

Noise Compliance Requirements for Distribution Transformers

1. Brief description

Guideline outlining acceptable placement of new distribution transformers to ensure compliance with the Environmental Protection (Noise Regulations) 1997.

1.1 Related policies

This guideline is made under and supports the *Safety, Health & Environment Policy (EDM 31986289)*

1.2 Introduction

The purpose of this document is to outline the acceptable placement of new distribution transformers in the Western Power network so that they are deemed to comply with the *Western Australian Environmental Protection (Noise Regulations) 1997* (known as the Noise Regulations). This document also provides guidance on what measures can be put in place to achieve compliance in more complex scenarios where separation distances are not able to be achieved.

1.3 Scope

This procedure is to be used by internal and external parties when locating/placing new distribution transformers. Western Power will use this document to assess compliance of a proposed distribution transformer location with the Noise Regulations.

This procedure only applies to new ground mounted (padmount) distribution transformers. Western Power has an approval through *Regulation 17 of the Noise Regulations* that outlines compliance requirements for existing distribution transformers connected to the network. For subdivision applications, this document should be read in conjunction with the Underground Distribution Scheme (UDS) Manual. Pole mounted transformers are not included in this document due to their additional separation from nearby receptors in most circumstances.

1.4 Context

The Regulations

The Noise Regulations prescribe the allowable noise levels for residential, commercial and industrial premises. These regulations govern the level of noise that Western Power is allowed to emit from its facilities. The regulations prescribe assigned levels for various times of the day and include adjustments for the surrounding context, such as proximity to major roads (influencing factors), as well as for tonal noise. In the most stringent situations, Western Power is required to ensure that the noise level received from the transformers outside neighbouring residential properties is no more than 30 dB(A) (as transformers also have a 5 dB(A) tonal penalty).

The development of this procedure

The Department of Environment Regulation and the Urban Development Institute of Australia (UDIA) have worked with Western Power to develop a simple process for both Western Power and external parties to use to achieve compliance with the Noise Regulations. The process is informed by planning schemes and traffic levels through the application of influencing factors. The approach uses a distance-based method and steps through a hierarchy of controls in order to achieve compliance.

Application

Generally, transformers are located close to residential properties to allow for efficient distribution of electricity to the public. The separation distance between the transformer and the Noise Sensitive Premises is the main factor that determines the impact at this premise. The size of the transformer, presence of a fence or boundary wall and the amount of nearby commercial land, industrial land and major roads will determine the required separation distance.

2. Details

The instructions outlined in this document allows the user to work their way through each step until they have achieved compliance with the Noise Regulations. The approach is intended to be flexible to ensure that in complying with Noise Regulations, the public is not then negatively impacted (for example visual impact or the cost of compliance).

Compliance with this guideline and the Regulation 17 approval is conditional upon procurement of transformers compliant with the reduced sound power level of the Australian Standard *AS 60076.10-2009 Power transformers- Determination of sound levels*¹. If the transformer to be used does not meet this standard the designer is required to demonstrate that the installed transformer will still meet the requirements of the noise regulations (whether through a sufficient buffer or installed mitigation).

The designer shall provide Western Power with information (in report form) on each development documenting how each transformer has complied with this procedure. Western Power may audit this information as part of the existing design conformance review process. Worked examples are included in Appendix 1 to this document.

The key steps associated with locating new distribution transformers in order to achieve compliance are outlined below.

2.1 Step 1: Determine distance from transformer to property boundary of nearest noise sensitive premise

The transformer is deemed to comply if the distances in the following table can be met.

Note: designers must still ensure minimum fire risk separation distances are met per the WA Distribution Connections Manual and Distribution Substation Manual.

¹ Data calculations in this document are based on 3dB below the reduced sound power levels in the standard based on transformer sound power tests.

Table 1: Separation Distances

Transformer	Distance of transformer to lot boundary
1000 kVA	7 metres
Up to 630 kVA	5.5 metres

If the above distances cannot be achieved, move to Step 2.

2.2 Step 2: Determine distance requirements from transformer to property boundary with influencing factor

The Noise Regulations provide an allowance to increase the received noise levels when Noise Sensitive Premises are located close to major roads and industrial or commercial precincts. This allowance is termed an Influencing Factor and is based on the amount of industrial and commercial lands, as well as the major and secondary roads within two defined circles – 100m and 450m from the receiving point.

The Influencing Factor can be calculated using zoning information from Local Structure Plans, Local Planning Schemes, Town Planning Schemes and Main Roads traffic data. Schedule 3 of the Noise Regulations provides instruction on how to calculate influencing factors. The Influencing Factor should be considered at the design phase when locating or upgrading a distribution transformer and may reduce the distance required between a transformer and a property boundary to comply.

The table below outlines the Influencing Factor and the distance reduction they result in. Note: if the premises has already been built this distance can be measured to the nearest Habitable Room.

Table 2: Separation distances and influencing factors

Influencing Factor	0 dB	2 dB	4 dB	6 dB
Description of typical influencing factor (example)	No major or secondary roads, no commerce or industry within 450m	Major road between 100 and 450m; or Secondary Road within 100m; or 20% of land within 450m is zoned industrial; or 40% of land within 450m is zoned commercial	Two secondary roads within 100m; or 1 Secondary Road within 100m and 40% of land within 450m zoned commercial	Major road within 100m; or 1 secondary road within 100m and 40% of land within 450m zoned industrial
Multi story residence or single story, no fence – deemed to comply distance between transformer and property boundary	5.5m for <=630 kVA transformers 7m for 1000 kVA transformers	4.5m for <=630 kVA transformers 5.5m for 1000 kVA transformers	3.5m for <=630 kVA transformers 4.5m for 1000 kVA transformers	3.0m for <=630 kVA transformers 3.5m for 1000 kVA transformers

Notes:

- 1) Distances apply between the boundary and edge of the main transformer tank.
- 2) If multiple transformer are being installed the designer is required to demonstrate that the substation will still meet the requirements of the noise regulations.

If the above distances are met, it is deemed to comply. If the above distances cannot be achieved, move to Step 3.

2.3 Step 3a: Determine noise affected area (with fence)

If the distance between the transformer and the property boundary is less than the distances outlined in steps 1 and 2 the installation of a fence or barrier is an effective way to reduce noise levels and therefore reduce the required separation distance. It will be necessary to determine the *noise affected area* to see whether compliance can be achieved.

To obtain the full effect the fence must be solid, with no gaps and be constructed of brick, fibro, colourbond, steel, concrete or a similar material.

Note: Where electrically conductive materials are to be or have been used the potential for step touch voltages needs to be considered. For more information refer to the UDS Manual.

The table below indicates the *noise affected area* for varying fence heights and sides.

The distances listed in the table are the *noise affected areas*, which is the distance from the transformer within which it could be expected that noise from the transformer will exceed the assigned levels in the *Noise Regulations*. If the green highlighted distances can be achieved, the transformer is *deemed to comply*.

Table 3: Separation distances and fences

Transformer Rating	Fence height above transformer (mm)	Number of fenced sides	Influencing Factor			
			0 dB	2 dB	4 dB	6 dB
			Noise affected area – distance (m)			
<=630 kVA	400	3	2.8	2.2	1.8	<1.5
		2	2.5	2	1.7	<1.5
		1	2.2	1.8	<1.5	<1.5
	800	3	2.2	1.8	<1.5	<1.5
		2	2	1.7	<1.5	<1.5
		1	1.8	<1.5	<1.5	<1.5
1000 kVA	400	3	3.5	2.8	2.2	1.8
		2	3.1	2.5	2	1.7
		1	2.8	2.2	1.8	<1.5
	800	3	2.8	2.2	1.8	<1.5
		2	2.5	2	1.7	<1.5
		1	2.2	1.8	<1.5	<1.5

Note: Distances apply to the edge of the main transformer tank. Interpolation of table figures is permitted for fence heights in between 400 & 800mm above the transformer height.

How to use and interpret Table 3:

If there is a premise already established -

- The approval provides that an exceedance is permitted so long as the noise affected area does not intrude into a habitable room within the noise sensitive premise. An intrusion is only considered likely if a habitable room has or is likely to have a window (of 1m² area or greater) within the noise affected area.

Where there is no premise established -

- As the Residential Design Codes (R-codes) do not permit a major opening to a habitable area to be located within 1.5 m of the boundary of the lot and the minimum distance permitted between a transformer and a lot boundary is 0.6m, a minimum of 2.1m separation will be achieved in most circumstances.
- Therefore all noise affected areas calculated at 2.1m or less (green cells) will automatically be deemed to comply and no further action is required.
- If the size of the noise affected area is greater than 2.1m, the area may be reduced by raising the height of the boundary fence (as per heights in Table 3).
- As the goal is to protect the occupants of a future property, Western Power will require evidence that a fence will ultimately be included once a premise is established. This may be in the form of a model contract, statutory declaration or similar.

If the above criteria are met, it is deemed to comply. If the above criteria cannot be met, move to Step 4.

2.4 Step 3b: Determine noise affected area (without fence)

Alternatively, developers or designers may choose to apply special design controls to the affected lots (in lieu of fencing or in the case of non-standard fencing which does not provide the required mitigation) to comply. If this is the case, refer to Step 4 for guidance. Compliance with the approval will still need to be demonstrated when submitting the standard assessment template.

2.5 Step 4: Other noise mitigation methods

Where the *noise affected area* is or is likely to intrude into a *habitable room*, further measures are required to achieve compliance.

Existing noise sensitive premises

- Where a building is already present, noise control measures must be implemented to reduce the noise affected area in order to achieve compliance. Control measures may include treatments at the premise (e.g. double glazing or other noise reduction treatments) or at the transformer (e.g. barrier or enclosure). Verification that an alternative treatment method meets the requirement of the approval shall be submitted to Western Power.

Future noise sensitive premises

- Where a building is not yet present (e.g. in new developments) a planning measure will need to be put in place to ensure that the design of the building is carried out in such a way that a habitable room is not impacted by a noise affected area. This may take the form of a notification on the title (e.g. 70A of the *Western Australian Transfer of Land Act 1893*) or – if there is a Detailed Area Plan (DAP) in place – a clause in the DAP. The notification should

identify the noise affected portion of the lot (i.e. the noise affected area). A suggested notification could read as follows:

- A small portion of this lot may be affected by noise from a distribution transformer located near to the property boundary. The building design must ensure that windows of habitable rooms are acoustically treated or not located within <<<distance to be determined using Tables 1 and 2 in this document and advised to Western Power in the application form>>> metres of the lot boundary adjacent to the transformer.

3. Dictionary

Words in the first column of the following table are defined terms and have the corresponding meaning shown in the second column of the table.

Defined term	Meaning
Accountable	The staff member ultimately answerable for the correct and thorough completion of the objective or communication, and the one who delegates the work to those responsible. For example, an Accountable officer approves work that the responsible officer provides.
Approval	Means the Environmental Protection (Western Power Electrical Distribution Transformers Noise Emissions) Approval 2014
Deemed to comply	Based on instructions provided in this document, the location of the transformer is considered to be compliant with the Regulations.
Distribution transformer	Ground mounted transformer connected to the distribution network. Distributes electricity to a local neighbourhood by stepping down high voltage electricity to a lower voltage. Note pole top transformers are excluded from the scope of this document.
Detailed Area Plan (DAP)	These are design guidelines approved by individual councils under their structure plan provisions.
Guideline	Statements or practices aimed at streamlining a particular business process according to a set routine or sound practice. Guidelines can be mandatory or optional.
Habitable room	As per the State Planning Policy 3.1: Any room used for normal domestic activities that includes bedrooms, living rooms, lounge rooms, music room, sitting rooms, television room, kitchen, dining room, sewing room, study, playroom, sunroom, gymnasium, fully enclosed swimming pool or patio. Excludes: Bathroom, laundry, water closet, food storage pantry, walk in wardrobe, corridor, hallway, lobby, photographic dark room, clothes drying room, verandah, unenclosed swimming pool or patio or other spaces of a specialised nature occupied neither frequently nor for extended periods of time.
Informed	Those staff members who are kept up-to-date on progress, often only on completion of communication and advice.
Influencing factor	An adjustment to assigned noise levels for noise sensitive premises located close to major roads and industrial or commercial precincts, outlined in Schedule 3 of the Noise Regulations.

Defined term	Meaning
Major opening	<p>As per the State Planning Policy 3.1: A window, door or other opening in the external wall of a habitable room that provides an external means of light or view for that room, but does not include openings that:</p> <ul style="list-style-type: none"> • In aggregate do not exceed 1 square metre in any such wall (provided that adjoining or continuous windows at the junction of two walls forming an internal angle of 90 degrees or less shall be aggregated. • Are glazed in an obscure material and are unable to be opened, or have a sill height of not less than 1.6 metres above floor level.
Major road	<p>As per Schedule 3 of the Noise Regulations, Major roads are those with an estimated average daily traffic count of >15,000 vehicles. Roads that are planned to have a volume above these thresholds may be used to adjust the influencing factor for distribution transformers.</p>
Noise affected area	<p>Means distance measured from the casing of a transformer within which the noise emissions from the transformer are likely to exceed the assigned levels specified in the Noise Regulations.</p>
Noise regulations	<p>Means the Environmental Protection (Noise) Regulations 1997</p>
Notification on title	<p>Means a notification to be placed on a certificate of title to inform future design takes into account noise regulation compliance.</p>
Noise sensitive premises	<p>As defined in Schedule 1 Part C of the Noise regulations, key examples include premises occupied solely or mainly for residential or accommodation purposes. A full list is provided in the Schedule.</p>
Residential Design Codes (R-Codes)	<p>State Planning Policy 3.1. The R-Codes outline the 'rules' which apply to residential development. They are used as the basis for assessing residential subdivision proposals. Further information is available -</p> <p>http://www.planning.wa.gov.au/637.asp</p> <p>http://www.planning.wa.gov.au/dop_pub_pdf/r_codesspp_3.1.pdf</p>
Regulation 17 of the Noise Regulations	<p>Process of seeking variation to the Noise Regulations where a person is of the opinion that he or she cannot reasonably or practicably comply with a standard prescribed under the Noise Regulations, or that a proposal of that person will not be reasonably or practicably capable of complying with that standard, that person may apply to the Minister for approval to allow the emission of noise in that case to exceed or vary from the standard.</p>
Secondary road	<p>As per Schedule 3 of Noise Regulations, Secondary roads are those with an estimated average daily traffic count of 6,000 – 15,000 vehicles. Roads that are planned to have a volume above these thresholds may be used to adjust the influencing factor for distribution transformers.</p>
Tonal noise	<p>Measured noise limits are automatically increased if the levels are deemed to be tonal in nature (described as a 'whining' or 'droning' characteristic) as measured under section 9 of the noise regulations. Distribution transformers are generally tonal in nature.</p>
Underground Distribution Scheme Manual (UDS Manual)	<p>Provides guidance and assistance in planning and achieving a new development or connection to Western Power's distribution network.</p> <p>http://www.westernpower.com.au/idd/guidelinesmanuals.html</p>
Zone	<p>Means land use zoning as shown in a Local Planning Scheme, Town Planning Scheme or an approved Local Structure Plan.</p>

4. Content owner

Name & Surname	Business Unit
Gordon East, Assurance Manager	SEQT

5. Review

This Guideline will be reviewed and evaluated by the content owner at least once in every three year period taking into account the purpose of the Guideline and the outcome of the compliance review.

6. References

Environmental Protection (Noise) Regulations 1997

http://www.slp.wa.gov.au/legislation/agency.nsf/dec_main_mrtitle_1399_homepage.html

Underground Distribution Scheme (UDS) Manual

<http://www.westernpower.com.au/ldd/guidelinesmanuals.html>

Regulation 17 Approval -

[http://www.slp.wa.gov.au/gazette/gazette.nsf/searchgazette/9EEA3F3121B09D4E48257CCF000AB8D4/\\$file/Gg064.pdf](http://www.slp.wa.gov.au/gazette/gazette.nsf/searchgazette/9EEA3F3121B09D4E48257CCF000AB8D4/$file/Gg064.pdf)

Environmental Protection Authority Report

<http://www.epa.wa.gov.au/EIA/EPAREports/Pages/ElectricalDistributionTransformers-NoiseRegulation17Variation.aspx>

Residential Design Codes

<http://www.planning.wa.gov.au/637.asp>

Western Australian Transfer of Land Act 1893

AS 60076.10-2009 Power transformers- Determination of sound levels

7. Related documents

	EDM reference
Safety, Health & Environment Policy	31986289

8. Approval history

Version	Approved by	Date of approval	Resolution no.	Notes
1.	Steven Hayward, Safety, Health & Environment Governance Manager	16 December 2014	NA	Initial issue
2.	Acting Head of Safety, Environment, Quality and Training	28/12/2017	NA	Minor updates to clarify distances and updated template.
3.				

Appendix 1

Worked examples

The maps are indicative only and illustrate the concept of influencing factors from major roads, required separation distances and when memorial on titles may be required.

Please refer to the body of this document for further description of these concepts and Western Power compliance requirements for distribution transformer noise.

Example 1:

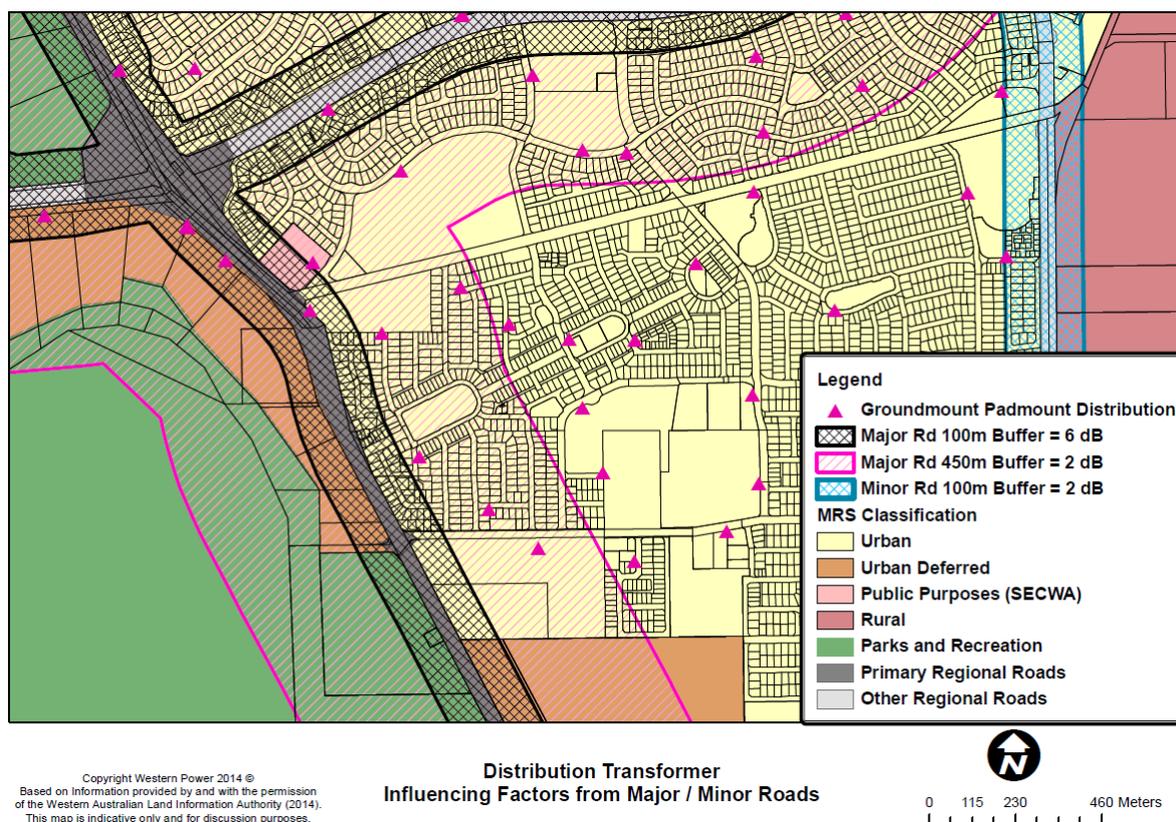


Figure 1 - Influencing Factor from Roads

Residents that live within 100m from a minor road and up to 450m from a major road (carriageway) will receive between 2-6dB(A) allowance known as a influencing factor. This translates into a reduction in the required buffer distance.

Example 2:

The width of a local road carriageway is sufficient to provide the required buffer distance between a transformer and noise sensitive premise. In this example, the transformer has been placed in public open space however any non-sensitive premise (such as the carpark of a local shopping centre) could be used.

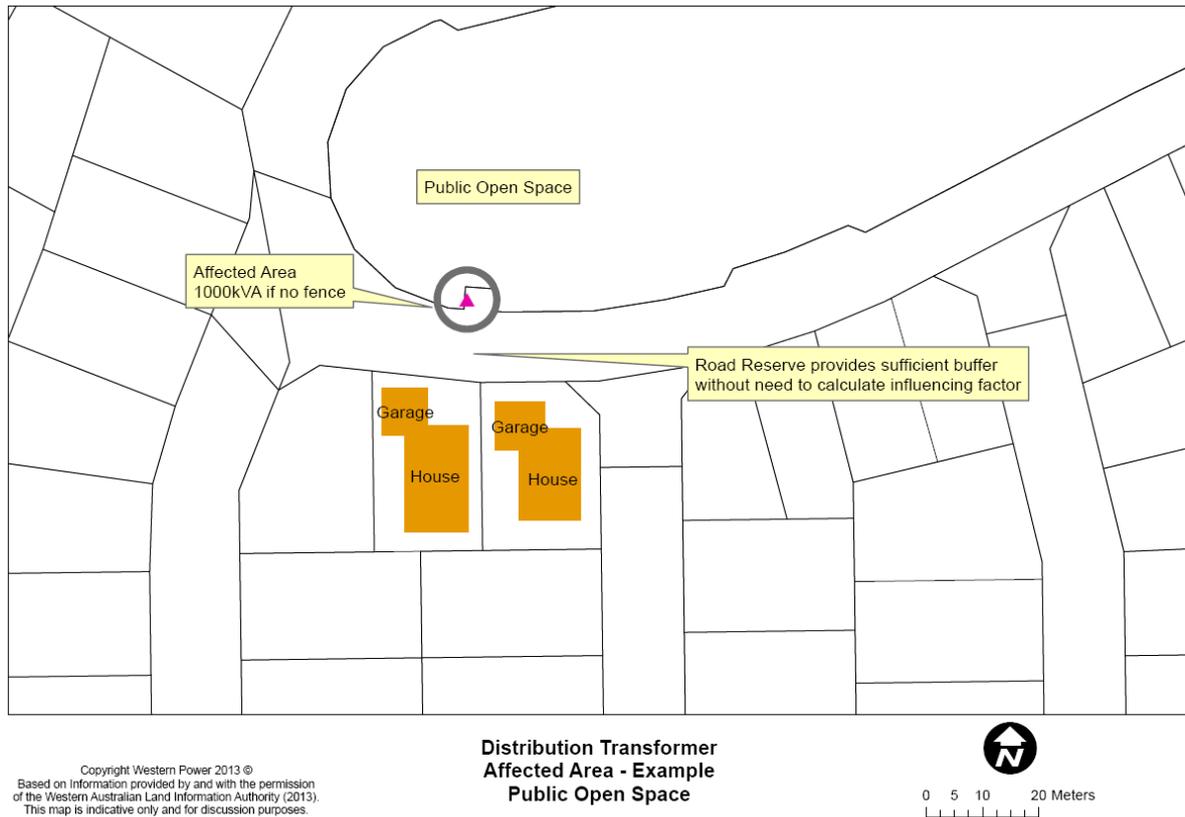


Figure 2 - Using roads to provide required buffers

The width of a local road carriageway is sufficient to provide the required buffer distance between a transformer and noise sensitive premise. In this example, the transformer has been placed in public open space however any non-sensitive premise (such as the carpark of a local shopping centre) could be used.

Example 3:

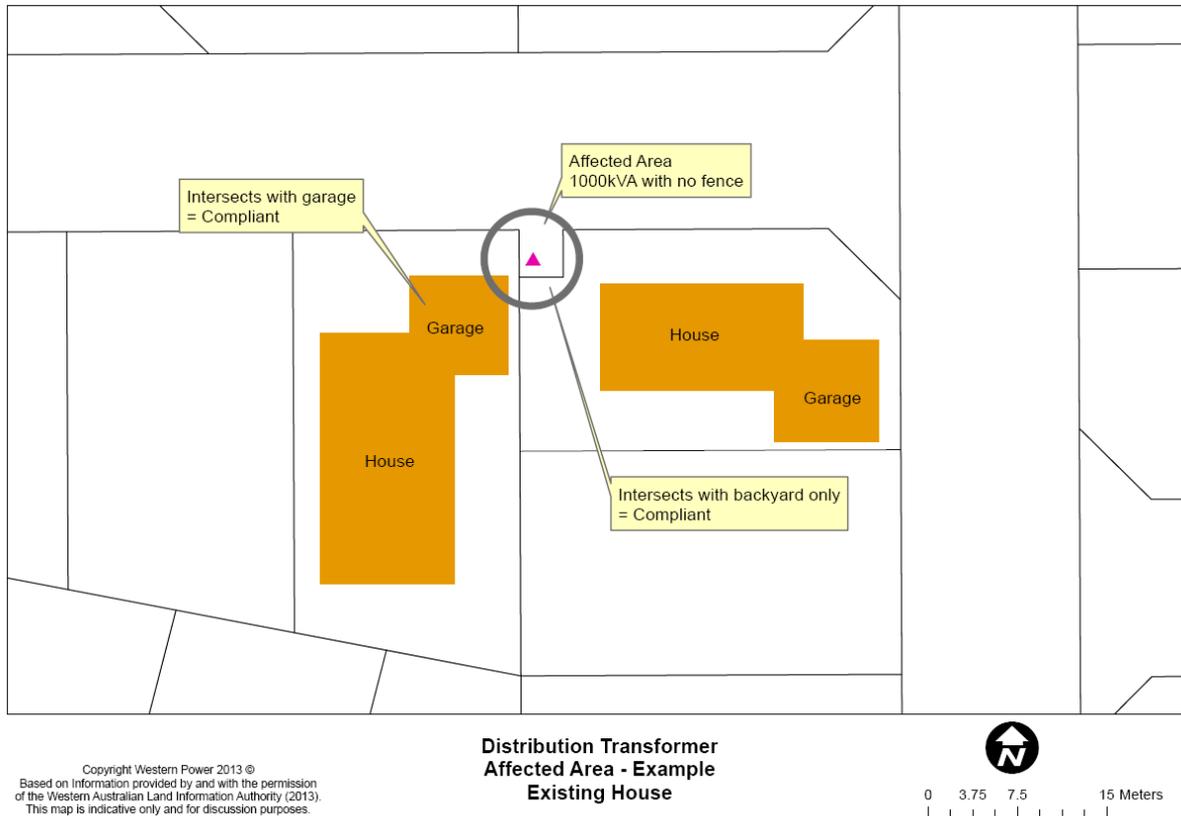


Figure 3 - Transformer between existing premises

There is no longer a requirement to meet the compliance levels in non-habitable areas such as garages, backyards, laundries and toilets. In this example, the transformer is sufficiently far enough from the habitable areas of the premise, meaning the design is compliant.

Example 4:

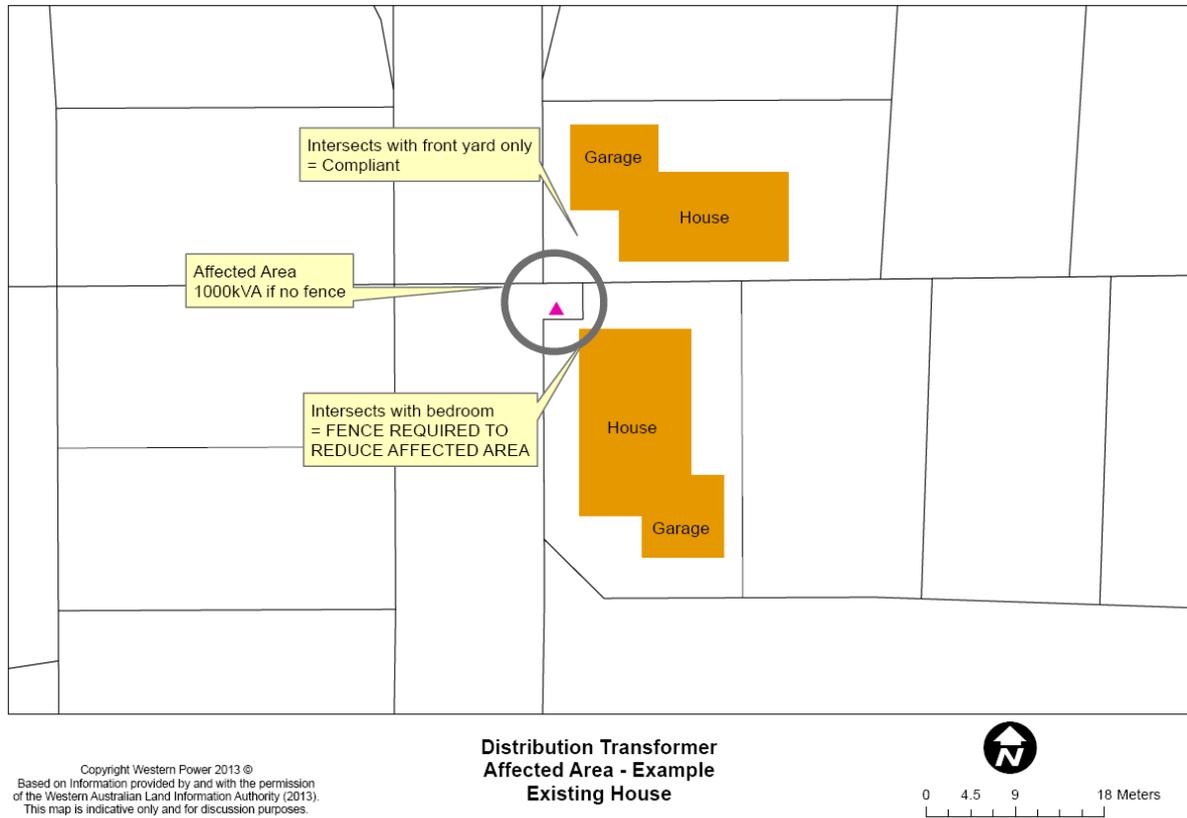


Figure 4 - Transformer between existing premises requiring fence

In this example, the affected area includes a habitable area of the premise. Therefore mitigation, such as a fence is required for the design to be compliant.

Example 5:

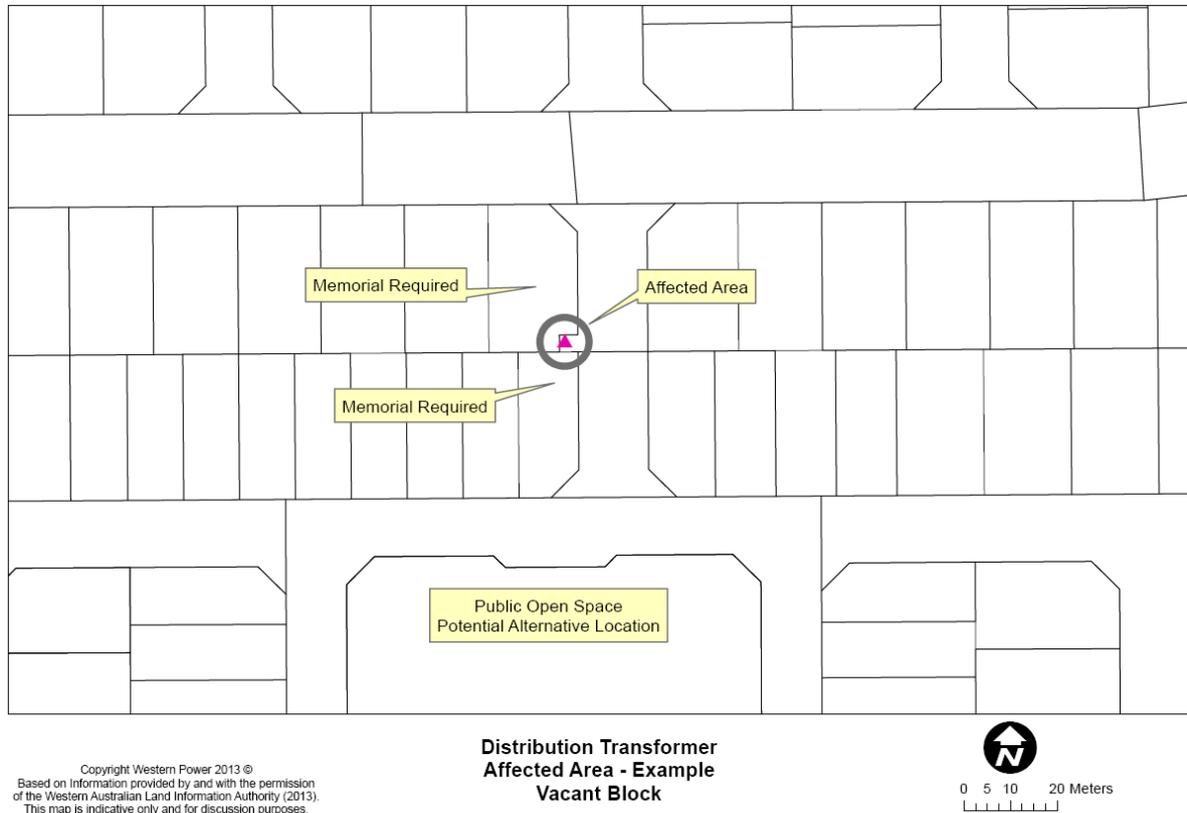


Figure 5 - Undeveloped land

In this example, no premises have been constructed and there is potential for non-compliance as the affected area around the transformer extends into the residential lot. The site would become noncompliant if a habitable area was built in this zone. To make the design compliant, the land holder must be made aware of the potential for transformer noise