

Appendix

Appendix 1: Suitability factors

The complete set of evaluation factors used for the development of the suitability maps for the Petroleum resources, Geothermal resources, carbon geological storage (CGS), underground gas storage (UGS) and Groundwater resources.

Resource	Interval	Factor	Significance	Source	Weight (AHP)
Petroleum	G1low	Petroleum field (density)	proxy for exploration success	EDIN (S&P)	0.21
Petroleum	G1low	Reservoir (IRCM Kingia) (presence)	presence of reservoir, pore space	WAPIMS (DEMIRS), 3DGEO (2013)	0.21
Petroleum	G1low	Seal (Carynginia) (presence)	presence of containment	3DGEO (2013)	0.21
Petroleum	G1low	Fault (density)	proxy for presence of structure and closure	WAPIMS (DEMIRS)	0.21
Petroleum	G1low	Petroleum prospect (density)	proxy for prospectivity	EDIN (S&P)	0.09
Petroleum	G1low	Petroleum permit (presence)	presence exploration or production rights	WAPIMS (DEMIRS)	0.05
Petroleum	G1low	Pipeline (distance to)	proxy for commercial viability	WAPIMS (DEMIRS)	0.02
Petroleum	G1up	Petroleum field (density)	proxy for prospectivity	EDIN (S&P)	0.21
Petroleum	G1up	Reservoir (Wagina Beekeeper Dongara) (presence)	presence of reservoir, pore space	Mory and lasky (1996)	0.21
Petroleum	G1up	Seal (Kockatea) (thickness)	presence of containment	WAPIMS (DEMIRS)	0.21
Petroleum	G1up	Fault (density)	proxy for presence of structure and closure	WAPIMS (DEMIRS)	0.21
Petroleum	G1up	Petroleum prospect (density)	proxy for prospectivity	EDIN (S&P)	0.09
Petroleum	G1up	Petroleum permit (presence)	presence exploration or production rights	WAPIMS (DEMIRS)	0.05
Petroleum	G1up	Pipeline (distance to)	proxy for commercial viability	WAPIMS (DEMIRS)	0.02
Petroleum	G2A1	Petroleum field (density)	proxy for prospectivity	EDIN (S&P)	0.21
Petroleum	G2A1	Reservoir (Cattamarra) (presence)	presence of reservoir, pore space	WAPIMS (DEMIRS), 3DGEO (2013)	0.21
Petroleum	G2A1	Seal (Cadda) (thickness)	effectiveness of containment	Mory and lasky (1996)	0.21
Petroleum	G2A1	Fault (density)	proxy for presence of structure and closure	WAPIMS (DEMIRS)	0.21
Petroleum	G2A1	Petroleum prospect (density)	proxy for prospectivity	EDIN (S&P)	0.09
Petroleum	G2A1	Petroleum permit (presence)	presence exploration or production rights	WAPIMS (DEMIRS)	0.05
Petroleum	G2A1	Pipeline (distance to)	proxy for commercial viability	WAPIMS (DEMIRS)	0.02
CGS	G1low	Seal (Carynginia) (presence)	presence of containment	3DGEO (2013)	0.43

CGS	G1low	Reservoir (IRCM) (presence)	presence of reservoir, pore space	WAPIMS (DEMIRS), 3DGEO (2013)	0.43
CGS	G1low	Fault (density)	proxy for compartmentalisation and baffle reducing flow	WAPIMS (DEMIRS)	0.09
CGS	G1low	Fault (at Kockatea level) (distance)	proxy for permeability increase and potential risk near major faults	WAPIMS (DEMIRS)	0.04
CGS	G1up	Seal (Kockatea) (thickness)	effectiveness of containment	WAPIMS (DEMIRS)	0.43
CGS	G1up	Reservoir (Wagina Beekeeper Dongara) (presence)	presence of reservoir, pore space	WAPIMS (DEMIRS), 3DGEO (2013)	0.43
CGS	G1up	Fault (density)	proxy for compartmentalisation and baffle reducing flow	WAPIMS (DEMIRS)	0.09
CGS	G1up	Fault (at Kockatea level) (distance)	proxy for permeability increase and potential risk near major faults	WAPIMS (DEMIRS)	0.04
CGS	G2A1	Seal (Cadda) (thickness)	effectiveness of containment	Mory and lasky (1996)	0.43
CGS	G2A1	Reservoir (Lesueur Cattamarra) (presence)	presence of reservoir, pore space	WAPIMS (DEMIRS), 3DGEO (2013)	0.43
CGS	G2A1	Fault (density)	proxy for compartmentalisation and baffle reducing flow	WAPIMS (DEMIRS)	0.09
CGS	G2A1	Fault (at Cadda level) (distance)	proxy for permeability increase and potential risk near major faults	WAPIMS (DEMIRS)	0.04
UGS	G1low	Field for storage (presence)	presence of constrained storage site	WAPIMS (DEMIRS), EDIN (S&P), Craig <i>et al.</i> (2022)	0.67
UGS	G1low	Seal (Carynginia) (presence)	presence of containment	3DGEO (2013)	0.14
UGS	G1low	Reservoir (IRCM Kingia) (presence)	presence of reservoir, pore space	WAPIMS (DEMIRS), 3DGEO (2013)	0.14
UGS	G1low	Fault (density)	proxy for presence of structure and closure	WAPIMS (DEMIRS)	0.05
UGS	G1up	Field for storage (presence)	presence of constrained storage site	WAPIMS (DEMIRS), EDIN (S&P), Craig <i>et al.</i> (2022)	0.67
UGS	G1up	Seal (Kockatea) (thickness)	effectiveness of containment	WAPIMS (DEMIRS)	0.14
UGS	G1up	Reservoir (Wagina Beekeeper Dongara) (presence)	presence of reservoir, pore space	WAPIMS (DEMIRS), 3DGEO (2013)	0.14
UGS	G1up	Fault (density)	proxy for presence of structure and closure	WAPIMS (DEMIRS)	0.05
UGS	G2A1	Field for storage (presence)	presence of constrained storage site	WAPIMS (DEMIRS), EDIN (S&P), Craig <i>et al.</i> (2022)	0.67
UGS	G2A1	Seal (Cadda) (thickness)	effectiveness of containment	3DGEO (2013)	0.14
UGS	G2A1	Reservoir (Cattamarra) (presence)	presence of reservoir, pore space	WAPIMS (DEMIRS), 3DGEO (2013), Mory and lasky (1996)	0.14
UGS	G2A1	Fault (density)	proxy for presence of structure and closure	WAPIMS (DEMIRS)	0.05

Geothermal	G1low	Reservoir (Kingia) (presence and temperature)	presence of reservoir, pore space and temperature	WAPIMS (DEMIRS)	0.75
Geothermal	G1low	Geothermal permit (presence)	presence exploration or production rights	WAPIMS (DEMIRS)	0.25
Geothermal	G1up	Reservoir (Wagina Beekeeper Dongara) (presence)	presence of reservoir, pore space and temperature	WAPIMS (DEMIRS), Mory and lasky (1996)	0.75
Geothermal	G1up	Geothermal permit (presence)	presence exploration or production rights	WAPIMS (DEMIRS)	0.25
Groundwater	G2A1	Aquifer (Cattamarra, Eneabba, Lesueur) (presence and salinity)	proxy for water resource potential	Department of Water (2017)	0.73
Groundwater	G2A1	Fault (density)	proxy for leakage risk	WAPIMS (DEMIRS)	0.17
Groundwater	G2A1	Bore (intersecting Cattamarra, Eneabba, Lesueur) (density)	proxy for stress on water resource	National Groundwater Information System	0.09
Groundwater	A2	Aquifer (Yarragadee) (presence and salinity)	proxy for water resource potential	Department of Water (2017)	0.73
Groundwater	A2	Fault (density)	proxy for leakage risk	WAPIMS (DEMIRS)	0.17
Groundwater	A2	Bore (intersecting Yarragadee) (density)	proxy for stress on water resource	National Groundwater Information System	0.09
Groundwater	AboveA2	Aquifer (Parmelia, Leederville) (presence and salinity)	proxy for water resource potential	Department of Water (2017)	0.74
Groundwater	AboveA2	Fault (density)	proxy for leakage risk	WAPIMS (DEMIRS)	0.17
Groundwater	AboveA2	Bore (intersecting Parmelia, Leederville) (density)	proxy for stress on water resource	National Groundwater Information System	0.09
Groundwater	AboveA2 (superficial)	Aquifer (superficial) (presence and salinity)	proxy for water resource potential		0.74
Groundwater	AboveA2 (superficial)	Fault (superficial fault) (density)	proxy for leakage risk	WAPIMS (DEMIRS)	0.17
Groundwater	AboveA2 (superficial)	Bore (intersecting superficial aquifer) (density)	proxy for stress on water resource	National Groundwater Information System	0.09

Appendix 2: Suitability maps description

Suitability – petroleum, Lower Permian (G1low)

Suitability factors and weight (see Appendix 1)

- Petroleum field density – Proxy for exploration success (0.21)
- Reservoir (IRCM Kingia) presence – Pore space availability (0.21)
- Seal (Carynginia) presence – Containment capability (0.21)
- Fault density – Indicator of structural closure (0.21)
- Petroleum prospect density – Proxy for prospectivity (0.09)

- Petroleum permit presence – Exploration or production rights (0.05)
- Pipeline distance – Proxy for commercial viability (0.02)

High suitability areas

- Concentrated in the northern Dandaragan Trough, Dongara Terrace, Beharra Springs Terrace and Donkey Creek Terrace.

Geological influence

- High suitability correlates strongly with known Lower Permian petroleum accumulations.
- Controlled by the presence of Lower Permian reservoirs and the Carynginia Formation top seal.

Spatial distribution

- Defined by clusters around Lower Permian fields.

Key controlling factors

- Distribution of petroleum accumulations, reservoirs and top seal integrity.

Moderate suitability areas

- Extends from the Irwin Terrace to the Beermullah Trough.
- Controlled by the distribution of Lower Permian reservoirs.

Suitability – CGS, Lower Permian (G1low)

Suitability factors and weight (see Appendix 1)

- Seal (Carynginia) presence – Containment effectiveness (0.43)
- Reservoir (IRCM) presence – Pore space availability (0.43)
- Fault density – Indicator of compartmentalisation and baffle reducing flow (0.09)
- Fault at Kockatea level (distance) – Proxy for permeability increase and risk near major faults (0.04)

High suitability areas

- Concentrated in Wicherina Terrace, Allanooka Terrace, Dandaragan Trough, Dongara Terrace, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Beagle Ridge, Beermullah Trough.

Geological influence

- CGS suitability is strongly controlled by the presence of Lower Permian reservoirs within the CGS depth window (800 m–3200 m) and the Carynginia Formation top seal.

Spatial distribution

- Widespread, elongated N-S to NNW-SSE corridor (~220 km by 40 km).

Key controlling factors

- Reservoir presence and CGS depth window constraints.

Suitability – UGS, Lower Permian (G1low)

Suitability factors and weight (see Appendix 1)

- Field for storage presence – Constrained storage site (0.67)
- Seal (Carynginia) presence – Containment effectiveness (0.14)
- Reservoir (IRCM, Kingia) presence – Pore space availability (0.14)
- Fault density – Indicator of structural closure (0.05)

High suitability areas

- No high suitability in Lower Permian.

Moderate suitability areas

- Northern Dandaragan Trough, Beharra Springs Terrace, northern Cadda Terrace.

Geological influence

- Storage suitability is linked to known Lower Permian depleted petroleum fields, reservoir quality and containment effectiveness.

Spatial distribution

- Defined by depleted field outlines, extending up to 20 km.

Key controlling factors

- Field production status and containment structure presence.

Suitability – geothermal, Lower Permian (G1low)

Suitability factors and weight (see Appendix 1)

- Reservoir (Kingia) presence and temperature – Pore space and thermal potential (0.75)
- Geothermal permit presence – Exploration or production rights (0.25)

High suitability areas

- Northern Dandaragan Trough, Donkey Creek Terrace, Beharra Springs Terrace, Cadda Terrace.

Geological influence

- Suitability is based on Kingia Sandstone presence above the 5000 m depth threshold, with reservoir temperature modelling from DEMIRS (2025).

Spatial distribution

- Elongated N-S corridor (~100 km long).

Key controlling factors

- Reservoir presence and thermal gradient.

Moderate suitability areas

- Northern Dandaragan Trough, Dongara Terrace, Beharra Springs Terrace, Beagle Ridge, Cadda Terrace.
- Controlled by temperature of the Kingia Sandstone reservoir.

Suitability – petroleum, Upper Permian (G1up)

Suitability factors and weight (see Appendix 1)

- Petroleum field density – Proxy for prospectivity (0.21)
- Reservoir (Wagina, Beekeeper, Dongara) presence – Pore space availability (0.21)
- Seal (Kockatea) thickness – Containment capability (0.21)
- Fault density – Indicator of structural closure (0.21)
- Petroleum prospect density – Proxy for prospectivity (0.09)
- Petroleum permit presence – Exploration or production rights (0.05)
- Pipeline distance – Proxy for commercial viability (0.02)

High suitability areas

- Concentrated in northern Dandaragan Trough, Dongara Terrace, Beharra Springs Terrace and Donkey Creek Terrace.

Geological influence

- High suitability aligns with known Upper Permian petroleum accumulations.
- Reservoir presence (Wagina Sandstone, Dongara Sandstone, Beekeeper Formation) and Kockatea Shale as the regional top seal drive suitability.

Spatial distribution

- Clusters around Upper Permian fields.

Key controlling factors

- Presence and distribution of known petroleum accumulations, reservoirs, and top seal integrity.

Moderate suitability areas

- Extends from the Wicherina Terrace to the Beermullah Trough.

- Controlled by the distribution of Upper Permian reservoirs.

Suitability – CGS, Upper Permian (G1up)

Suitability factors and weight (see Appendix 1)

- Seal (Kockatea) thickness – Containment effectiveness (0.43)
- Reservoir (Wagina, Beekeeper, Dongara) presence – Pore space availability (0.43)
- Fault density – Indicator of compartmentalisation and baffle reducing flow (0.09)
- Fault at Kockatea level (distance) – Proxy for permeability increase and risk near major faults (0.04)

High suitability areas

- Wicherina Terrace, Allanooka Terrace, Dandaragan Trough, Dongara Terrace, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Beagle Ridge, Beermullah Trough, Yarra Yarra Terrace.

Geological influence

- Suitability is controlled by the presence of Upper Permian reservoirs within the CGS depth window (800 m–3200 m) and the regional Kockatea Shale top seal.

Spatial distribution

- Widespread, elongated N-S to NNW-SSE corridor (~220 km by 40 km).

Key controlling factors

- Presence of Upper Permian reservoirs and top seal integrity.

Suitability – UGS, Upper Permian (G1up)

Suitability factors and weight (see Appendix 1)

- Field for storage presence – Constrained storage site (0.67)
- Seal (Kockatea) thickness – Containment effectiveness (0.14)
- Reservoir (Wagina, Beekeeper, Dongara) presence – Pore space availability (0.14)
- Fault density – Indicator of structural closure (0.05)

High suitability areas

- Dongara Terrace, Beharra Springs Terrace, Northern Dandaragan Trough, Donkey Creek Terrace.

Geological influence

- Storage suitability is linked to the distribution of known Upper Permian depleted petroleum fields, reservoir properties, and production status.

Spatial distribution

- Defined by field outlines, extending up to 10 km in length.

Key controlling factors

- Reservoir suitability and containment integrity in depleted petroleum fields.

Moderate suitability areas

- Same tectonic elements as high suitability areas.
- Controlled by the production status of Upper Permian depleted fields.

Suitability – geothermal, Upper Permian (G1up)

Suitability factors and weight (see Appendix 1)

- Reservoir (Wagina, Beekeeper, Dongara) presence and temperature – Pore space and thermal potential (0.75)
- Geothermal permit presence – Exploration or production rights (0.25)

High suitability areas

- Donkey Creek Terrace, northern Dandaragan Trough, Coomallo Trough.

Geological influence

- Suitability is based on the presence of Upper Permian reservoirs at sufficient depths to reach geothermal gradient thresholds.
- Modelled temperature data for the Top Permian (DEMIRS, 2025) confirms areas with viable thermal potential.

Spatial distribution

- Elongated N-S corridor (~80 km long).

Key controlling factors

- Reservoir presence and subsurface thermal gradient determine geothermal suitability.

Moderate suitability areas

- From northern Bookara Shelf to southern Cadda Terrace.
- Controlled by variations in modelled temperature at the top of the Permian reservoirs.

Suitability – petroleum, Triassic-Lower Jurassic (G2A1)

Suitability factors and weight (see Appendix 1)

- Petroleum field density – Proxy for prospectivity (0.21)
- Reservoir (Cattamarra) presence – Pore space availability (0.21)
- Seal (Cadda) thickness – Effectiveness of containment (0.21)
- Fault density – Indicator of structural closure (0.21)
- Petroleum prospect density – Proxy for prospectivity (0.09)
- Petroleum permit presence – Exploration or production rights (0.05)
- Pipeline distance – Proxy for commercial viability (0.02)

High suitability areas

- Coomallo Trough and Beermullah Trough.

Geological influence

- Suitability is controlled by the presence of Triassic-Lower Jurassic reservoirs in Cattamarra Coal Measures and the regional top seal (Cadda Formation).
- High suitability aligns with known Triassic and Lower Jurassic petroleum accumulations.

Spatial distribution

- Clusters around Triassic-Lower Jurassic fields.

Key controlling factors

- Presence and distribution of known petroleum accumulations, reservoirs, and the effectiveness of the top seal.

Moderate suitability areas

- Extends from the Bookara Shelf to the Mandurah Terrace.
- Controlled by the distribution of Cattamarra Coal Measures reservoirs.

Suitability – CGS, Triassic-Lower Jurassic (G2A1)

Suitability factors and weight (see Appendix 1)

- Seal (Cadda) thickness – Containment effectiveness (0.43)
- Reservoir (Lesueur, Cattamarra) presence – Pore space availability (0.43)
- Fault density – Indicator of compartmentalisation and baffle reducing flow (0.09)
- Fault at Cadda level (distance) – Proxy for permeability increase and risk near major faults (0.04)

High suitability areas

- Dandaragan Trough, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Coomallo Trough, Beermullah Trough, Mandurah Terrace, Yarra Yarra Terrace, Barberton Terrace.

Geological influence

- Suitability is defined by the presence of Triassic-Lower Jurassic reservoirs within the CGS depth window and the regional Cadda Formation top seal.

Spatial distribution

- Widespread, elongated N-S to NNW-SSE corridor (~270 km by 40 km).

Key controlling factors

- Distribution of Triassic and Lower Jurassic reservoirs and top seal thickness.

Moderate suitability areas

- Pockets between the Bookara Shelf and Beagle Ridge, including Mandurah Terrace and Barberton Terrace.
- Controlled by the distribution and thickness of the Cadda Formation (<20 m = higher risk; 20–100 m = average containment potential; > 100 m = good containment potential).

Suitability – UGS, Triassic-Lower Jurassic (G2A1)

Suitability factors and weight (see Appendix 1)

- Field for storage presence – Constrained storage site (0.67)
- Seal (Cadda) thickness – Containment effectiveness (0.14)
- Reservoir (Cattamarra) presence – Pore space availability (0.14)
- Fault density – Indicator of structural closure (0.05)

High suitability areas

- No high suitability in Triassic-Lower Jurassic.

Moderate suitability areas

- Coomallo Trough, Beermullah Trough.

Geological influence

- Moderate suitability is controlled by the distribution of known Triassic-Lower Jurassic depleted petroleum fields and reservoir quality.

Spatial distribution

- Defined by field outlines, extending up to 10 km.

Key controlling factors

- Presence of depleted petroleum reservoirs with good containment integrity.

Suitability – groundwater, Triassic-Lower Jurassic (G2A1)

Suitability factors and weight (see Appendix 1)

- Aquifer salinity (Cattamarra, Eneabba, Lesueur) – Proxy for water resource potential (0.73)
- Fault density – Proxy for leakage risk (0.17)
- Bore density (intersecting aquifers) – Proxy for stress on water resources (0.09)

High suitability areas

- Northern region: Bookara Shelf, Greenough Shelf.
- Southern region: Beagle Ridge, Cadda Terrace, Beermullah Trough.

Geological influence

- Suitability is controlled by the distribution and reported salinity of the Cattamarra, Eneabba and Lesueur aquifers.

Spatial distribution

- Two distinct high-suitability areas.
- The southern high-suitability region is within a N-S corridor (~150 km by 20 km).

Key controlling factors

- Groundwater salinity variations in the Cattamarra, Eneabba and Lesueur aquifers.

Moderate suitability areas

- Marginal moderate suitability zones exist along the edges of the high suitability regions.

Suitability – groundwater, Upper Jurassic (A2)

Suitability factors and weight (see Appendix 1)

- Aquifer salinity (Yarragadee) – Proxy for water resource potential (0.73)
- Fault density – Proxy for leakage risk (0.17)
- Bore density (intersecting aquifer) – Proxy for stress on water resources (0.09)

High suitability areas

- From Bookara Shelf to Mandurah Terrace, excluding Irwin Terrace, Yarra Yarra Terrace, Beagle Ridge and Barberton Terrace.

Geological influence

- Suitability is controlled by the distribution and reported salinity of the Yarragadee aquifer.

Spatial distribution

- Widespread, elongated N-S corridor (~330 km by 60 km).

Key controlling factors

- Groundwater salinity and aquifer presence define suitability.

Moderate suitability areas

- Marginal moderate suitability zones exist at the east and west edges of the high suitability zone.

Suitability – groundwater, Cretaceous (abA2) – Leederville Parmelia

Suitability factors and weight (see Appendix 1)

- Aquifer (Parmelia, Leederville) presence and salinity – Proxy for water resource potential (0.74)
- Fault density – Proxy for leakage risk (0.17)
- Bore density (intersecting aquifers) – Proxy for stress on water resources (0.09)

High suitability areas

- Dandaragan Trough, Beermullah Trough, Mandurah Terrace.

Geological influence

- Suitability is primarily controlled by the distribution and reported salinity of the Leederville and Parmelia aquifers.

Spatial distribution

- Widespread, elongated N-S corridor (~270 km by <60 km).

Key controlling factors

- Groundwater salinity variations and aquifer presence in the Leederville and Parmelia formations.

Suitability – groundwater, Cenozoic (abA2) – Superficial

Suitability factors and weight (see Appendix 1)

- Aquifer (Superficial) presence and salinity – Proxy for water resource potential (0.74)
- Fault density (superficial faults) – Proxy for leakage risk (0.17)
- Bore density (intersecting superficial aquifer) – Proxy for stress on water resources (0.09)

High suitability areas

- Greenough Shelf, Dongara Terrace, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Beagle Ridge, Beermullah Trough, Mandurah Terrace.

Geological influence

- Suitability is controlled by aquifer salinity and distribution of superficial groundwater reservoirs.

Spatial distribution

- Elongated N-S corridor (~300 km by 30 km).

Key controlling factors

- Groundwater salinity and reservoir presence.

Appendix 3: Interaction maps description

Interaction – Lower Permian (G1low)

Resources: Petroleum, CGS, Geothermal, UGS

High interaction

- Spatial distribution
 - High-interaction cases make up 4% of all interactions.
 - Present in Allanoooka Terrace, Dandaragan Trough, Beharra Springs Terrace, Dongara Terrace, Donkey Creek Terrace, and Cadda Terrace.
 - Two major clusters are observed:
 - Northern Dandaragan Trough extending across Beharra Springs and Dongara Terraces.
 - Beharra Springs Terrace and northern Donkey Creek Terrace.
 - A north-south high-interaction corridor extends from southern Beharra Springs Terrace to Cadda Terrace.
- Most dominant resource in high-interaction cases
 - CGS (93%) dominates, indicating its dependence on key geological formations.
 - Geothermal (64%) and Petroleum (52%) follow as secondary contributors.
- Resource Pairing Frequency
 - 91% of high-interaction cases involve 2 resources, while 9% involve 3.

- Most common high-interaction combinations
 - Petroleum (m), CGS (h), Geothermal (h) – 47% of high-interaction cases.
 - Petroleum (h), CGS (h), Geothermal (m) – 24% of high-interaction cases.

Moderate interactions

- Spatial distribution
 - Moderate interactions represent 24% of all interactions.
 - Cover Bookara Shelf, Wicherina Terrace, Allanooka Terrace, Dandaragan Trough, Beharra Springs Terrace, Dongara Terrace, Donkey Creek Terrace, Cadda Terrace, Beagle Ridge and Beermullah Trough.
 - Forms a 230 km by 50 km corridor surrounding high-interaction zones.
- Most dominant resource in moderate interaction cases
 - Petroleum (100%) appears in all moderate interaction cases.
 - CGS (84%) and Geothermal (43%) also feature prominently.
- Most common moderate interaction combinations
 - Petroleum (m), CGS (h) – 57% of moderate interaction cases.
 - Petroleum (m), CGS (h), Geothermal (m) – 26% of moderate interaction cases.

Resource dominant cases

- Distribution
 - Resource-dominant cases represent only 0.5% of all interactions.
- Most dominant resource
 - CGS is the only dominant resource in this category.

Interaction – Upper Permian (G1up)

Resources: Petroleum, CGS, Geothermal, UGS

High interaction

- Spatial distribution
 - High-interaction cases make up 2% of all interactions.
 - Observed in Allanooka Terrace, Dandaragan Trough, Beharra Springs Terrace, Dongara Terrace, Donkey Creek Terrace and Cadda Terrace.
 - Two high-interaction clusters align with known petroleum accumulations in Permian reservoirs.
- Most dominant resource in high-interaction cases
 - Petroleum (97%) dominates, followed by CGS (87%) and Geothermal (11%).

- Most common high-interaction combinations
 - Petroleum (h), CGS (h), Geothermal (m) – 69% of all high-interaction cases.
 - Petroleum (h), CGS (h), Geothermal (m), UGS (h) – 7% of all high-interaction cases.

Moderate interaction

- Spatial distribution
 - Moderate interactions represent 21% of all interactions.
 - Cover Bookara Shelf, Wicherina Terrace, Allannooka Terrace, Greenough Shelf, Dongara Terrace, Beharra Springs Terrace, Dandaragan Trough, Donkey Creek Terrace, Beagle Ridge, Cadda Terrace, Beermullah Trough.
 - A 200 km by 50 km corridor surrounds high-interaction zones.
- Most common moderate interaction combinations
 - Petroleum (m), CGS (h), Geothermal (m) – 42% of moderate interaction cases.
 - CGS (h), Geothermal (m) – 19% of moderate interaction cases.

Resource dominant cases

- Distribution
 - Resource-dominant cases represent 6% of all interactions.
- Most dominant resource
 - CGS (h) is the most frequently dominant resource.

Interaction – Triassic-Lower Jurassic (G2A1)

Resources: Petroleum, CGS, UGS, Groundwater

High interaction

- Spatial distribution
 - High-interaction cases account for 0.7% of all interactions.
- Most dominant resource in high-interaction cases
 - CGS (100%) dominates, followed by Petroleum (97%) and Groundwater (3%).
- Most common high-interaction combinations
 - Petroleum (h), CGS (h) – 85% of high-interaction cases.
 - Petroleum (h), CGS (h), Groundwater (m) – 12% of high-interaction cases.

Moderate interaction

- Spatial distribution
 - Moderate interactions account for 31% of all interactions.

- Most common moderate interaction combinations
 - Petroleum (m), CGS (h) – 68% of moderate interaction cases.
 - Petroleum (m), CGS (m) – 28% of moderate interaction cases.

Appendix 4: Thematic interaction maps description

Petroleum interaction – Lower Permian (G1low)

Petroleum with high suitability

- Spatial distribution
 - Covers 2% of the Northern Perth Basin.
 - Located on Allanooka Terrace, Dandaragan Trough, Beharra Springs Terrace, Dongara Terrace, Donkey Creek Terrace.
 - Two main clusters observed:
 - Northern Dandaragan Trough, Beharra Springs Terrace and Dongara Terrace.
 - Beharra Springs Terrace and northern Donkey Creek Terrace.
- Most frequent interactions
 - CGS (86%) is the primary interacting resource.
 - Geothermal (30%) is the secondary interacting resource.
 - No isolated occurrences. Petroleum always interacts with at least one resource.

Petroleum with moderate suitability

- Spatial distribution
 - Covers 41% of the northern Perth Basin.
 - Found on Irwin Terrace, Wicherina Terrace, Bookara Shelf, Allanooka Terrace, Greenough Shelf, Dongara Terrace, Dandaragan Trough, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Beagle Ridge, Yarra Yarra Terrace, Coomallo Trough, Beermullah Trough.
- Most frequent interactions
 - CGS (48%) is the primary interacting resource.
 - Geothermal (27%) is the secondary interacting resource.
 - 18% of petroleum with moderate suitability occurs without interactions.

CGS interaction – Lower Permian (G1up)

CGS with high suitability

- Spatial distribution
 - Covers 21% of the northern Perth Basin.
 - Present on Bookara Shelf, Allanooka Terrace, Greenough Shelf, Dongara Terrace, Dandaragan Trough, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Beagle Ridge, Beermullah Trough.

- Most frequent interactions
 - Petroleum (98%) is the primary interacting resource.
 - Geothermal (41%) is the secondary interacting resource.
 - 2% of CGS with high suitability occurs without interactions, mostly in Cadda Terrace and Beermullah Shelf.

Petroleum interaction – Upper Permian (G1up)

Petroleum with high suitability

- Spatial distribution
 - Covers 2% of the Northern Perth Basin.
 - Found on Allanooka Terrace, Dongara Terrace, Dandaragan Trough, Beharra Springs Terrace, Donkey Creek Terrace.
 - Two main clusters align with known petroleum accumulations in Permian reservoirs.
- Most frequent interactions
 - Geothermal (95%) is the primary interacting resource.
 - CGS (80%) is the secondary interacting resource.
 - 0.4% of petroleum with high suitability occurs without interactions.

Petroleum with moderate suitability

- Spatial distribution
 - Covers 18% of the Northern Perth Basin.
 - Present on Wicherina Terrace, Bookara Shelf, Allanooka Terrace, Greenough Shelf, Dongara Terrace, Dandaragan Trough, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Beagle Ridge, Coomallo Trough, Beermullah Trough.
- Most frequent interactions
 - Geothermal (80%) is the primary interacting resource.
 - CGS (64%) is the secondary interacting resource.
 - 1% of petroleum with moderate suitability occurs without interactions.

CGS interaction – Upper Permian (G1up)

CGS with high suitability

- Spatial distribution
 - Covers 22% of the northern Perth Basin.
 - Present on Bookara Shelf, Allanooka Terrace, Greenough Shelf, Dongara Terrace, Dandaragan Trough, Beharra Springs Terrace, Donkey Creek Terrace, Cadda

Terrace, Beagle Ridge, Yarra Yarra Terrace, Coomallo Trough and Beermullah Trough.

- Most frequent interactions
 - Geothermal (61%) is the primary interacting resource.
 - Petroleum (55%) is the second most frequent interacting resource.
 - 20% of high-suitability CGS areas occur without interactions, mostly in Bookara Shelf, Allanooka Terrace, Greenough Shelf and Beermullah Trough.

Petroleum interaction – Triassic-Lower Jurassic (G2A1)

Petroleum with high suitability

- Spatial distribution
 - Covers 1% of the Northern Perth Basin.
 - Found on Dandaragan Trough, Coomallo Trough and Beermullah Trough.
- Most frequent interactions
 - CGS (61%) is the primary interacting resource.
 - Geothermal (9%) is the secondary interacting resource.
 - 37% of high-suitability Petroleum occurs without interactions, making it more isolated than in deeper intervals.

Petroleum with moderate suitability

- Spatial distribution
 - Covers 39% of the Northern Perth Basin.
 - Present on Bookara Shelf, Allanooka Terrace, Greenough Shelf, Dongara Terrace, Dandaragan Trough, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Beagle Ridge, Coomallo Trough, Beermullah Trough and Mandurah Terrace.
- Most frequent interactions
 - CGS (78%) is the primary interacting resource.
 - Groundwater (2%) shows limited interaction with Petroleum.
 - 4% of moderate-suitability Petroleum occurs in isolation.

CGS interaction – Triassic-Lower Jurassic (G2A1)

CGS with high suitability

- Spatial distribution
 - Covers 27% of the northern Perth Basin.

- Present on Dandaragan Trough, Beharra Springs Terrace, Donkey Creek Terrace, Cadda Terrace, Yarra Yarra Terrace, Coomallo Trough, Beermullah Trough, Barberton Terrace and Mandurah Terrace.
- Most frequent interactions
 - Petroleum (81%) is the primary interacting resource.
 - Groundwater (1%) shows minimal overlap with CGS.
 - 19% of high-suitability CGS areas occur without interactions, primarily in Dandaragan Trough, Cadda Terrace and Beermullah Trough.

Groundwater interaction – Triassic-Lower Jurassic (G2A1)

Groundwater with high suitability

- Spatial distribution
 - Covers 3% of the northern Perth Basin.
 - Found on Greenough Shelf, Beagle Ridge, Cadda Terrace, Beermullah Trough.
- Most frequent interactions
 - Petroleum (23%) and CGS (23%) are the primary interacting resources.
 - 66% of high-suitability groundwater occurs without interactions, mostly in Beagle Ridge, Cadda Terrace and Beermullah Trough.

**As Australia's national science
agency and innovation catalyst,
CSIRO is solving the greatest
challenges through innovative
science and technology.**

CSIRO. Unlocking a better future
for everyone.

Contact us

1300 363 400
+61 3 9545 2176
csiro.au/contact
csiro.au

For further information

CSIRO Energy
Karsten Michael
+61 8 6436 8759
Karsten.michael@csiro.au
csiro.au/energy