NSW Public Works

Tumut FCC Helicopter Hangar

Statement of Environmental Effects

Report Number: P-FY20253450-PWO-ENV-RP-0003-A2

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Snowy Valleys Council

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Cover photo: Drone image of Tumut aerodrome hardstand works

Source: Public Works 2025

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Abbreviations

Item	Description
CEMP	Construction Environmental Management Plan
CLM Act	*Contaminated Land Management Act 1997*
DA	Development Application
DCP	Development Control Plan
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	NSW Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
FCC	Fire Control Centre
LEP	Local Environmental Plan
LGA	Local Government Area
NSW PW	NSW Public Works
POEO Act	*Protection of the Environment Operations Act 1997*
RFS	Rural Fire Service
SEE	Statement of Environmental Effects
SEPP	State Environmental Planning Policy
SVC	Snowy Valleys Council

1. Introduction

1.1 Background

This Statement of Environmental Effects (SEE) accompanies an application to Snowy Valleys Council (SVC) for the construction of a helicopter hangar within a proposed RFS Fire Control Centre (FCC)at Tumut Aerodrome, Wee Jasper Road, Tumut (hereafter referred to as the Proposal). site.

This SEE describes the subject site and the surrounding area, together with the relevant planning controls and policies relating to the site and the type of development proposed. It provides an assessment of the proposed development against the matters for consideration as set out in Section 4.15 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2 Summary of the Proposal

Snowy Valleys Council received a grant under the Plantations Fire Protection Fund Program of $3,850,00 (GST exclusive), for the Tumut Aerodrome Hangar. The Plantations Fire Protection Fund Program is intended to provide protection of critical timber supplies in the Murray Region. This Program will improve resilience into this important regional industry through measures to deliver fire prevention, detection and response works.

As a requirement of the grant, a Maintenance Period of five years on project completion is a requirement of SVC. The local timber industry has committed $10,000 each for five years to help cover the ongoing maintenance and running costs of the hangar. It is anticipated that the RFS Fire Control Centre will be completed within this timeframe and responsibility for the hangar thence forth would then align to the arrangement in place for the FCC.

The proposed helicopter hangar would form one part of the broader aerodrome upgrade. The helicopter hangar would be located within the Rural Fire Service (RFS) FCC which would be subject to future approval and construction. The proposal is described in further detail in Section 3 and Section 4 of this SEE. The proposed plans are provided in Appendix A.

2. Section 4.15 Considerations

This SEE has been prepared to meet the requirements of Section 4.15 (1) of the EP&A Act, which require a consent authority to take into consideration a number of matters as relevant to the development. These matters, and how they have been considered as part of this SEE, are detailed in Table 2-1 below.

As a result of the assessment, it is concluded that development of the site in the manner proposed is considered to be acceptable and is worthy of the support of the Council.

Table 2-1: Section 4.15 (1) The Evaluation – Matters for Consideration

Section 4.15 (1) Considerations	Where addressed in the SEE
(a) the provisions of any of the following that that apply to the land to which the development application relates	
(i) any environmental planning instrument, and	Section 5.2 and 5.3
(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority (unless the Secretary has notified the consent authority that the making of the proposed instrument has been deferred indefinitely or has not been approved), and	N/A
(iii) any development control plan, and	Section 5.5
(iv) any planning agreement that has been entered into under section 7.4, or any draft planning agreement that a developer has offered to enter into under section 7.4, and	N/A
(v) the regulations (to the extent that they prescribe matters for the purposes of this paragraph), and	Section 5.2
(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality,	Section 5 and Section 0
(c) the suitability of the site for the development,	Section 6.3
(d) any submissions made in accordance with this Act or the regulations,	Council to consider
(e) the public interest.	Section 6.4

3. The Site and Surrounding Environment

3.1 Site Description

The Tumut Aerodrome is located about 3.9km north of the township of Tumut. The Site is located within the aerodrome north of the existing facilities within Lot 2 DP1075294, Lot 4 DP528649 and a public paper road corridor. The hangar would be constructed within the RFS FCC which is shown indicatively in Figure 3-3 (Aviation Projects, 2023).

The Site is entirely zoned SP2 Infrastructure (Airport) under the Tumut Local Environmental Plan (LEP) 2012. A new access point is currently under construction as part of other works underway on the Site, with this road to provide access from Wee Jasper Road, a sealed regional road. Prior to development of the Site for RFS/airport/aerodrome facilities, the site was a cleared open paddock that would house some livestock. To the south of the Site, within the aerodrome land but outside the FCC area, is an existing farm dam.

The site location and boundary are shown in Figure 3-3 and Figure 3-1. An aerial image of the site is provided in Figure 3-2. Figure 3-4 shows the works underway as of March 2025, which were approved as part of an REF for other development within the Aerodrome (The environmental factor , 2024).

The surrounding environment is comprised of predominantly cleared agricultural and residential land that contains restricted areas of remnant vegetation, several agricultural properties and dwellings, and a residential estate north of the Site (Bombowlee). To the south of the aerodrome Bombowlee Creek flows towards the west and includes scattered riparian vegetation. The land surrounding the aerodrome is zoned RU1 Primary Production (refer to Figure 5-1).

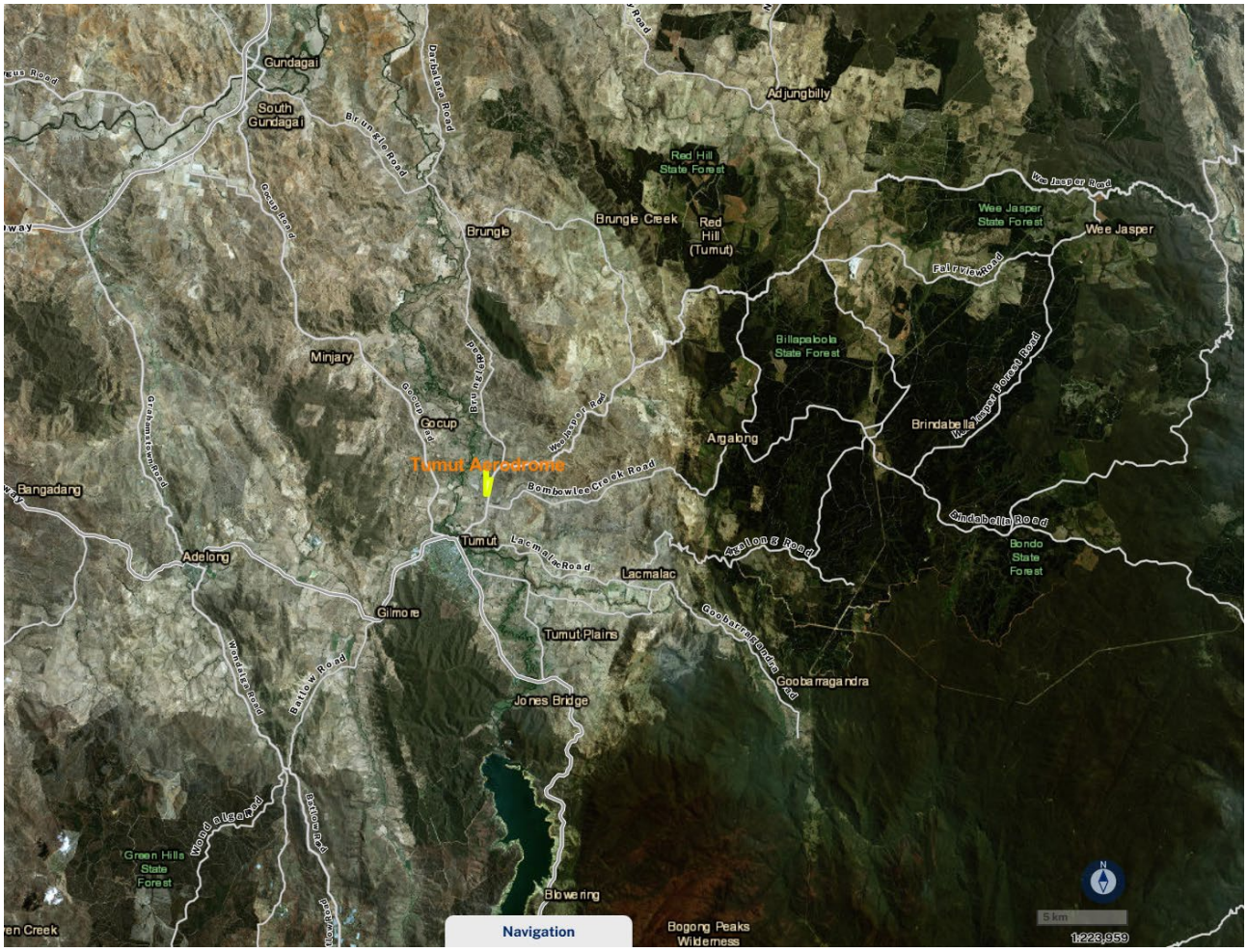


Figure 3-1: Location map of subject site (outlined in yellow)

Source: NSW Spatial data explorer, March 2025

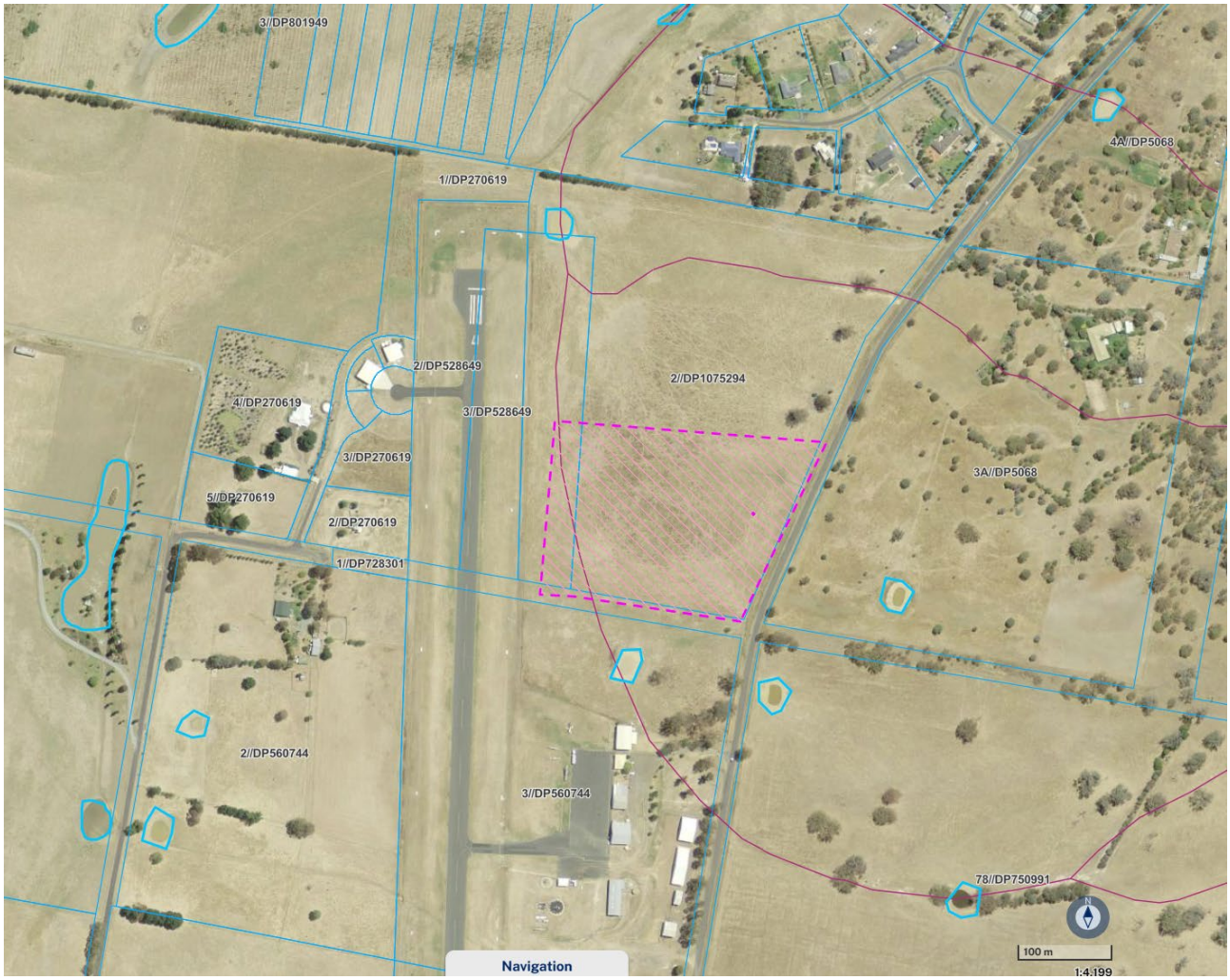


Figure 3-2: Aerial view of the subject site (approximate extent of RFS Control Centre outlined in purple)

Source: NSW Spatial data explorer, March 2025

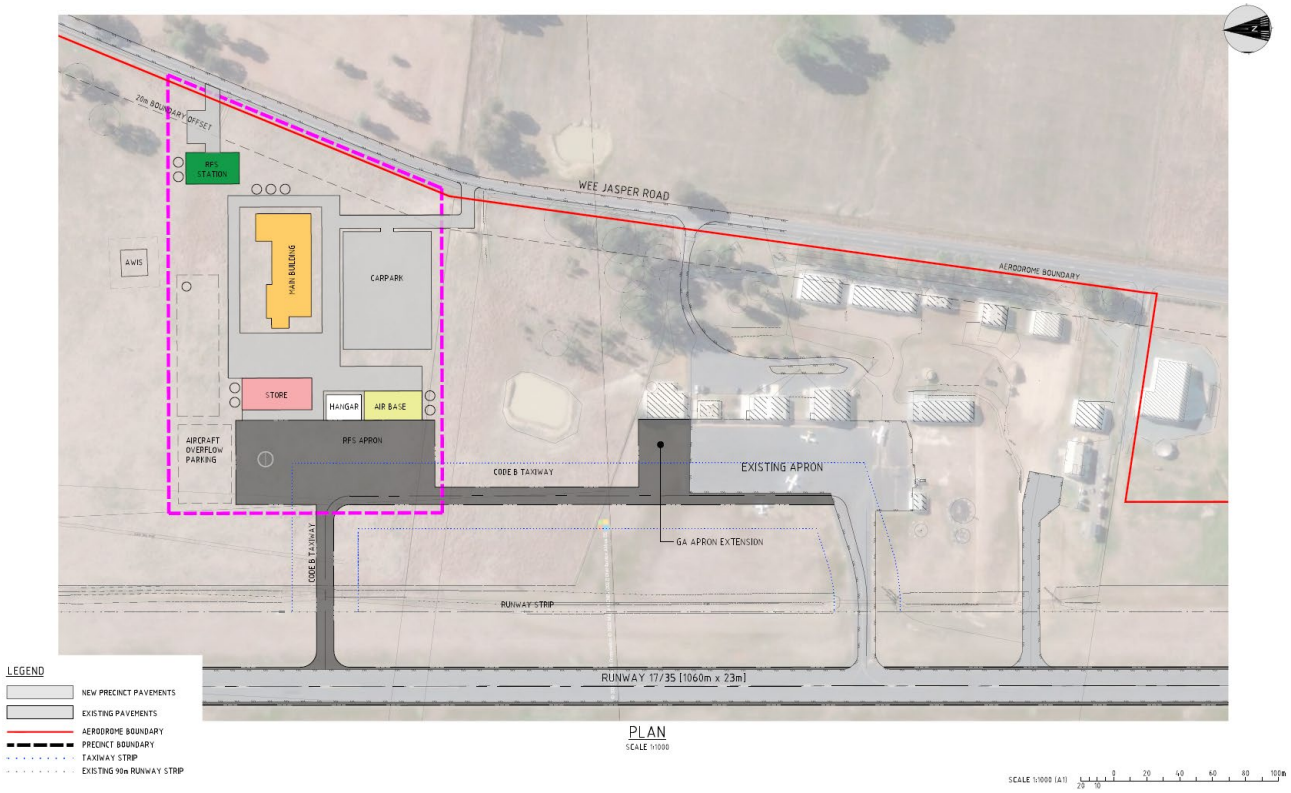


Figure 3-3: RFS control centre indicatively shown within the purple outline

Source: Tumut Aerodrome Masterplan, April 2023

Figure 3-4 Construction underway on Site as of March 2025

Source: NSW PW, March 2025

3.2 Land Ownership

The site is owned by SVC. The Public Road reserve that intersects the site is mapped as Crown Land (refer to Figure 3-5). SVC has confirmed that they are the roads authority and that the full transfer of ownership of this land within the aerodrome has been issued to SVC.

Figure 3-5: Crown Land

Source: NSW Planning Portal, March 2025

4. The Proposal

This section provides a description and overview of the Proposal.

4.1 Proposal Description

The Proposal would involve construction of a new helicopter hangar within the Tumut Aerodrome and the Tumut FCC. Aviation Projects has prepared a Master Plan for the site, which outlines the sites future upgrade of the aerodrome (refer to Figure 3-3). The hangar location is shown indicatively in the plans provided in Figure 4-1 and Figure 4-2, with complete preliminary designs provided in Appendix A. The detailed design of the facility would be undertaken as part of a design and construct contract by the contractor.

The development would also include ancillary facilities as shown in Figure 4-2. The facilities would include a multipurpose space, office, amenities and storage facilities, with potential for alternative internal fit outs in the final design.

The hangar would include five regular staff. The site would be activated/manned on an as needs basis and scheduled learning and development for members. The airbase would be activated/manned in the event of emergencies, forecast to be during high fire danger periods.

Figure 4-1: Design – Site diagram

Source: HavenandMather, June 2025

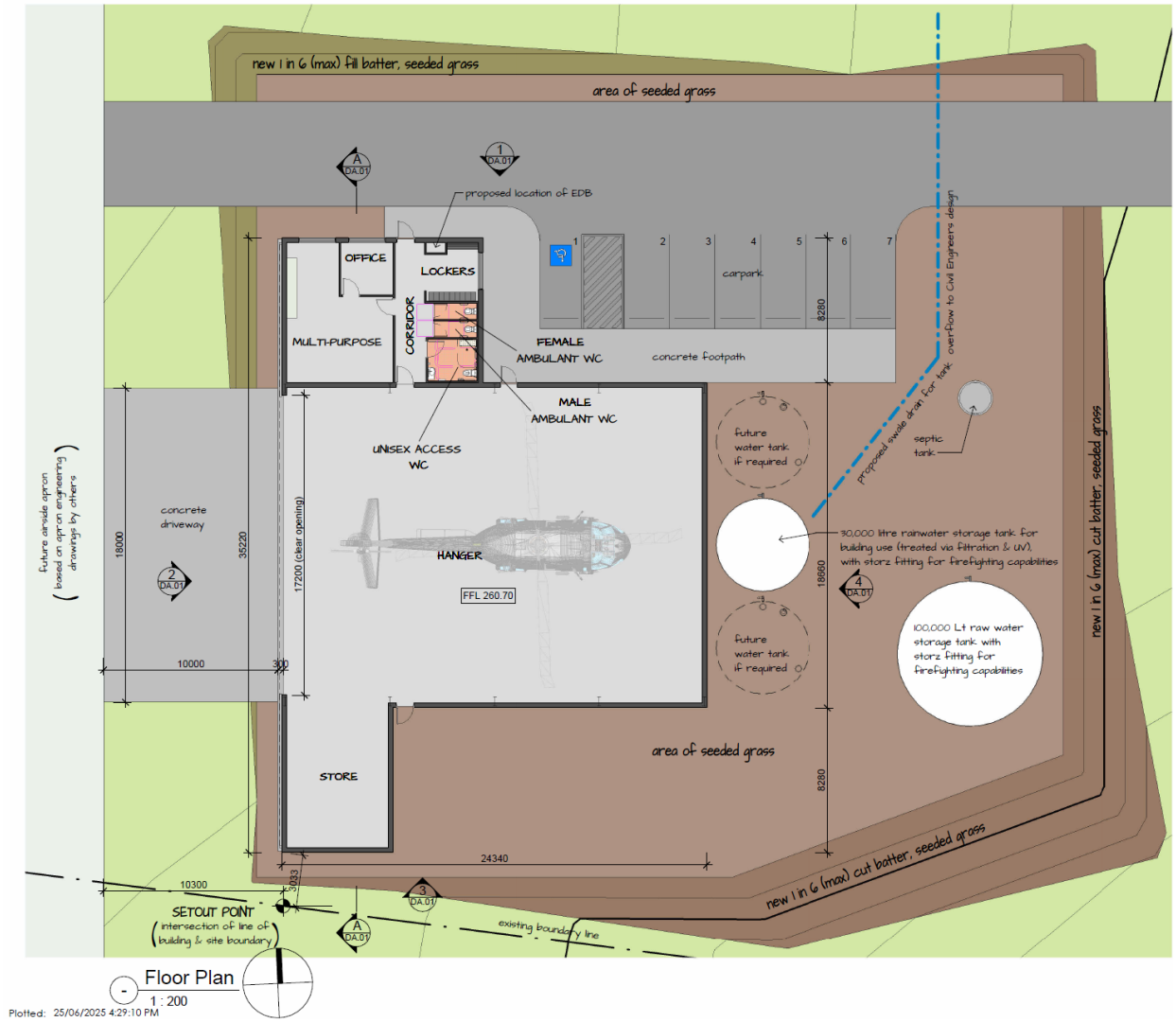


Figure 4-2 Floor plan

Source: HavenandMather, June 2025

4.2 Construction Considerations

4.2.1 Construction Activities

The proposed development is likely to include the following general activities by the contractor(s):

- Preparation of a Construction Environmental Management Plan (CEMP);
- Establishment of site preliminaries such as entry/exit points, erosion and sediment controls, stormwater management controls, temporary protection fencing, etc;
- Loading/unloading, transportation and placement of construction equipment and building materials;
- Construction of the new FCC helicopter hangar including;
    - Main hangar to accommodate helicopter and level interface with Airside apron.
    - Storage areas within main hangar
    - Multifunction room with office and kitchenette.
    - Building amenities and change facility.
    - On site septic and potable water storage
    - 100,000 litre raw water storage tank.
    - New sealed access road onto Wee Jasper Road.
    - Accessible and vehicle carparking up to 10 spaces.
    - Perimeter fencing and landscaping
- Completion of minor external/internal fittings including furniture transportation and installation (refer to concept floor plan in Figure 4-2);
- Make good/repair any damage caused to Council assets during the construction process; and
- Clean-up site and remove all materials and equipment from the site and make good. Clean site and any facilities used during the construction process.

The successful contractor will construct a compound within the site.

4.2.2 Construction Equipment

Construction equipment will include the following or similar equipment as required:

- Light commercial and passenger vehicles;
- Excavator;
- Drilling rigs for installation of boarded piers
- Crane, low loader transporters and delivery/material transport vehicles, including truck and dog for transport of excavated material;
- Concrete agitator trucks, bob cat, backhoe, trenching machines and auger; and

- Chain saws, jackhammers and pneumatic hand tools.

4.2.3 Construction Timing

Hours of construction will be as follows:

- Monday to Friday: 7.30am to 6.00pm.
- Saturdays: 7.30am to 1.00pm.
- Sundays and Public Holidays: No work allowed unless special permission granted.

Construction is anticipated to take approximately 20 weeks.

4.2.4 Construction Environmental Management

The construction contractor will be required to prepare and implement a site-specific Construction Environmental Management Plan (CEMP). The CEMP will include work procedures and mitigation control measures, including but not limited to, the following:

- Any conditions of consent and any other licence/approval conditions;
- Emergency response plan in case of a pollution incident;
- Complaints handling procedure and a 24-hour telephone contact number;
- Waste Management Plan, identifying appropriate procedures for handling and disposal of waste, in accordance with the *Protection of the Environment Operations Act 1997* and the *Protection of the Environment Operations (Waste) Regulation 2014*;
- Soil and Water Management Plan.

5. Statutory Framework and Development Controls

5.1 Consultation

A pre-lodgement meeting was undertaken with SVC on 28 March 2025 as part of this proposal. It was identified during this meeting that the following documents would be required to support the Development Application:

- SEE (this report)
- Cost estimate report (provided with the Development Application [DA] submission)
- Effluent Disposal Report (refer to Appendix B)
- Bushfire Assessment Report (refer to Appendix D)

The key matters to consider in the assessment were also discussed, including the following:

- The air and transport provisions of the *State Environmental Planning Policy (Transport and Infrastructure) 2021* (refer to Section 5.3.1).
- The Tumut Local Environmental Plan (LEP) 2012, 'Essential Services' and 'Groundwater Vulnerability' clauses (refer to Section 5.4.2 and Section 5.4.4).
- Chapter 3 of the Snowy Valleys Development Control Plan (DCP) 2024 (refer to Section 5.5).

5.2 Legislation

The following legislation is relevant to the Proposal.

5.2.1 Environmental Planning and Assessment Act 1979

The proposed works require development consent from SVC and would be assessed under Division 4, Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Section 4.15 of the EP&A Act requires that the consent authority take into account the likely impacts of the development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.

This SEE has been prepared to meet the requirements of Section 4.15 of the Act, as demonstrated in Table 2-1.

Ecological Sustainability Development

The encouragement of ecologically sustainable development (ESD) is one of the Objectives of the EP&A Act. The principles of ESD are:

a) *the precautionary principle — namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*

> *(i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*

(ii) an assessment of the risk-weighted consequences of various options,

b) *inter-generational equity — namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,*

c) *conservation of biological diversity and ecological integrity — namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,*

d) *improved valuation, pricing and incentive mechanisms — namely, that environmental factors should be included in the valuation of assets and services, such as:*

(i) polluter pays — that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,

(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,

(iii) environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

The works are consistent with the principles of ecologically sustainable development. Environmental safeguards have been proposed to be implemented during the works to prevent long term and irreversible environmental degradation in accordance with the precautionary principle and inter-generational integrity. The proposed works would not impact on biological diversity and ecological integrity. The conservation of energy, water and waste and optimising the use of State assets during and after the works is consistent with environmental factors being included in the valuation (and management) of assets and services.

5.2.2 Environmental Planning and Assessment Regulation 2021

Section 61 of the *Environmental Planning and Assessment Regulation 2021* prescribes a number of matters that must be taken into consideration by a consent authority in determining a development application, for the purposes of Section 4.15 of the EP&A Act. A review of these matters indicates that none are relevant to the proposed development.

5.2.3 Rural Fires Act 1997

The Proposal site is mapped as Bushfire Prone Land as per the Bushfire Prone Land Map certified by the NSW RFS.

Section 100B of the *Rural Fires Act 1997* requires RFS approval for development on bush fire prone land for a special fire protection purpose. The Proposal is not categorised as a special fire protection purpose and therefore approval from the RFS is not required for the Proposal. Nevertheless, bushfire risks at the site have been considered for the Proposal (see Appendix D).

5.2.4 Contaminated Land Management Act 1997

The *Contaminated Land Management Act 1997* (CLM Act) establishes a process for investigating and remediating contaminated land. The NSW Environmental Protection Authority (EPA) identifies sites that exhibit contamination and require regulation under Division 2, Part 3 of the CLM Act.

A search of the EPA Section 58 and 60 contaminated site registers on 31 March 2025 did not return any results for the suburb of Bombowlee. Further discussion on land contamination is included in Section 5.5.

5.2.5 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) regulates air, noise, land and water pollution. The EPA is generally responsible for implementing the POEO Act and will be the appropriate regulatory authority for the Proposal.

The Proposal does not constitute a scheduled activity listed under Schedule 1 of the POEO Act and therefore an environment protection licence is not required. Furthermore, as management measures will be implemented to prevent water pollution, it is considered unlikely that a licence will be required under Section 120 of the POEO Act for the pollution of waters.

Other relevant provisions of the POEO Act that the Proposal will need to comply with include:

- Section 115 – It is an offence to dispose of waste in a manner that harms or is likely to harm the environment; and
- Section 116 – It is an offence to cause any substance to leak, spill or otherwise escape (whether from a container or not) in a manner that harms or is likely to harm the environment.

All contractors will comply with POEO Act, including the requirement to notify EPA under Section 148 if a pollution event occurs that causes or threatens material harm to the environment.

5.2.6 Protection of the Environment Operations (Waste) Regulation 2014

The *Protection of the Environment Operations (Waste) Regulation 2014* sets out the provisions with regards to non-licensed waste activities and non-licensed waste transporting, in relation to the way in which waste must be stored, transported, and the reporting and record-keeping requirements. The works will be undertaken to be consistent with the requirements of this regulation.

The classification, management, transportation and disposal of waste from the works is to be undertaken in accordance with the relevant provisions of the POEO Act and the *Protection of the Environment Operations (Waste) Regulation 2014* and *Waste Classification Guidelines Part 1: Classifying Waste* (EPA, 2014) *and Addendum* (EPA, 2016). It is an offence to transport waste to a place that cannot lawfully receive that waste, or cause or permit waste to be so transported (under section 143 of the POEO Act).

5.3 Environmental Planning Instruments

The following environmental planning instruments are relevant to the Proposal.

5.3.1 State Environmental Planning Policy (Transport and Infrastructure) 2021

SEPP (Transport & Infrastructure) 2021 aims to assist in the effective delivery of transport and public infrastructure by improving certainty and regulatory efficiency. It provides clear definition of the environmental assessment and approval process for transport and public infrastructure and services facilities.

The proposed development does not trigger any referral requirements under the SEPP (Transport and Infrastructure) 2021 and the proposal is not traffic generating development.

Section 2.25 of SEPP (Transport & Infrastructure) notes that development for the purpose of hangars for aircraft storage or maintenance are permitted with consent within the boundaries of an existing air transport facility if the development is ancillary to the air transport facility.

5.4 Tumut Local Environmental Plan 2012

5.4.1 Zoning

The Proposal Site is zoned SP2 Infrastructure (airport) (see Figure 5-1). The objectives and activities for RU2 zoning contained in the Tumut LEP are listed below:

Objectives of zone

- *To provide for infrastructure and related uses.*
- *To prevent development that is not compatible with or that may detract from the provision of infrastructure.*

Development for the purposes of emergency services facilities can be carried out with development consent under the Tumut LEP within the zone.

5.4.2 Clause 6.4 Groundwater Vulnerability

The objectives of this clause are as follows:

(a) to maintain the hydrological functions of key groundwater systems,

(b) to protect vulnerable groundwater resources from depletion and contamination as a result of development.

The Proposal Site is located within a Groundwater Vulnerability area as shown on the Groundwater Vulnerability Map under the LEP (see Figure 5-2 below). Before determining this development application SVC must consider the following items which have been identified and discussed in Table 5-1. The table concludes that the Proposal would not have a significant impact on groundwater vulnerability, provided that an appropriate set of measures are included in an Erosion and Sediment Control Plan (ESCP).

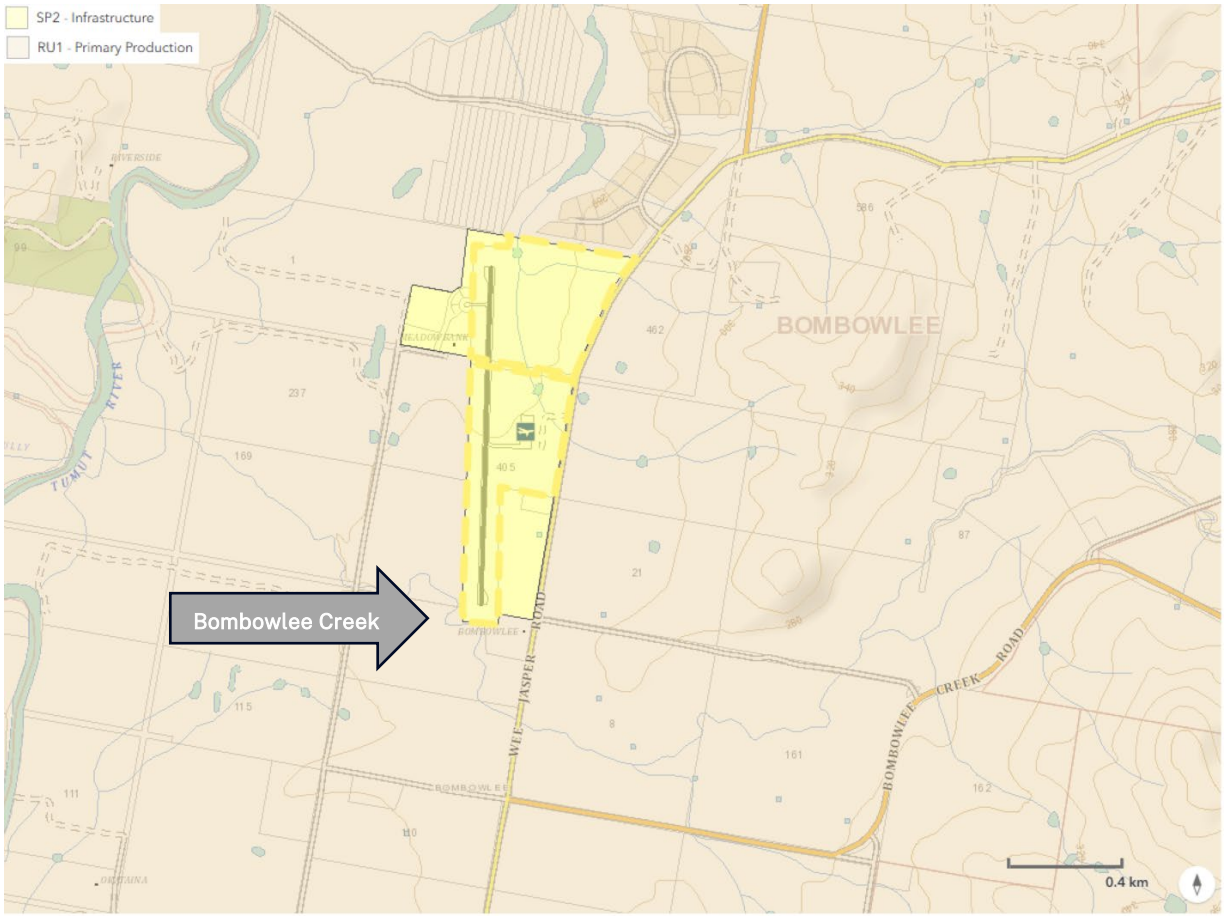


Figure 5-1: Land Use Zone (Aerodrome property outlined in yellow)

Source: NSW Planning Portal, March 2025

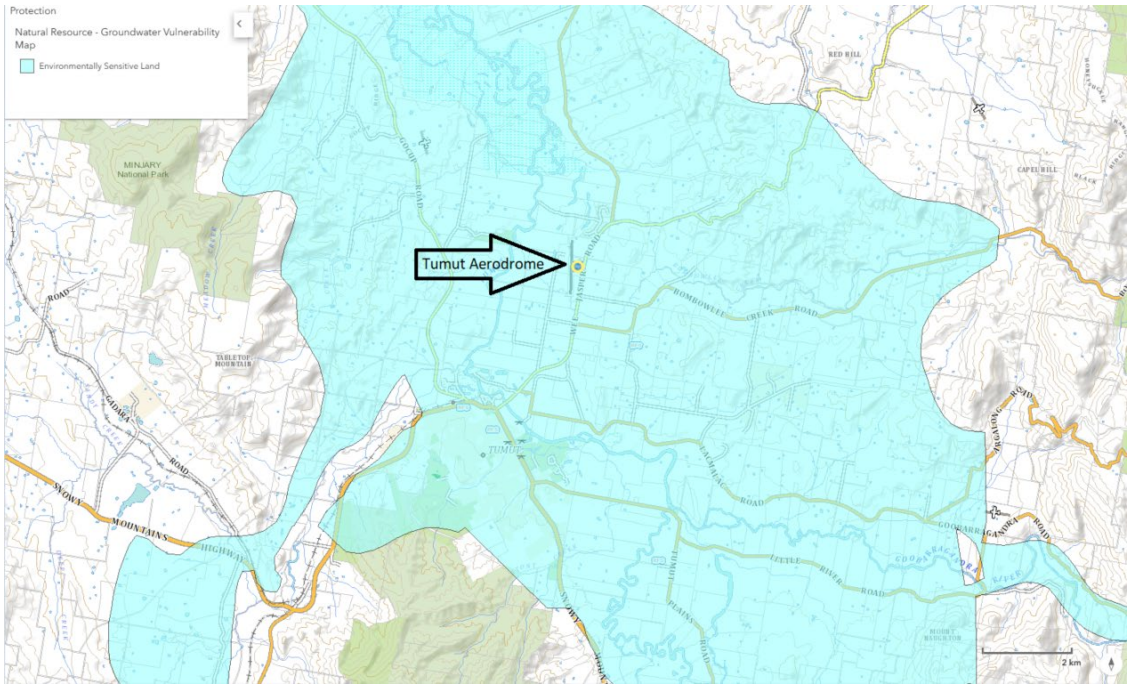


Figure 5-2: Groundwater vulnerability

Source: NSW Planning Portal, March 2025

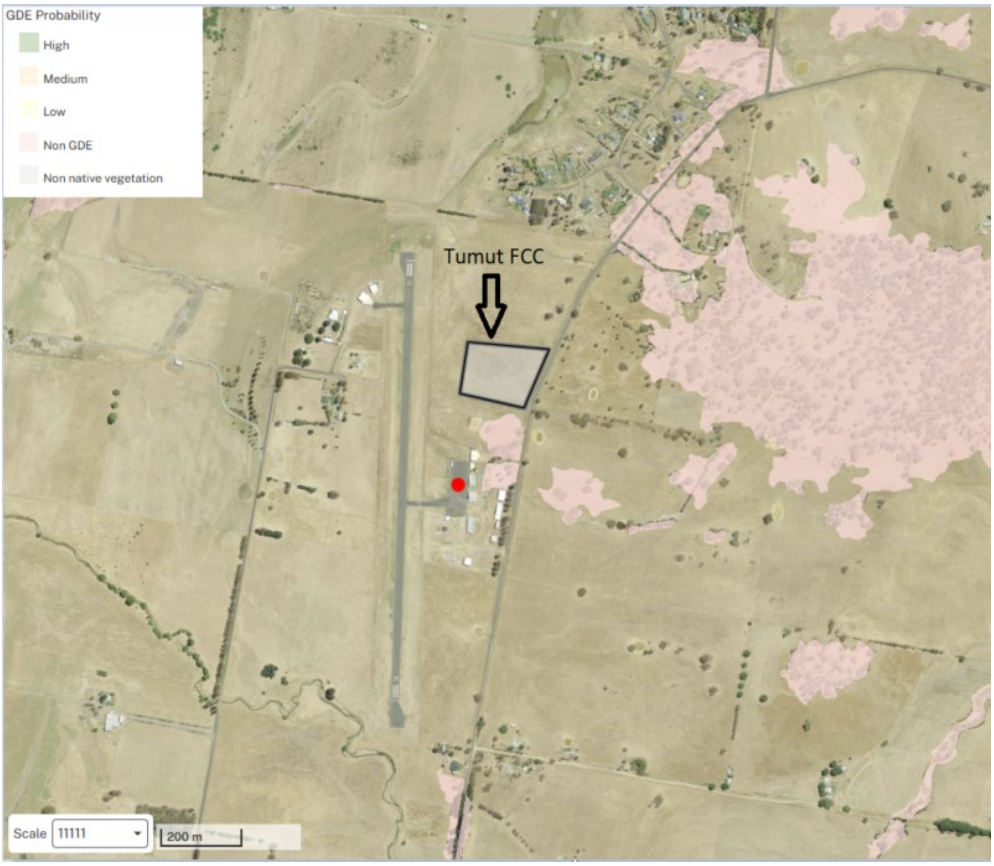


Figure 5-3: Groundwater dependant ecosystems

Source: The Central Resource for Sharing and Enabling Environmental Data (SEED) in NSW, March 2025

Table 5-1: Matters relating to groundwater vulnerability to be considered before determining the development application

Consideration	Impact Assessment	Mitigation Measures
(a) the likelihood of groundwater contamination from the development (including from any on-site storage or disposal of solid or liquid waste and chemicals),	The construction works would generate a waste stream including excavated materials, general construction waste, and some chemicals may be used and stored onsite such as oils and petrol. With the implementation of standard erosion and sediment control measures there would be no significant risk/impacts to groundwater. During operation of the hangar, any chemicals stored onsite would be contained within the hangar and would be stored as per the relevant industry codes.	Prepare and implement a site-specific Soil and Water Management Plan. This would incorporate sediment control measures which are appropriate for the site conditions and construction methodology in line with Landcom's *Managing Urban Stormwater, Soils & Construction Guidelines* (The Blue Book).

Consideration	Impact Assessment	Mitigation Measures
(b) any adverse impacts the development may have on groundwater dependent ecosystems,	The Groundwater Dependent Ecosystems – Probability mapping was referenced as per Figure 5-3. No groundwater dependant ecosystems were noted within the Proposal Site.	Nil
(c) the cumulative impact the development may have on groundwater (including impacts on nearby groundwater extraction for a potable water supply or stock water supply),	It is expected that the hangar would utilise a modest amount of water during construction and operation. Water would likely be sourced from licenced contractors during construction and during operation the site would be connected to the Tumut local water supply.	Nil
(d) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.	Relevant mitigation measures are noted for consideration (a)	N/A, refer to consideration (a)

5.4.3 Clause 6.9 Airspace Operations

The clause includes the following objectives:

(a) to provide for the effective and ongoing operation of the Tumut Airport by ensuring that such operation is not compromised by proposed development that penetrates the Limitation or Operations Surface for that airport,

(b) to protect the community from undue risk from that operation.

A Windshear Assessment Report has been undertaken by Aviation Projects and is attached as Appendix E. The assessment concluded that windshear and turbulence levels for Tumut Aerodrome's runway are not expected to be materially affected by the proposed helicopter hangar for crosswinds below 55 knots. It was considered that during crosswinds of 55 knots or above the runway would unlikely be in use.

5.4.4 Clause 6.11 Essential Services

The clause provides that consent should not be granted unless SVC is satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required—

(a) the supply of water,

(b) the supply of electricity,

(c) the disposal and management of sewage,

(d) stormwater drainage or on-site conservation,

(e) suitable vehicular access.

The design of the hangar, as a component of the FCC, would provide for the required essential services. The Proposal Site would be connected to the local electrical grid as well as water. Final water drainage works would be indicated in the detailed designs for the FCC, which would also include the final design of the new access to come off Wee Jasper Road.

Sewage would be managed through an effluent disposal systems. An Effluent Disposal System Septic Design is attached to this document as Appendix B.

5.5 Snowy Valleys Development Control Plan 2024

The Snowy Valleys Development Control Plan 2024 (DCP) provides detailed planning controls relevant to the site and the proposal. An assessment against the relevant controls is provided in Table 5-2, which confirms that the proposal complies with the relevant provisions in the DCP.

Table 5-2: DCP Compliance Assessment

Control	Compliance
3.2.1 Vehicle Access Standards	Vehicle access would be provided as shown in the plan in Appendix A. Detailed assessment has not been undertaken as the number of vehicles accessing the site would be limited to a small number during the construction period, followed by up to 7 light vehicles accessing the site on a daily basis. Given the use of the site an approximate 90-degree sealed tie in to Wee Japer Road is considered appropriate to facilitate site access. Due to the lack of significant roadside vegetation, sight distances in both directions have been assumed to be adequate.
3.2.2 Bushfire	The site includes area mapped as Bushfire Prone Land. A bushfire assessment has been undertaken which considers the NSW Rural Fire Service (RFS) *Planning for Bushfire Protection Guidelines* and AS3959 (refer to Appendix B).
3.2.3 Car Parking	The design for the hangar incorporates parking for 7 vehicles, including accessible parking. The proposed helicopter crew would be up to 5 people but would typically comprise 3-4 crew members. Therefore the parking provided is considered sufficient for the proposed use of the facility, with no more than 5 spaces required for typical operational activities (excluding visitors).
3.2.4 Construction Over Council Land and Services	The Tumut Aerodrome is owned by SVC. Approval from SVC would be sought prior to connection/disturbance to any Council owned and managed facilities. A dial before you dig search would be undertaken prior to construction. If any services are identified by the search then a detailed service location survey would be undertaken. Public access to the site would be strictly prohibited due to its location within the secure Tumut Aerodrome site, and as such the Proposal does not pose a risk to the public or interrupt any existing public movements.
3.2.5 Contaminated Land	Section 3.1 of this SEE notes that the site has historically been used for some livestock operations until 2025 when construction of the aerodrome upgrade commenced. A search of the Environment Protection Agency (EPA) Section 58 and 60 contaminated site registers on 31 March 2025 did not return any results for the suburb of Bombowlee.

Control	Compliance
	Work completed on adjacent land for the aerodrome upgrade REF did not find evidence of existing contamination (The environmental factor , 2024). The hangar site is located in an adjacent area with the same history of landuse as the area assessed in the aerodrome upgrade REF. Therefore it is considered reasonable to assume there is no existing contamination risk present onsite. The CEMP would include incorporate a pollution incident response management plan that defines appropriate procedures for notification of pollution incidents to the required authorities in accordance with s. 147 to 153 of the POEO Act and requires response actions to be implemented in order to address any risks such as incidents posed to the environment, property or surrounding communities.
3.2.6 Cut and Fill	Given the relatively flat nature of the site, the development is not anticipated to exceed the maximum level of cut of 1.0 metre below the existing ground level and the maximum level of fill is not likely to exceed 1.0 metre above existing ground level. The amount of cut and fill required, if any, would be confirmed as part of the detailed design process.
3.2.7 Demolition	The Proposal would not require any demolition works.
3.2.8 Development Near Electrical Easements	There are no high voltage electricity transmission easements within proximity of the Proposal based on data available from NSW Six Maps Clip & Ship. The Development would require electrical connection. This would be discussed with the relevant service provider and secured during site commissioning.
3.2.9 Erosion and Sediment Control	The Requirements of the DCP in relation to erosion and sediment control would be considered in an Erosion and Sediment Control Plan (ESCP) (refer to Section 5.4.2).
3.2.10 Flooding	The Proposal Site is not located within the Flood Planning Area under the Tumut LEP but is located within alluvial soils which may be subject to flooding (refer to Figure 5-4). The hangar would be designed to the 1% Annual Exceedance Probability with an additional 500mm freeboard.
3.2.11 Heritage	A search of the State Heritage Inventory and the Australian Heritage Database on 31 March 2025 indicated that there are no items of heritage significance within proximity to the site.

Control	Compliance
3.2.12 Landscaping	No specific landscaping is proposed as part of the hangar development. A general set out is included in the design plans (see Appendix A) showing that the land impacted by the Proposal would be reseeded to reinstate groundcover following construction.
3.2.13 On-site Wastewater Management	During construction activities, site wastes including effluent would be managed by the construction contractor/s, through the use of temporary amenities. During operation the hangar would be connected to an effluent management system. An Effluent Disposal System Septic Design has been completed by ASCT and attached as Appendix B. The design is supported by a geotechnical investigation attached as Appendix C. The effluent system is designed to accommodate 9-10 people, with the hangar planned to house up to five regular staff.
3.2.14.1 Sewerage	As above, the sewage at the hangar would be managed by a septic system, designed in accordance with the Effluent Disposal System Septic Design in Appendix B.
3.2.14.2 Water supply	The Proposal would not connect to the Council mains supply. Water would be supplied via onsite water tanks.
3.2.14.3 Electricity	The Proposal Site would be connected to the grid, with the connection details to be negotiated with the service provider.
3.2.14.4 Telecommunications	Arrangements would be made to provide the site with the required telecommunications infrastructure.
3.2.15 Retaining Walls	It is not expected that the Proposal would require a retaining wall above 600mm.
3.2.16 Safer By Design	As the hangar forms a small component of the broader FCC within the Tumut Aerodrome, a crime risk assessment has not been considered necessary.
3.2.17 Stormwater/roof Water Management	The hangar would include appropriate gutting and drainage features. The overall storm water layout would be included as a part of the detailed designs in a separate DA for the FCC.

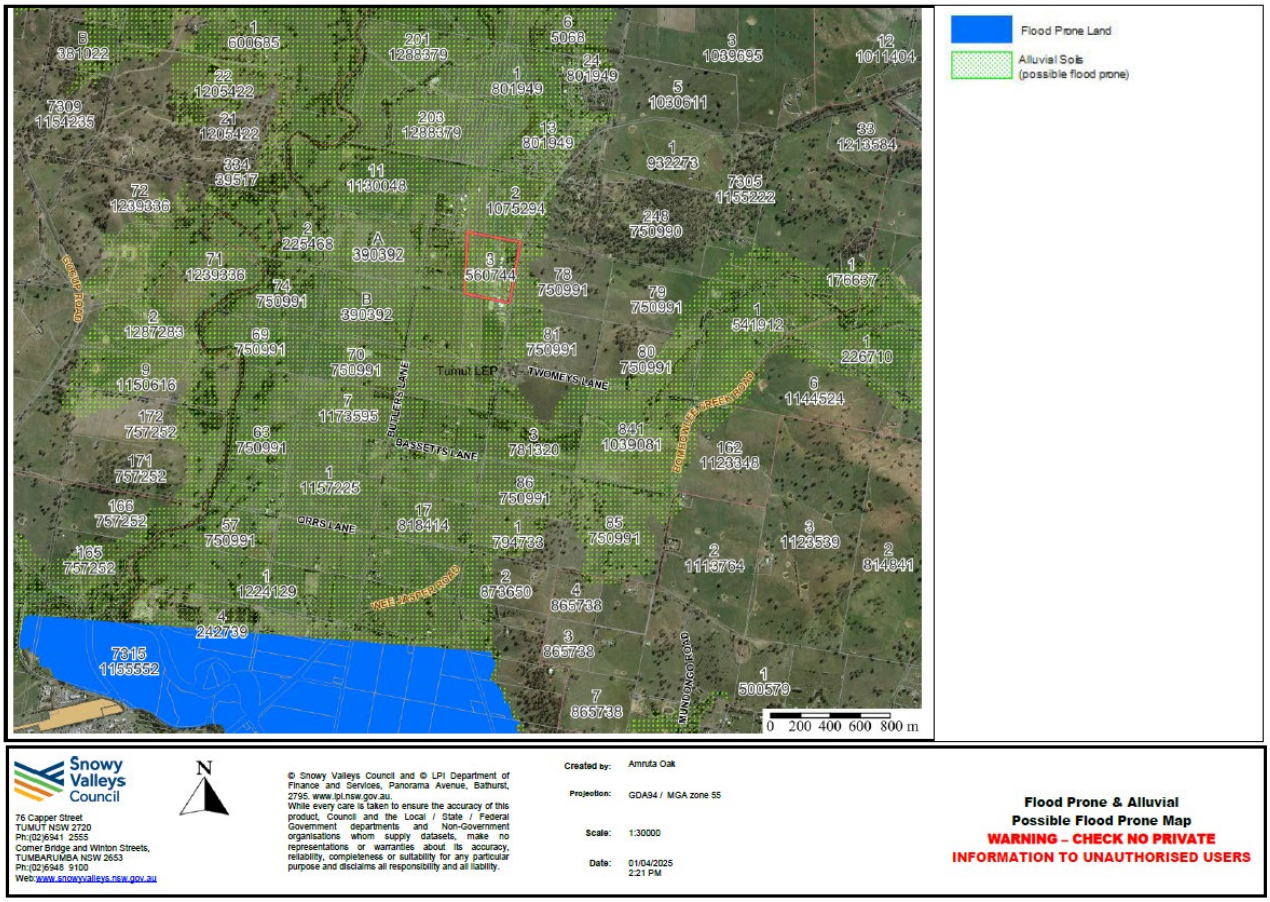


Figure 5-4 Flood Prone Land (Proposal site outlined in red)

Source: Snowy Valleys Council 2025

6. Conclusion and Recommendations

6.1 Environmental Planning Instruments – Section 4.15 (a)

The provisions of relevant environmental planning instruments relating to the Proposal are provided in this SEE and have been satisfactorily addressed.

6.2 Impacts of the Development – Section 4.15 (b)

The proposed development has been assessed considering the potential environmental, economic and social impacts as outlined below:

- Natural Environment: The proposed development will not result in any impacts on the natural environment, including on the land under the building or on the existing street trees in the public domain.
- Built Environment: The proposed works will not result in any adverse impacts to any listed heritage item.
- Social: No adverse social impacts. The proposed works would contribute to more affective fire emergency response in the region.
- Economic: No adverse economic impacts. The proposal will employ workers across a range of disciplines which will result in positive economic impacts.

6.3 Suitability of the Site – Section 4.15 (c)

In accordance with s4.15(1)(c) of the EP&A Act 1979, the site is considered highly suitable for the proposed development for the following reasons:

- The proposed works comply with relevant State- and local-level planning instruments and guidelines.
- The proposed works are assessed as not generating any adverse impacts on the biodiversity of the site and will not result in any long-term significant impact on the surrounding terrestrial and aquatic environment if the recommended mitigation measures within this SEE are applied.
- The proposal will enable the long-term use of the site for aeronautical purposes in an area which is already assigned to the SP2 Infrastructure (airport) zoning.

6.4 The Public Interest – Section 4.15 (d)

The proposed development is considered to be in the public interest for the following reasons:

- The proposal is consistent with relevant local strategic plans and fully complies with the relevant local planning controls.
- No adverse environmental, social or economic impacts will result from the proposal.
- The proposal will enable enhanced fire emergency response.

6.5 Recommendations

This SEE has been prepared to meet the requirements of Section 4.15 (1) of the Act, which require a consent authority to take into consideration a number of matters as relevant to the development. Based on the assessment of planning & environmental issues in the above report, it is concluded that development of the site in the manner proposed is considered to be acceptable and is worthy of the support of the Council.

7. References

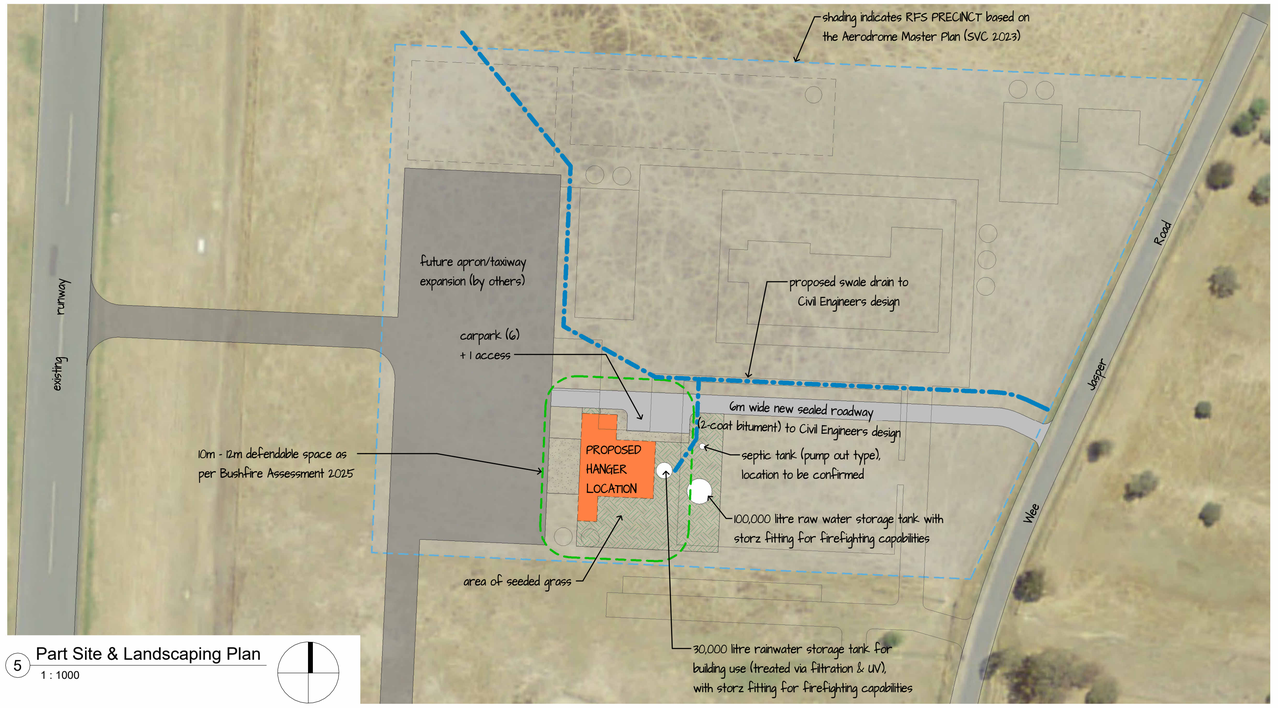
Aviation Projects. (2023). *Aerodrome Master Plan 2023 TUMUT AERODROME.*

EPA. (2014). *Waste Classification Guidelines Part 1: Classifying Waste .*

EPA. (2016). *Addendum to the Waste Classification Guidelines (2014) – Part 1: classifying waste .*

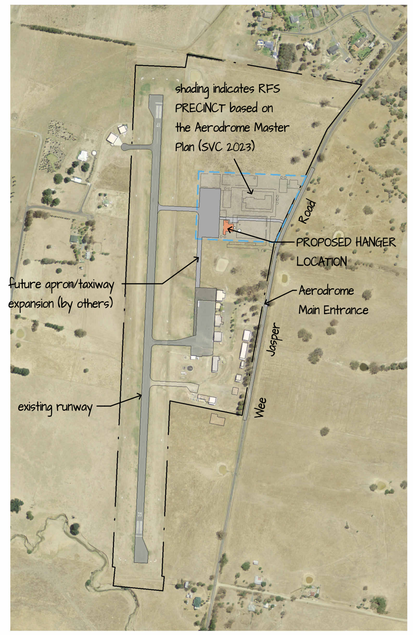
The environmental factor . (2024). *Tumut Aerodrome Upgrade REF.*

Appendix A Plans

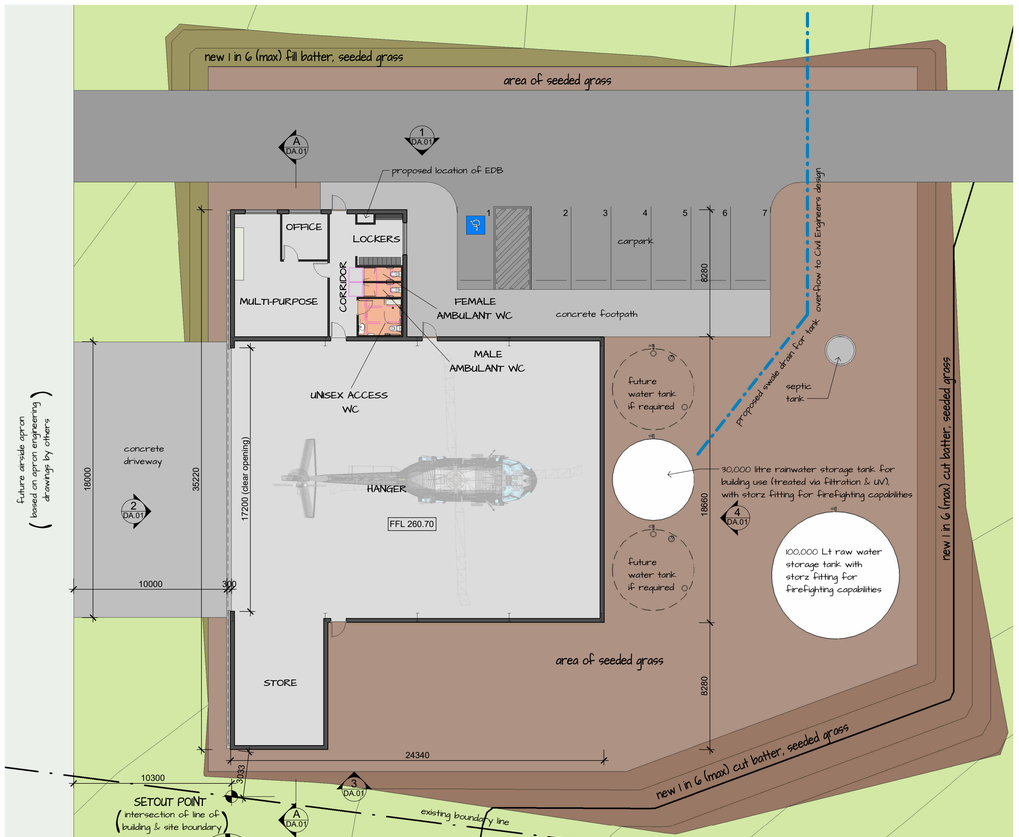


5 Part Site & Landscaping Plan
1 : 1000

Notes:
- refer to Bushfire Assessment (Peterson Bushfire 2025)
- new building to be constructed to BAL-29 requirements of AS3959-2018.



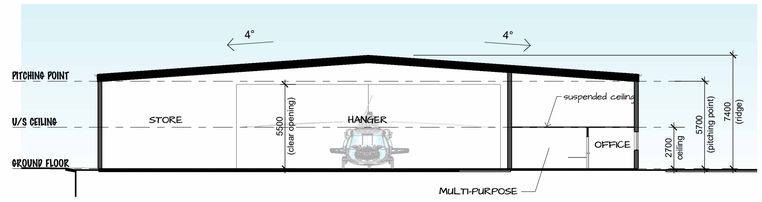
. Locality Plan
1 : 7500



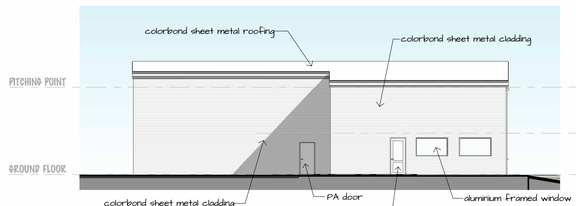
- Floor Plan
1 : 200

Plotted: 25/06/2025 4:29:10 PM

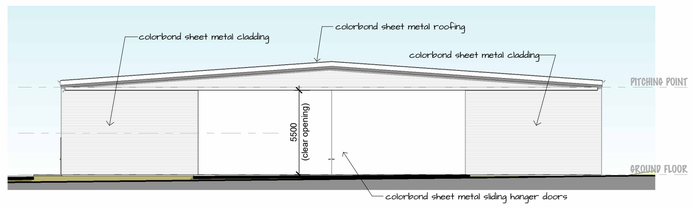
External colour scheme
Roof: colorbond "shale grey"
Walls: colorbond "dune"



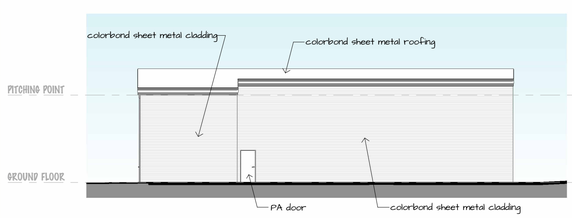
A Typical Section
1 : 200



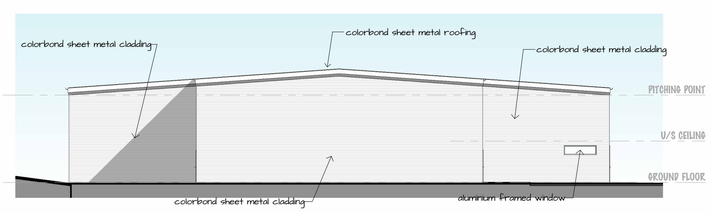
1 North Elevation
1 : 200



2 West Elevation
1 : 200



3 South Elevation
1 : 200



4 East Elevation
1 : 200

PRELIMINARY

2 0 2 4 6 8 10m
1:200

HavenhandMather ARCHITECTS PLANNERS
Member Australian Institute of Architects
Havenhand & Mather Architects Pty Ltd
02 6331 7155
PO Box 208, Bathurst 2795
mail@havenhandmather.com.au
Architects Registration Board: 6799

Aviation Hangar Tumut Airport

TUMUT AERODROME, WEE JASPER ROAD, TUMUT NSW
NSW Public Works

DEVELOPMENT APPLICATION
Locality Plan, Part Site Plan, Floor Plan & Elevations

JOB No. : 2510
SCALE : As indicated @A1
DATE : 25.06.2025
DRAWN : CJG
CHECKED : DFM

DA.01

Appendix B Effluent Disposal Plan

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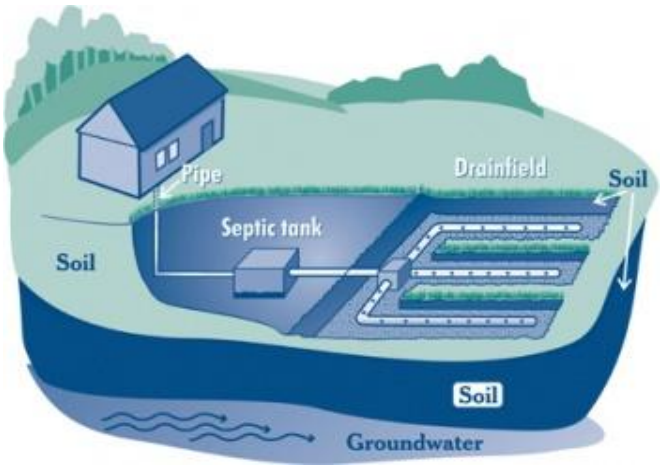

Effluent Disposal System

Septic Design

Prepared by ASCT – Coffs Coast office, for NSW Public Works.

SUBJECT SITE

405 Wee Jasper Road,
Bombowlee, NSW 2720.

ASCT Reference
H25-516-ESD.

Coffs Coast Laboratory
17 June Street, Coffs Harbour NSW 2450
(02) 6649 1172
coffs.coast@asct.com.au

26th June 2025

NSW Public Works

Riverina
Western Region

To whom it may concern,

Re: Proposed land capability assessment and effluent design for Industrial Airplane Hanger Development at 405 Wee Jasper Road, Bombowlee, NSW 2720.

Australian Soil and Concrete Testing (ASCT) is pleased to present the completed report for Effluent Disposal System design, in response to your request. As per your commission, ASCT was tasked with investigation works appropriate to classification of the site in accordance with Australian Standard AS 1547:2012 – On site Domestic Wastewater Management, and associated parameters requisite to the proper design & construction of Effluent Disposal system.

Details of our investigation process, the findings and results are contained within the body of this report. However, please find below a summation of the investigation results:

Field Test Depth	0.0 – 1.5m
Design loading rate & Land application area for trenches (AS 1547) (Water Balance Calculation)	DLR = 5mm/day LAA = 140.5m^2 Combined LAA & Reserve Area = 281.0m^2
Design loading rate & Land application area for beds (AS 1547) (Water Balance Calculation) Option No.1	DLR = 5mm/day LAA = 142.5m^2 Combined LAA & Reserve Area = 285.0m^2
Design loading rate & Land application area for wide beds (AS 1547) (Water Balance Calculation) Option No.2	DLR = 5mm/day LAA = 142.5m^2 Combined LAA & Reserve Area = 285.0m^2
Recommended Septic Tank minimum size	4500L
Design Irrigation rate & Land application area for AWTS (AS 1547) (Water Balance Calculation)	DIR = 3.0mm/day LAA = 313.2m^2 / Reserve Area = 313.2m^2
Recommended System (Client Preferred)	Aeriated Wastewater Treatment System to a Pump-out System (Collection well

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	minimum of 8400L). (**See Section 6.0 – Site problems for detail**)

Introduction & Project Understanding

It is purpose of this investigation to assess for the suitability of an onsite treated effluent disposal system at 405 Wee Jasper Road, Bombowlee, NSW 2720.

It is our understanding that a land capability assessment is required, and septic system is proposed for the site. Accurate information regarding the 'footprint' of the proposed structure was available at the time of investigation.

Information, including anecdotal evidence, provided by our client has been accepted as accurate & complete, and incorporated into the investigation process as appropriate.

1.0 Desktop Study

ASCT maintains an extensive library of previous AS1547 & AS2870 classifications. This important resource is consulted with every ASCT site investigation, and appropriate information has been employed during this investigation.

Following information was obtained via Desktop review of site.

Soil Landscape References	Common Soil type in area is Sandy Clays	
	Ground Water Depth	Greater than 5m depth
	Drainage / Landform	Linear Planar
	Flood Hazard	Low
	Surface condition	Dry land, hard soil
	Soil Salinity	Low
	Erosion Hazard	Low
Underlying Geology [2]	Inspection of soil mapping for the area, *WAGGA WAGGA - Geological Series Sheet S 55-15 (1:250,000)*, predicts soils of the Qa – *Alluvial* origin.	
Ground Water Review	Large dam at a distance of 188m to the north-west, Tumut River at a distance of 1190m to the west.	

Refer to:

1. Bureau of meteorological online climate Data Website.
2. https://minview.geoscience.nsw.gov.au/

3. https://www.olg.nsw.gov.au/wp-content/uploads/Easy-septic-guide.pdf.
4. https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address.
5. https://portal.spatial.nsw.gov.au/portal/apps/sites/#/homepage/pages/map-viewers

3.0 Field Work

Field work at the investigation site was conducted by an ASCT representative on the 3rd of April 2025

. These works included.

- Recording of all significant site features having, or potentially having, an effect on the site classification.
- Recording the location, and/or physical measurements, of certain significant features (e.g.: ASCT test drill test holes, Tree heights, Slopes, Structures, Bore well, natural water stream & any other residence.
- Digital photography.
- A determination of the field permeability on the site soils.
- Excavation and logging of one or more test holes.
- An assessment of groundwater conditions.
- The retrieval of one or more soil samples, for subsequent laboratory testing.

3.1 Site Description

The site as found by ASCT on the day of the field work is described below. Photo and a simple plan of the site are included in Appendix A.

The site is located within the grounds of the Tumut Aerodrome amidst gently terrain and bordering grazing paddocks. The proposed building location (PBL) slopes towards the north at 1-2%. The proposed land application area (LAA) is located to the north of the PBL with a linear planar downward slope to the west at 5%.

The sites surface is comprised of bare soil with a large topsoil stockpile covering most of the PBL

No outcropping of large boulders is evident within the site.

No trees or vegetation which could affect the sites normal moisture conditions were observed.

No significant water sources were observed within 100 meters.

At the time of investigation vehicle/drill rig access onto the site was easily achievable.

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3.2 Sub-Surface Profile

Detailed borehole logs, in accordance with AS 1547, are included in Appendix A.

In essence: the sub-surface profile consists of Fine Sandy Loam (FSL) overlain Sandy Clay (SC) and Silty Clay (SiC) through to the target investigation depth. The site exhibits soil stratum which ASCT have determined to be of natural origin.

The investigation results indicate that an essentially uniform sub-surface profile exists at the site.

3.3 Groundwater

No groundwater was encountered during the investigation fieldwork.

While it is impossible to accurately predict future levels in a complex groundwater system, especially in a limited investigation such as this, ASCT does not believe that groundwater will be an issue at this site.

4.0 Laboratory Work

During the fieldwork phase disturbed soil samples were retrieved from the boreholes at each horizon, samples were submitted to our NATA accredited ASCT Tumut facility for testing to help assess and design the required application area & system, all testing is conducted in accordance with Australian Standards.

5.0 Interpretation, Analysis & Design

Incorporating appropriate values from the laboratory tests, field work assessment & information from the Client, the Land Capability Rating is summarised below.

Land Features	Land Capability Rating					
General Characteristics	**Very Good (1)**	**Good (2)**	**Fair (3)**	**Poor (4)**	**Very Poor (5)**	Client's Site Results
Site Drainage /Runoff (Landform)	Very Slow	Slow	Moderate	Rapid	Very Rapid	**2**
Flood / Inundation Potential (Yearly Return Exceedances)	Never		<1 in 100	<1 in 20	>1 in 20	**2**
Slope (%)	0-2	2-8	8-12	12-20	>20	**2**

Landslip	No Info				Present or Past failure	**1**
Seasonal Water table Depth (m) (including Perched water table)	>5	5 - 2.5	2.5 – 2.0	2.0 – 1.5	<1.5	**2**
Rainfall (mm/Year)	<450	450-650	650 - 750	750 -1000	>1000	**4**
Pan Evaporation (mm/Yr.)	>1500	1250-1500	1000-1200	-	<1000	**1**
Soil Profile Characteristics						
Structure	High	Moderate	Weak	Massive	Single Grained	**3**
Profile Depth	>2	1.5-2m	-	1.5-1.0m	<1m	**4**
Percolation (mm/hr)	50-75	20-50 75-150	15-20 150-300	300-500	<15 >500	**2**
Stoniness (%)	<10		10-20	-	>20	**1**
Emerson Test	5&6	4	3	2	1	**3**

We have calculated the expected volume change associated with natural changes in soil moisture, and its effect at the surface of the soil profile. After reviewing the above results, the site material is classified as 'Category 5' (refer to AS 1547 :2012 Table 5.1).

5.1 Design

Average value of Permeability <0.06m/day on underlaying material considered from test results, allowing for a design loading rate for land application (DLR) = 5mm/day from AS1547:2012 Table L1.

Incorporating a non-standard 5-bedroom dwelling therefore allowing for required population equivalent, the design (allowing for 6 bedrooms or the population equivalent of 9-10 at a rate of 150L per person/day as per AS1547:2012 Table H2 All wastes), recommended minimum septic tank size of 4500L refer to AS 1547 :2012 Table J1).

The plumbing to the **"Land Application Area"** shall be provided with gravity functionality or mechanically pumped depending on the layout and requirements on each individual design, filter cloth should be installed to help minimise the contamination of the distribution or filter material with multiple inspection ports as required to ensure blockages and failures are noticed on all systems. when dose loading the absorption trench or bed with a percentage slope design of 5% with a maximum length of 20 meters is recommended for all conventional systems including the evapotranspiration or other variations to the standard conventional trench or bed systems.

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Standard Absorption Trench System (Source AS1547:2012)

TRENCHES	LENGTH	WIDTH	DEPTH	SPACING
13	18.0m	0.6m	0.55m	1.0m

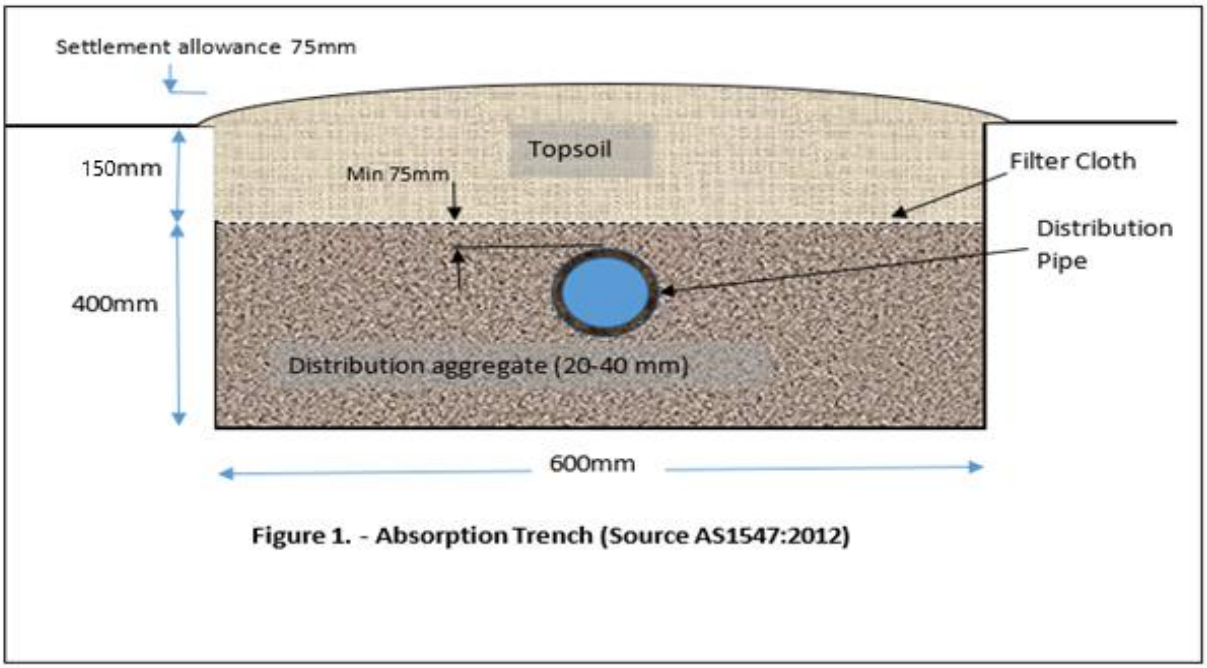

Figure 1. - Absorption Trench (Source AS1547:2012)

Standard Absorption Bed System (Source AS1547:2012) – Option 1

BEDS	LENGTH	WIDTH	DEPTH	SPACING
5	19.0m	1.5m	0.6m	1.0m

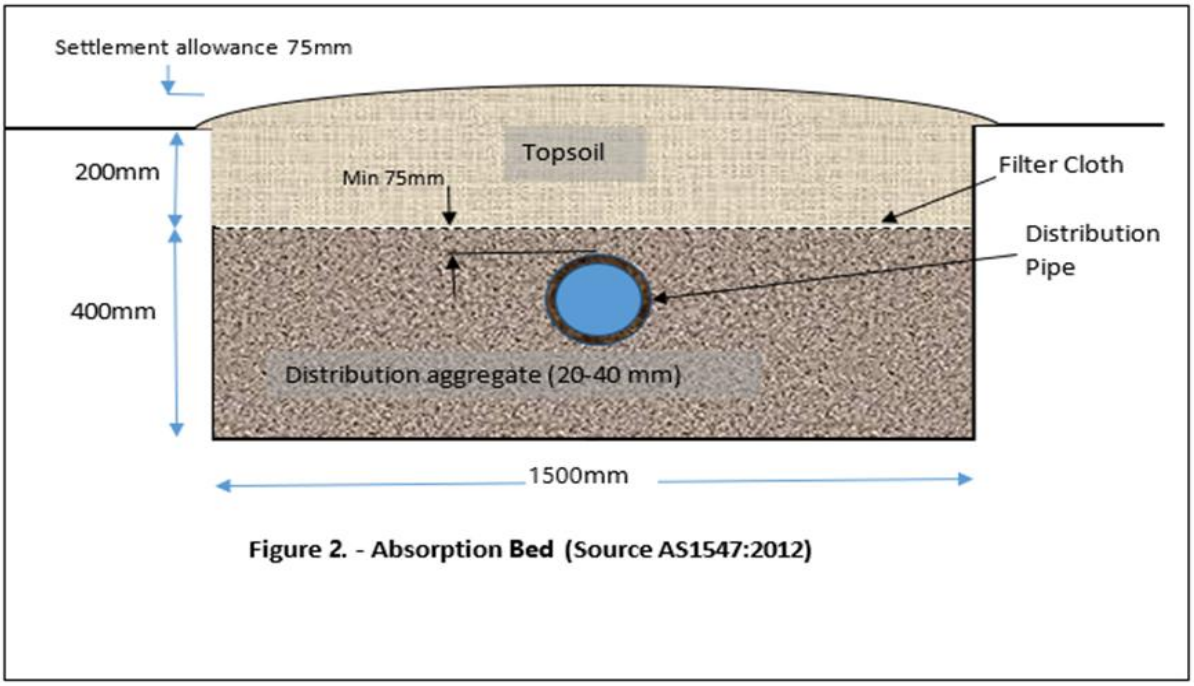

Figure 2. - Absorption Bed (Source AS1547:2012)

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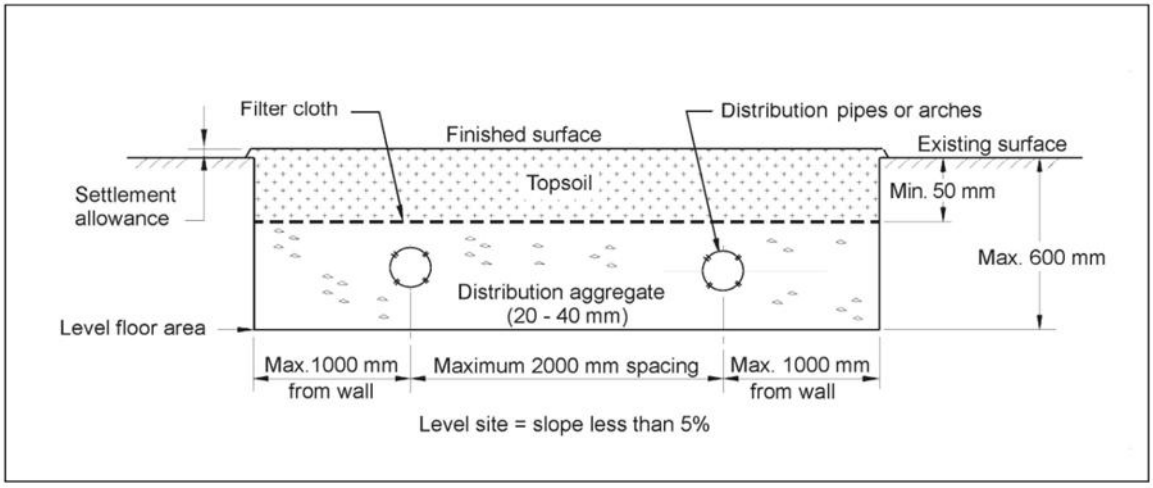
Standard Absorption Bed System (Source AS1547:2012) – Option 2 (Wide)

BEDS	LENGTH	WIDTH	DEPTH	SPACING
3	19.0m	2.5m	0.6m	1.0m



NOTE: LPED lines can be used instead of distribution pipes when dose loading effluent into beds.

FIGURE L5 CONVENTIONAL BED

Aeriated Wastewater Treatment System (Source AS1547:2012)

Aeriated wastewater treatment system (AWTS) size suitable for a non-standard 5-bedroom dwelling allowing for 6 bedrooms or the population equivalent of 9-10 at a rate of 150L/person/day as per AS1547:2012 Table H2 All wastes), allowing for a design irrigation rate for land application of subsurface irrigation (DIR) = 3.0mm/day as per the AS1547:2012 Table M1.

Based on the above data available & water balance analysis, the minimum subsurface irrigation area is recommended of 313.2m^2, providing the above design irrigation rate is not exceeded and assuming that on site planting will occur. That m^2 area should be set aside again for the reserve application area as per AS1547 requirements.

As per AS1547:2012 Table M1 notes for drip irrigation in category 1,2, and 6 soils to have a depth of 100-150mm, for category 3 to 5 soils to have a depth of 150-250mm in good quality topsoil to slow the soakage and assist with nutrient reduction. ASCT recommends that all irrigation system trenches are excavated to the maximum depth of 250mm and filled with a good quality topsoil material to help ensure the onsite wastewater managed within the boundaries of the site.

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Typical Sub-Surface Irrigation System

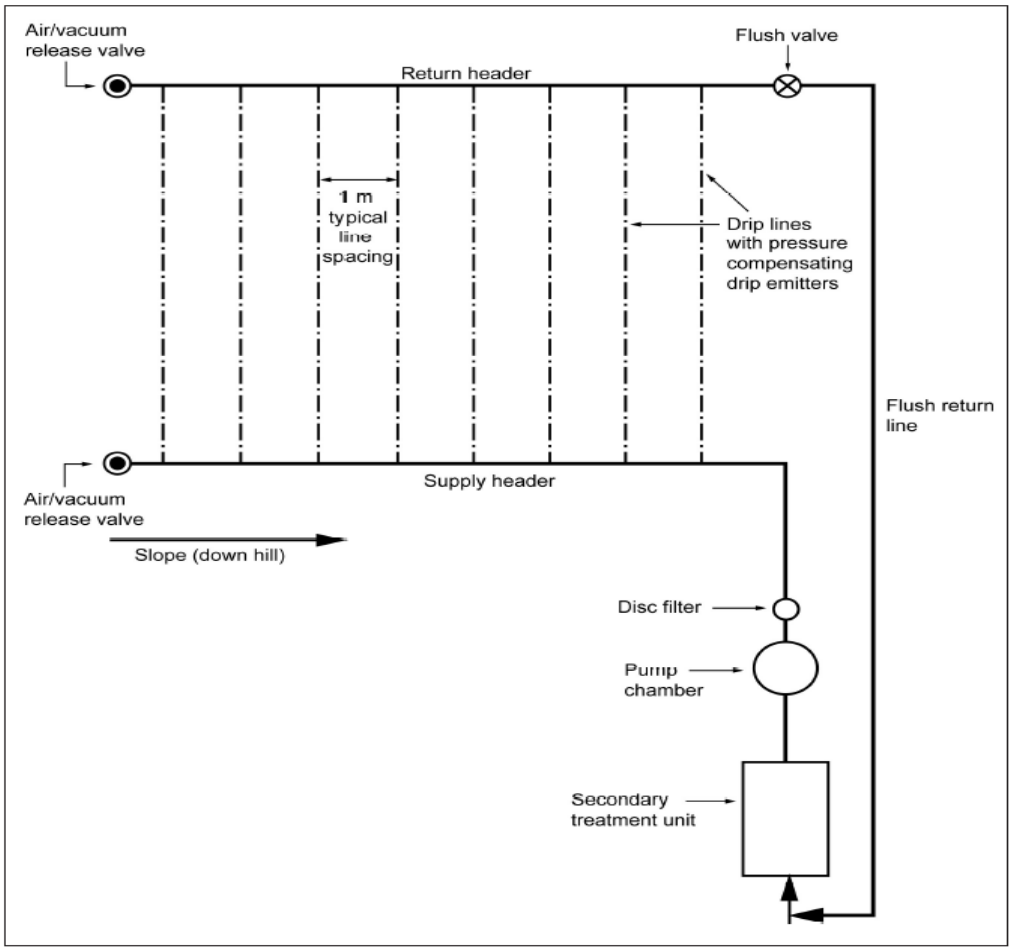

FIGURE M1 DRIP IRRIGATION SYSTEM – EXAMPLE LAYOUT OF COMPONENTS

Servicing and Maintenance Care

The AWTS systems have been designed to provide long-term, effective treatment of household sewage and wastewater. Just like your vehicle requires a service to run smoothly, correct operation and maintenance of the system will ensure it operates at peak performance.

No matter what wastewater treatment system you buy, you must comply with local Council regulations. These regulations require servicing of all on-site wastewater systems in accordance with manufacturer's specifications and that the work is to be undertaken by an accredited technician.

(Note: Some Councils require a minimum of two services per year regardless of the type of wastewater system).

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6.0 Site Problems

AS 1547 contains a list of potential problems that exclude or limit a site from being suitable for one or more of the 'Normal' On-site Domestic Wastewater Management systems.

ASCT found on the day of the field investigation the location for the proposed application area presented problems that as per the AS1547 and/or other requirement guidelines which could limit the onsite wastewater management systems we can use and the site preparations that will be required to ensure safe and efficient onsite wastewater management.

- Non-standard building to Pump-out System detail

The client, NSW public works has requested a pump out system for the new aircraft hangar development, although this is not a site problem it is slightly different to standard onsite wastewater management systems and is normally looked at for these industrial applications. This system will not be designed to the soil profile but rather the population equivalents and daily water loading rates.

The system to be installed will consist of the aeriated wastewater treatment system into a collection well of equal to 7-days of daily flow for a weekly pump out, this is quite large as for a 6-room dwelling the population equivalent is 9-10 @ DWR of 120L per person, it should be a minimum of 8400 litres which could be split into 2 tanks. Using the location provided as shown in appendix A and initially tested for onsite wastewater treatment capability there will be plenty of setback distance between the nearest structures and room provided for the pump out installation requirements.

I have left the below site problems and secondary design as a back up recommended installation if ever required.

- Groundwater Vulnerability
- Riparian Lands and Watercourses
- Horticultural Land

The site highlighted with above planning points on the NSW planning portal website, with the potential issue in mind the proposed application area is located approximately 188 meters from the nearest dam which flows through overland ephemeral waterways to the nearest environmentally significant area on the map being the Tumut River as shown in Appendix B, this distance is greater than the standard required setback distance of 100m set by AS1547 to the closest streams or ground water sources, this also will help keep it out of the surrounding horticultural lands.

Using tables R1 and R2 in Appendix R of the AS1547 document and considering the main factors of:

- Quality of effluent – lower constraint
- setback distance – lower to medium constraint
- Slope – lower constraint
- Application area position – lower constraint
- Drainage – lower constraint
- Flood potential – medium constraint
- Geology and Soils – lower constraint
- Application method – lower constraint

The current proposed LAA location is setback into and away from seasonal waterways on the property significantly enough to ensure there is no potential of wastewater effluent migrating off

site and/or into these sensitive areas with the overland flow access to the ephemeral gullies and waterways. It is also recommended to install an AWTS utilise the better soil profile within the 0.0 to 1.0m depth by relying less on the conventional absorption process by growing vigorous vegetation and therefore promoting loss through evapotranspiration and plant uptake for greater nutrient removal.

To ensure the potential of wastewater effluent travelling downslope and across the site and into the closest nearest water source or offsite, it is highly recommended that there is the installation of interceptor bunds upslope and drains downslope of the application area to divert and slow run-off during the wetter periods.

7.0 Responsibilities

Owners Responsibility details as per NSW Govt:

If your home is not connected to the sewer, you may have an on-site sewerage management system, such as a conventional septic tank, composting toilet, or secondary treated system.
There are special regulations that apply to these systems. As the owner of the property, it is the owner's responsibility to ensure that the system is approved by your local council and that it is working properly. On-site systems can be a risk to the health of your family and other community members if they are not properly maintained. They can also cause harm to the environment.
To ensure that your system meets the requirements, you will need to obtain two approvals from your local council.

- The first approval is to install the system.
- The second approval is to operate the system.

After you obtain these approvals, the council will carry out regular inspections to make sure the system is working properly. Councils can charge inspection fees for this service.
If you have any questions about the on-site sewerage system requirements, your local council can help, or consult the Guidelines for onsite wastewater management found on the NSW website.
We have taken every care to be to accurate, complete & objective in the execution of your commission. Should you have any queries, or require further assistance, please do not hesitate to contact our office. This report is your intellectual property and we will not provide it to any 3rd party without your permission. May we also respectfully request that if you provide this report to others (e.g.: your builder): you provide it in its' entirety, to avoid any miscommunication.

Yours faithfully,

Luke Thompson

Laboratory Manager (CET – On-Site Wastewater Management)

Australian Soil & Concrete Testing Pty Ltd

LIMITATIONS OF GEOTECHNICAL SITE INVESTIGATION

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COMMISSION OF SERVICES

This Site assessment report ("The Effluent Design Report") has been prepared in accordance with the commission set out in the contract or quote, or as otherwise agreed between the Customer and Australian Soil & Concrete Testing P/L (ASCT). The commission may be limited by a range of factors such as time, cost, accessibility or site constraints and conditions.

RELIANCE ON INFORMATION PROVIDED

In preparing the report, ASCT has relied upon information provided, surveys, analyses, designs, plans and other documentation provided by the customer or other individuals and organisations, most of which are referred to in preparing the report. Except as otherwise stated in the report, ASCT has not verified the accuracy or completeness of the information provided to the extent that the statements, opinions, facts, information, conclusions and recommendations in the report are based in whole or in part on the information provided. The recommendations and conclusions are contingent upon the accuracy and completeness of the information provided. ASCT will not be liable in relation to incorrect conclusions should any information provided, or site condition be incorrect or have been concealed, withheld, misrepresented, or otherwise not fully disclosed to ASCT.

GEOTECHNICAL INVESTIGATION

Geotechnical site classification is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical lot classification reports are prepared to meet the specific needs of individuals. This report was prepared expressly for the Customer and expressly for the purposes indicated. Use by any other persons for any purpose or by the customer for a different purpose, may result in problems which ASCT cannot be responsible for. The Customer should not use this report for other than its intended purpose without seeking additional geotechnical advice.

THIS GEOTECHNICAL REPORT IS BASED ON SITE SPECIFIC FACTORS

This geotechnical report is based on a subsurface investigation which only identifies the conditions at the locations and time when the investigation was undertaken. Unless further geotechnical advice is obtained this geotechnical report cannot be used when the nature of the site is changed or when the proposed development is modified for the site.

This geotechnical report cannot be applied to an adjacent site. The Limitations of Geotechnical Site Investigation in assessing a site from a limited number of boreholes or test pits is the possibility that actual conditions may vary from those identified at the investigation locations. The Site investigation identifies specific subsurface conditions only at those points from which samples have been taken. The investigation programme undertaken is used to provide a general profile of the subsurface condition. The information obtained from the site investigation and subsequent laboratory testing is used to form a presumed opinion regarding the overall subsurface conditions and their likely behaviour regarding the proposed development. The borehole logs are the subjective interpretation of the limited site investigation and cannot always be definitive.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

A geotechnical report is based on conditions which existed at the time of site investigation. The subsurface conditions may change due to natural forces or man-made influences. Civil works at or adjacent to the site and natural events such as floods or groundwater fluctuations may also affect subsurface conditions and the relevance of the geotechnical report. The geotechnical report should therefore be regarded as preliminary and ASCT should be consulted if unexpected conditions are encountered to determine the impact on the recommendations of the report.

AVOID MISINTERPRETATION
The geotechnical report may be misinterpreted by other design professionals. ASCT should be retained to explain relevant geotechnical findings and to review the adequacy of plans and specifications and the implications to the report. The geotechnical report should be maintained as a whole and should not be copied, divided, or altered.

GEOTECHNICAL INVOLVEMENT DURING CONSTRUCTION
It is recommended that ASCT should be retained through the construction stage to confirm the actual subsurface conditions are consistent with the geotechnical report. If variations are encountered additional tests may be required to confirm conditions comply with the design specifications and advise on changes to the construction if required.

REPORT FOR BENEFIT OF CUSTOMER
The geotechnical report has been prepared for the benefit of the customer and no other party. ASCT assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusion expressed in the report. ASCT will not be responsible for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusion expressed in the report (including, without limitation, matters arising from any negligent act or omission of ASCT or any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy and completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

OTHER LIMITATIONS
ASCT will not be liable to update or revise the report to consider any events of emergent circumstances or facts occurring or becoming apparent after the date of the report.

APPENDIX A - Site Plans and Buffer Distances and Borehole Logs.

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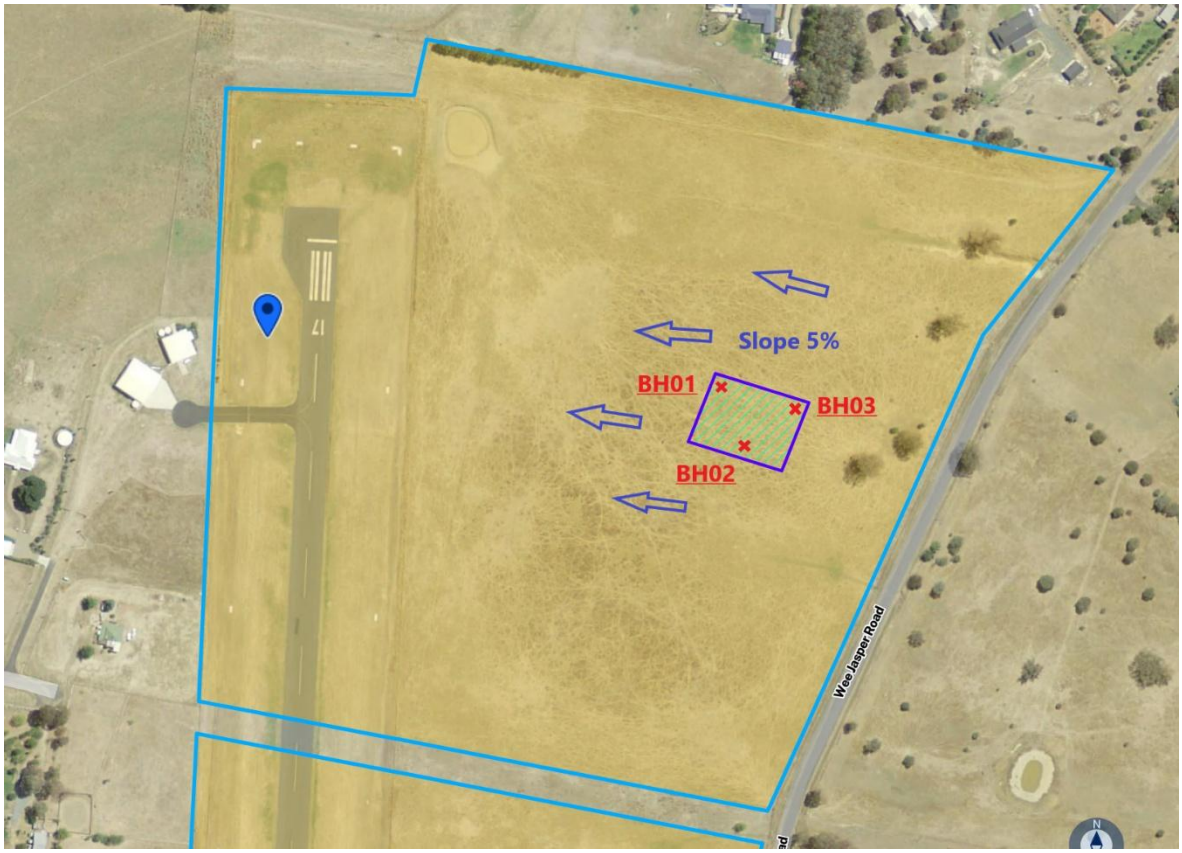
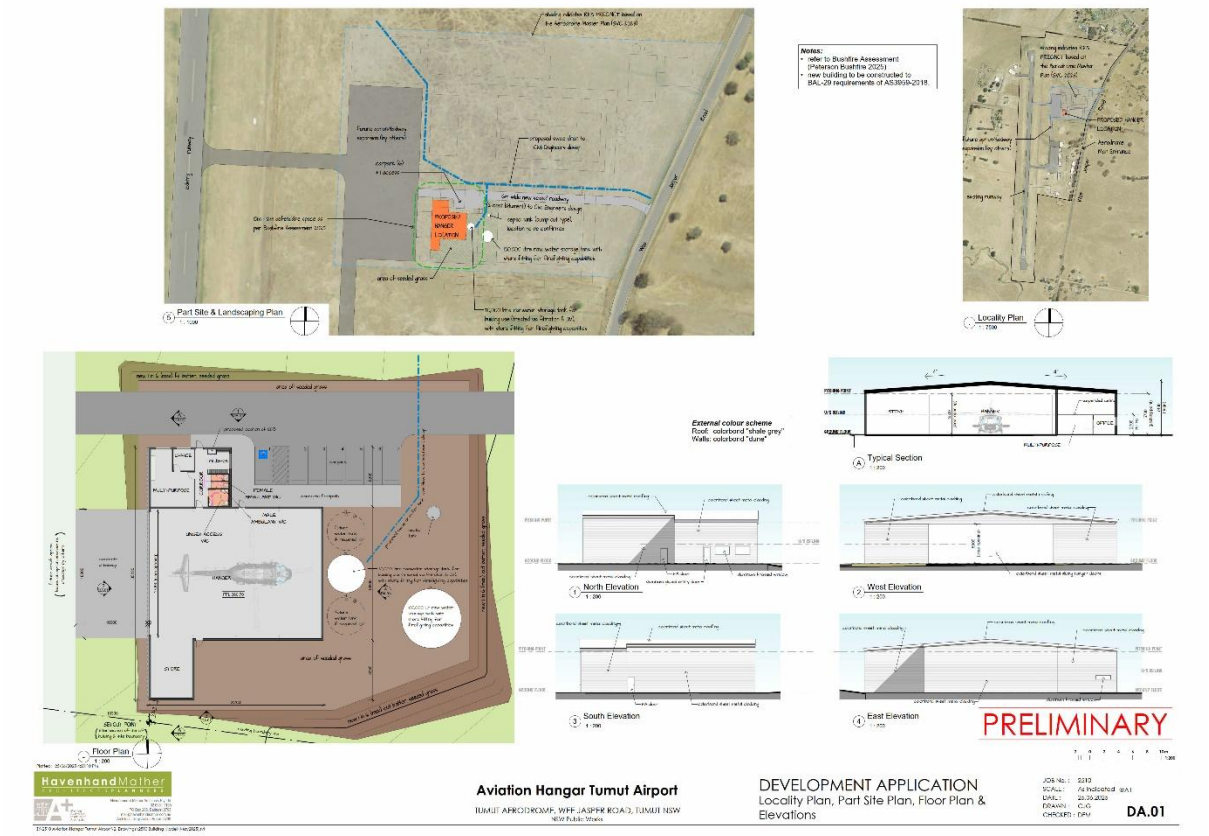
Photograph of the site with ASCT test locations and layout.



Draft design showing the location of the hangar and the proposed treatment field.



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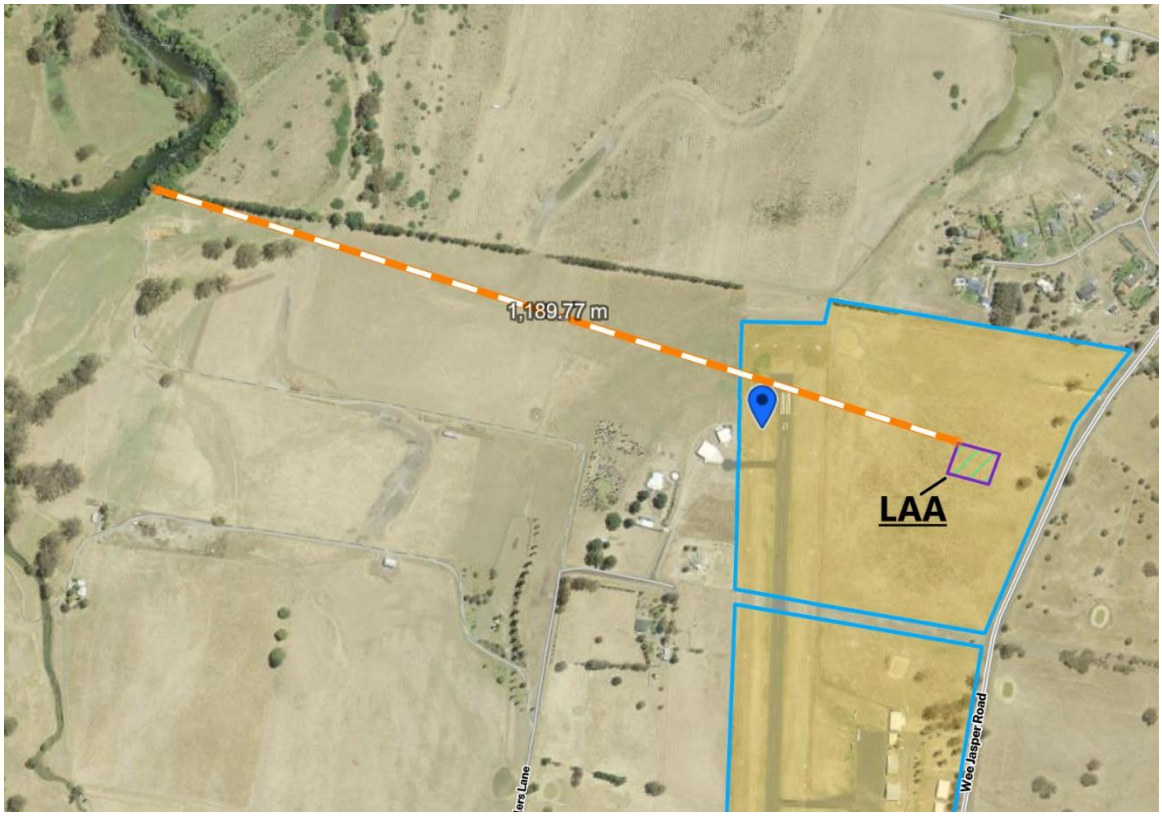
NSW SDT Explorer overhead Photo of the site showing the distance to closest water source (dam).

NSW SDT Explorer overhead Photo of the site showing the distance to closest groundwater source (Tumut River).



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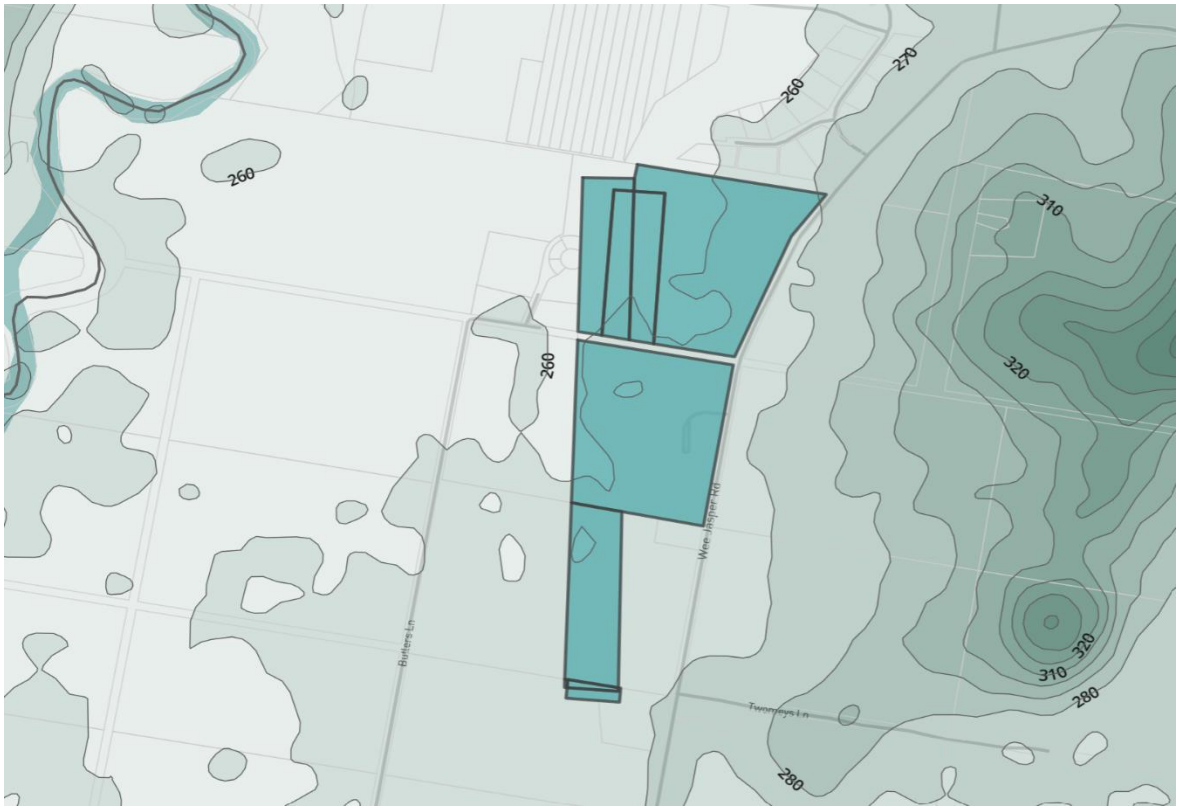
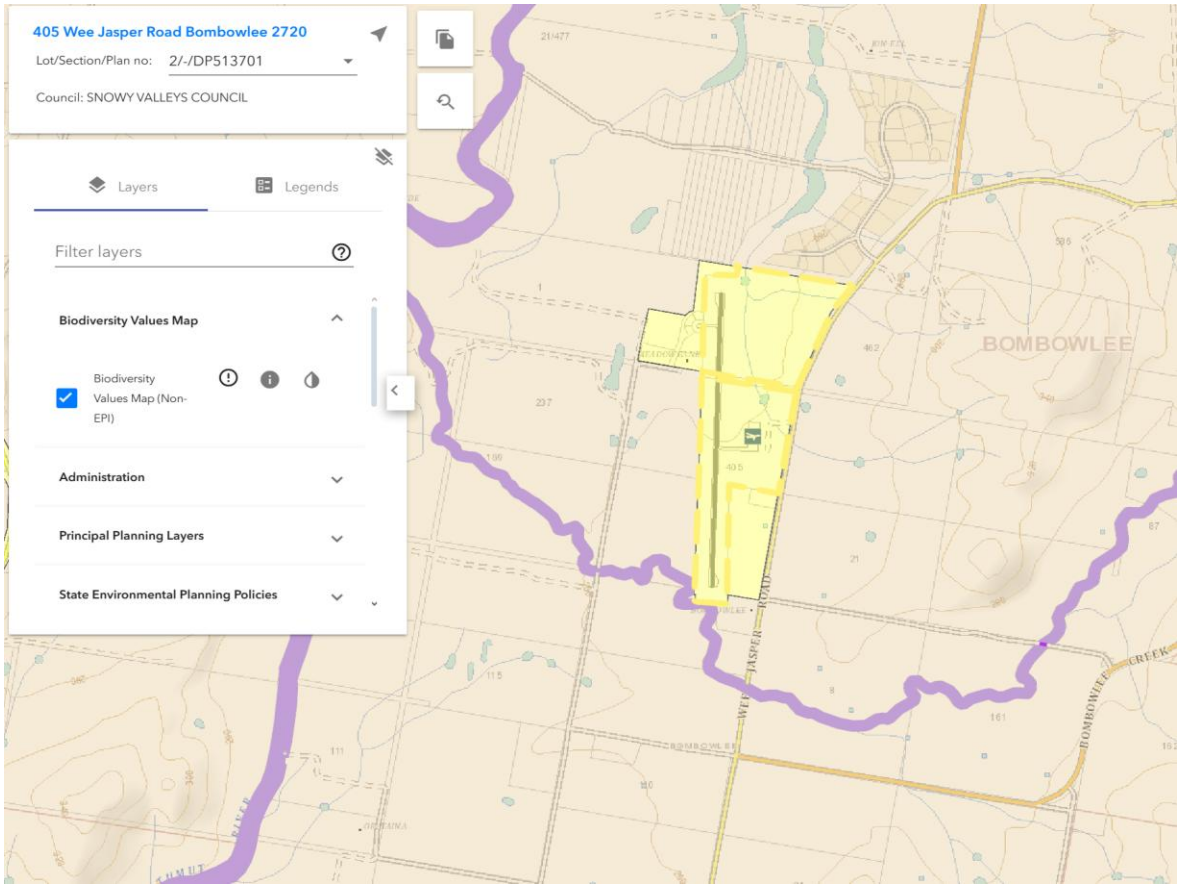
Archistar overhead plan showing the contours throughout the site.



NSW planning portal overhead plan showing the biodiversity value area throughout the lot.



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NSW flood imagery viewer overhead plan showing the flood planning area throughout the lot.

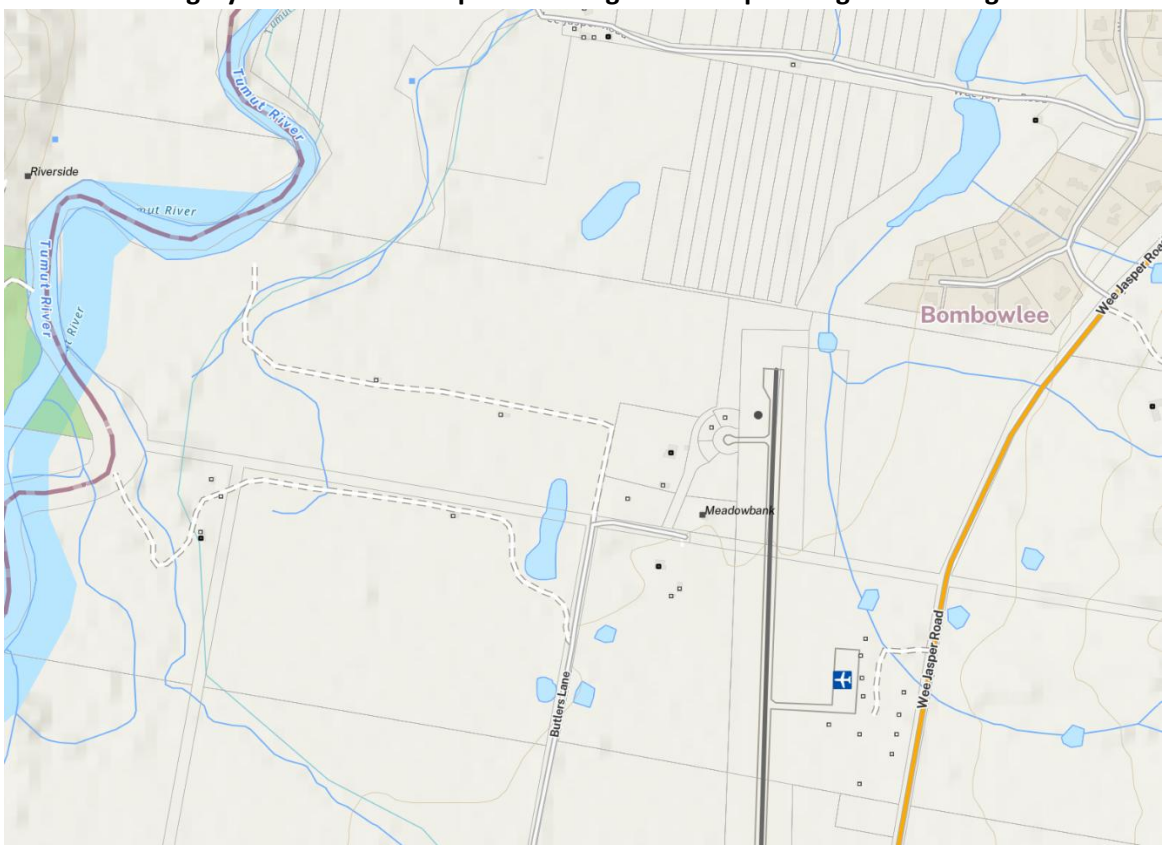
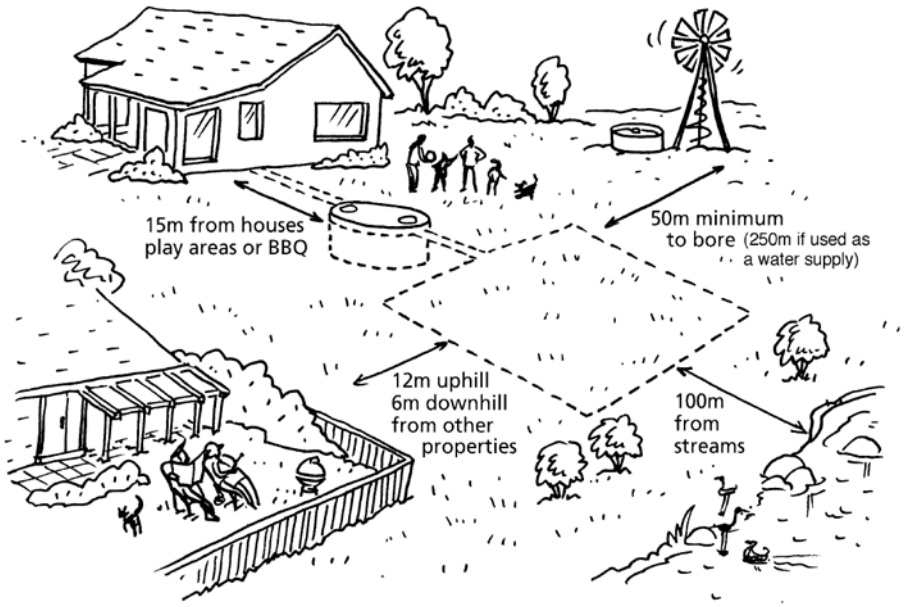


Illustration with standard recommended setback distances.



Groundwater is easily contaminated. Make sure your septic system is located a safe distance from wells, bores, creeks, lakes and houses.

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TEST HOLE LOG - BH 1

Client:	NSW Public Works	**ASCT Ref No:**	H25-516
Project:	405 Wee Jasper Road Bombowlee	**Sample Date:**	3/04/2025
Northing/Easting:	#N/A	**Sample Team:**	Alex
Surface Elevation:	Exisiting Surface, Australian Height Datum (AHD) =	**Sample Equipment:**	Spiral auger
Watertable Depth:	Unknown	**Sample Method:**	Disturbed
Lab Testing:	Denotes samples submitted to Lab for further testing.		

Depth	Symbol	Category	Soil Description
m		Table E1	AS 1547: Appendix E (Symbol, Category, Classification, Abundance, Size, Structure, Colour)
0.0			
0.1			
0.2	**FSL**	**2**	Fine Sandy Loam, few, fine gravel, moderate, brown.
0.3			
0.4			
0.5			
0.6	**SC**	**4**	Sandy Clay, few, fine gravel, weak, pale brown.
0.7			
0.8			
0.9			
1.0			
1.1			
1.2			
1.3	**SiC**	**5**	Silty Clay, very few, fine gravel, weak, pale brown.
1.4			
1.5			Terminated @ target depth

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TEST HOLE LOG - BH 2

Client:	NSW Public Works	**ASCT Ref No:**	H25-516
Project:	405 Wee Jasper Road Bombowlee	**Sample Date:**	3/04/2025
Northing/Easting:	#N/A	**Sample Team:**	Alex
Surface Elevation:	Exisiting Surface, Australian Height Datum (AHD) =	**Sample Equipment:**	Spiral auger
Watertable Depth:	Unknown	**Sample Method:**	Disturbed
Lab Testing:	Denotes samples submitted to Lab for further testing.		

Depth	Symbol	Category	Soil Description
m		Table E1	AS 1547: Appendix E (Symbol, Category, Classification, Abundance, Size, Structure, Colour)
0.0			
0.1			
0.2	**FSL**	**2**	Fine Sandy Loam, few, fine gravel, moderate, brown.
0.3			
0.4			
0.5			
0.6			
0.7	**SC**	**4**	Sandy Clay, few, fine gravel, weak, pale brown.
0.8			
0.9			
1.0			
1.1			
1.2			
1.3	**SiC**	**5**	Silty Clay, very few, fine gravel, weak, pale brown.
1.4			
1.5			Terminated @ target depth

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TEST HOLE LOG - BH 3

Client:	NSW Public Works	**ASCT Ref No:**	H25-516
Project:	405 Wee Jasper Road Bombowlee	**Sample Date:**	3/04/2025
Northing/Easting:	#N/A	**Sample Team:**	Alex
Surface Elevation:	Exisiting Surface, Australian Height Datum (AHD) =	**Sample Equipment:**	Spiral auger
Watertable Depth:	Unknown	**Sample Method:**	Disturbed
Lab Testing:	Denotes samples submitted to Lab for further testing.		

Depth	Symbol	Category	Soil Description
m		Table E1	AS 1547: Appendix E (Symbol, Category, Classification, Abundance, Size, Structure, Colour)
0.0			
0.1			
0.2	**FSL**	**2**	Fine Sandy Loam, few, fine gravel, moderate, brown.
0.3			
0.4			
0.5			
0.6			
0.7	**SC**	**4**	Sandy Clay, few, fine gravel, weak, pale brown.
0.8			
0.9			
1.0			
1.1			
1.2			
1.3	**SiC**	**5**	Silty Clay, very few, fine gravel, weak, pale brown.
1.4			
1.5			Terminated @ targeted depth

APPENDIX B – Design Data & Property Report.

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Trench Design Calculations

Water Balance Calculation=

Client Address:	405 Wee Jasper Road Bombowlee				Project No:	H25-516							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Month	Days	Pan Evap E(mm)	Evapotranspiration Et= (% of E)	Median Rain fall R (mm)	Retained Rainfall (% of R) (mm)	DLR per month (mm)	Disposal Rate Per month (mm)	Effluent Applied per month (L)	Design Area = m^2	Proposed area m^2	new Disposal Capacity=	Difference (mm)	Bed depth used (mm)	Actual Depth used (mm)
Jan	31	248.0	186.0	50.9	38.2	155	302.83	27900	92.13	140.4	198.7	-104.1	0.00	198.7
Feb	28	235.0	176.3	34.9	26.2	140	290.08	25200	86.87	140.4	179.5	-110.6	0.00	179.5
Mar	31	191.0	143.3	52.6	39.5	155	258.80	27900	107.81	140.4	198.7	-60.1	0.00	198.7
Apr	30	101.0	75.8	44.7	33.5	150	192.23	27000	140.46	140.4	192.3	0.1	0.08	192.4
May	31	72.0	54.0	73.2	54.9	155	154.10	27900	181.05	140.4	198.7	44.6	44.62	243.4
Jun	30	45.0	33.8	86.0	64.5	150	119.25	27000	226.42	140.4	192.3	73.1	73.06	310.0
Jul	31	52.0	39.0	97.0	72.8	155	121.25	27900	230.10	140.4	198.7	77.5	77.47	349.2
Aug	31	85.0	63.8	104.6	78.5	155	140.30	27900	198.86	140.4	198.7	58.4	58.42	334.6
Sep	30	123.0	92.3	82.2	61.7	150	180.60	27000	149.50	140.4	192.3	11.7	11.71	262.4
Oct	31	194.0	145.5	86.4	64.8	155	235.70	27900	118.37	140.4	198.7	-37.0	0.00	210.4
Nov	30	219.0	164.3	75.2	56.4	150	257.85	27000	104.71	140.4	192.3	-65.5	0.00	192.3
Dec	31	295.0	221.3	64.8	48.6	155	327.65	27900	85.15	140.4	198.7	-128.9	0.00	198.7
		1860		852.5	Max Area	230.10	m^2	Mean Area	143.45	m^2	Max depth used (mm)			349.2
Trial Bed length=	18	m	0.6	m	No. of Trenches	13	Trial area=	140.4	m^2	Total Bed Area== (Q)/(R x W)				
Allowable Stored Effluent Depth Max (mm)=			350	Depth used	349.2	mm	F.O.S=	1.0	(F.O.S.)>1 needed					
System Plot Area=		20	x	9.8										
Design Conclusions									Strips Spacing=1m Edge to edge					
Design System	Trenches	Trench Dimension	L=	18	W=	0.6	D=	60 cm	No Of Strips=	13	Layers=	2		

Bed Design Calculations (Option No.1)

Water Balance Calculation=

Client Address:	405 Wee Jasper Road Bombowlee				Project No:	H25-516							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Month	Days	Pan Evap E(mm)	Evapotranspiration Et= (% of E)	Median Rain fall R (mm)	Retained Rainfall (% of R) (mm)	DLR per month (mm)	Total Disposal (mm)=	Effluent Applied per month (L)	Design Area = m^2	Proposed area m^2	new Disposal Capacity=	Difference (mm)	Bed depth used (mm)	Actual Depth used (mm)
Jan	31	248.0	186.0	50.9	38.2	155	302.8	27900	92.13	142.5	195.8	-107.0	0.00	195.8
Feb	28	235.0	176.3	34.9	26.2	140	290.1	25200	86.87	142.5	176.8	-113.2	0.00	176.8
Mar	31	191.0	143.3	52.6	39.5	155	258.8	27900	107.81	142.5	195.8	-63.0	0.00	195.8
Apr	30	101.0	75.8	44.7	33.5	150	192.2	27000	140.46	142.5	189.5	-2.8	0.00	189.5
May	31	72.0	54.0	73.2	54.9	155	154.1	27900	181.05	142.5	195.8	41.7	41.69	237.5
Jun	30	45.0	33.8	86.0	64.5	150	119.3	27000	226.42	142.5	189.5	70.2	70.22	301.4
Jul	31	52.0	39.0	97.0	72.8	155	121.3	27900	230.10	142.5	195.8	74.5	74.54	340.6
Aug	31	85.0	63.8	104.6	78.5	155	140.3	27900	198.86	142.5	195.8	55.5	55.49	325.8
Sep	30	123.0	92.3	82.2	61.7	150	180.6	27000	149.50	142.5	189.5	8.9	8.87	253.8
Oct	31	194.0	145.5	86.4	64.8	155	235.7	27900	118.37	142.5	195.8	-39.9	0.00	204.7
Nov	30	219.0	164.3	75.2	56.4	150	257.9	27000	104.71	142.5	189.5	-68.4	0.00	189.5
Dec	31	295.0	221.3	64.8	48.6	155	327.7	27900	85.15	142.5	195.8	-131.9	0.00	195.8
		1860		852.5	Max Area	230.10	m^2	Mean Area	143.45	m^2	Max depth used (mm)			340.6
Trial Bed length=	19	m	1.5	m	No. of Beds=	5	Trial area=	142.5	m^2	Total Bed Area== (Q)/(R x W)				
Allowable Stored Effluent Depth Max (mm)=			350	Depth used	340.6	mm	F.O.S=	1.0	(F.O.S.)>1 needed					
System Plot Area=		21	x	9.5										
Design Conclusions									Strips Spacing=1m Edge to edge					
Design System	Beds	Trench Dimension	L=	19	W=	1.5	D=	60 cm	No Of Strips=	5	Layers=	2		

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Bed Design Calculations (Option No.2)

Water Balance Calculation=

Client Address:	405 Wee Jasper Road Bombowlee				Project No:	H25-516								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Month	Days	Pan Evap E(mm)	Evapotranspiration Et= (% of E)	Median Rain fall R (mm)	Retained Rainfall (% of R) (mm)	DLR per month (mm)	Total Disposal (mm)=	Effluent Applied per month (L)	Design Area = m^2	Proposed area m^2	new Disposal Capacity=	Difference (mm)	Bed depth used (mm)	Actual Depth used (mm)
Jan	31	248.0	186.0	50.9	38.2	155	302.8	27900	92.13	142.5	195.8	-107.0	0.00	195.8
Feb	28	235.0	176.3	34.9	26.2	140	290.1	25200	86.87	142.5	176.8	-113.2	0.00	176.8
Mar	31	191.0	143.3	52.6	39.5	155	258.8	27900	107.81	142.5	195.8	-63.0	0.00	195.8
Apr	30	101.0	75.8	44.7	33.5	150	192.2	27000	140.46	142.5	189.5	-2.8	0.00	189.5
May	31	72.0	54.0	73.2	54.9	155	154.1	27900	181.05	142.5	195.8	41.7	41.69	237.5
Jun	30	45.0	33.8	86.0	64.5	150	119.3	27000	226.42	142.5	189.5	70.2	70.22	301.4
Jul	31	52.0	39.0	97.0	72.8	155	121.3	27900	230.10	142.5	195.8	74.5	74.54	340.6
Aug	31	85.0	63.8	104.6	78.5	155	140.3	27900	198.86	142.5	195.8	55.5	55.49	325.8
Sep	30	123.0	92.3	82.2	61.7	150	180.6	27000	149.50	142.5	189.5	8.9	8.87	253.8
Oct	31	194.0	145.5	86.4	64.8	155	235.7	27900	118.37	142.5	195.8	-39.9	0.00	204.7
Nov	30	219.0	164.3	75.2	56.4	150	257.9	27000	104.71	142.5	189.5	-68.4	0.00	189.5
Dec	31	295.0	221.3	64.8	48.6	155	327.7	27900	85.15	142.5	195.8	-131.9	0.00	195.8
		1860		852.5	Max Area	230.10	m^2	Mean Area	143.45	m^2	Max depth used (mm)			340.6
Trial Bed length=	19	m	2.5	m	No. of Beds=	3	Trial area=	142.5	m^2	Total Bed Area== (Q)/(R x W)				
Allowable Stored Effluent Depth Max (mm)=			350	Depth used	340.6	mm	F.O.S=	1.0	(F.O.S.)>1 needed					
System Plot Area=		21	x	9.5										
Design Conclusions									Strips Spacing=1m Edge to edge					
Design System	Beds		Trench Dimension	L=	19	W=	2.5	D=	60 cm	No Of Strips=	3	Layers=	2	

AWTS Design Calculations for Subsurface Irrigation

Water Balance Calculation=

Client Address:	405 Wee Jasper Road Bombowlee				Project No:	H25-516								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Month	Days	Pan Evap E(mm)	Evapotranspiration Et= (% of E)	Median Rain fall R (mm)	Retained Rainfall (% of R) (mm)	DIR per month (mm)	Total Disposal (mm)=	Effluent Applied per month (L)	Design Area = m^2	Proposed area m^2	new Disposal Capacity=	Difference (mm)	Bed depth used (mm)	Actual Depth used (mm)
Jan	31	248.0	186.0	50.9	38.2	93	240.8	27900	115.85	313.2	89.1	-151.7	0.00	89.1
Feb	28	235.0	176.3	34.9	26.2	84	234.1	25200	107.66	313.2	80.5	-153.6	0.00	80.5
Mar	31	191.0	143.3	52.6	39.5	93	196.8	27900	141.77	313.2	89.1	-107.7	0.00	89.1
Apr	30	101.0	75.8	44.7	33.5	90	132.2	27000	204.20	313.2	86.2	-46.0	0.00	86.2
May	31	72.0	54.0	73.2	54.9	93	92.1	27900	302.93	313.2	89.1	-3.0	0.00	89.1
Jun	30	45.0	33.8	86.0	64.5	90	59.3	27000	455.70	313.2	86.2	27.0	26.96	113.2
Jul	31	52.0	39.0	97.0	72.8	93	59.3	27900	470.89	313.2	89.1	29.8	29.83	145.9
Aug	31	85.0	63.8	104.6	78.5	93	78.3	27900	356.32	313.2	89.1	10.8	10.78	129.7
Sep	30	123.0	92.3	82.2	61.7	90	120.6	27000	223.88	313.2	86.2	-34.4	0.00	97.0
Oct	31	194.0	145.5	86.4	64.8	93	173.7	27900	160.62	313.2	89.1	-84.6	0.00	89.1
Nov	30	219.0	164.3	75.2	56.4	90	197.9	27000	136.47	313.2	86.2	-111.6	0.00	86.2
Dec	31	295.0	221.3	64.8	48.6	93	265.7	27900	105.03	313.2	89.1	-176.6	0.00	89.1
		1860		852.5	Max Area	470.89	m^2	Mean Area	231.78	m^2	Max depth used (mm)			145.9
Trial Bed length=	29	m	0.6	m	No. of Strips	18	Trial area=	313.2	m^2	Total Bed Area== (Q)/(R x W)				
Allowable Stored Effluent Depth Max (mm)=			150	Depth used	145.9	mm	F.O.S=	1.0	(F.O.S.)>1 needed					
System Plot Area=		31	x	12.8										
Design Conclusions									Strips Spacing=1m Edge to edge					
Design System	Subsurface Irrigation		Trench Dimension	L=	29	W=	0.6	D=		No Of Strips=	18	Layers=	2	

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ASCT

NSW GOVERNMENT

Property Report

405 WEE JASPER ROAD BOMBOWLEE 2720

Property Details

Address:	405 WEE JASPER ROAD BOMBOWLEE 2720		
Lot/Section /Plan No:	1/-/DP513701	2/-/DP1075294	2/-/DP513701
	2/-/DP528649	3/-/DP513701	3/-/DP513702
	3/-/DP528649	3/-/DP560744	4/-/DP528649
Council:	SNOWY VALLEYS COUNCIL		

Summary of planning controls

Planning controls held within the Planning Database are summarised below. The property may be affected by additional planning controls not outlined in this report. Please contact your council for more information.

Local Environmental Plans	Tumut Local Environmental Plan 2012 (pub. 21-12-2012)
Land Zoning	SP2 - Infrastructure: (pub. 24-2-2023)
Height Of Building	NA
Floor Space Ratio	NA
Minimum Lot Size	NA
Heritage	NA
Land Reservation Acquisition	NA
Foreshore Building Line	NA
Groundwater Vulnerability	Groundwater Vulnerability
Local Provisions	Airport Development Area
	Horticultural Land
Riparian Lands and Watercourses	Riparian Lands and Watercourses

Detailed planning information

State Environmental Planning Policies which apply to this property

State Environmental Planning Policies can specify planning controls for certain areas and/or types of development. They can also identify the development assessment system that applies and the type of environmental assessment that is required.

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)

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ASCT

NSW GOVERNMENT

Property Report

405 WEE JASPER ROAD BOMBOWLEE 2720

- State Environmental Planning Policy (Biodiversity and Conservation) 2021: Allowable Clearing Area (pub. 21-10-2022)
- State Environmental Planning Policy (Biodiversity and Conservation) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008: Land Application (pub. 12-12-2008)
- State Environmental Planning Policy (Housing) 2021: Land Application (pub. 26-11-2021)
- State Environmental Planning Policy (Industry and Employment) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Planning Systems) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Primary Production) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Resilience and Hazards) 2021: Land Application (pub. 2 -12-2021)
- State Environmental Planning Policy (Resources and Energy) 2021: Land Application (pub. 2-12-2021)
- State Environmental Planning Policy (Sustainable Buildings) 2022: Land Application (pub. 29-8-2022)
- State Environmental Planning Policy (Transport and Infrastructure) 2021: Land Application (pub. 2-12-2021)

Other matters affecting the property

Information held in the Planning Database about other matters affecting the property appears below. The property may also be affected by additional planning controls not outlined in this report. Please speak to your council for more information

1.5 m Buffer around Classified Roads	Classified Road Adjacent
Bushfire Prone Land	Vegetation Buffer
	Vegetation Category
Land near Electrical Infrastructure	This property may be located near electrical infrastructure and could be subject to requirements listed under Transport and Infrastructure SEPP 2021 Clause 2.48. Please contact Essential Energy for more information.
Local Aboriginal Land Council	BRUNGLE/TUMUT
Regional Plan Boundary	Riverina Murray

This report provides general information only and does not replace a Section 10.7 Certificate (formerly Section 149)

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Appendix C Geotechnical investigation

GEOTECHNICAL SITE INVESTIGATION

Prepared by ASCT - Tumut office, for NSW Public Works

SUBJECT SITE

405 Wee Jasper Road, Bombowlee, NSW 2720.

ASCT Reference

H25-516.

Lab: Unit 3, 11 Jarrah Road, Tumut NSW 2720
(02) 6947 2059
tumut@asct.com.au

9th April 2025

Ref No: H25-516.

NSW Public Works

Riverina
Western Region

To whom it may concern,

Re: Proposed Industrial Airplane Hanger Development at 405 Wee Jasper Road, Bombowlee, NSW 2720.

Australian Soil and Concrete Testing Pty Ltd (ASCT) is pleased to present the completed *Geotechnical Site Investigation* report, in response to your request.

As per your commission, ASCT was tasked with investigation works appropriate to classification of the site in accordance with *Australian Standard AS 2870 – Residential Slabs & Footings*, and associated parameters requisite to the proper design & construction of a structural footings system.

Details of our investigation process, the findings and results are contained within the body of this report. However, please find below a summation of the investigation results;

Site Classification (AS 2870)	Normal Site - Class H1 – Highly Reactive
Characteristic Surface Movement (Y_s)	40 to 60mm
Allowable Bearing Capacity	100 to 300 kPa
Groundwater	Not Encountered

Lab: Unit 3, 11 Jarrah Road, Tumut NSW 2720
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1.0 Introduction & Understanding

The subject of this site investigation report is;

405 Wee Jasper Road, Bombowlee, NSW 2720.

It is our understanding that a new industrial shed is proposed for the site. Accurate information regarding the 'footprint' of the proposed structure wasn't available at the time of investigation.

Information, including anecdotal evidence, provided by our client has been accepted as accurate & complete, and incorporated into the investigation process as appropriate.

2.0 Desktop Study

ASCT maintains an extensive library of previous AS 2870 site classifications. This important resource is consulted with every ASCT site investigation, and appropriate information has been employed during this investigation.

A limited inspection of the available aerial photography, provided no significant information regarding the site history.

Inspection of soil mapping for the area, *WAGGA WAGGA - Geological Series Sheet S 55-15 (1:250,000)*, predicts soils of the Qa – *Alluvial* origin.

The site was determined to lie within *Climatic Zone 1*, and therein have a *Depth of design suction change* (H_s) in the order of 1.5m.

Having regard to the guidance provided within AS 2870, a value of *Soil suction change* (ΔpF) of 1.2 Pico farads (pF) was deemed appropriate for the site.

3.0 Field Work

Field work at the investigation site was conducted by ASCT representative on the 3rd of April 2025.

These works included;

- Recording of all significant site features having, or potentially having, an effect on the site classification.
- Recording the location, and/or physical measurements, of certain significant features (e.g.: ASCT test holes, Tree heights, Slopes, Structures).
- Digital photography.
- A determination of the ultimate bearing pressure exhibited by the site soils.
- Excavation, and logging of one or more test holes.
- An assessment of groundwater conditions.
- The retrieval of one or more soil samples, for subsequent laboratory testing.

3.1 Site Description

The site as found by ASCT on the day of the field work is described below. Photo and a simple plan of the site are included in Appendix A.

The site is located within the grounds of the Tumut Aerodrome amidst gently terrain and bordering grazing paddocks. The proposed building location (PBL) slopes towards the north at 1-2%

The sites surface is comprised of bare soil with a large topsoil stockpile covering most of the PBL

No outcropping of large boulders is evident within the site.

No trees or vegetation which could affect the sites normal moisture conditions were observed.

No significant water sources were observed.

At the time of investigation vehicle/drill rig access onto the site was easily achievable.

3.2 Sub-Surface Profile

Detailed borehole logs, in accordance with AS 1726 section 6.2, are included in Appendix A.

In essence; the sub-surface profile consists of Silty Clays (CH) through to the target investigation depth.

The site exhibits soil stratum which ASCT have determined to be of natural origin.

The investigation results indicate that an essentially uniform sub-surface profile exists at the site.

The sub-surface conditions encountered are unlikely to hinder normal footing construction.

3.3 Groundwater

No groundwater was encountered during the investigation field-work.

The presence of groundwater table and seepage depends on rainfall, ground conditions, permeability, adjacent creek, or river water levels and will differ over time.

While it is impossible to accurately predict future levels in a complex groundwater system, especially in a limited investigation such as this, ASCT does not believe that groundwater will be an issue at this site.

3.4 Bearing Capacity

Where possible ASCT employs the results of AS 1289.6.3.2 – Dynamic Cone Penetrometer (DCP) testing, in the assessment of bearing capacity. In such instances the results of the DCP testing are included on the borehole logs, provided in Appendix A. Other inputs, such as visual/tactile assessments and the use of portable engineering equipment (e.g.: pocket penetrometer), also contribute to the overall assessment.

Having allowance for the weakest state of foundation materials, during normal (natural) site conditions, we have determined the allowable (or design) bearing capacity to be;

Borehole 1: From surface level to a depth of 0.9m below surface level: In excess of 200kPa. This is excellent and more than adequate for the support of a normal footings system.

Borehole 2: From surface level to a depth of 1.0m below surface level: In excess of 200kPa. This is excellent and more than adequate for the support of a normal footings system.

Borehole 3: From surface level to a depth of 1.0m below surface level: In excess of 200kPa. This is excellent and more than adequate for the support of a normal footings system.

It must be noted that the DCP test is not particularly reliable as an indicator of strength in hard soils, soft rock or soils containing gravel.

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4.0 Laboratory Work

During the fieldwork phase disturbed soil samples were retrieved from Borehole 1, at varying depths.

The sample was submitted to our NATA accredited Tumut facility for testing, in accordance with;

AS 1289.3.1.2 – Liquid Limit of a Soil (One point Casagrande), and

AS 1289.3.6.1 – Particle Size Distribution.

This laboratory testing produced results of;

Borehole	Depth	Liquid Limit %	% Passing 0.075mm sieve
1	0.6	62	88
1	1.1	57	91

5.0 Characteristic Surface Movement

Incorporating appropriate values for the Climatic Zone, depth of design suction change (H_S), soil suction change (ΔpF), lateral restraint factor (α), the thickness of each layer (h), and the properties of each layer (Instability Index I_{pt}); We have calculated the expected volume change associated with natural changes in soil moisture, and its' effect at the surface of the soil profile.

The resultant value is known as the *Characteristic Surface Movement* (Y_S), and we have determined it to be in the order of 40 to 60mm in line with AS 2870 Site Class H1 – "Highly Reactive".

Should the site undergo significant cuts and/or filling the *Characteristic Surface Movement* (Y_S) and site classification must be reassessed following earthworks and fill placement. ASCT can assist on this regard where required.

6.0 Site Problems

AS 2870 contains a list of potential problems that exclude a site from being classified under one of the 'Normal' classifications. Such sites are classified as Class P, so that the issues can be addressed using a tailored solution, by a professional Engineer.

ASCT is pleased to report that none of these potential problems were encountered at your site.

7.0 Earthworks, Site Preparation and Trafficability (If Applicable)

Any earthworks undertaken should be carried out in a responsible manner in accordance with the relevant parts of AS3798 – 2007. It is recommended that all earthworks be carried out under Level 1 inspection and testing arrangements as detailed in clause 8.2 of AS3798-2007.

Prior to the placement of any structural fill across the site, any topsoil, unsuitable, deleterious and organically contaminated surface soils should be stripped to depths exposing competent ground. In addition, any tree roots remaining from any clearing operations should be completely removed.

The stripped surface prior to filling should be tyned, moisture conditioned and re-compacted to the minimum density ratios detailed in AS 3798-2007 of 95% Standard compaction for residential and 98% standard compaction for commercial developments.

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All bulk fill materials should be placed in layers of approximately 0.2m loose and be moisture conditioned within the range of ±2% of Optimum Moisture Content (OMC). Then compacted to the minimum density ratios detailed in AS 3798-2007 of 95% Standard compaction for residential developments and 98% standard compaction for commercial developments.

Excluding any organic and deleterious materials, it is considered that the majority of materials won from excavation on site will generally be suitable for reuse as bulk filling provided that moisture content of the soils on placement approximates to the Optimum Moisture Content (OMC).

Where medium to high plasticity clays are proposed to be re-used as new structural filling materials in building or pavement areas, it is recommended that the cohesive material be placed at depth and granular material or weathered rock be placed close to the subgrade level. This will reduce the effects of seasonal moisture changes and foundations soil reactivity and improve surface trafficability.

It is appropriate to maintain surface drainage conditions during earthworks and ensure that runoff water is discharged away from the construction area to prevent any water ponding. Generally, clayey and silty materials are susceptible to moisture changes.

8.0 Responsibilities

The Australian Standard AS 2870 includes the following statements "*Footing design and construction involves a number of steps: site classification, selection of the footings system, structural design, construction in accordance with the required design details and construction methods, and proper maintenance. In particular, the owner has a responsibility to ensure the site is properly maintained and the Standard attempts to guide owners in this area.*".

We draw your attention to this responsibility and have provided a copy of the CSIRO BTF-18 "Foundation maintenance and Footing performance: A Homeowner's Guide" to assist you. The measures suggested in the CSIRO guide are simple & cost effective, and we recommend that you observe them in consultation with your designer.

We have taken every care to be to accurate, complete & objective in the execution of your commission. Should you have any queries, or require further assistance, please do not hesitate to contact our office. This report is your intellectual property and we will not provide it to any 3rd party without your permission. May we also respectfully request that if you provide this report to others (e.g.: your builder): you provide it in its' entirety, to avoid any miscommunication.

Yours faithfully,
Australian Soil & Concrete Testing Pty Ltd

Alex Fawns
Laboratory Manager – ASCT Tumut

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LIMITATIONS OF GEOTECHNICAL SITE INVESTIGATION

COMMISSION OF SERVICES
This geotechnical site assessment report ("The Geotechnical Report") has been prepared in accordance with the commission set out in the contract or quote, or as otherwise agreed between the Customer and Australian Soil & Concrete Testing P/L (ASCT). The commission may be limited by a range of factors such as time, cost, accessibility or site constraints and conditions.

RELIANCE ON INFORMATION PROVIDED
In preparing the report, ASCT has relied upon information provided, surveys, analyses, designs, plans and other documentation provided by the customer or other individuals and organisations, most of which are referred to in preparing the report. Except as otherwise stated in the report, ASCT has not verified the accuracy or completeness of the information provided to the extent that the statements, opinions, facts, information, conclusions and recommendations in the report are based in whole or in part on the information provided. The recommendations and conclusions are contingent upon the accuracy and completeness of the information provided. ASCT will not be liable in relation to incorrect conclusions should any provided information or site condition be incorrect or have been concealed, withheld, mis-represented or otherwise not fully disclosed to ASCT.

GEOTECHNICAL INVESTIGATION
Geotechnical site classification is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical lot classification reports are prepared to meet the specific needs of individuals. This report was prepared expressly for the Customer and expressly for the purposes indicated. Use by any other persons for any purpose or by the customer for a different purpose, may result in problems which ASCT cannot be responsible for. The Customer should not use this report for other than its intended purpose without seeking additional geotechnical advice.

THIS GEOTECHNICAL REPORT IS BASED ON SITE SPECIFIC FACTORS
This geotechnical report is based on a subsurface investigation which only identifies the conditions at the locations and time when the investigation was undertaken. Unless further geotechnical advice is obtained this geotechnical report cannot be used when the nature of the site is changed or when the proposed development is modified for the site.

This geotechnical report cannot be applied to an adjacent site. The *Limitations of Geotechnical Site Investigation* in making an assessment of a site from a limited number of boreholes or test pits is the possibility that actual conditions may vary from those identified at the investigation locations. The Site investigation identifies specific subsurface conditions only at those points from which samples have been taken. The investigation programme undertaken is used to provide a general profile of the subsurface condition. The information obtained from the site investigation and subsequent laboratory testing is used to form a presumed opinion regarding the overall subsurface conditions and their likely behaviour with regard to the proposed development. The borehole logs are the subjective interpretation of the limited site investigation and cannot always be definitive.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT
A geotechnical report is based on conditions which existed at the time of site investigation. The subsurface conditions may change due to natural forces or man-made influences. Civil works at or adjacent to the site and natural events such as floods or groundwater fluctuations may also affect subsurface conditions and the relevance of the geotechnical report. The geotechnical report should therefore be regarded as preliminary and ASCT should be consulted if unexpected conditions are encountered to determine the impact on the recommendations of the report.

SLOPE STABILITY

This report does not cover slope stability. If this is required, an independent assessment and investigation should be undertaken by a qualified Geotechnical Engineer.

AVOID MISINTERPRETATION

The geotechnical report may be misinterpreted by other design professionals. ASCT should be retained to explain relevant geotechnical findings and to review the adequacy of plans and specifications and the implications to the report. The geotechnical report should be maintained as a whole and should not be copied, divided or altered.

GEOTECHNICAL INVOLVEMENT DURING CONSTRUCTION

It is recommended that ASCT should be retained through the construction stage to confirm the actual subsurface conditions are consistent with the geotechnical report. If variations are encountered additional tests may be required to confirm conditions comply with the design specifications and advise on changes to the construction if required.

REPORT FOR BENEFIT OF CUSTOMER

The geotechnical report has been prepared for the benefit of the customer and no other party. ASCT assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusion expressed in the report. ASCT will not be responsible for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusion expressed in the report (including, without limitation, matters arising from any negligent act or omission of ASCT or any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy and completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

OTHER LIMITATIONS

ASCT will not be liable to update or revise the report to take into account any events of emergent circumstances or facts occurring or becoming apparent after the date of the report.

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APPENDIX A – Site Photos, Site Plan & Borehole Logs.

View of the site facing a northerly direction.

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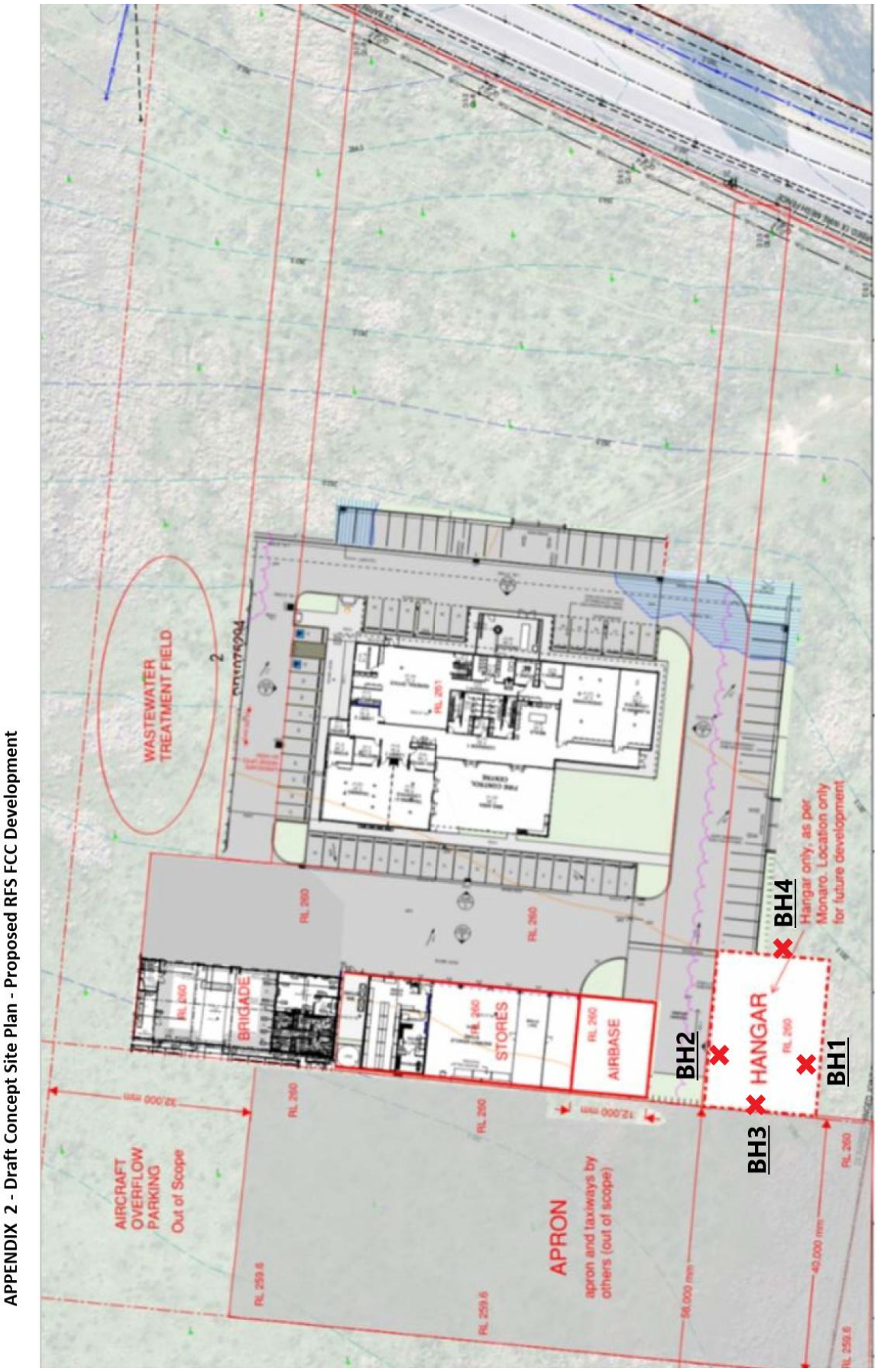

Plan of the site with ASCT approximate testing locations.

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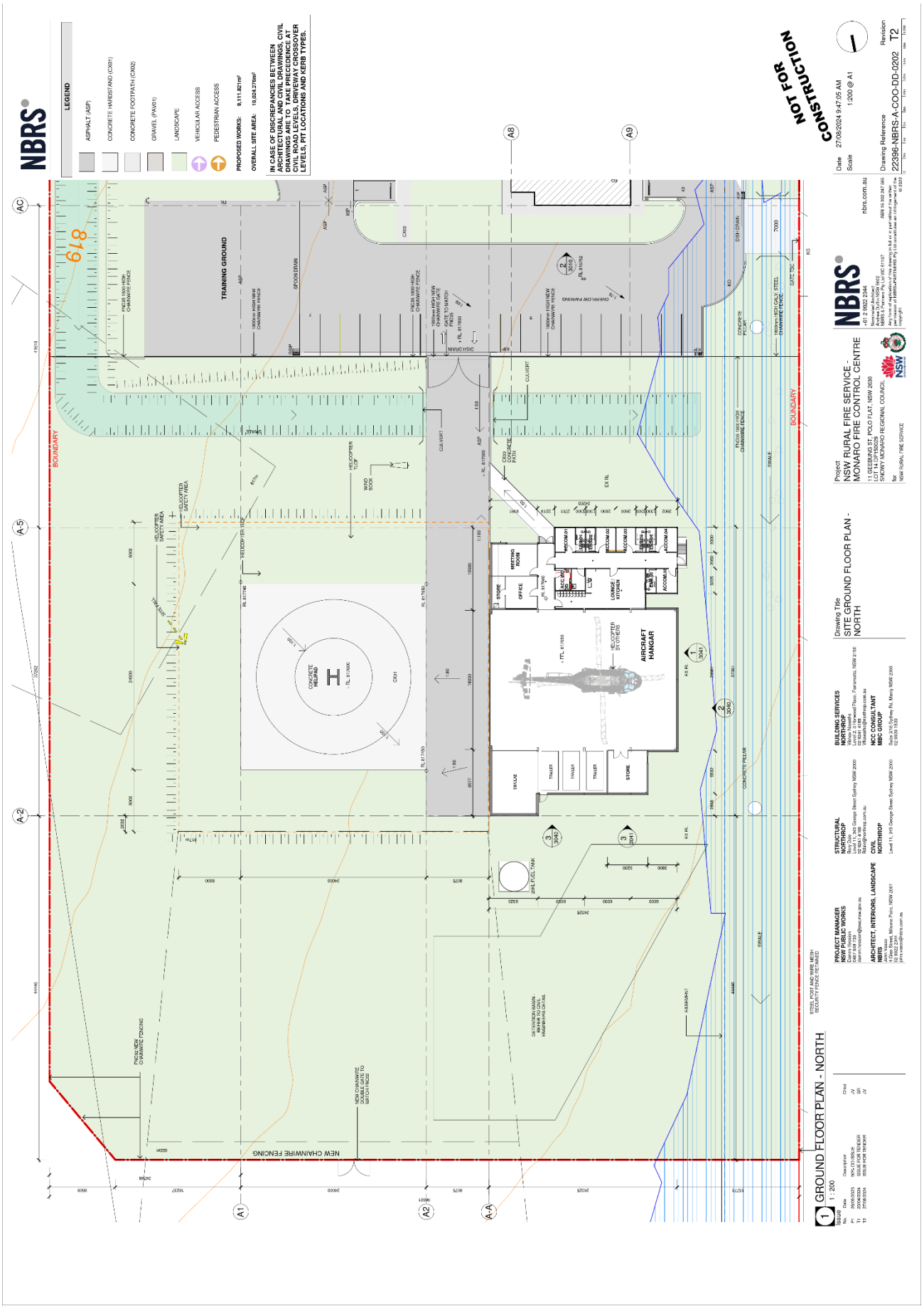

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BOREHOLE LOG SHEET - 1

Client:	NSW Public Works	**ASCT Ref No:**	H25-516
Project:	(Street #) 405 Wee Jasper Road, Bombowlee	**Client Ref No:**	NA
Borehole Position:	See Site Markup	**Excavation Method:**	Power Auger
Surface Elevation:	Existing Surface Level	**Excavation Device:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density / Rock Strength	DCP Blows / 100mm	Test Sample
					Cone Tip	
0.0		ML	**CLAYEY SILT, NATURAL:** pale brown, with fine sand, rapid dilatancy, low plastic, low dry strength, moist <PL	Very Stiff	7	
0.1					7	
0.2		ML	**CLAYEY SILT, NATURAL:** pale brown, with fine gravel, rapid dilatancy, low plastic, low dry strength, moist <PL	Hard	12	
0.3					11	
0.4					11	
0.5		CH	**SILTY CLAY, NATURAL:** brown, trace sand, high plastic, high dry strength, moist <PL	Hard	12	
0.6					11	Disturbed
0.7					12	
0.8					28	
0.9		CH	**SILTY CLAY, NATURAL:** pale brown, trace sand, high plastic, high dry strength, moist <PL		Stopped	
1.0						
1.1						Disturbed
1.2						
1.3						
1.4						
1.5		CH	**SILTY CLAY, NATURAL:** pale brown, trace sand, high plastic, high dry strength, moist >PL			
1.6						
1.7						
1.8						
1.9						
2.0						
2.1			**END DRILLING @ 2.0m: TARGET DEPTH REACHED**			
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
3.3						
3.4						
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5.0						

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BOREHOLE LOG SHEET - 2

Client:	NSW Public Works	**ASCT Ref No:**	H25-516
Project:	(Street #) 405 Wee Jasper Road, Bombowlee	**Client Ref No:**	-
Borehole Position:	See Site Markup	**Excavation Method:**	Power Auger
Surface Elevation:	Existing Surface Level	**Excavation Device:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density / Rock Strength	DCP Blows / 100mm	Test Sample
					Cone Tip	
0.0		ML	**CLAYEY SILT, NATURAL:** pale brown, with fine sand, rapid dilatancy, low plastic, low dry strength, moist <PL	Very Stiff	7	
0.1					8	
0.2		ML	**CLAYEY SILT, NATURAL:** pale brown, with fine gravel, rapid dilatancy, low plastic, low dry strength, moist <PL	Hard	11	
0.3					12	
0.4					11	
0.5		CH	**SILTY CLAY, NATURAL:** brown, trace sand, high plastic, high dry strength, moist <PL	Hard	15	
0.6					12	
0.7					17	
0.8					26	
0.9		CH	**SILTY CLAY, NATURAL:** pale brown, trace sand, high plastic, high dry strength, moist <PL	Hard	28	
1.0					Stopped	
1.1						
1.2						
1.3						
1.4						
1.5		CH	**SILTY CLAY, NATURAL:** pale brown, trace sand, high plastic, high dry strength, moist >PL			
1.6						
1.7						
1.8						
1.9						
2.0						
2.1			**END DRILLING @ 2.0m: TARGET DEPTH REACHED**			
2.2						
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2.4						
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2.6						
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2.8						
2.9						
3.0						
3.1						
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Lab: Unit 3, 11 Jarrah Road, Tumut NSW 2720
(02) 6947 2059
tumut@asct.com.au

BOREHOLE LOG SHEET - 3

Client:	NSW Public Works	**ASCT Ref No:**	H25-516
Project:	(Street #) 405 Wee Jasper Road, Bombowlee	**Client Ref No:**	-
Borehole Position:	See Site Markup	**Excavation Method:**	Power Auger
Surface Elevation:	Existing Surface Level	**Excavation Device:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density / Rock Strength	DCP Blows / 100mm	Test Sample
					Cone Tip	
0.0		ML	**CLAYEY SILT, NATURAL:** pale brown, with fine sand, rapid dilatancy, low plastic, low dry strength, moist <PL	Very Stiff	7	
0.1					7	
0.2		ML	**CLAYEY SILT, NATURAL:** pale brown, with fine gravel, rapid dilatancy, low plastic, low dry strength, moist <PL	Hard	13	
0.3					14	
0.4					15	
0.5		CH	**SILTY CLAY, NATURAL:** brown, trace sand, high plastic, high dry strength, moist <PL	Hard	18	
0.6					12	
0.7					12	
0.8					18	
0.9		CH	**SILTY CLAY, NATURAL:** pale brown, trace sand, high plastic, high dry strength, moist <PL	Hard	28	
1.0					Stopped	
1.1						
1.2						
1.3						
1.4						
1.5		CH	**SILTY CLAY, NATURAL:** pale brown, trace sand, high plastic, high dry strength, moist >PL			
1.6						
1.7						
1.8						
1.9						
2.0						
2.1			**END DRILLING @ 2.0m: TARGET DEPTH REACHED**			
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
3.3						
3.4						
3.5						
3.6						
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Lab: Unit 3, 11 Jarrah Road, Tumut NSW 2720
(02) 6947 2059
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BOREHOLE LOG SHEET - 4

Client:	NSW Public Works	**ASCT Ref No:**	H25-516
Project:	(Street #) 405 Wee Jasper Road, Bombowlee	**Client Ref No:**	NA
Borehole Position:	See Site Markup	**Excavation Method:**	Power Auger
Surface Elevation:	Existing Surface Level	**Excavation Device:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density / Rock Strength	DCP Blows / 100mm	Test Sample
					Cone Tip	
0.0		ML	**CLAYEY SILT, NATURAL:** pale brown, with fine sand, rapid dilatancy, low plastic, low dry strength, dry	Very Stiff	8	
0.1					7	
0.2					8	
0.3		ML	**CLAYEY SILT, NATURAL:** pale grey, with fine sand, rapid dilatancy, low plastic, low dry strength, dry	Very Stiff	9	
0.4					9	
0.5					7	
0.6		CH	**SILTY CLAY, NATURAL:** dark brown, trace sand, high plastic, high dry strength, moist <PL	Hard	15	
0.7					14	
0.8					15	
0.9					18	
1.0		CH	**SILTY CLAY, NATURAL:** pale brown, with fine sand, high plastic, high dry strength, dry	Hard	22	
1.1					28	
1.2					Stopped	
1.3						
1.4						
1.5						
1.6		CH	**SILTY CLAY, NATURAL:** brown, with fine sand, high plastic, high dry strength, moist >PL			
1.7						
1.8						
1.9						
2.0						
2.1			**END DRILLING @ 2.0m: TARGET DEPTH REACHED**			
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
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3.5						
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3.7						
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5.0						

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Foundation Maintenance and Footing Performance:
A Homeowner's Guide

PUBLISHING
BTF 18-2011
replaces
Information
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870-2011, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction
There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion
All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation
This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume, particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil
All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure
This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.

In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes

Notes
1. Where controlled fill has been used, the site may be classified A to E according to the type of fill used.
2. Filled sites. Class P is used for sites which include soft fills, such as clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soil subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise.
3. Where deep-seated moisture changes exist on sites at depths of 3 m or greater, further classification is needed for Classes M to E (M-D, H1-D, H2-D and E-D).

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Tree root growth
Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation
Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

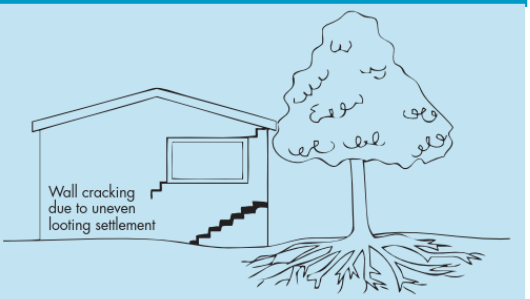
Seasonal swelling/shrinkage in clay
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Trees can cause shrinkage and damage



Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots
In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself
Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures
Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

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The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation causes a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem. Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870-2011.

AS 2870-2011 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing

Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage

In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

Protection of the building perimeter

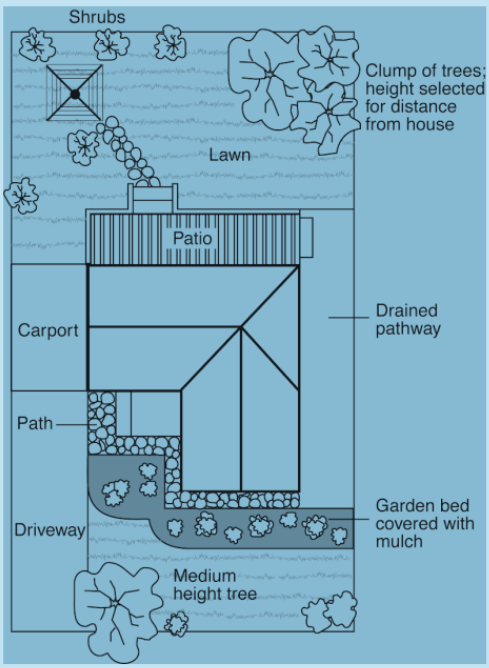
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving should

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly.	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired.	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 mm but also depends on number of cracks	4

Gardens for a reactive site



extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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Appendix D Bushfire Assessment

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Bushfire Assessment

Helicopter Hangar

Tumut Aerodrome

NSW Public Works

27 June 2025

(Ref: 25045)

report by
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FPA AUSTRALIA (NO.BPAD18882)
BPAD LEVEL 3 ACCREDITED PRACTITIONER
ABN 28 607 444 833

Contents

1 Introduction

Street or property name:	405 Wee Jasper Road		
Suburb, town or locality:	Bombowlee	**Postcode:**	2720
Lot/DP no:	Lot 2 DP 1075294		
Local Government Area:	Snowy Valleys Council		

1.1 Background

NSW Public Works commissioned Peterson Bushfire to prepare a Bushfire Assessment Report for a proposed helicopter hangar located on land identified as 'bushfire prone land'. This report presents the assessment and recommendations to ensure compliance with the relevant bushfire protection legislation and policy. It has been prepared by a consultant accredited by the Fire Protection Association of Australia's BPAD scheme (Accreditation No. BPD-L3-18882).

1.2 Location and description of the proposal

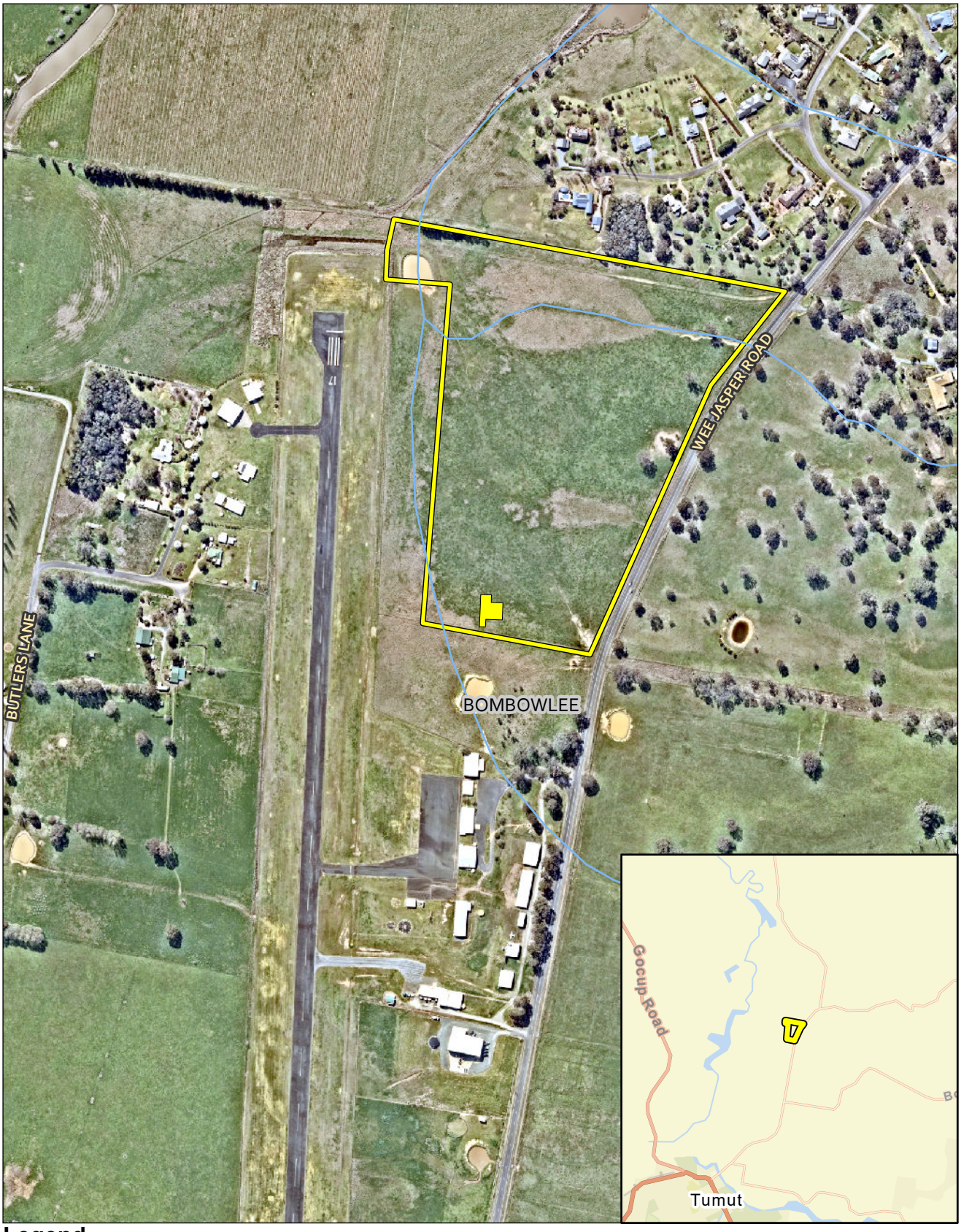
The subject land is located within the Tumut Aerodrome approximately 5 kms north of Tumut. The location of the subject land is shown on Figure 1.

The proposal consists of a helicopter hangar within the aerodrome to be managed by RFS and to be used for fire incidents in the South West Slopes region.

The proposal consists of:

- The construction of a building that will contain:
    - Helicopter hangar
    - Multi-purpose room and office
    - Amenities
    - Storage room
- Driveway off Wee Jasper Road
- Internal accessway to the south to link up with the existing Aerodrome buildings
- Internal accessway to the west to link up with the runway

The development site plan is included as Figure 2.



Legend

- Watercourse
- Subject Land
- Hanger

N

DKGIS

Date: 26/06/2025

0 125 250 500

Metres

Figure 1: Location of the Subject Land

Coordinate System: GDA2020 MGA Zone 55

Imagery: © Nearmap

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Legend

- Watercourse
- Subject Land
- Cadastre
- Hanger
- Future Paving

N

DKGIS

Date: 26/06/2025

0 5 10 20

Metres

Figure 2: The Proposal

Coordinate System: GDA2020 MGA Zone 55

Imagery: © Nearmap

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1.3 Assessment requirements

The subject land is identified as bushfire prone land by the Snowy Valleys Council as shown by the bushfire prone land mapping on Figure 3. The development does not involve habitable uses (Class 1, 2 or 3) or Special Fire Protection Purpose (SFPP) development as defined by 'Planning for Bush Fire Protection 2019' (PBP). Section 8.3 of PBP prescribes the assessment methodology and bushfire protection measures for other uses that do not involve a habitable dwelling or SFPP development.

In order to comply with PBP, the following conditions must be met:

- *satisfy the aim and objectives of PBP outlined in Chapter 1;*
- *consider any issues listed for the specific purpose for the development set out in this chapter; and*
- *propose an appropriate combination of bushfire protection measures.*

It is also important to ensure that a 'defendable space' is provided for the size and scale of the development.

The aim and objectives of PBP are listed below:

1. *The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.*
2. The objectives are to:
    a) *afford buildings and their occupants protection from exposure to a bush fire;*
    b) *provide for a defendable space to be located around buildings;*
    c) *provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings;*
    d) *ensure that appropriate operational access and egress for emergency service personnel and occupants is available;*
    e) *provide for ongoing management and maintenance of BPMs; and*
    f) *ensure that utility services are adequate to meet the needs of firefighters.*

Section 8.3.1 of PBP lists the issues specific to Buildings Class 5-8. As stated in PBP, the NCC does not provide for any bushfire specific performance requirements for these building classes. As such the Asset Protection Zones (APZ) and Bushfire Attack Levels (BAL) do not apply as deemed-to-satisfy provisions for bushfire protection. The general fire safety construction provisions of the NCC are taken as acceptable solutions however construction requirements for bushfire protection (i.e. BALs) are to be considered on a case-by-case basis in order to satisfy the aim and objectives of PBP.

The specific issues to be assessed for Buildings Class 5-8 are in relation to access, water supply and services, and emergency and evacuation planning as follows:

1. *Provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation;*
2. *Provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development;*
3. *Provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building; and*
4. *Provide for the storage of hazardous materials away from the hazard wherever possible.*

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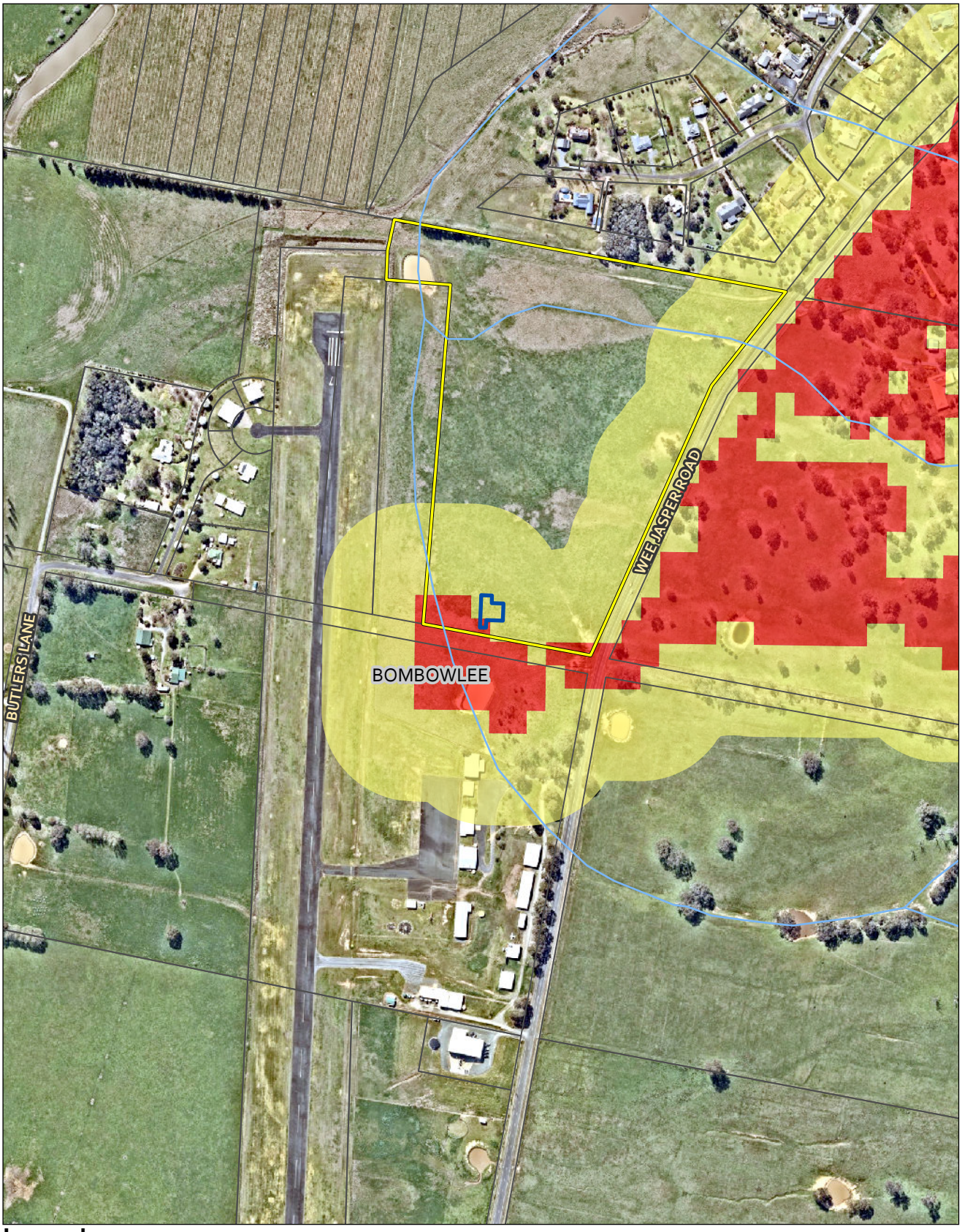
2 Bushfire prone land

The purpose of bushfire prone land mapping is to identify lands that may be subject to bushfire risk based simply of the presence of vegetation that could act as a hazard. The maps are a planning tool used to trigger further detailed assessment. They do not present a scalable measure of hazard, threat or risk. These parameters are to be determined under further assessment in accordance with PBP (i.e. this Bushfire Assessment Report).

The Snowy Valleys Council Bushfire Prone Land Map presented in Figure 3 identifies the subject land and some adjoining lands as Vegetation Category 1, which represents potential woodland or forest hazards in this instance. Any development proposal within a lot containing mapped bushfire prone land (i.e. bushfire prone property) is to comply with the requirements of PBP.

The maps are produced at a broad scale by desk-top Geographic Information Systems (GIS) covering an entire Local Government Area (LGA). They are often conservative and are designed to identify any potential bushfire threat of all levels. Most importantly, the identification of bushfire prone land does not preclude development. The maps are not prescriptive and simply trigger further detailed assessment.

The identification of bushfire hazards is discussed in the following Section 3 and is based on a detailed site inspection, therefore superseding the vegetation categorisation mapping shown on the bushfire prone land map.



Legend

- Watercourse
- Subject Land
- Hanger
- Cadastre

Bushfire Prone Land

- Vegetation Buffer
- Vegetation Category 1

N

DKGIS

Date: 26/06/2025

0 50 100 200

Metres

Figure 3: Bushfire Prone Land

Coordinate System: GDA2020 MGA Zone 55

Imagery: © Nearmap

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3 Bushfire hazard

An assessment of the bushfire hazard is necessary to determine the application of bushfire protection measures such as APZ location and dimension. This section provides a detailed account of the vegetation communities (bushfire fuels) and the topography (effective slope) that combine to create the bushfire hazard that may affect bushfire behaviour.

3.1 Predominant vegetation

The 'predominant vegetation' influencing fire behaviour approaching the proposed building has been assessed in accordance with the methodology specified by PBP. The vegetation within the 140 m assessment area is mapped on Figure 4 and consists of cleared paddocks that have the potential to act as a grassland hazard depending on the rates of growth, curing, grazing or other agricultural activities. These adjoining lands have therefore been categorised as 'grassland' for the determination of APZ and BAL. The runway to the west and Aerodrome area to the south are categorised as managed land as they are regularly mown.

3.2 Effective slope

The 'effective slope' influencing fire behaviour has been assessed in accordance with the methodology specified within PBP. This is conducted by measuring the slope that would most significantly influence fire behaviour where the hazard has been identified within 100 m of the proposed development. The effective slope was assessed from a 2 m contour layer.

The effective slope under the surrounding grassland hazard has been assessed as being within the PBP slope class of 'upslope/flat' to the east and south, and 'downslope 0-5 degrees' to the north and west. The slope assessment is indicated on Figure 4.

Legend

- Contour - 2m
- Watercourse
- Subject Land
- Hanger
- Cadastre
- Vegetation Assessment Area

Vegetation Formation

- Grassland

- Future Paving

Asset Protection Zone

- Asset Protection Zone - 10m
- Asset Protection Zone - 12m

N

DKGIS

Date: 26/06/2025

0 10 20 40

Metres

Figure 4: Bushfire Hazard Analysis and Asset Protection Zone (APZ) Coordinate System: GDA2020 MGA Zone 55

Imagery: © Nearmap

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4 Bushfire protection measures

PBP requires the assessment of a suite of bushfire protection measures that in total provide an adequate level of protection for development proposals on bush fire prone land. The measures required to be assessed for the development type proposed are listed in Table 1 below and are discussed in detail in the remainder of this section.

Table 1: Generic PBP bushfire protection measures

Aim & Objectives (PBP Section 1.1)	Measures
Aim	
The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.	• Achieving the objectives below will satisfy the aim.
Objectives	
1. *Afford buildings and their occupants protection from exposure to a bush fire;*	• Building setbacks from bushfire hazards to avoid critical limits. • Building construction specifications or standards. • Defendable space - Providing fire-fighter access between buildings and the bushfire hazard.
2. *Provide for a defendable space to be located around buildings;*	
3. *Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings;*	
4. Ensure that appropriate operational access and egress for emergency service personnel and occupants is available;	• Access to public road • Adequacy of internal property roads • Assessment of perimeter access
5. Provide for ongoing management and maintenance of BPMs; and	• Design and layout to ensure maintenance can occur by occupants without reliance on other parties

Aim & Objectives (PBP Section 1.1)	Measures
6. *Ensure that utility services are adequate to meet the needs of firefighters.*	• Water supply for fire-fighting including provisions for hydrants or static water supplies. • Ensuring installation of electricity and gas supplies do not contribute to the risk of fire to a building.

Table 2: Specific PBP bushfire protection measures for buildings Class 5-8

Objectives (PBP Section 8.3.1)	Measures
1. *Provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation.*	• Access to public road • Adequacy of internal property roads including assessment of perimeter access • Defendable space - Providing fire-fighter access between buildings and the hazard
2. *Provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development.*	• Bushfire Emergency Management and Evacuation Plan • Adequacy of internal property roads
3. *Provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.*	• Water supply for fire-fighting including provisions for hydrants or static water supplies. • Ensuring installation of electricity and gas supplies do not contribute to the risk of fire to a building.
4. *Provide for the storage of hazardous materials away from the hazard wherever possible.*	• Appropriate storage of hazardous materials away from bushfire hazards.

4.1 Access

4.1.1 Public road access

PBP requires an access design that enables safe evacuation whilst facilitating adequate emergency and operational response. Development should have an alternate access or egress option depending on the bushfire risk, the density of the development, and the chances of the road being cut by fire for a prolonged period.

The subject land gains direct access from Wee Jasper Road which provides access in alternate directions.

The public road system is adequate for evacuation and emergency response.

4.1.2 Internal property roads

The proposed internal property road from Wee Jasper Road will be approximately 140 m long and 6 m wide and will culminate in a large hard stand area. The design complies with the required standard of 'property access road' as specified within Table 5.3b of PBP.

Additional provisions for bushfire protection are not required.

4.1.3 Defendable space

For habitable development types such as dwellings, the application of a bushfire hazard building setback (i.e. APZ) is related to the vulnerability of an asset typically in terms of combustibility of external materials or the nature of the occupants. The resulting APZ dimension would stipulate a building construction standard (i.e. Bushfire Attack Level – BAL) under Australian Standard *AS 3959-2018 Construction of buildings in bushfire-prone areas*.

As the land use does not include a dwelling or habitable building, PBP does not prescribe an APZ dimension. The general fire safety requirements of the NCC are accepted as adequate bushfire protection for the developments involving Class 5 to 8 buildings.

However, PBP does require the consideration of a managed hazard-separation area for fire-fighting purposes referred to as 'defendable space'. A defendable space is an area between the building and the bushfire hazard that provides an environment in which fire-fighters can undertake property protection after the passage of a bushfire with some level of safety. The defendable space dimension is defined by the ability to gain access around an asset and conduct defensive fire-fighting operations. Relying on a defendable space in lieu of an APZ is deemed acceptable whereby construction satisfies NCC building and structural fire requirements.

In the case of the proposed building, a defendable space should be provided to ensure a building construction standard no higher than BAL-29 (refer to Section 4.2 below). To achieve this, the defendable space should be a minimum of 10 m to the east and south, and 12 m to the west and north. The recommended defendable space is shown on Figure 4. The defendable space will be complemented by the adjoining hardstand and paved areas.

4.2 Construction standards

As introduced in Section 1.3, building construction provisions for bushfire protection within Australian Standard *AS 3959-2018 Construction of buildings in bushfire-prone areas* (AS 3959) do not apply to developments of the type proposed as a deemed-to-satisfy requirement under the NCC. Due to the type of development and compliance with NCC requirements for building and structural fire, it is generally accepted that buildings will survive bushfire attack. In addition, staff will not reside at the site and will be familiar with evacuation routes.

However, as stated within Section 8.3.1 of PBP, consideration of building construction provisions is required to satisfy the aim and objectives of PBP and the assessment of which is to be made on a case-by-case basis.

Based on the minimum defendable space recommended in Section 4.1, the building would be subject to BAL-29 based on a BAL assessment carried out in accordance with PBP Table A1.12.6 (FFDI-80).

It is recommended in this instance for the proposed building be designed and constructed to comply with BAL-29 construction specifications listed within AS 3959 and the NSW variation listed within Section 7.5.2 of PBP. This recommendation is based on the importance of the facility as a community and government asset and its role in emergency management.

4.3 Landscaping and vegetation management

The defendable space as shown on Figure 4 is to be maintained to comply with the standard of an Inner Protection Area (IPA) as described within Appendix A4.1.1 of PBP and repeated below. This can be achieved by a compliant landscaping design and regular mowing.

PBP A4.1.1 Inner Protection Areas (IPAs)

> *The IPA is the area closest to the building and creates a fuel-managed area which can minimise the impact of direct flame contact and radiant heat on the development and act as a defendable space. Vegetation within the IPA should be kept to a minimum level. Litter fuels within the IPA should be kept below 1cm in height and be discontinuous.*
>
> *In practical terms the IPA is typically the curtilage around the building, consisting of a mown lawn and well maintained gardens.*
>
> *When establishing and maintaining an IPA the following requirements apply:*
>
> - ***Trees***
> - *tree canopy cover should be less than 15% at maturity;*
> - *trees at maturity should not touch or overhang the building;*
> - *lower limbs should be removed up to a height of 2m above the ground;*
> - *tree canopies should be separated by 2 to 5m; and*

- *preference should be given to smooth barked and evergreen trees.*

- ***Shrubs***
  - *create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided;*
  - *shrubs should not be located under trees;*
  - *shrubs should not form more than 10% ground cover; and*
  - *clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.*
- ***Grass***
  - *grass should be kept mown (as a guide grass should be kept to no more than 100mm in height); and*
  - *leaves and vegetation debris should be removed.*

4.4 Emergency and evacuation

A 'Bushfire Emergency Management and Evacuation Plan' can be prepared depending on the level of bushfire risk. A plan is prepared in accordance with the NSW Rural Fire Service document 'A Guide to Developing a Bushfire Emergency Management and Evacuation Plan' (RFS 2014). The preparation of a 'Bushfire Emergency Management and Evacuation Plan' is not recommended in this case due to the low bushfire risk.

4.5 Water supply and other utilities

4.5.1 Water supply

Hydrants are not available along Wee Jasper Road or within the subject land. As such, a static water supply is to be relied upon for fire-fighting. The proposed 30,000 and 100,000 litre tanks to be installed alongside the building can fulfill this requirement. It is recommended that the tanks be constructed from non-combustible materials (e.g. steel or concrete) and have a 65 mm metal Storz outlet with gate or ball valve installed at the base.

4.5.2 Electricity supply

The supply of electricity will be provided underground. Compliance is therefore achieved.

4.5.3 Gas supply

Any gas services are to be installed and maintained in accordance with Australian Standard *AS/NZS 1596-2014 The storage and handling of LP gas*.

4.6 Hazardous materials

The storage of combustible or hazardous materials external to the building is not restricted given the low bushfire risk.

5 Conclusion and recommendations

The proposal consists of a helicopter hangar to be located on bushfire prone land in Bombowlee, NSW. The bushfire hazard consists of grassland paddocks only.

As stated within Section 8.3.1 of PBP, the NCC does not provide for any bushfire specific performance requirements for the type of development or use proposed. As such APZs and BALs do not apply as deemed-to-satisfy provisions for bushfire protection. However, PBP requires a defendable space and assessment of construction measures.

The proposed building will have a compliant defendable space and effective APZ of 10-12 m resulting in BAL-29. BAL compliance is recommended for the building due to the significance of the asset to the community.

PBP requires an assessment of the proposal against the aim and objectives of PBP and the four specific objectives for buildings Class 5-8. Tables 3 and 4 below summarise how the objectives have been satisfied. This assessment concludes that all objectives are satisfied with the adoption of the recommendations listed following Tables 3 and 4.

Table 3: Compliance with PBP aim and objectives

Aim & Objectives (PBP Section 1.1)	Compliance statement
Aim	
The aim of PBP is to provide for the protection of human life and minimise impacts on property from the threat of bush fire, while having due regard to development potential, site characteristics and protection of the environment.	Achieving the objectives below will satisfy the aim.
Afford buildings and their occupants protection from exposure to a bush fire;	Section 4.1.3 and 4.2 demonstrates compliance. BAL compliance recommended for the building.
Provide for a defendable space to be located around buildings;	Section 4.1.3 demonstrates compliance. Defendable space and effective APZ of at least 10-12 m for the building.
Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings;	Section 4.1.3 and 4.2 demonstrates compliance. BAL compliance recommended for the building.

Aim & Objectives (PBP Section 1.1)	Compliance statement
Ensure that appropriate operational access and egress for emergency service personnel and occupants is available;	Section 4.1.1 and 4.1.2 demonstrates compliance. Six m wide driveway and hardstand will achieve compliance. No further recommendations.
Provide for ongoing management and maintenance of BPMs; and	Section 4.3 demonstrates compliance. The defendable space is to be maintained in accordance with IPA requirements.
Ensure that utility services are adequate to meet the needs of firefighters.	Section 4.5 demonstrates compliance. Proposed 30,000 and 100,000 litre tanks to be made available to fire-fighters and recommendation for compliant installation of gas supply if proposed.

Table 4: Compliance with PBP Section 8.3.1 objectives

Objectives (PBP Section 8.3.1)	Compliance statement
Provide safe access to/from the public road system for firefighters providing property protection during a bush fire and for occupant egress for evacuation	Section 4.1.1 and 4.1.2 demonstrates compliance. Six metre wide driveway and hardstand will achieve compliance. No further recommendations.
Provide suitable emergency and evacuation (and relocation) arrangements for occupants of the development	Section 4.4 demonstrates compliance. Preparation of 'Bushfire Emergency Management and Evacuation Plan' not recommended.
Provide adequate services of water for the protection of buildings during and after the passage of bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building	Section 4.5 demonstrates compliance. Proposed 30,000 litre tank to be made available to fire-fighters and recommendation for compliant installation of gas supply if proposed.
Provide for the storage of hazardous materials away from the hazard wherever possible	Section 4.6 demonstrates compliance. No restriction on the storage of combustible or hazardous materials external to the building.

The following recommendations were made within this report:

1. A minimum defendable space (i.e. APZ) is to be provided around the building of 10 m to the east and south, and 12 m to the north and west.

2. Landscaping and maintenance of the defendable space is to comply with the standard of an Inner Protection Area (IPA) as described in Appendix A4.1.1 of *Planning for Bush Fire Protection 2019* (PBP).

3. The proposed building is to be designed and constructed to comply with BAL-29 construction specifications listed within AS 3959 and the NSW variation listed within Section 7.5.2 of *Planning for Bush Fire Protection 2019* (PBP).

4. The 30,000 and 100,000 litre tanks adjacent the building are to be constructed from non-combustible materials (e.g. steel or concrete) and have a 65 mm metal Storz outlet with gate or ball valve installed at the base.

5. Any gas services installed are to be in accordance with *AS/NZS 1596-2014 The storage and handling of LP gas* (Standards Australia, 2014).

In the author's professional opinion, with the adoption of the above recommendations, the proposed development will comply with *Planning for Bush Fire Protection 2019* (PBP).

David Peterson

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

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References

NSW Rural Fire Service (RFS). 2014. *A Guide to Developing a Bushfire Emergency Management and Evacuation Plan*. State of New South Wales through the NSW Rural Fire Service.

NSW Rural Fire Service (RFS). 2019. *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities and Developers*. State of New South Wales through the NSW Rural Fire Service.

Standards Australia. 2014. *The storage and handling of LP Gas*, AS/NZS 1596-2014, Standards Australia International Ltd, Sydney.

Standards Australia. 2018. *Construction of buildings in bushfire-prone areas*, AS 3959, Standards Australia International Ltd, Sydney.

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Appendix E Windshear Assessment

Duncan Mitchell
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Bathurst NSW 2795

JUNE 2025

By email: dmitchell@svc.nsw.gov.au; darren.hession@pwa.nsw.gov.au

Our reference: YTMU07

Dear Duncan / Darren

Re: Tumut Aerodrome Helicopter Hangar – Preliminary Desktop Windshear Assessment (Updated)

This correspondence sets out the results of a preliminary desktop windshear assessment undertaken for the proposed Helicopter Hangar at Tumut Aerodrome in accordance with the National Airports Safeguarding Framework (NASF) *Guideline B: Managing the Risk of Building Generated Windshear and Turbulence at Airports* (version 2.2.5 dated May 2018).

1.1. Background

NSW Public Works is managing a project for the Snowy Valleys Council to construct a new Helicopter Hanger at the Tumut Aerodrome as shown in Figure 1 (source: NSW Public Works).

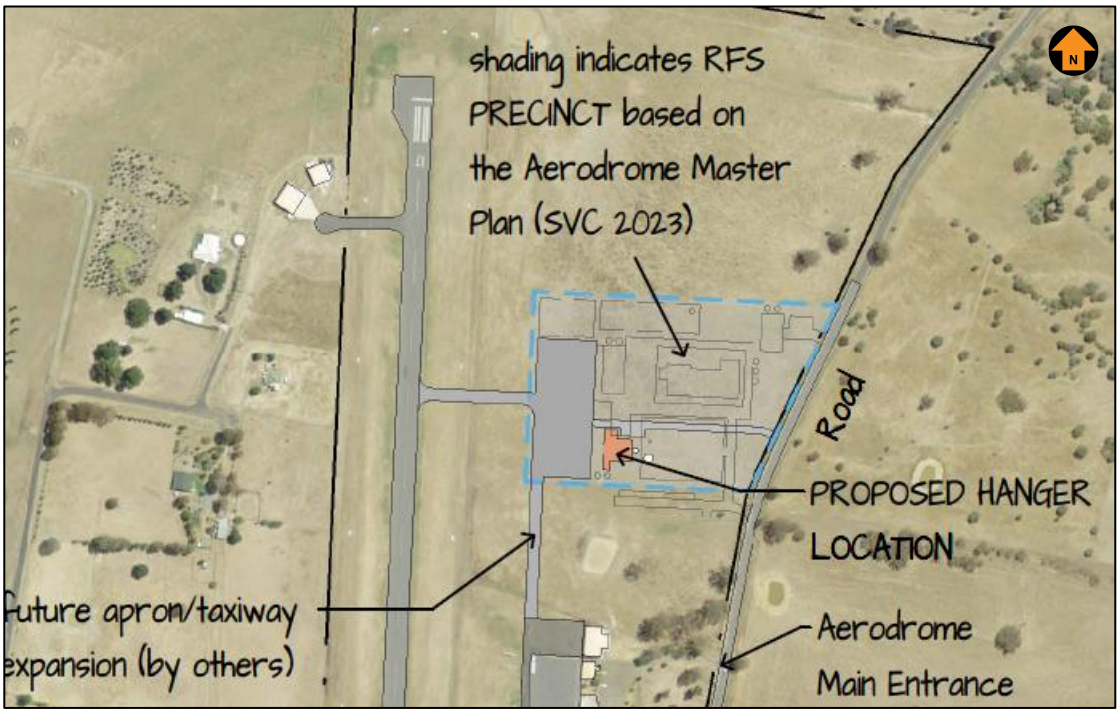

Figure 1 Proposed Hangar Location

The proposed hangar building is located approximately 300 m from the northern RWY 17 threshold and 171.5 m from the centreline of Runway 17/35. The building has a width (parallel to the runway) of 35.22 m, a length / depth (perpendicular to the runway) of 24.34 m and a height of 7.4 m above finished floor level.

The windshear assessment trigger area at Tumut Aerodrome as defined in NASF Guideline B is shown in Figure 2 and Figure 3 (source: NASF Guideline B).

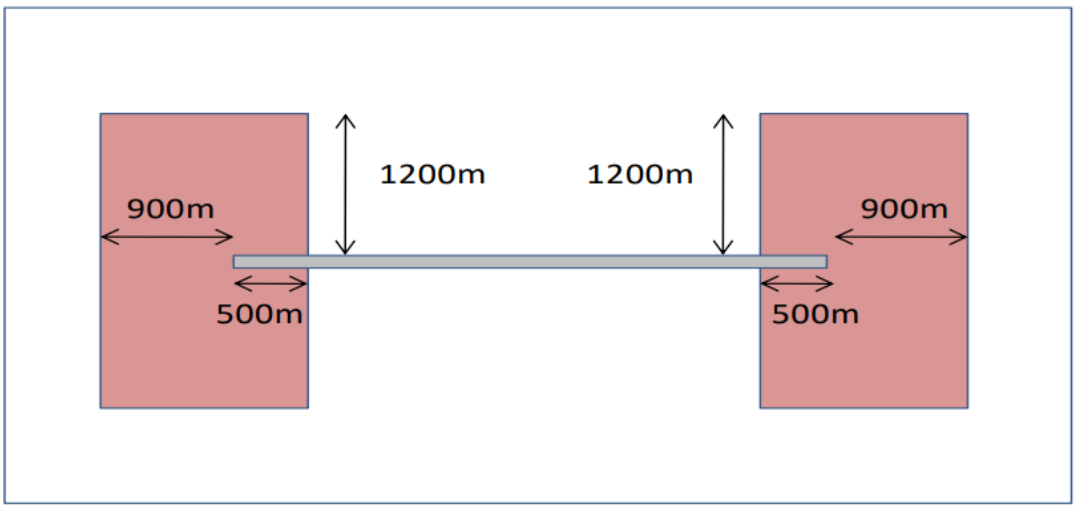

Figure 1: Assessment trigger area around runways, within which buildings should be assessed

Figure 2 Extract NASF Guideline B – Figure 1

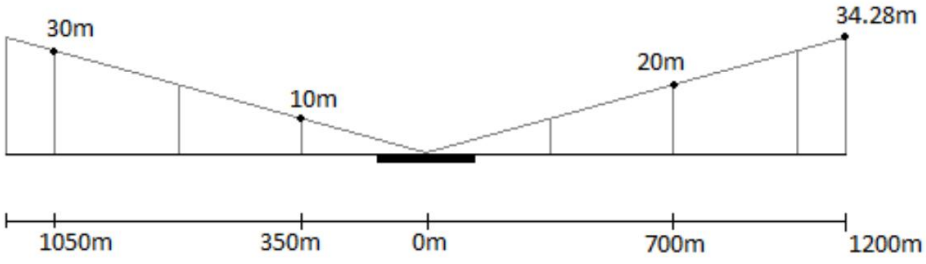

Figure 2: (Top) Plan view of the 1:35 surface within the assessment trigger area. (Bottom) Elevation view of the 1:35 surface, looking down the runway centreline. Illustrative purposes only – not to scale.

Figure 3 Extract NASF Guideline B – Figure 2

The 1:35 windshear assessment surface relative to the proposed hangar is shown in Figure 4 (source: NSW Public Works).

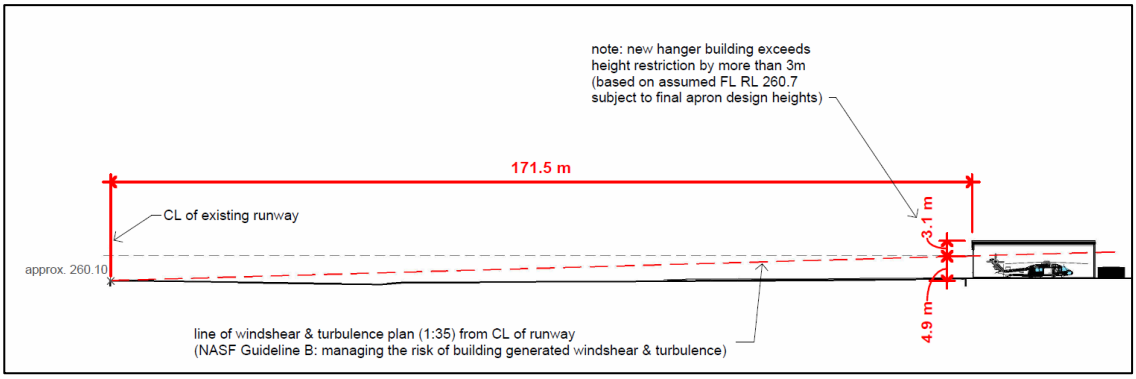

Figure 4 1:35 Windshear Assessment Surface relative to proposed hangar

The proposed building is located within the windshear assessment trigger area associated with the existing runway and penetrating the 1:35 windshear assessment surface and as such further assessment is required to consider windshear and turbulence effects and ensure that the building will not create an unacceptable risk to aircraft operations.

NASF Guideline B sets out a preliminary desktop assessment methodology suitable for smaller aerodromes to assess the windshear risk associated with proposed development. The corresponding windshear assessment undertaken by wind engineering specialist Synergetics is attached to this correspondence and summarised at section 1.3.

1.2. Client Material

The windshear assessment undertaken in accordance with NASF Guideline B has been based on the following material provided by NSW Public Works:

- Drawing DA.01 dated 26.06.2025 – Aviation Hangar Tumut Airport, Locality Plan, Part Site Plan, Floor Plan & Elevations

1.3. Windshear Assessment

The attached preliminary desktop windshear assessment demonstrates that the NASF Guideline B windshear criteria would be exceeded for windspeeds in excess of approximately 55 knots.

As a general guide, the maximum crosswind limit for typical light GA aircraft operating at Tumut Aerodrome would be in the order of up to 20 knots to 30 knots, and therefore it is highly unlikely that the runway would be in use during weather conditions with windspeeds approaching 55 knots.

In conclusion, windshear and turbulence levels for Tumut Aerodrome's runway are not expected to be materially affected by the proposed helicopter hangar for crosswinds below 55 knots.

If you wish to clarify or discuss the contents of this correspondence, please contact me on 0403 361 610.

Kind regards

Ashley Grummitt

Aviation Consultant

26 June 2025

encl. NASF Guideline B review – Hangar Development – Tumut Aerodrome (Synergetics)

SYNERGETICS

26 June 2025

Ashley Grummitt
Aviation Projects Pty Ltd
19/200 Moggill Road
Taringa, QLD 4068

Dear Ashley,

RE: NASF Guideline B review of proposed helicopter hangar development at Tumut Aerodrome.

Introduction

I am writing to provide a desktop windshear and turbulence assessment, in accordance with NASF B (DIRD, 2018), for a proposed helicopter hangar development on the eastern side of Tumut Aerodrome.

Building and site description

The proposed helicopter hangar measures 35.2 m by 24.3 m, with the ridge rising 7.4 m above ground level. An 8.3 m concrete apron on the north side accommodates parking. A drawing and aerial photo of these details is provided in Figure 1 and Figure 2.

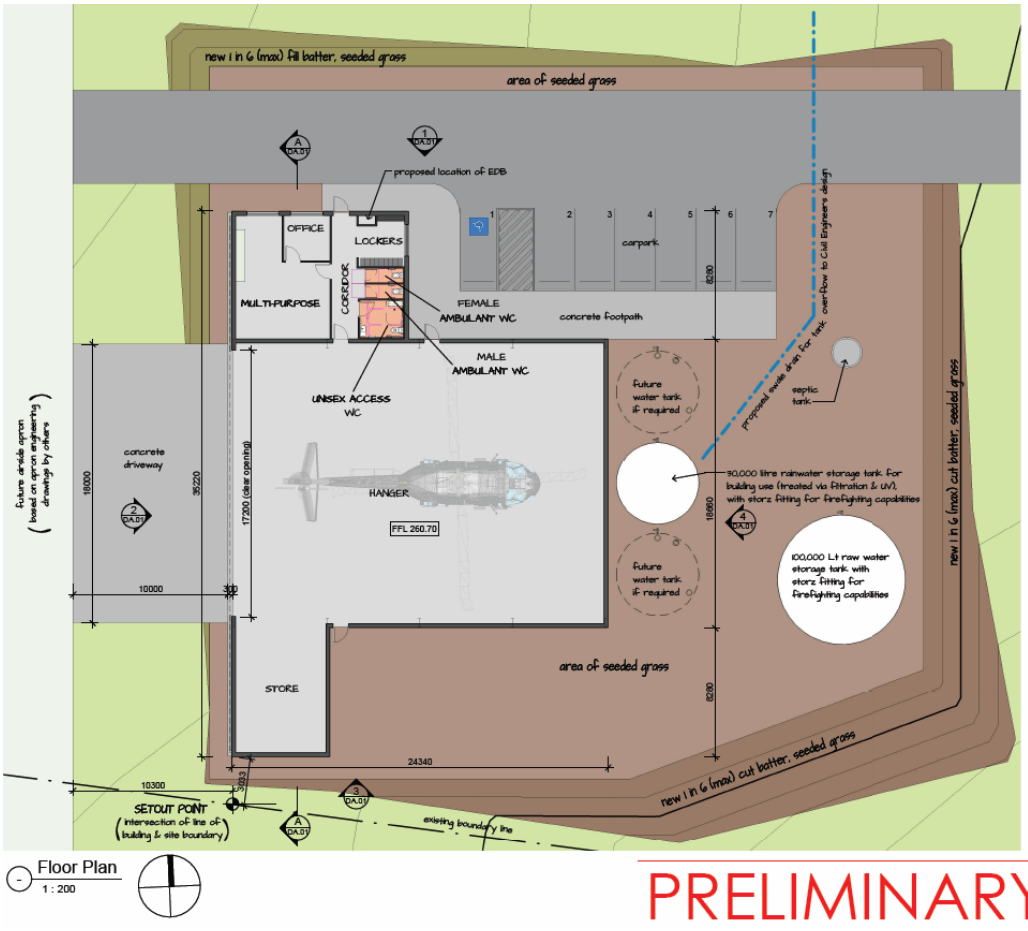

Figure 1 - Detailed plan view of the proposed helicopter hangar. Image reproduced from (Havenhand & Mather Architects Pty Ltd, 2025).

Figure 2 - Aerial photograph of Tumut Aerodrome. The location of the proposed helicopter hangar is coloured red. North is to the top of the image. Image accessed from Nearmap, 2024.

Determination if an assessment is required

Our assessment begins with a quantitative comparison for Tumut Aerodrome runway to determine the extent of assessment required against the following NASF B criteria:

1) 'within the assessment trigger area' (DIRD, 2018) Paragraph 49 which is used to identify buildings that could pose a safety risk against three assessment distances:
   a) <1200 m perpendicular distance[1] from runway centreline;
   b) <900 in front of runway threshold; and
   c) <500 along runway threshold; and
2) '>1:35 height to distance ratio' NASF B (DIRD, 2018) Paragraphs 51, 52 and 53 used to rule out buildings that clearly *will not* pose a risk.

The 'within the assessment trigger area' NASF B (DIRD, 2018) criteria is determined by assessment against three assessment distances (Paragraph 49a, 49b and 49c) as shown in Attachment A. If all three of the assessment distances are satisfied, then the 'within the assessment trigger area' is satisfied.

[1] Measured from the closest point of proposed building to the runway centreline in a direction perpendicular to the runway centreline.

The relevant assessment distances were calculated as summarised in Table 1. These distances show that the proposed hangar is within the assessment trigger area for the runway, and hence, requires further assessment.

Table 1 – 'Within assessment trigger area' assessment criteria summary.

NASF B	Para 49a		Para 49b		Para 49c		All three distance criteria satisfied?
Runway	<1200 m from runway centreline[2]?		<900 in front of runway threshold[3]?		<500 along runway threshold[4]?		
	Distance (m)	<1200 m?	Distance (m)?	<900 m?	Distance (m)?	<500 m?	
17/35	171	YES	N/A	YES	260	YES	YES

The '>1:35 height to distance area' criterion, referred to in (DIRD, 2018) Paragraphs 51, 52 and 53, was assessed by calculating the ratio of building height to perpendicular distance to each runway, with building height referenced to the local ground level.[5] As summarised in Table 2, only Runway 17/35 does not satisfy the '>1:35 height to distance ratio', with a ratio of 1:21, and hence requires further assessment.

Table 2 – '>1:35 height to distance ratio' assessment criteria summary.

Runway	Distance[1] to runway centreline (m)	Building height (m)	Distance to height ratio	> 1:35 height to distance ratio satisfied?
17/35	171	7.4	23	NO

Assessment methodology

This desktop assessment considers both the windshear and turbulence generated by the proposed helicopter hangar. The assessment criteria in the latest draft of NASF B (DIRD, 2018), as summarised in Attachment A, have been applied where possible. Our expert judgement and experience with similar assessments has been employed where necessary.

[2] Measured from the closest point of building to the runway centreline in a direction perpendicular to the runway centreline.

[3] Measured along the runway centreline from the closest point of building in the landside direction.

[4] Measured along the runway from the closest point of building in the airport direction.

[5] The 1:35 ratio in NASF B Paragraph 51, 52 and 53 references the building height relative to the runway level and will hence increase the distance to height ratio for buildings on lower ground, or decrease it for buildings built on higher land. In the case of the gentle topology at Tumut Aerodrome, the width, length and strength of the building wake will not be materially affected by changes in relative level of the building Site and the runway as the air flow will be parallel to the ground level. In cases such as this building height referenced to local ground level is more relevant for assessment of potential turbulence and wind shear effects.

Analysis

Windshear

The Building Wind speed Deficit (BWD) method in NASF Guideline B is an empirical screening tool that converts a building's simple geometry into a quick estimate of wake strength. For isolated buildings like the proposed hangar it can provide an approximate estimate of the wake size. It provides the downstream distance (in building heights, H) at which the mean velocity deficit falls to four fixed fractions of the free stream wind speed[6] (0.48, 0.35, 0.22 and 0.11 V_H) for width to height ratios (W/H) from 1 to 8.

The proposed hangar development (35.2 m width, 7.4 m height) lies 171 m from the runway centreline about 23 building heights. NASF Guideline B's wake decay table shows the mean velocity deficit has already reduced to ≤ 0.11 V_H by 20 H for the proposed hangar[7]. This equates to the NASF B windshear criteria being exceeded for windspeeds of approximately 55 knots.

Turbulence

With regards to turbulence, our data shows that for the squat buildings with a rectangular floorplan such as the proposed building, shown in Figure 1, wind shear is the limiting factor, not turbulence. This view is supported by published measurements of turbulent building wakes (Hansen, 1975) which found that at a downwind distance of 18 building heights, turbulence was "essentially the same as the undisturbed boundary-layer flow", i.e. no additional turbulence was generated by the building. Only for very particular and much more complex building shapes at some other airports were turbulence effects found to be more significant. Hence, we would not expect turbulence effects for the proposed simple rectangular floorplan building to materially increase the level of turbulence over the runway.

Concluding comments

In conclusion, windshear and turbulence levels for Tumut Aerodrome's runway are not expected to be materially affected by the proposed helicopter hangar for crosswinds below 55 knots.

Regards,

James Brett

James Brett
BE (Hons) BSc MEngSc PhD
Principal Modelling Engineer

References

DIRD. (2018). *NASF Guideline B Managing the risk of building generated windshear and turbulence at airports.*

Hansen, A. P. (1975). *Wind-tunnel measurements in the wake of a simple structure in a simulated atmospheric flow.* National Aeronautics and Space Administration.

Havenhand & Mather Architects Pty Ltd. (2025). *Aviation Hangar Tumut Airport, Development Application, 26 Jun 2025.*

[6] At the height of the building roof.
[7] Based on the hangars Width/Height ratio of 4.75

Attachment A – NASB B summary (DIRD, 2018)

49. Buildings that could pose a safety risk are those located within a rectangular 'assessment trigger area' around the runway ends (see Figure 1, below):
    a. 1200m or closer perpendicular from the runway centreline (or extended runway centreline[1]);
    b. 900m or closer in front of runway threshold (towards the landside of the airport); and
    c. 500m or closer from the runway threshold along the runway.

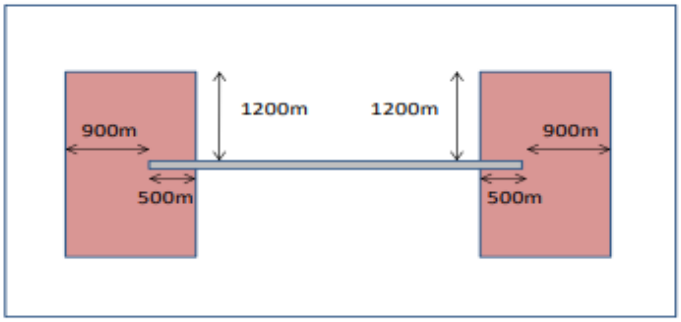

Figure 1: Assessment trigger area around runways, within which buildings should be assessed

Mitigation of risk by use of a height limitation surface

51. For buildings within the assessment trigger area, the first step is to consider the height of the building to determine its acceptability. The rule adopted in Australia is based on one developed in the Netherlands. This proposes that buildings should not penetrate a 1:35 surface extending perpendicular from the runway centreline (or extended runway centreline within the assessment trigger area). As the 1:35 surface extends from the runway centreline, when considering buildings against the 1:35 surface the building height should be measured above runway level.

52. In other words, the distance from the runway centreline to the closest point of the building should be more than 35 times the height (above runway level) of the building. Thus, a building with a height of 10 metres would be acceptable if it is located more than 350 metres perpendicular from the runway centreline (or extended runway centreline) and a building with a height of 20 metres would need to be located more than 700 metres from the runway centreline (or extended runway centreline).

53. The 1:35 surface can be applied to rule out buildings that will clearly not pose a risk. This will therefore be the first test that will be applied when approval authorities/decision makers are presented with a building to assess within the trigger area. This approach will enable the vast majority of developments at regional airports to be assessed very quickly. The 1:35 surface is very conservative and any building that does not penetrate the surface is not expected to create unsafe wind effects.