodiversity of season changes in weather interact strongly with long-term climate and broad types of vegetation cover. In highly unexpected results, replanted native woodland vegetation acts as weather refuges during drought, but the magnitude of these positive benefits manifest primarily in cooler and wetter climates and mainly for smaller bodied birds. This work is based on ~ 2 decades of study in a 1 million ha natural experiment and has major implications for restoration programs.

Publication and citations	Impact / significance
Fischer J and **Lindenmayer DB.** (2007). Landscape modification and habitat fragmentation: a synthesis. *Global Ecology and Biogeography*, 16, 265-280. Google Scholar citations: 1665	This paper is regarded as one of the citation classics in the field of habitat fragmentation and landscape change. It outlines landscape processes and patterns and the inter-relationships between patterns and processes.
Lindenmayer DB and Likens GE. (2009). Adaptive monitoring: a new paradigm in long-term studies. *Trends in Ecology and Evolution*, 24, 482-6. Google Scholar citations: 591	This paper describes the new concept of Adaptive Monitoring which allows pre-existing monitoring programs to evolve and change in response to new information, new protocols and other factors.
Lindenmayer DB and Likens GE. (2010, 2018). *Effective Ecological Monitoring*. Second Edition. CSIRO Publishing, Melbourne and Earthscan. Google Scholar citations: 295	This book emphasizes the authors' collective perspectives on the key features which characterize good (and not so good) monitoring programs. The book's content is drawn from the collective experiences of the authors in establishing and maintaining long-term ecological studies. This volume was fully revised, given widespread demand. At the 2016 SAOEN conference in South Africa, one of the keynote speakers suggested to other scientists that if they read only one book, *Effective Ecological Monitoring* should be that book.
Lindenmayer DB, Hobbs RJ, Montague-Drake R, Alexandra J, Bennett A, et al. (2008). A checklist for ecological management of landscapes for conservation. *Ecology Letters*, 11, 78-91. Google Scholar citations: 644	This paper is a highly cited and widely downloaded paper in *Ecology Letters*. It sets out general principles for guiding landscape management in agricultural areas. The European Commission's Science for Environment Policy News Alert in February 2008 recommended it to 17,000 landscape managers in Europe.
Keith H, Mackey BG and **Lindenmayer DB** (2009). Re-evaluation of forest biomass carbon stocks and lessons from the world's most carbon-dense forests. *Proceedings of the National Academy of Sciences of the USA*, 106, 11635-11640. Google Scholar citations: 612	This paper assessed carbon stocks, not using modelling, but based on actual on-the-ground measurements on long-term research sites. Moreover, the assessments included not just overstorey trees but also fallen timber and the understorey layers. This approach to empirical carbon assessment showed that far more carbon is stored in these primary forests than previously recognized – a result that has major implications for key international bodies such as the IPCC in relation to carbon sequestration and storage.
Lindenmayer DB, Cunningham RB, Donnelly CF, Nix HA and Lindenmayer BD. (2002). Effects of forest fragmentation on bird assemblages in a novel landscape context. *Ecological Monographs*, 72, 1-18. Google Scholar citations: 232	This paper was based on a major landscape experiment and revealed unexpected responses of forest and woodland birds arising from the large-scale establishment of exotic pine plantations.
Lindenmayer DB, Margules CR and Botkin D. (2000). Indicators of biodiversity for ecologically sustainable forest management. *Conservation Biology*, 14, 941-950 Google Scholar citations: 964	This paper outlined for the first time some of the major problems with the indicator and surrogate approaches.
Lindenmayer DB and Fischer J. (2006). *Habitat Fragmentation and Landscape Change*. Island Press, Washington, D.C. 329 pp. Google Scholar citations: 1008	This book is a major synthesis of the key topics in the effects of landscape change habitat fragmentation on biodiversity and ecosystem processes. It presents novel perspectives on species, habitat and landscape level concepts and was based on the authors' extensive body of empirical work on these topics.
Lindenmayer DB, Possingham HP, Lacy RC, McCarthy MA and Pope ML. (2003). How accurate are population models? Lessons from landscape-scale population tests in a fragmented system. *Ecology Letters* 6: 41-47. Google Scholar citations: 123	This paper was the first study to test the accuracy of predictions from population viability models at the landscape scale.

Publication and citations	Impact / significance
Lindenmayer DB, Pierson J, Barton P, Beger M, Branquinho C, Calhoun A, Caro T, Greig H, Gross J, Heino J, Hunter M, Lane P, Longo C, Martin K, McDowell WH, Mellin C, Salo H, Tulloch A and Westgate M. (2015). A new framework for selecting environmental surrogates. *Science of the Total Environment*, 538, 1029-1038. Google Scholar citations: 43	The paper draws together novel perspectives on the application of surrogates and indicators across a range of disciplines and presents a new framework – An Adaptive Surrogacy Framework – to identify and continuously improve the application of surrogates.

Publications impact – citations record

I am one of the world's most productive and highly-cited ecologists. As of 14 May 2020, a Web of Knowledge search shows that my publications have been cited 33,786 times (an average 48.7 citations per paper over a subset of 697 publications). My H-index is 88. My Google Scholar Index is 123. I am listed among the top 2000 Highly Cited Researchers (h>100) according to Google Scholar Citations public profiles across all disciplines (http://www.webometrics.info/en/node/58).

My Elsevier Dashboard shows that my papers have been viewed 481,000 times and cited 30,445 times. My m-index is 2.5 which is classes me as "an outstanding scientist" according to Hirsch (2005; PNAS, doi:10.1073/pnas.0507655102).

Based on citation analyses through Google Scholar, I am ranked #1 globally for total citations in forest ecology, #6 globally in conservation biology, and #30 globally in ecology. Other metrics analyses have been ranked higher in ecology. For example, an analysis by https://academic.microsoft.com/topic/18903297 shows that I am in **the top 10 authors in Ecology globally over the past decade**.

My Citations Metrics according to Google Scholar as at 24 May 2020 are:

Citation indices	All	Since 2015
Citations	64 411	31 181
h-index	123	80
i10-index	691	525

I am a 2019 Web of Science Highly Cited Researcher. I am listed in the 2019, 2018, 2017, 2015, and 2014 Clarivate Highly Cited Lists (https://clarivate.com/hcr/2017-researchers-list/). These lists identify the authors of the most Highly Cited Papers in their field (in my case, environment/ecology). Highly Cited Papers are defined as those that rank in the top 1% by citations for field and year indexed in the Web of Science. I am also a member of an elite group of 0.5% of scientists globally that have published >10 peer-reviewed scientific articles in international journals annually each year for more than 15 years. Several of my papers are regarded as citation classics. For example, three of my papers are among the 10 most down-loaded articles in *Biological Conservation*, *Ecology Letters* and *Trends in Ecology and Evolution*. I am among the most highly cited authors in journals such as PLOS One (in 2017). In 2019, a global assessment was completed of global researcher rankings (Ionnidis et al. 2019). **That analysis showed that I was ranked 2768 in the top 100 000 researchers globally, with with the career publications records of 6.9 m researchers examined. This analysis places me in the top 0.04% of researchers of researchers globally**.

Citation metrics have limitations. Indeed, I have written many articles for journals that are widely read by resource managers and policy makers – people who do not cite articles but nevertheless have enormous impact on practical environmental management. These articles do not contribute to citation metrics and may even detract from them.

I have written 45 books including several about guidelines for enhanced biodiversity conservation in landscapes also utilised for their natural resources. These books have substantial national and international readership and have received international acclaim. For example, my co-authored textbook *Conserving Forest Biodiversity* has been hailed as: "*…a pioneering effort to encompass the vast field of knowledge and practice of forest biodiversity conservation*" (Rudolph, 2003, *Conservation Biology* 17, 1463-4); "*Simply put, the book is excellent. I have found few other books that so elegantly blend the practice of natural resources management with the promise of conservation and landscape ecology theory*" (Kashian, 2004, *Landscape Ecology* 19, 703-4). In a book co-edited with Professor Jerry Franklin, I brought together a dozen of the world's leading experts on ecologically sustainable forestry practices and crafted an important volume on transitions to sustainability in a wide range of forest types around the world (*Towards Forest Sustainability,* Island Press, 2003). The book integrated the social, economic and policy dimensions of wood production with environmental aspects of biodiversity conservation and water production. Lindenmayer's textbook *Habitat Fragmentation and Landscape Change* has received critical acclaim as "*a thorough treatment of a complicated and diverse topic…the most thorough and readable synthesis…I have seen*" (Davis, 2007, *Austral Ecology* 32, 477-8). My book *Large-scale Landscape Experiments: Lessons from Tumut* (Cambridge Uni. Press, 2009) was reviewed as "*…a superb book…it should be read by anyone interested in large scale macro-ecology, not just for the ecological and conservation insights, but to gain a deeper perspective on how do this type of research well*" (Marrs, 2010, *Biological Conservation* 143 1031).

In 2010, I lead-authored the book *Effective Ecological Monitoring* (Earthscan, London) which outlined ways in which biodiversity monitoring and environmental monitoring can be greatly improved to promote improved management outcomes. This book is already widely read and highly regarded. For example, "*…it illuminates the practical as well as the deep intellectual challenges of long-term science"* (Schimel, 2011, *Quarterly Review of Biology* 86, 217-18).

Publications impact – journal summary

Journal	No. papers	Journal	No. papers
Science	17	Forest Ecology and Management	42
Nature	7	Wildlife Research	34
Proc. of the National Academy of Sciences	8	PLOS One	31
Ecological Monographs	6	Journal of Applied Ecology	24
Trends in Ecology and Evolution	21	Landscape Ecology	16
Biological Conservation	78	Oikos	15
Conservation Biology	30	Conservation Letters	17
Nature Climate Change	4	Australian Journal of Zoology	12
Nature Communications	3	Austral Ecology	28
Nature Ecology and Evolution	7	Pacific Conservation Biology	13
Biodiversity and Conservation	18	Molecular Ecology	9
Diversity and Distributions	15	Ecography	10
Oecologia	7	Journal of Biogeography	9
Ecology	3	Ecosystems	4
Ecological Applications	21	Animal Conservation	10
Ecological Management and Restoration	20	Journal of Zoology	3
Frontiers in Ecology and the Environment	14	Landscape and Urban Planning	4
Ecosphere	4	Australian Mammalogy	4
Restoration Ecology	8	Emu	7
Canadian Journal of Forest Research	5	Australian Forestry	9
Ecology Letters	4	Agriculture, Ecosystems & Environment	6
Environmental Management	4	Journal of Environmental Management	7
Biological Reviews	3	Science of the Total Environment	6
Ecological Indicators	6	Others	147

Thesis

Ph.D thesis completed in 1989. *"The ecology and habitat requirements of Leadbeater's Possum".* [Nominated for Crawford Prize]

Books – 45 (31 1st authored or edited)

B45 2018. LINDENMAYER, D.B. Michael, D., Crane, M., Florance, D and Burns, E. (2018). Restoring Farm Woodlands for Wildlife. CSIRO Publishing, Melbourne. 122 pp.

B44 2018. LINDENMAYER, D.B. and Likens, G.E. (2018). Effective Ecological Monitoring. Second Edition. CSIRO Publishing, Melbourne and Earthscan. 224 pp.

B43 2018. Michael, D.R. and LINDENMAYER, D.B (2018). Rocky Outcrops in Australia: Ecology, Conservation and Management. CSIRO Publishing, Melbourne. 184 pp. **Certificate of Commendation in the 2018 Whitley Awards.**

B42 2018. Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). (2018). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. 480 pp. **Certificate of Commendation in the 2018 Whitley Awards.**

B41 2018. Garnett, S., Latch, P. LINDENMAYER, D.B. and Woinarski, J. (Editors). (2018). Recovering Australian Threatened Species: A Book of Hope. CSIRO Publishing, Melbourne. 360 pp. **Certificate of Commendation in the 2018 Whitley Awards.**

B40 2016. LINDENMAYER, D.B., Michael, D., Crane, M., Okada, S., Florance, D., Barton, P. and Ikin, K. (2016). Wildlife Conservation in Farm Landscapes. CSIRO Publishing, Melbourne. 220 pp. **Winner of 2017 Whitley Award for Conservation in Action**.

B39 2016. Hunter, M.L., LINDENMAYER, D.B. and Calhoun, A. (2016). Saving the Earth as a Career: Advice on Becoming a Conservation Professional. Second Edition. Blackwells Publishers, Oxford. 224 pp.

B38 2015. LINDENMAYER, D.B., Blair, D., McBurney, L. and Banks, S. (2015). Mountain Ash: Fire, Logging and the Future of Victoria's Giant Forests. CSIRO Publishing, Melbourne. 173 pp.

B37 2015. LINDENMAYER, D.B., Barton, P. and Pierson, J.C. (Editors) (2015). Indicators and Surrogates of Biodiversity and Environmental Change. CSIRO Publishing, Melbourne. CRC Press, London. 206 pp.

B36 2014. LINDENMAYER, D.B., Dovers, S. and Morton, S. (Editors). (2014). Ten Commitments Revisited: Securing Australia's Future Environment. CSIRO Publishing, Melbourne. 328 pp.

B35 2014. LINDENMAYER, D.B., MacGregor, C.M., Dexter, N. and Fortescue, M. (2014). Booderee National Park: The Jewel of Jervis Bay. CSIRO Publishing, Melbourne. 142 pp.

B34 2014. LINDENMAYER, D.B., Burns, E., Thurgate, N. and Lowe, A. (Editors) (2014). Biodiversity and Environmental Change: Monitoring, Challenges and Direction. CSIRO Publishing, Melbourne. 610 pp.

B33 2013. Viggers, J.I., Weaver, H.J. and LINDENMAYER, D.B. (2013). Melbourne's Water Catchments. Perspectives on a world class water supply. CSIRO Publishing, Melbourne. 131 pp.

B32 2012. LINDENMAYER, D.B., Cunningham, S.A. and Young, A. (Editors) (2012). Land Use Intensification. Effects on Agriculture, Biodiversity and Ecological Processes. CSIRO Publishing, Melbourne and CRC Press, United Kingdom. 158 pp.

B31 2012. LINDENMAYER, D.B. and Gibbons, P. (Editors) (2012). Biodiversity Monitoring in Australia. CSIRO Publishing, Melbourne. 210 pp.

B30 2011. Munro, N. and LINDENMAYER, D.B. (2011). Planting for Wildlife: A Practical Guide to Restoring Native Woodlands. CSIRO Publishing, Melbourne. 84 pp.

B29 2011. LINDENMAYER, D.B., Archer, S., Barton, P., Bond, S., Crane, M., Gibbons, P., Kay, G., MacGregor, C., Manning, A., Michael, D., Montague-Drake, R., Munro, N., Muntz, R., Okada, S. and Stagoll, K. (2011). What Makes a Good Farm for Wildlife? CSIRO Publishing, Melbourne. 160 pp.

B28 2010. LINDENMAYER, D.B., Bennett, A.F. and Hobbs, R.J. (Editors). (2010). Temperate Woodland Conservation and Management. CSIRO Publishing, Melbourne. 400 pp.

B27 2010. LINDENMAYER, D.B., Blair, D., McBurney, L. and Banks, S. (2010). Forest Phoenix. How a Great Forest Recovers After Wildfire. CSIRO Publishing, Melbourne. 128 pp. **Note:** Winner of 2011 Whitley Award for Ecological Zoology.

B26 2010. Michael, D. and LINDENMAYER, D.B. (2010). Reptiles of the NSW Murray Catchment: A Guide to Their Identification, Ecology and Conservation. CSIRO Publishing, Melbourne. 238 pp.

B25 2010. LINDENMAYER, D.B. and Likens, G.E. (2010). Effective Ecological Monitoring. CSIRO Publishing, Melbourne and Earthscan. 170 pp. Reprinted 2014.

B24 2009. Steffen, W., Burbidge, A., Hughes, L., Kitching, R., LINDENMAYER, D.B., Musgrave, W., Stafford-Smith, M. and Werner, P. (2009) Australia's Biodiversity and Climate Change. CSIRO Publishing, Melbourne. 248 pp.

B23 2009. LINDENMAYER, D.B. (2009). Large-Scale Landscape Experiments. Lessons from Tumut. Cambridge University Press, Cambridge. 287 pp

B22 2009. LINDENMAYER, D.B. (2009). Forest Pattern and Ecological Process: A Synthesis of 25 Years of Research. CSIRO Publishing, Melbourne. 302 pp. **Note:** Winner of 2010 Whitley Award for Zoological Text.

B21 2008. LINDENMAYER, D.B., Dovers, S., Hariss Olson, M. and Morton, S. (Editors). (2008). 10 Commitments: Reshaping the Lucky Country's Environment. CSIRO Publishing, Melbourne.

B20 2008. LINDENMAYER, D.B., Burton, P. and Franklin, J.F. (2008). Salvage Logging and Its Ecological Consequences. Island Press and CSIRO Publishing, Melbourne. 227 pp.

B19 2007. LINDENMAYER, D.B. (2007). On Borrowed Time. Australia's Biodiversity Crisis. CSIRO Publishing and Penguin, Melbourne. 138 pp.

B18 2007. LINDENMAYER, D.B. and Hobbs, R.J. (Editors). (2007). Managing and Designing Landscapes for Conservation: Moving from Perspectives to Principles. Blackwell Publishing, Oxford.

B17 2007. Hunter, M.L. and LINDENMAYER, D.B. and Calhoun, A. (2007). Saving the Earth as a Career: Advice on Becoming a Conservation Professional. Blackwells Publishers, Oxford. 201 pp.

B16 2006. LINDENMAYER, D.B. and Fischer, J. (2006). Habitat Fragmentation and Landscape Change. Island Press, Washington, D.C. 329 pp.

B15. 2006. LINDENMAYER, D.B. and Beaton, E. (2006). Life in the Tall Eucalypt Forests. New Holland Publishers, Sydney. Reprinted Edition. 96 pp.

B14 2005. LINDENMAYER, D.B., Beaton, E., Crane, M., Michael, D., MacGregor, C. and Cunningham, R. (2005). Woodlands: A Disappearing Landscape. CSIRO Publishing, Melbourne. Reprinted 2017.

B13 2005. LINDENMAYER, D.B. and Burgman, M.A. (2005). Practical Conservation Biology. CSIRO Publishing, Melbourne. 608 pp. **Note:** Winner of 2006 Whitley Award for Conservation Text.

B12 2004. Salt, D., LINDENMAYER, D.B. and Hobbs, R.J. (2004). Trees and Biodiversity. A Guide for Farm Forestry. Rural Industries Research and Development Corporation, Canberra, Australia. 201 pp.

B11 2003. LINDENMAYER, D.B., Claridge, A.W., Hazell, D., Michael, D.R., Crane, M., MacGregor, C.I. and Cunningham, R.B. (2003). Wildlife on Farms. How to Conserve Native Animals. CSIRO Publishing. Melbourne. 118 pp.

B10 2003. LINDENMAYER, D.B. and Franklin, J.F. (Editors) (2003). Towards Forest Sustainability. Island Press, Washington D.C. (Co-published with CSIRO Publishing). ISBN 0643068235. 244 pp.

B9 2003. Cary, G., LINDENMAYER, D.B. and Dovers, S. (Editors) (2003). Australia Burning: Fire Ecology, Policy and Management Issues. CSIRO Publishing, Melbourne.

B8 2002. Mackey, B.G., LINDENMAYER, D.B., Gill, A. M., McCarthy, M. A. and Lindesay, J. A. (2002). Wildlife, Fire and Future Climate: A Forest Ecosystem Analysis. CSIRO Publishing. Melbourne. 188 pp.

B7 2002. LINDENMAYER, D.B. and Franklin, J.F. (2002). Conserving Forest Biodiversity: A Comprehensive Multiscaled Approach. Island Press, Washington. 351 pp.

B6 2002. LINDENMAYER, D.B. (2002). Gliders of Australia. A Natural History. University of NSW Press, Sydney. 160 pp.

B5 2002. Gibbons, P. and LINDENMAYER, D.B. (2002). Tree Hollows and Wildlife Conservation in Australia. CSIRO Publishing, Melbourne. 211 pp.

B4 2000. LINDENMAYER, D.B. and Beaton, E. (2000). Life in the Tall Eucalypt Forests. New Holland Publishers, Sydney. 96 pp.

B3 1998. Burgman, M.A. and LINDENMAYER, D.B. (1998). Conservation Biology for the Australian Environment. Surrey Beatty and Sons, Chipping Norton, Sydney. 380 pp.
Note: Winner of 1999 Whitley Award for Conservation Biology text (with Associate-Professor Mark Burgman). A second print run of this book commenced in September 1999, 6 months after it was first published.

B2 1996. LINDENMAYER, D.B. (1996). Wildlife and Woodchips: Leadbeater's Possum as a Testcase of Sustainable Forestry. University of New South Wales Press, Sydney. 156 pp.
Note: Winner of 1997 Whitley Award for Conservation Biology Text and Highly Commended for Whitley Medal and nominated for 1996 Eureka Science Prize - finished in last 5 finalists.

B1 1995. LINDENMAYER, D.B. and Possingham, H.P. (1995). The Risk of Extinction: Ranking Management Options for Leadbeater's Possum. Centre for Resource and Environmental Studies, The Australian National University and The Australian Nature Conservation Agency, Canberra. 204 pp.
Note: Book nominated for 1999 Eureka Science Prize - Lindenmayer and Possingham were the joint winners of this prize.

Book chapters – 113 (75 1st authored)

BC113 2019. Fijn, N., LINDENMAYER, D. and Young, M. (2019). Conclusion. Pp. 209-214 in N. Fijn, editor. Learning from experience. Conversations with family farmers from the woodlands of south-eastern Australia. Sustainable Farms, The Australian National University, Canberra.

BC112 2019. Fijn, N., LINDENMAYER, D. and Young, M. (2019). Introduction. Pp. 1-11 in N. Fijn, editor. Learning from experience. Conversations with family farmers from the woodlands of south-eastern Australia. Sustainable Farms, The Australian National University, Canberra.

BC111 2018. Keith, H., Vardon, M. and LINDENMAYER, D. (2018). Ecosystem accounting to inform decisions about forest management in the Central Highlands, Australia. Chapter 5, pp. 105-114 in Ruijs, A. and Vardon, M. (Eds), 2nd Policy Forum on Natural Capital Accounting for Better Decision Making: Applications for Sustainable Development - Part 2: Case Studies. World Bank WAVES, Washington D.C. https://www.wavespartnership.org/en/knowledge-center/2nd-policy-forum-natural-capital-accounting-better-decision-making-applications

BC110 2018. Robinson, N.M, Legge, S., Scheele, B.C., LINDENMAYER, D.B., Southwell, D.M., Wintle, B.A., Bickerton, D., Brooks, L., Carter, O., Dickman, C., Gillespie, G., Kanowski, J., Koleck, J., Lahoz-Monfort, J.J., Lintermans, M., Marsh, H., Paltridge, R., Radford, J., Skroblin, A. and Wayne, A. (2018). Essential principles to guide monitoring of threatened biodiversity. In: Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. pp. 427-438.

BC109 2018. Robinson, N.M, Morgain, R., Legge, S., Scheele, B.C., LINDENMAYER, D.B., Southwell, D.M., Bennison, K., Benshemesch, J., Bickerton, D., Brooks, L., Carter, O., Dickman, C., Ehmke, G., Kanowski, J.,

Koleck, J., Linternamns, M., Marsh, H., Oliver, D., Paltridge, R., Radford, J., Skroblin, A., Wayne, A. and Woinarski, J.C.Z. (2018). Organisational perspectives on threatened species monitoring. In: Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. pp 413-426.

BC108 2018. Scheele, B.C. and LINDENMAYER, D.B. (2018). Summary: Monitoring and adaptive management of threatened biodiversity. In: Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. pp. 407-410.

BC107 2018. LINDENMAYER, D.B. (2018). Difficulties in fitting an adaptive management approach to threatened species monitoring. In: Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. pp. 397-406.

BC106 2018. LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C. and Legge, S. (2018). Summary: The value of monitoring threatened biodiversity. In: Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. pp. 205-208.

BC105 2018. LINDENMAYER, D.B. (2018). The multiple benefits of monitoring threatened species: Leadbeater's possum as a case study. In: Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. pp. 193-204.

BC104 2018. Legge, S., Scheele, B.C., Woinarski, J.C.Z., Garnett, S.T., Keith, D.A., Lintermans, M., Robinson, N.M. and LINDENMAYER, D.B. (2018). Summary: monitoring extent and adequacy for threatened biodiversity. In: Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. pp. 127-133.

BC103 2018. Legge, S., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M., Wintle, B.A., Woinarski, J.C.Z. and Bayraktarov, E. (2018). Introduction: Making it count. in Legge, S.M., LINDENMAYER, D.B., Robinson, N.M., Scheele, B.C., Southwell, D.M. and Wintle, B.A. (Editors). Monitoring Threatened Species and Ecological Communities. CSIRO Publishing, Melbourne. pp 1-10.

BC102 2018. Garnett, S.T., Latch, P., LINDENMAYER, D.B., Pannell, D.J. and Woinarski, J.C.Z. (2018). More than hope alone: factors influencing the successful recovery of threatened species in Australia. In: Garnett, S., Latch, P. LINDENMAYER, D.B. and Woinarski, J. (Editors). (2018). Recovering Australian Threatened Species: A Book of Hope. CSIRO Publishing, Melbourne. pp. 315-323.

BC101 2018. LINDENMAYER, D.B., MacGregor, C. and Dexter, N. (2018). Progress in the conservation of populations of the eastern bristlebird from central coastal New South Wales and Jervis Bay Territory. In: Garnett, S., Latch, P. LINDENMAYER, D.B. and Woinarski, J. (Editors). Recovering Australian Threatened Species: A Book of Hope. CSIRO Publishing, Melbourne. pp. 115-124.

BC100 2018. Garnett, S.T., Latch, P., LINDENMAYER, D.B. and Woinarski, J.C.Z. (2018). Turning threatened species around: celebrating what we have done well. In: Garnett, S., Latch, P. LINDENMAYER, D.B. and Woinarski, J. (Editors). Recovering Australian Threatened Species: A Book of Hope. CSIRO Publishing, Melbourne. pp. 1-4.

BC99 2016. Burns, E.L., Zammit, C., Attwood, S.J. and LINDENMAYER, D.B. (2016). The Environmental Stewardship Program: Lessons on creating long-term agri-environment schemes. In: Ansell, D., Gibson, F. and Salt, D. (Editors). Learning from Agri-environment Schemes in Australia: Investing in Biodiversity and other Ecosystem Services on Farms. ANU E-Press, Canberra. pp. 33-51.

BC98 2015. LINDENMAYER, D.B., Pierson, J., Barton, P., Lane, P., Tulloch, A. and Westgate, M. (2015). A diversity of approaches to ecological surrogates and key knowledge gaps. In: LINDENMAYER, D.B., Barton, P. and Pierson, J. (Editors). Indicators and Surrogates of Biodiversity and Environmental Change. CSIRO Publishing, Melbourne. CRC Press, London. pp. 189-194.

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BC96 2015. LINDENMAYER, D.B., Pierson, J. and Barton, P. (2015). Introduction – disciplinary and multi-disciplinary perspectives on ecological indicators and surrogates. In: LINDENMAYER, D.B., Barton, P. and Pierson, J. (Editors). Indicators and Surrogates of Biodiversity and Environmental Change. CSIRO Publishing, Melbourne. CRC Press, London. pp. 1-4.

BC95 2015. DellaSala, D., Hanson, C., LINDENMAYER, D.B. and Furnish, J. (2015). In the aftermath of mixed- and high-severity fire: logging and related actions degrade mixed and high-severity burn areas In: DellaSala, D. and Hanson, C. (Editors). The Ecological Importance of High-Severity Fires: Nature's Phoenix. Elsevier, Amsterdam. pp. 313-347.

BC94 2015. Pulsford, I., LINDENMAYER, D., Wyborn, C., Lausche, B., Worboys, G. L., Vasilijević, M. and Lefroy, T. (2015). Connectivity conservation management. In: Worboys, G.L., Lockwood, M., Kothari, A., Feary, S. and

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BC93 2015. Woodley, S., MacKinnon, K., McCanny, S., Pither, R., Prior, K., Salafsky, N. and LINDENMAYER, D. (2015). Managing Protected Areas for biological diversity and ecosystem functions. In: Worboys, G.L., Lockwood, M., Kothari, A., Feary, S. and Pulsford, I. (Editors). Protected Area Governance and Management. ANU Press, Canberra. pp. 651-684. This book has been downloaded 72 670 times since it was published.

BC92 2014. Woinarski, J.C.Z., Burbidge, A.H., Comer, S., Harley, D., Legge, S., LINDENMAYER, D.B. and Partridge, T.B. (2014). Fire and biodiversity in Australia. In: Stow, A., Maclean, N. and Holwell, G.I. (Editors). Austral Ark: The State of Wildlife in Australia and New Zealand. Cambridge University Press, Melbourne. pp. 537-559.

BC91 2014. LINDENMAYER, D.B. (2014). The environmental implications of population growth. In: Goldie, J. (Editor). Sustainable Futures: Linking Population, Resources and the Environment. CSIRO Publishing, Melbourne.

BC90 2014. Possingham, H.P. and LINDENMAYER, D.B. (2014). Biodiversity. In: LINDENMAYER, D.B., Dovers, S. and Morton, S. (Editors). Ten Commitments Revisited: Securing Australia's Future Environment. CSIRO Publishing, Melbourne.

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BC88 2014. LINDENMAYER, D., Dovers, S. and Morton, S. (2014). Synthesis and overview. In: LINDENMAYER, D.B., Dovers, S. and Morton, S. (Editors). Ten Commitments Revisited: Securing Australia's Future Environment. CSIRO Publishing, Melbourne.

BC87 2014. LINDENMAYER, D., Dovers, S. and Morton, S. (2014). Introduction. In: LINDENMAYER, D.B., Dovers, S. and Morton, S. (Editors). Ten Commitments Revisited: Securing Australia's Future Environment. CSIRO Publishing, Melbourne.

BC86 2014. Sparrow, B., Dormontt, E., Thurgate, N., Burns, E. LINDENMAYER, D.B. and Lowe, A. (2014). Our capacity to tell an Australian ecological story. In: LINDENMAYER, D.B., Burns, E., Thurgate, N. and Lowe, A. (Editors). Biodiversity and Environmental Change: Monitoring, Challenges and Direction. CSIRO Publishing, Melbourne.

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BC82 2014. Keith, D. LINDENMAYER, D.B., Lowe, A., Russell-Smith, J., Barrett, Enright, N.J., Fox, B.J., Guerin, G., Paton, D.C., Tozer, M.G. and Yates, C.J. (2014). Heathlands. In: LINDENMAYER, D.B., Burns, E., Thurgate, N. and Lowe, A. (Editors). Biodiversity and Environmental Change: Monitoring, Challenges and Direction. CSIRO Publishing, Melbourne.

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BC77 2012. LINDENMAYER, D.B. (2012). Land use intensification in natural forest settings. In: LINDENMAYER, D.B., Cunningham, S.A. and Young, A. (Editors). Land Use Intensification. Effects on Agriculture, Biodiversity and Ecological Processes. CSIRO Publishing, Melbourne and CRC Press, United Kingdom, pp. 113-122.

BC76 2012. LINDENMAYER, D.B., Cunningham, S.A. and Young, A. (2012). Land use intensification - a challenge for humanity. In: LINDENMAYER, D.B., Cunningham, S.A. and Young, A. (Editors). Land Use Intensification. Effects on Agriculture, Biodiversity and Ecological Processes. CSIRO Publishing, Melbourne and CRC Press, United Kingdom, pp. 1-4.

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INR1 Beggs, R., Tulloch, A.I.T., Pierson, J., Blanchard, W., Crane, M. and LINDENMAYER, D.B. Native to Nemesis: a cultural history of the Noisy Miner. (*Australian Zoologist*) (in review).

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Chris Dickman, FAA, FRZS
Professor in Terrestrial Ecology

6 July 2020

Re.: Manyana Coast Pty Ltd, New South Wales Residential Development, Lot 172 DP 755923 and Lot 823 DP 247285, Manyana, NSW; EPBC Act referral 2020/8704

The following comments are made in relation to the above proposal at Manyana, NSW, and the referral documents associated with it.

- 17.2 hectares of vegetation (all unburnt) are proposed to be disturbed / removed in stages from the site. On page 26 of the Ecoplanning Matters of National Environmental Significance assessment (MNES) report it is stated that there are large areas of unburnt vegetation (219 ha) in the locality (i.e. within 5 km of the site). Thus, the development would remove almost 8% of the unburnt vegetation within a 5 km radius. The 219 ha of unburnt vegetation in the locality itself comprises only 5.4% of the mapped vegetation; the rest has been burnt in varying degrees of severity. Thus, *all* unburnt vegetation should be viewed as important habitat.

- Although only one EPBC Act-listed species was found on the site, past or district records of greater gliders, spotted-tailed quolls, southern short-nosed bandicoots, swift parrots and black-faced monarchs could potentially move into the habitat if it were allowed to remain. For all these threatened species, habitat loss is a key reason why their populations have declined to date.

- Although 17.2 ha would be removed, the area affected by the removal process and building / construction disturbance would be much greater. This effect arises from the 'edge effect' phenomenon. Here, the 'hard' edge of the development may lead to greater wind throw along the newly created edges with surrounding forest and woodland. Weeds, invasive species such as foxes and feral cats, and pathogens (e.g. *Phytophthera*) are likely to use the disturbed edges to invade further into the native vegetation. Native species such as noisy miners are likely also to move in to take advantage of the disturbed forest edge habitat, and people's pets (cats and dogs) will certainly exploit the surrounding bushland once the new residences become occupied. All of the EPBC Act-listed species noted above are likely to be partly or highly susceptible to these disturbance effects. Hence, 17.2 ha represents only the readily visible area of disturbance to threatened species; the actual area of disturbance would cover a considerably greater area.

- Several records were made of bandicoots, including 361 photos from remote cameras that putatively showed *Perameles nasuta* (MNES report, page 75). However, photos of this species can be easy to mistake for those of the EPBC Act-Endangered *Isoodon obesulus*. Were photographs of the bandicoots double checked to confirm that all were *P. nasuta*?

- In several instances, a comment is made to the effect that the proposed site does not support an ecologically significant proportion of the population of particular species. In the case of the black-faced monarch, there are breeding records at the development site, and the entire site is considered to be suitable foraging habitat, although no monarchs were detected during the recent surveys owing to their timing

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(the species migrates north during winter). Given that so much of the black-faced monarch's east coast forest habitat burnt during the 2019-2020 fire season, a powerful argument can be made that *all* potentially suitable habitat that didn't burn is important. The same point can be made for the grey-headed flying-fox, which was detected on the site. Whereas a forest block of 20 ha may have been assessed as not ecologically important for this species pre-fire, after the fire *all* potentially suitable unburnt habitat is likely to become more important. Similar arguments can be made for other migratory species such as the rufous fantail, satin flycatcher and, especially, the critically endangered swift parrot. Both the rufous fantail and satin flycatcher migrate north over winter, and thus were not to be expected at the site or broader region during the recent surveys. However, given that over 5 million hectares of potential forest habitat for these species burnt in the 2019-2020 fires in NSW alone, it would be reasonable to expect that any small parcels of unburnt habitat would assume disproportionate importance for these species when they return. Swift parrots do occur in coastal and subcoastal forest habitats in winter; their absence during the recent surveys is not surprising, however, owing to their extreme rarity. The MNES report (page 58) comments that the swift parrot's preferred *Eucalyptus* species were not found or not flowering at the site during their survey, although flowering *Eucalyptus globoidea* was observed. This species may not usually be a preferred food source for swift parrots but, as noted above, when vast areas of habitat, with the food and shelter resources they provide have been burnt, nominally suboptimal habitats may be temporarily essential for persistence.

- I believe that a more precautionary approach should be taken with respect to certain species that are not currently listed on the EPBC Act. The bushfires reduced the populations of many species that were not listed as threatened under the Act, but the Department of Agriculture, Water and Environment has recognised that some of these non-listed species would be in urgent need of management intervention post fire (see: https://www.environment.gov.au/biodiversity/bushfire-recovery/priority-animals), effectively recognising that it takes years before any nominated species make it onto the EPBC Act. Species that could occur, or are known to occur, in the proposal site include the gang-gang cockatoo, south-eastern glossy black cockatoo, mainland dusky antechinus, and southern water skink (Provisional list of animals requiring urgent management intervention, 20 March 2020 - see above webpage). Other species that could be considered at elevated risk following the fires are those that occur at the site that are listed on the NSW BC Act, such as the varied sitella and little lorikeet, and others that may occur but were not detected due to the methods used, such as the eastern pygmy-possum.

For the above reasons, I do not believe that it would be appropriate to approve development of the Manyana site. Habitat that remains unburnt in the wake of intense and broadscale bushfires, such as those over the 2019-2020 fire season, assumes disproportionate importance as a refuge. In short, I believe the Manyana Beach Estate project is likely to have a significant impact on federally listed threatened species as per the EPBC Act specifications. Thus, I urge that these points be taken into consideration and that a decision be taken to conserve Lots 172 DP 755923 and Lot 823 DP 247285. Thank you.

s47F(1)

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July 7, 2020

Review of the referral (2020/8704) and supporting documents submitted to the Federal Department of Agriculture, Water and the Environment for the proposed 182 lot residential sub-division development, known as Manyana Beach Estate, Manyana, NSW

Prepared by Brendan Ryan BSc MSc

REVIEWED DOCUMENTS

1. A list of the documents assessed for this review are provided in the References list, but essentially included the referral form (Ecoplanning 2020b), MNES assessment (Ecolplanning 2020a), A response to DoEE (Ecoplanning 2018a), a subsequent response to DoEE (Ecoplanning 2018b) as well as the Flora and Fauna Management Plans (Ecoplanning 2017, and 2019b) and Flora and Fauna Impact assessment (BES 2006).

2. The review also included a thorough investigation of the NSW BioNet Atlas, an EPBC Act Protected Matters Search as well as interrogation of my own records for the locality.

3. This review also follows an earlier review of the development supporting documents prepared on flora and fauna OMVI (2020).

4. As well as my review of the documents above, my opinion is based on my own knowledge and observations of the ecology of the local area over the last 30 years, during which my family has owned a property located near the subject site.

SUMMARY

5. The subject property is Lot 172 DP 755923 & Lot 823 DP 247285 Berringer Road and Cunjurong Point Road, Manyana, NSW, 2539

6. After reviewing the referral and supporting documents prepared by Ecoplanning Pty Ltd, in my opinion there remain a number of impacts on Matters of National Environmental Significance (MNES) that have not yet been assessed. Not only have the questions I previously raised in a review submitted to the proponent (OMVI 2020) not been answered, but a large number of MNES entities have simply been disregarded or avoided in the referral, which raises a number of serious concerns around the preparation of the referral and other letters to the department under the *Environmental Protection and Biodiversity Conservation Act* (EPBC Act).

7. There are potentially fifty-one (51) conservation dependant species, listed on the EPBC Act known in the locality based on inspection of the NSW BioNet Atlas (Table 1 in Appendix A) and EPBC Act Protected Matters Search tool (Appendix B). Only seven (7) were afforded a cursory assessment of impact in the referral and supporting documents (Ecoplanning 2018a, 2018b, 2020a and 2020b).

8. Furthermore, there has been very little additional survey effort recorded by the proponent's consultant since 2006, to develop their understanding on all MNES, especially vegetation and flora species.

9. Pertinently, when examining the objectives and priorities, and the species recently added to the provisional list of animals requiring urgent management intervention following the 2019/2020 bushfires (20 March 2020) (WTSBREP 2020) and the reference document (Legge et al, 2020), in my opinion the first priority activity to "*protect unburnt areas within or adjacent to recently burnt ground that provides refuges*" is of paramount importance in this case, given that so much (95%) of the locality was heavily impacted and that the area of the development was retained intact with no impact from the fire. Therefore, in my opinion, the subject site should be considered under this priority objective and places this land in the First Priority category.

10. Further, considering this subject land is known refuge for numerous local floral and faunal species as well as recorded four (4) EPBC Act listed threatened species: Rufous Fantail, Black-faced Cuckoo, Greater Glider and Grey-headed Flying-fox as well as additional three (3) priority listed species: Gang-gang Cockatoo, Glossy Black-cockatoo and Mainland Dusky

Antechinus (BES 2006, Ecoplanning 2017, 2018a, 2018b, 2019b, 2020a and 2020b), all EPBC Act listed species should be regarded under this priority action and protected from additional impacts in the wake of the 2019/2020 bushfires.

11. While cursory assessments cover a minimum seven (7) listed species in the referral documents, these assessments did not adequately take into account the severity and impact of the fires around the unburnt refuge and failed to consider the subject site as the last remaining refuge for each species, or consider the loss of this refuge in cumulation with the heavily impacted landscape as required.

12. Having completed my own assessments of significance under the MNES significant impact guidelines for each of the species later described, I am of the opinion that numerous EPBC Act listed species will be significantly impacted by the removal of this refuge habitat.

13. My own assessment of significance utilised all available data, including the referral documents and many of the data sources referenced therein. A detailed assessment for each species was confounded by the absence of any qualitative data on the species' occupation not only within the subject site, but also in areas outside and adjacent to the area. Due to primarily to the lack of surveys conducted by the proponent. Further compounded by the 2019/2020 bushfires which resulted in approximately 95% of the locality being impacted extensively by fire. The project area now represents the ***only*** unburnt and intact habitat for the species considered.

14. Moreover, when considering the priority actions of the amended EPBC Act, the removal of this habitat may not only be significant for these species, but in the absence of any qualitative data for a species outside of the refuge, the removal of current habitat may have landscape scale consequences, such as locally extinction. Species, that are at risk include those that were not surveyed for and not assessed in the referral: include Leafless Tongue Orchid and Stuttering Frog, as well as recently priority listed: ***Pterostylis ventricosa*** Mustard-bellied Snake, Gang-gang Cockatoo, Glossy Black-cockatoo, Superb Lyrebird, Pilotbird, Mainland Dusky Antechinus, Yellow-bellied Glider and Golden-tipped Bat (refer to Table 1 Appendix A for complete list).

15. Table 1, provided in Appendix A, summarises the species known from the locality and highlights how many of these species were surveyed, and/or considered in the referral documents. This table also highlights my own assessment of habitat suitability as well as a determination of likely presence/absence. It also includes the result of my own assessment of

significance in relation to the proposed residential sub-division in the wake of the 2019/2020 bushfires, where priority actions and the lack of scientific certainty has helped derive the outcome.

16. The MNES assessments of significance that I have conducted for species listed under the EPBC Act, on the information available to me, included the following findings[1]:

- Twenty-one (21) species are likely to be significantly impacted by the project. This is given the known presence of those species in the locality, the level of extant impact from the 2019/2020 bushfire, and either the lack of information garnered at the subject site, or the complete absence of any targeted surveys and therefore assumed presence. These species include the critically endangered: Swift Parrot; endangered: Spotted-tail Quoll, Southern Brown Bandicoot, vulnerable: Leafless Tongue Orchid, Stuttering Frog, Greater Glider, Grey-headed Flying-fox, Large-eared Pied Bat; migratory: Rufous Fantail, Satin Flycatcher, Black-faced Monarch, Speckled Monarch; and recent priority listed species; *Pterostylis ventricosa*, Mustard-bellied Snake, Gang-gang Cockatoo, Glossy Black-cockatoo, Superb Lyrebird, Pilotbird, Mainland Dusky Antechinus, Yellow-bellied Glider and Golden Tipped Bay (Table 1).

- Thirty-one (31) species with insufficient data for the subject site or surrounds to be able assess the species against the significant impact guidelines. Under the precautionary principle, these species would also be significantly impacted if assumed present in this absence of qualitative data.

The presence of Littoral Rainforest and Coastal Vine Thickets of Eastern Australia in the north-eastern third to a quarter of the subject site. Again, in the absence of qualitative or quantitative data it must be assumed present, and its removal would constitute a significant impact on the Endangered Ecological Community (EEC). Given the data provided in Google Earth Engine Burnt Area Map (GEEBAM 2020), the extent of the severity of the 2019/2020 bushfires meant that large areas of Littoral Rainforest and Coastal Vine Thickets were impacted locally and remnant stands will be vital for the regeneration of this EEC up and down the coast, thus increasing the importance of this remnant and the severity of impact if removed and cumulation to existing impacts locally

[1] MNES assessments of significance can be provided where required.

FLORA AND VEGETATION COMMUNITIES

17. Of note the MNES assessment reports and letters from 2018 (Ecoplanning 2018a, and 2018b) rely solely on a single extra day of survey "*…undertaken on 14 June 2017 by Thomas Hickman (Ecologist, Ecoplanning) and Kieren Northam (Graduate Ecologist, Ecoplanning*)" and some remote camera surveys in March 2018 *"from 11/3/2018 until 29/3/2018."* This involved 9 cameras in only two short transects (Figure 5, Ecoplanning 2018b).

18. Informed by my 25 plus years as an ecologist, in my experience, it is not possible to concurrently quantify and qualify the vegetation, undertake hollow-bearing tree surveys and also undertake flora and fauna habitat assessment across the 20.2 ha area in a single day of survey (Ecoplanning 2017 and 2019b). Particularly given this is a site had not previously been investigated by the consultant.

19. Despite the consultants being made fully aware through concerns raised by the Federal Department in 2018, they still did not undertake any additional flora surveys. There were no additional plots, no threatened species transects and the consultant has simply relied on data more than 14 years old. This information according to Ecoplanning's own assessment process is "*historical*" (see page 2 of Ecoplanning 2018). After requests from the DAWE (formerly DoEE) specifically about vegetation type, the plant community typing should have been updated with new survey data. The community boundaries should have been updated the across the site. And the qualified plant community types should have been assessed against the scientific descriptions of all known threatened ecological communities in the locality as requested by DAWE in 2018. This seems at odds with the requirement under EPBC Act and requests from the department.

20. The Referral cites the same vegetation types from the BES (2006) assessment with absolutely no change. When reviewing the referral against the species lists provided in the Management plans produced for the site (Ecoplanning 2017, 2009a and 2019b), there have been no changes in the species listed, including no additions to either the native species count or weed species count, no modification of community boundaries and no updating of vegetation typing. Even the projected foliage cover, canopy height and other information about the vegetation communities remains identical to that in BES (2006).

21. Ecoplanning (2020a) has a stated scope to "*…to contemporise previous MNES assessments for certain bushfire affected species identified as potentially occurring on site by Ecoplanning*

(refer Attachment 1) and listed in the 'Provisional list of animals requiring urgent management intervention' released on 20 March 2020 by the Commonwealth Department of Agriculture, Water and Environment (DAWE 2020)." However, the recent report fails to:

1. update the floral species diversity or abundance;
2. undertake any targeted threatened flora species searches;
3. update the plant community typing;
4. update the species likely to occur under on the EPBC Act; and
5. does not include those species that have recently be listed provisionally for urgent management intervention, several of which were recorded in the 2006 surveys and were again recorded by Ecoplanning in the current surveys.

22. In my experience, having conducted numerous repeated surveys for both vegetation composition and integrity as well as for target species, I am aware, as is most of the scientific community, that vegetation composition, abundance or functioning is not static. These attributes change depending on climate and disturbance over time. Considering the referral and other supporting documents rely wholly on information now 14 years old, the distribution and composition is likely to have changed. If no changes have occurred there should have been data collected to support this proposition.

23. Noting in BES (2006) that the vegetation community described as Moist Bangalay Forest was referred to as a variant of Bangalay Forest and the Bangalay – Rainforest of Mills (1998), where "*…with continued protection from fire driving the succession towards the Bangalay – Rainforest. Communities dominated by Bangalay with an understorey dominated by rainforest species Bangalay – Rainforest*…". Therefore, given the size of the patch and similarity to this vegetation type in Mills (1998), and the absence of fire for at least the last 30 years (B. Ryan *pers obs*) there is a very strong possibility this community now conforms to a Rainforest community.

24. Moreover, as stated in BES (2006) and noted in my previous review (OMVI 2020); "*The community would represent a depauperate example of the Coastal Lowland Sub Tropical / Littoral Rainforest of Thomas et al. (2000), …*", this vegetation may now meet the criteria (this

remains untested) for either Littoral rainforest OR Illawarra-Shoalhaven sub-tropical Rainforest and as such should be further examined. Noting the absence of recent flora surveys conducted for the 'updated' reporting for the subject site (Ecoplanning, 2017, 2008a, 2018b, 2019a, 2019b, 2020a and 2020b).

25. The only reference to updating vegetation types or conducting flora surveys in these documents includes a single day in 2017, which is shown in Figure 2.2 (Ecoplanning 2020a) on page 10, and this appears not to have included any effort in the area mapped as Moist Bangalay Forest.

SOILS AND GEOLOGY:

26. I have previously discussed the errors in the description of the soils in my earlier review (OMVI 2020). However, the description for the referral is identical and remains a 'cut and paste' from BES (2006).

27. At a site scale the soils types are very different to the 1:250000 scale mapping cited. After questioning from the Department, it would normally be expected that 'on-site' soil profiling would be conducted by the proponent's consultants to aid in the differentiation of the soils and underlaying geology for engineering purposes. In fact, the geotechnical surveys apparently already undertaken on the site had been used as the "significant start' to the development to keep the 2008 Approval alive. If this information is available it would greatly assist the ecological consultant in updating the vegetation types across the subject site in line with the most relevant and contemporary datasets such as the NSW Plant Community Types Database, thus better informing the department in its previous questioning.

MICROBAT SURVEY EFFORT

28. As raised in my previous review (OMVI 2020), the surveys effort for microbats is minimal. A single ultrasonic call detector was deployed in 2005 for three (3) hours over two (2) nights. Despite the reference to additional call detection surveys being carried out in 2020 (see Table 2.5, page 15, in Ecoplanning 2020a) there is no reference in the methods and no results supplied.

29. Therefore, the entire effort relied upon for the referral (3 hours) is now more the 14 years old did not meet the guidelines in 2005 and certainly does not meet any of the current guidelines

(e.g. OEH 2018) for microbat surveys. Considering the potential presence of EPBC Act listed species in the locality the referral (based on this effort) is not adequate and more survey effort must be undertaken for microbats across the site.

30. With only 3 hours of ultrasonic call recording in the early evening, and no other technique of detection utilised, such has harp trapping, and after a request from DAWE (formerly DoEE), a level of effort commensurate with the potential impact on all threatened species or as prescribed by contemporary guidelines (e.g. OEH 2018) should have been undertaken. Some species cannot be surveyed for using limited call recording and there are numerous threatened species known from the locality, including the Large-eared Pied Bat or and Golden-tipped Bat, which require detailed survey effort, as prescribed in surveys guidelines (e.g. OEH 2018) in order to determine presence or absence. The survey effort undertaken for the proponent does not meet any formalised survey guidelines and given the recent local records of these species, the suitability of habitat recorded within the subject site, there is habitat for these species, and its removal as a result of clearing for the development will significantly impact these two species.

IMPACTS ON SPECIFIC TAXA NOT ASSESSED IN REFERRAL

31. The 2019-20 bushfires in the region have had severe impacts on many animal species. The fires have covered an unusually large area and, in many places, they have burnt with unusually high intensity. Some species were considered threatened before the fires and were already listed on the EPBC Act (Table 1). Following the fires, the considerable loss of habitat has placed these species at increased risk. Many other fire-affected faunal species were considered secure and not threatened before the fires, but have now lost much of their habitat, they may now be imperilled (Table 1).

32. There are potentially fifty-one (51) conservation dependant species, listed on the EPBC Act known in the locality based on inspection of the NSW BioNet Atlas (Table 1 in Appendix A) and EPBC Act Protected Matters Search tool (Appendix B). Only seven (7) were afforded a cursory assessment of impact in the referral and supporting documents (Ecoplanning 2018a, 2018b, 2020a and 2020b).

33. Ecoplanning (2020a) and the referral form, reference several other species now listed on the Priority for conservation intervention under the EPBC Act, but no impacts are assessed under

the Act despite the requirement for addressing all MNES. These species are highlighted in Table 1 (Appendix A), and several are discussed below.

White-throated Needletail (Migratory Species)

34. Regularly seen in the skies above Manyana, the White-throated Needletail have recently been added to the high priority list of threatened and migratory animal species needing urgent management intervention under the EPBC Act following the 2019/2020 bushfire (DAWE 2020).

35. The species is not referenced in the referral and appears not even to have been considered in database searches despite this species being raised in my previous report. More information on the importance of this unburnt remnant for the White-throated Needletail should be sought for the department.

36. The White-throated Needletail was not assessed in the referral.

Dusky Antechinus (Priority listed species)

37. As raised in my previous report, the Dusky Antechinus has been recorded in the subject site and is known from the locality (BioNet Atlas). The Dusky Antechinus has recently been added to the high priority list of threatened and migratory animal species needing urgent management intervention following the 2019/2020 bushfire (DAWE 2020).

38. Table 12.1 Appendix B Species List (Ecoplanning 2020a), aims to update the "vertebrate' species recorded in the MBE area. Concerningly this table references a significant number of un-identified photographs of "*Non-target rodents and dasyurids*" and further states this 'group' being "*The most frequent record on remote cameras in 2020, totalling 9,311 photos across 10 cameras*"

39. In my opinion, these photos should have been analysed for EPBC Act listed species known to occur in the area or that are listed in the Protected Matters Searches conducted for the several reports now submitted to DAWE. The Dusky Antechinus, which is now listed in the provisional species needing urgent conservation action was recorded in 2006 (BES 2006), is known to occur locally (B. Ryan *pers obs*) but was not looked for in the 9311 photos of rodents and dasyurids.

40. In my opinion, a seemingly random grouping of both small eutherians and marsupials, which are generally very easy to distinguish, should have been afforded a concerted analysis before the referral was submitted.

41. There are several threatened species within this grouping including the Smokey Mouse (*Pseudomys fumeus*) or New Holland Mouse (*Pseudomys novaehollandiae*). This is a considerable failing of this referral and requires remediation.

42. The Dusky Antechinus, the Smokey Mouse and the New Holland Mouse were not assessed in the referral,

Glossy Black-cockatoo (Priority listed species)

43. The Glossy Black-cockatoo is known from the Manyana area and is regularly seen in the subject lands.

44. The Glossy Black-cockatoo was recently added to the high priority list of threatened animal species needing urgent management intervention following the 2019/2020 bushfire (DAWE 2020). More information on the importance of this unburnt remnant for the Glossy Black-cockatoo should be provided to the department. The loss of potential foraging and breeding habitat as recorded in the referral documents (BES 2006, Ecoplanning 2017, 2018a, 2018b, 2019b, 2020a and 2020b) and in the wake of the 2019/2020 bushfires which has removed a considerable area of habitat for the species outside of the subject site would be a significant impact on the Glossy Black-cockatoo.

45. The Glossy Black-cockatoo was not assessed in the referral.

Gang-gang Cockatoo (Priority listed species)

46. Gang-gang Cockatoos were recorded in December 2005 (BES 2006) and in recent surveys (Ecoplanning 2020a). In fact, the species was recorded on six separate occasions alone during the Ecoplanning 2020 site surveys. Gang-gangs are recorded regularly in the Manyana area also during the breeding season October and January.

47. The Gang-gang was recently added to the high priority list of threatened animal species needing urgent management intervention following the 2019/2020 bushfire (DAWE 2020). More

information on the importance of this unburnt remnant for the Gang-gang Cockatoo should be provided to the department. The loss of potential foraging and breeding habitat as recorded in the referral documents (BES 2006, Ecoplanning 2017, 2018a, 2018b, 2019b, 2020a and 2020b) and in the wake of the 2019/2020 bushfires which has removed a considerable area of habitat for the species outside of the subject site would be a significant impact on the Gang-gang Cockatoo.

48. The Gang-gang Cockatoo was not assessed in the referral.

Yellow-bellied Glider (Priority listed species)

49. Yellow-bellied gliders have been recorded in lands immediately adjacent to the subject site. The species' presence is referenced in an appendix to BES (2006) and numerous records occur in the surrounding national parks estate (BioNet Atlas). The species was not considered in the referral, despite the known occurrence.

50. The Yellow-bellied Glider was recently added to the high priority list of threatened animal species needing urgent management intervention following the 2019/2020 bushfire (DAWE 2020). More information on the importance of this unburnt remnant for the Yellow-bellied Glider should be provided to the department. The loss of potential foraging and breeding habitat as recorded in the referral documents (BES 2006, Ecoplanning 2017, 2018a, 2018b, 2019b, 2020a and 2020b) and in the wake of the 2019/2020 bushfires which has removed a considerable area of habitat for the species outside of the subject site, would be a significant impact on the Yellow-bellied glider.

51. ***The Yellow-bellied Glider was not assessed in the referral.***

Golden Tipped Bat (Priority listed species)

52. Golden-tipped Bats have been recorded in locality. The species was not surveyed for during any of the site surveys between 2004 and 2020 despite suitable habitat being present. The species was not considered in the referral, despite the potential occurrence.

53. The Golden-tipped Bat was recently added to the high priority list of threatened animal species needing urgent management intervention following the 2019/2020 bushfire (DAWE 2020). More information on the importance of this unburnt remnant for the Golden-tipped Bat should

be provided to the department. The loss of potential foraging and breeding habitat as recorded in the referral documents (BES 2006, Ecoplanning 2017, 2018a, 2018b, 2019b, 2020a and 2020b) and in the wake of the 2019/2020 bushfires which has removed a considerable area of habitat for the species outside of the subject site, would be a significant impact on the Gloden-tipped Bat.

54. ***Golden-tipped Bat was not assessed in the referral.***

Threatened terrestrial orchids - *Thick-lipped Spider Orchid (vulnerable and priority listed); Leafless Tongue Orchid (vulnerable and priority listed); East Lynne Midge Orchid (vulnerable and priority listed); Bauer's Midge Orchid (endangered); Jervis Bay Leek Orchid (endangered and priority listed), Illawarra Greenhood (endangered), Eastern Underground Orchid (vulnerable and priority listed) and Pterostylis ventricosa (priority listed)*

55. Considering that no additional targeted surveys for any flora species has been undertaken since the 2006 assessment, considerably more work is now required to fulfil an assessment under the EPBC Act and relevant survey guidelines (DoE 2014).

56. There are at least seven (7) EPBC Act listed threatened terrestrial orchids (table 1) in the locality as well as one additional priority listed terrestrial orchid, which should have been afforded the minimum survey effort and assessment under the EPBC Act (DoE 2014). While surveys for the Leafless Tongue orchid was conducted in 2005 (BES 2006), the same report suggested conducting follow up surveys of the species during optimal conditions as a recommendation. Without having conducted the appropriate surveys for these species, the assumption of presence is warranted under the precautionary principal.

57. Alternatively, surveys for each species should be conducted, at optimal flowering, using reference sites to garner local flowering, in accordance with surveys guidelines.

58. Moreover, give the intensity of the 2019/2020 bushfires and that known local populations of at least two of the species were impacted (B Ryan *pers obs*), more information on the importance of this unburnt remnant for these threatened orchids should also be provided to the department

59. ***Threatened terrestrial orchids were not assessed in the referral.***

IMPACTS ON SPECIFIC TAXA MUST BE RE-ASSESSED IN REFERRAL

Koala (vulnerable and priority listed)

60. The referral (Ecoplanning 2020a and 2020b) correctly states "*The site is mapped as Pink on the NSW SEPP 2019–Koala Habitat Protection, Koala Development Application Map"* and "*… the presence of a number of Koala Feed trees listed for the South Coast under the SEPP…*", however, it is incorrect in the following: "*there are no Koala records within a 10 km radius of the site within the past 10 years. The most recent record is 44 km away from 2020 and the closest record 11.3 km away from 2004 (DPIE 2020)".* There are in fact several recent sightings recorded in the BioNet Atlas in the locality with two in 2019 from Sussex Inlet Road to the north (13km north of the subject site) and a number of road kills recorded along the Princes Highway north of the Bendalong turn off (5 km north west of the subject site) as well as one sighting by a Manyana local in Conjola National Park from 1999 and another from Washerwoman's Creek in 1980. While not all are within the arbitrary last 10-year period, they are still all valid records which suggests a persistent population of Koalas in adjacent forest, including Conjola National Park.

61. Much like the far South Coast, there has been suggestions that koalas do occur but in low numbers and the statement from the referral that the species doesn't occur due to the veracity of the records, their age or simply not including them is concerning. Detailed surveys including scat sampling should have been used to add any weight to the species presence/absence rather than simply relying on the BioNet atlas.

62. The potential presence of the Koala in the locality is all the more important now after the impact of the 2019/2020 bushfires across the species range and evidence presented to the upper house inquiry looking at koala populations and habitat in NSW. Among the committee's recommendations was that *"…the NSW government urgently prioritise the protection of koala habitat and corridors in the planning and implementation stages of urban growth areas. "* (NSW PLC Committee No. 7 2020). At the very least a more thorough survey is required for the koala and a more detailed assessment of the impact of potential habitat loss in light of the impact of more than 95% of the forest in the locality (Ecoplanning 2020a). This needs to be completed and the information on the importance of this unburnt remnant for the Koala provided to the department.

Large-eared Pied Bat (vulnerable and priority listed)

63. In reference to the Large-eared Pied Bat Ecoplanning (2020a) state: "*An impact assessment was not undertaken for Large-eared Pied Bat due to the low likelihood of occurrence. The species is associated with areas of extensive cliffs and caves (OEH 2018a) and areas of low to mid-elevation dry open forest nearby these features. There are no records of this species in the locality with the closest records in the ranges that contain these key habitat features south and west of the study area."* Yet no detailed surveys were conducted in or near by the subject site.

64. Moreover, despite the assertion from Ecoplanning above, there are numerous suitable cliff lines and rock scree slopes that could harbour roost sites for the species in the locality, including on Bendalong Mountain, incised creeks throughout Conjola NP and along the coast. There is also a long history of mining in the Manyana Bendalong areas and numerous mines and/or adits available for roosting of this species. Investigation of local topographic maps would have alerted the assessor to this fact. Therefore, given the presence of numerous potential roost sites for the species within the daily nightly foraging, along with the presence of local database records, the presence cannot be discounted.

65. Given this, the Large-eared Pied Bat should be afforded more than this cursory assessment and given the impact of the 2019/2020 bushfires the species should be assessed on a cumulative basis, where the removal of up to 95% of foraging within the locality (Ecoplanning 2020a), the increased loss of intact forest within the subject site is assessed accordingly. This information should then be provided to the department for their consideration.

Southern Brown Bandicoot

66. The Southern Brown Bandicoot, listed as endangered on both the NSW BC Act and Commonwealth EPBC Act has now also been added to the high priority list of threatened and migratory animal species needing urgent management intervention under the EPBC Act following the 2019/2020 bushfire (DAWE 2020).

67. From the Ecoplanning 2018b "*The precautionary principle was applied, and an Assessment of Significance was undertaken for Southern Brown Bandicoot, assuming the habitat in the study area is suitable for foraging and breeding. The habitat surveys identified potential foraging and breeding habitat for this species and so both habitat types were assessed*." However, following the bushfires and with the same habitat remaining the species was assumed absent in

the referral (Ecoplanning 2020a and 2020b). Moreover, the use of the Precautionary Principle was not pursued despite an observation of the species within the subject site from 2017.

68. Instead the consultant described in detail how they questioned the record, approached the then NSW Office Of Environment and Heritage to question the veracity of the record, which subsequently was downgraded from an "observation" to a "possible ID" despite the observer being quoted as saying "*…he is confident it was a Southern Brown Bandicoot*." , and that he and others had recorded the species in nearby areas. The observer also "*…subsequently discussed additional sightings of Southern Brown Bandicoot by local wildlife carers at Cunjurong Point and by himself at Monument Beach in previous years.*" Despite this seemingly confident record not only with the subject site but also in the surrounding areas, the species was determined not to be present. The questioning of a submitted record is no reason to not undertake the appropriate surveys, in fact it is even more reason to assess it without equivocation.

69. This survey work would include trapping, camera traps (some undertaken in small portions of the site), dedicated spotlighting surveys where the experience of the surveyor would be suitable to differentiate the Long-nosed Bandicoot from the Southern Brown. Noting the species are quite different, having a different colour shape and gait. The differences were also highlighted in Ecoplanning's (2018b) own report: "*The identification was confirmed due to the large upright ears, pale tops to feet, elongated nose and the illusion of barring in the flanks which are distinctive features of the Long-nosed Bandicoot (Andrew Claridge, pers. comm. 16 April 2018).*"

70. While some camera trapping was conducted for the species, in portions of the subject site, no additional trapping was conducted and following the extent and intensity of the 2019/2020 and the impact to 95% of the forest within the locality (Ecoplanning 2020a) there is now very little other dense stands of vegetation preferred by this species in the area and therefore the clearing of this remaining habitat would likely result in the cumulative significant impact on this species, which may negatively impact on the species continued occupation in the locality.

71. This should have been considered in a cumulative impact assessment under the EPBC Act within the referral rather than a simple absence determination.

Greater Glider (vulnerable and priority listed)

72. It remains concerning that the referral maintains a reliance on veracity of database records in the absence of targeted surveys or actual habitat assessment : *"The only reliable post-2010 record of this species in the Manyana-Bendalong area, or within approximately 5 km of the site, is from west of Pine Street, Bendalong in 2013. Since 2013, there is only one record of the species within 5 km of the site, in 2017, which is located on the edge of the site. The veracity of this record is unclear, as this record was entered with a similar source and timing to two other unusual records, including a Southern Brown Bandicoot record later downgraded from "sighting" to "possible ID" (Ecoplanning 2020)."*

73. This despite in 2018 (Ecoplanning 2018b) the assessment of significance states "*The study area contains a number of hollows suitable for Greater Glider. Additionally, the Greater Glider has a small home range (1 ha – 4 ha) and hence the study area could provide foraging and breeding habitat for multiple breeding individuals."* The absence of individuals sighted during targeted surveys has resulted in the author(s) declaring the species does not exist, even locally. This result has been derived despite the species being recorded in the locality by NPWS researchers and that the subject site being described by the author(s) and independent experts as good quality habitat for the species, with numerous known foraging eucalypts, and more than 15 suitable hollows.

74. Given the devastation of the 2019/2020 bushfires and the extreme loss of habitat for the Greater Glider locally (95%), any further loss of suitable habitat should be assessed in cumulation and in consideration of the local losses, any further loss should be considered significant.

Migratory birds - Black-faced Monarch (migratory and priority listed); Rufous Fantail (migratory) and Satin Flycatcher (migratory)

75. These species were assessed in pre-fire habitat conditions and relate to the site's purported 'insignificance' based on the habitat available outside in adjoining lands. This is no longer the case and once it is time for the annual migration of the species, the MBE area may represent the only suitable breeding habitat available in the locality. There is no information and considering 95% of the locality has been heavily impacted by recent bushfires (Ecoplanning 2020a, page 26), the assessment on these species must be re-done on a cumulative basis.

Swift Parrot (critically endangered and priority listed)

76. Again, for the Swift Parrot the referral seeks to degrade recent records from the BioNet Atlas which appears to be the primary source of information for the assessment, seemingly to derive an outcome already determined by the author(s) in the absence of targeted surveys: *"… Only one Swift Parrot record exists in the locality (5 km radius). This record includes a note that the Swift Parrot was recorded in a mixed flock with Rainbow Lorikeets, despite Saunders & Heinsohn (2008) listing Rainbow Lorikeets as a competitor species which have a negative effect on the likelihood of Swift Parrot occurrence."*.

77. There have been very few targeted surveys for the species in the Manyana Area and less in the surrounding national parks estate. Records close to towns and villages are likely to be more common simply because there will be more interaction between observers and the parrot. The absence of records can't be used to downgrade the habitat suitability of the land for the species. Even now more important after the fires.

78. There are numerous species that flower during the migration of the Swift Parrot recorded in the reports for the development. All but one is disregarded by Ecoplanning (2020a and 220b), being the Swamp Mahogany where it was stated "*Of the tree species known to be important for foraging, only Eucalyptus robusta may occur on site in low numbers (though none could be found in BES (2006) or Ecoplanning (2020) surveys)."* and that the remnant intact vegetation was described: "*The site could potentially be used for foraging activities during winter non-breeding dispersal across mainland SE Australia, however the foraging resources available are low*.", twice.

79. This statement is simply incorrect, and despite its replication, the statement doesn't account for the diversity and abundance of other over-winter flowering species known from the site and surrounds including: Swamp Mahogany (previously recorded on site and is known from adjacent land); Lemon-scented Gum (planted individuals in adjacent lands); Grey Ironbark (numerous trees recorded across the subject site, and is currently flowering); Small-leaved Stringybark (also recorded across the subject site in large numbers and is currently flowering); Blue-gum x Bangalay hybrid (one of the most common species recorded in the Manyana area which differs in its annual flowering and is very numerous on the subject site); Forest Red Gum (known from immediately adjacent land and kore broadly across the Manyana area).

80. There is therefore a very high percentage of canopy species, not to mention the mesic species that are also flowering or fruiting at present in the subject land as the dominant canopy and mid-stratum species. This therefore provides suitable foraging habitat for the Swift Parrot and given the current known population size (less than 2000 birds) this critically endangered species will need all the foraging habitat it can find during the migration following the catastrophic 2019/2020 bushfires.

81. Other statements are completely unverified such as:

- "*… does not indicate that the site or surrounding locality may constitute an area of important foraging habitat for Swift Parrots during their irregular movements into the South Coast of NSW (Ecoplanning 2020*).";
- *"Should the Swift Parrot use the site for foraging, winter foraging activities in the region are not likely to be significantly affected by the loss of poor-quality foraging habitat on site, and Swift Parrots are likely to persist in the area as significant foraging resources will remain on site and areas of unburnt canopy vegetation in the locality."*
- *"Existing records indicate that the site and surrounding locality are unlikely to be used by large proportions of the populations. Large movements of Swift Parrots have been recorded in the South Coast region only south of Ulladulla and only in association with large flowering events of Spotted Gum. Only single birds have been observed in the Manyana locality."*
- *"The site is not likely to contain large numbers of flowering eucalypts at a time coincident with Swift Parrot movements into the area and the site has not supported significant Swift Parrot feeding behaviour as documented in any of the reviewed database or regional sources (Ecoplanning 2020)."*

No surveys were conducted in areas of unburnt forest for the assessment and recent records, including those from Ulladulla in 2020 and in Yatte Yattah "*Further afield, the nearest record of a larger flock, 26 birds in Yatte Yattah, is approximately 8km from site…*" clearly highlights the importance of the area for the migration of the species, which migrates up the coastal plain of southern NSW. There *are* recent records, and an abundance of winter-flowering eucalypts within the subject site.

82. Further, the flock of Swift Parrots from Yatte Yattah are: *"…seen foraging in a paddock in Eucalyptus tereticornis, … which does not occur on site."* This remains untested, given the presence of Forest Red Gum (*E. tereticornis*), a recorded foraging species for the Swift parrot is known on immediately adjacent lands (B Ryan pers obs). immediately east of the subject site. Not only is there Forest Red Gum but also Woollybutt (*E. longifolia*), Bimble Box (*E. populnea*) and tracts for Illawarra and south coast lowland forest and woodland (ISCLFW) (a Critically Endangered Ecological Community) in and around the Manyana area. A literature review or site inspection would have discovered this. ISCLFW is known to be important for the Swift Parrot regionally, and where this vegetation community occurs, so too does records of the Swift Parrot (e.g. the 26 birds recorded at Yatte Yattah. ISCLFW would have been wide spread in the region prior to European settlement and much of the lowland area, including Yatte Yattah and the Red Head area. Therefore, would have represented important foraging habitat for the Swift Parrot historically. A literature review of examination of recent reginal vegetation mapping datasets along with the associated reports (Tozer et al 2010) would have assisted in this assessment.

83. The recent observation in 2017 qualifies this. I also note in the reference list, Ecoplanning states that the BioNet Atlas is reliable and a good source of information with "Nil" uncertainties. Yet the company has denigrated or questioned recent records of federally listed species on or near the subject site. Similarly, in their report to the department in 2018 (Ecoplanning 2018b) in reference to the Swift Parrot it states: "… *it is likely that this species moves through the locality through the autumn and winter, without being detected or added to the Atlas."* Which is a reasonable statement given the number of experienced bird watchers that permanently live in the area and that outside of the small townships the locality is National Park and infrequently surveyed for such transient species.

84. Moreover, the same report (Ecoplaning 2018) states: "… *the study area has already been considered potential foraging habitat…* ". Why did this assumption of presence not continue to the current referral, especially following the habitat lost as a result of the 2019/2020 bushfire?

85. On a cumulative assessment basis this 20 hectares is now of considerably greater importance for the migrating species. With a great deal of their foraging habitat burnt from the Victorian Boarder through to the Illawarra, remnants such as the subject site with known winter-flowering species are critical for the successful migration.

86. With more than 95% of the locality impacted by the 2019/2020 bushfires (Ecoplanning 2020a), any and all remnants are critical for the migration of this critically endangered species during the migration this year. This should have been considered in a cumulative impact assessment under the EPBC Act within the referral rather than a simple absence determination.

Grey-headed Flying-fox (Vulnerable and priority listed)

87. The Grey-headed Flying-fox is regularly seen in the Manyana area and there are numerous records on the NSW BioNet Alas. There are several nearby temporary summer camps, such as in Conjola National Park (DECCW 2010) and Yatte Yattah (the only camp referred to in Ecoplanning 2020). The extent to which these camp sites were impacted by the 2019/2020 bushfires is not known and the importance of this unburnt remnant for the Grey-headed Flying-fox is as yet un-substantiated.

88. The species was also recorded in the surveys conducted for the referral and supporting documents: "*Small numbers (one individual heard on each of two night's survey, out of a total of 10 survey-nights and 114 person-hours of nocturnal survey on the site) of Grey-headed Flying-foxes were recorded foraging on the site during nocturnal surveys. One dead Grey-headed Flying-fox was found opportunistically on site."* Following the 2019/2020 bushfires the substantial loss of foraging and likely roosting habitat has greatly impacted the resources for the Grey-headed Flying-fox. Generally, a migrant to the south coast temporary camps in summer, the remaining foraging habitat and un-burnt forest on or near creeks will be critical for the species later this year when the migration commences. The planned removal even in stages as part of the proposed development will therefore impact the Grey-headed Flying-fox, to what extent has not been substantially assessed in the Ecoplanning referral.

89. Similarly, statements such as "*The proposed action will remove approximately 17.18 ha of vegetation. This broad ranging species is not likely to decline due to the removal of this small area of intermittently used foraging habitat*" are made, is despite 80% of the Shoalhaven having been burnt in the 2019/2020 bush fires and more than 95% of the locality according to Ecoplanning's own calculations (Ecoplanning 2020a). This statement also comes without having determined the impact on the local temporary camps or assessed the loss of a vast amount of their foraging habitat on the migration or the cumulative loss with the planned intact vegetation removal.

90. A new assessment of significance for the Grey-headed Flying-fox is therefore warranted given the absence of any of this data.

Google Earth Engine Burnt Area Map and the local bushfire impact assessment

91. Examining the GEEBAM field verification by the proponent also raises more questions. How does this all relate to the site and the immediate vicinity? The closest photo appears to be photo 28, which is a photo of the recently cleared residential land of another development known as the Coast development which states that it was verified with "*intact understorey*", when there is no data in GEEBAM. The photo clearly shows an absence of most native vegetation. This photo is of recently cleared land in the 'Coast' residential estate. The site has been levelled and mulched and there is little understorey at all let alone can it be called intact.

92. The Ecoplanning analysis clearly highlights the vast impact of the 2019/2020 Bushfires: "*Analysis of the GEEBAM found that within 5 km of the site (the 'locality') out of a total of 4,049 ha, 3,064 ha of vegetation has been burnt in either 'Very High' or 'High' Burnt Area Class (75.7 %). Burnt Area Classes 'Medium' and 'Low' total approximately 593 ha (14.6 %) in the locality, much of which is found in Conjola National Park. There are also large areas of unburnt vegetation in the locality, totalling approximately 219 ha (5.4 %).*" This relates to approximately 95% of the area within 5km being impacted by fire. Given the estimates of 80% of the Shoalhaven being similarly impacted and the vast number of wildlife decimated, any removal of intact forest in these areas must be seen as an impact that, on a cumulative basis, is significant.

93. However, the clear bias in the author's interpretation of these results is evident when commenting that the 5% remaining equates to "*large areas of unburnt vegetation*". Moreover, stating that these remaining areas will support all the species that escaped the devastation is unsupported.

94. Further sweeping untested statements such as: "*The GEEBAM was ground-truthed … and found that Burnt Area Classes 'Low' and 'Medium' still contained habitat for the threatened species assessed, including unburnt and intact canopy and mid-storey, unburnt or regenerating groundcover, and hollow-bearing trees without significant fire damage or evidence of high-intensity fire (e.g. blackened trunks and/or epicormic growth).*" cannot be substantiated when no surveys were conducted to determine whether the 'threatened species' resided in these areas or supported any of the biodiversity that is known from the subject site.

95. These cumulative impacts, where individual direct impacts can be described as minor, when assessed together as multiple and successive impacts, will result in significant and long-lasting biodiversity loss, potentially resulting in local extinctions or worse. With all EPBC Act listed species already at risk of extinction, the importance of considering all current and proposed threats in culmination is critical to determine actual threat of extinction. It is not correct to isolate these impacts, in fact it is a requirement of an assessor to address all of them in totality. In this case, the extent and intensity of the fires really have changed the way the we must assess further loss and this is must be the way this development should be assessed.

96. The assessor has also used guidelines for applying the NSW Biodiversity Assessment Method at severely burnt sites to estimate the period over which habitat will recover after bushfire (DPIE 2020) rather than published literature highlighting the impact of clearing unburnt forest in a burnt firegrounds, or literature that highlights the time in which a species (including the subject species) responds to intense bushfires or what recorded recovery periods are for these species.

97. In this case where guidelines highlight that assessors should hold off assessing sites for two-years post fire in order to gain a more approximate census of biodiversity pre-fire, should not be used as evidence for substantial recovery of habitat for specific species, when untested and unverified. This should be obtained from pre-reviewed literature for that specific taxa. There is a plethora of scientific research on the impact of fires or habitat destruction on the forest flora and fauna and efforts should have been taken to discover the relevant data to aid in the MNES assessment (Ecoplanning 2020a).

98. An untested, unsubstantiated assumption that intensely burnt forest will support suitable habitat for arboreal mammals, or large forest owls after two years is simply false. Suitable hollows lost in these fires will not develop in two years, The soil chemistry and other abiotic factors that derive the suitability of foliage for herbivores, like the greater glider will take considerably more time than 2 years, as it will take many more year for the soil biota to recover, the leaf litter to develop. The intensity and scale of the 2019/2020 fires have decimated the faunal vectors across un-precented tracts of the south coast. It will take many more years for these vectors to recover to support the recovery: to help disperse the pollen; the spores and seed.

99. The assumption of recovery within two years or within the timeframe of the staged development proposed does simply not based on rigorous assessment of the surrounding fire grounds, nor detailed site surveys for all MNES. Moreover, the same intensely burnt firegrounds are the

reporting repository for fauna to be displaced from the development site. This is the same land the nest boxes for the development's 'Offset" have been installed post fires. Assuming the 2-year recovery, those animals relocated in the first two stages of the development proposal would be placed into area unfit to support them. This raises not only issues of conservation but also ethics, where starvation or death from exposure are possible.

100. Again, in my opinion, misrepresentations to the department such as this fall a long way outside the requirement for a robust scientific assessment of all matters of national environmental significance and a great deal of additional information must be provided to the department in order to be able to properly quantify the actual impact of this development, especially post fire, and more importantly in the absence of qualified scientific data.

CONCLUSION – Matters of National Environmental Significance

101. In my opinion, it is of considerable concern that, in the wake of the scale and devastation of the 2019/2020 bushfires, the assessment of *all* MNES were summarised in the referral and supporting documents as such:

- *"The proposal is unlikely to be a controlled action nor have significant impacts on any MNES given it is unlikely to substantially modify an area of important habitat for any threatened or migratory species or place any important populations at risk of extinction "*
- *"…. and the area of habitat removed cannot support an ecologically significant proportion of the population of these species at a national or international level."*

102. Yet the referral has not addressed *all* the MNES known to occur in the locality (Table 1) (also see Appendix C in Ecoplanning 2018b) but cursorily addresses potential impacts on seven (7) species of fauna. The referral has ignored the other threatened species known from the locality, the species recently added under the provisional lists post bushfire and the numerous other migratory species known from the locality.

103. Further, there has been no adequate recent survey to update the site biodiversity as a whole. The limited surveys for the 'target' species fail to even consider the potential presence of other MNES entities. The referral does not assess those listed species that were recorded or the were

provided by the Department in 2017/18 or by the recent reports provided by Manyana Matter Environmental Association, including my previous report (OMVI 2020) which contained a near complete list of those species, and was referenced in Ecoplanning (2020a).

104. The referral simply does not provide enough certainty, in the form of scientifically rigorous data to determine a non-significant result (as it does).

105. There has been no assessment of indirect impacts of MNES, including: a near doubling of traffic entering and leaving the Manyana area as a direct result of the development; nor the increased pressures on beaches, estuaries and coastal lakes, which are the known breeding grounds for several Nationally and Internationally Threatened shore birds.

106. Similarly concerning, is that the denigration of local BioNet records is neither tested or validated through survey. This misrepresents known threatened species records on and near the site.

107. Scientific certainty is essential, not only to prevent potential local extinctions, but most critically to assess the impacts on ALL MNES entities, especially after 95% (based on the referrals own data) of the lands within 5km radius of the site was heavily impacted by the devastating 2019/2020 bushfires and more than 80% of the Local Government Area was similarly devastated.

108. Given this absence of certainty, and in consideration of the precautionary principle, the removal of un-burnt forest with habitat for a large range (Table 1) of threatened species (and potentially EECs) must be considered significant. Moreover, following the unprecedented impact of the 2019/2020 bushfires and the subsequent priority listing of 7 endangered ecological communities, 471 plants and 119 fauna species; the removal of this forest is of greater significance. Given the potential presence of at least 1 EEC, 21 likely significantly impacted threatened and priority listed species as well as more than 31 species with insufficient data, the proposal should be called in as a controlled action to accurately determine the true extent of this impact.

109. I am happy to discuss this report and its findings further, or to provide the department with a more detailed understanding of the biodiversity values from a person who has lived in the area for more than 30 years, please do not hesitate to contact me.

Sincerely,

s47F(1)

Brendan Ryan BSc. MSc.
Director
OMVI Ecological

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APPENDIX A

Table 1: EPBC listed conservation dependent species known from the Manyana Area. Includes species known from the project area, whether targeted surveys have ever been conducted and whether the species was assessed in the referral or supporting documents.

Count	Species	Common Name	BC Act Status	EPBC Act Status	HPS post bushfires (Y/N)	Local record	No of local records	Surveys undertaken in EIS	Present absent in EIS or FFMP	Suitable habitat in MBE	Additional assessment required	Species included in referral to Commonwealth	Result of OMVI assessment of significance.
Plants													
1	*Baloskion longipes*	Dense Cord-rush	V	V	Y	-	0	general flora	NO	YES	YES	NO	no data
2	*Correa baeuerlenii*	Chef's Cap Correa	V	V	Y	-	0	general flora	NO	YES	YES	NO	no data
3	*Caladenia tessellata*	Thick-lipped Spider-orchid	E	V	Y	EPBC PM search	0	NO – surveys not conducted during flowering. No targeted surveys	NO	YES	YES	NO	no data
4	*Cryptostylis hunteriana*	Leafless Tongue-orchid	V	V	Y	BioNet. + B Ryan pers obs + EPBC PM search.	+14	Partly - conducted over 2/3 of MBE area during only one season	NO	YES	YES	NO	Significant impact
5	*Cynanchum elegans*	White-flowered Wax Plant	E	E	Y	EPBC PM search	0	general flora	NO	YES	YES	NO	no data
6	*Genoplesium vernale*	East Lynne Midge Orchid	V	V	Y	EPBC PM search	0	NO – surveys not conducted during flowering. No targeted surveys conducted for this species.	NO	YES	YES	NO	no data

Count	Species	Common Name	BC Act Status	EPBC Act Status	HPS post bushfires (Y/N)	Local record	No of local records	Surveys undertaken in EIS	Present absent in EIS or FFMP	Suitable habitat in MBE	Additional assessment required	Species included in referral to Commonwealth	Result of OMVI assessment of significance.
7	*Genoplesium baueri*	Bauer's Midge Orchid	E	E	-	EPBC PM search	0	NO – surveys not conducted during flowering. No targeted surveys conducted for this species.	NO	YES	YES	n/a	no data
8	*Melaleuca biconvexa*	Biconvex Paperbark	V	V	Y	EPBC PM search	0	general flora	NO	YES	YES	NO	no data
9	*Melaleuca deanei*	Deane's Melaleuca	V	V	Y	-	0	general flora	NO	YES	YES	NO	no data
10	*Prasophyllum affine*	Jervis Bay Leek Orchid	E	E	Y	-	0	NO – surveys not conducted during flowering. No targeted surveys conducted for this species.	NO	YES	YES	NO	no data
11	*Pterostylis gibbosa*	Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood	E	E	-	EPBC PM search	0	NO – surveys not conducted during flowering. No targeted surveys conducted for this species.	NO	YES	YES	NO	no data
12	*Pterostylis ventricosa*		CE	-	Y	B Ryan pers obs	+10	NO – surveys not conducted during flowering. No	NO	YES	YES	NO	Significant impact

Count	Species	Common Name	BC Act Status	EPBC Act Status	HPS post bushfires (Y/N)	Local record	No of local records	Surveys undertaken in EIS	Present absent in EIS or FFMP	Suitable habitat in MBE	Additional assessment required	Species included in referral to Commonwealth	Result of OMVI assessment of significance.
								targeted surveys conducted for this species.					
13	*Rhizanthella slateri*	Eastern Underground Orchid	V	V	Y	-	0	NO – surveys not conducted during flowering. No targeted surveys conducted for this species.	NO	YES	YES	NO	no data
14	*Syzygium paniculatum*	Magenta Lilly Pilly	E	V		-	0	general flora	NO	YES	YES	NO	no data
15	*Thesium australe*	Austral Toadflax, Toadflax	V	V	Y	BioNet + EPBC PM search	1	NO	NO	Potential	YES	NO	no data
16	*Wilsonia backhousei*	Narrow-leafed Wilsonia	V	V	-	BioNet	1	general flora	NO	limited	YES	NO	no data
Invertebrates													
1	*Euastacus guwinus*	Tianjara Crayfish	-	-	Y	-	0	NO – no aquatic surveys conducted	NO	Potential	YES	NO	no data
Amphibians													
1	*Litoria littlejohni*	Littlejohn's Tree Frog	V	V	Y	EPBC PM search	0	general fauna	NO	potential	YES	NO	no data
2	*Mixophyes balbus*	Stuttering Frog	E	V	Y	PM search	0	general fauna	NO	potential	YES	NO	Significant impact

Count	Species	Common Name	BC Act Status	EPBC Act Status	HPS post bushfires (Y/N)	Local record	No of local records	Surveys undertaken in EIS	Present absent in EIS or FFMP	Suitable habitat in MBE	Additional assessment required	Species included in referral to Commonwealth	Result of OMVI assessment of significance.
3	*Heleioporus australiacus*	Giant Burrowing Frog	V	V	Y	PM search	0	general fauna	NO	potential	YES	NO	no data
4	*Litoria aurea*	Green and Golden Bell Frog	E	V	Y	BioNet	9	general fauna	NO	potential	YES	NO	no data
Reptiles													
1	*Eulamprus tympanum*	Southern Water-skink	-	-	Y	PM search		general fauna	NO	potential	YES	NO	no data
2	*Drysdalia rhodogaster*	Mustard-bellied Snake	-	-	Y	BioNet + B Ryan pers obs	+3	general fauna	NO	YES	YES	NO	Significant impact
Birds													
1	*Hirundapus caudacutus*	White-throated Needletail	-	M	Y	BioNet records + B Ryan pers obs	+ 16	general birds	NO	YES	YES	NO	no data
2	*Apus pacificus*	Fork Tailed Swift	-	M	-	BioNet + B Ryan pers obs	6	general birds	NO	YES	YES	NO	no data
3	*Merops ornatus*	Rainbow Bee-eater	-	M	-	B Ryan pers obs	+ 1	general birds	NO	YES	YES	NO	no data
4	*Haliaeetus leucogaster*	White-bellied Sea-eagle	V	M	-	BioNet + B Ryan pers obs	+ 53	general birds	NO	YES	YES	NO	no data

Count	Species	Common Name	BC Act Status	EPBC Act Status	HPS post bushfires (Y/N)	Local record	No of local records	Surveys undertaken in EIS	Present absent in EIS or FFMP	Suitable habitat in MBE	Additional assessment required	Species included in referral to Commonwealth	Result of OMVI assessment of significance.
5	*Numenius madagascariensis*	Eastern Curlew	V	M	-	BioNet + B Ryan pers obs	2	general fauna	NO	NO	NO	NO	no data
6	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	-	Y	in EIS and BioNet, and photos on site this year	39	general birds	YES	YES	YES	NO	Significant impact
7	*Calyptorhynchus lathami*	Glossy Black-cockatoo	V	-	Y	BioNet records and resident in Manyana.	56	general birds	YES	YES	YES	NO	Significant impact
8	*Pezoporus wallicus wallicus*	Eastern Ground Parrot	V	-	Y	BioNet	1	general fauna	NO	limited	YES	NO	no data
9	*Lathamus discolor*	Swift Parrot	E	CE	Y	BioNet records + B Ryan pers obs	2	general birds	NO	YES	YES	YES	Significant impact
10	*Menura novaehollandiae*	Superb Lyrebird	-	-	Y	Recorded last week by Birdlife Shoalhaven	100+	general birds	NO	YES	YES	NO	Significant impact
11	*Pycnoptilus floccosus*	Pilot Bird	-	-	Y	BioNet records + B	+ 2	general birds	NO	YES	YES	NO	Significant impact

Count	Species	Common Name	BC Act Status	EPBC Act Status	HPS post bushfires (Y/N)	Local record	No of local records	Surveys undertaken in EIS	Present absent in EIS or FFMP	Suitable habitat in MBE	Additional assessment required	Species included in referral to Commonwealth	Result of OMVI assessment of significance.
						Ryan pers obs							
12	*Dasyornis brachypterus*	Eastern Bristlebird	E	E	Y	BioNet	1	general fauna	NO	potential	YES	NO	no data
13	*Anthochaera phrygia*	Regent Honeyeater	CE	CE	Y	BioNet	5	general birds	NO	YES	YES	NO	no data
14	*Rhipidura rufifrons*	Rufous Fantail	-	M	-	EIS + BioNet + B Ryan pers obs	+ 50	general fauna	YES	YES	YES	NO	Significant impact
15	*Myiagra cyanoleuca*	Satin Flycatcher	-	M	-	BioNet + B Ryan pers obs	+ 6	general birds	NO	YES	YES	YES	Significant impact
16	*Monarcha melanopsis*	Black-faced Monarch	-	M	Y	BioNet records + B Ryan pers obs.+ EIS	+30	general birds	YES	YES	YES	YES	Significant impact
17	*Symposiachrus trivirgatus*	Spectacled Monarch	-	M	-	B. Ryan pers obs	2	general birds	NO	YES	YES	NO	Significant impact
Mammals													
1	*Antechinus mimetes (swainsonii)*	Mainland Dusky Antechinus	-	-	Y	BioNet records + B Ryan pers obs.+ EIS	+ 9	Elliott trapping	YES	YES	YES	NO	Significant impact

Count	Species	Common Name	BC Act Status	EPBC Act Status	HPS post bushfires (Y/N)	Local record	No of local records	Surveys undertaken in EIS	Present absent in EIS or FFMP	Suitable habitat in MBE	Additional assessment required	Species included in referral to Commonwealth	Result of OMVI assessment of significance.
2	*Dasyurus maculatus*	Spotted-tail Quoll	V	E	Y	BioNet	3	NO – some spotlighting but no dedicated trapping	NO	YES	YES	YES	Significant impact
3	*Isoodon obesulus obesulus*	Southern Brown Bandicoot	E	E	Y	BioNet + B Ryan pers obs.	6	none no targeted surveys	NO	YES	YES	YES	Significant impact
4	*Phascolarctos cinereus*	Koala	V	V	Y	BioNet	2	general fauna	NO	YES	YES	NO	no data
5	*Petaurus australis*	Yellow-bellied Glider	V	-	Y	BioNet + B. Ryan pers obs	18	spotlighting	NO – but recorded by same company in adjoining lots	YES	YES	NO	Significant impact
6	*Petauroides volans*	Greater Glider	-	V	Y	EIS + BioNet + B Ryan pers obs	45	spotlighting	YES	YES	YES	YES	Significant impact
7	*Potorous longipes*	Long-footed Potoroo	CE	E	Y	BioNet	17	NO – some spotlighting but no dedicated trapping	NO	YES	YES	NO	no data
8	*Pseudomys fumeus*	Smoky Mouse	CE	E	Y		0	Ground Elliotts. No pitfalls	NO	YES	YES	NO	no data

Count	Species	Common Name	BC Act Status	EPBC Act Status	HPS post bushfires (Y/N)	Local record	No of local records	Surveys undertaken in EIS	Present absent in EIS or FFMP	Suitable habitat in MBE	Additional assessment required	Species included in referral to Commonwealth	Result of OMVI assessment of significance.
9	*Pseudomys novaehollandiae*	New Holland Mouse	-	V	Y	BioNet	0	Ground Elliotts. No pitfalls	NO	YES	YES	NO	no data
Bats													
1	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	Y	BioNet records + B Ryan pers obs.+ EIS	58	YES	YES	YES	YES	YES	Significant impact
4	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V	Y		0	Anabat	NO	YES	YES	NO	Significant impact
5	*Phoniscus papuensis*	Golden-tipped Bat	V	-	Y	BioNet	2	NO – no harp trapping	NO	YES	YES	NO	Significant impact

Key
HPS – High priority species for urgent conservation intervention following the 2019/2020 bushfires
No data – there is no data available for the subject site or surrounds to be able assess the species against the significant impact guidelines.
Significant Impact – the lack of scientific certainty, known occurrence and extent of cumulative impact as a result of clearing the refuge habitat will significantly impact this species.
Status
V = vulnerable on either/or the NSW BC Act 2016, or Commonwealth EPBC Act 1999
E = Endangered on either/or the NSW BC Act 2016, or Commonwealth EPBC Act 1999
EP = Endangered Population on either/or the NSW BC Act 2016, or Commonwealth EPBC Act 1999
CE = Critically Endangered on either/or the NSW BC Act 2016, or Commonwealth EPBC Act 1999

APPENDIX B

EPBC Act Protected Matters Search 11 May 2020 for a 10km radius of the subject site

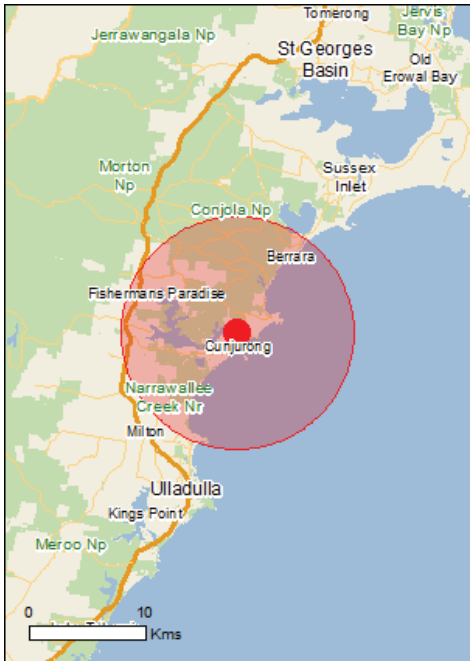
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

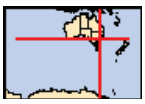
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/05/20 15:15:41



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 10.0Km



Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	72
Listed Migratory Species:	54

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	75
Whales and Other Cetaceans:	14
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	4
Regional Forest Agreements:	1
Invasive Species:	38
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
Temperate East

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Illawarra and south coast lowland forest and woodland ecological community	Critically Endangered	Community likely to occur within area
Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area

Name	Status	Type of Presence
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Prototroctes maraena Australian Grayling [26179]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species

Name	Status	Type of Presence
FOI LEX-21110 Document 2d		habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat may occur within area
Genoplesium baueri Yellow Gnat-orchid [7528]	Endangered	Species or species habitat may occur within area
Genoplesium vernale East Lynne Midge-orchid [68379]	Vulnerable	Species or species habitat may occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
FOI LEX-21110 Document 2d		
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat may occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Cosmocampus howensis Lord Howe Pipefish [66208]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat likely to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Conjola	NSW
Morton	NSW
Narrawallee Creek	NSW
Yatteyattah	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
Southern RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance(WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area

Mammals

Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

Plants

Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat may occur within area
Nassella trichotoma Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-35.25613 150.50938

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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BirdLife Shoalhaven is a branch of BirdLife Australia Limited ABN 75 149 124 774

July 7 2020

To: Hon Sussan Ley

Federal Minister For Environment

REFERENCE: 2020/8704 MANYANA COAST P L

CONCERNS ASSOCIATED WITH THE MANYANA RESIDENTIAL DEVELOPMENT

BirdLife Shoalhaven [BLS], a branch of BirdLife Australia [BLA] with over 750 members and supporters submits the following for your consideration in relation to the Ozy Homes Manyana Residential Development and associated unburnt bushland of the Manyana area, which continues to be the subject of significant community concern and protest.

RECOMMENDATION

That given the habitat, ecology, threatened species, biodiversity and post-bushfire considerations, BLS fully supports and recommends your intervention as Federal Minister with the continued development of the site. BLS would maintain there are critical environmental considerations associated with the provisions of the EPBC Act and associated threatened species and biodiversity of the site and that these apply in a post-bushfire context that has no precedent.

Rob Dunn
President BirdLife Shoalhaven
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0438 250 600

Chris Grounds

Chris Grounds
Conservation Officer BirdLife Shoalhaven
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1.0 POST-BUSHFIRE CONCERNS

1.1 The development site was not subject to burn in the 2019-2020 Bushfires, which impacted at least 70% of the Shoalhaven natural environment and in particular, the coastal forests and adjacent National Parks. However, the site is in close proximity to extensive areas of intense and damaging forest burn associated with the Lake Conjola National Park, the Bendalong Road and Bendalong precincts. [see photo above of Conjola National Park on the Bendalong Road to Manyana.]

1.2 On that basis **the site is thus extremely important refugia and should be managed on that basis.**

1.3 On a biodiversity basis any moratorium on the residential development could not possibly be anything less than 12 months but then only on a provisional basis at least until burnt areas are considered to be restored and the development situation reassessed. That could be as much as five years and perhaps a decade.

CONJOLA NATIONAL PARK

OZY HOMES RESIDENTIAL DEVELOPMENT BLOCK

1.4 BLS is on record with Shoalhaven Council and the state government in proposing that the surviving environments of refugia will require special management approach and that a long term moratorium on clearing and further damage to ecology must be part of that in the process of environmental recovery.

1.5 BLS is concerned that ecological assessments associated with the Development Application are not adequate or sufficiently rigorous and in some respects are dated, which is associated with the now very dated approval of the original development application of 2008.

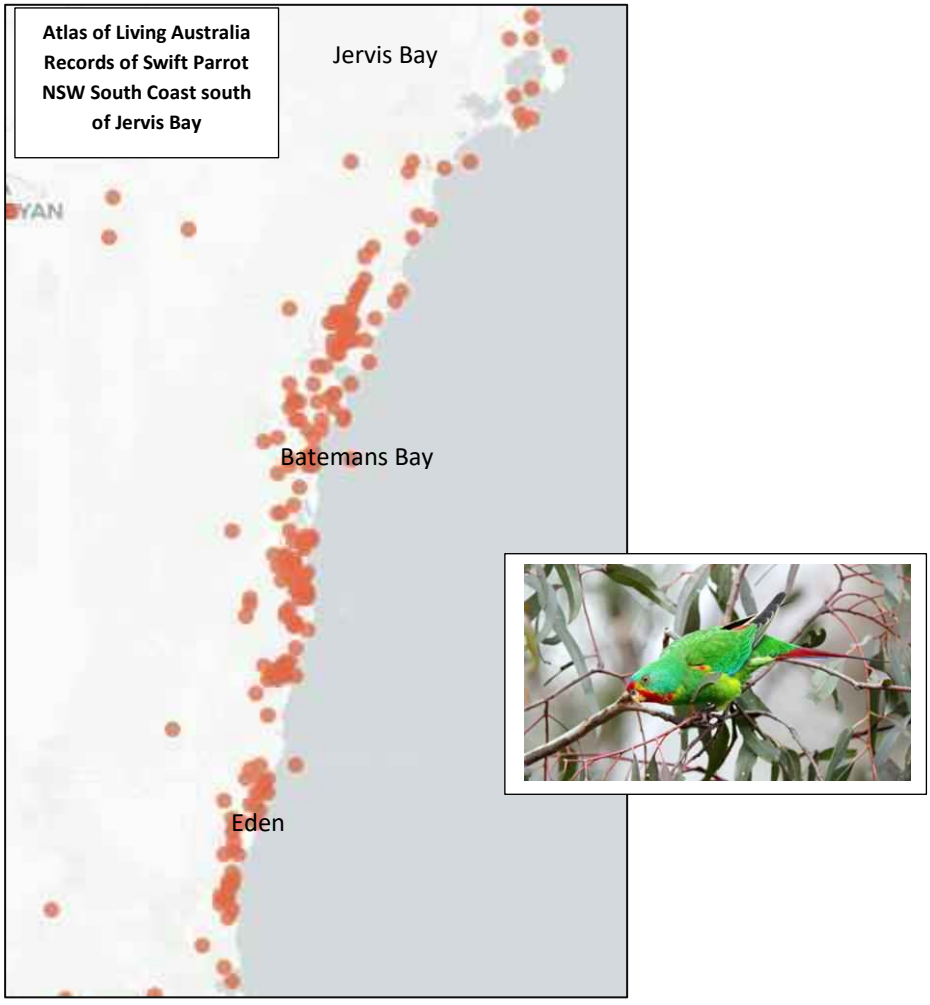
2.0 SPECIFIC CRITICALLY ENDANGERED - THREATENED SPECIES CONSIDERATIONS

2.1 BLS has specific **concerns regarding the Swift Parrot, which is listed under the EPBC Act 1999 as "Critically Endangered",** thus at the highest risk of extinction in the immediate future. These concerns exist in any year but more especially so in this bushfire recovery period. The species listed in NSW as "Endangered". The species breeds in Tasmania in summer and migrates to the mainland for the winter. It is nomadic on the mainland, moving between sites for varying periods of times. There are now less than 1,000 breeding pairs but their habitat is threatened, especially with logging in Tasmania.

2.2 The species is the "trigger" species for the declared **Ulladulla–Merimbula Key Biodiversity Area [KBA]** and thus part of both national and international system of identifying critical bird biodiversity areas. There is a 2017 sighting record by OEH-NPWS at Manyana of this species.

2.3 There is an extensive historical record for the presence of the species on the south coast especially in the area from Nowra to Eden. [see map below of species records Atlas of Living Australia-CSIRO below]

2.4 Clearing of existing forest and refugia will impact on the habitat and foraging of this key species.



2.5 BLS notes that scientific records and databases show that there is an historic and contemporary record of 360 bird species in the Shoalhaven and that 61 of these species is listed either federally or on state-NSW lists as Threatened Species. **Of these 61 Threatened Species there are 20 species listed on the Federal-EPBC Act listed, including 2 species which are known on the Manyana site, the Swift Parrot and the Glossy Black Cockatoo.**

2.6 BLS would also note that the Atlas of Living Australia [CSIRO] database supported by the Birdata Atlas indicates a record of 87 bird species within a 1km radius of the site and that 6 of these species are Threatened Species. This speaks strongly to the biodiversity values of the site, a biodiversity that the EPBC Act is intended to protect, particularly when such biodiversity itself it is threatened in the bushfire context.

3.0 HABITAT and BIODIVERSITY ISSUES

3.1 In the 2019-2020 Bushfires circumstance all such species are believed to have been severely impacted and their recovery will depend on the continued existence of refugia such as the Manyana site.

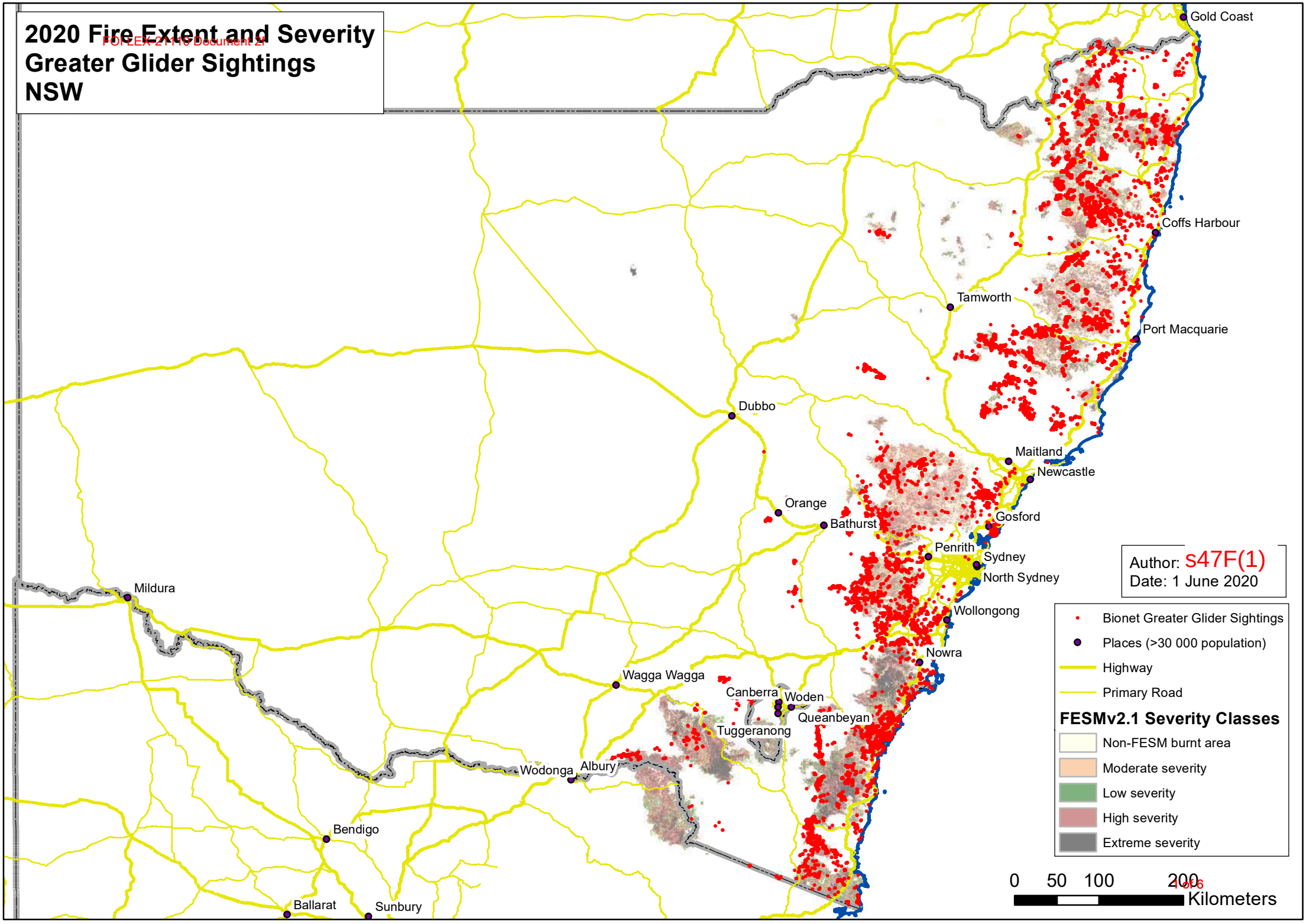
3.2 This circumstance is accentuated by the fact that the Bushfires occurred in the warm or summer season when there is a considerable migration of a range of species, known in the Manyana area, into the south coast and Shoalhaven.

3.3 This circumstance can be further appreciated with the realization that the ability of all bird species to survive and recover in the Shoalhaven at sites such as Manyana is linked very strongly to the foraging available from the flowering of forest trees, a number of which flower from early to late winter or during the cool season. However, the 2020 season in the Shoalhaven and on the south coast will be particularly challenging because of the extensive impact of the 2019-2020 bushfires on vegetation communities. [Refer Season Calendar after 3.7]

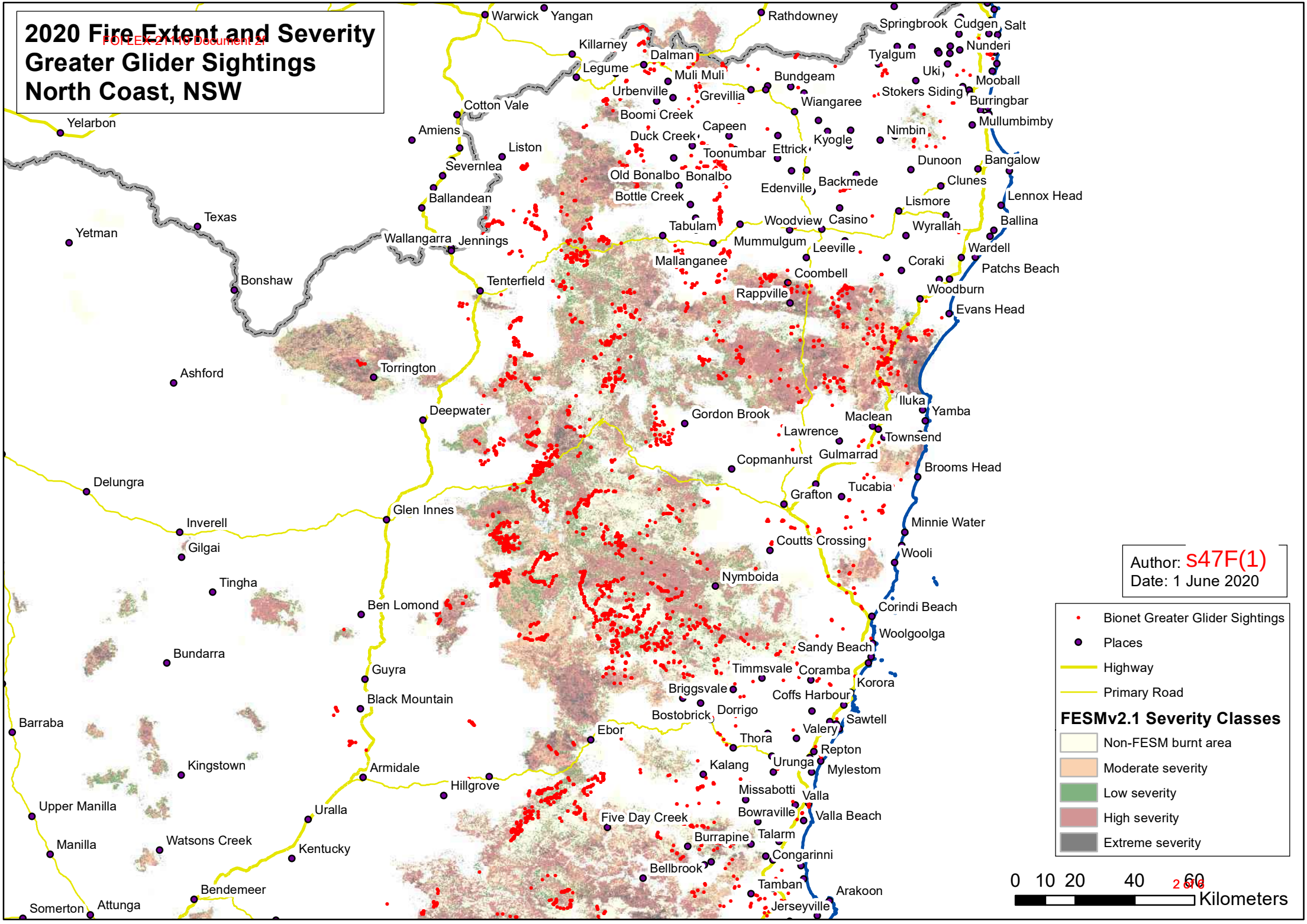
CONCLUSION

BLS would ask that you, as Minister, invoke with the Manyana site, the very name and purpose of the Federal EPBC Act 1999 in its purpose to Conserve Environment and Protect Biodiversity.

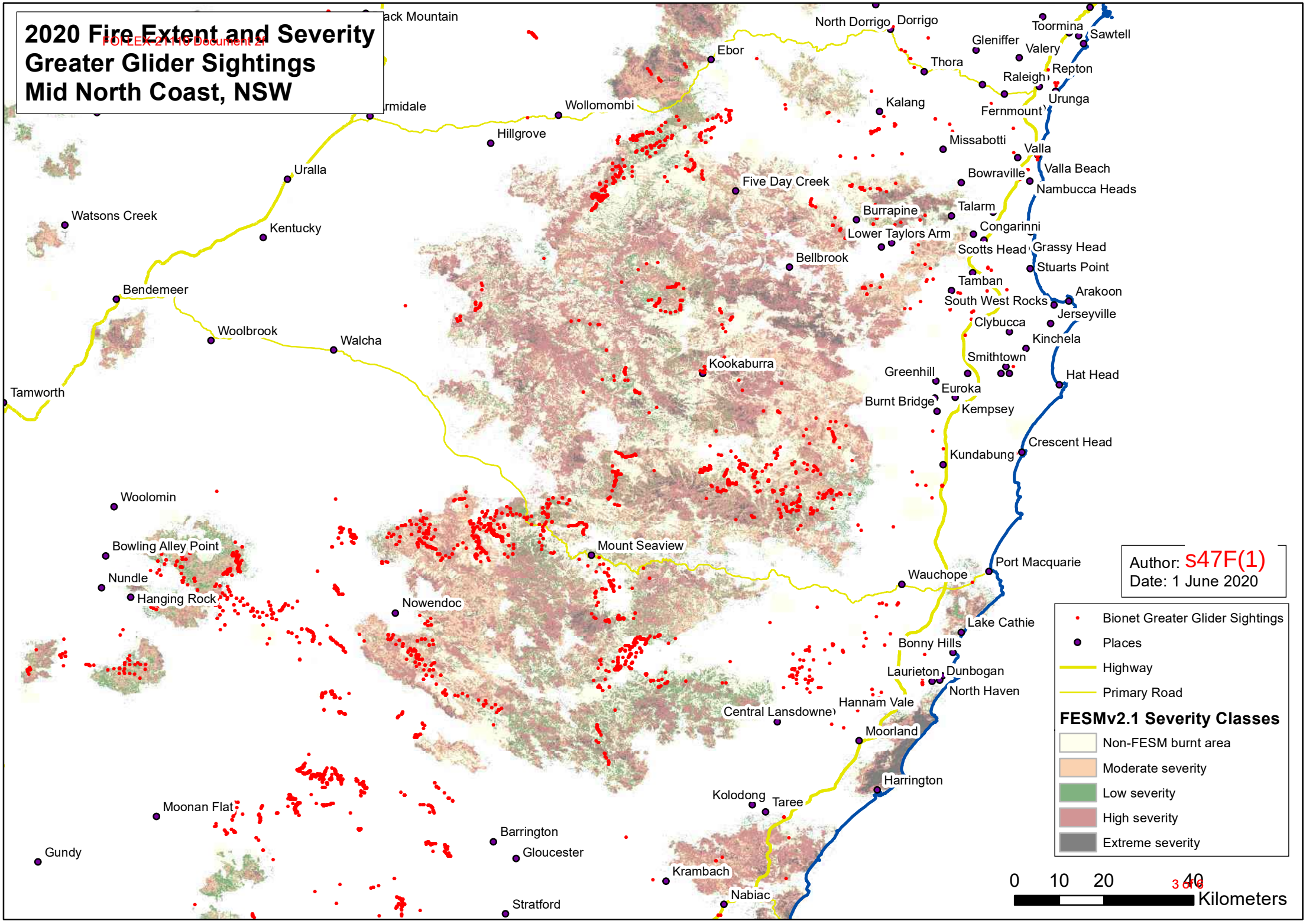
Birdlife Shoalhaven acknowledges the Aboriginal people of the Shoalhaven, their care of country, birds and habitat and pays respects to all Elders.


2020 Fire Extent and Severity
Greater Glider Sightings
NSW
FOI EX-21-16 Document 2F
Gold Coast
Coffs Harbour
Tamworth
Port Macquarie
Dubbo
Maitland
Newcastle
Orange
Bathurst
Gosford
Penrith
Sydney
North Sydney
Wollongong
Nowra
Mildura
Wagga Wagga
Canberra
Woden
Queanbeyan
Tuggeranong
Wodonga
Albury
Bendigo
Ballarat
Sunbury
Author: s47F(1)
Date: 1 June 2020
Bionet Greater Glider Sightings
Places (>30 000 population)
Highway
Primary Road
FESMv2.1 Severity Classes
Non-FESM burnt area
Moderate severity
Low severity
High severity
Extreme severity
0 50 100 200
Kilometers
1 of 6

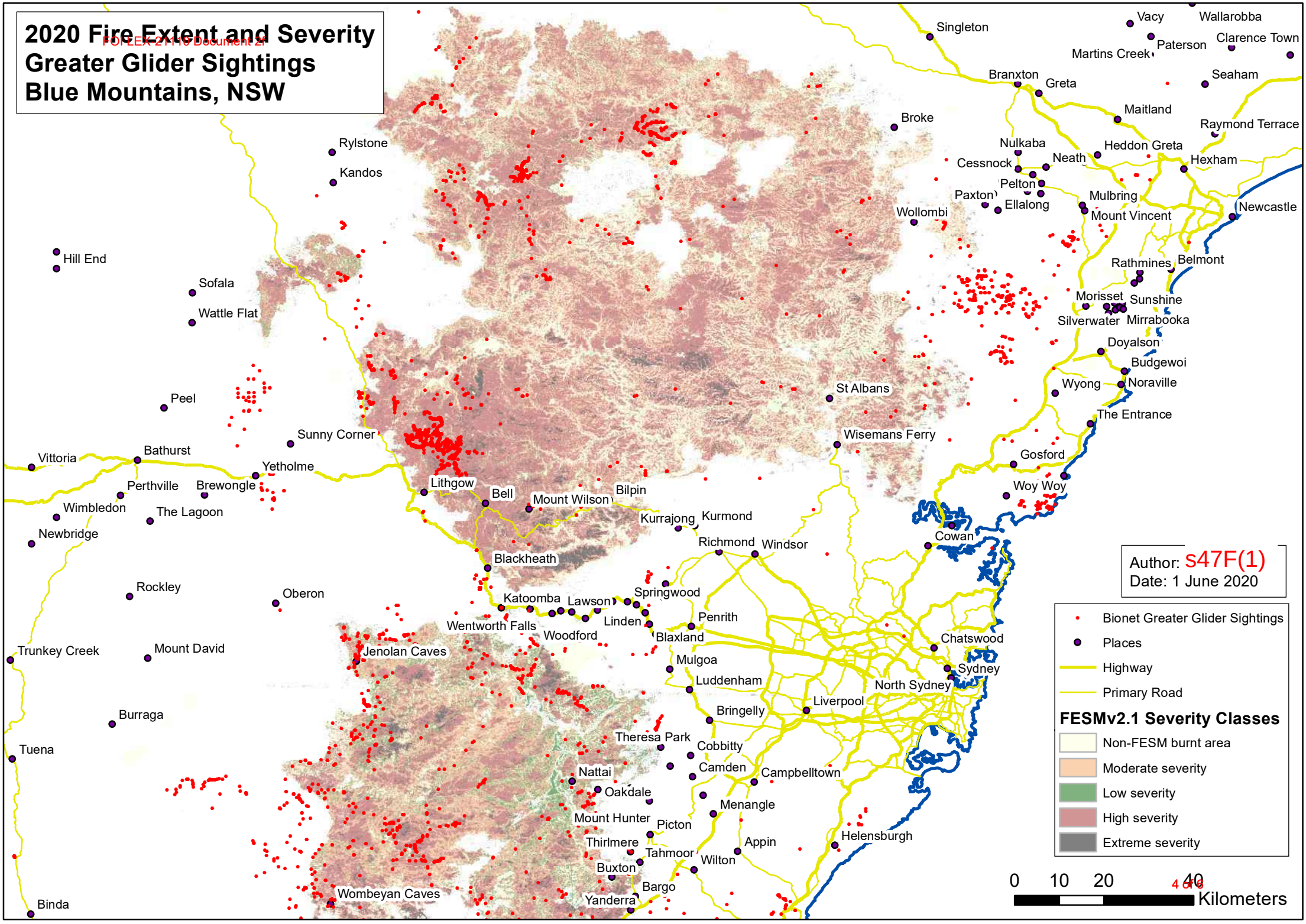
2020 Fire Extent and Severity
Greater Glider Sightings
North Coast, NSW

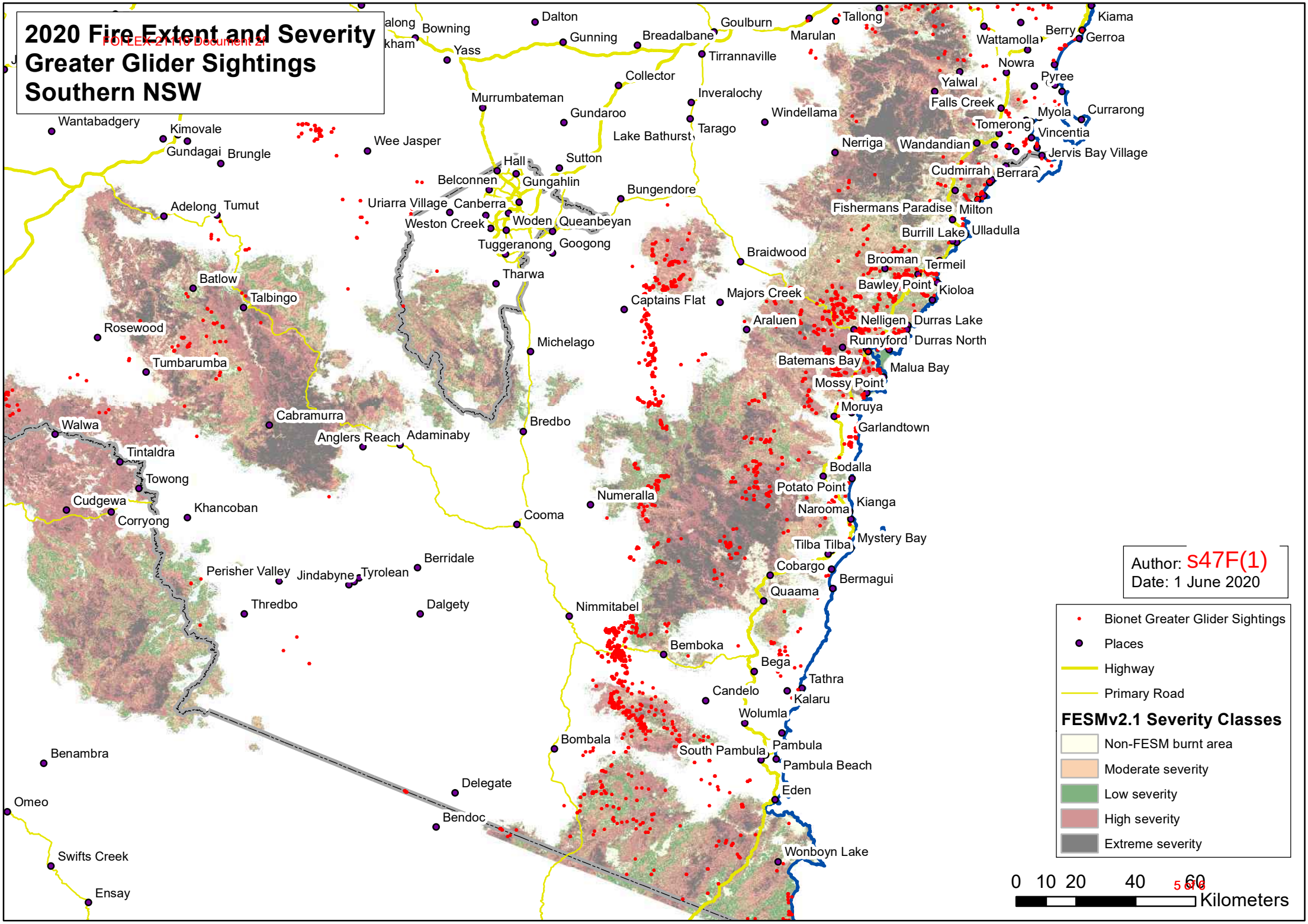


2020 Fire Extent and Severity
Greater Glider Sightings
Mid North Coast, NSW

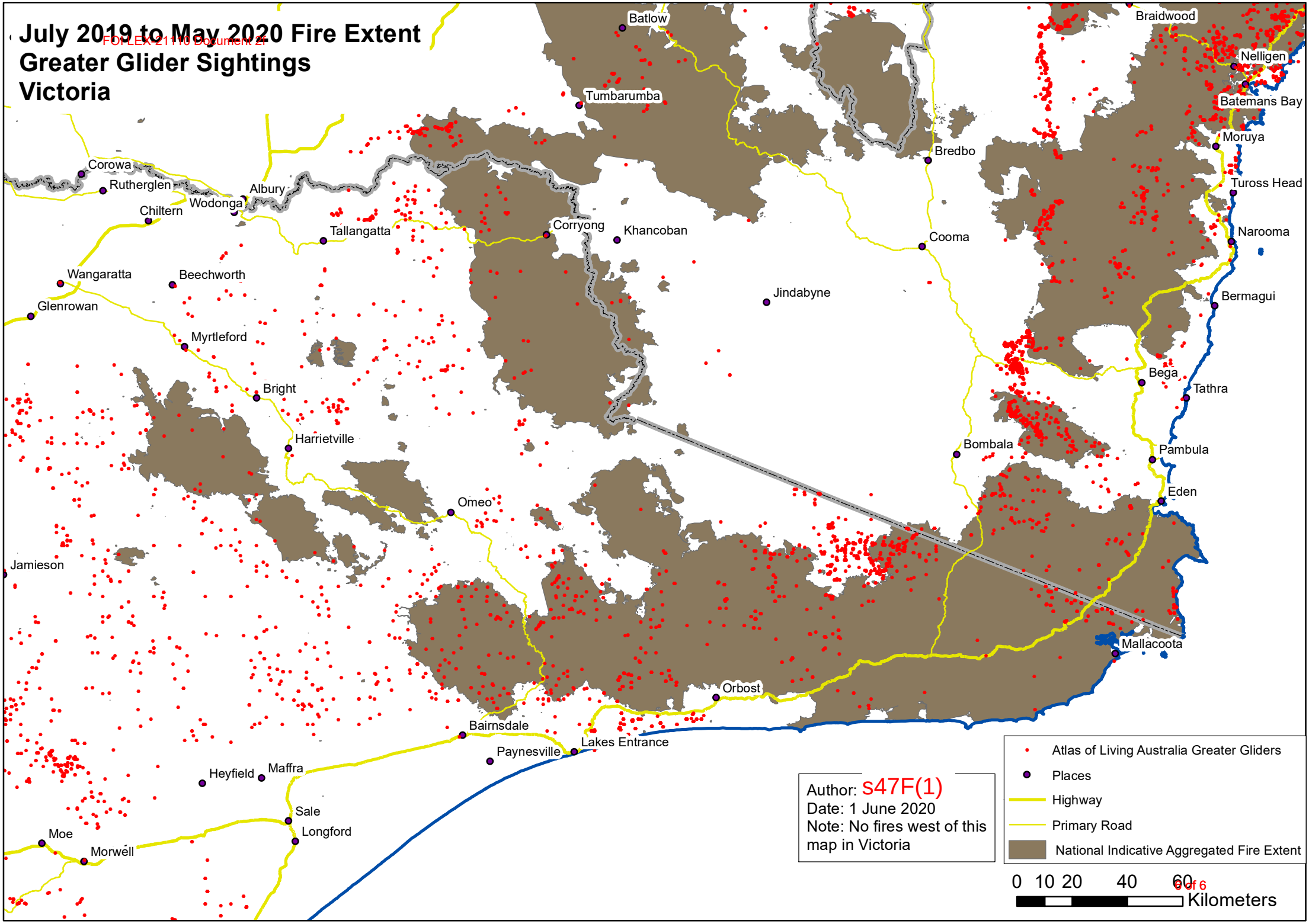


2020 Fire Extent and Severity
Greater Glider Sightings
Blue Mountains, NSW




2020 Fire Extent and Severity
Greater Glider Sightings
Southern NSW
FOI EX-21-16 Document 24
Author: s47F(1)
Date: 1 June 2020
Bionet Greater Glider Sightings
Places
Highway
Primary Road
FESMv2.1 Severity Classes
Non-FESM burnt area
Moderate severity
Low severity
High severity
Extreme severity
0 10 20 40 60
Kilometers
5 of 6
Wantabadgery
Kimovale
Gundagai
Brungle
Wee Jasper
Adelong
Tumut
Batlow
Talbingo
Rosewood
Tumbarumba
Walwa
Tintaldra
Towong
Cudgewa
Corryong
Khancoban
Cabramurra
Anglers Reach
Adaminaby
Perisher Valley
Jindabyne
Tyrolean
Berridale
Thredbo
Dalgety
Benambra
Omeo
Swifts Creek
Ensay
Delegate
Bendoc
Bowning
Yass
Dalton
Gunning
Breadalbane
Goulburn
Tallong
Marulan
Tirrannaville
Collector
Murrumbateman
Gundaroo
Inveralochy
Tarago
Lake Bathurst
Windellama
Hall
Sutton
Belconnen
Gungahlin
Bungendore
Uriarra Village
Canberra
Weston Creek
Woden
Queanbeyan
Tuggeranong
Googong
Tharwa
Michelago
Bredbo
Cooma
Numeralla
Captains Flat
Braidwood
Majors Creek
Araluen
Nimmitabel
Bemboka
Bombala
South Pambula
Pambula
Pambula Beach
Eden
Wonboyn Lake
Bega
Tathra
Candelo
Kalaru
Wolumla
Bodalla
Potato Point
Kianga
Narooma
Tilba Tilba
Mystery Bay
Cobargo
Bermagui
Quaama
Moruya
Garlandtown
Mossy Point
Batemans Bay
Malua Bay
Runnyford
Durras North
Nelligen
Durras Lake
Bawley Point
Kioloa
Brooman
Termeil
Burrill Lake
Ulladulla
Fishermans Paradise
Milton
Cudmirrah
Berrara
Nerriga
Wandandian
Jervis Bay Village
Tomerong
Vincentia
Falls Creek
Yalwal
Nowra
Wattamolla
Berry
Kiama
Gerroa
Pyree
Myola
Currarong

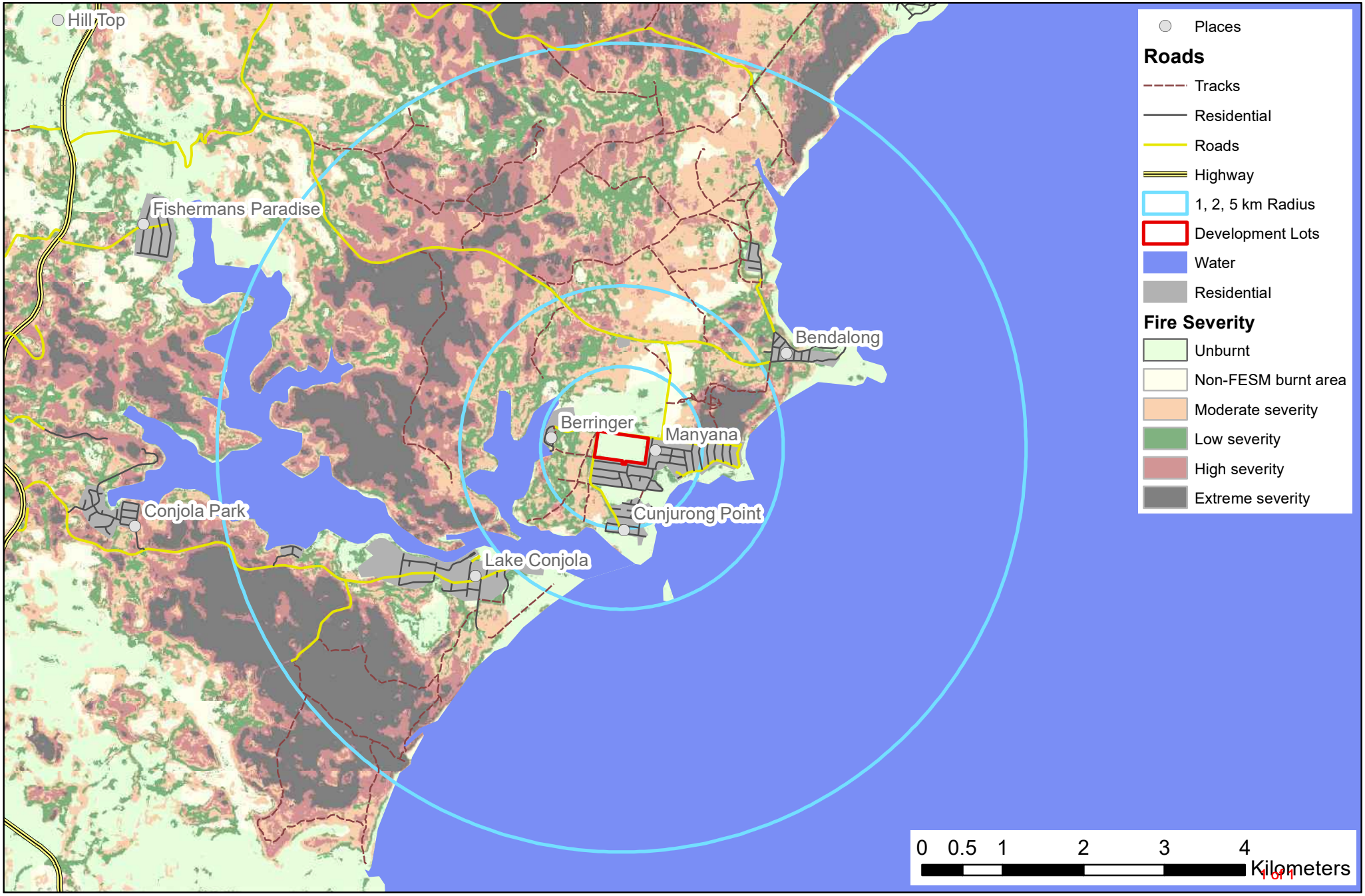
July 2019 to May 2020 Fire Extent
Greater Glider Sightings
Victoria

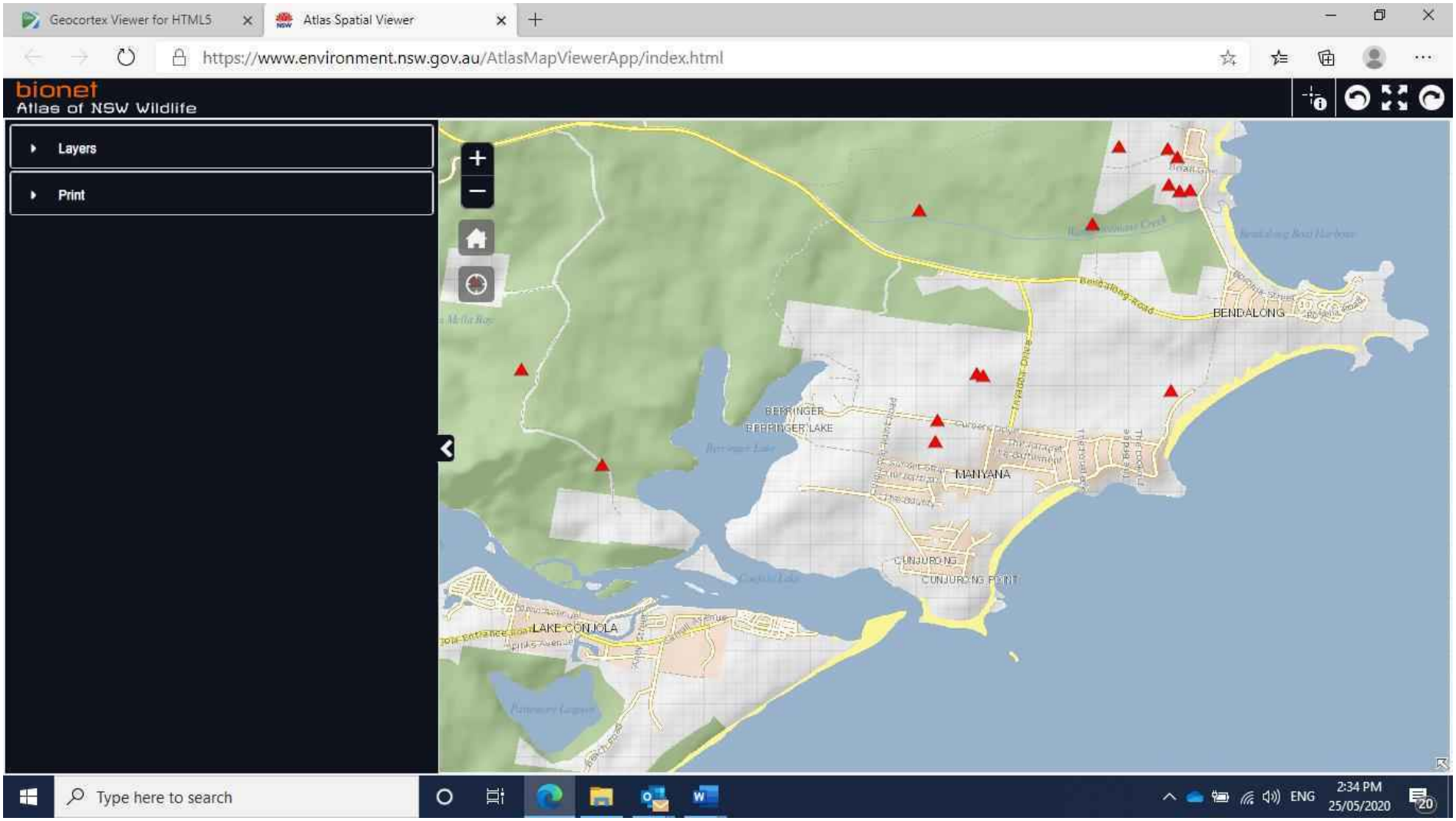


Author: s47F(1)
Date: 1 June 2020
Note: No fires west of this map in Victoria

Manyana
Fire Extent and Severity

Author: s47F(1)
Date: 30 May 2020




Geocortex Viewer for HTML5
Atlas Spatial Viewer
https://www.environment.nsw.gov.au/AtlasMapViewerApp/index.html
bionet
Atlas of NSW Wildlife
Layers
Print
BENDALONG
BERRINGER
BERRINGER LAKE
MANYANA
CUNJURONG
CUNJURONG POINT
LAKE CONJOLA
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ENG
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25/05/2020