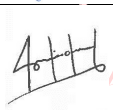
Standard – Horizon Power Environmental Conditions

Standard Number: HPC-9EJ-01-0001-2013

Document Control		
Author	**Name:** Paul Savig **Position:** Senior Standards Engineer	 Digitally signed by Paul Savig Date: 2020.10.20 15:25:22 +08'00'
Reviewed By	**Name:** Leonard Lee **Position:** Senior Engineer Networks	 Digitally signed by Leonard Lee Date: 2020.10.20 15:28:55 +08'00'
Document Owner	**Name:** Sandeep Magan **Position:** Engineering Services Manager / Principal Engineer	 Digitally signed by Sandeep Magan Date: 2020.10.21 09:56:14 +08'00'
Approved By *	**Name:** Marc Beckx **Position:** Manager Engineering & Project Services	 Marc Beckx 2020.10.21 10:15:37 +08'00'
Date Created/Last Updated	20 October 2020	
Review Frequency **	5 yearly	
Next Review Date **	20 October 2025	

** Shall be the Process Owner and is the person assigned authority and responsibility for managing the whole process, end-to-end, which may extend across more than one division and/or functions, in order to deliver agreed business results.*

*** Frequency period is dependent upon circumstances– maximum is 5 years from last issue, review, or revision whichever is the latest. If left blank, the default shall be 1 year unless otherwise specified.*

Revision Control		
Revision	**Date**	**Description**
1	20/10/2020	Revise environmental conditions table, wind requirements and map details
0	26/05/2014	Initial Document Creation

STAKEHOLDERS The following positions shall be consulted if an update or review is required:	***NOTIFICATION LIST*** The following positions shall be notified of any authorised change:
Manager Engineering Services	Project Director, Major Projects
Manager Systems & Network Planning	Asset Managers
	Manager Assets Services

TABLE OF CONTENTS

1 PURPOSE 4

2 SCOPE AND APPLICATION 4

3 NORMATIVE REFERENCES 4

3.1 Standards 4

3.2 Definitions and Abbreviations 5

3.2.1 Definitions 5

3.2.2 Abbreviations 5

4 REQUIREMENTS 6

4.1 General 6

4.2 Regions 7

4.3 Maps Depicting Environmental Conditions 7

4.3.1 Altitude 7

4.3.2 Humidity 8

4.3.3 Lightning 8

4.3.4 Pollution 8

4.3.5 Seismic Interaction 8

4.3.6 Soil 8

4.3.7 Solar Radiation 9

4.3.8 Temperature 9

4.3.9 Wind 9

APPENDIX A – REVISION INFORMATION 11

APPENDIX B – REGIONAL OFFICES (MAP 1) 12

APPENDIX C – ALTITUDES (MAP 2) 13

APPENDIX D – HUMIDITY (MAP 3) 14

APPENDIX E – LIGHTNING (MAP 4) 15

APPENDIX F – POLLUTION (MAP 5) 16

APPENDIX G – SEISMIC DISTURBANCES (MAP 6) 17

APPENDIX H – SOIL CONDITIONS (MAP 7) 18

APPENDIX I – SOLAR RADIATION (MAP 8) 19

APPENDIX J – TEMPERATURE VALUES (MAP 9) 20

APPENDIX K – CYCLONIC WINDS (MAP 10) 21

1 PURPOSE

This Standard sets forth Horizon Power's required Environmental Conditions for all Generation, Transmission and Distribution Assets, thus eliminating the need to continually repeat the Environmental Conditions in each and every Document, Standard, Specification or Tender.

2 SCOPE AND APPLICATION

This Standard shall be used to define the allowable, maximum or minimum Environmental Conditions required by Horizon Power's for its Assets, (whether part of an electrical network or not).

This Standard shall be applied in the following circumstances:

Design of New Assets;

Leasing of Equipment;

Installation of New Assets;

Purchasing of all Assets/Equipment;

Operation of leased or purchased Assets; and

Tendering of Projects.

3 NORMATIVE REFERENCES

3.1 Standards

The following documents contain provisions that, through reference in the text, constitute requirements of this standard. At the time of publication, the editions were valid. All standards and specifications are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below. Information on currently valid national and international standards and specifications can be obtained from SAI Global – Standards On-Line data base or equivalent standards database.

Table 1: - Referenced Documents

Document	Description
AS/NZS 1170.2: 2011	Structure design actions - Wind Actions
AS/NZS 1170.4: 2007	Minimum design loads on structures - Earthquake Loads
AS 4312: 2019	Atmospheric Corrosivity zones in Australia
AS/NZS 7000: 2016	Overhead line design
HB 331: 2020	Overhead line design handbook
ISSN 1039-7205: 2012	Soil-landscapes of Western Australia's Rangelands and Arid Interior

3.2 Definitions and Abbreviations

For the purposes of this standard the following definitions and abbreviations apply:

3.2.1 Definitions

Table 2: - List of Definitions

Definition	Description
Distribution High Importance	Any distribution overhead network assets that require higher reliability due to reasons including but not limited to: a. Criticality of the line b. Close proximity to navigable waterway crossings c. Close proximity to railway track d. Difficulty to access area/terrain

3.2.2 Abbreviations

Table 3: - List of Abbreviations

Abbreviation	Description
dB	decibels
EDC	Earthquake Design Category

4 REQUIREMENTS

4.1 General

All assets bought or built, all equipment leased or purchased, all designs, installations and operations undertaken shall meet or take into consideration the following environmental conditions.

Table 4: Environmental Conditions

Condition	Requirement
Altitude	Not exceeding 1000 m above mean sea level.
Corrosion[1]	Distribution Assets – C3 Medium Transmission Assets – C5 Very High
Humidity (Relative)	0% to 100%, wet/condensing
Lightning (Isokeraunic Levels)	6-12 strikes/km^2 per year
Pollution (Deposits)	Insulation Levels for areas of: • Heavy pollution shall be 31 mm/kV; and • All other areas 20 mm/kV.
Pollution (Noise)	Less than 60 dB
Seismic	EDC II as per AS/NZS 1170.4
Soil Ambient Temperature	Soil ambient temperature shall be taken as: * 30°C or; * Maximum air temperature at the location minus 15°C Whichever one is greater
Soil Thermal Resistivity	Between 1.0°C.m/W and 3.8°C.m/W
Soil Water logged (in specific areas)	Wet salty soil due to accumulation of salt water for long periods. Salt concentration can be as high 5000 mg/litre in certain areas.
Solar Radiation (Peak Maximum Intensity)	1.1 kW/m^2
Temperature Air	-5°C minimum to 50°C maximum
Temperature Black Body in sunlight	80°C maximum
Wind Maximum Velocities	

Assets	Wind velocity (m/s)		
	Region A	Region C	Region D
Overhead Network Assets[2]			
Distribution	39	52	60
Distribution High Importance	41	56	66
Transmission (> 33 kV)	43	61	72
Ground-mounted/Substation Assets[3]			
Distribution	43	58.8	72.6
Transmission	46	73.5	93.5

Condition	Requirement
Other – Live Line	Washing with water having a resistivity above 600 Ω.cm

Note:

1. As per AS/NZS 4312:2019, Atmospheric Corrosivity categories Section 3.2
2. As per HB 331:2020, F_C and F_D for network assets are taken as 1
3. As per AS/NZS 1170.2:2002, F_C and F_D are respectively taken as 1.05 and 1.1

4.2 Regions

Horizon Power shares the task, with Western Power, of supplying electrical power to Western Australia (WA) as shown in Appendix B.

Due to the large area required to be covered by Horizon Power, it has subdivided its area of responsibility into District Offices, namely:

East Kimberley looking after Halls Creek, Kalumburu, Kununurra, Lake Argyle, Warmun and Wyndham;

West Kimberley looking after Ardyaloon, Beagle Bay, Bidyadanga, Broome, Camballin, Derby, Fitzroy Crossing, Lombadina/Djarindjin and Yungngora;

East Pilbara looking after Marble Bar, Nullagine, Port Hedland and South Hedland;

West Pilbara looking after Cossack, Karratha, Onslow, Point Samson and Roebourne;

Gascoyne/Mid West looking after Carnarvon, Coral Bay, Denham, Exmouth and Gascoyne Junction; Cue, Meekatharra, Mount Magnet, Sandstone, Wiluna and Yalgoo; and

Esperance looking after Esperance, Hopetoun, Laverton, Leonora, Menzies and Norseman.

These District Office's contact details are available on Horizon Power's web page and the Offices should be contacted for any particular environmental conditions relating to their area.

4.3 Maps Depicting Environmental Conditions

The maps below are just representations of information sourced from various agencies, Horizon Power recommends that the correct data be obtained from the respective agencies.

4.3.1 Altitude

Map 2 in Appendix C depicts the topography of Western Australia ranging from areas 0 to 300 metres above mean sea level to areas over 600 metres.

Information can be sourced from:

http://www.en-au.topographic-map.com/maps/oe/Western-Australia/

4.3.2 *Humidity*

Map 3 in Appendix D indicates the relative humidity for Western Australia varying between 30% and 70%.

Information can be sourced from:

http://www.http://www.bom.gov.au/jsp/ncc/climate_averages/relative-humidity/

4.3.3 *Lightning*

Map 4 in Appendix E depicts the isokeraunic activity of Western Australia varying from 6-12 strikes/km^2 per year in the Kimberley, to 2-6 strikes/km^2 per year in the Pilbara, and .05-3 strikes/km^2 per year along the South Coast.

Information can be sourced from:

http://www.http://www.bom.gov.au/jsp/ncc/climate_averages/thunder-lightning/

4.3.4 *Pollution*

Map 5 in Appendix F indicates the salt pollution along the Western Australian coast line.

Deposits can be in the form of:

Dust from agriculture or very sandy areas. Wind borne dust deposits may accumulate over a number of months followed by high humidity with heavy dew or light rain.

Salt from the sea (up to 50 km). At points along a 4 km wide West Coast strip, salt deposits can reach levels as high as 40 mg/100 cm^2 per month (Region A).

The Atmospheric Corrosivity Zone is determined by the duration of wetness and airborne salt. The greater the duration of wetness the greater the amount of corrosion which would correspond to salt pollution.

Noise discharge is also considered pollution, but its effect is more related to the effect on human beings. Assets and electrical equipment shall not have high noise emissions. Horizon Power shall give preference to assets and equipment with the lowest noise emissions.

Information can be sourced from:

http://www.der.wa.gov.au/

4.3.5 *Seismic Interaction*

Map 6 in Appendix G depicts the likelihood of seismic activity occurring within Western Australia. There has been little impact, from seismic disturbances, on Horizon Power's assets and equipment.

Information can be sourced from:

http://www.ga.gov.au/about/projects/seismic/

4.3.6 *Soil*

Map 7 in Appendix H attempts to display the various locations of soil types within Western Australia.

There are different resistivity values for different soil types, which would impact on the installation requirements of assets and equipment. The Table 5 below provides general resistance data for soils types. This information needs to be verified by on site tests.

Table 5: Soil Types

Soil Type	Resistance (Ωm)
Wet organic soil	5-50
Clays	10-50
'Typical soil'	50-100
Moist sand and gravel	60-200
Loam and broken stone	200-350
Slate, shale, sandstone	100-1,000
Very dry soil	1,000-2,500
Damp sand	200-500
Dry sand	1,000-2,500
Stony/rocky ground	1,000-10,000
Dry gravel	1,000-5,000
Bed rock	5,000-10,000

Concerns:

Karratha – high concentration of hard rock (trenching is difficult)

Onslow – high concentration of salt (corrosion is prevalent)

Information can be sourced from:

http://www.asris.csiro.au/

4.3.7 Solar Radiation

Map 8 in Appendix I indicates the average daily solar radiation exposure for Western Australia which varies from 4.722 kW/m^2, in the Esperance area, to 6.667 kW/m^2, in the Kimberley/Pilbara area.

Information can be sourced from:

http://www.bom.gov.au/jsp/ncc/climate_averages/solar-exposure

4.3.8 Temperature

Map 9 in Appendix J indicates the recorded maximum air temperature annual for Western Australia varying from 24°C in the Esperance area to 42°C in the Kimberley area.

Information can be sourced from:

http://www.http://www.bom.gov.au/jsp/ncc/climate_averages/decadal-temperature/

4.3.9 Wind

Map 10 in Appendix K depicts the various wind zones that could be expected in Western Australia which varies between cyclonic gusts to steady breezes.

Base regional wind speed and the associated wind return period shall be selected for a particular set of asset/structure based on:

1. The criticality of the asset/structure. Also referred to as importance level / security level, this is typically determined based on the magnitude of safety, economical, social, environmental consequence in the event of a failure. A higher importance level can also be applied to assets installed in areas not easily accessible for maintenance purposes.
2. The expected design working life of the asset

For above-ground assets, Horizon Power typically adopts an asset working life of 50 years. Taking into consideration the criticality of the assets, the following are the recommended wind return period (WRP):

1. Overhead network assets (Based on AS/NZS 7000:2016 section 6.2.2 and Table 6.2)
    a. Distribution – WRP = 50 years (line security level 1)
    b. Distribution High Importance – WRP = 100 years (line security level 2)
    c. Transmission (>33 kV) – WRP = 200 years (line security level 3)
2. Ground-mounted/Substation assets (Based on AS/NZS 1170.0:2002 – Appendix F and Table 3.2)
    a. Distribution – WRP = 100 years (importance level 1)
    b. Transmission – WRP = 1000 years (importance level 3)

Whilst Table 3.2 specifically applies to New Zealand structure, unfortunately similar guidance on application of importance level is not provided under Appendix F of the Standard for Australian structures. The table is thus still referred to due to unavailability of a more credible guide.

Information can be sourced from:

http://www.bom.gov.au/

APPENDIX A – REVISION INFORMATION

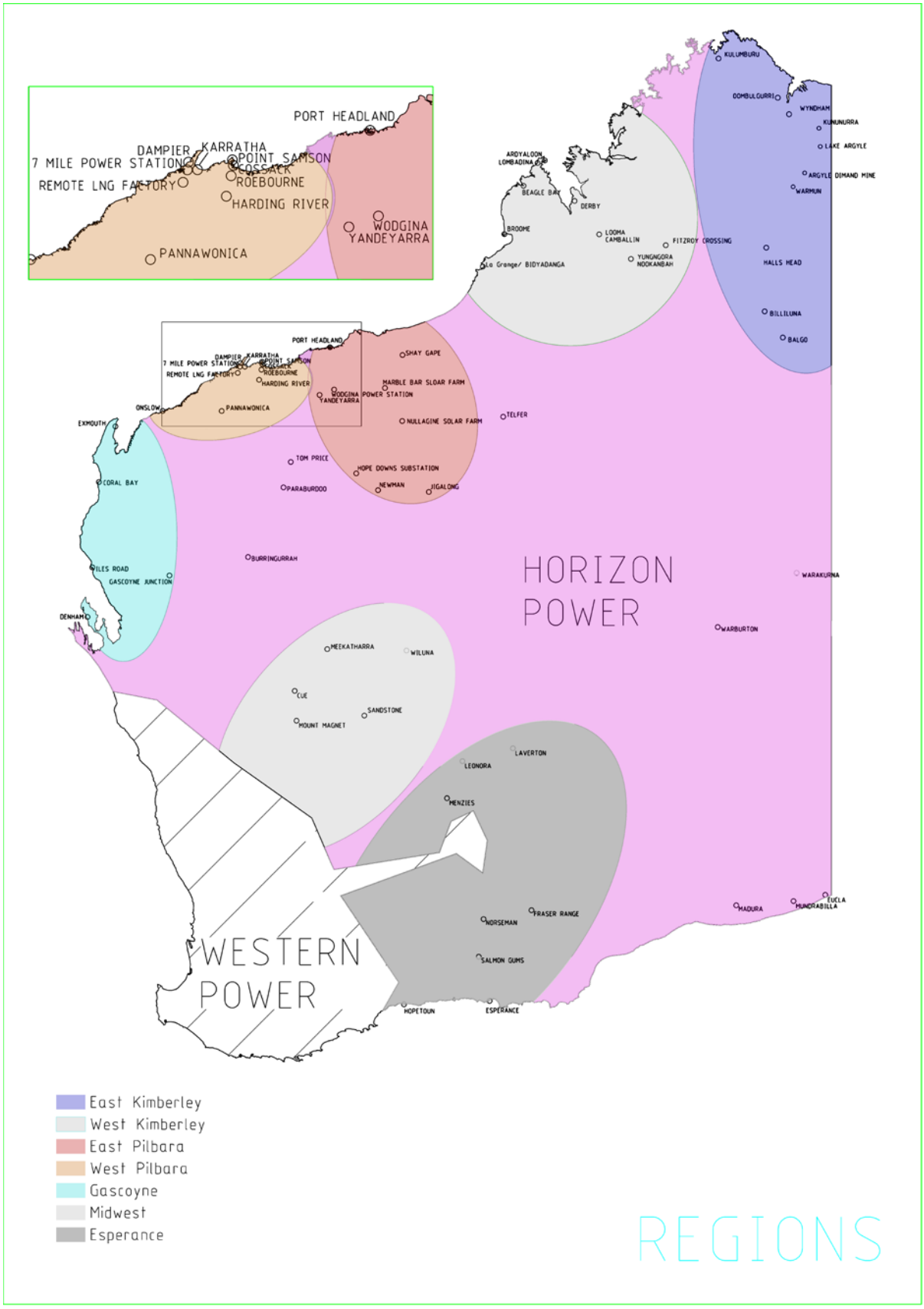
Horizon Power has endeavoured to provide standards of the highest quality and would appreciate notification if any errors are found or even queries raised.

Each Standard makes use of its own comment sheet which is maintained throughout the life of the standard, which lists all comments made by stakeholders regarding the standard.

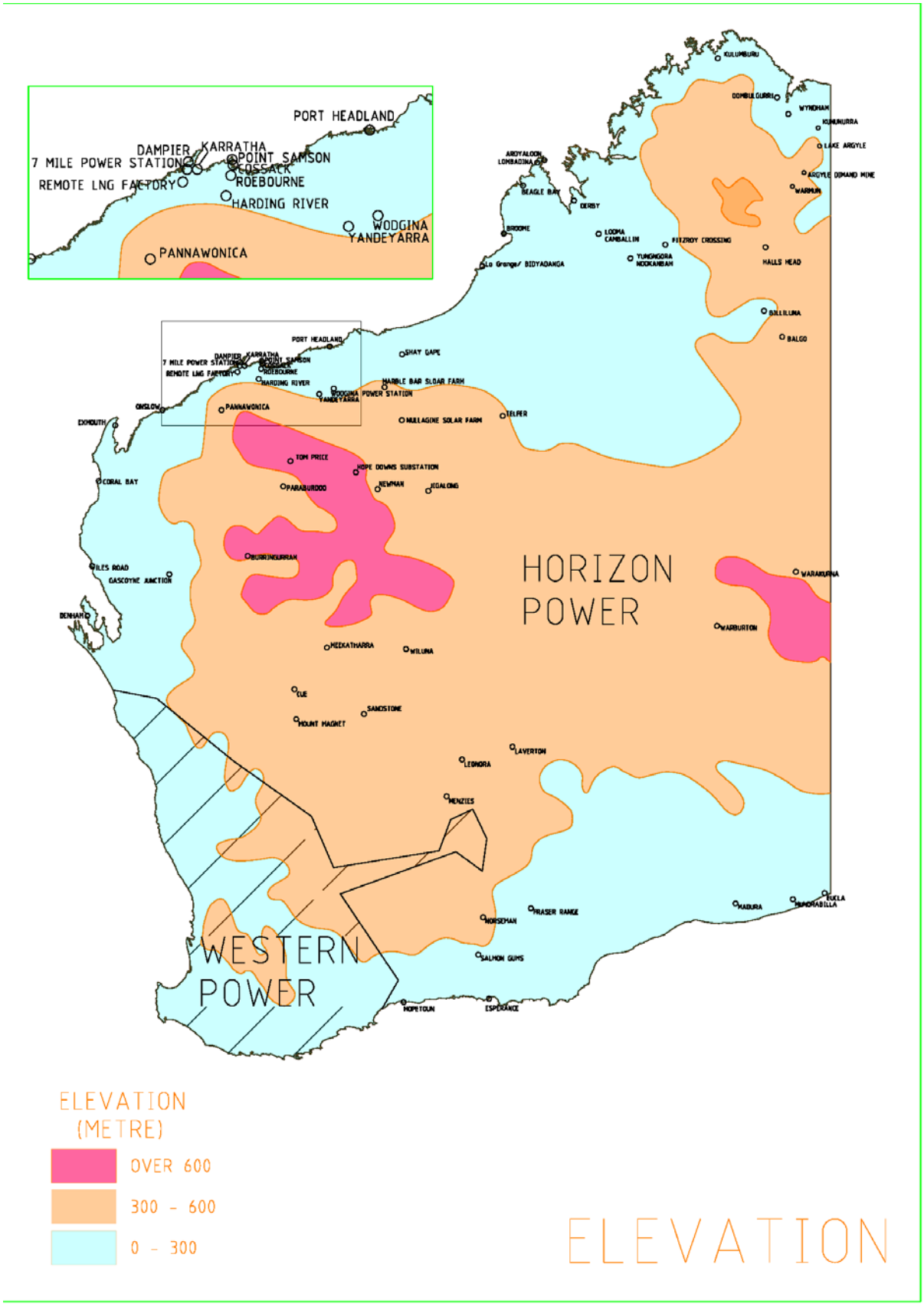
The Document **HPC-9EJ-01-0001-2013 - COMM** found in **DM#: 1820424** can be used to record any errors or queries found in or pertaining to this standard, which can then be addressed whenever the standard gets reviewed.

Date	Rev No.	Notes
26/05/2014	0	First Issue
20/10/2020	1	Revise environmental conditions table, wind requirements and map details

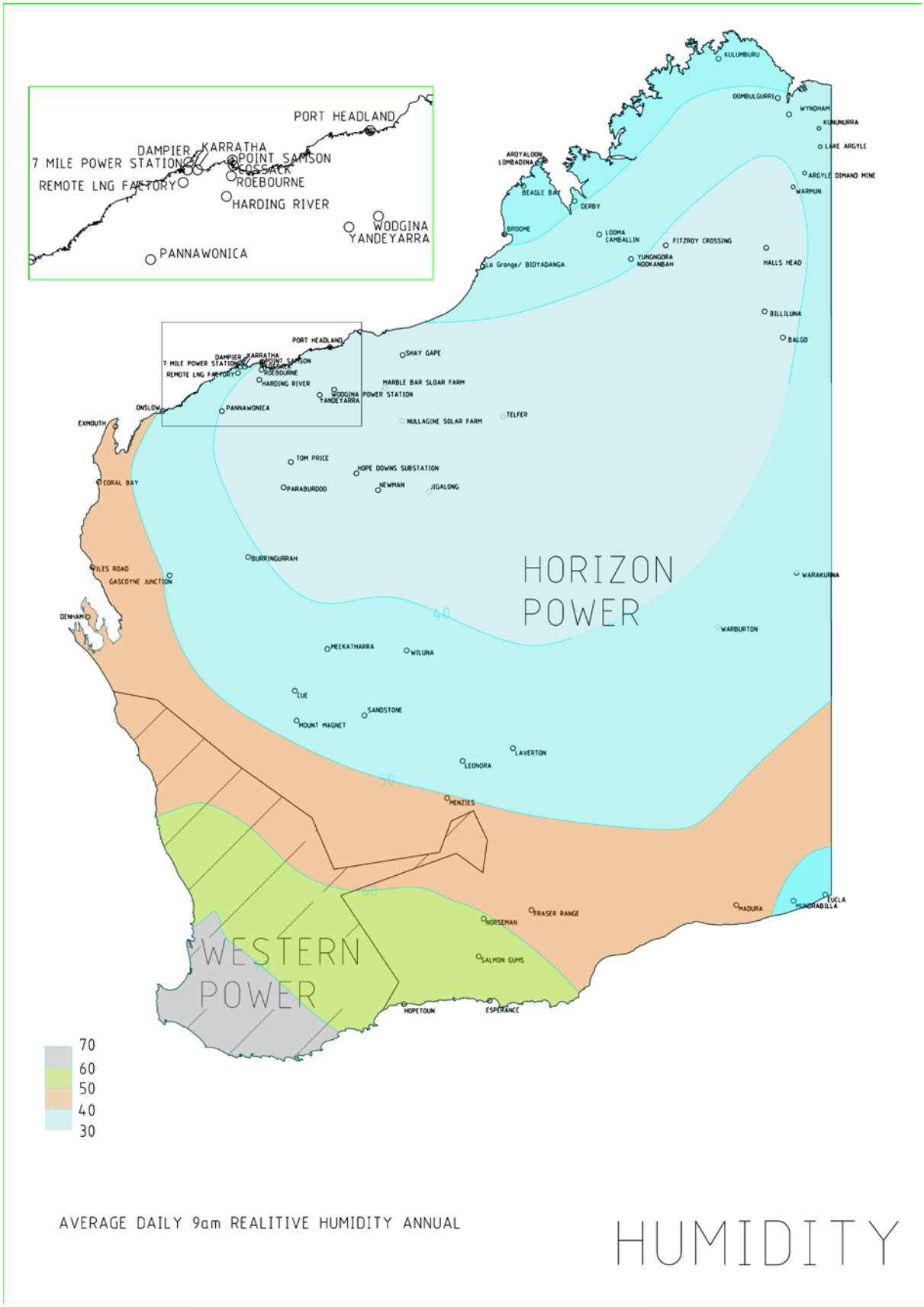
APPENDIX B – REGIONAL OFFICES (MAP 1)



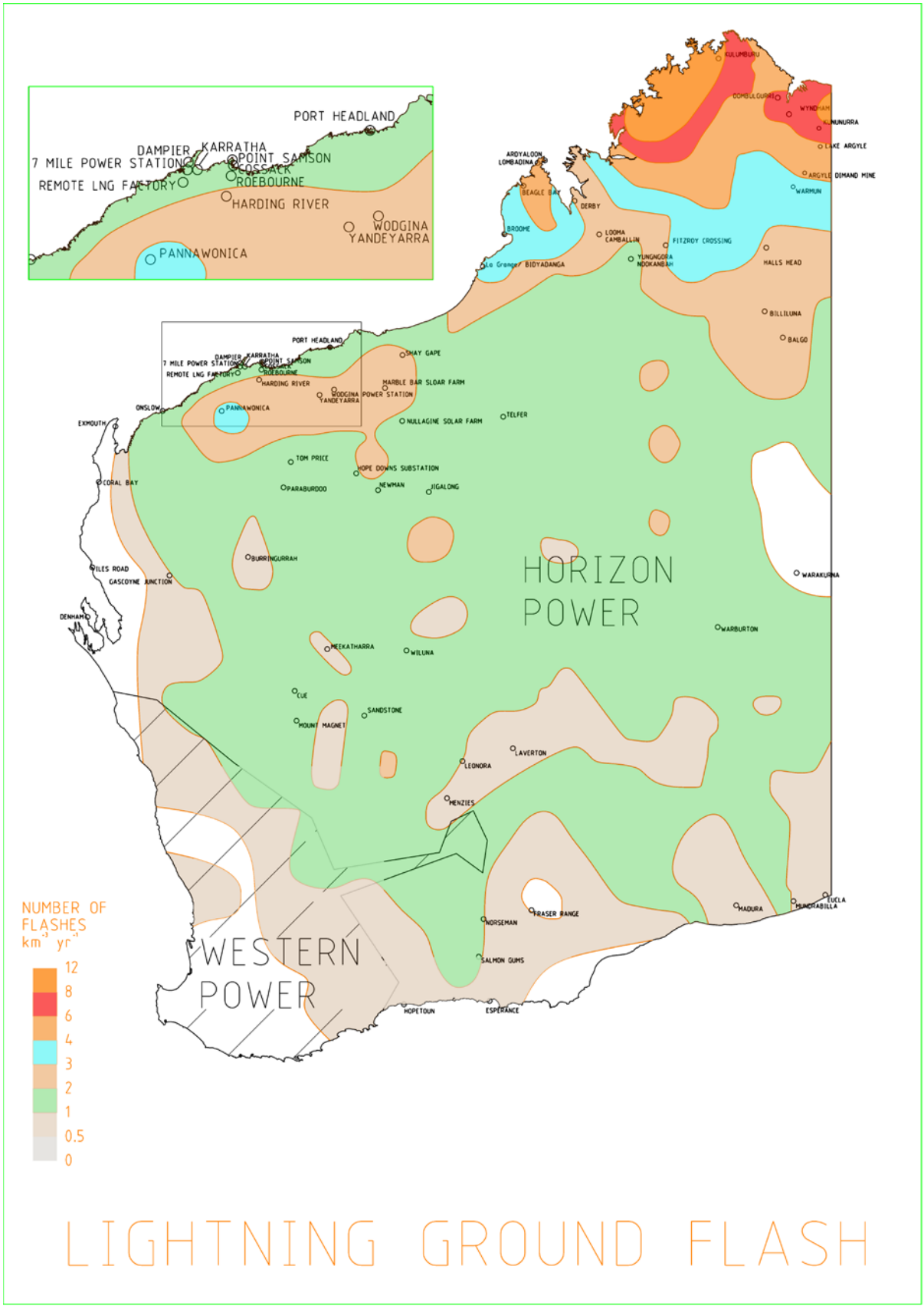
APPENDIX C – ALTITUDES (MAP 2)



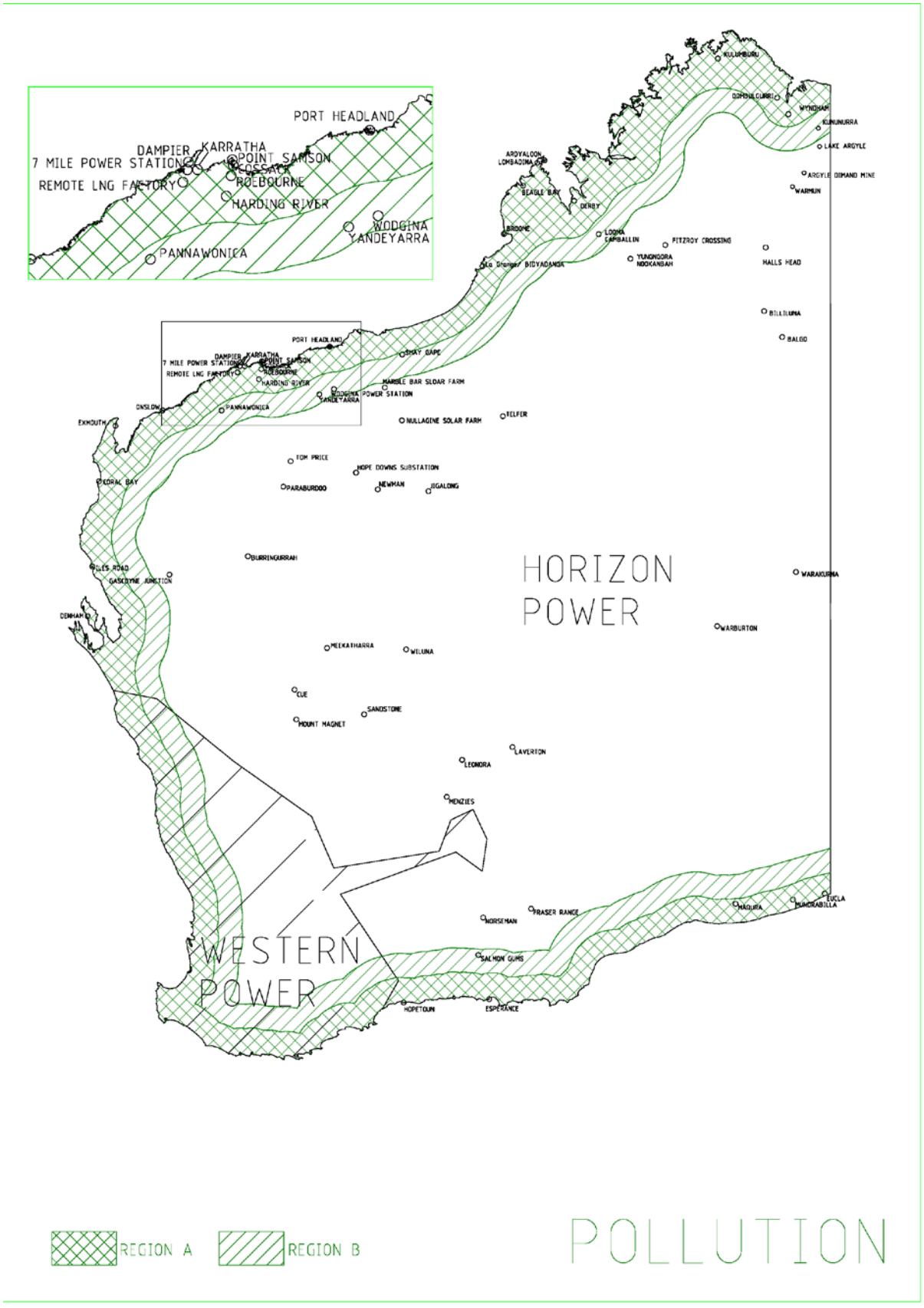
APPENDIX D – HUMIDITY (MAP 3)



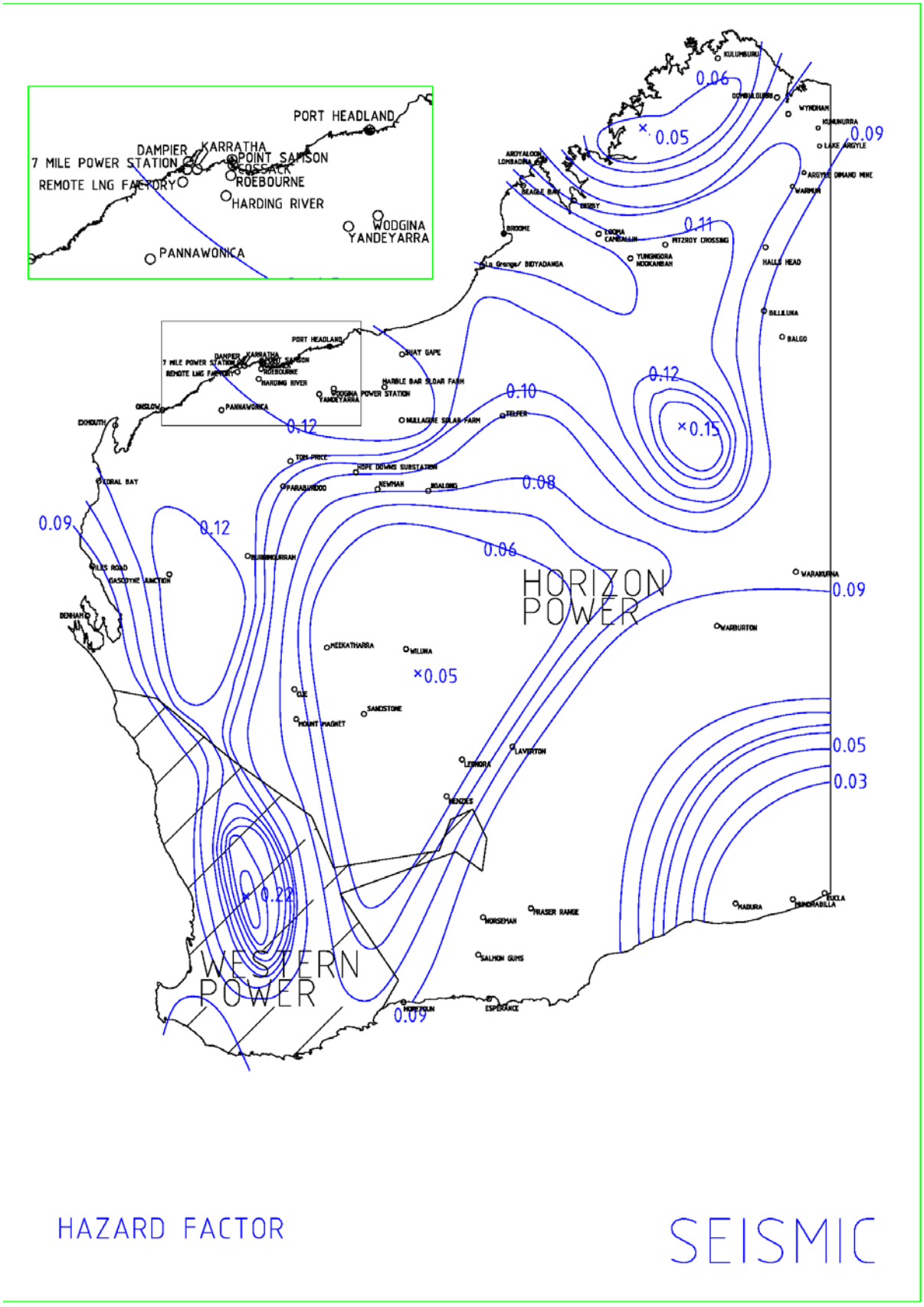
APPENDIX E – LIGHTNING (MAP 4)



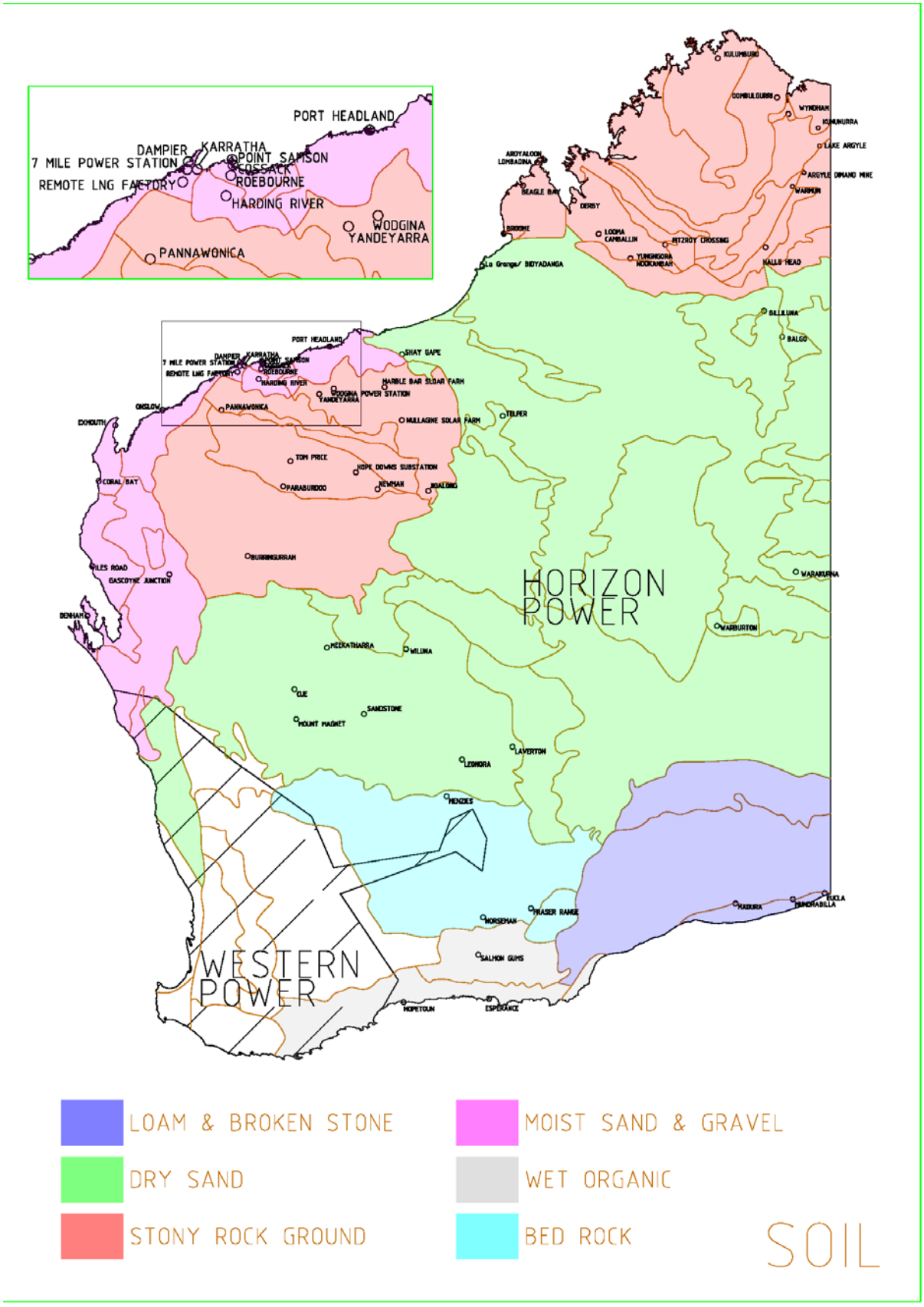
APPENDIX F – POLLUTION (MAP 5)



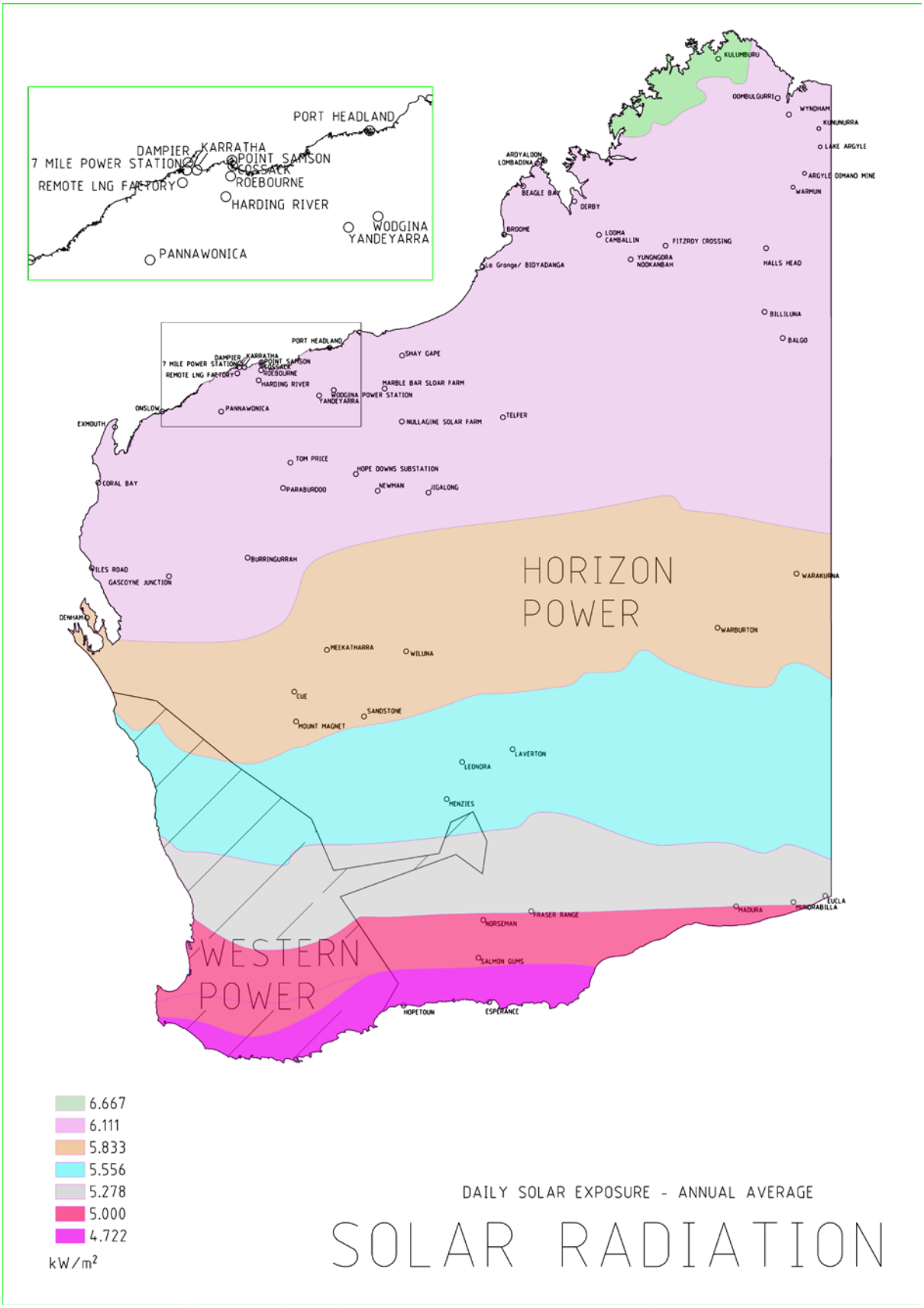
APPENDIX G – SEISMIC DISTURBANCES (MAP 6)



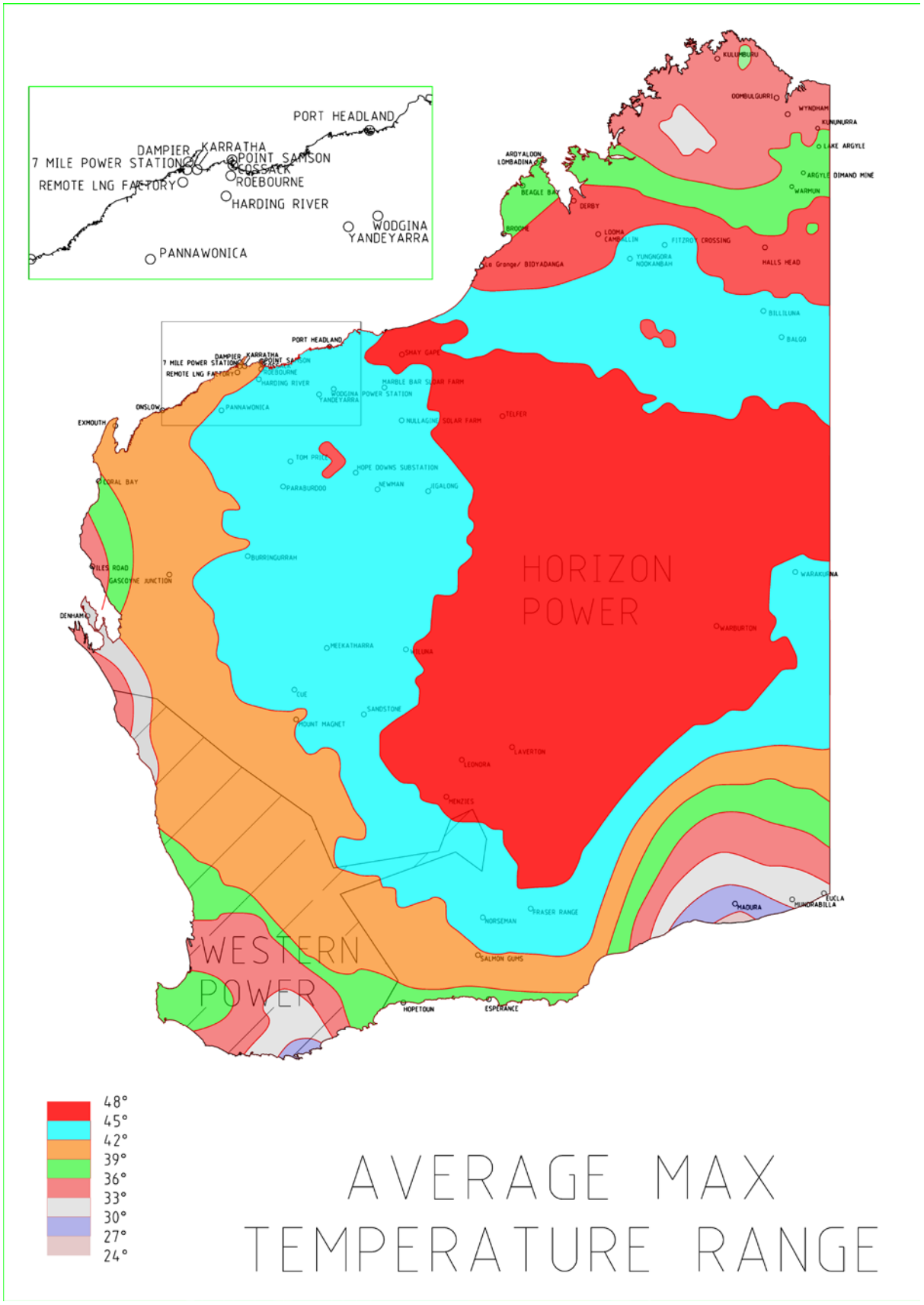
APPENDIX H – SOIL CONDITIONS (MAP 7)



APPENDIX I – SOLAR RADIATION (MAP 8)



APPENDIX J – TEMPERATURE VALUES (MAP 9)



APPENDIX K – CYCLONIC WINDS (MAP 10)