APPENDIX I

Groundwater Monitoring Baseline Data

I-1 MONITORING BORES

There are four pairs of eight monitoring bores at Senex that monitor the alluvium and the deeper formations as presented in Table 1.1 and spatially shown in Figure 1.1.

Table 1.1 Monitoring Bore Summary

Name	GDA94 Zone 56		Drilled Depth (m)	Screened Interval	Water Level (mbGL)	Screened Unit
	Easting	Northing				
ATLAS-13M-D	782185	7101921	36.5	30.5 – 36.5	10.06	Westbourne Formation
ATLAS-13M-S	782184	7101917	11.0	6.0 – 9.0	Dry	Alluvium
ATLAS-14M-D	783221	7102910	46.0	40.0 – 46.0	13.23	Springbok Sandstone
ATLAS-14M-S	783217	7102907	11.0	7.0 – 10.0	Dry	Alluvium
ATLAS-15M-D	783871	7096028	36.0	29.0 – 35.0	6.64	Westbourne Formation
ATLAS-15M-S	783869	7096012	11.4	8.4 – 11.4	4.02	Alluvium
ATLAS-19M-D	783359	7102620	50	24.0 – 30.0 39.0 – 40.0	13.12	Springbok Sandstone
ATLAS-19M-S	783356	7102616	8	4.5 – 7.5	Dry	Alluvium

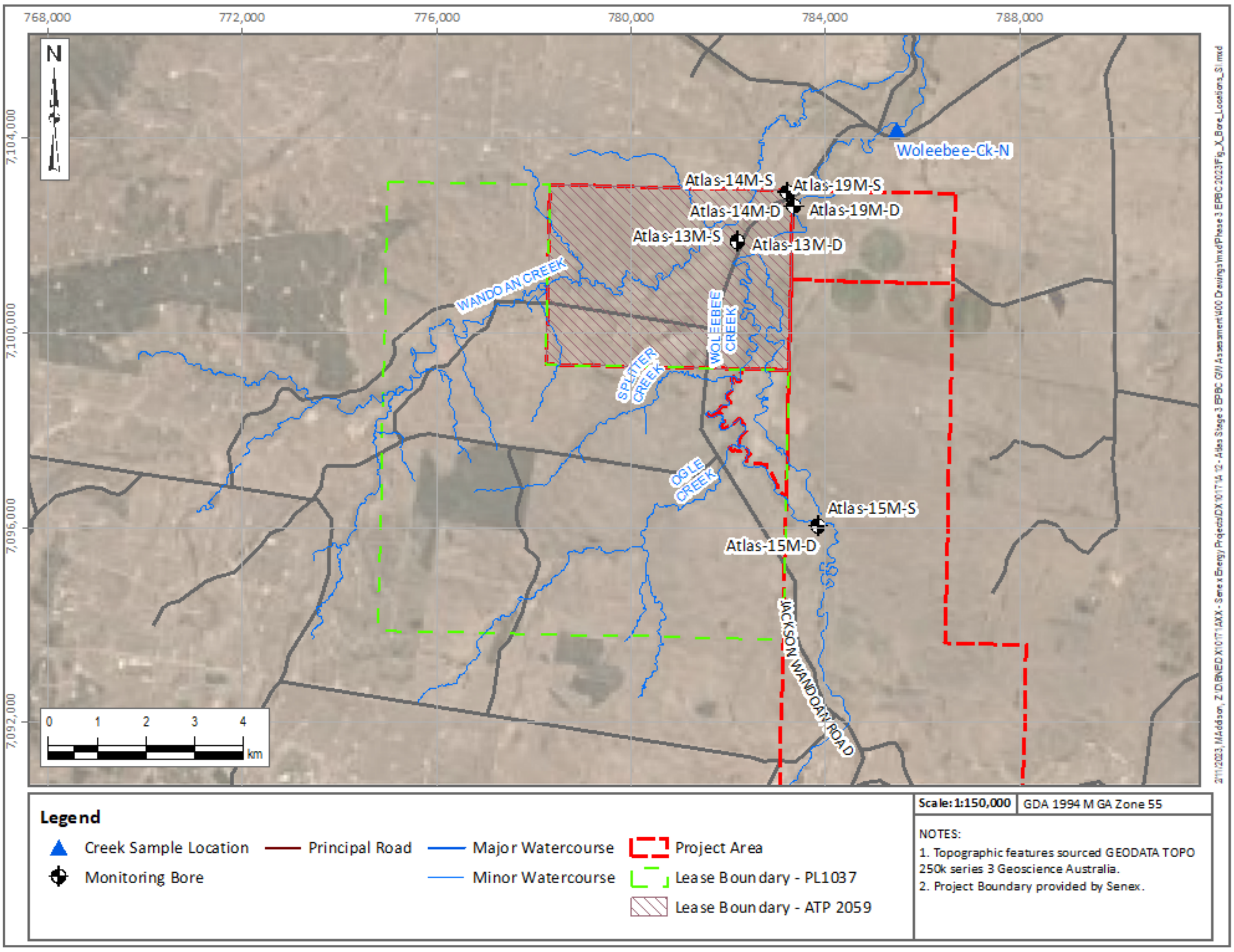


Figure 1.1 Installed Monitoring Bore Locations

I-1.1 Hydrographs

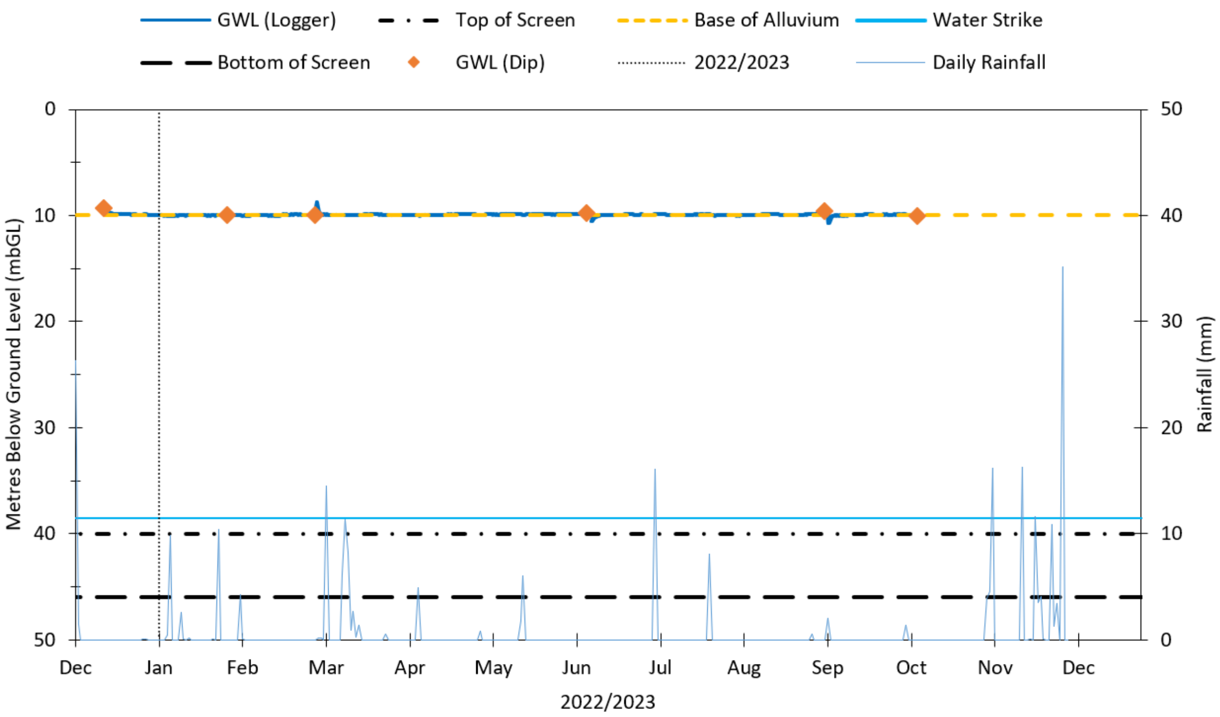


Figure 1.2 Hydrograph for Atlas-13M-D

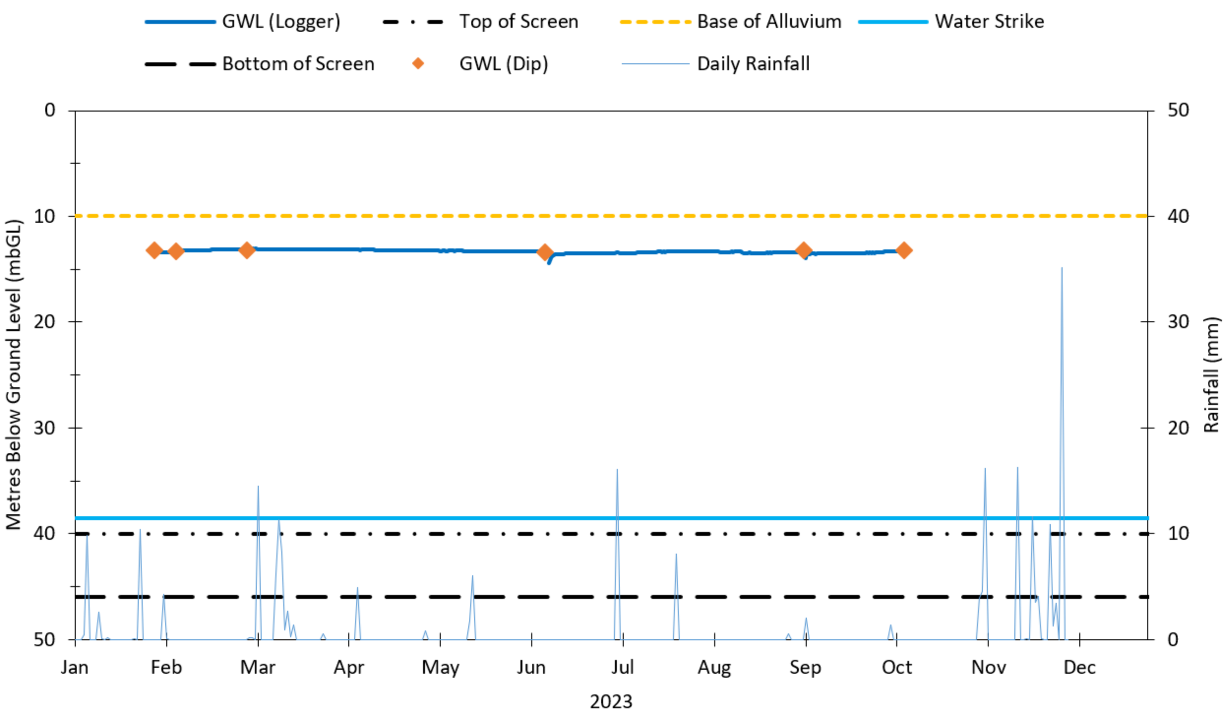


Figure 1.3 Hydrograph for Atlas-14M-D

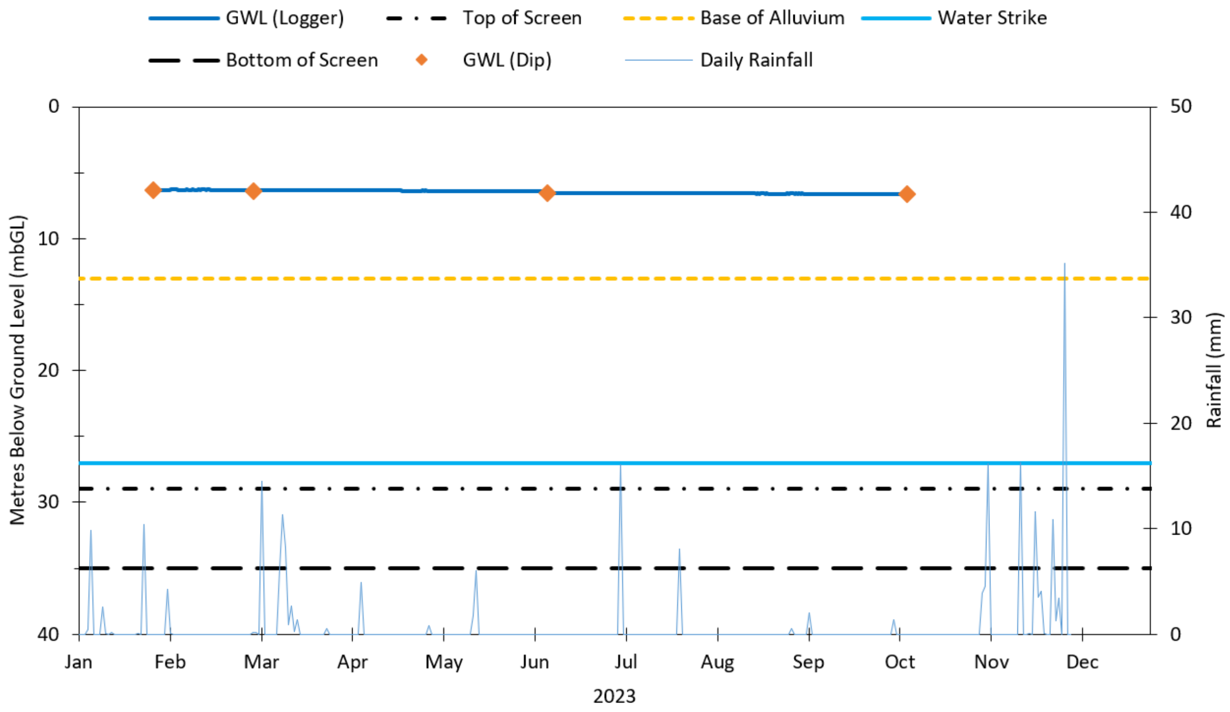


Figure 1.4 Hydrograph for Atlas-15M-D

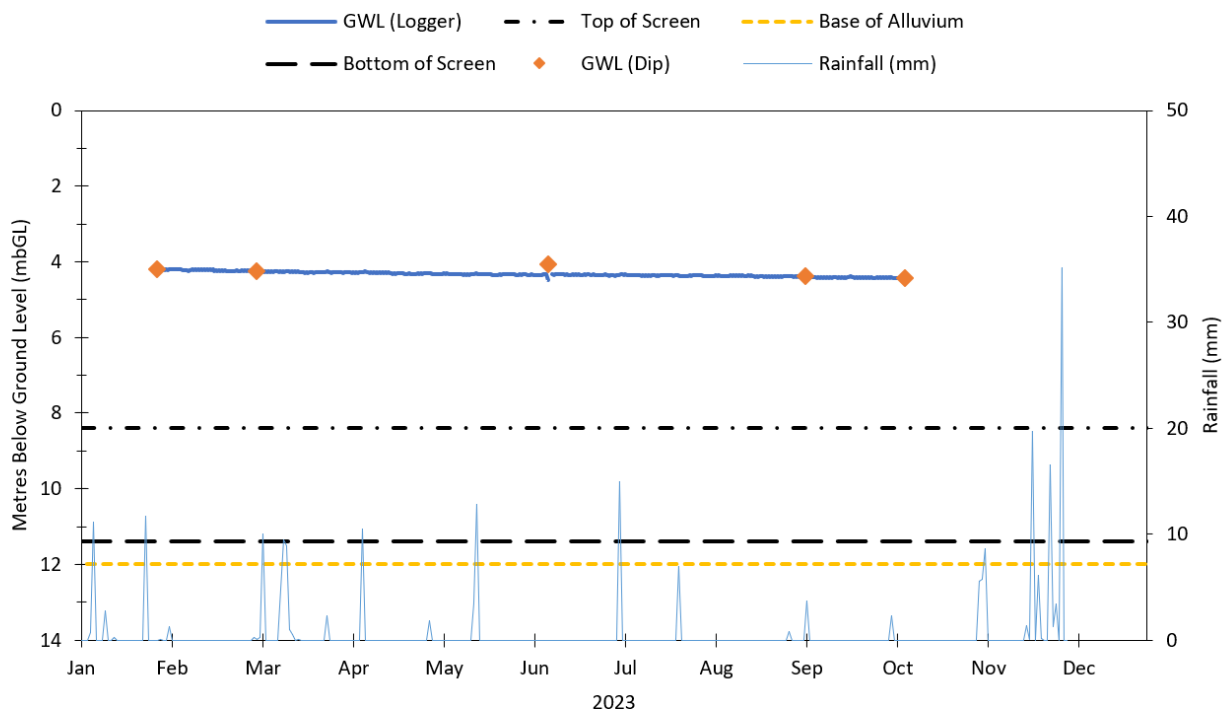


Figure 1.5 Hydrograph for Atlas-15M-S

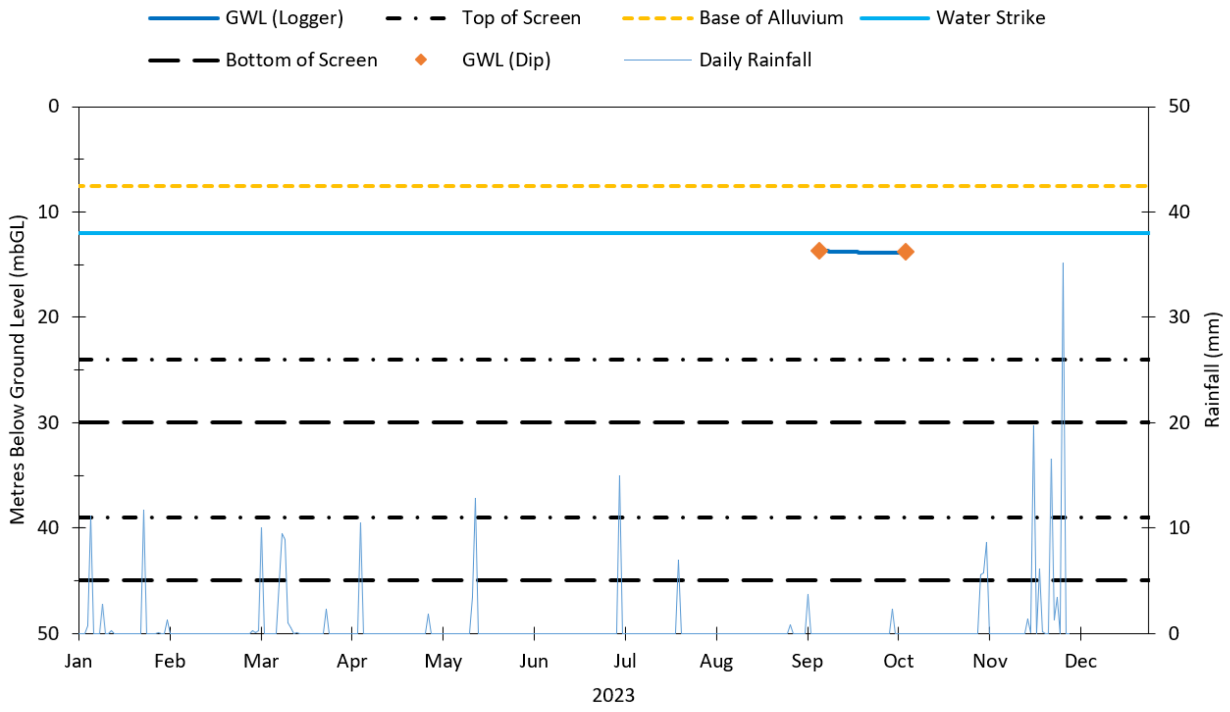
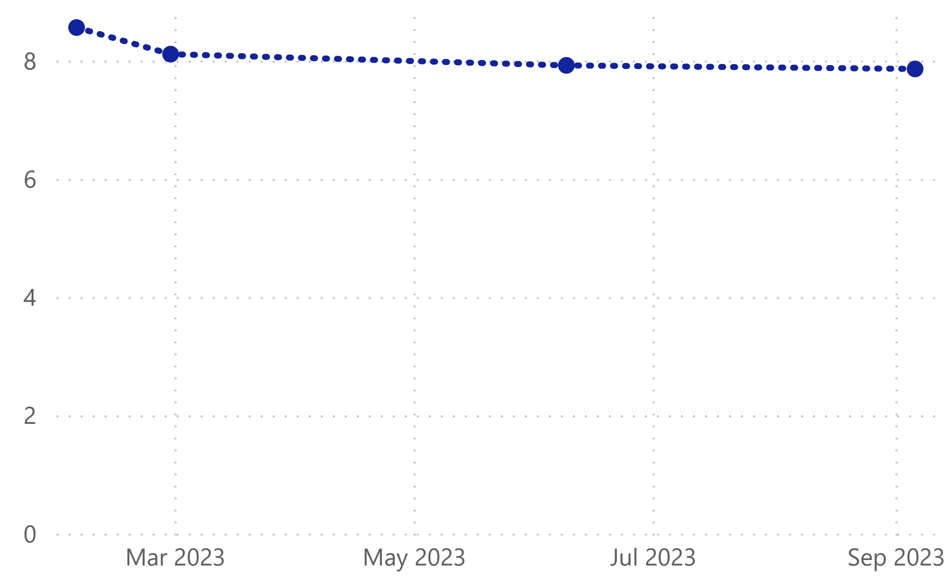


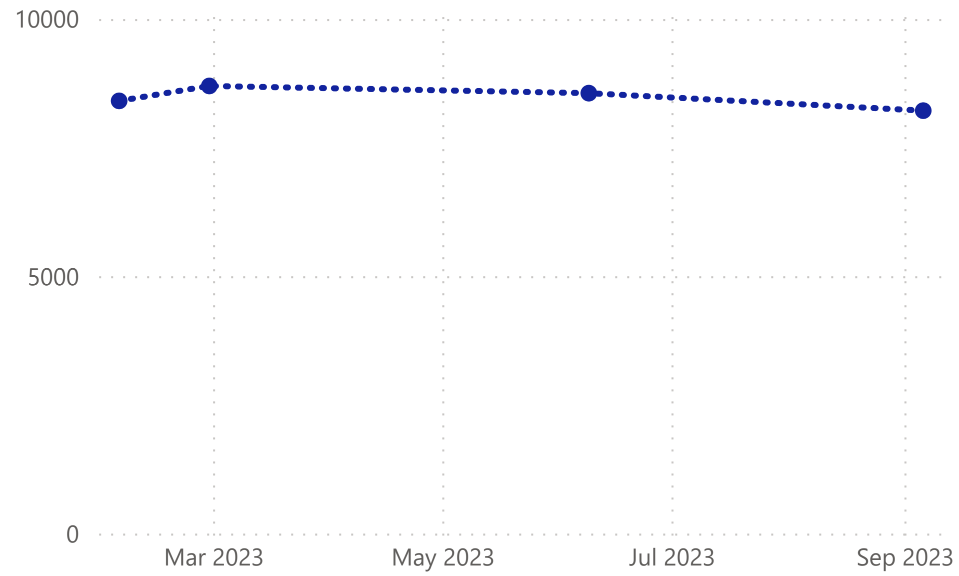
Figure 1.6 Hydrograph for Atlas-19M-D

● Atlas-13M-D

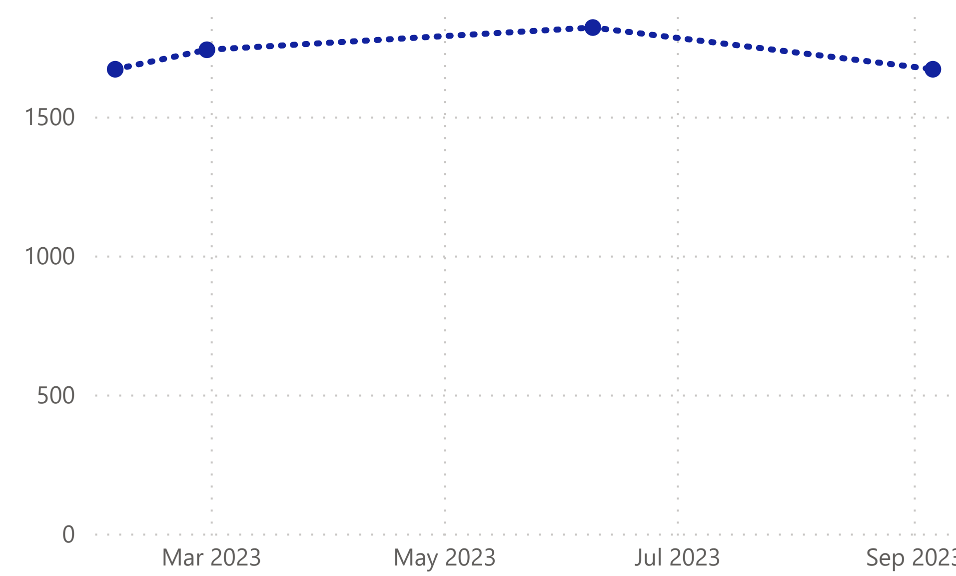
pH (pH unit)



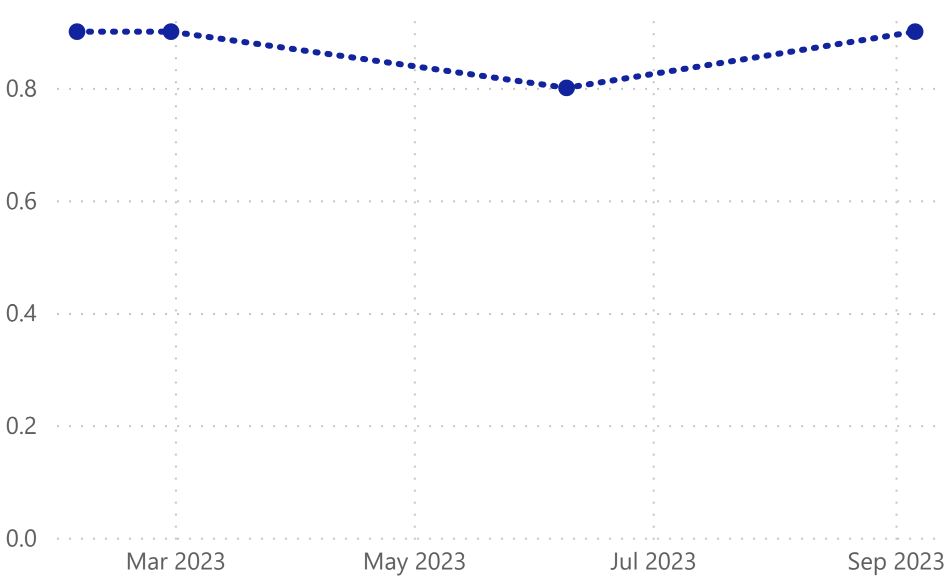
EC (µS/cm)



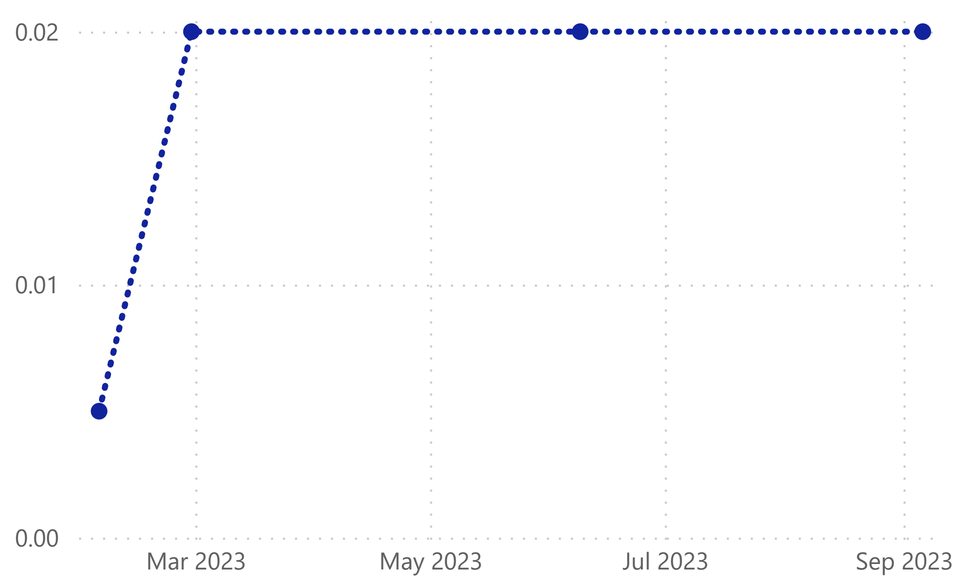
Sodium (mg/L)



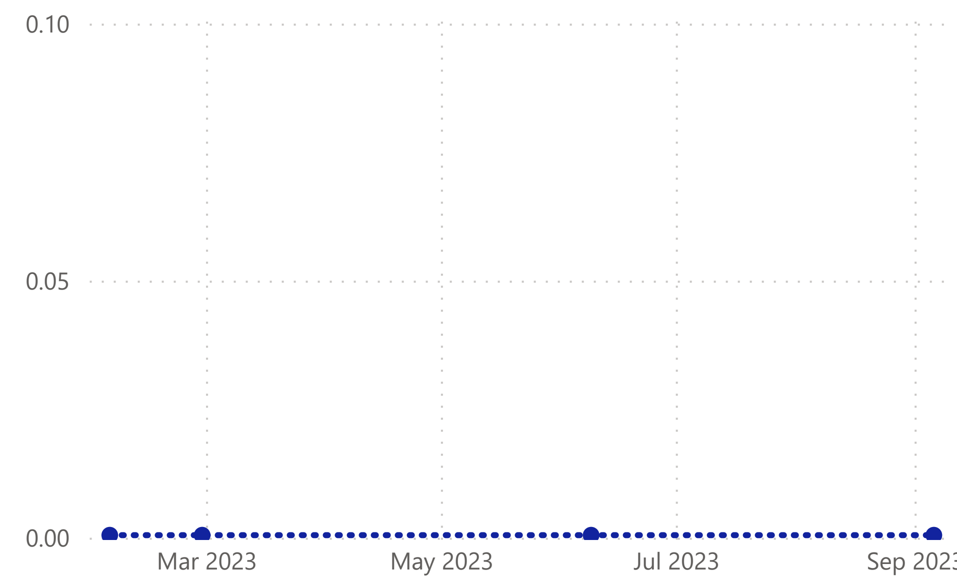
Fluoride (mg/L)



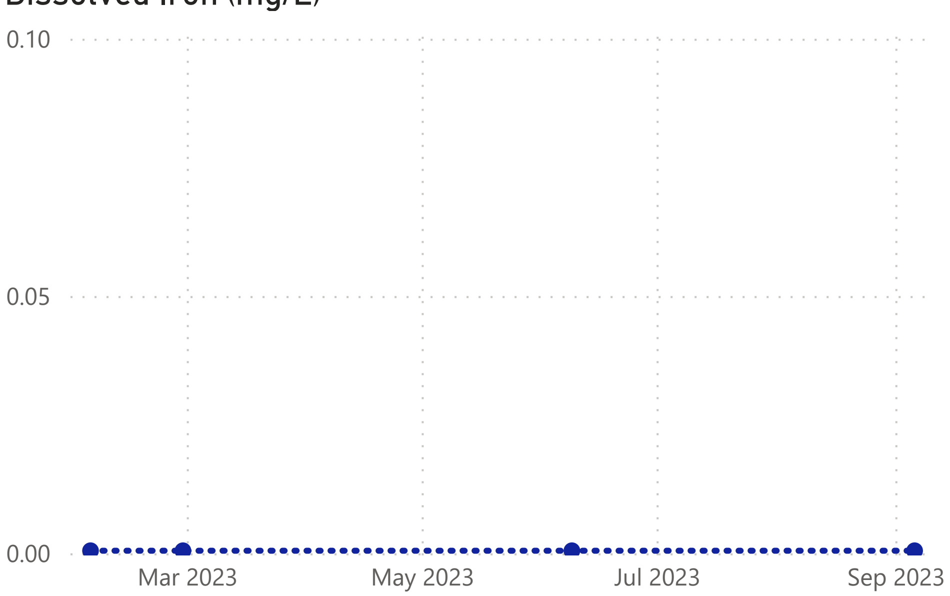
Dissolved Aluminium (mg/L)



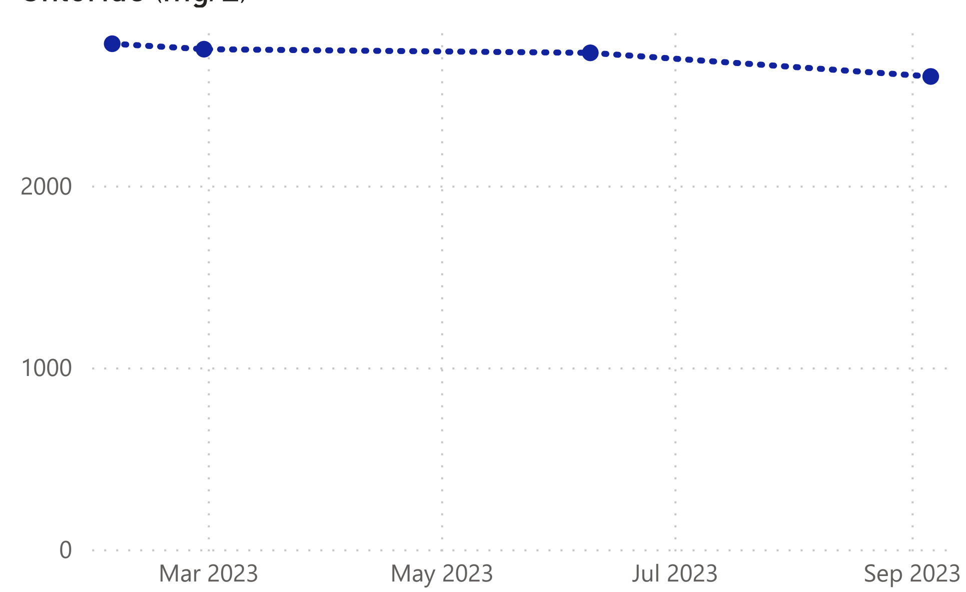
Dissolved Lead (mg/L)



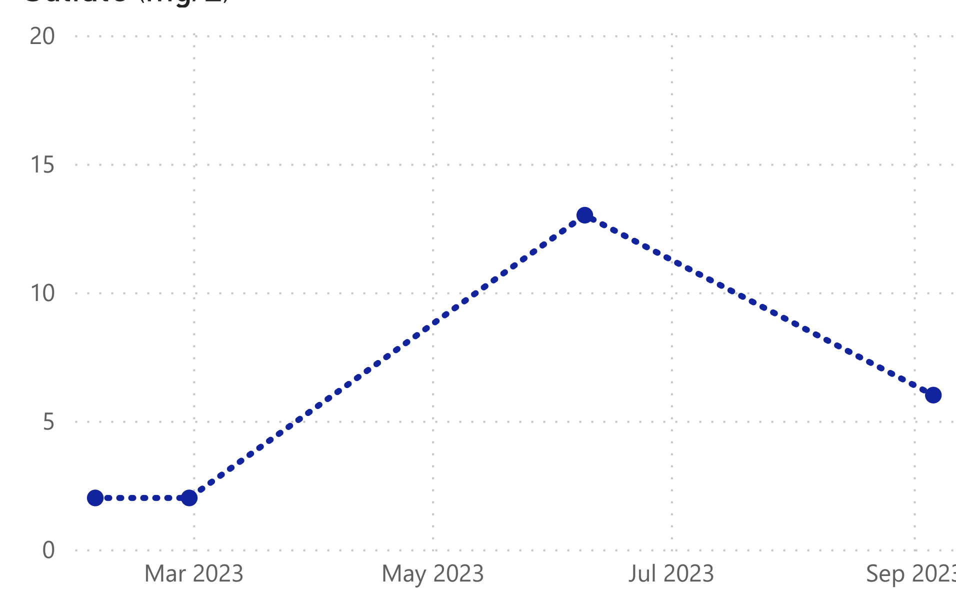
Dissolved Iron (mg/L)



Chloride (mg/L)

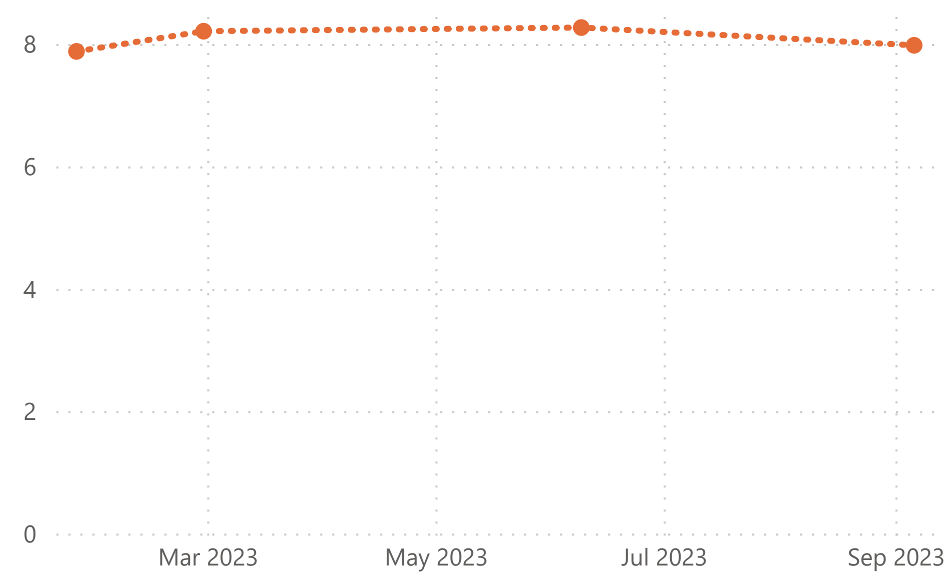


Sulfate (mg/L)

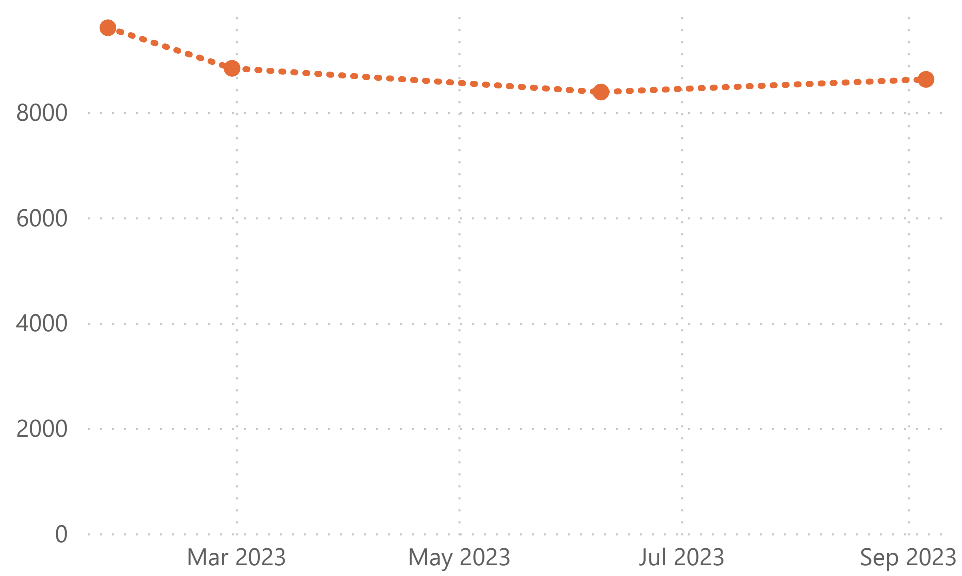


Atlas-14M-D

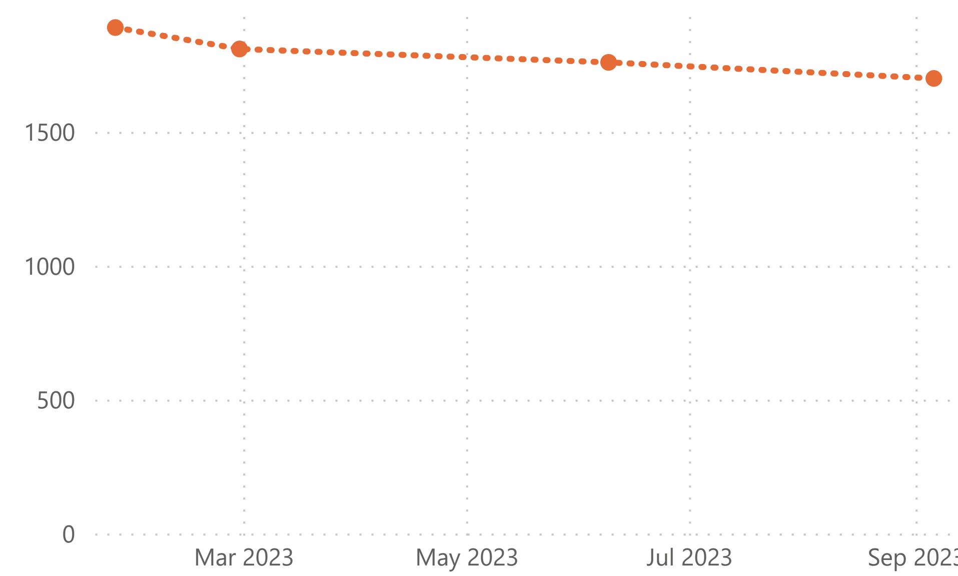
pH (pH unit)



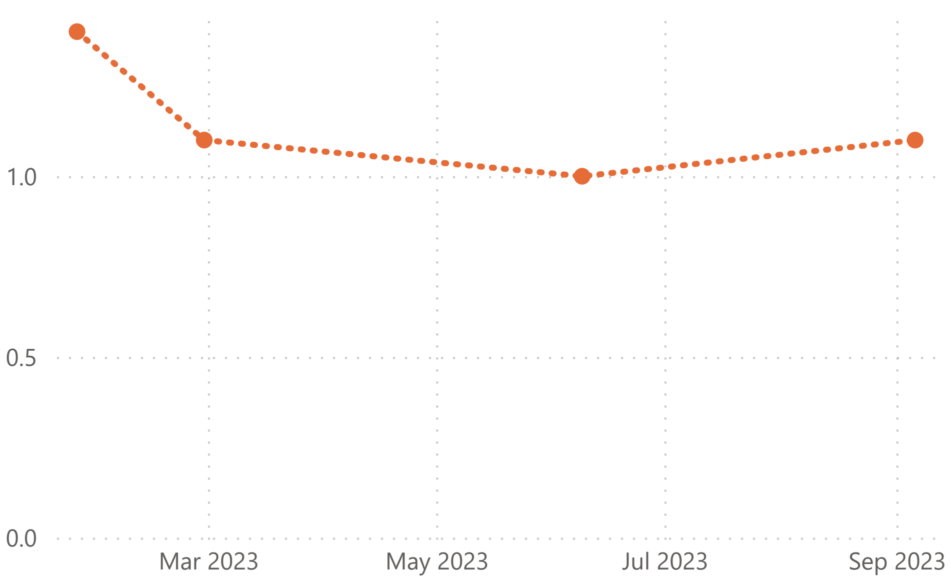
EC (µS/cm)



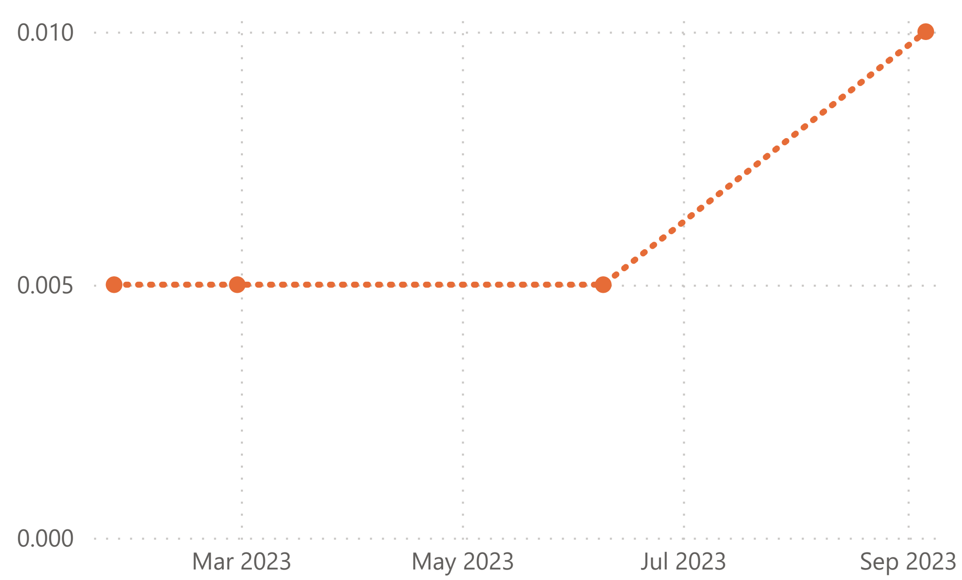
Sodium (mg/L)



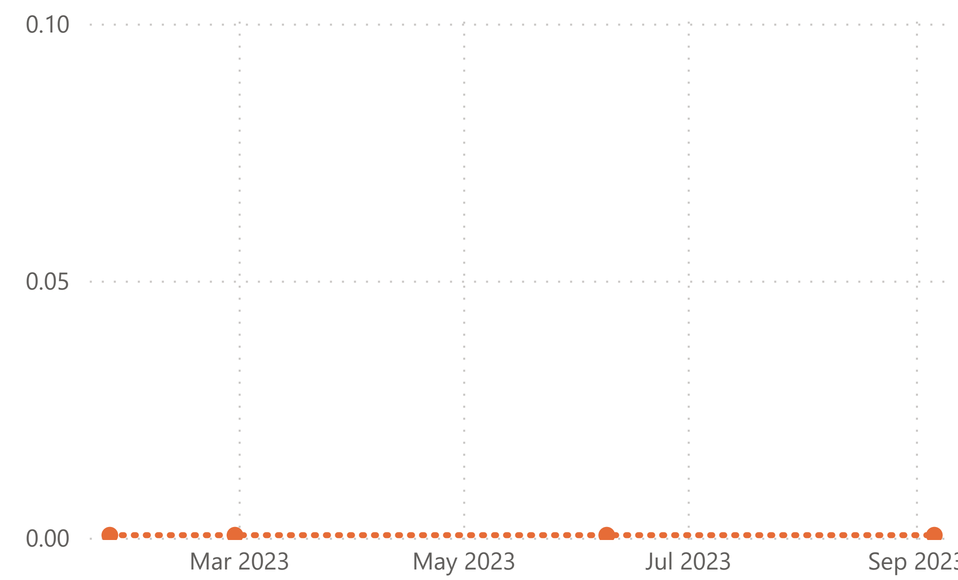
Fluoride (mg/L)



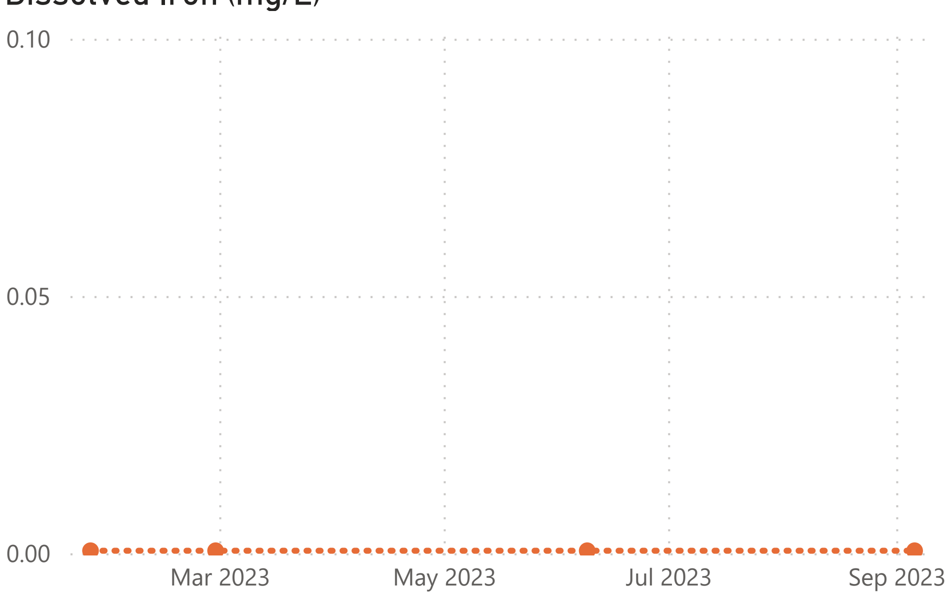
Dissolved Aluminium (mg/L)



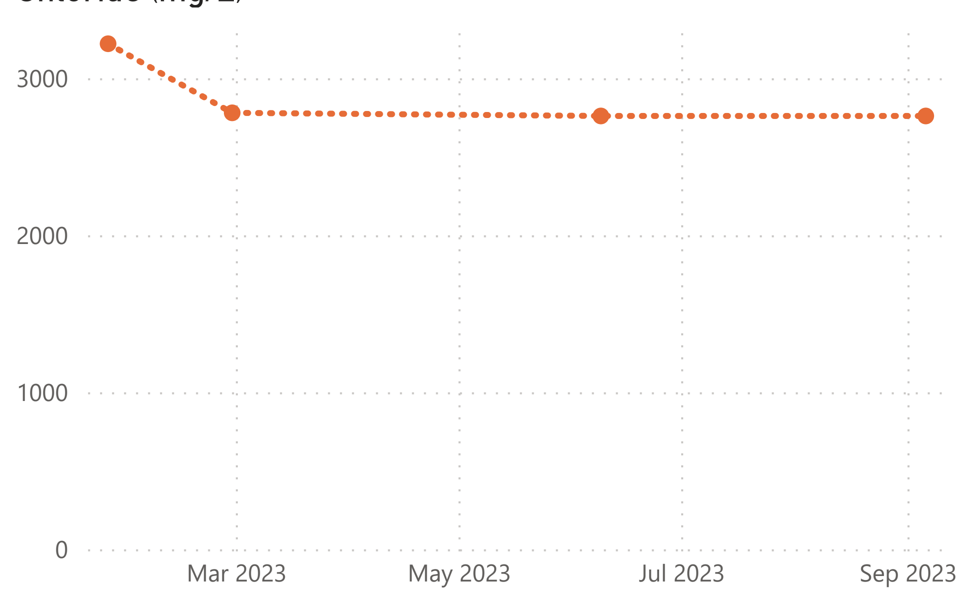
Dissolved Lead (mg/L)



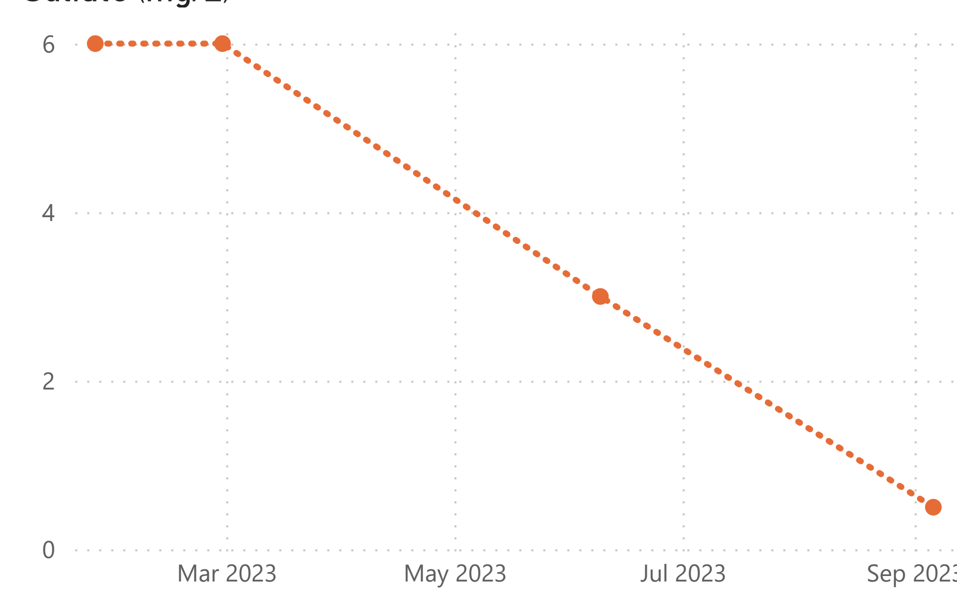
Dissolved Iron (mg/L)



Chloride (mg/L)

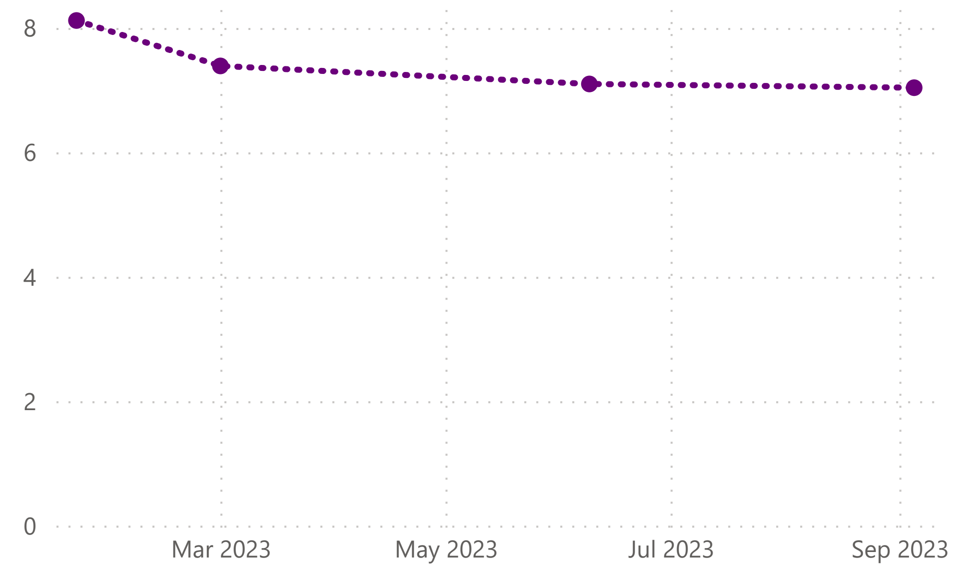


Sulfate (mg/L)

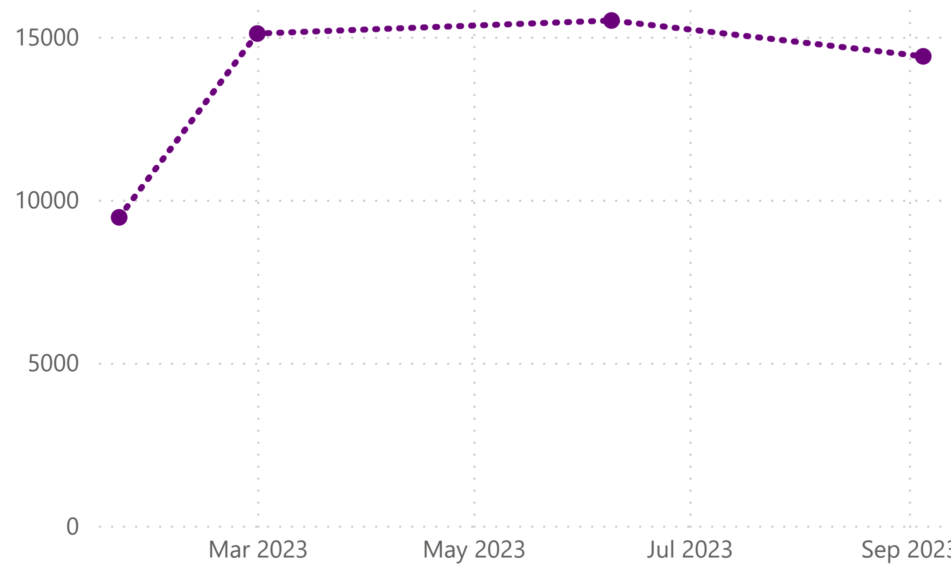


● Atlas-15M-D

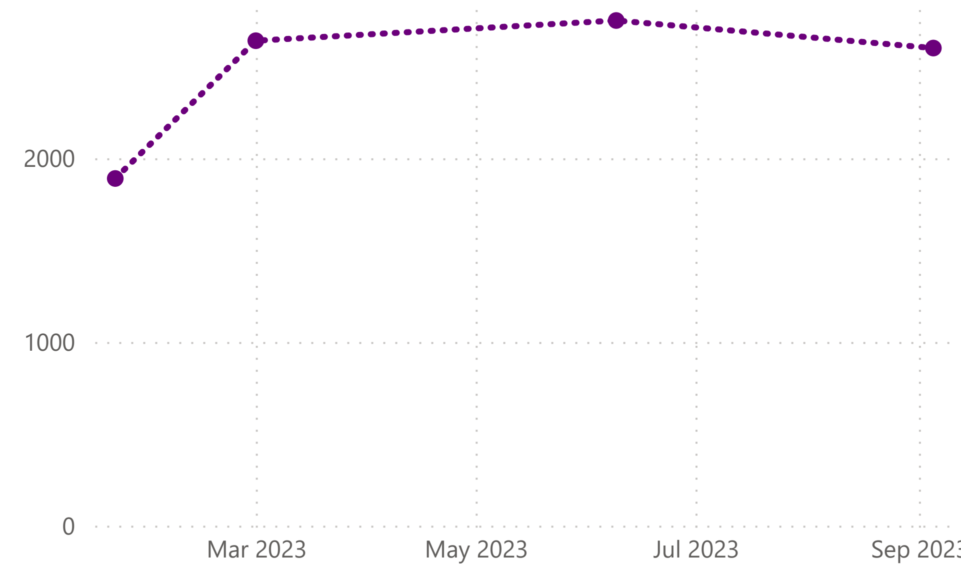
pH (pH unit)



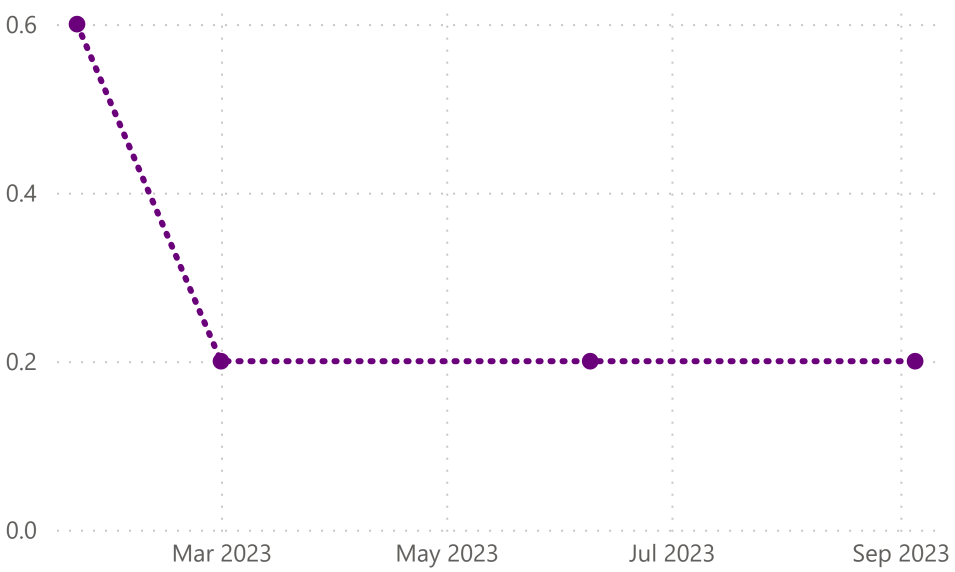
EC (µS/cm)



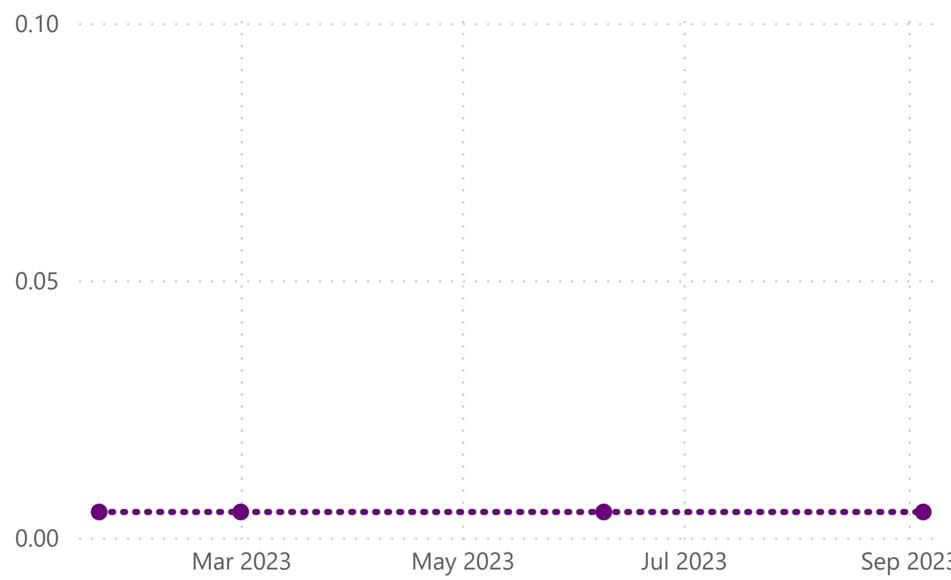
Sodium (mg/L)



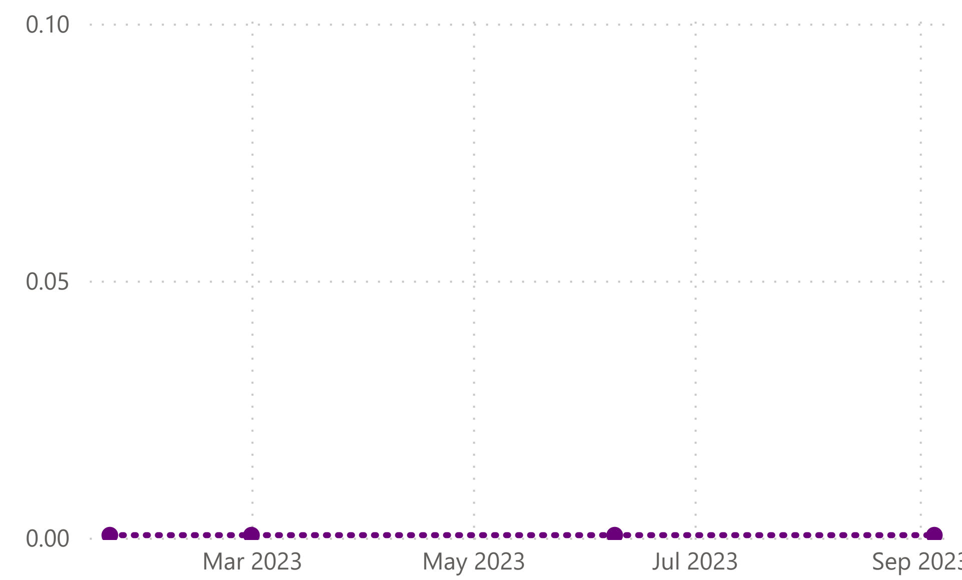
Fluoride (mg/L)



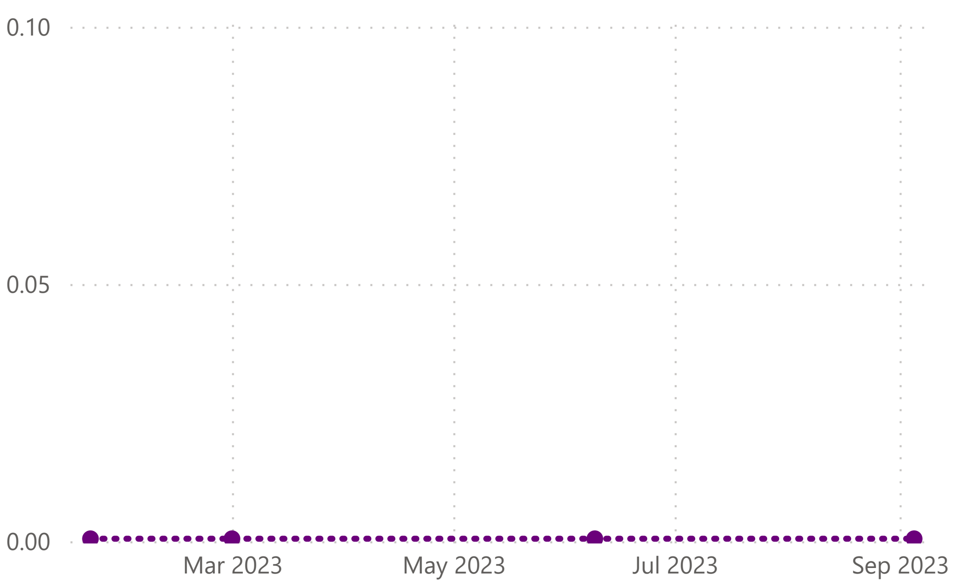
Dissolved Aluminium (mg/L)



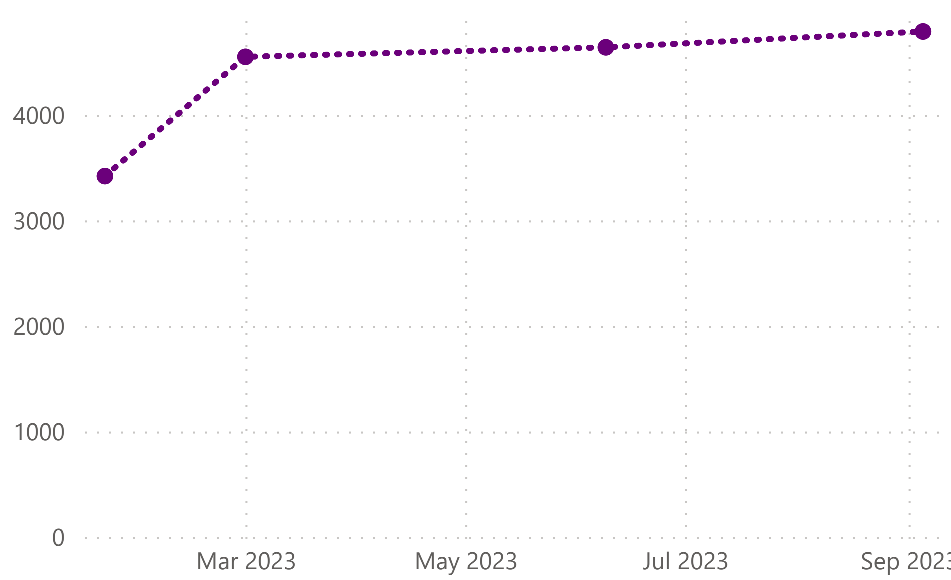
Dissolved Lead (mg/L)



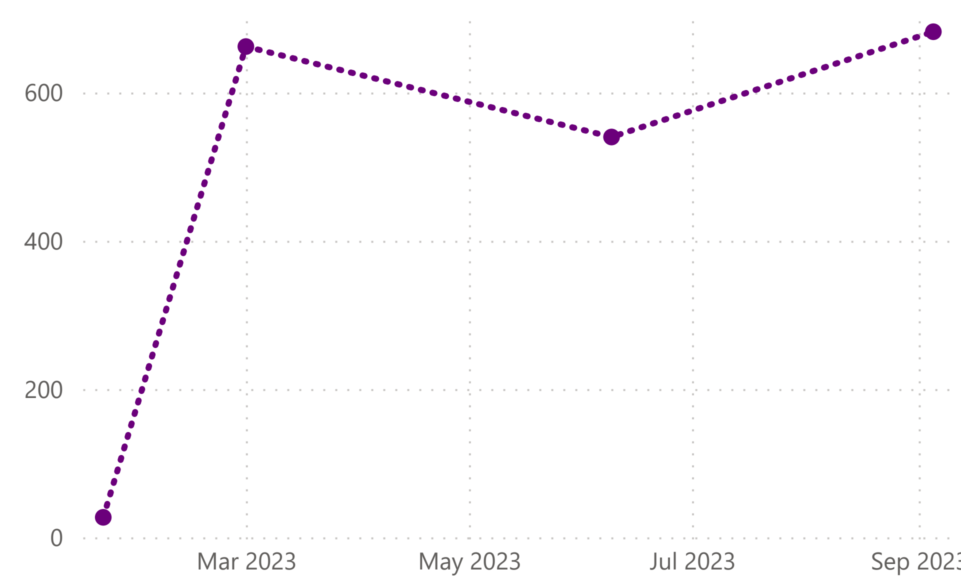
Dissolved Iron (mg/L)



Chloride (mg/L)

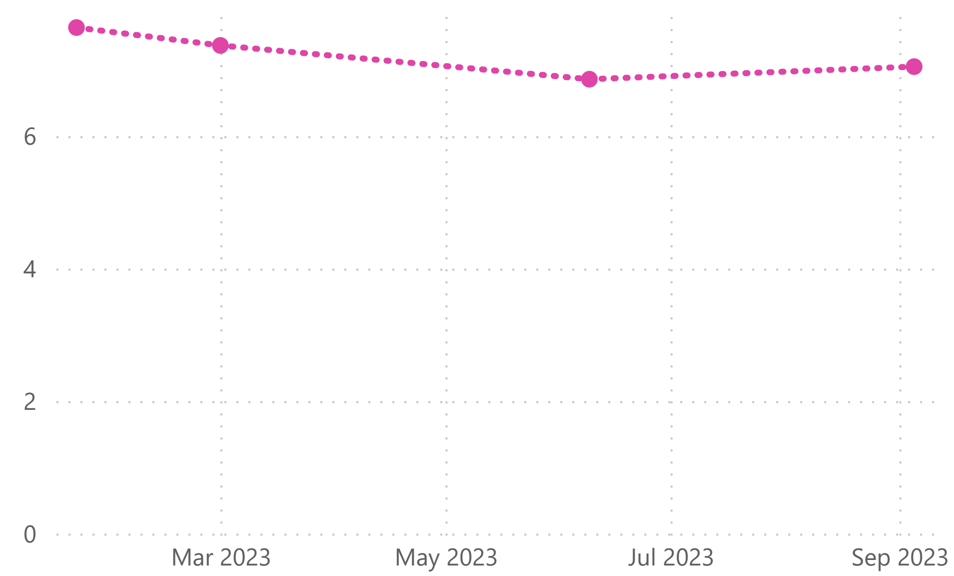


Sulfate (mg/L)

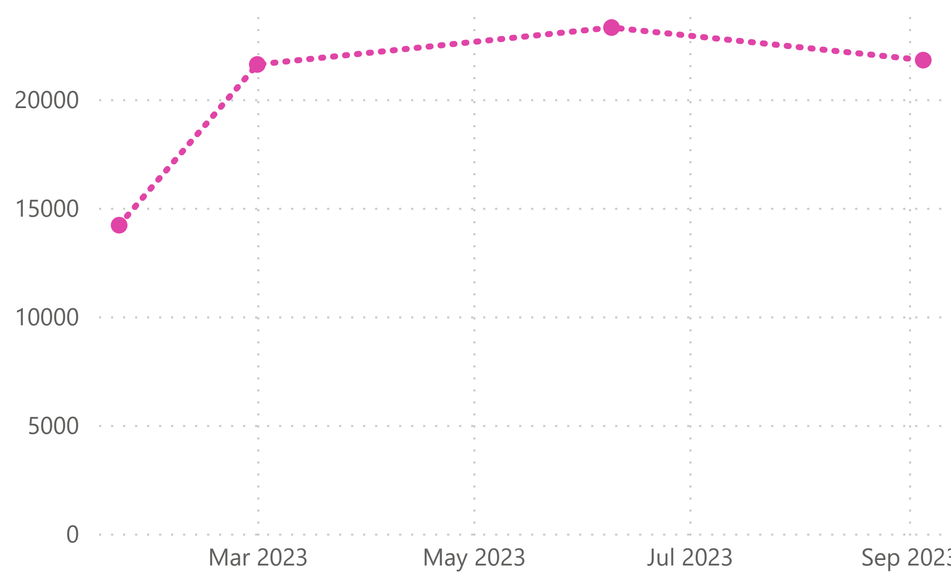


Atlas-15M-S

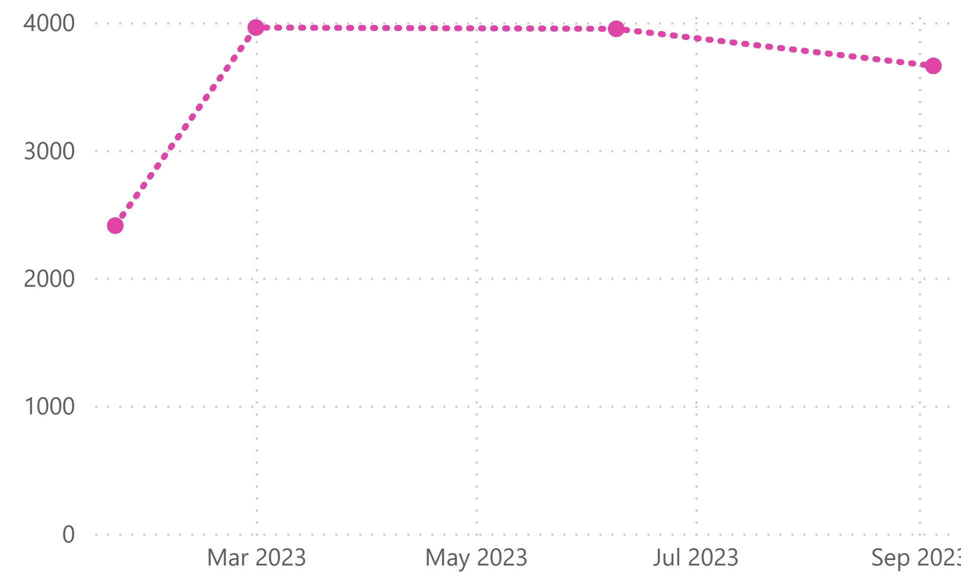
pH (pH unit)



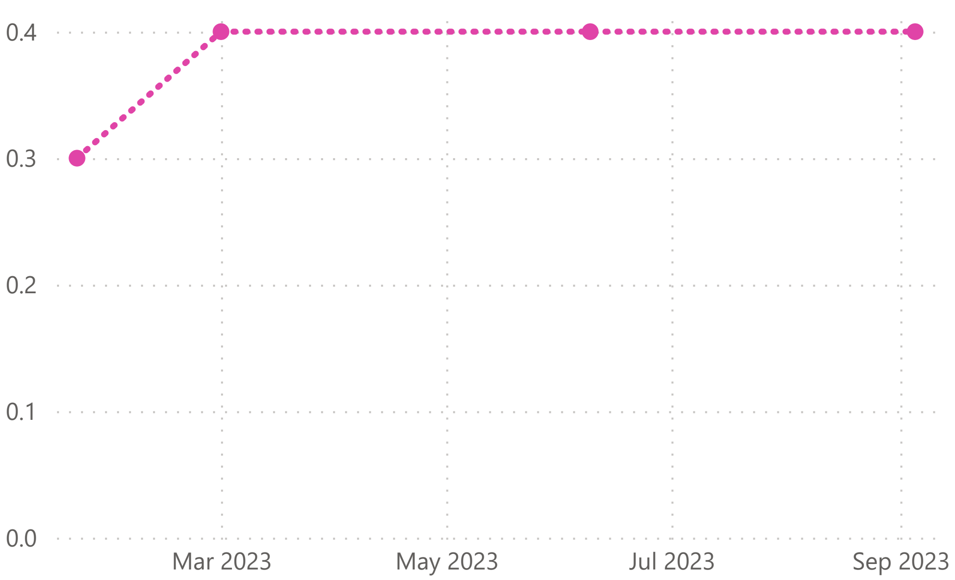
EC (µS/cm)



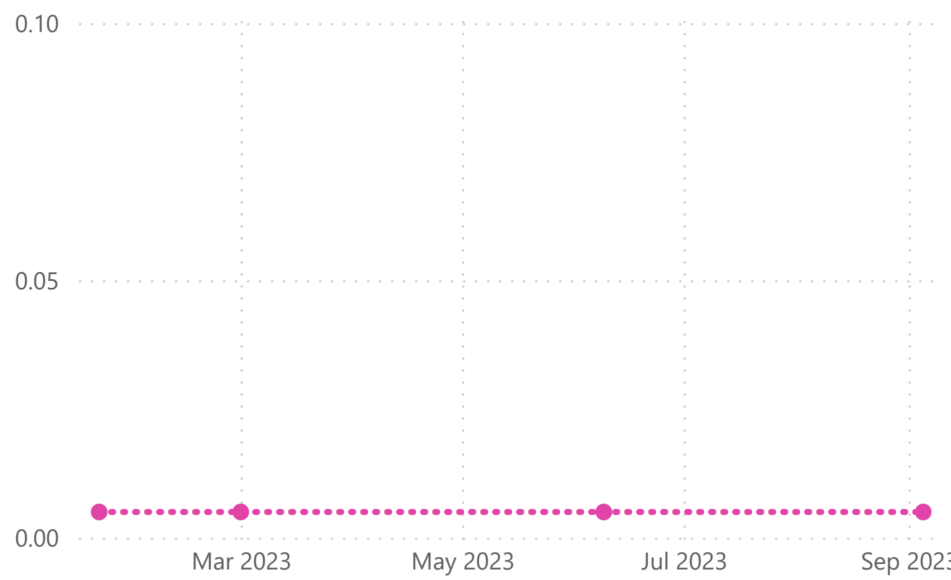
Sodium (mg/L)



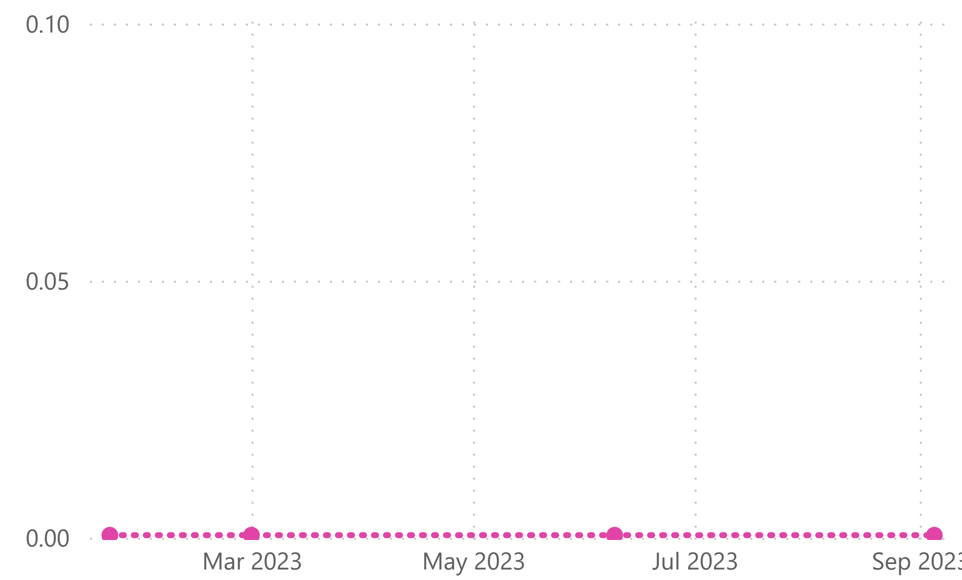
Fluoride (mg/L)



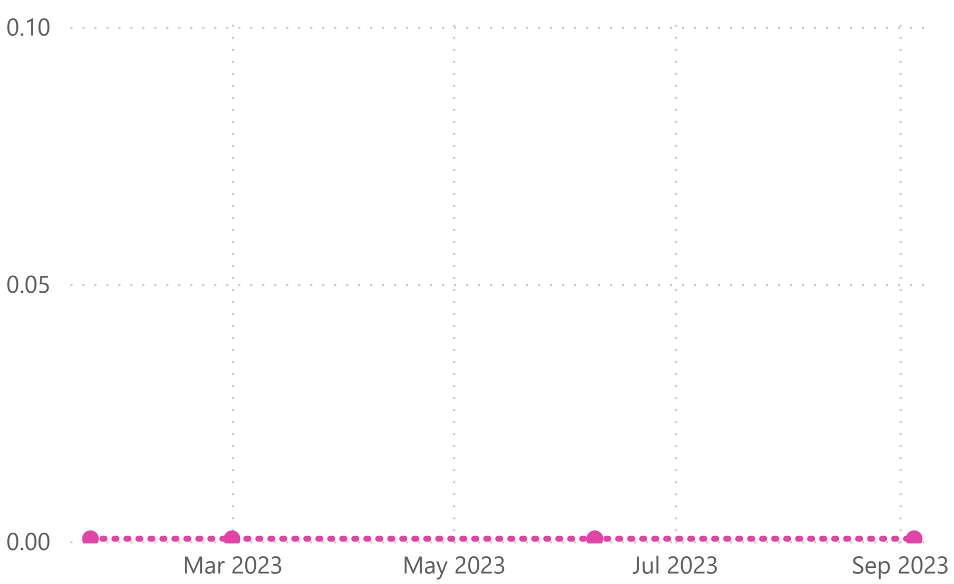
Dissolved Aluminium (mg/L)



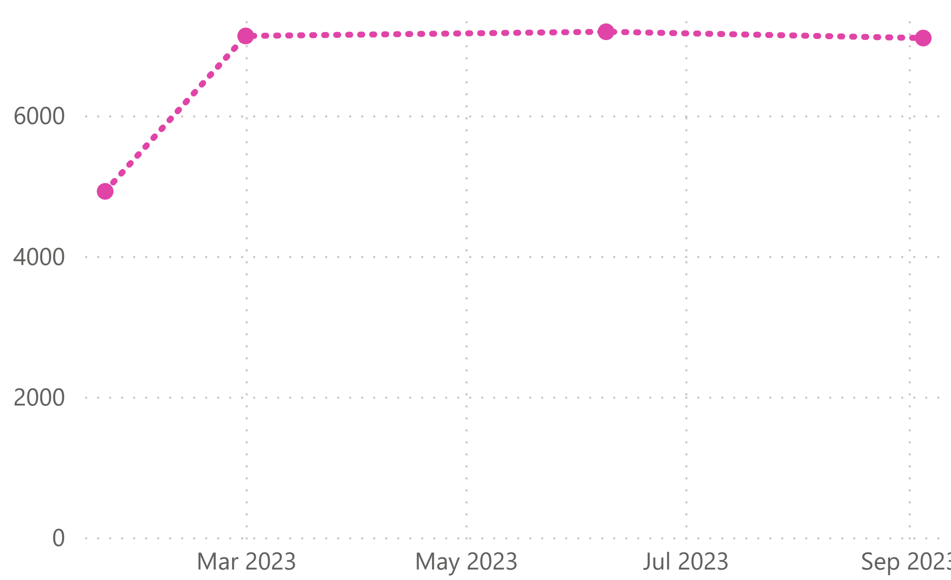
Dissolved Lead (mg/L)



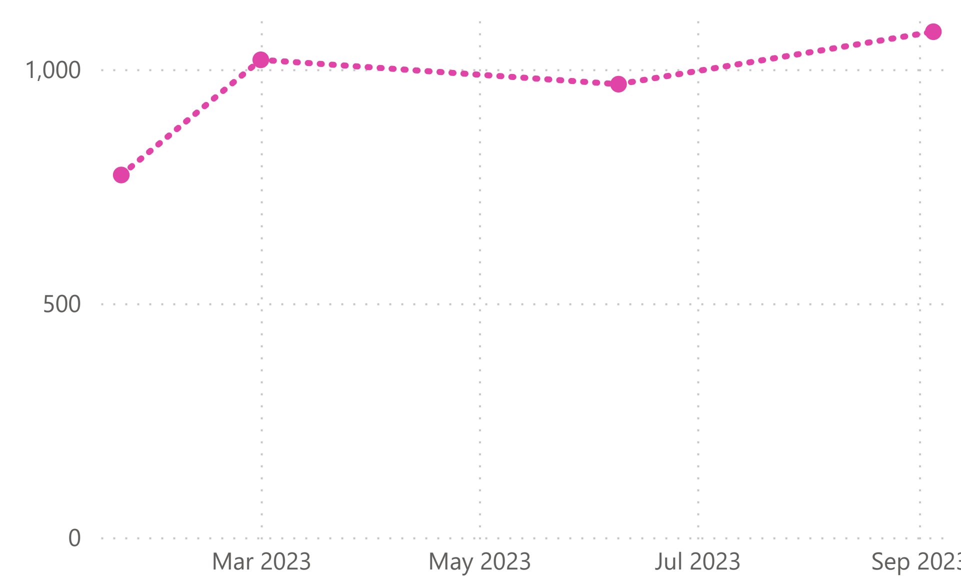
Dissolved Iron (mg/L)



Chloride (mg/L)

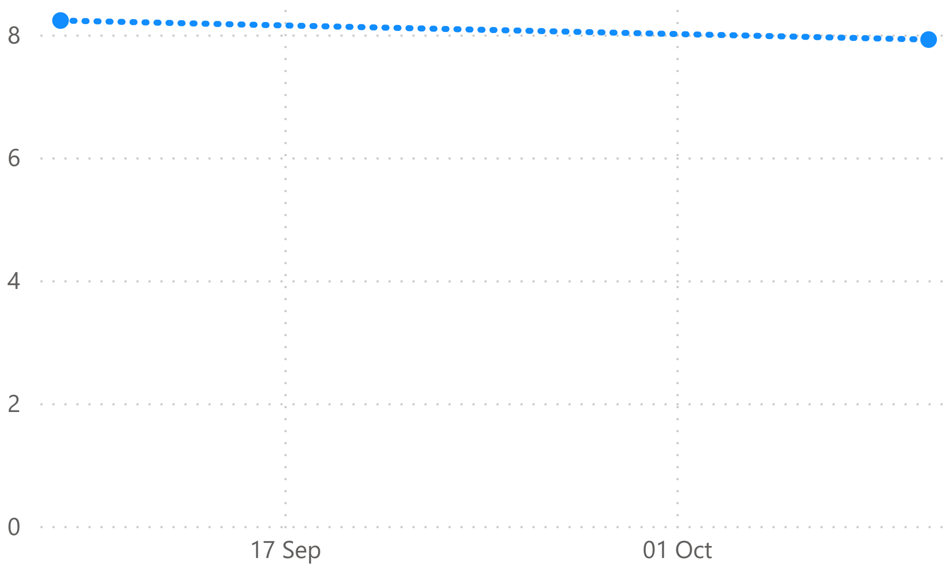


Sulfate (mg/L)

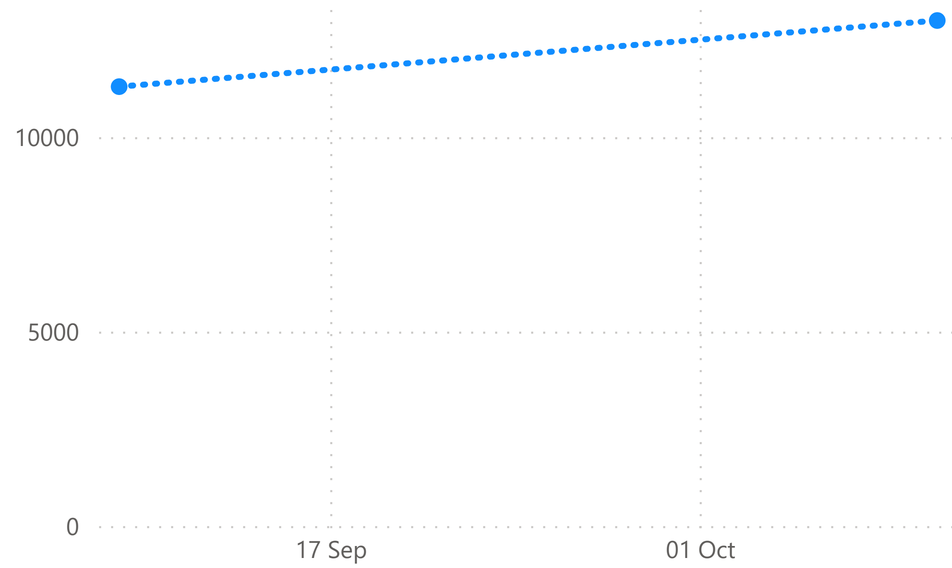


Atlas-19M-D

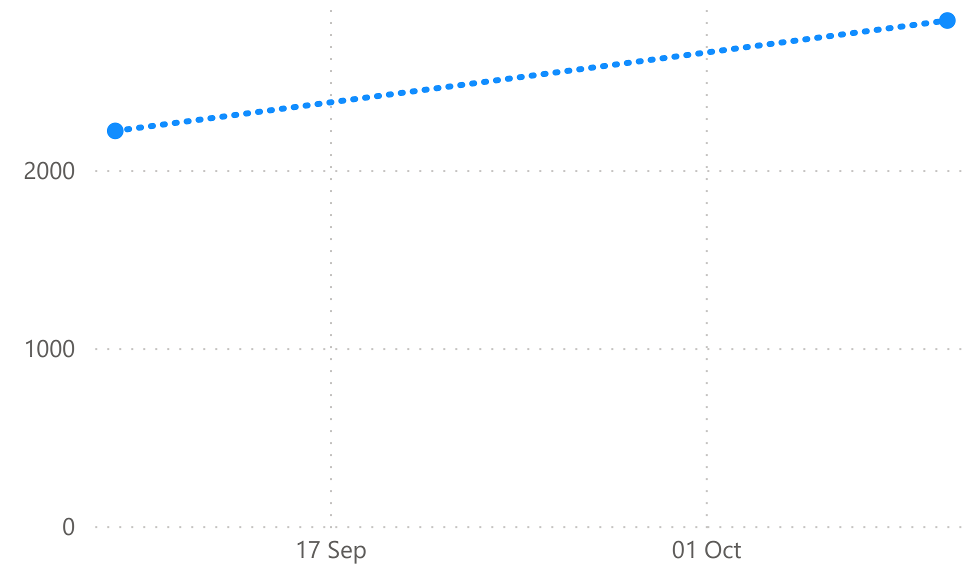
pH (pH unit)



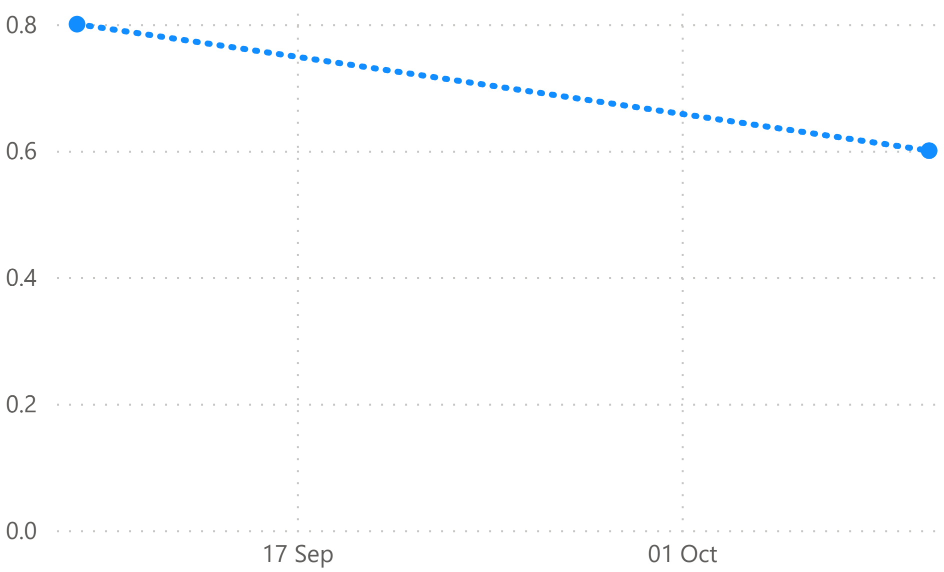
EC (µS/cm)



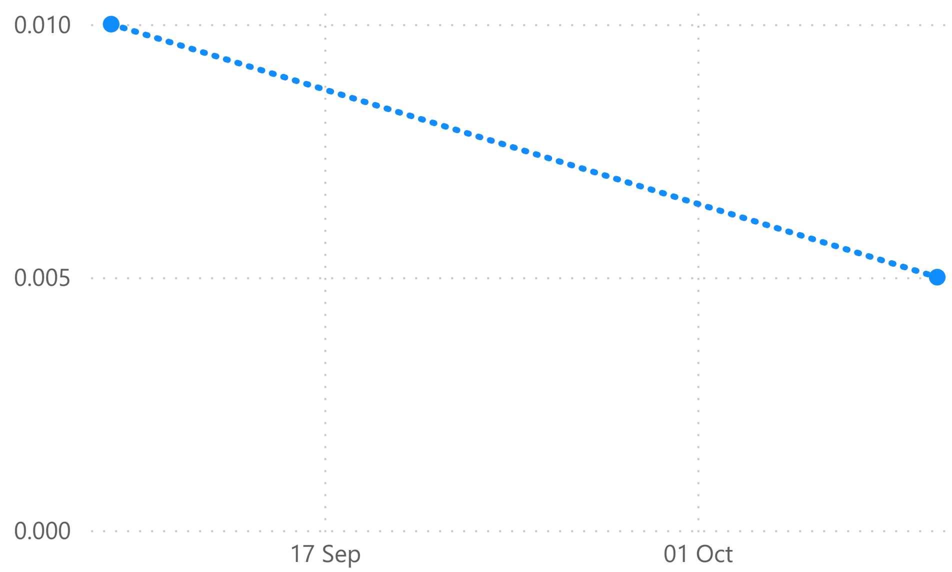
Sodium (mg/L)



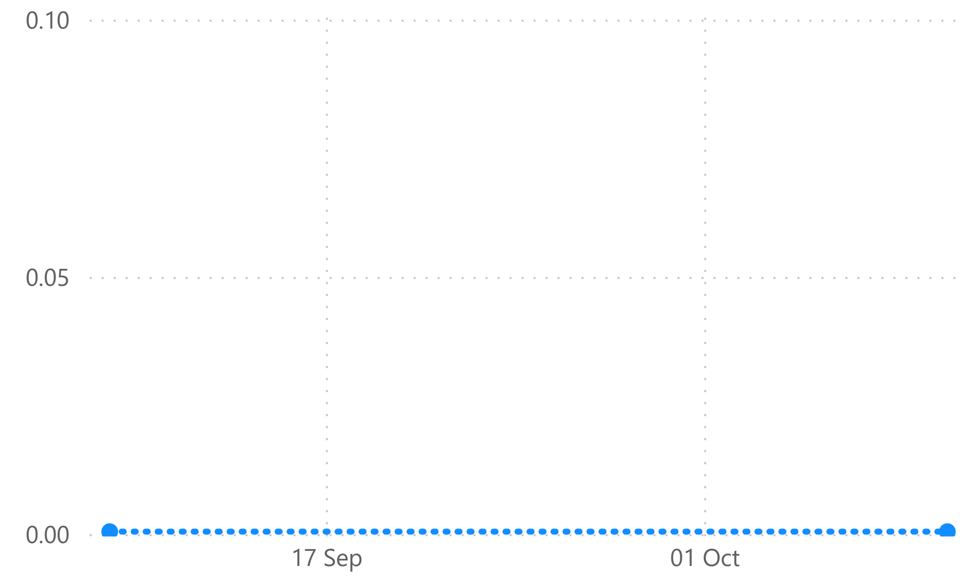
Fluoride (mg/L)



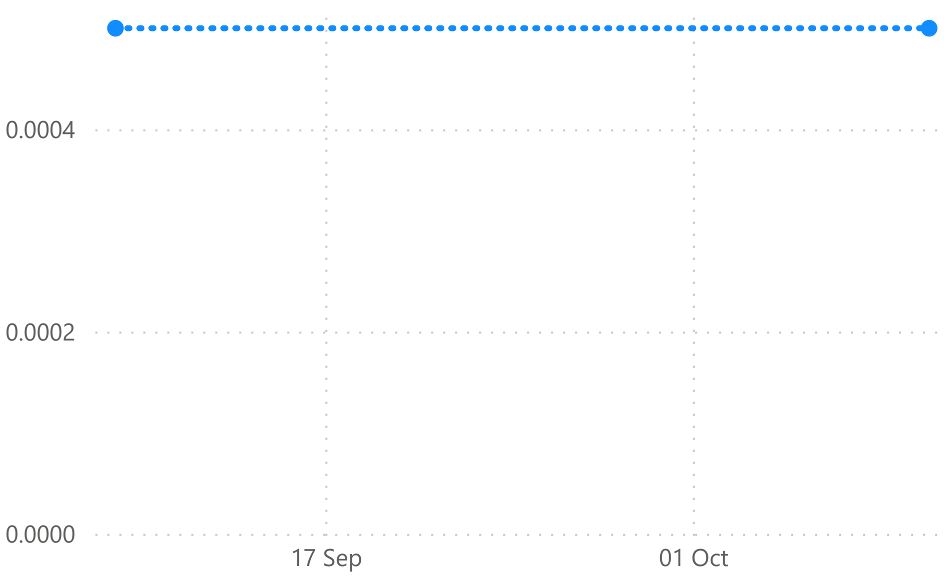
Dissolved Aluminium (mg/L)



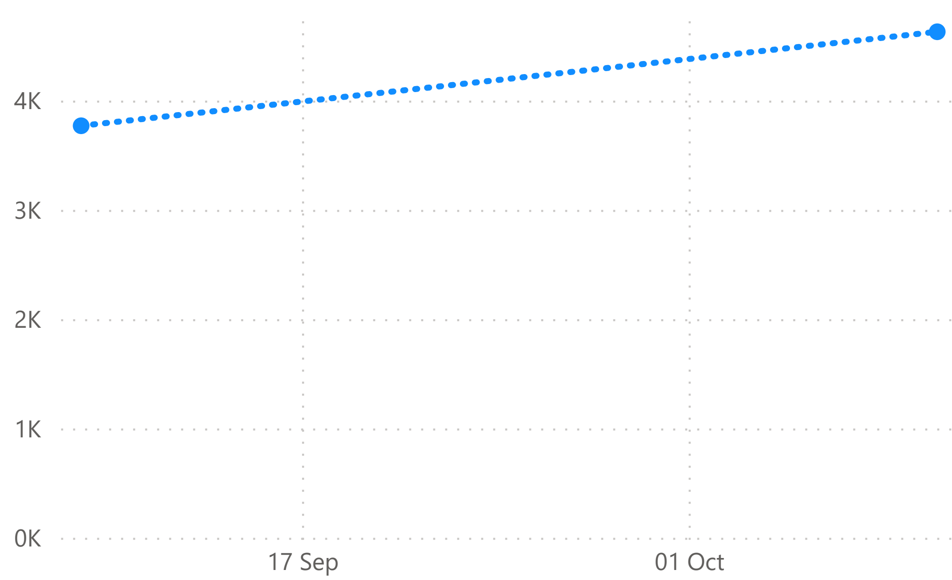
Dissolved Lead (mg/L)



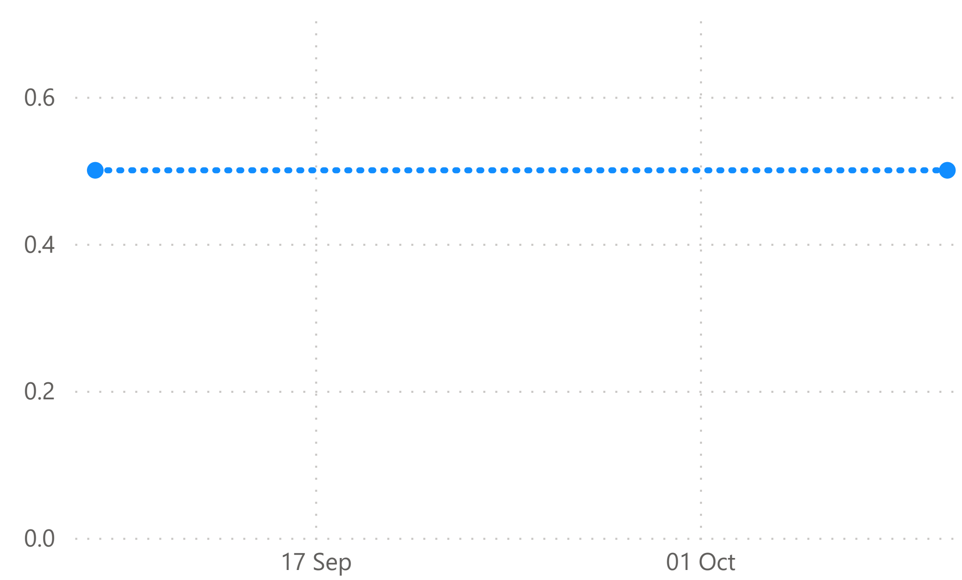
Dissolved Iron (mg/L)



Chloride (mg/L)



Sulfate (mg/L)



APPENDIX II

OGIA Model Parameters

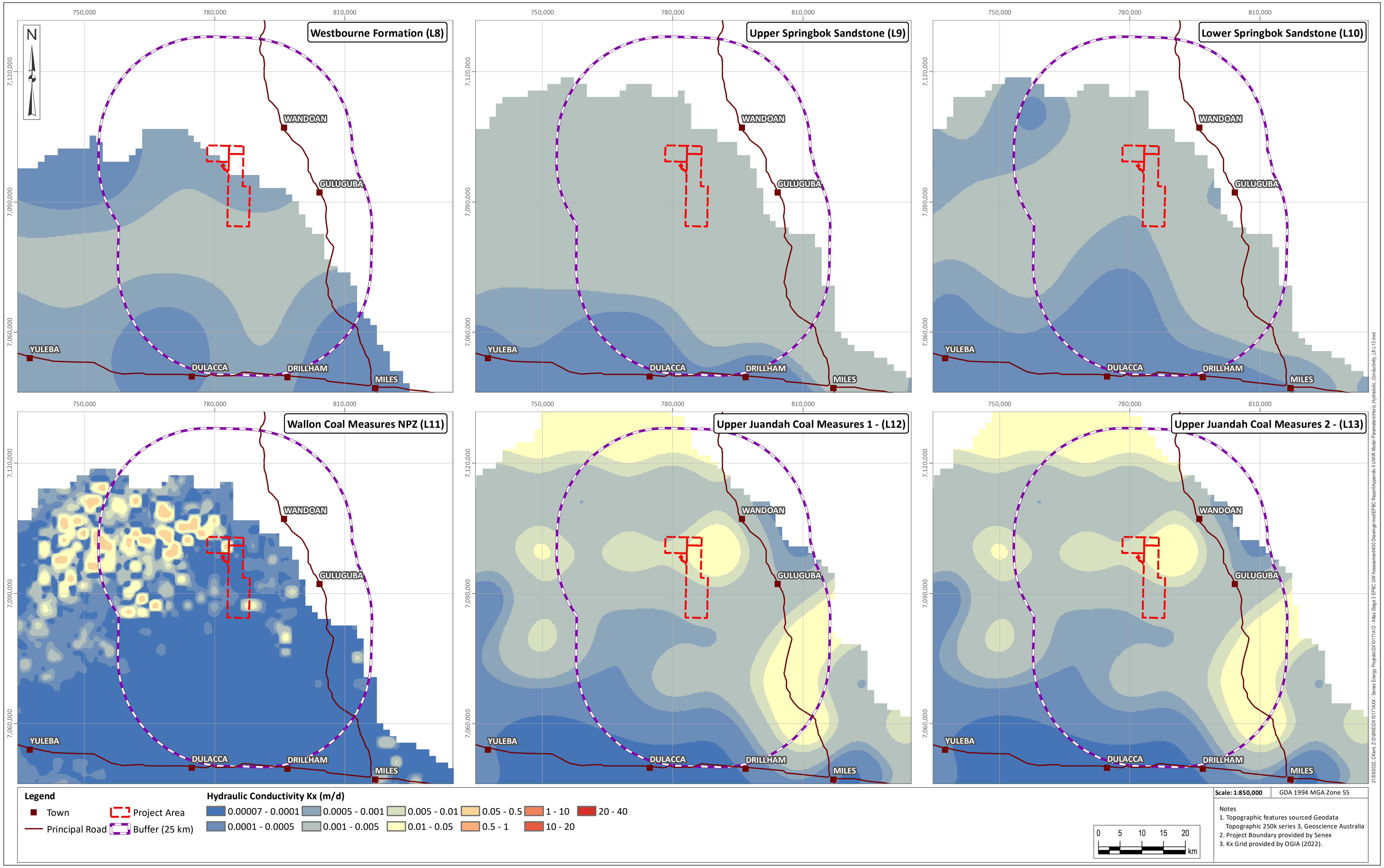


Figure II-1 Horizontal Hydraulic Conductivity (L8 – Westbourne Formation to L 13 – Upper Juandah Coal Measures – Layer 2)

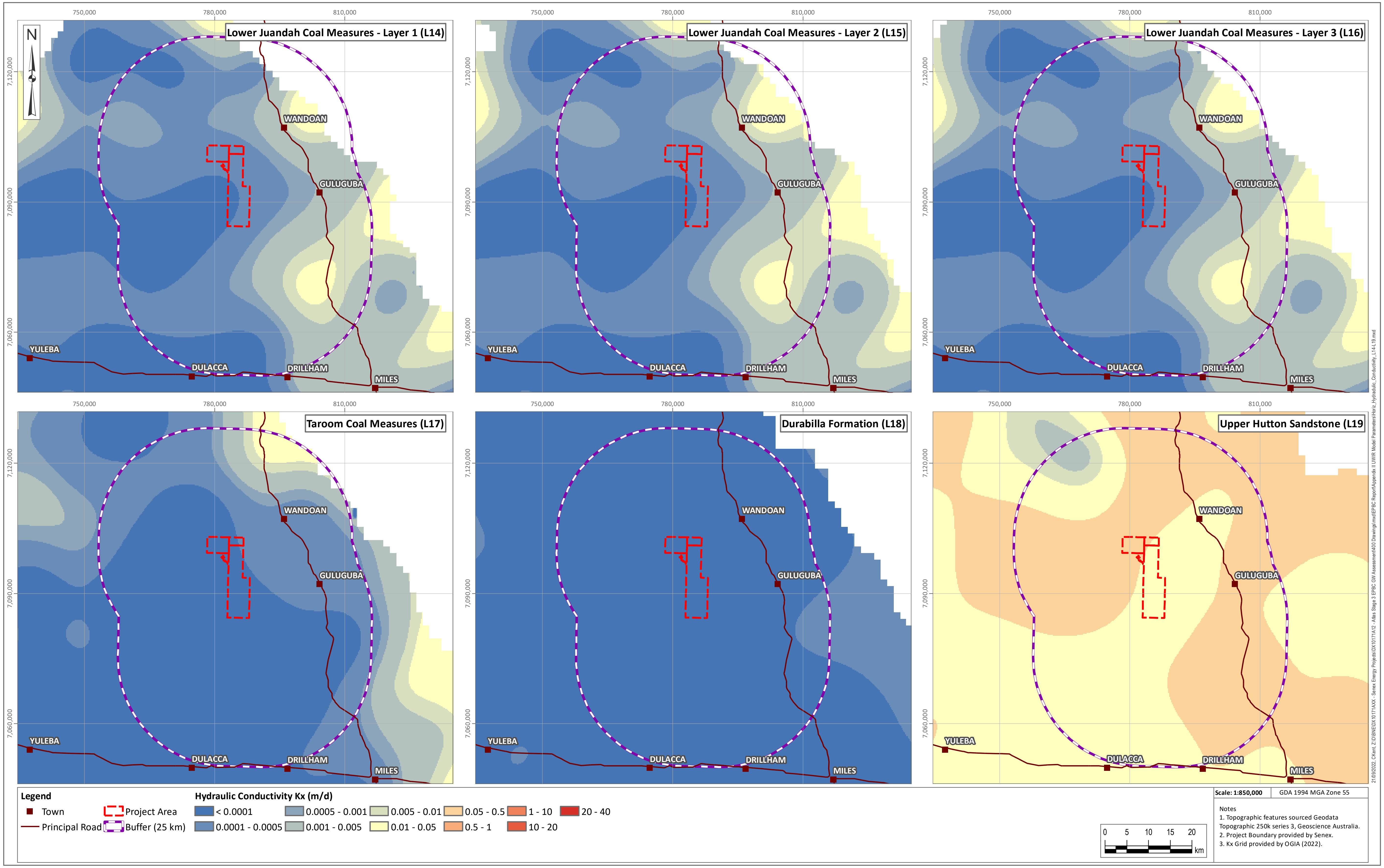


Figure II-2 Horizontal Hydraulic Conductivity (L14 Lower Juandah Coal Measures Layer 1 to L 19 Upper Hutton Sandstone)

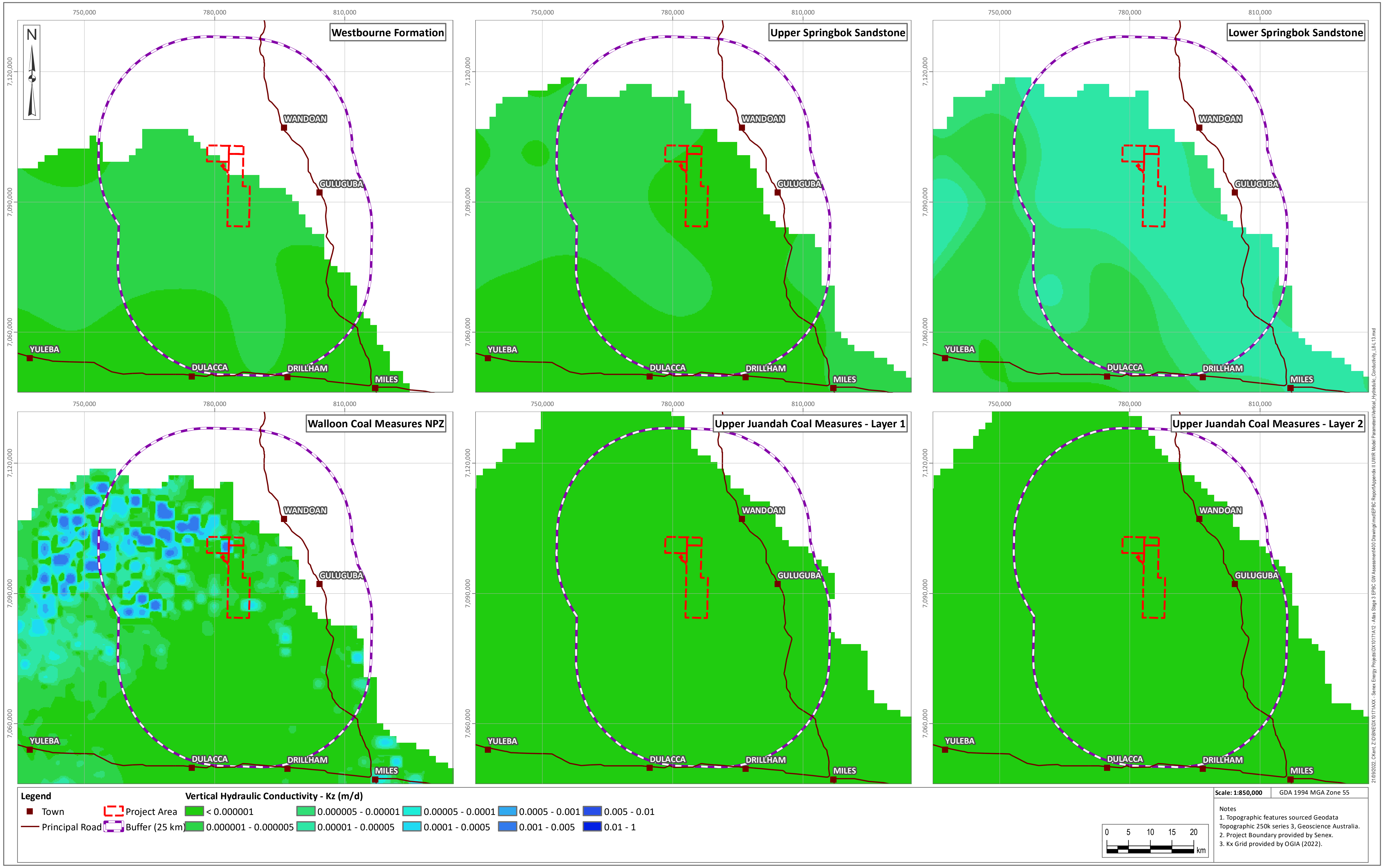


Figure II-3 Vertical Hydraulic Conductivity (L8 – Westbourne Formation to L 13 – Upper Juandah Coal Measures – Layer 2)

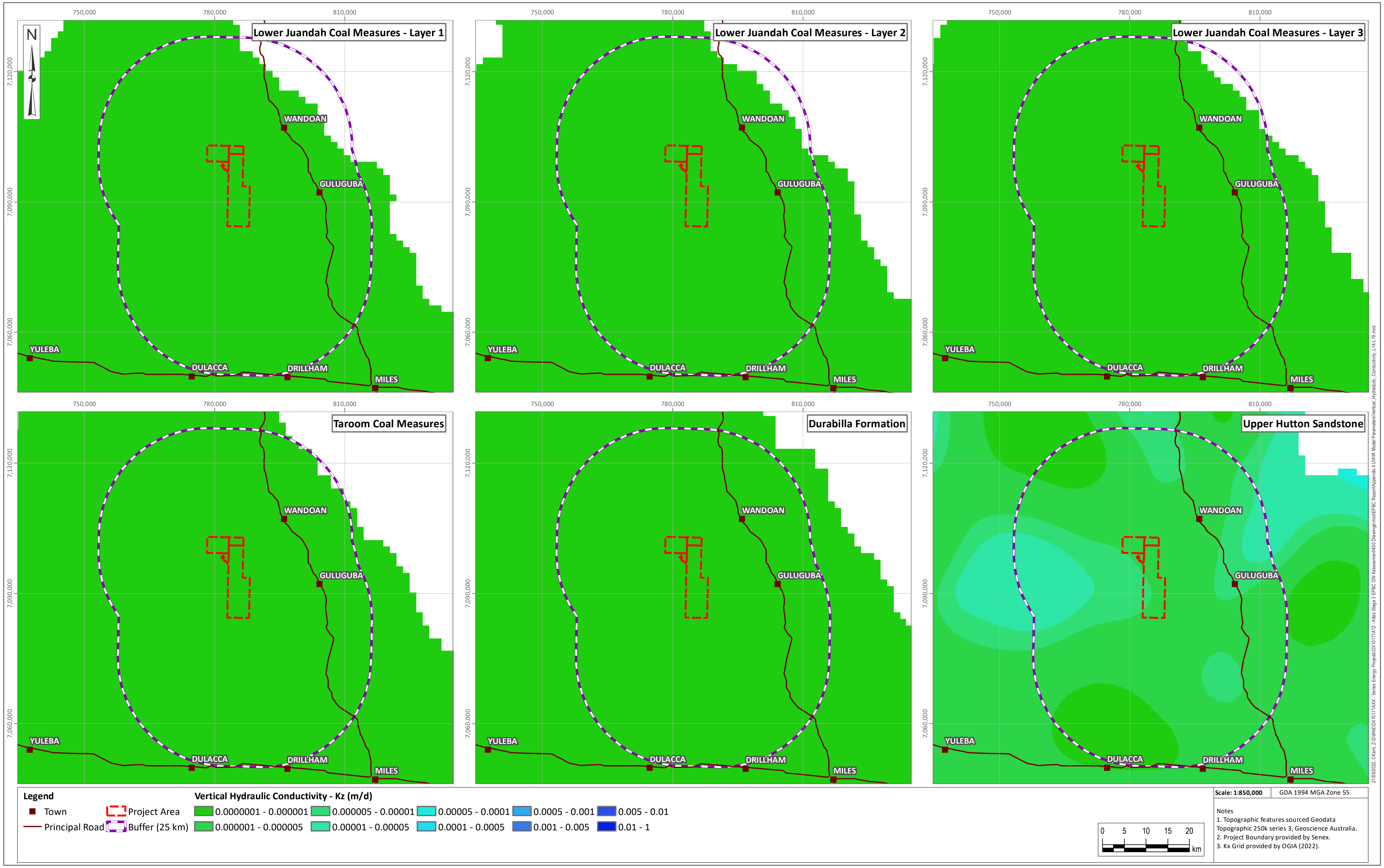


Figure II-4 Vertical Hydraulic Conductivity (L14 Lower Juandah Coal Measures Layer 1 to L 19 Upper Hutton Sandstone)

APPENDIX III

Predicted Drawdown Extent – Project Only

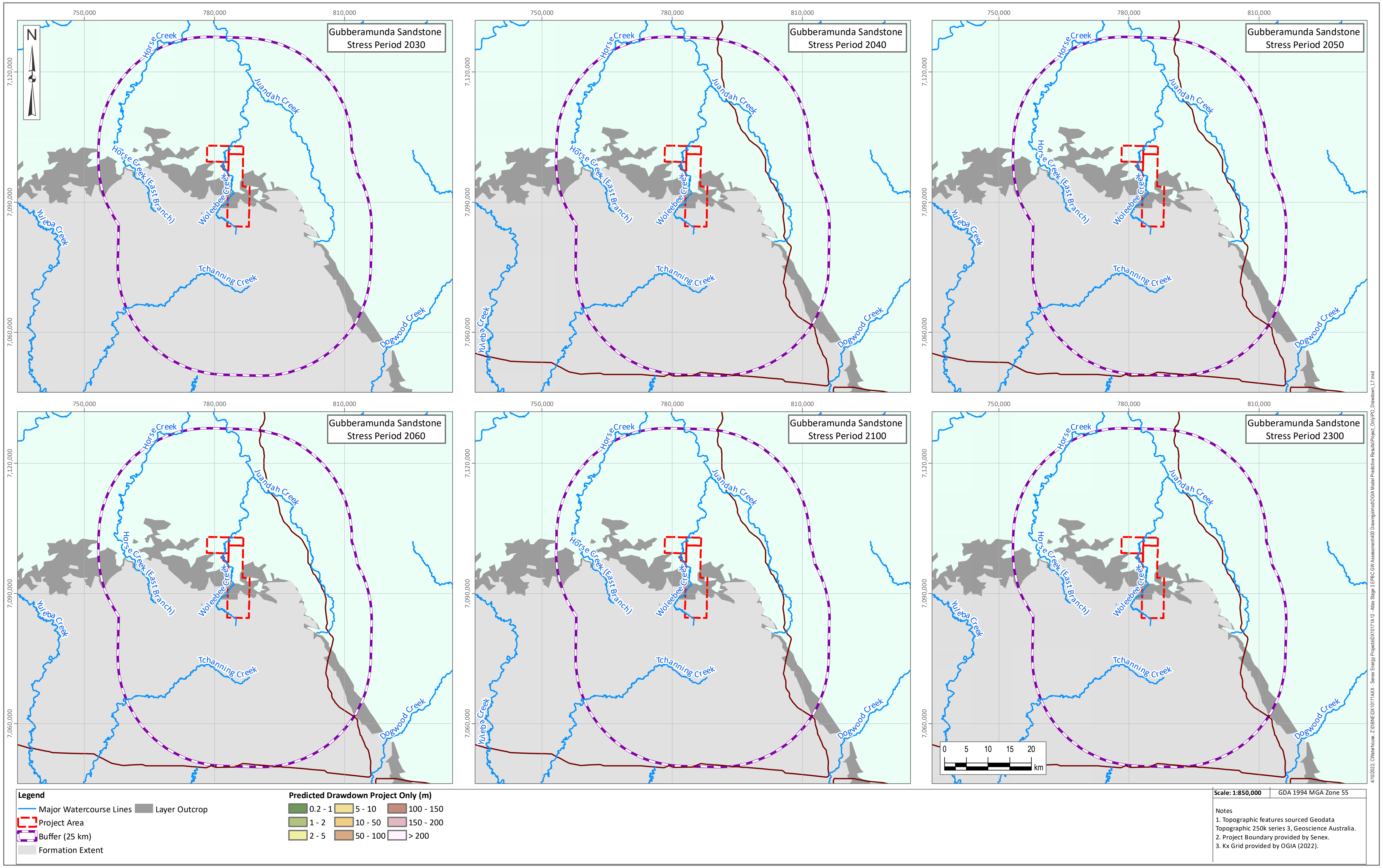


Figure III-1 Project Only Drawdown – Layer 7 – Gubberamunda Sandstone

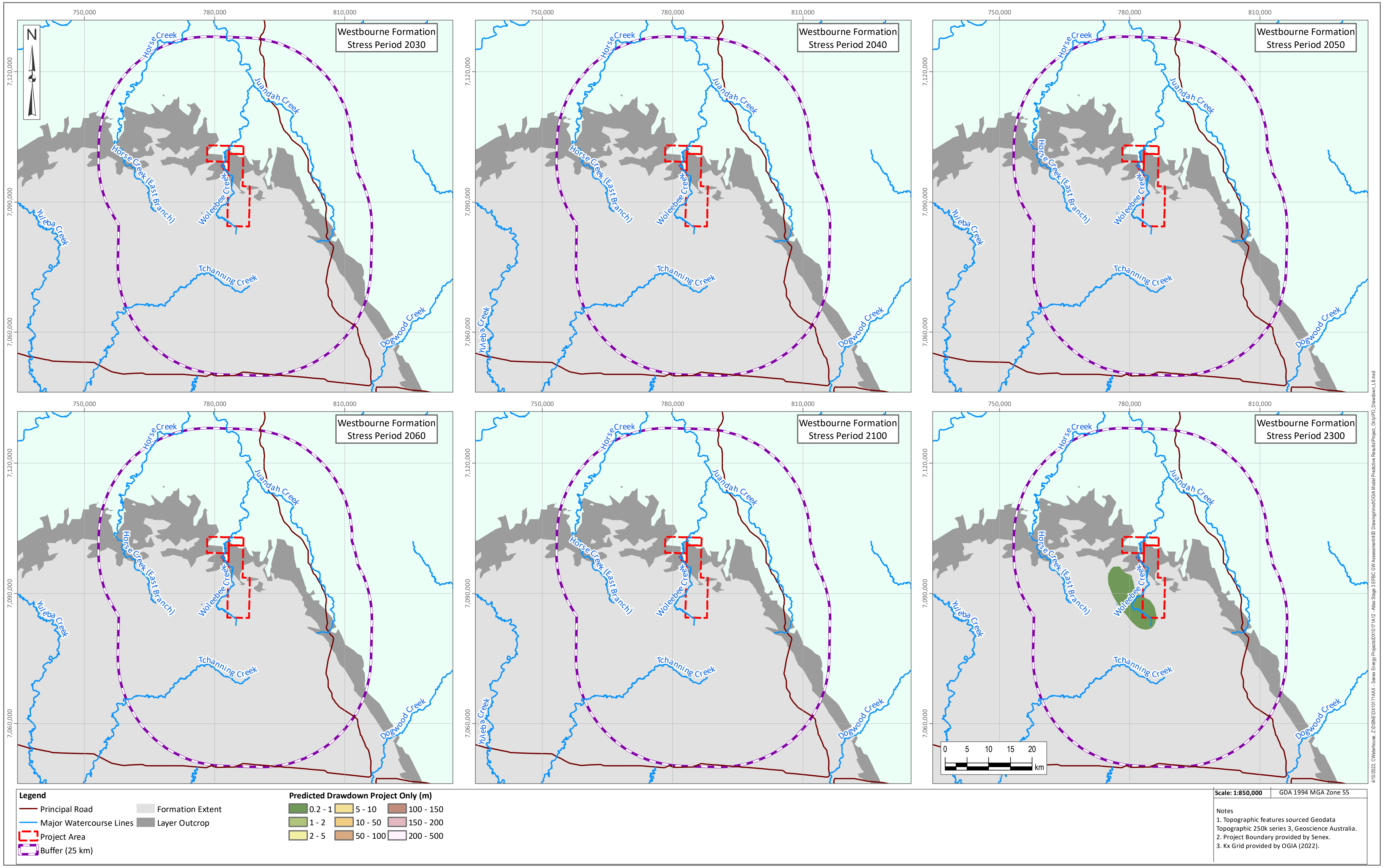


Figure III-2 Project Only Drawdown – Layer 8 – Westbourne Formation

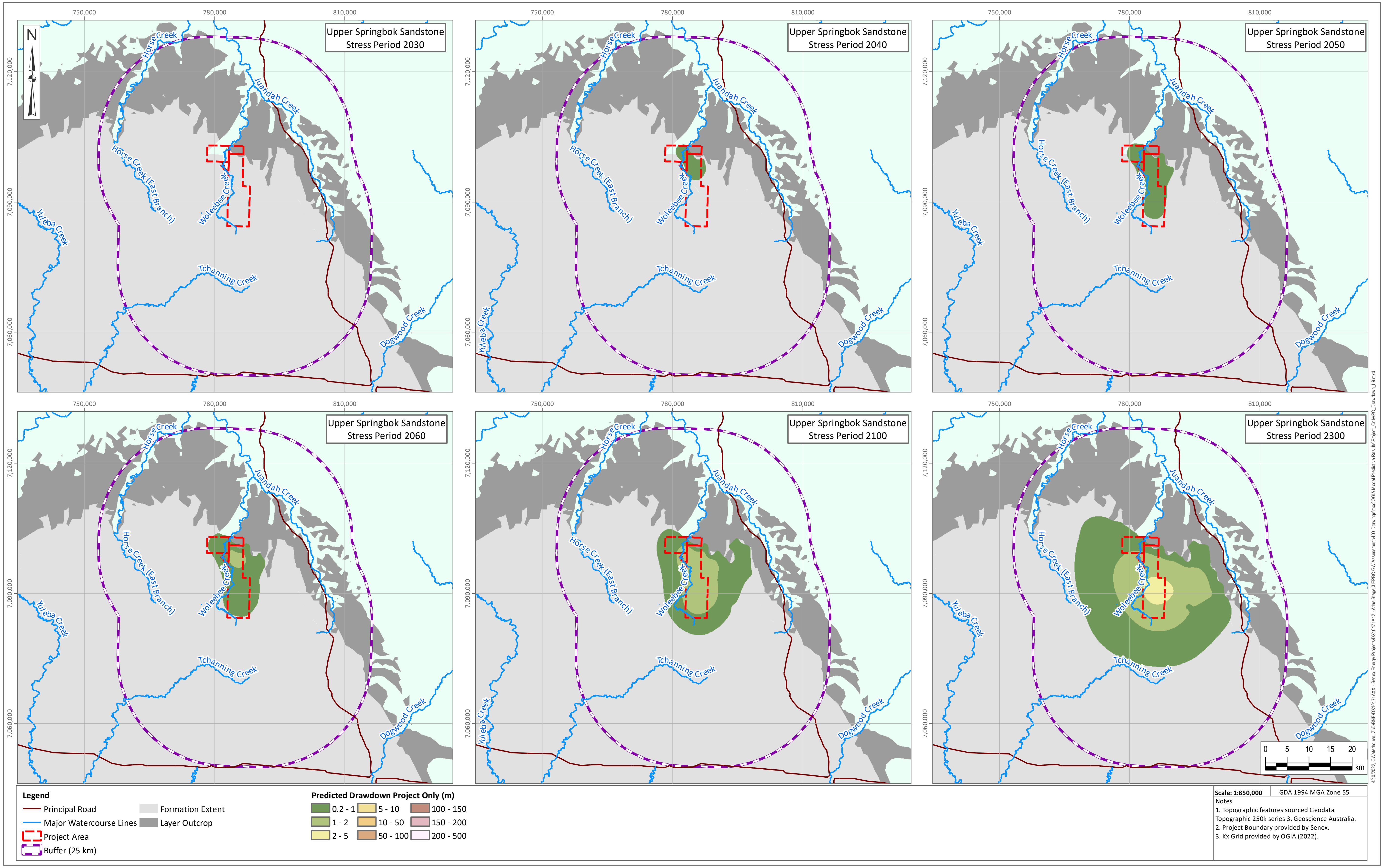


Figure III-3 Project Only Drawdown – Layer 9 – Upper Springbok Sandstone

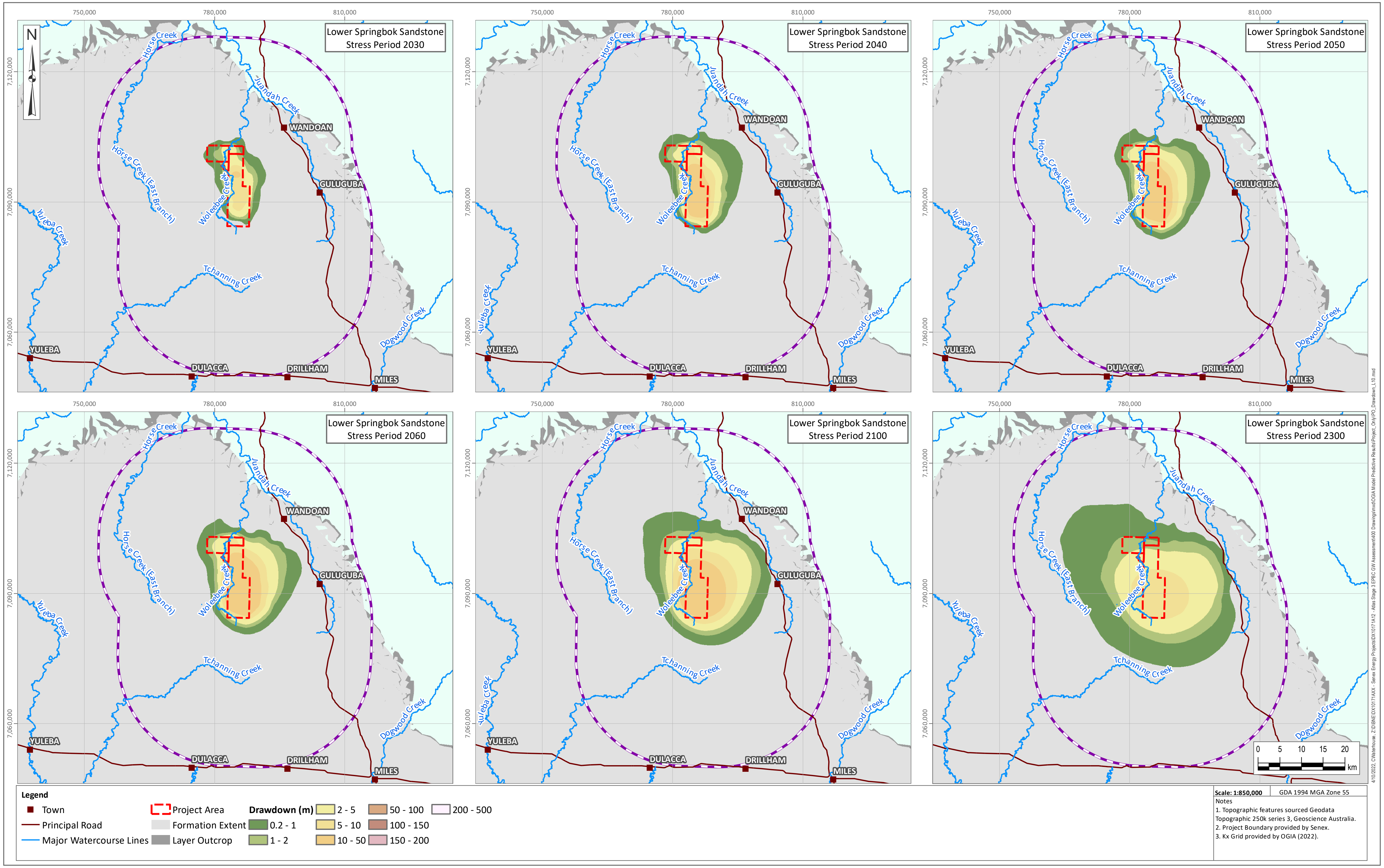


Figure III-4 Project Only Drawdown – Layer 10 – Lower Springbok Sandstone

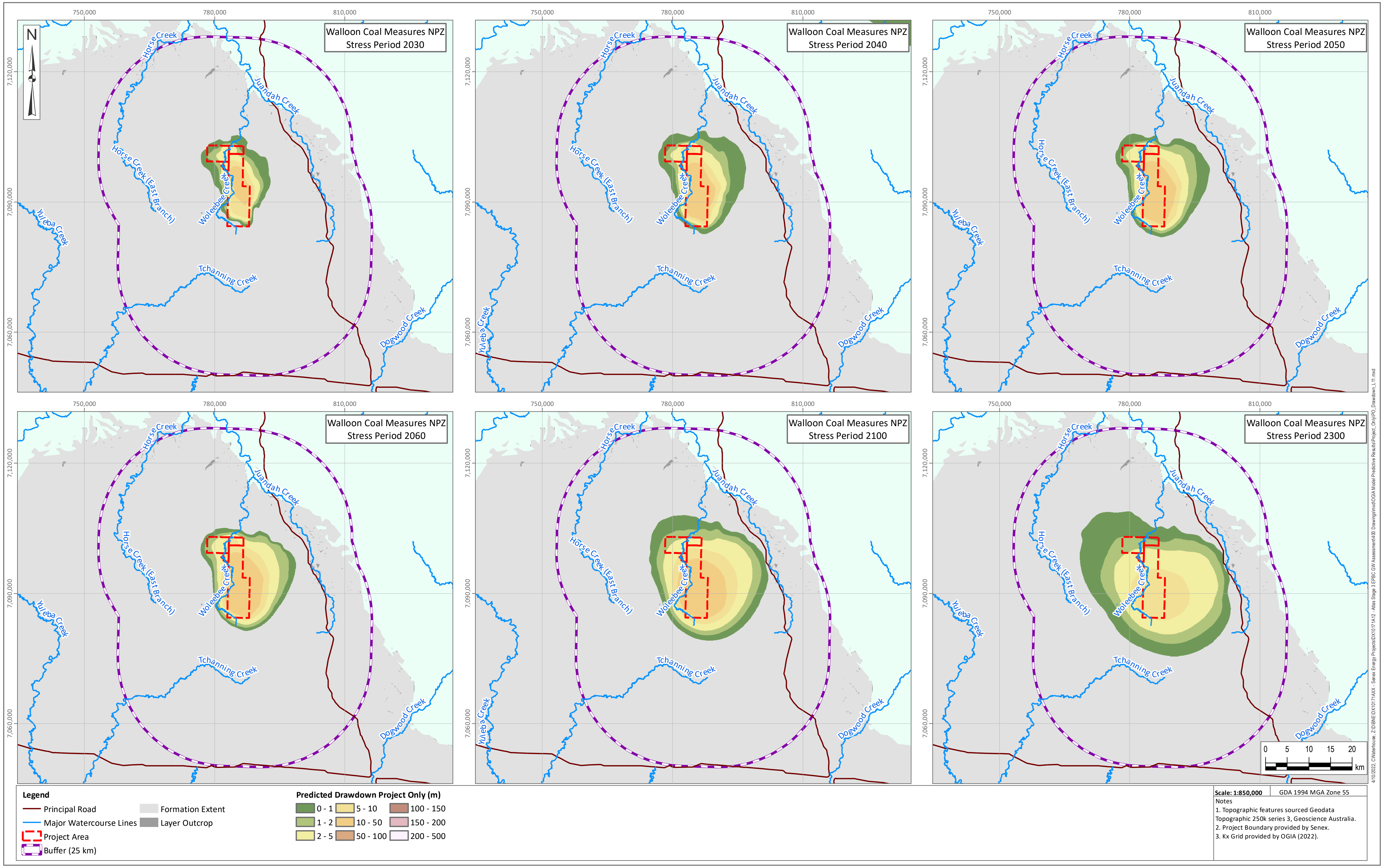


Figure III-5 Project Only Drawdown – Layer 11 – Walloon Coal Measures Non-Productive Zone

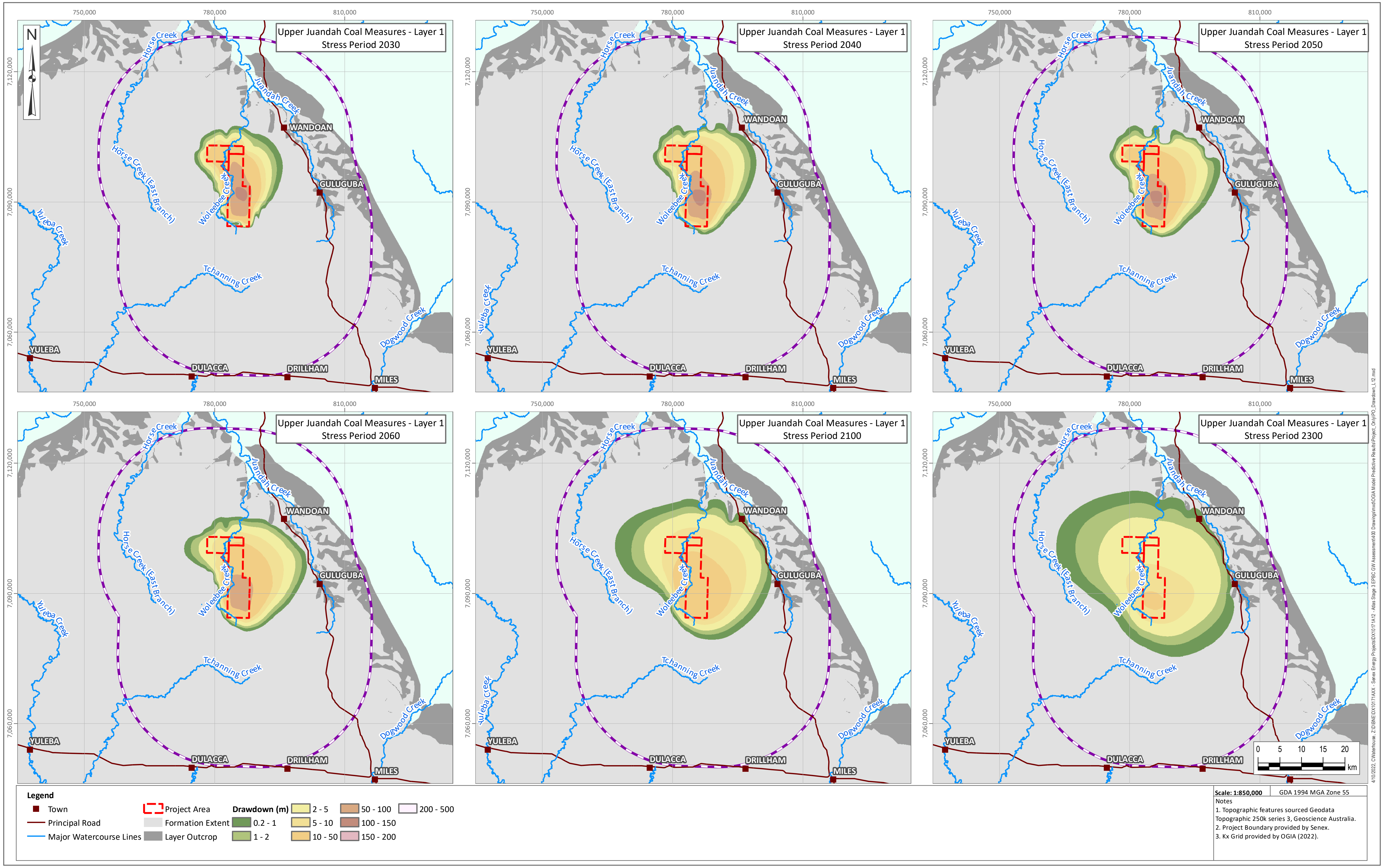


Figure III-6 Project Only Drawdown – Layer 12 – Upper Juandah Coal Measures Layer 1

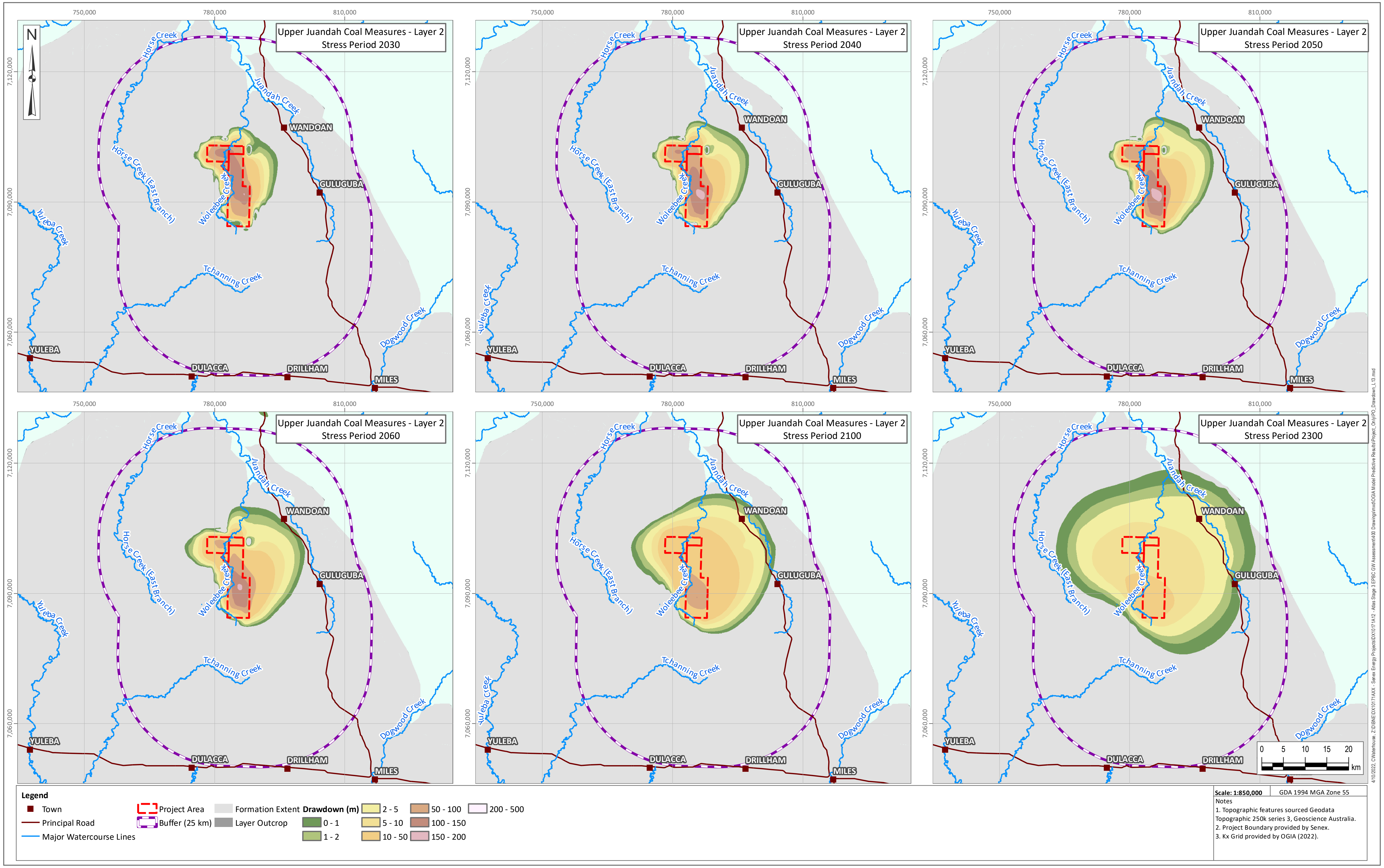


Figure III-7 Project Only Drawdown – Layer 13 – Upper Juandah Coal Measures Layer 2

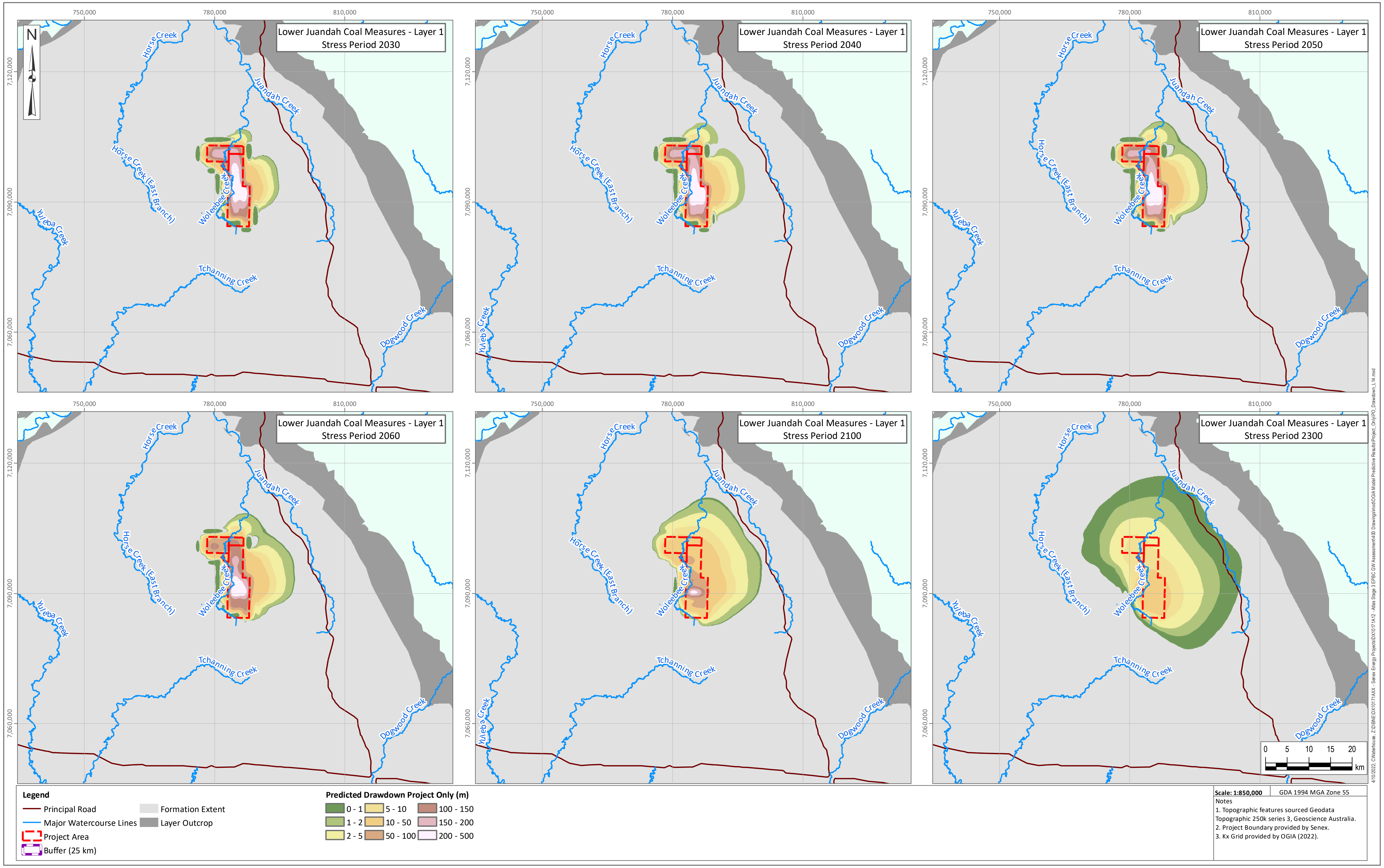


Figure III-8 Project Only Drawdown – Layer 14 – Lower Juandah Coal Layer 1

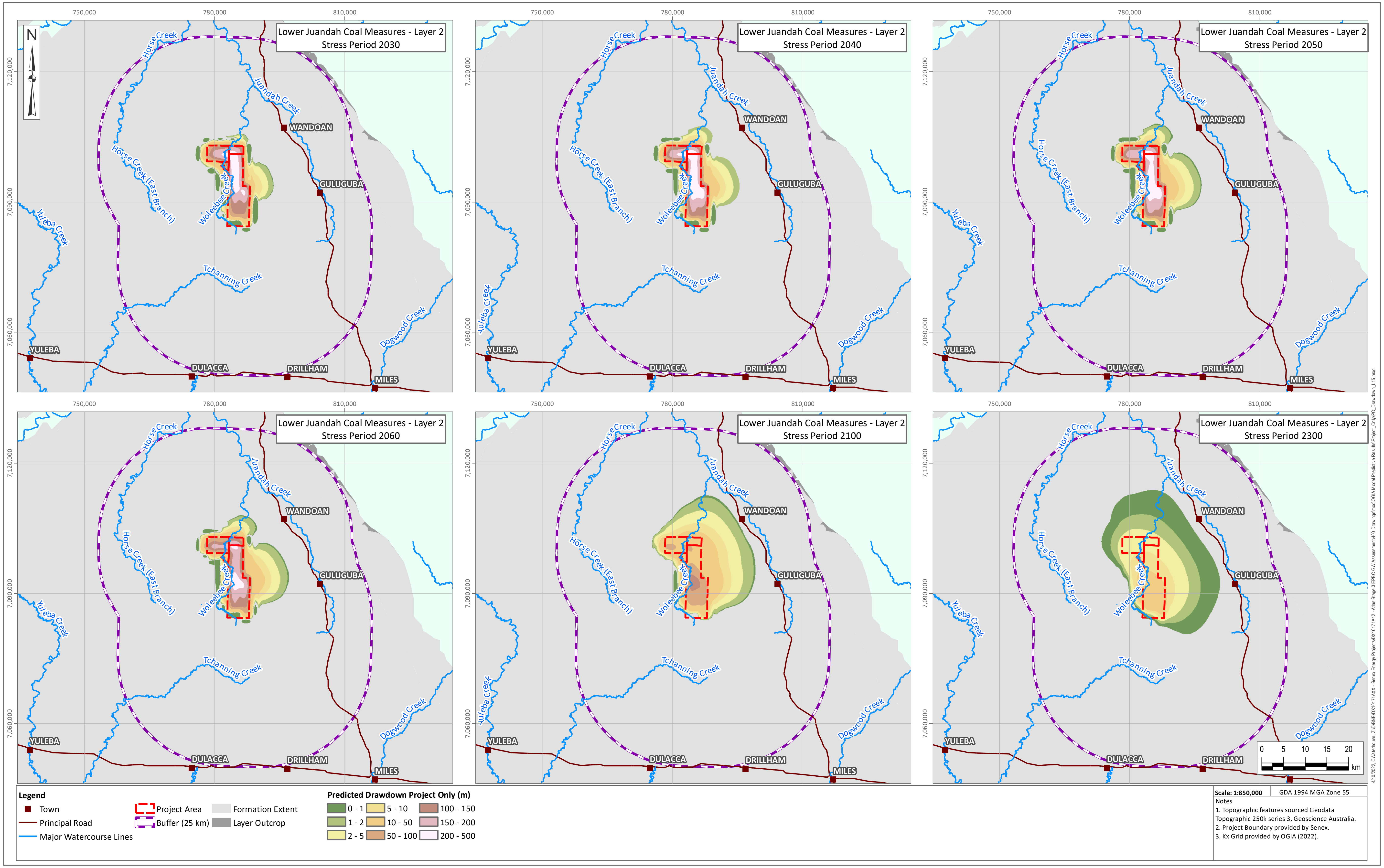


Figure III-9 Project Only Drawdown – Layer 15 – Lower Juandah Coal Layer 2

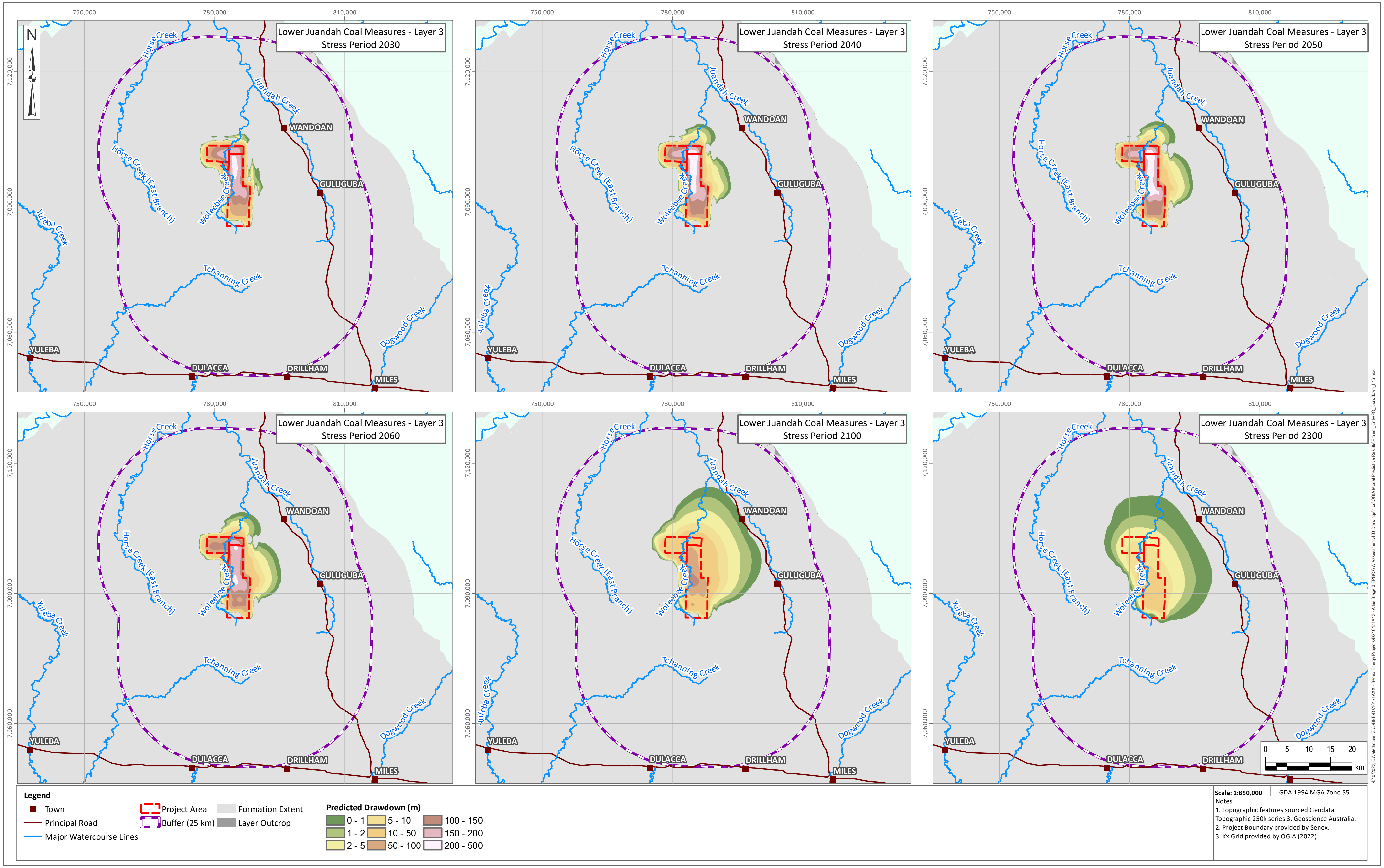


Figure III-10 Project Only Drawdown - Layer 16 – Lower Juandah Coal Layer 3

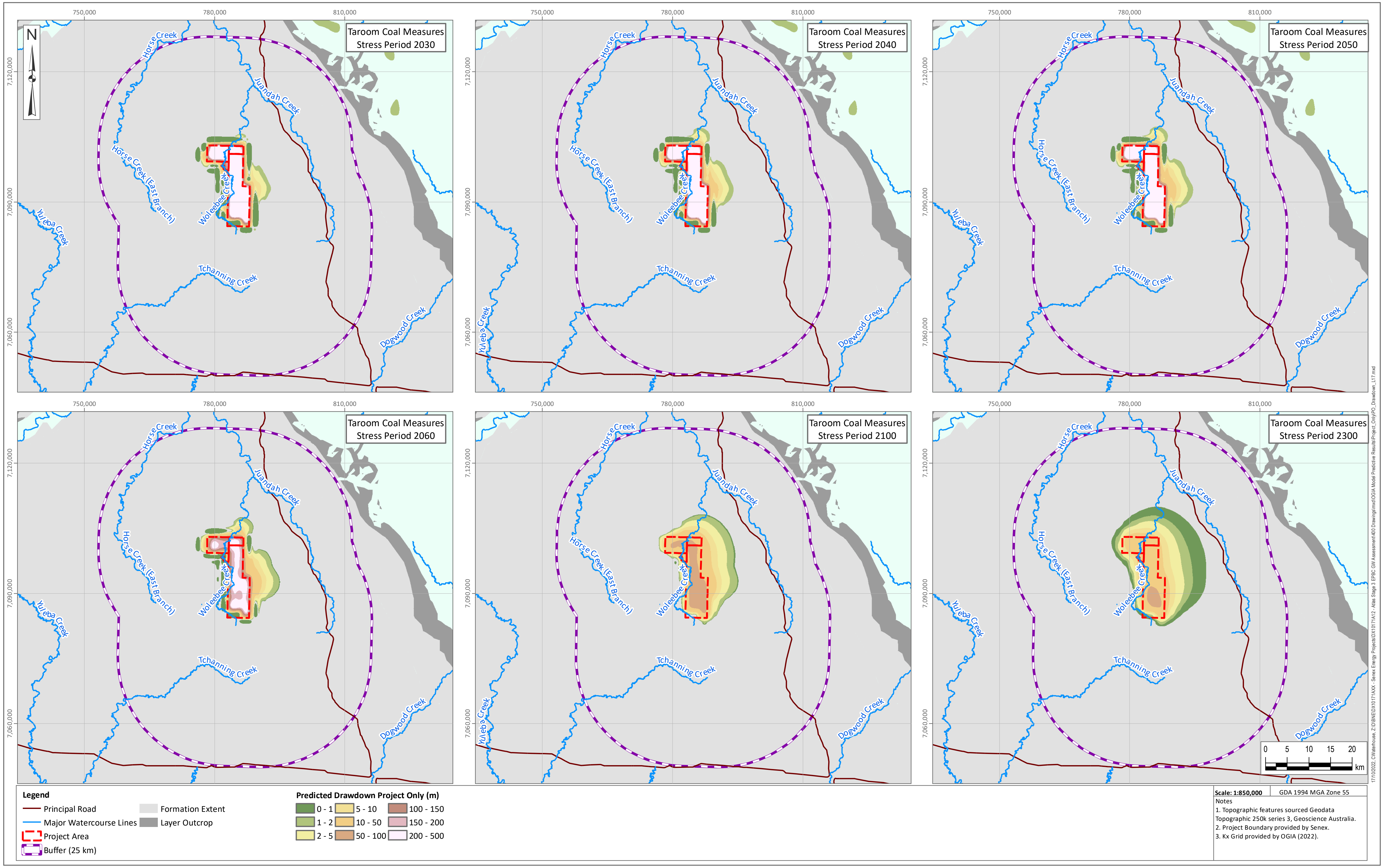


Figure III-11 Project Only Drawdown - Layer 17 – Taroom Coal Measures

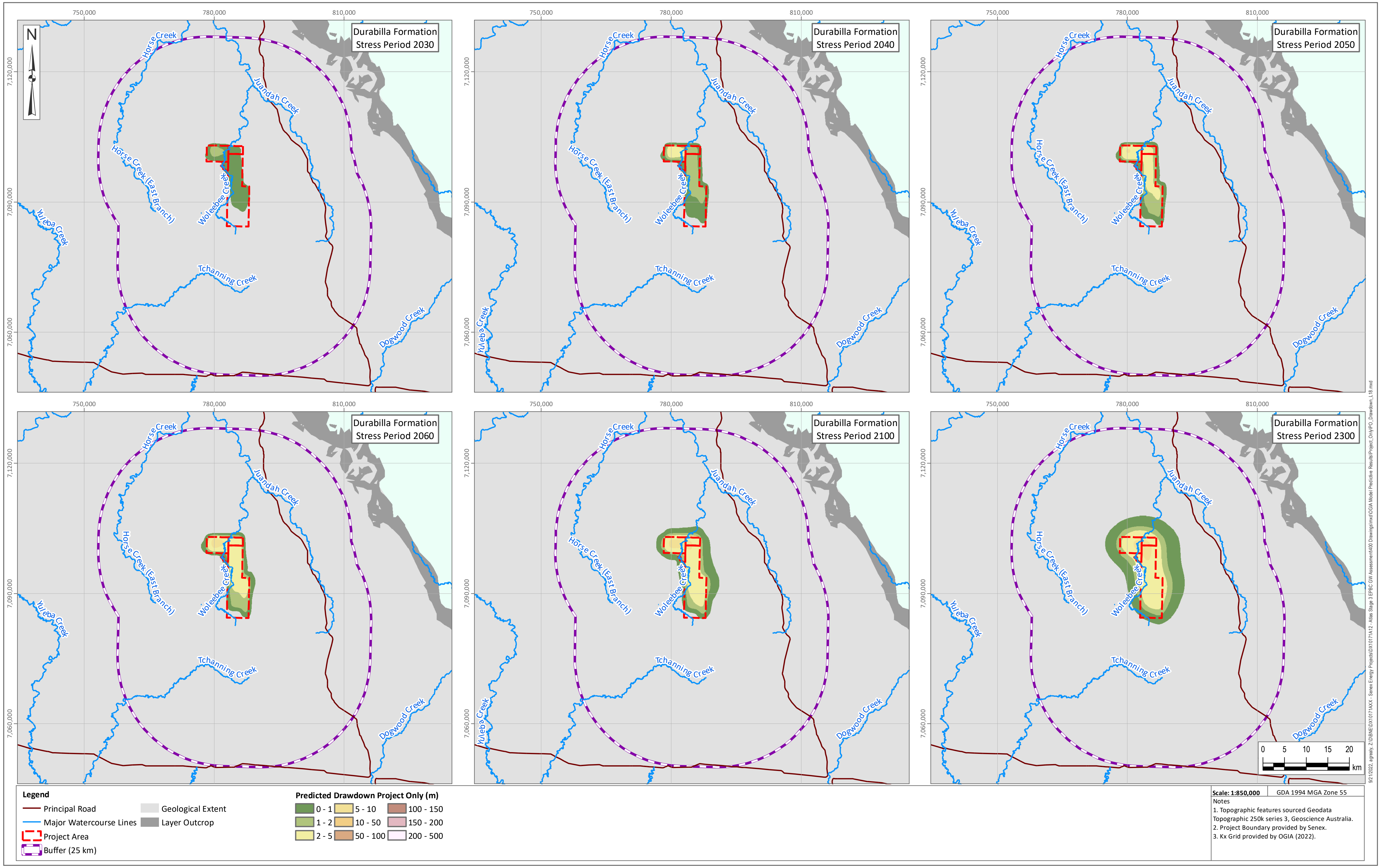


Figure III-12 Project Only Drawdown - Layer 18 – Durabilla Formation

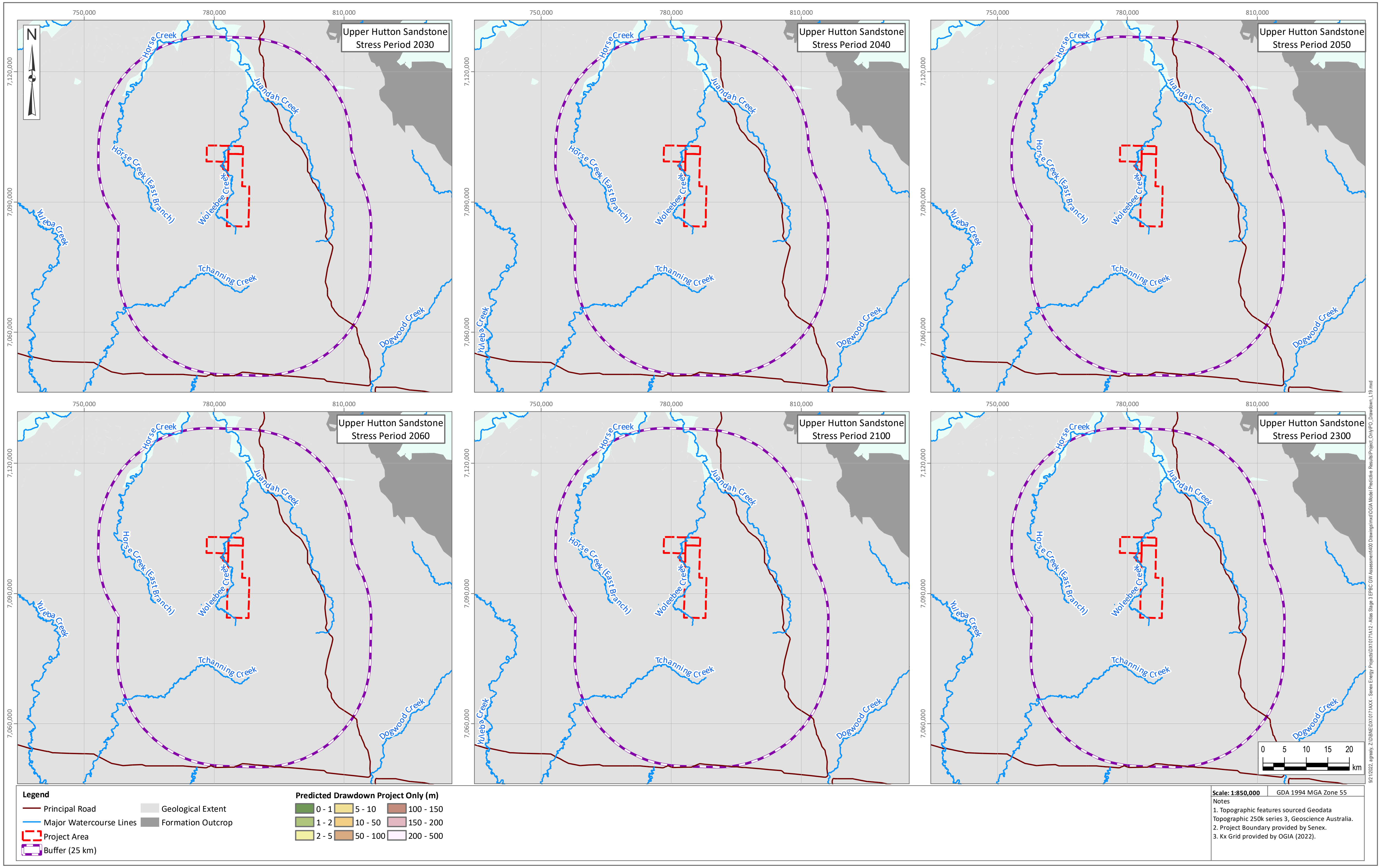


Figure III-13 Project Only Drawdown - Layer 19 – Upper Hutton Sandstone

APPENDIX IV

Predicted Drawdown Extent - Cumulative

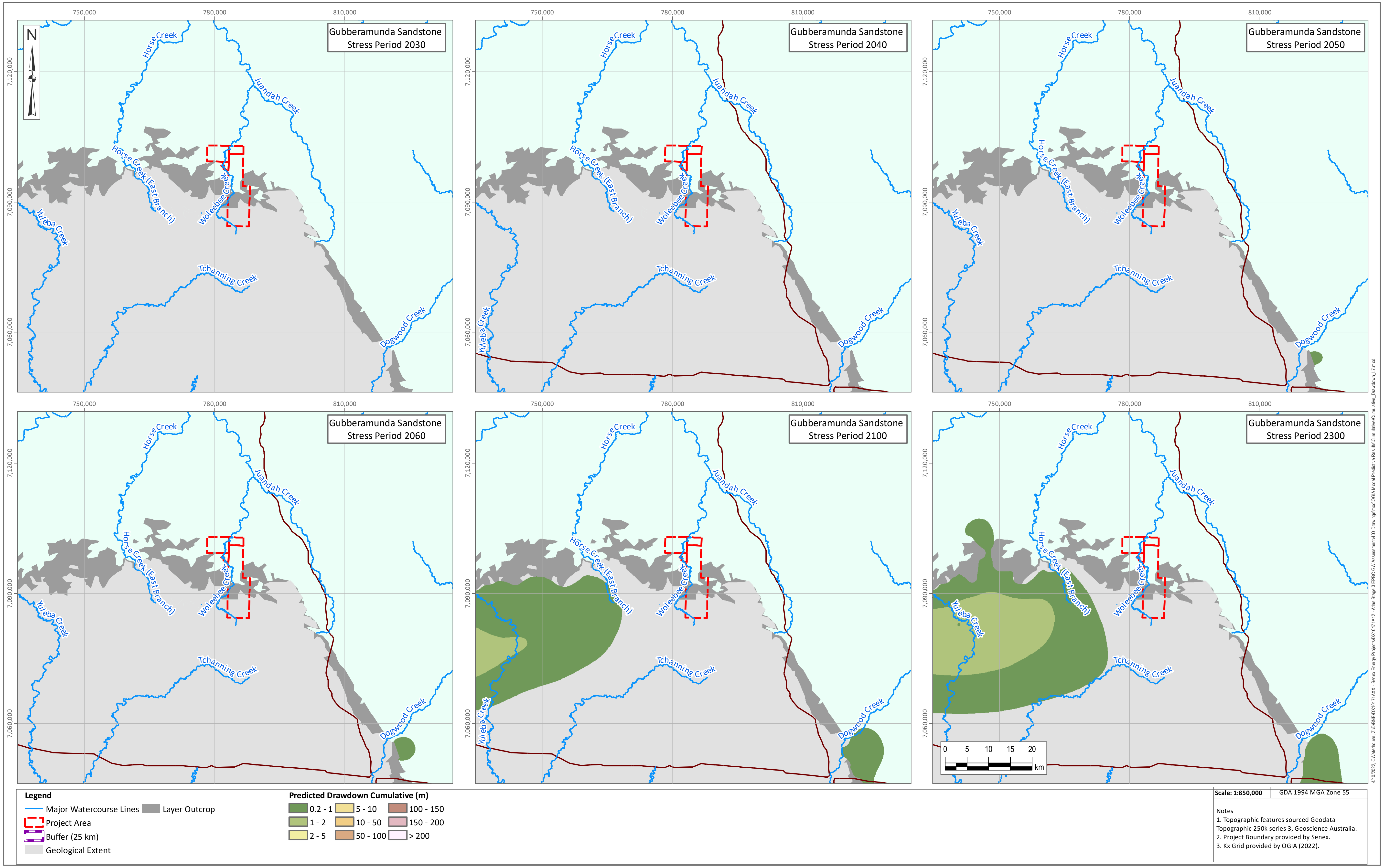


Figure IV-1 Cumulative Drawdown – Layer 7 – Gubberamunda Sandstone

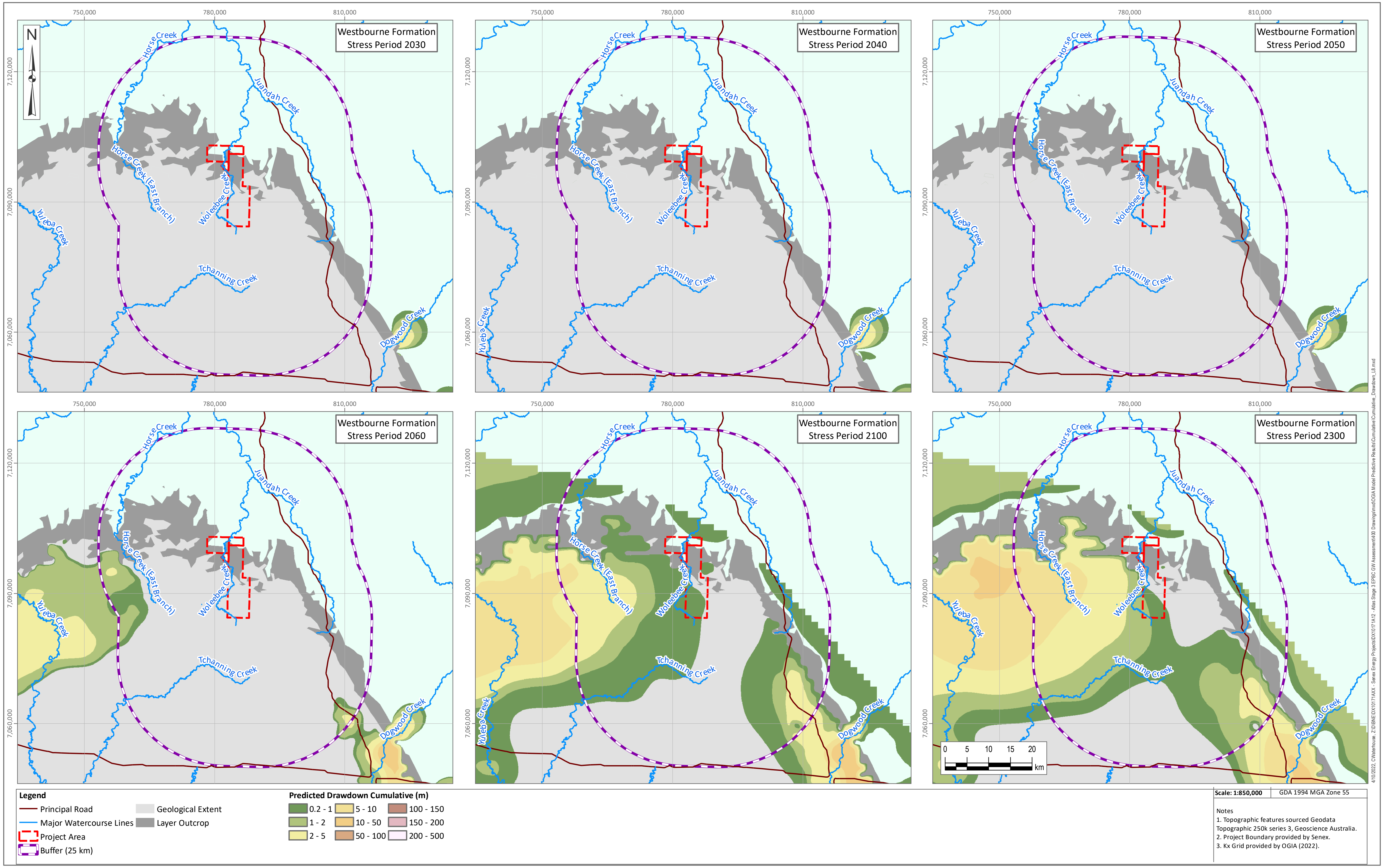


Figure IV-2 Cumulative Drawdown – Layer 8 – Westbourne Formation

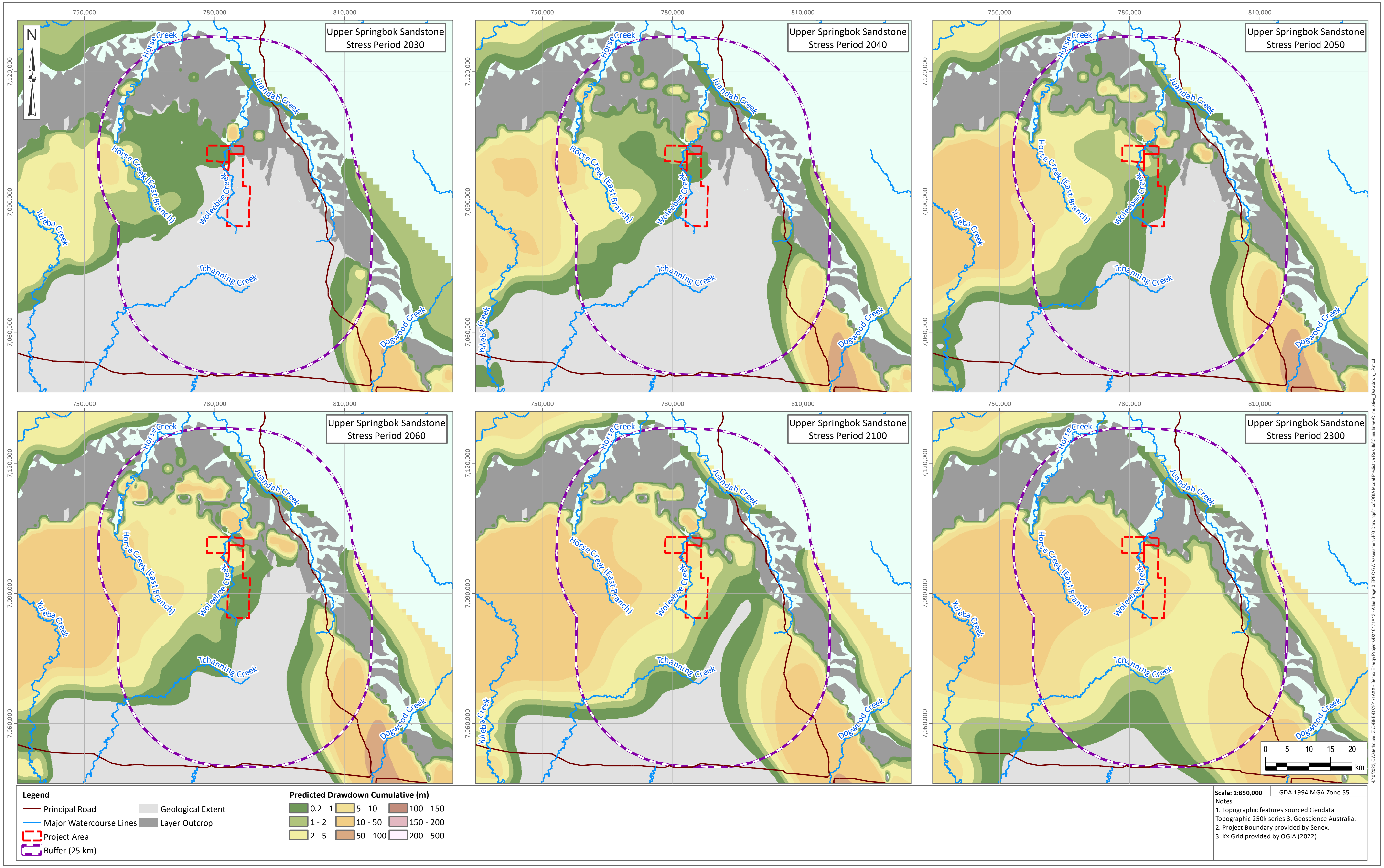


Figure IV-3 Cumulative Drawdown – Layer 9 – Upper Springbok Sandstone

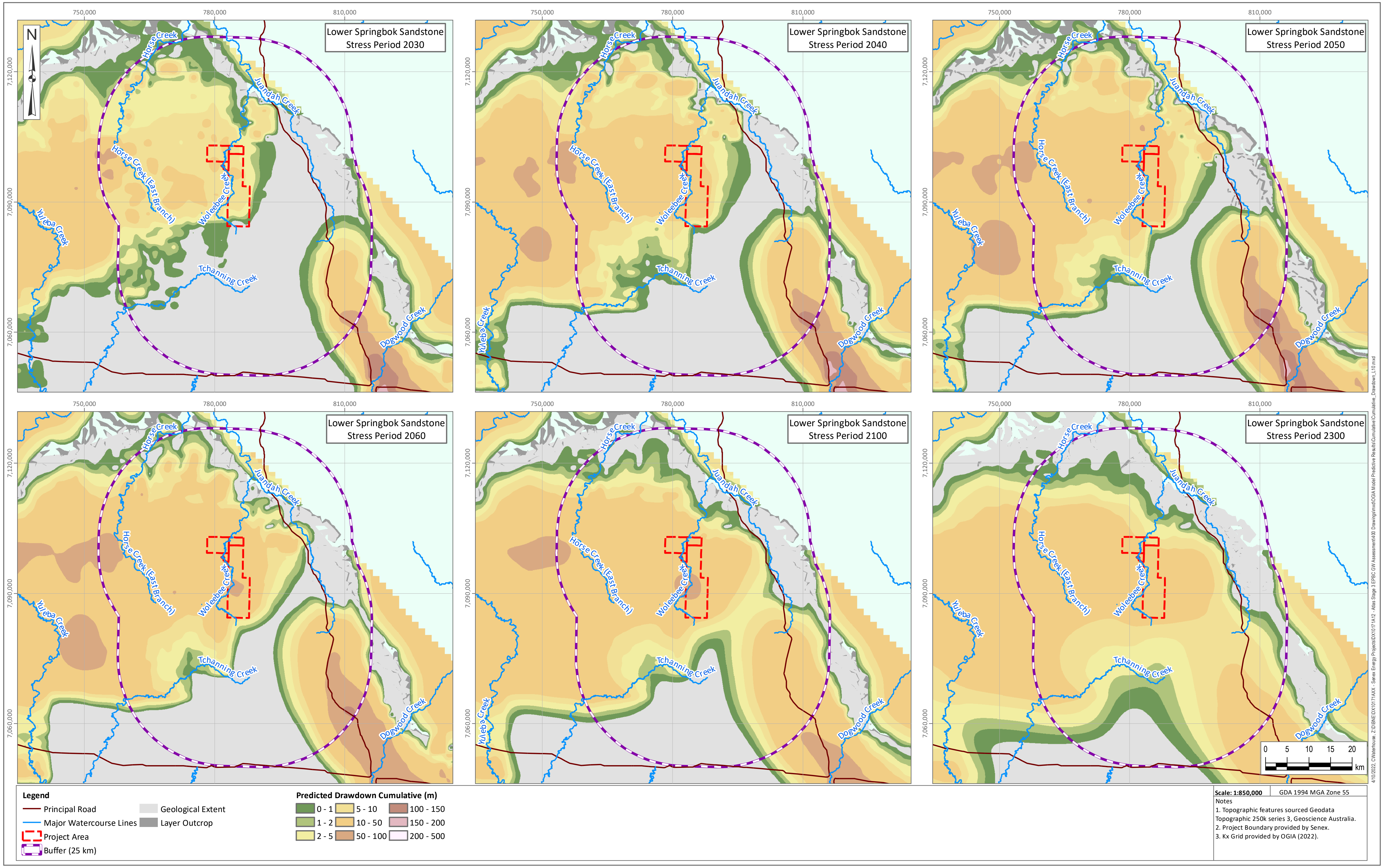


Figure IV-4 Cumulative Drawdown – Layer 10 – Lower Springbok Sandstone

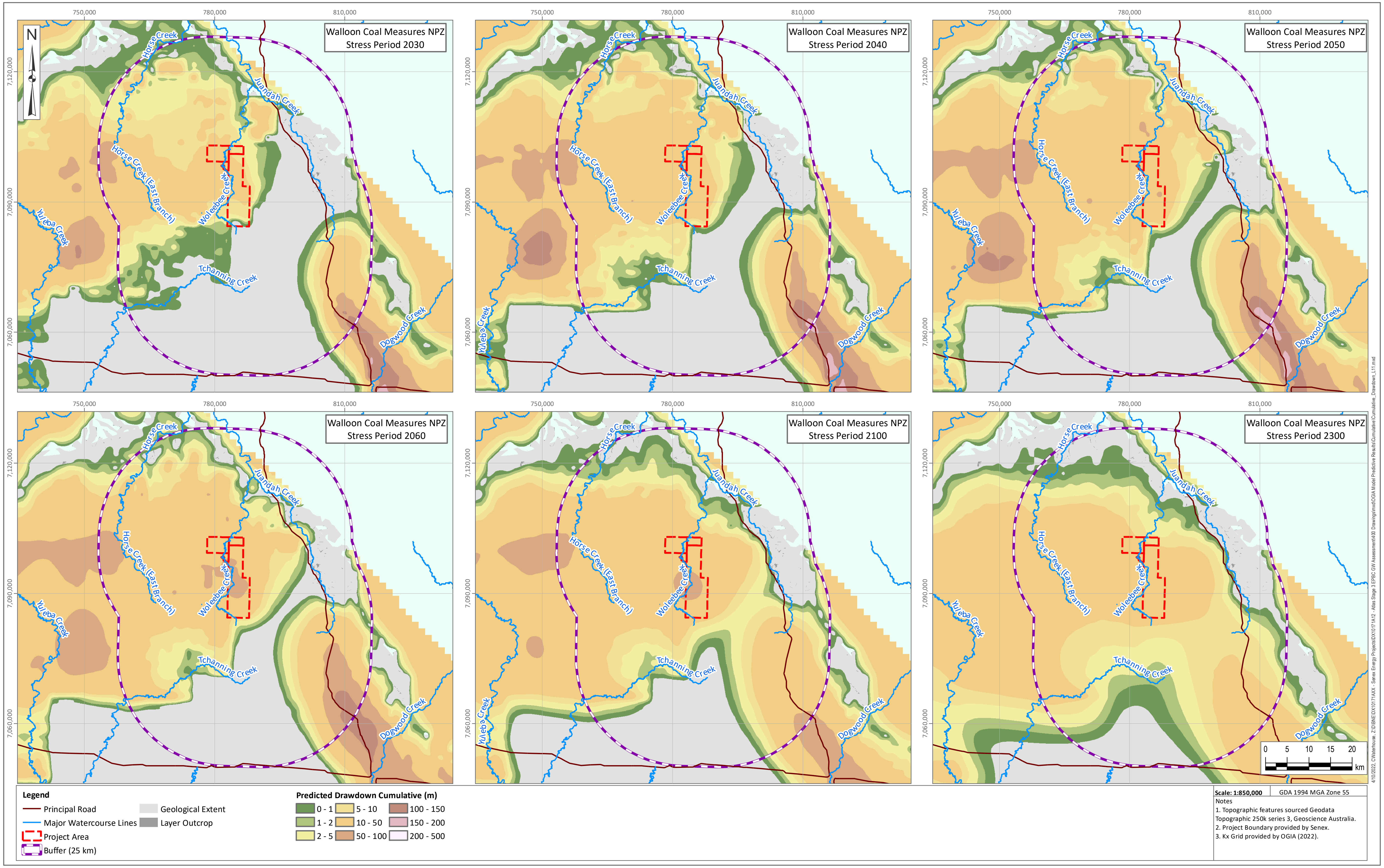


Figure IV-5 Cumulative Drawdown – Layer 11 – Walloon Coal Measures Non-Productive Zone

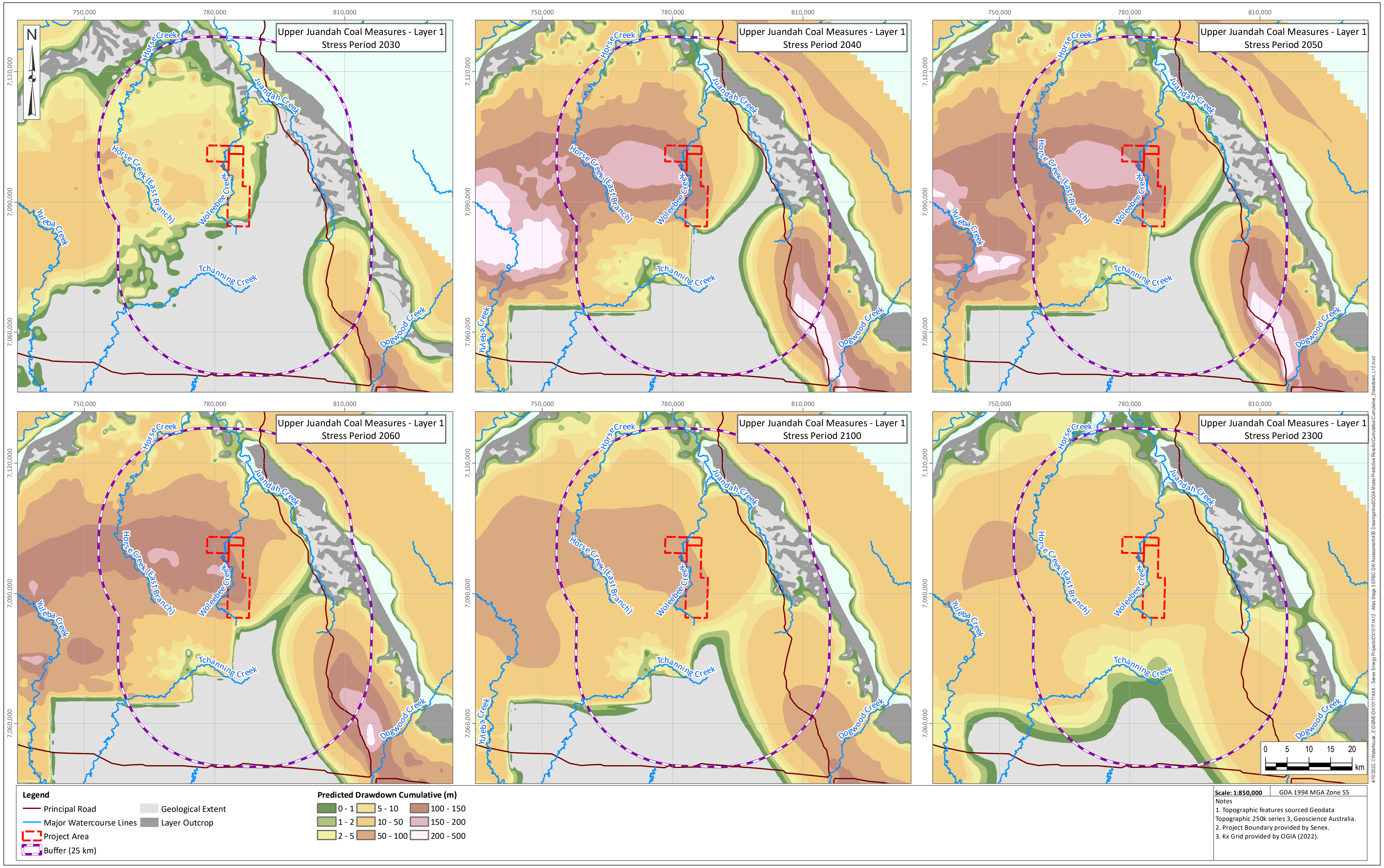


Figure IV-6 Cumulative Drawdown – Layer 12 – Upper Juandah Coal Measures Layer 1

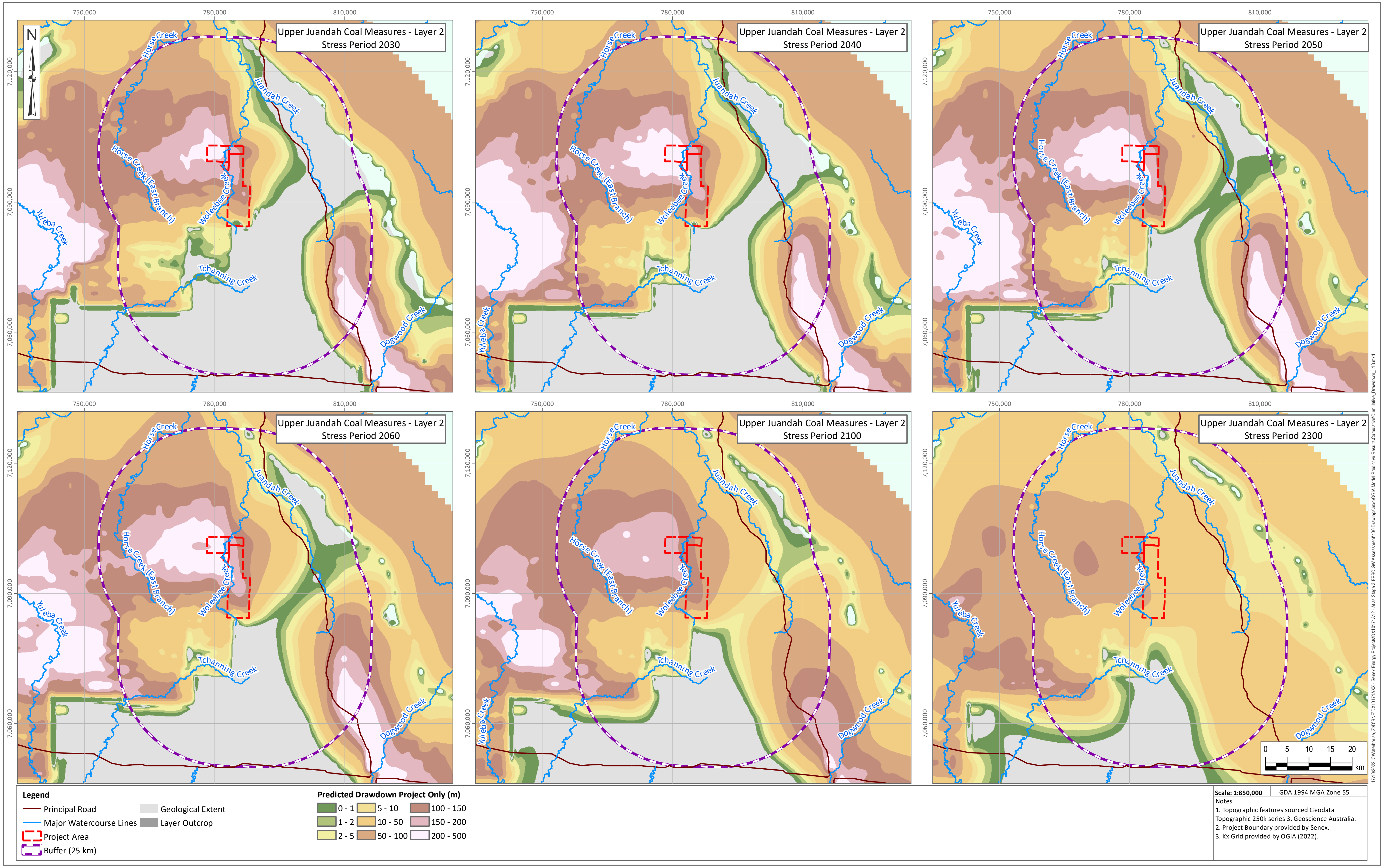


Figure IV-7 Cumulative Drawdown – Layer 13 – Upper Juandah Coal Measures Layer 2

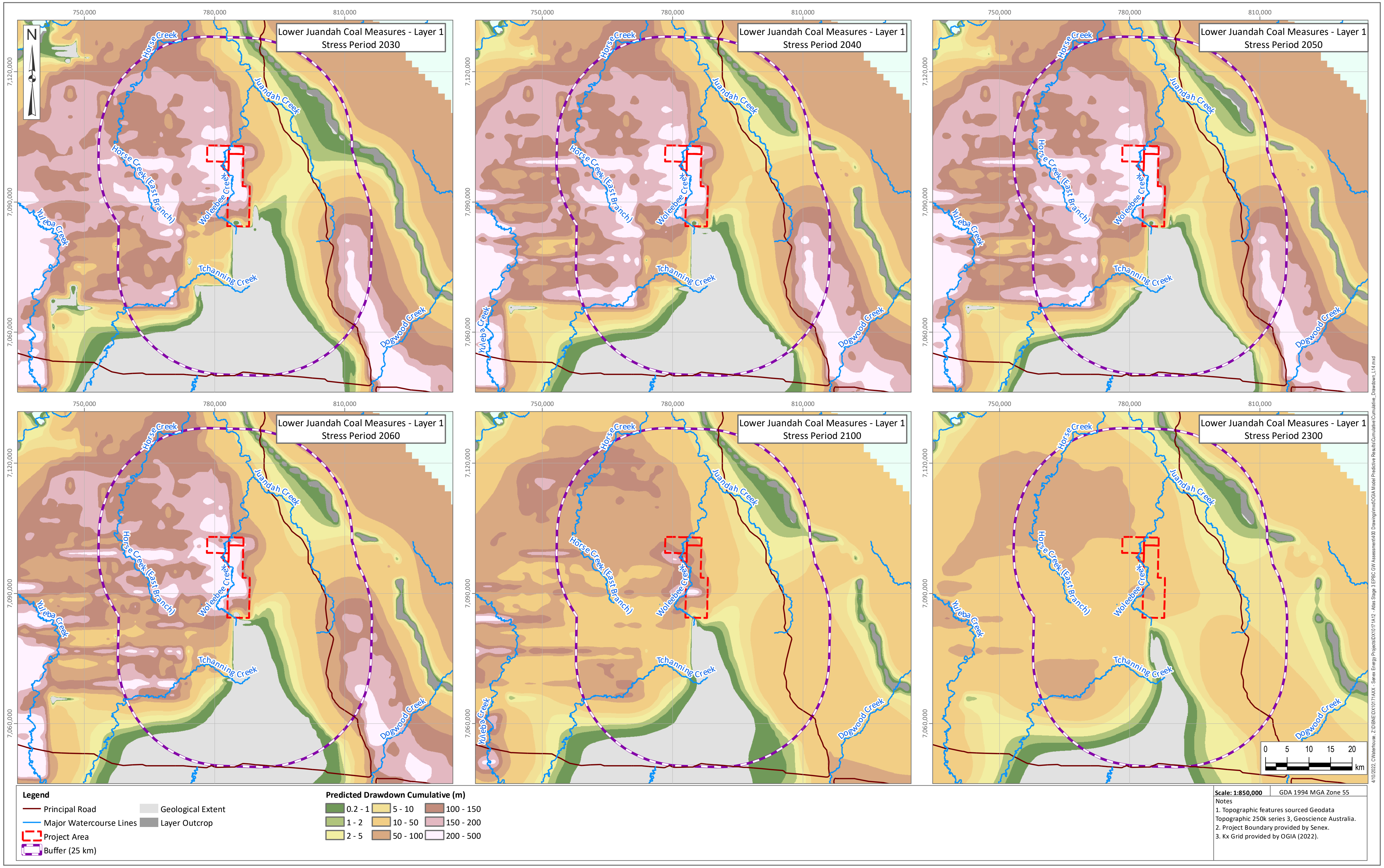


Figure IV-8 Cumulative Drawdown – Layer 14 – Lower Juandah Coal Layer 1

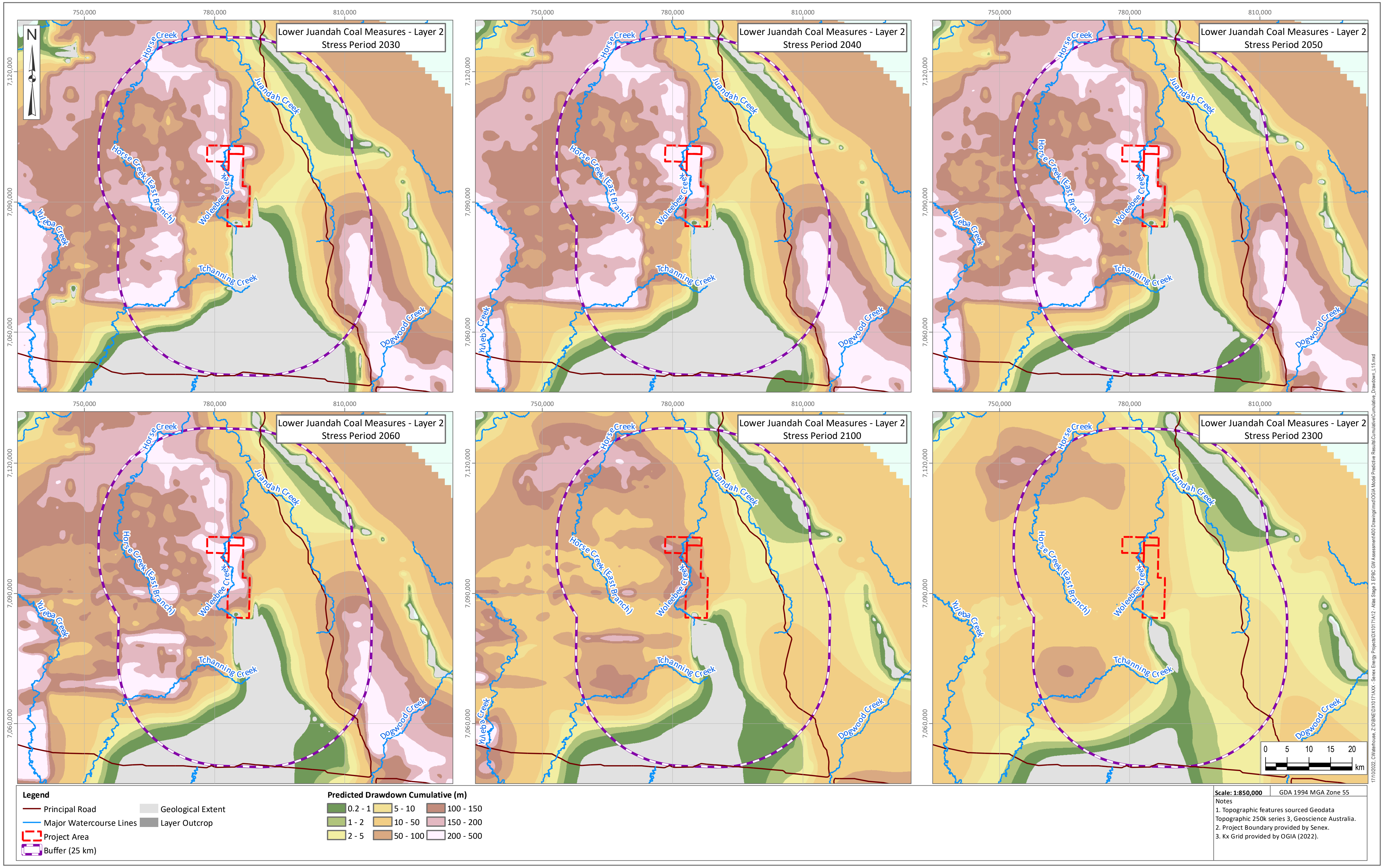


Figure IV-9 Cumulative Drawdown – Layer 15 – Lower Juandah Coal Layer 2

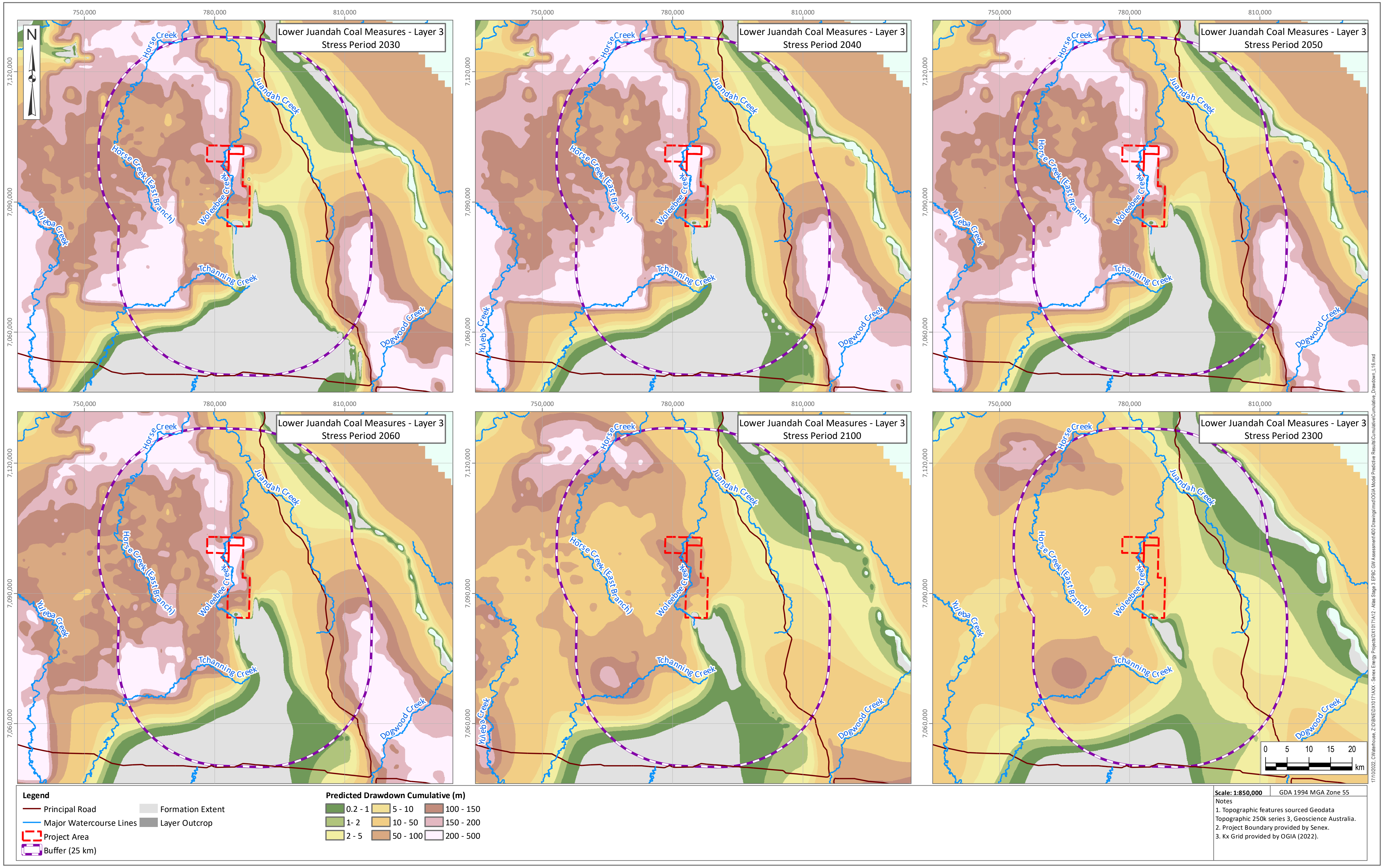


Figure IV-10 Cumulative Drawdown - Layer 16 – Lower Juandah Coal Layer 3

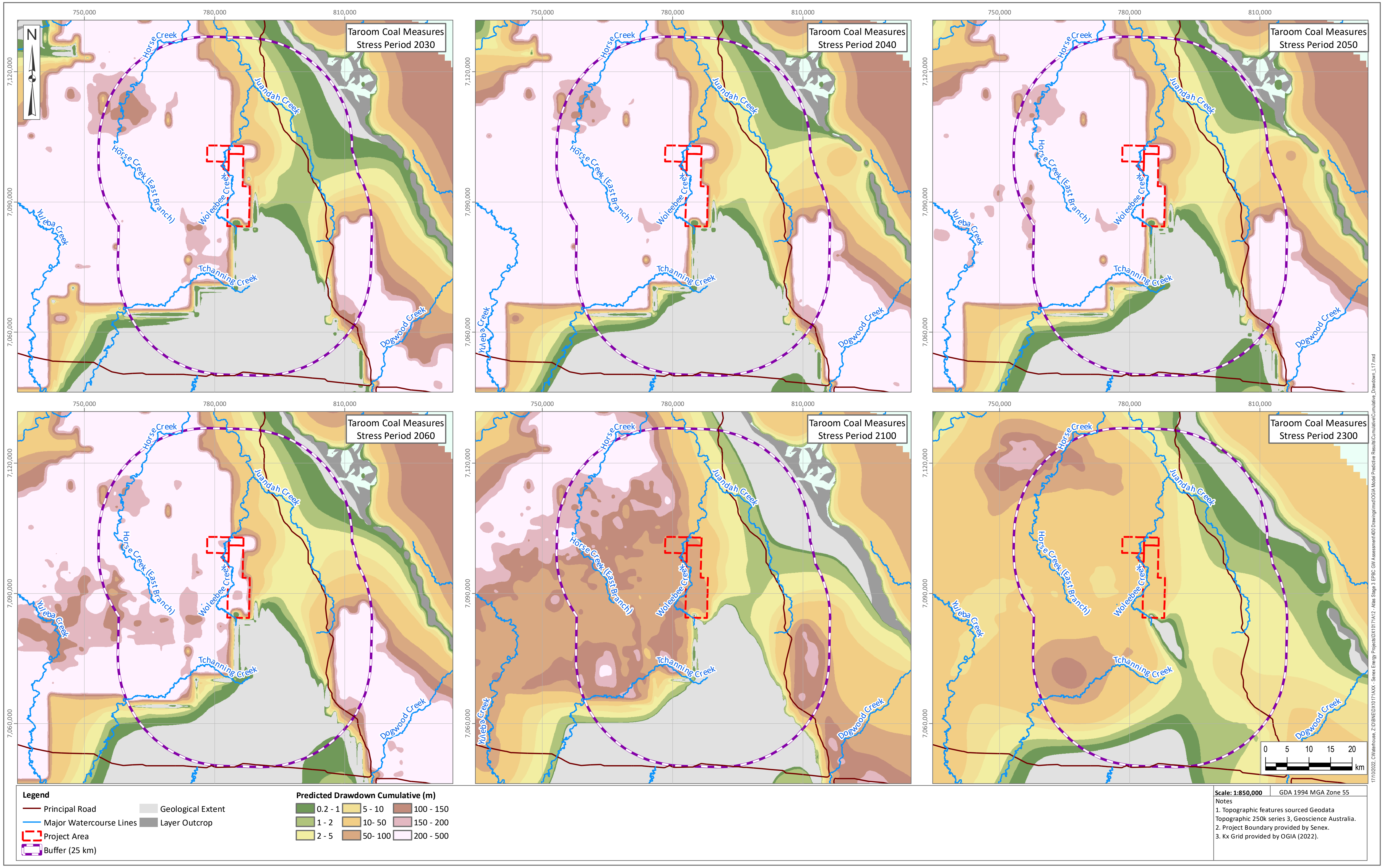


Figure IV-11 Cumulative Drawdown - Layer 17 – Taroom Coal Measures

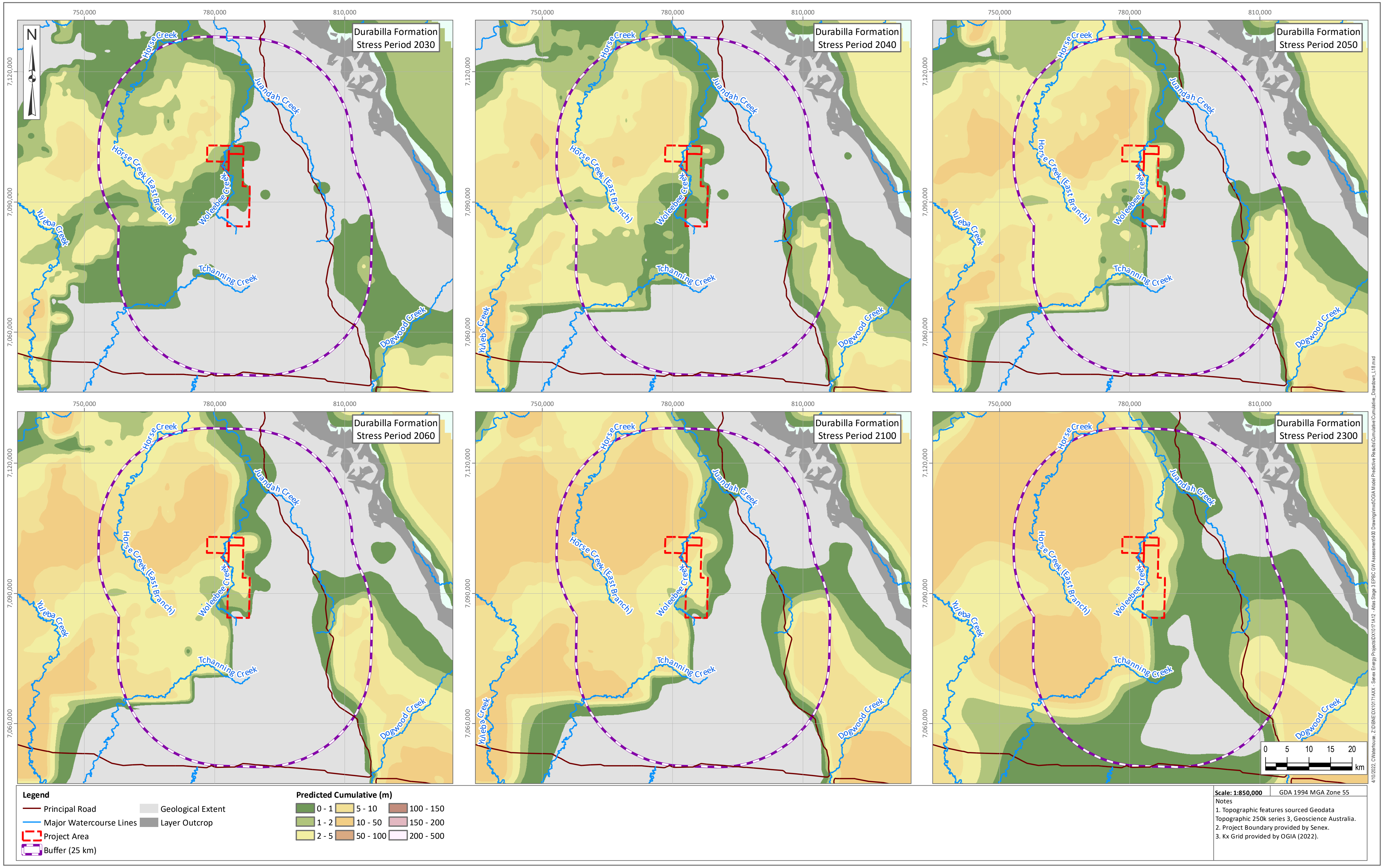


Figure IV-12 Cumulative Drawdown - Layer 18 – Durabilla Formation

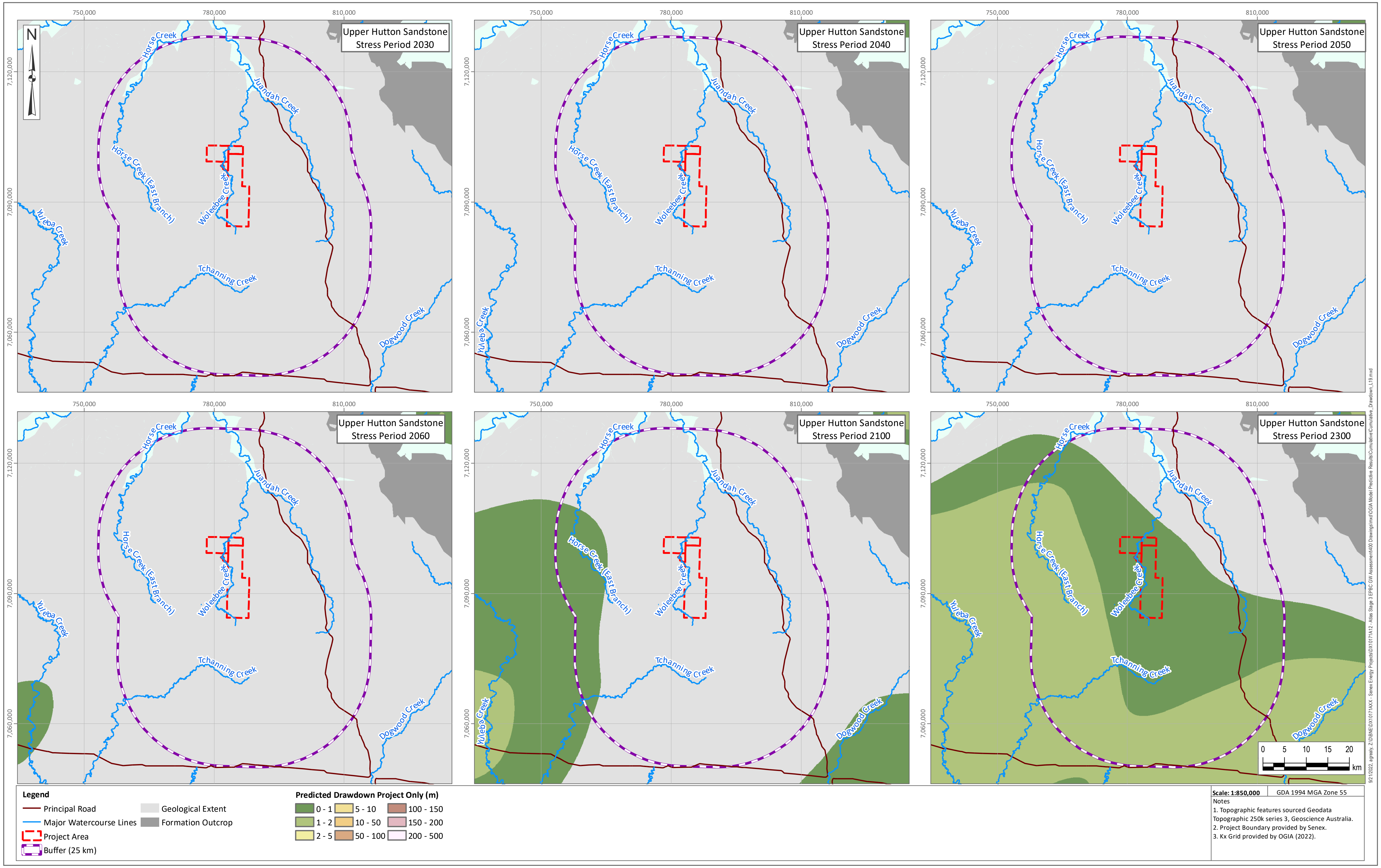


Figure IV-13 Cumulative Drawdown - Layer 19 – Upper Hutton Sandstone

APPENDIX V

Uncertainty Analysis

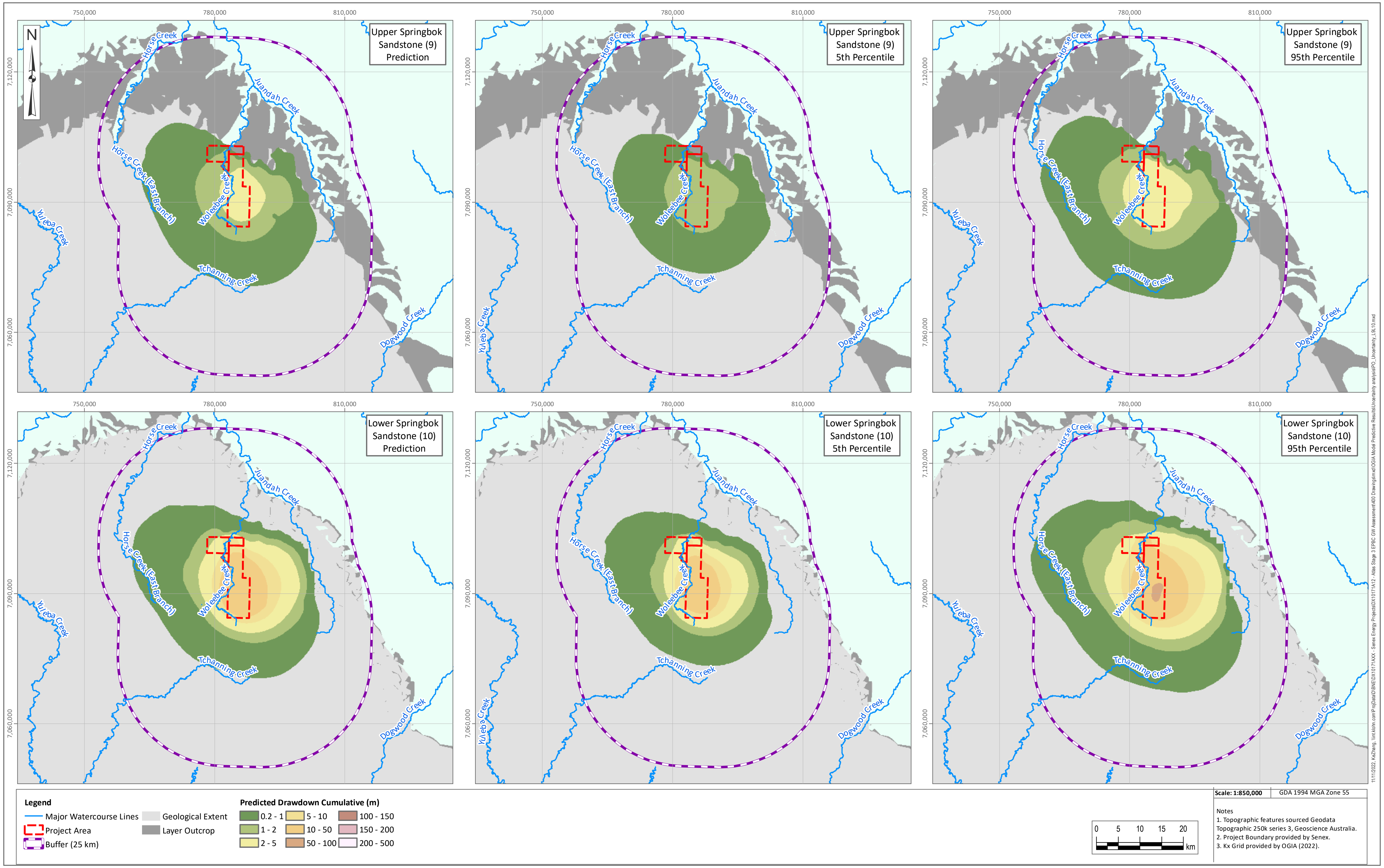


Figure V-1 Project Only Maximum Drawdown Pattern – Predicted Drawdown, 5th Percentile and 95th Percentile, Layer 9 (Upper Springbok Sandstone) and Layer 10 (Lower Springbok Sandstone)[1]

[1] Drawdown for the alluvium (Layer 1), Gubberamunda Sandstone (Layer 7) and Westbourne (Layer 8) are not presented as predicted drawdown is <0.2 m.

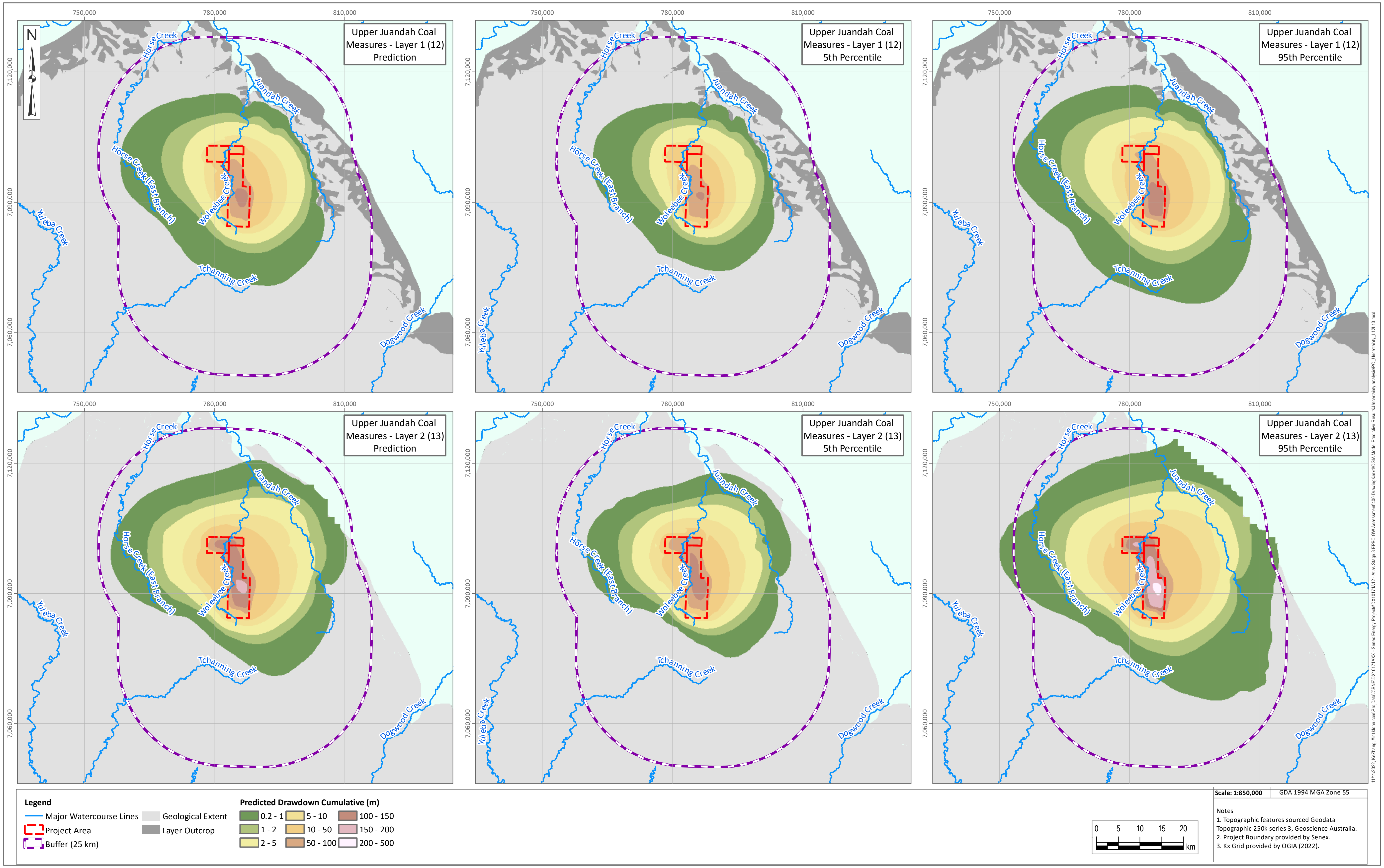


Figure V-2 **Project Only Maximum Drawdown Pattern – Predicted Drawdown, 5th Percentile and 95th Percentile, Layer 12 (Upper Juandah Coal Measures Layer 1) and Layer 13 (Upper Juandah Coal Measures Layer 2)**

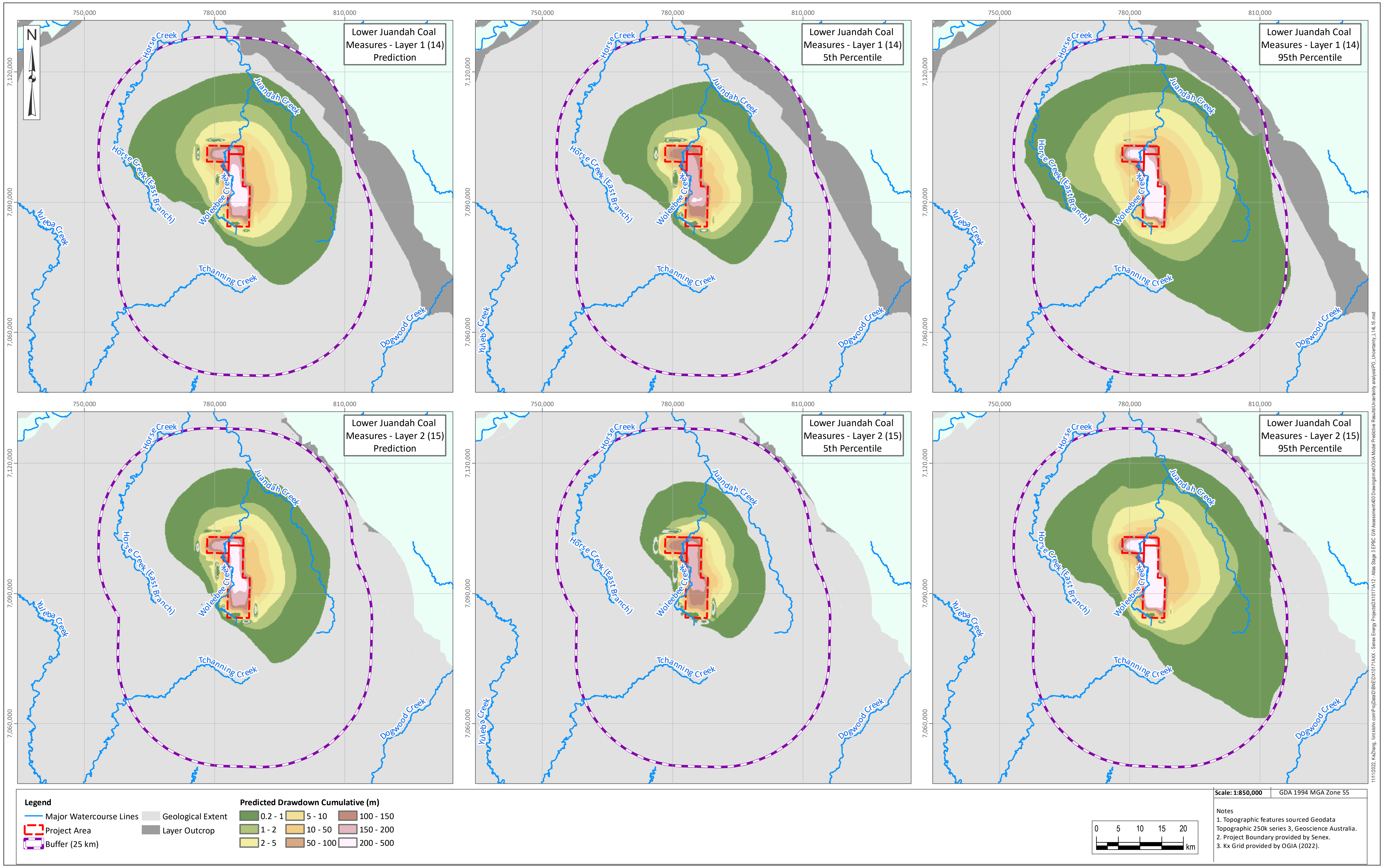


Figure V-3 Project Only Maximum Drawdown Pattern – Predicted Drawdown, 5th Percentile and 95th Percentile, Layer 14 (Lower Juandah Coal Measures Layer 1) and Layer 15 (Lower Juandah Coal Measures Layer 2)

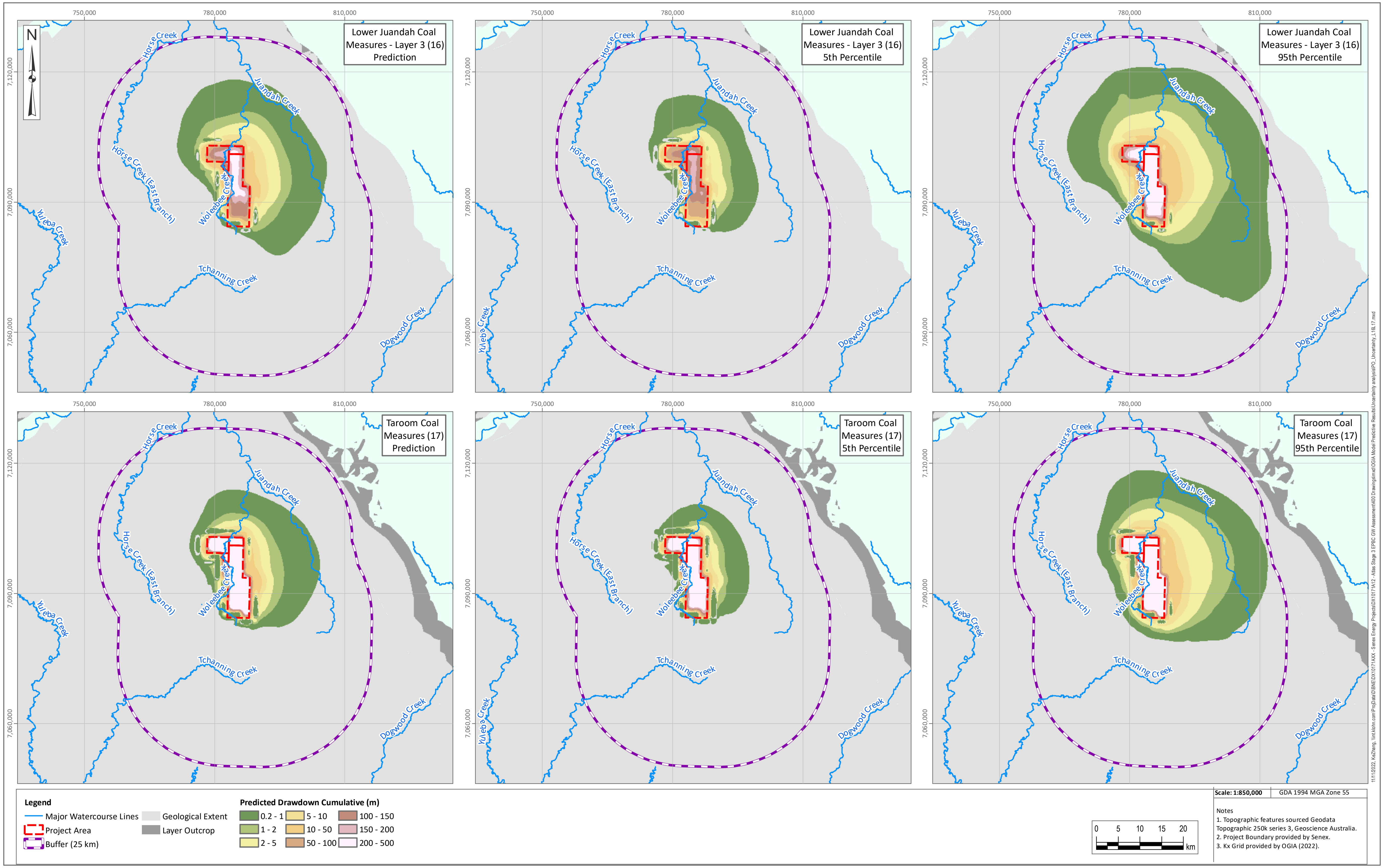


Figure V-4 Project Only Maximum Drawdown Pattern – Predicted Drawdown, 5th Percentile and 95th Percentile, Layer 16 (Lower Juandah Coal Measures Layer 3) and Layer 17 (Taroom Coal Measures)[2]

[2] Drawdown for the Upper Hutton Sandstone (Layer 19) is not presented as predicted drawdown is less than 0.2 m

APPENDIX VI

Groundwater Bore – Impact Assessment

Appendix VI
Groundwater Bore Impact Assessment

Table VI-1 Bores Exceeding the Trigger Threshold as a results of the Project (Total 23 Bores)

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-1	Upper Juandah Coal Measures	Max. drawdown from L12/L13	123.34	✓	152.81	✓	81%
ATLS3-2	Upper Juandah Coal Measures	Max. drawdown from L12/L13	36.04	✓	50.81	✓	71%
ATLS3-3	Upper Juandah Coal Measures	Max. drawdown from L12/L13	19.82	✓	125.60	✓	16%
ATLS3-4	Upper Juandah Coal Measures	Max. drawdown from L12/L13	18.42	✓	233.16	✓	8%
ATLS3-5	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	14.01	✓	200.50	✓	7%
ATLS3-6	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	14.01	✓	200.50	✓	7%
ATLS3-7	Upper Juandah Coal Measures	Max. drawdown from L12/L13	11.56	✓	174.97	✓	7%
ATLS3-8	Taroom Coal Measures	L17 Taroom Coal Measures	10.38	✓	396.11	✓	3%
ATLS3-9	Upper Juandah Coal Measures	Max. drawdown from L12/L13	9.06	✓	67.68	✓	13%
ATLS3-10	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	8.92	✓	14.52	✓	61%
ATLS3-11	Upper Juandah Coal Measures	Max. drawdown from L12/L13	7.72	✓	84.76	✓	9%
ATLS3-12	Upper Juandah Coal Measures	Max. drawdown from L12/L13	7.72	✓	84.76	✓	9%
ATLS3-13	Upper Juandah Coal Measures	Max. drawdown from L12/L13	7.72	✓	84.76	✓	9%
ATLS3-14	Upper Juandah Coal Measures	Max. drawdown from L12/L13	7.47	✓	83.79	✓	9%
ATLS3-15	Upper Juandah Coal Measures	Max. drawdown from L12/L13	7.47	✓	83.79	✓	9%
ATLS3-16	Upper Juandah Coal Measures	Max. drawdown from L12/L13	7.47	✓	83.79	✓	9%
ATLS3-17	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	6.95	✓	63.91	✓	11%
ATLS3-18	Upper Juandah Coal Measures	Max. drawdown from L12/L13	6.05	✓	56.62	✓	11%
ATLS3-19	Upper Juandah Coal Measures	Max. drawdown from L12/L13	6.05	✓	56.62	✓	11%
ATLS3-20	Upper Juandah Coal Measures	Max. drawdown from L12/L13	5.74	✓	52.48	✓	11%
ATLS3-21	Upper Juandah Coal Measures	Max. drawdown from L12/L13	5.47	✓	55.05	✓	10%
ATLS3-22	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	5.46	✓	222.84	✓	2%
ATLS3-23	Upper Juandah Coal Measures	Max. drawdown from L12/L13	5.18	✓	45.76	✓	11%

Table IV-2 Bores Exceeding the Trigger Threshold within the Cumulative Scenario, with Contribution from the Project (Total 216 bores)

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-24	Upper Juandah Coal Measures	Max. drawdown from L12/L13	4.71	×	42.42	✓	11%
ATLS3-25	Upper Juandah Coal Measures	Max. drawdown from L12/L13	4.58	×	32.19	✓	14%
ATLS3-26	Upper Juandah Coal Measures	Max. drawdown from L12/L13	4.30	×	23.49	✓	18%
ATLS3-27	Upper Juandah Coal Measures	Max. drawdown from L12/L13	4.11	×	204.03	✓	2%
ATLS3-28	Upper Juandah Coal Measures	Max. drawdown from L12/L13	4.00	×	19.15	✓	21%
ATLS3-29	Upper Juandah Coal Measures	Max. drawdown from L12/L13	3.95	×	38.42	✓	10%
ATLS3-30	Upper Juandah Coal Measures	Max. drawdown from L12/L13	3.95	×	38.42	✓	10%
ATLS3-31	Upper Juandah Coal Measures	Max. drawdown from L12/L13	3.92	×	38.30	✓	10%
ATLS3-32	Upper Juandah Coal Measures	Max. drawdown from L12/L13	3.88	×	44.92	✓	9%
ATLS3-33	Upper Juandah Coal Measures	Max. drawdown from L12/L13	3.56	×	15.36	✓	23%
ATLS3-34	Upper Juandah Coal Measures	Max. drawdown from L12/L13	3.36	×	27.63	✓	12%
ATLS3-35	Upper Juandah Coal Measures	Max. drawdown from L12/L13	3.27	×	22.24	✓	15%
ATLS3-36	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.90	×	224.72	✓	1%
ATLS3-37	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.87	×	34.25	✓	8%
ATLS3-38	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.87	×	34.25	✓	8%
ATLS3-39	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.84	×	38.26	✓	7%
ATLS3-40	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.84	×	38.26	✓	7%
ATLS3-41	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.82	×	32.73	✓	9%
ATLS3-42	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.40	×	13.58	✓	18%
ATLS3-43	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	2.33	×	8.32	✓	28%
ATLS3-44	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.29	×	212.81	✓	1%
ATLS3-45	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.22	×	178.28	✓	1%
ATLS3-46	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	2.19	×	9.27	✓	24%
ATLS3-47	Upper Juandah Coal Measures	Max. drawdown from L12/L13	2.18	×	11.87	✓	18%
ATLS3-48	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	2.12	×	7.02	✓	30%
ATLS3-49	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	1.97	×	10.05	✓	20%
ATLS3-50	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.95	×	9.70	✓	20%
ATLS3-51	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	1.80	×	8.23	✓	22%
ATLS3-52	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	1.78	×	10.95	✓	16%
ATLS3-53	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.72	×	224.35	✓	1%
ATLS3-54	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.72	×	224.35	✓	1%
ATLS3-55	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.68	×	10.05	✓	17%
ATLS3-56	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.61	×	60.25	✓	3%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-57	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	1.59	✗	5.33	✓	30%
ATLS3-58	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	1.51	✗	92.37	✓	2%
ATLS3-59	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.46	✗	117.89	✓	1%
ATLS3-60	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.46	✗	117.89	✓	1%
ATLS3-61	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.39	✗	134.54	✓	1%
ATLS3-62	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.39	✗	134.54	✓	1%
ATLS3-63	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.38	✗	133.40	✓	1%
ATLS3-64	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	1.30	✗	5.03	✓	26%
ATLS3-66	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.16	✗	145.63	✓	1%
ATLS3-68	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.12	✗	128.45	✓	1%
ATLS3-69	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.12	✗	128.45	✓	1%
ATLS3-70	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.12	✗	128.45	✓	1%
ATLS3-71	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	1.11	✗	23.12	✓	5%
ATLS3-75	Upper Juandah Coal Measures	Max. drawdown from L12/L13	1.03	✗	136.64	✓	1%
ATLS3-76	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.99	✗	125.49	✓	1%
ATLS3-78	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.93	✗	149.67	✓	1%
ATLS3-79	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.88	✗	5.75	✓	15%
ATLS3-80	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.88	✗	5.81	✓	15%
ATLS3-81	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.88	✗	5.81	✓	15%
ATLS3-82	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.85	✗	7.96	✓	11%
ATLS3-83	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.81	✗	160.40	✓	1%
ATLS3-84	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.81	✗	160.40	✓	1%
ATLS3-86	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.77	✗	12.81	✓	6%
ATLS3-87	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.74	✗	17.83	✓	4%
ATLS3-88	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.68	✗	142.07	✓	0%
ATLS3-89	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.68	✗	142.07	✓	0%
ATLS3-90	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.68	✗	15.12	✓	4%
ATLS3-91	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.66	✗	26.75	✓	2%
ATLS3-96	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.60	✗	156.18	✓	0%
ATLS3-97	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.58	✗	214.71	✓	0%
ATLS3-99	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.57	✗	6.72	✓	8%
ATLS3-101	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.56	✗	115.56	✓	0%
ATLS3-102	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.52	✗	12.22	✓	4%
ATLS3-103	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.52	✗	12.22	✓	4%
ATLS3-104	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.52	✗	60.28	✓	1%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-105	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.51	×	222.33	✓	0%
ATLS3-106	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.51	×	222.33	✓	0%
ATLS3-107	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.51	×	106.69	✓	0%
ATLS3-112	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.48	×	7.84	✓	6%
ATLS3-113	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.48	×	6.62	✓	7%
ATLS3-114	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.47	×	14.77	✓	3%
ATLS3-115	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.45	×	111.37	✓	0%
ATLS3-116	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.44	×	13.35	✓	3%
ATLS3-117	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.44	×	13.35	✓	3%
ATLS3-118	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.43	×	150.20	✓	0%
ATLS3-119	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.42	×	126.70	✓	0%
ATLS3-120	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.42	×	38.08	✓	1%
ATLS3-121	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.42	×	38.08	✓	1%
ATLS3-122	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.42	×	38.08	✓	1%
ATLS3-123	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.42	×	38.08	✓	1%
ATLS3-126	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.40	×	67.59	✓	1%
ATLS3-127	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.38	×	138.52	✓	0%
ATLS3-128	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.38	×	95.72	✓	0%
ATLS3-129	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.38	×	25.15	✓	1%
ATLS3-130	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.35	×	147.80	✓	0%
ATLS3-131	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.35	×	147.70	✓	0%
ATLS3-132	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.34	×	162.33	✓	0%
ATLS3-133	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.34	×	130.95	✓	0%
ATLS3-134	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.34	×	131.99	✓	0%
ATLS3-135	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.34	×	131.99	✓	0%
ATLS3-136	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.34	×	126.47	✓	0%
ATLS3-137	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.34	×	135.52	✓	0%
ATLS3-138	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.33	×	8.52	✓	4%
ATLS3-139	Walloon Coal Measures NPZ	L11 Walloon Coal Measures NPZ	0.32	×	31.55	✓	1%
ATLS3-140	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.31	×	126.12	✓	0%
ATLS3-141	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.31	×	126.12	✓	0%
ATLS3-142	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.31	×	8.70	✓	4%
ATLS3-143	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.29	×	115.99	✓	0%
ATLS3-144	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.29	×	7.15	✓	4%
ATLS3-146	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.27	×	30.16	✓	1%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-148	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.27	✗	6.40	✓	4%
ATLS3-149	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.27	✗	133.02	✓	0%
ATLS3-150	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.27	✗	133.02	✓	0%
ATLS3-151	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.25	✗	24.73	✓	1%
ATLS3-152	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.25	✗	33.56	✓	1%
ATLS3-153	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.23	✗	12.31	✓	2%
ATLS3-154	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.22	✗	118.79	✓	0%
ATLS3-155	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.22	✗	131.88	✓	0%
ATLS3-156	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.22	✗	25.69	✓	1%
ATLS3-158	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.20	✗	102.87	✓	0%
ATLS3-159	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.20	✗	18.82	✓	1%
ATLS3-160	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.18	✗	11.66	✓	2%
ATLS3-161	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.18	✗	318.62	✓	0%
ATLS3-162	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.18	✗	318.62	✓	0%
ATLS3-163	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.18	✗	111.39	✓	0%
ATLS3-164	Walloon Coal Measures NPZ	L11 Walloon Coal Measures NPZ	0.18	✗	21.42	✓	1%
ATLS3-165	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.18	✗	81.61	✓	0%
ATLS3-166	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.17	✗	42.34	✓	0%
ATLS3-167	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.17	✗	157.32	✓	0%
ATLS3-168	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.16	✗	81.76	✓	0%
ATLS3-169	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.16	✗	81.76	✓	0%
ATLS3-171	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.16	✗	103.28	✓	0%
ATLS3-172	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.15	✗	11.31	✓	1%
ATLS3-173	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.15	✗	318.60	✓	0%
ATLS3-174	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.15	✗	318.60	✓	0%
ATLS3-175	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.15	✗	318.60	✓	0%
ATLS3-176	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.15	✗	26.31	✓	1%
ATLS3-177	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.15	✗	111.49	✓	0%
ATLS3-178	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.15	✗	122.69	✓	0%
ATLS3-179	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.15	✗	122.69	✓	0%
ATLS3-180	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.14	✗	105.51	✓	0%
ATLS3-182	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.14	✗	99.94	✓	0%
ATLS3-183	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.14	✗	99.94	✓	0%
ATLS3-184	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.14	✗	83.19	✓	0%
ATLS3-186	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.13	✗	90.75	✓	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-187	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.13	✗	90.75	✓	0%
ATLS3-188	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.13	✗	90.75	✓	0%
ATLS3-189	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.13	✗	19.78	✓	1%
ATLS3-190	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.13	✗	18.85	✓	1%
ATLS3-191	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.13	✗	79.01	✓	0%
ATLS3-192	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.12	✗	93.56	✓	0%
ATLS3-193	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.12	✗	6.33	✓	2%
ATLS3-194	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.12	✗	71.92	✓	0%
ATLS3-195	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.12	✗	100.11	✓	0%
ATLS3-196	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.12	✗	83.83	✓	0%
ATLS3-197	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.11	✗	5.21	✓	2%
ATLS3-199	Taroom Coal Measures	L17 Taroom Coal Measures	0.11	✗	271.10	✓	0%
ATLS3-200	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.11	✗	273.34	✓	0%
ATLS3-202	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.10	✗	134.03	✓	0%
ATLS3-203	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.10	✗	95.42	✓	0%
ATLS3-204	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.10	✗	25.24	✓	0%
ATLS3-206	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.10	✗	79.26	✓	0%
ATLS3-207	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.10	✗	79.26	✓	0%
ATLS3-208	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.10	✗	76.71	✓	0%
ATLS3-209	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.10	✗	28.89	✓	0%
ATLS3-808	Springbok Sandstone	Max. drawdown from L9 and L10	0.10	✗	55.73	✓	0%
ATLS3-211	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.10	✗	95.03	✓	0%
ATLS3-212	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.10	✗	95.03	✓	0%
ATLS3-213	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.09	✗	138.17	✓	0%
ATLS3-214	Westbourne Formation	L8 Westbourne Formation	0.09	✗	5.65	✓	2%
ATLS3-215	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.09	✗	75.15	✓	0%
ATLS3-216	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.09	✗	116.44	✓	0%
ATLS3-217	Westbourne Formation	L8 Westbourne Formation	0.09	✗	6.27	✓	1%
ATLS3-219	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.08	✗	7.35	✓	1%
ATLS3-221	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.08	✗	38.40	✓	0%
ATLS3-222	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.08	✗	82.38	✓	0%
ATLS3-223	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.08	✗	76.13	✓	0%
ATLS3-224	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.08	✗	76.13	✓	0%
ATLS3-225	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.08	✗	18.49	✓	0%
ATLS3-226	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.08	✗	41.99	✓	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-227	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.07	✗	73.47	✓	0%
ATLS3-228	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.07	✗	73.47	✓	0%
ATLS3-229	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.07	✗	74.50	✓	0%
ATLS3-230	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.07	✗	69.24	✓	0%
ATLS3-231	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.07	✗	233.96	✓	0%
ATLS3-233	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.07	✗	68.44	✓	0%
ATLS3-234	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.07	✗	34.91	✓	0%
ATLS3-236	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.07	✗	36.11	✓	0%
ATLS3-237	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.07	✗	243.75	✓	0%
ATLS3-238	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.06	✗	72.66	✓	0%
ATLS3-239	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.06	✗	21.86	✓	0%
ATLS3-241	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.06	✗	225.48	✓	0%
ATLS3-242	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.05	✗	76.16	✓	0%
ATLS3-243	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.05	✗	25.63	✓	0%
ATLS3-246	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.05	✗	51.28	✓	0%
ATLS3-247	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.05	✗	51.28	✓	0%
ATLS3-250	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.04	✗	9.26	✓	0%
ATLS3-252	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.04	✗	297.18	✓	0%
ATLS3-254	Taroom Coal Measures	L17 Taroom Coal Measures	0.04	✗	189.55	✓	0%
ATLS3-255	Westbourne Formation	L8 Westbourne Formation	0.04	✗	9.68	✓	0%
ATLS3-256	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.03	✗	191.60	✓	0%
ATLS3-257	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.03	✗	191.60	✓	0%
ATLS3-258	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.03	✗	14.29	✓	0%
ATLS3-259	Taroom Coal Measures	L17 Taroom Coal Measures	0.03	✗	332.36	✓	0%
ATLS3-260	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.03	✗	16.17	✓	0%
ATLS3-261	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.03	✗	7.41	✓	0%
ATLS3-262	Taroom Coal Measures	L17 Taroom Coal Measures	0.03	✗	132.49	✓	0%
ATLS3-264	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.02	✗	205.30	✓	0%
ATLS3-265	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.02	✗	205.30	✓	0%
ATLS3-266	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.02	✗	68.25	✓	0%
ATLS3-267	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.02	✗	43.62	✓	0%
ATLS3-270	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.02	✗	24.55	✓	0%
ATLS3-273	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.02	✗	10.05	✓	0%
ATLS3-274	Taroom Coal Measures	L17 Taroom Coal Measures	0.01	✗	102.42	✓	0%
ATLS3-275	Taroom Coal Measures	L17 Taroom Coal Measures	0.01	✗	102.42	✓	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-276	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.01	×	12.85	✓	0%
ATLS3-279	Taroom Coal Measures	L17 Taroom Coal Measures	0.01	×	466.12	✓	0%
ATLS3-299	Taroom Coal Measures	L17 Taroom Coal Measures	0.01	×	286.82	✓	0%
ATLS3-300	Taroom Coal Measures	L17 Taroom Coal Measures	0.01	×	286.82	✓	0%
ATLS3-323	Taroom Coal Measures	L17 Taroom Coal Measures	0.01	×	532.60	✓	0%
ATLS3-329	Durabilla Formation	L18 Durabilla	0.01	×	8.60	✓	0%
ATLS3-349	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.01	×	6.08	✓	0%
ATLS3-350	Taroom Coal Measures	L17 Taroom Coal Measures	0.01	×	597.95	✓	0%

Table IV-3 Bores Exceeding the Trigger Threshold within the Cumulative Scenario with No Project Contribution (Total Nine Bores)

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-351	Taroom Coal Measures	L17 Taroom Coal Measures	0.00	×	494.09	✓	0%
ATLS3-366	Durabilla Formation	L18 Durabilla	0.00	×	7.86	✓	0%
ATLS3-439	Taroom Coal Measures	L17 Taroom Coal Measures	0.00	×	12.57	✓	0%
ATLS3-445	Durabilla Formation	L18 Durabilla	0.00	×	9.31	✓	0%
ATLS3-446	Durabilla Formation	L18 Durabilla	0.00	×	9.31	✓	0%
ATLS3-587	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.00	×	9.73	✓	0%
ATLS3-673	Taroom Coal Measures	L17 Taroom Coal Measures	0.00	×	6.85	✓	0%
ATLS3-742	Upper Springbok Sandstone	L10 Upper Springbok Sandstone	0.00	×	31.65	✓	0%
ATLS3-755	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.00	×	263.81	✓	0%

Table IV-4 Summary of Bores which do not Exceed the Trigger Threshold Both in Project and Cumulative Scenario (Total 562 bores)

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-65	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	1.29	×	4.69	X	0%
ATLS3-67	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	1.12	×	4.19	X	0%
ATLS3-72	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	1.10	×	4.18	X	0%
ATLS3-73	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	1.05	×	4.24	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-74	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	1.04	×	3.90	×	0%
ATLS3-77	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.96	×	3.48	×	0%
ATLS3-85	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.79	×	4.80	×	0%
ATLS3-92	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.60	×	3.29	×	0%
ATLS3-93	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.60	×	3.29	×	0%
ATLS3-94	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.60	×	3.29	×	0%
ATLS3-95	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.60	×	3.29	×	0%
ATLS3-98	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.57	×	3.87	×	0%
ATLS3-100	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.56	×	3.85	×	0%
ATLS3-108	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.48	×	4.22	×	0%
ATLS3-109	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.48	×	4.22	×	0%
ATLS3-110	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.48	×	4.22	×	0%
ATLS3-111	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.48	×	4.22	×	0%
ATLS3-124	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.41	×	3.83	×	0%
ATLS3-125	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.41	×	3.85	×	0%
ATLS3-145	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.29	×	1.72	×	0%
ATLS3-147	Upper Juandah Coal Measures	Max. drawdown from L12/L13	0.27	×	3.56	×	0%
ATLS3-157	Taroom Coal Measures	L17 Taroom Coal Measures	0.21	×	4.33	×	0%
ATLS3-170	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.16	×	4.65	×	0%
ATLS3-181	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.14	×	1.94	×	0%
ATLS3-185	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.14	×	2.48	×	0%
ATLS3-198	Westbourne Formation	L8 Westbourne Formation	0.11	×	2.78	×	0%
ATLS3-201	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.10	×	2.21	×	0%
ATLS3-205	Taroom Coal Measures	L17 Taroom Coal Measures	0.10	×	4.08	×	0%
ATLS3-210	Hutton	Max. drawdown L19/20	0.00	×	0.32	×	0%
ATLS3-218	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.08	×	1.78	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-220	Westbourne Formation	L8 Westbourne Formation	0.08	×	4.74	×	0%
ATLS3-232	Westbourne Formation	L8 Westbourne Formation	0.07	×	0.24	×	0%
ATLS3-235	Westbourne Formation	L8 Westbourne Formation	0.07	×	0.54	×	0%
ATLS3-240	Taroom Coal Measures	L17 Taroom Coal Measures	0.06	×	3.51	×	0%
ATLS3-244	Westbourne Formation	L8 Westbourne Formation	0.05	×	3.11	×	0%
ATLS3-245	Westbourne Formation	L8 Westbourne Formation	0.05	×	0.55	×	0%
ATLS3-248	Taroom Coal Measures	L17 Taroom Coal Measures	0.05	×	1.52	×	0%
ATLS3-249	Taroom Coal Measures	L17 Taroom Coal Measures	0.05	×	1.52	×	0%
ATLS3-251	Taroom Coal Measures	L17 Taroom Coal Measures	0.04	×	2.30	×	0%
ATLS3-253	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.04	×	2.79	×	0%
ATLS3-263	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.03	×	0.47	×	0%
ATLS3-268	Westbourne Formation	L8 Westbourne Formation	0.02	×	3.26	×	0%
ATLS3-269	Durabilla Formation	L18 Durabilla Formation	0.02	×	0.72	×	0%
ATLS3-271	Westbourne Formation	L8 Westbourne Formation	0.02	×	2.70	×	0%
ATLS3-272	Westbourne Formation	L8 Westbourne Formation	0.02	×	3.36	×	0%
ATLS3-277	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.14	×	0%
ATLS3-278	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.14	×	0%
ATLS3-280	Westbourne Formation	L8 Westbourne Formation	0.01	×	3.34	×	0%
ATLS3-281	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.60	×	0%
ATLS3-282	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.43	×	0%
ATLS3-283	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.69	×	0%
ATLS3-284	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.55	×	0%
ATLS3-285	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.55	×	0%
ATLS3-286	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.82	×	0%
ATLS3-287	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.66	×	0%
ATLS3-288	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.01	×	0.86	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-289	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.17	×	0%
ATLS3-290	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.10	×	0%
ATLS3-291	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.10	×	0%
ATLS3-292	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.15	×	0%
ATLS3-293	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.36	×	0%
ATLS3-294	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.13	×	0%
ATLS3-295	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.01	×	0.74	×	0%
ATLS3-296	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.11	×	0%
ATLS3-297	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.24	×	0%
ATLS3-298	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.33	×	0%
ATLS3-301	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.13	×	0%
ATLS3-302	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.08	×	0%
ATLS3-303	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.36	×	0%
ATLS3-304	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.36	×	0%
ATLS3-305	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.36	×	0%
ATLS3-306	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	1.18	×	0%
ATLS3-307	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.11	×	0%
ATLS3-308	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.11	×	0%
ATLS3-309	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.11	×	0%
ATLS3-310	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.01	×	0.70	×	0%
ATLS3-311	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.54	×	0%
ATLS3-312	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.13	×	0%
ATLS3-313	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.99	×	0%
ATLS3-314	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.28	×	0%
ATLS3-315	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.63	×	0%
ATLS3-316	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.07	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-317	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.14	×	0%
ATLS3-318	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.86	×	0%
ATLS3-319	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.46	×	0%
ATLS3-320	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.46	×	0%
ATLS3-321	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.07	×	0%
ATLS3-322	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.07	×	0%
ATLS3-324	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.22	×	0%
ATLS3-325	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.02	×	0%
ATLS3-326	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.06	×	0%
ATLS3-327	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.06	×	0%
ATLS3-328	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.06	×	0%
ATLS3-330	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.06	×	0%
ATLS3-331	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.06	×	0%
ATLS3-332	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.06	×	0%
ATLS3-333	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.06	×	0%
ATLS3-334	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.05	×	0%
ATLS3-335	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.10	×	0%
ATLS3-336	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.15	×	0%
ATLS3-337	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.72	×	0%
ATLS3-338	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.05	×	0%
ATLS3-339	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.36	×	0%
ATLS3-340	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.36	×	0%
ATLS3-341	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.24	×	0%
ATLS3-342	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.17	×	0%
ATLS3-343	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.17	×	0%
ATLS3-344	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.17	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-345	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.07	×	0%
ATLS3-346	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.07	×	0%
ATLS3-347	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.01	×	0.17	×	0%
ATLS3-348	Taroom Coal Measures	L17 Taroom Coal Measures	0.01	×	4.76	×	0%
ATLS3-352	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.20	×	0%
ATLS3-353	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	1.11	×	0%
ATLS3-354	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.03	×	0%
ATLS3-355	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.07	×	0%
ATLS3-356	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.07	×	0%
ATLS3-357	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.04	×	0%
ATLS3-358	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.99	×	0%
ATLS3-359	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.23	×	0%
ATLS3-360	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.12	×	0%
ATLS3-361	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.18	×	0%
ATLS3-362	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.18	×	0%
ATLS3-363	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.04	×	0%
ATLS3-364	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.55	×	0%
ATLS3-365	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.27	×	0%
ATLS3-367	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.04	×	0%
ATLS3-368	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.14	×	0%
ATLS3-369	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.14	×	0%
ATLS3-370	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.14	×	0%
ATLS3-371	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.14	×	0%
ATLS3-372	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.14	×	0%
ATLS3-373	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.03	×	0%
ATLS3-374	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.04	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-375	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.04	×	0%
ATLS3-376	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.18	×	0%
ATLS3-377	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.15	×	0%
ATLS3-378	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.21	×	0%
ATLS3-379	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.21	×	0%
ATLS3-380	Orallo Formation	L6 Orallo Formation	0.00	×	0.06	×	0%
ATLS3-381	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.11	×	0%
ATLS3-382	Orallo Formation	L6 Orallo Formation	0.00	×	0.11	×	0%
ATLS3-383	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.09	×	0%
ATLS3-384	Orallo Formation	L6 Orallo Formation	0.00	×	0.05	×	0%
ATLS3-385	Orallo Formation	L6 Orallo Formation	0.00	×	0.09	×	0%
ATLS3-386	Lower Springbok Sandstone	L10 Lower Springbok Sandstone	0.00	×	3.25	×	0%
ATLS3-387	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.03	×	0%
ATLS3-388	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.18	×	0%
ATLS3-389	Orallo Formation	L6 Orallo Formation	0.00	×	0.11	×	0%
ATLS3-390	Orallo Formation	L6 Orallo Formation	0.00	×	0.03	×	0%
ATLS3-391	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.60	×	0%
ATLS3-392	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.11	×	0%
ATLS3-393	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.11	×	0%
ATLS3-394	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.11	×	0%
ATLS3-395	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.02	×	0%
ATLS3-396	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	1.08	×	0%
ATLS3-397	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	1.09	×	0%
ATLS3-398	Orallo Formation	L6 Orallo Formation	0.00	×	0.06	×	0%
ATLS3-399	Orallo Formation	L6 Orallo Formation	0.00	×	0.11	×	0%
ATLS3-400	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.05	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-401	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.02	×	0%
ATLS3-402	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.02	×	0%
ATLS3-403	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.09	×	0%
ATLS3-404	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.13	×	0%
ATLS3-405	Orallo Formation	L6 Orallo Formation	0.00	×	0.04	×	0%
ATLS3-406	Orallo Formation	L6 Orallo Formation	0.00	×	0.03	×	0%
ATLS3-407	Orallo Formation	L6 Orallo Formation	0.00	×	0.03	×	0%
ATLS3-408	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.19	×	0%
ATLS3-409	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.24	×	0%
ATLS3-410	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.05	×	0%
ATLS3-411	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.07	×	0%
ATLS3-412	Orallo Formation	L6 Orallo Formation	0.00	×	0.05	×	0%
ATLS3-413	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.46	×	0%
ATLS3-414	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.38	×	0%
ATLS3-415	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.78	×	0%
ATLS3-416	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.51	×	0%
ATLS3-417	Orallo Formation	L6 Orallo Formation	0.00	×	0.09	×	0%
ATLS3-418	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.93	×	0%
ATLS3-419	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.96	×	0%
ATLS3-420	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.03	×	0%
ATLS3-421	Orallo Formation	L6 Orallo Formation	0.00	×	0.04	×	0%
ATLS3-422	Orallo Formation	L6 Orallo Formation	0.00	×	0.14	×	0%
ATLS3-423	Taroom Coal Measures	L17 Taroom Coal Measures	0.00	×	0.49	×	0%
ATLS3-424	Orallo Formation	L6 Orallo Formation	0.00	×	0.04	×	0%
ATLS3-425	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.03	×	0%
ATLS3-426	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.03	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-427	Orallo Formation	L6 Orallo Formation	0.00	×	0.20	×	0%
ATLS3-428	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.74	×	0%
ATLS3-429	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.75	×	0%
ATLS3-430	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.13	×	0%
ATLS3-431	Orallo Formation	L6 Orallo Formation	0.00	×	0.17	×	0%
ATLS3-432	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	1.24	×	0%
ATLS3-433	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	1.17	×	0%
ATLS3-434	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.56	×	0%
ATLS3-435	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.43	×	0%
ATLS3-436	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.04	×	0%
ATLS3-437	Orallo Formation	L6 Orallo Formation	0.00	×	0.02	×	0%
ATLS3-438	Orallo Formation	L6 Orallo Formation	0.00	×	0.10	×	0%
ATLS3-440	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-441	Orallo Formation	L6 Orallo Formation	0.00	×	0.14	×	0%
ATLS3-442	Orallo Formation	L6 Orallo Formation	0.00	×	0.14	×	0%
ATLS3-443	Orallo Formation	L6 Orallo Formation	0.00	×	0.23	×	0%
ATLS3-444	Orallo Formation	L6 Orallo Formation	0.00	×	0.05	×	0%
ATLS3-447	Orallo Formation	L6 Orallo Formation	0.00	×	0.09	×	0%
ATLS3-448	Orallo Formation	L6 Orallo Formation	0.00	×	0.25	×	0%
ATLS3-449	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.41	×	0%
ATLS3-450	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.52	×	0%
ATLS3-451	Orallo Formation	L6 Orallo Formation	0.00	×	0.14	×	0%
ATLS3-452	Orallo Formation	L6 Orallo Formation	0.00	×	0.23	×	0%
ATLS3-453	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.25	×	0%
ATLS3-454	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.26	×	0%
ATLS3-455	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.01	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-456	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.07	×	0%
ATLS3-457	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.55	×	0%
ATLS3-458	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.74	×	0%
ATLS3-459	Orallo Formation	L6 Orallo Formation	0.00	×	0.08	×	0%
ATLS3-460	Orallo Formation	L6 Orallo Formation	0.00	×	0.28	×	0%
ATLS3-461	Orallo Formation	L6 Orallo Formation	0.00	×	0.21	×	0%
ATLS3-462	Orallo Formation	L6 Orallo Formation	0.00	×	0.05	×	0%
ATLS3-463	Orallo Formation	L6 Orallo Formation	0.00	×	0.04	×	0%
ATLS3-464	Orallo Formation	L6 Orallo Formation	0.00	×	0.08	×	0%
ATLS3-465	Orallo Formation	L6 Orallo Formation	0.00	×	0.08	×	0%
ATLS3-466	Orallo Formation	L6 Orallo Formation	0.00	×	0.08	×	0%
ATLS3-467	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.06	×	0%
ATLS3-468	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.04	×	0%
ATLS3-469	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.04	×	0%
ATLS3-470	Orallo Formation	L6 Orallo Formation	0.00	×	0.23	×	0%
ATLS3-471	Orallo Formation	L6 Orallo Formation	0.00	×	0.23	×	0%
ATLS3-472	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	1.36	×	0%
ATLS3-473	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.15	×	0%
ATLS3-474	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.03	×	0%
ATLS3-475	Orallo Formation	L6 Orallo Formation	0.00	×	0.09	×	0%
ATLS3-476	Taroom Coal Measures	L17 Taroom Coal Measures	0.00	×	2.34	×	0%
ATLS3-477	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.35	×	0%
ATLS3-478	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.01	×	0%
ATLS3-479	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-480	Bungil Formation	L4 Bungil Formation	0.00	×	0.05	×	0%
ATLS3-481	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.21	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-482	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.21	×	0%
ATLS3-483	Orallo Formation	L6 Orallo Formation	0.00	×	0.20	×	0%
ATLS3-484	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-485	Orallo Formation	L6 Orallo Formation	0.00	×	0.28	×	0%
ATLS3-486	Orallo Formation	L6 Orallo Formation	0.00	×	0.27	×	0%
ATLS3-487	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.01	×	0%
ATLS3-488	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.01	×	0%
ATLS3-489	Bungil Formation	L4 Bungil Formation	0.00	×	0.08	×	0%
ATLS3-490	Orallo Formation	L6 Orallo Formation	0.00	×	0.21	×	0%
ATLS3-491	Orallo Formation	L6 Orallo Formation	0.00	×	0.06	×	0%
ATLS3-492	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.90	×	0%
ATLS3-493	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.44	×	0%
ATLS3-494	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.44	×	0%
ATLS3-495	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.11	×	0%
ATLS3-496	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.46	×	0%
ATLS3-497	Bungil Formation	L4 Bungil Formation	0.00	×	0.05	×	0%
ATLS3-498	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.28	×	0%
ATLS3-499	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.26	×	0%
ATLS3-500	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-501	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-502	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-503	Orallo Formation	L6 Orallo Formation	0.00	×	0.09	×	0%
ATLS3-504	Orallo Formation	L6 Orallo Formation	0.00	×	0.07	×	0%
ATLS3-505	Orallo Formation	L6 Orallo Formation	0.00	×	0.24	×	0%
ATLS3-506	Orallo Formation	L6 Orallo Formation	0.00	×	0.24	×	0%
ATLS3-507	Orallo Formation	L6 Orallo Formation	0.00	×	0.24	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-508	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.00	×	0%
ATLS3-509	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.06	×	0%
ATLS3-510	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.08	×	0%
ATLS3-511	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.08	×	0%
ATLS3-512	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.08	×	0%
ATLS3-513	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.14	×	0%
ATLS3-514	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-515	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-516	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.08	×	0%
ATLS3-517	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.19	×	0%
ATLS3-518	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.18	×	0%
ATLS3-519	Lower Hutton Sandstone	L20 Lower Hutton Sandstone	0.00	×	0.34	×	0%
ATLS3-520	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.02	×	0%
ATLS3-521	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.02	×	0%
ATLS3-522	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-523	Orallo Formation	L6 Orallo Formation	0.00	×	0.05	×	0%
ATLS3-524	Bungil Formation	L4 Bungil Formation	0.00	×	0.06	×	0%
ATLS3-525	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-526	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-527	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-528	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-529	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-530	Orallo Formation	L6 Orallo Formation	0.00	×	0.09	×	0%
ATLS3-531	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.25	×	0%
ATLS3-532	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%
ATLS3-533	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.07	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-534	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.17	×	0%
ATLS3-535	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%
ATLS3-536	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.16	×	0%
ATLS3-537	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.19	×	0%
ATLS3-538	Orallo Formation	L6 Orallo Formation	0.00	×	0.06	×	0%
ATLS3-539	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.17	×	0%
ATLS3-540	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.17	×	0%
ATLS3-541	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.16	×	0%
ATLS3-542	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.05	×	0%
ATLS3-543	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%
ATLS3-544	Orallo Formation	L6 Orallo Formation	0.00	×	0.07	×	0%
ATLS3-545	Orallo Formation	L6 Orallo Formation	0.00	×	0.08	×	0%
ATLS3-546	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-547	Bungil Formation	L4 Bungil Formation	0.00	×	0.05	×	0%
ATLS3-548	Bungil Formation	L4 Bungil Formation	0.00	×	0.05	×	0%
ATLS3-549	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.19	×	0%
ATLS3-550	Orallo Formation	L6 Orallo Formation	0.00	×	0.06	×	0%
ATLS3-551	Bungil Formation	L4 Bungil Formation	0.00	×	0.05	×	0%
ATLS3-552	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.16	×	0%
ATLS3-553	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.14	×	0%
ATLS3-554	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-555	Orallo Formation	L6 Orallo Formation	0.00	×	0.11	×	0%
ATLS3-556	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.08	×	0%
ATLS3-557	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%
ATLS3-558	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.09	×	0%
ATLS3-559	Orallo Formation	L6 Orallo Formation	0.00	×	0.02	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-560	Bungil Formation	L4 Bungil Formation	0.00	×	0.11	×	0%
ATLS3-561	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%
ATLS3-562	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.16	×	0%
ATLS3-563	Orallo Formation	L6 Orallo Formation	0.00	×	0.11	×	0%
ATLS3-564	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.06	×	0%
ATLS3-565	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.04	×	0%
ATLS3-566	Orallo Formation	L6 Orallo Formation	0.00	×	0.03	×	0%
ATLS3-567	Bungil Formation	L4 Bungil Formation	0.00	×	0.11	×	0%
ATLS3-568	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%
ATLS3-569	Orallo Formation	L6 Orallo Formation	0.00	×	0.05	×	0%
ATLS3-570	Orallo Formation	L6 Orallo Formation	0.00	×	0.05	×	0%
ATLS3-571	Orallo Formation	L6 Orallo Formation	0.00	×	0.05	×	0%
ATLS3-572	Orallo Formation	L6 Orallo Formation	0.00	×	0.04	×	0%
ATLS3-573	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.11	×	0%
ATLS3-574	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.08	×	0%
ATLS3-575	Wallumbilla Formation	L3 - Wallumbilla Formation	0.00	×	0.06	×	0%
ATLS3-576	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.17	×	0%
ATLS3-577	Orallo Formation	L6 Orallo Formation	0.00	×	0.02	×	0%
ATLS3-578	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.03	×	0%
ATLS3-579	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.11	×	0%
ATLS3-580	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.11	×	0%
ATLS3-581	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.11	×	0%
ATLS3-582	Bungil Formation	L4 Bungil Formation	0.00	×	0.11	×	0%
ATLS3-583	Orallo Formation	L6 Orallo Formation	0.00	×	0.09	×	0%
ATLS3-584	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%
ATLS3-585	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-586	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.11	×	0%
ATLS3-588	Orallo Formation	L6 Orallo Formation	0.00	×	0.03	×	0%
ATLS3-589	Orallo Formation	L6 Orallo Formation	0.00	×	0.03	×	0%
ATLS3-590	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.01	×	0%
ATLS3-591	Bungil Formation	L4 Bungil Formation	0.00	×	0.04	×	0%
ATLS3-592	Bungil Formation	L4 Bungil Formation	0.00	×	0.12	×	0%
ATLS3-593	Bungil Formation	L4 Bungil Formation	0.00	×	0.12	×	0%
ATLS3-594	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.16	×	0%
ATLS3-595	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%
ATLS3-596	Bungil Formation	L4 Bungil Formation	0.00	×	0.10	×	0%
ATLS3-597	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.11	×	0%
ATLS3-598	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.75	×	0%
ATLS3-599	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.01	×	0%
ATLS3-600	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.11	×	0%
ATLS3-601	Bungil Formation	L4 Bungil Formation	0.00	×	0.12	×	0%
ATLS3-602	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.10	×	0%
ATLS3-603	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.03	×	0%
ATLS3-604	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.03	×	0%
ATLS3-605	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.02	×	0%
ATLS3-606	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.11	×	0%
ATLS3-607	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.10	×	0%
ATLS3-608	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.11	×	0%
ATLS3-609	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.11	×	0%
ATLS3-610	Bungil Formation	L4 Bungil Formation	0.00	×	0.12	×	0%
ATLS3-611	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.12	×	0%
ATLS3-612	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.12	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-613	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.09	×	0%
ATLS3-614	Upper Hutton Sandstone	L19 Upper Hutton Sandstone	0.00	×	0.09	×	0%
ATLS3-615	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.69	×	0%
ATLS3-616	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.70	×	0%
ATLS3-617	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.03	×	0%
ATLS3-618	Bungil Formation	L4 Bungil Formation	0.00	×	0.13	×	0%
ATLS3-619	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.69	×	0%
ATLS3-620	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.67	×	0%
ATLS3-621	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.67	×	0%
ATLS3-622	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.66	×	0%
ATLS3-623	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.66	×	0%
ATLS3-624	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.65	×	0%
ATLS3-625	Bungil Formation	L4 Bungil Formation	0.00	×	0.10	×	0%
ATLS3-626	Orallo Formation	L6 Orallo Formation	0.00	×	0.03	×	0%
ATLS3-627	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.62	×	0%
ATLS3-628	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.62	×	0%
ATLS3-629	Other Alluvium	L1 - Alluvium	0.00	×	0.10	×	0%
ATLS3-630	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.04	×	0%
ATLS3-631	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.04	×	0%
ATLS3-632	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.61	×	0%
ATLS3-633	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.61	×	0%
ATLS3-634	Bungil Formation	L4 Bungil Formation	0.00	×	0.03	×	0%
ATLS3-635	Cenozoic Sediments	L1 - alluvium	0.00	×	0.11	×	0%
ATLS3-636	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.61	×	0%
ATLS3-637	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.60	×	0%
ATLS3-638	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.61	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-639	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.60	×	0%
ATLS3-640	Other Alluvium	L1 - Alluvium	0.00	×	0.11	×	0%
ATLS3-641	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.59	×	0%
ATLS3-642	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.60	×	0%
ATLS3-643	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.15	×	0%
ATLS3-644	Bungil Formation	L4 Bungil Formation	0.00	×	0.05	×	0%
ATLS3-645	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.60	×	0%
ATLS3-646	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.60	×	0%
ATLS3-647	Other Alluvium	L1 - Alluvium	0.00	×	0.09	×	0%
ATLS3-648	Other Alluvium	L1 - Alluvium	0.00	×	0.09	×	0%
ATLS3-649	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.59	×	0%
ATLS3-650	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.59	×	0%
ATLS3-651	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.58	×	0%
ATLS3-652	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.58	×	0%
ATLS3-653	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.08	×	0%
ATLS3-654	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.57	×	0%
ATLS3-655	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.03	×	0%
ATLS3-656	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.58	×	0%
ATLS3-657	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.13	×	0%
ATLS3-658	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.13	×	0%
ATLS3-659	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.13	×	0%
ATLS3-660	Other Alluvium	L1 - Alluvium	0.00	×	0.09	×	0%
ATLS3-661	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.56	×	0%
ATLS3-662	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-663	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.55	×	0%
ATLS3-664	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.54	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-665	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.53	×	0%
ATLS3-666	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.53	×	0%
ATLS3-667	Bungil Formation	L4 Bungil Formation	0.00	×	0.05	×	0%
ATLS3-668	Upper Evergreen Formation	L21 Upper Evergreen Formation	0.00	×	0.13	×	0%
ATLS3-669	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.53	×	0%
ATLS3-670	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.53	×	0%
ATLS3-671	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.54	×	0%
ATLS3-672	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.54	×	0%
ATLS3-674	Precipice Sandstone	L24 Precipice Sandstone	0.00	×	0.51	×	0%
ATLS3-675	Bungil Formation	L4 Bungil Formation	0.00	×	0.02	×	0%
ATLS3-676	Bungil Formation	L4 Bungil Formation	0.00	×	0.02	×	0%
ATLS3-677	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.03	×	0%
ATLS3-678	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-679	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-680	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-681	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%
ATLS3-682	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-683	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-684	Cenozoic Sediments	L1 - alluvium	0.00	×	0.08	×	0%
ATLS3-685	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-686	Cenozoic Sediments	L1 - alluvium	0.00	×	0.08	×	0%
ATLS3-687	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-688	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-689	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-690	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%
ATLS3-691	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-692	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%
ATLS3-693	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%
ATLS3-694	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-695	Bungil Formation	L4 Bungil Formation	0.00	×	0.05	×	0%
ATLS3-696	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%
ATLS3-697	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-698	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-699	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-700	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-701	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-702	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%
ATLS3-703	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-704	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-705	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%
ATLS3-706	Cenozoic Sediments	L1 - alluvium	0.00	×	0.07	×	0%
ATLS3-707	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-708	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-709	Cenozoic Sediments	L1 - alluvium	0.00	×	0.06	×	0%
ATLS3-710	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.01	×	0%
ATLS3-711	Bungil Formation	L4 Bungil Formation	0.00	×	0.01	×	0%
ATLS3-712	Bungil Formation	L4 Bungil Formation	0.00	×	0.01	×	0%
ATLS3-713	Other Alluvium	L1 - Alluvium	0.00	×	0.06	×	0%
ATLS3-714	Other Alluvium	L1 - Alluvium	0.00	×	0.06	×	0%
ATLS3-715	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.00	×	0%
ATLS3-716	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.00	×	0%
ATLS3-717	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.00	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-718	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.00	×	0%
ATLS3-719	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.02	×	0%
ATLS3-720	Orallo Formation	L6 Orallo Formation	0.00	×	0.01	×	0%
ATLS3-721	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-722	Lower Juandah Coal Measures	Max. drawdown from L14 to L16	0.00	×	0.00	×	0%
ATLS3-723	Bungil Formation	L4 Bungil Formation	0.00	×	0.00	×	0%
ATLS3-724	Other Alluvium	L1 - Alluvium	0.00	×	0.12	×	0%
ATLS3-725	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-726	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-727	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-728	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-729	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%
ATLS3-730	Other Alluvium	L1 - Alluvium	0.00	×	0.11	×	0%
ATLS3-731	Other Alluvium	L1 - Alluvium	0.00	×	0.13	×	0%
ATLS3-732	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.00	×	0%
ATLS3-733	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.00	×	0%
ATLS3-734	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.00	×	0%
ATLS3-735	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-736	Moolayember Formation	L25 Moolayember Formation	0.00	×	0.14	×	0%
ATLS3-737	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-738	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-739	Orallo Formation	L6 Orallo Formation	0.00	×	0.00	×	0%
ATLS3-740	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-741	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.00	×	0%
ATLS3-743	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-744	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-745	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-746	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-747	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-748	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-749	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-750	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-751	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-752	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-753	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-754	Rewan Group	L27 Rewan Group	0.00	×	1.54	×	0%
ATLS3-756	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-757	Orallo Formation	L6 Orallo Formation	0.00	×	0.00	×	0%
ATLS3-758	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.00	×	0%
ATLS3-759	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.00	×	0%
ATLS3-760	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-761	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-762	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-763	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-764	Lower Evergreen Formation	L23 Lower Evergreen Formation	0.00	×	0.04	×	0%
ATLS3-765	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-766	Moolayember Formation	L25 Moolayember Formation	0.00	×	0.16	×	0%
ATLS3-767	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.01	×	0%
ATLS3-773	Other Alluvium	L1 - Alluvium	0.00	×	0.11	×	0%
ATLS3-774	Other Alluvium	L1 - Alluvium	0.00	×	0.10	×	0%
ATLS3-775	Other Alluvium	L1 - Alluvium	0.00	×	0.09	×	0%
ATLS3-776	Other Alluvium	L1 - Alluvium	0.00	×	0.08	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-777	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-778	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-779	Other Alluvium	L1 - Alluvium	0.00	×	0.07	×	0%
ATLS3-780	Other Alluvium	L1 - Alluvium	0.00	×	0.06	×	0%
ATLS3-781	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.01	×	0%
ATLS3-782	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.01	×	0%
ATLS3-783	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.00	×	0%
ATLS3-784	Wallumbilla Formation	L3 - Wallumbilla Formation	0.00	×	0.00	×	0%
ATLS3-785	Upper Springbok Sandstone	L9 - Upper Springbok Sandstone	0.00	×	0.00	×	0%
ATLS3-786	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-787	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-788	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-789	Gubberamunda Sandstone	L7 Gubberamunda Sandstone	0.00	×	0.00	×	0%
ATLS3-790	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-791	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-792	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-793	Orallo Formation	L6 Orallo Formation	0.00	×	0.00	×	0%
ATLS3-794	Orallo Formation	L6 Orallo Formation	0.00	×	0.00	×	0%
ATLS3-795	Mooga Sandstone	L5 Mooga Sandstone	0.00	×	0.00	×	0%
ATLS3-796	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-797	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-798	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-799	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-800	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-801	Wallumbilla Formation	L3 - Wallumbilla Formation	0.00	×	0.00	×	0%
ATLS3-802	Bungil Formation	L4 Bungil Formation	0.00	×	0.00	×	0%

Senex ID	Aquifer Attribution	Impact Assessment Formation	Project Only Drawdown (m)	Trigger Exceeded - Project	Cumulative Drawdown (m)	Trigger Exceeded - Cumulative	Contribution of Project to Cumulative %
ATLS3-803	Wallumbilla Formation	L3 - Wallumbilla Formation	0.00	×	0.00	×	0%
ATLS3-804	Wallumbilla Formation	L3 - Wallumbilla Formation	0.00	×	0.00	×	0%
ATLS3-805	Bungil Formation	L4 Bungil Formation	0.00	×	0.00	×	0%
ATLS3-806	Wallumbilla Formation	L3 - Wallumbilla Formation	0.00	×	0.00	×	0%
ATLS3-807	Wallumbilla Formation	L3 - Wallumbilla Formation	0.00	×	0.00	×	0%
ATLS3-809	Orallo Formation	L6 Orallo Formation	0.00	×	0.00	×	0%
ATLS3-810	Westbourne Formation	L8 Westbourne Formation	0.00	×	0.00	×	0%
ATLS3-768	Metamorphic/igneous/old basement rocks	Layer 1 - basalt	0.00	×	0.08	×	0%
ATLS3-769	Metamorphic/igneous/old basement rocks	Layer 1 - basalt	0.00	×	0.07	×	0%
ATLS3-770	Metamorphic/igneous/old basement rocks	Layer 1 - basalt	0.00	×	0.07	×	0%
ATLS3-771	Metamorphic/igneous/old basement rocks	Layer 1 - basalt	0.00	×	0.08	×	0%
ATLS3-772	Metamorphic/igneous/old basement rocks	Layer 1 - basalt	0.00	×	0.12	×	0%

APPENDIX VII

Stygofauna Assessment

Freshwater Ecology Pty Ltd

Senex - Atlas Stage 3 Gas Project
Stygofauna Pilot Survey

Prepared for ERM
August 2022

Document Control Summary

Document Revisions

Project Title		Senex - Atlas Stage 3 Gas Project – Stygofauna Pilot Survey			
Project Manager		Dr Timothy Howell			
Document Title		FE22007_Atlas3StygoJun2022_V1			
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Table of Contents

1. Introduction

Senex's proposed Atlas Stage 3 project is located in the Surat Basin, 20 kilometres south-west of the town of Wandoan in Queensland. ERM was engaged by Senex manage ecological surveys and associated approval inputs for the Atlas Stage 3 project. Freshwater Ecology Consulting was engaged by ERM to undertake the stygofauna sampling component of the surveys.

KCB were engaged by Senex to undertake bore baseline assessment work for the Atlas Stage 3 project and their representatives helped facilitate the stygofauna sampling undertaken by Freshwater Ecology and described in this report.

2. General Terminology

In Australia, Groundwater Dependent Ecosystems (GDE's) are defined as 'ecosystems which require access to groundwater on a permanent or intermittent basis to meet all or some of their water requirements so as to maintain their communities of plants and animals, ecological processes and ecosystem services' (Richardson *et al*. 2011). Not all GDE's draw on groundwater directly and not all GDE's are solely reliant on groundwater.

Six types of Groundwater Dependent Ecosystems have been identified in Australia:

- Terrestrial vegetation that relies on the availability of shallow groundwater.
- Wetlands such as paperbark swamp forests and mound springs.
- River baseflow systems where groundwater discharge provides a significant baseflow component to the river.
- Aquifer and cave ecosystems where life exists independent of sunlight (this GDE contains stygofauna and is the focus of the current survey).
- Terrestrial fauna species, both native and introduced, that rely on groundwater as a source of drinking water.
- Estuarine and near-shore marine systems, such as coastal mangroves, salt marshes and sea-grass beds, which rely on the submarine discharge of groundwater.

Until recently (mid 1990's), aquifers were considered to be devoid of life, however, research in Australia and overseas has highlighted the fact that groundwater systems provide a critical habitat for a diverse range of aquatic fauna called stygofauna (Hose *et al*. 2015, Glanville *et al*. 2016). The term stygofauna encompasses;

- Stygobionts (stygobites) which are defined as being organisms that are obligate groundwater inhabitants for their entire life cycle (Sket 2008),
- Stygophiles which are defined as surface-dwelling species that complete some or all of their life cycle in groundwater (Sket 2008), and
- Stygoxenes which are defined as animals found accidentally in groundwater (Sket 2008).

Typically, it is the stygobionts and stygophiles that are referred to collectively as stygofauna (Hose *et al*. 2015) and these definitions will be adopted for this Atlas 3 Project survey.

3. What are Stygofauna?

Stygofauna are aquatic subterranean animals that are totally groundwater dependent and found throughout Australian aquifers. Groundwater ecology surveys and studies over the past 30 years in Australia have identified a diverse range of organisms inhabiting groundwater systems, however, whilst the groundwater ecosystem is diverse and unique, this ecosystem is probably the least studied globally. Tomlinson *et al.* (2008) noted that stygofauna are valued as a biodiversity resource, as indicators of groundwater ecosystem health and potential providers of ecosystem services including, nutrient cycling and storage (e.g. carbon, nitrogen, phosphorus), organic matter cycling and redistribution, water treatment (e.g. filtering water to remove toxins), water regulation (e.g. increasing the size of interstitial pore spaces to maintain hydraulic flow pathways and infiltration rates), and mineral weathering and formation.

Stygofauna are morphologically and physiologically different from even closely related surface-dwelling species having independently evolved common morphological traits such as lacking eyes, having hardened body parts, lacking body pigments and having worm-like body shapes and enhanced sensory appendages as an adaption to the groundwater environment (Humphreys 2006). Individuals from 9 of the 17 major stygofauna taxonomic groups identified by Botosaneanu (1986) have been recorded in the groundwater ecosystems of Queensland with undescribed families identified across a further 3 taxonomic groups (Nematoda, Rotifera, and Turbellaria). Groundwater fauna from the 5 remaining taxonomic groups yet to be identified in Queensland groundwater ecosystems include Decapoda, Polychaeta, Remipedia, Spelaeogriphacea, and Thermosbaenacea (Glanville *et al*. 2016). Many of Queensland's stygofauna communities are unstudied or understudied hampering both global and local comparisons. Despite this, Europe, North America and other areas of Australia (e.g. Western Australia) provide the most appropriate baseline for comparison given the higher survey effort employed in these regions (Deharveng *et al.* 2009, Halse *et al.* 2014). While research has identified that eastern Queensland supports moderately rich stygofauna communities (Hancock & Boulton 2008, Cook *et al.* 2012, Halse *et al.* 2014), analysis highlights that this estimate is too low due to the low sampling effort and limited sampling coverage that largely excludes arid regions and low taxonomic resolution (Glanville *et al*. 2016).

Many stygofauna communities around the world are dominated by amphipods, copepods, and isopods (Deharveng *et al.* 2009, Halse *et al.* 2014). Queensland stygofauna communities comprise copepods and isopods in proportions comparable with world averages (Eberhard *et al.* 2009) and copepod proportions comparable to experiences in eastern Australia and the Pilbara (Eberhard *et al.* 2009, Halse *et al.* 2014). However, Queensland stygofauna communities differ due to the dominance of oligochaetes (Eberhard *et al.* 2009), syncarids (Eberhard *et al.* 2009) and beetles (Eberhard *et al.* 2009). Dissimilar to many other stygofauna communities around the world, stygofauna communities in Queensland have a low proportion of molluscs (Eberhard *et al.* 2009). This compositional feature more closely reflects that of other Australian stygofauna communities (Hancock & Boulton 2008), including the Pilbara (Eberhard *et al.* 2009, Halse *et al.* 2014), than global experiences. These comparisons are limited by low sampling effort in many regions, however, the composition of Queensland stygofauna communities is clearly differentiated from that of most of the world (Glanville *et al*. 2016).

Stygofauna are adapted to groundwater environments and conditions of constant temperature, no sunlight, low nutrient and oxygen content, stable water quality and sediments that provide a limited and narrow pore space (Hose *et al.* 2015). Stygofauna have low metabolic rates and low reproductive rates relative to surface species which enables them to survive in the low energy, low oxygen groundwater environment. Groundwater ecosystems typically have few stygobiont species at any one locality and consequently low diversity. However, the isolation of aquifers and limited dispersal abilities of groundwater organisms has created a fauna dominated by short-range endemic species (Harvey 2002). As stygofauna are adapted to a stable physical and chemical subterranean environment, and as species often exhibit narrow geographic ranges, even slight alterations to the groundwater environment (i.e. flow, flux, pressure, level, quality and the transport of nutrients and organic matter) can result in significant changes to the composition and distribution of stygofauna communities and even the potential loss of species. The major pressures on groundwater systems in Queensland, as elsewhere, are from anthropogenic activities (i.e. agriculture, industry and domestic water supply) that modify aspects of the groundwater environment and impact on groundwater quantity (water levels and pressures), groundwater quality (salinity, chemistry, contamination) and groundwater interactions between surface and sub-surface systems. The pressures on groundwater ecosystems are also cumulative (Danielopol *et al.* 2003).

3.1 Ecological Requirements of Stygofauna

Twenty years ago it was believed that stygofauna only existed within a very narrow physico-chemical parameter range. More recent surveys and studies have shown that this is not the case and that stygofauna may be found across a more diverse physico-chemical range of groundwater systems than was previously commonly assumed. Only recently has the true biological diversity of aquifers begun to emerge, both in Australia and globally.

In 2016, Glanville *et al.*, reviewed a state-wide database which included 755 stygofauna samples from 582 sites in Queensland and the current knowledge on stygofauna biodiversity and biogeography. This study correlated stygofauna recordings against environmental data and reported the following important outcomes:

- Groundwater with a wide range of physico-chemical properties have been recorded as supporting groundwater ecosystems in Queensland.
- Stygofauna have been recorded living in groundwater ranging in depth from 0.1 to 63.2 metres below ground level; electrical conductivity ranging from 11.5 to 54,800 μS/cm; groundwater temperatures ranging from 17.0 to 30.7^{o}C, and groundwater pH ranging from 3.5 to 10.3.
- Stygofauna taxon richness shows a general negative trend with increasing depth to groundwater or electrical conductivity (a default measurement for salinity).
- Taxon richness is highest in neutral to slightly alkaline pH groundwater systems and in water temperatures between 18 and 27^{o}C.
- Taxon richness was shown to decrease sharply with increasing groundwater acidity and alkalinity.

It was acknowledged that the stygofauna preferences identified from the Queensland database may partially reflect the limited sampling effort that has occurred across physico-chemically diverse groundwater systems and that the data was predominantly from sites sampled only once.

Hose *et al.* (2015) also noted a number of key factors determining the presence/absence of stygofauna in aquifers:

- Stygofauna are predominantly found in aquifers with large (1mm or greater) pore spaces which are more common in alluvial, karstic and some fractured rock aquifers. The pore spaces within an aquifer matrix are a critical determinant of whether an aquifer can support large-bodied organisms as stygofauna move within an aquifer by either crawling or swimming. The size of the interstitial spaces also influences the hydraulic conductivity and flow of water which ultimately controls the delivery of carbon and oxygen throughout the ecosystem. Hahn & Fuchs (2009) identified that stygofauna were rare or absent in areas with hydraulic conductivity (K_f) less than 10^{-4}cm/s.
- Stygofauna diversity and abundance typically decreases with depth below ground. Stygofauna are rarely found more than 100 m below ground level and are most abundant less than 20 m below ground (Hancock & Boulton 2008).
- Stygofauna are found across a range of water quality conditions (from fresh to saline), but are most common in fresh and brackish water (i.e. where EC is less than 5,000 µS/cm). 4T (2012) in their review of stygofauna data from Australia reported that stygofauna have been found in hypersaline groundwater (86,900 µS/cm), but are most common at salinities less than 10,000 µS/cm.
- Stygofauna are rarely found in hypoxic groundwater where dissolved oxygen concentrations are less than 0.3 mg/L. 4T (2012) reported that stygofauna have been recorded in groundwater with dissolved oxygen concentrations ranging from 0.2 to 15.3 mg/L.
- Stygofauna are more abundant in areas of surface water-groundwater exchange when compared to deeper areas or those further along the groundwater flow path remote from areas of exchange or recharge with poor hydraulic conductivity. Schmidt *et al.* (2007) noted that hydrological exchange between aquifer and surface water can be more important than other hydrogeological conditions in shaping stygofauna assemblages.

Stygofauna were recorded inhabiting a wide range of lithologies, including unconsolidated sedimentary material (e.g. alluvium, sand); consolidated sedimentary rocks (e.g. sandstone) and fractured rocks (e.g. basalt, granite, volcanics). Whilst sampling data are scarce or absent for many lithologies, the results from Glanville *et al.* (2016) suggest that groundwater systems cannot be eliminated as potential habitat for stygofauna based solely on geology or lithology. Stygofauna were also shown to exist across a diverse physico-chemical range of groundwater systems, and as a result, general assumptions of habitat suitability should not be used to guide sampling activities.

Stygofauna are adapted to a low nutrient (particularly carbon) and oxygen environment. For aquifers to sustain stygofauna there must be a continuous vertical flow of dissolved organic carbon (DOC) from the surface to the aquifer. It is this carbon plus dissolved nutrients that are the basis of the simple food web that sustains bacteria and fungi (biofilms) which stygofauna can feed on (Humphreys 2006). It is largely for this reason that stygofauna diversity and abundance decrease with depth and distance along groundwater flow paths as nutrient supplies decline.

3.2 Stygofauna Diversity

Hose *et al.* (2015) reports that in 2000 there were over 7,800 known stygofaunal species globally, however, large research efforts in Australia and Europe have shown that this number is an underestimation. Guzik *et al.* (2010) reported some 770 stygofauna taxa were known from Western Australia alone, however, this value was estimated to be only 20% of the true number of stygobiont taxa. True richness for the region may be in excess of 4,000 stygobitic species. Based on these values, and the fact that the diversity of stygofauna in the eastern states is largely unexplored, it is likely Australia is globally significant in terms of stygofauna diversity (Hose *et al.* 2015).

Many of Queensland's stygofauna communities are unstudied or understudied, hampering both global and local comparisons. Queensland is known to host at least 24 described families and 23 described genera of stygofauna across 9 of the 17 major stygofaunal taxonomic groups. Undescribed families have also been recorded across a further three major stygofauna taxonomic groups (Glanville *et al.* 2016). The composition of stygofauna in Queensland is broadly consistent with the world average with the notable exception of high richness of oligochaetes and syncarids and low numbers of molluscs. Despite indications that a significant diversity of stygofauna is likely to exist across Queensland groundwater systems, stygofauna biodiversity largely remains undocumented due to limited sampling effort, limited taxonomic resolution and the tendency for stygofauna to exhibit morphological similarities (Glanville *et al.* 2016).

3.3 Potential Impacts on Groundwater and Stygofauna

There are three major changes in groundwater conditions that can directly threaten the integrity of groundwater ecosystems. These stressors are:

- Spatial and temporal changes in water level (i.e. groundwater drawdown);
- Altered groundwater quality; and
- Altered aquifer properties (including aquifer porosity, hydraulic conductivity and depressurisation).

Such changes in the physical and chemical properties of an aquifer, either individually or cumulatively, are likely to affect the occurrence and/or the distribution of stygofauna in an aquifer. Cumulative impacts from multiple stressors need to be considered in combination when assessing impacts on the groundwater environment. Stygofauna exhibit high rates of endemism (short-range endemics) with species often restricted to small geographic areas.

3.4 Knowledge Gaps Regarding Stygofauna

In 2015, Hose *et al.* published a report commissioned by ACARP entitled "Stygofauna in Australian Groundwater Systems: Extent of Knowledge". This report identified a number of emerging issues where knowledge is lacking with regards to risks to aquifer ecosystems from activities that impact groundwater quantity and quality (e.g. mining, water supply, agriculture). In particular, Hose *et al.* (2015) identified a very limited ability to understand and subsequently predict impacts of dewatering/depressurisation of aquifers on stygofauna communities. Additional knowledge-deficient areas were identified as:

- The role of coal seams as stygofauna habitat;
- Water quality tolerance of stygofauna – toxicants and physico-chemical stressors;
- Groundwater foodwebs as a pathway to impact stygofauna;
- Taxonomy and distribution of stygofauna species, and
- Links between hydrological modelling and impacts on stygofauna.

Targeted research and further surveys/studies are required to inform and improve our ability to assess the risk to groundwater ecosystems from operations/industries that impact on groundwater quantity, groundwater quality and groundwater interactions.

4. Sampling Program for Stygofauna

A total of 32 groundwater bores were identified by KCB as being potentially sampleable across and in proximity of the Atlas 3 Project Area. Attempts were made to find each bore and sample them. Several of the bore locations no longer had bores at them, and several others were not able to be sampled (due to either no pumps or existing infrastructure that could not be removed to allow access for stygofauna nets). A total of 12 bores were able to be sampled for stygofauna. The locations of the 12 groundwater bores sampled within the proposed Atlas 3 Project study area are shown in **Figure 1**. The location and history of each bore are presented in **Table 1** and bore hole characteristics presented in **Table 2** below. The bores ranged from full (bore number 14193 was overflowing to 173.1 metres deep), with some bores slotted at particular depths and others open below a certain point. Bore ages varied from 1945 through to 1999. The bores intersected various formations, with one being directly into the alluvium. All operating bores were being used for watering cattle.

Bore inspection and sampling was conducted for this project by Freshwater Ecology from 11th to 16th June 2022.

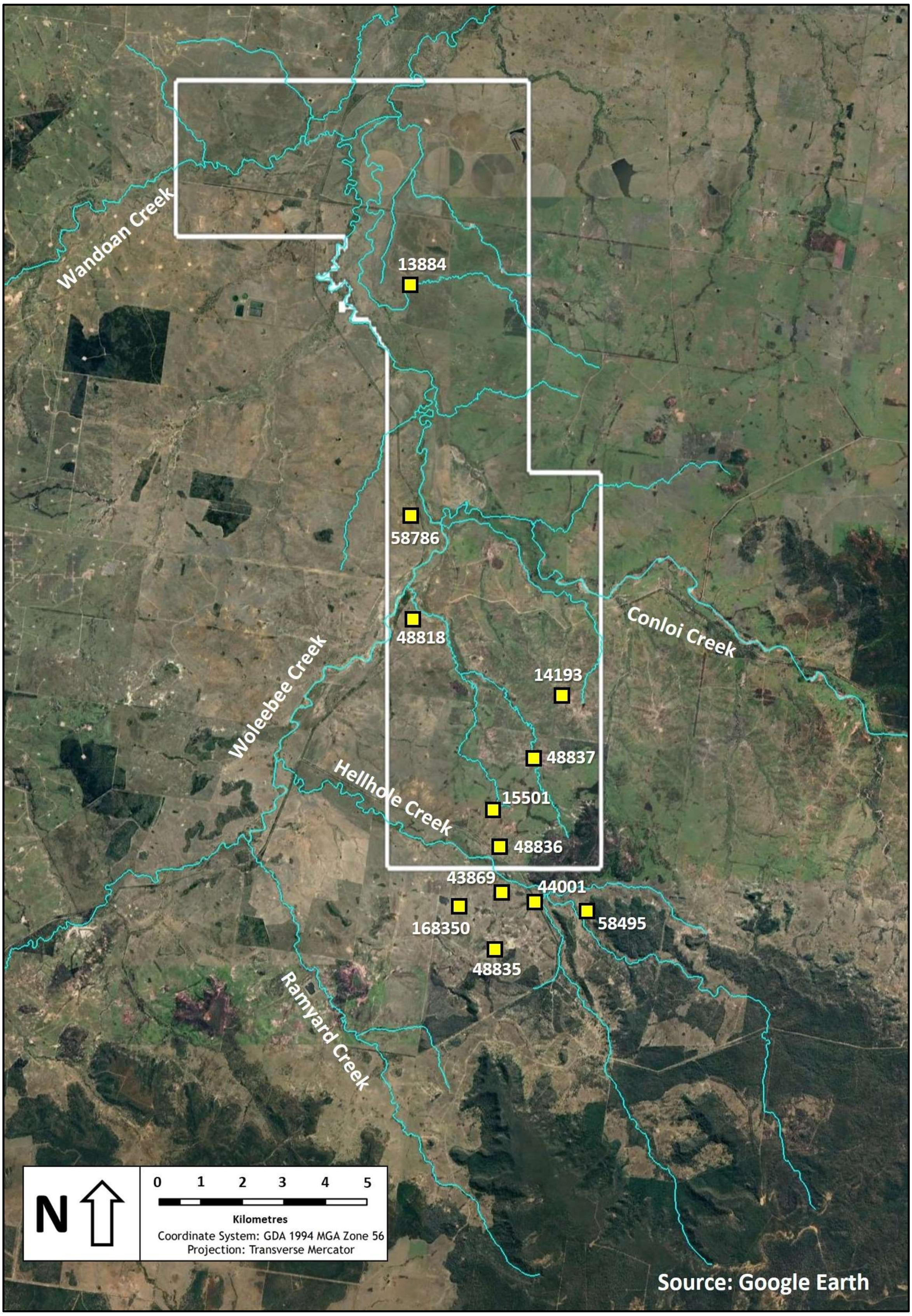

Figure 1: Location of bores sampled for stygofauna

Table 1: **Location of groundwater bores sampled for stygofauna** (N/A – data not available)

Bore Code	Easting (WGS84 55J)	Northing (WGS84 55J)	Strata description	Bore Purpose	Date Drilled	Date Sampled
13844	783791	7098227	Upper Springbok Sandstone	Abandoned	2/06/1958	15/06/2022
58786	783626	7092910	Westbourne formation	Not operative	7/05/1999	11/06/2022
48818	783638	7090412	Gubberamunda Sandstone	Cattle watering	28/03/1974	11/06/2022
14193	786999	7088621	Gubberamunda Sandstone	Cattle watering	1/07/1960	12/06/2022
48837	786446	7087185	Gubberamunda Sandstone	Cattle watering	14/01/1975	13/06/2022
15501	785451	7085947	Gubberamunda Sandstone	Cattle watering	18/12/1962	13/06/2022
48836	785645	7084939	Gubberamunda Sandstone	Cattle watering	31/08/1945	13/06/2022
43869	785702	7084004	Orallo Fm - Gubberamunda Sandstone	Cattle watering	3/08/1973	14/06/2022
44001	786472	7083702	Orallo formation – Gubberamunda Sandstone	Abandoned	10/10/1973	14/06/2022
168350	784545	7083655	Gubberamunda Sandstone	Cattle watering	N/A	14/06/2022
58495	787448	7083477	Orallo formation	Cattle watering	N/A	16/06/2022
48835	785363	7082702	Gubberamunda Sandstone	Cattle watering	14/01/1975	13/06/2022

Table 2: Bore Hole Characteristics (mBGL - metres below ground level; mBTOC - metres below top of casing; EoH – end of hole; SWL – standing water level) (N/A – data not available)

Bore Code	Depth to EoH * (mBGL)	SWL (mBTOC)	Bore Diameter (mm)	Slotted Depth * (m)
13884	173.1	full	152	105.2-110.3
58786	76	33.5	125	72-76
48818	38.1	9.1	125	12.4-38.1
14193	N/A	N/A	125	N/A
48837	47.5	16.2	125	31.7-47.5
15501	106.4	37.2	125	53.9-106.4
48836	91.5	N/A	125	48.8-91.5
43869	109.8	N/A	125	51.6-109.8
44001	112.8	27.6	125	44.8-112.8
168350	N/A	N/A	125	N/A
58495	36	30.1	152	N/A
48835	137.3	N/A	125	101.5-137.2

***values obtained for bore hole logs,**

5. Project Methodology

5.1 Desktop Assessment

A review was undertaken to search for available data and reports on stygofauna within and adjacent to the Atlas 3 Project Area. This included searches for projects in adjacent areas known to have undertaken environmental assessments as well as the Queensland subterranean aquatic fauna database (Queensland Government 2022). There were no available reports found for adjacent projects. As such, it was determined that the most appropriate approach to sampling was to undertake a pilot survey to address the knowledge gaps in the desktop review. A pilot survey typically consists of sampling a minimum of ten bores with bore locations satisfying specific criteria for conducting stygofauna surveys.

5.2 Sampling Team

Field sampling for the Atlas 3 Project was conducted by Dr Timothy Howell from Freshwater Ecology. Dr Howell is a professional aquatic ecologist with experience in stygofauna sample collection and analysis. Tim Howell has more than 20 years' experience as an aquatic ecologist and 12 years' specific experience working on groundwater ecology projects throughout Australia. Freshwater Ecology was supported in the field by Dr Matthew Forbes from KCB.

5.3 Stygofauna Sampling

A total of 12 groundwater bores were sampled for stygofauna in accordance with the methods defined in Queensland Environment Protection (Water) Policy 2009 – Monitoring and Sampling Manual for Biological Assessment (DES 2018) and following established sampling techniques defined elsewhere in Australia and overseas (DSITI 2015, Hancock & Boulton 2008, Dumas & Fontanini 2001, WA EPA Guidance Statements 54 and 54a 2003 & 2007). The field sampling program adopted by Freshwater Ecology met all requirements required for conducting a stygofauna pilot survey.

There are two recommended sampling methods for stygofauna—netting and pumping. Netting is a passive sampling method that collects animals residing within the bore casing. Pumping is an active sampling method that collects groundwater and fauna from within the bore casing and the surrounding aquifer through groundwater recharge. Both methods were used in the current assessment depending on the infrastructure, or lack of, associated with each bore.

Netting was undertaken in three groundwater bores (13884, 58786, 44001) that were 125mm in diameter using a 50mm diameter phreatobiological net (net design and construction conformed with WA EPA Guideline [2003 & 2007] specifications). Nets were made of 50 µm nybolt mesh material and weighted at the bottom with a brass fixture and an attached plastic collecting jar. The net was lowered to the bottom of the bore, bounced three to five times to dislodge any resting animals, and slowly retrieved. At the top of each haul (the aim was always to collect between 4 and

6 hauls with all hauls reaching the bottom of the bore), the collecting jar was rinsed into a 50 µm mesh brass sieve and the net lowered again.

The pumping method was used at the remaining nine groundwater bores which had fixed pumps that were all run off solar panels. Three rows of ten x 9 litre buckets were set out adjacent to the pump. The buckets were filled sequentially once the water from the pump began to flow. To reduce spilling, the buckets were filled to near the top but not full. This ensured that at least 250 litres was collected for each bore. Each bucket was sequentially filtered through the 50 µm mesh brass sieve. As there was little suspended material in the pumped samples for this project, they were collectively washed into a single sample jar for each site.

Once all net hauls were completed or all the buckets from pumping had been filtered through the sieve, the entire sieve contents were then transferred to a labelled sample jar and preserved in methylated spirits (DNA testing of aquatic specimens was not required for this project). A small amount of Rose Bengal, which stains animal tissue pink, was added to each sample to aid in sample processing.

All field equipment was of high quality and fit for purpose, well maintained and operated in accordance with scientific protocols specified above.

5.4 Laboratory Processing of Field Samples

Field samples were logged into a Laboratory Information Management System to record and track sample processing details. Stygofauna sample containers were drained of methylated spirits and stain and washed gently into channelled Sedgwick-Rafter counting trays to create a thin layer of sediment spread across the bottom of the tray. Samples were then sorted under a stereomicroscope with 10x objective lenses and a zoom capability of between 6.3x and 60x. All aquatic animals present were removed (stygofauna and non-stygofauna) and identified to Order/Family level (or lower taxonomic rank if visually possible) in accordance with standard Queensland Government ToR for an EIS and placed in labelled, polyethylene containers filled with 100% AR Grade ethanol for long-term storage.

Sample sorting and initial identification was undertaken by Chris Pietsch from Blue Earth Environmental. Photographs of the sampled specimens considered to be potentially stygofauna were sent to Dr Peter Hancock to determine whether they were likely to be stygofauna and thus require further detailed identification.

5.5 Groundwater Quality Sampling

Groundwater sampling preceded biological sampling to ensure the groundwater contained within the bore was undisturbed. The field meter was calibrated in the laboratory prior to its use in the field, with calibrations regularly cross-checked in the field. All water quality monitoring equipment was of high quality and fit for purpose, well maintained and operated in accordance with the manufacturer's specifications.

Groundwater quality sampling was conducted differently at bores that were open (i.e. sites that were sampled with the netting method) to those with attached pumping infrastructure (i.e. those sampled by the pumping method). Water was measured for temperature (^{o}C), pH (units), electrical conductivity (µS/cm), dissolved oxygen (mg/L) and turbidity (NTU) using a multi-parameter water quality meter to provide a general estimate of standing groundwater quality.

For open bores, water samples were collected from each bore using a bailer lowered by hand to approximately 2 m to 3 m below the water surface (SWL) prior to stygofauna sampling. Care was taken to slowly and gently pour water from the bailer into a container prior to inserting the WQ probes so as to reduce any artificial aeration that might occur during this process. As this could not be totally eliminated, dissolved oxygen results should be treated with caution.

At sites with existing pumping infrastructure, water quality was measured in the buckets filled from the pump. Water quality was recorded in the 1st, 5th, 10th, 15th, 20th, 25th and 30th buckets for each site. Only the water quality results for the 30th buckets results are reported here as this is likely to be more reflective of the water quality conditions of the groundwater rather than in the bore itself.

6. Results

A review of the Queensland subterranean aquatic fauna database identified 32 bores that had been sampled within a 50 kilometre radius of the Atlas 3 Project Area. Closer examination of the coordinates determined that six of the bores were given a second name (i.e. data from the same bore had been recorded twice), reducing the number of bores previously sampled for stygofauna to 26 (Figure 2).

Examination of the results from the 26 bores determined that only four had recorded true stygobites and a further six bores had identified fauna that was subsequently considered not to be stygobites, and were most likely stygophiles (i.e. species which occasionally utilise groundwater but are not dependent on it). However, as this was not confirmed these styophiles will not be discussed further. All four sites from which stygobites had been recorded were along Horse Creek, approximately 25 kilometres north-west of the northern part of the Atlas 3 Project Area. With the exception of one sample which recorded specimens from the crustacean family Bathynellidae, all specimens were crustaceans from the sub-class Copepoda (of the genus either *Dussartstenocaris* or *Parastenocaris*).

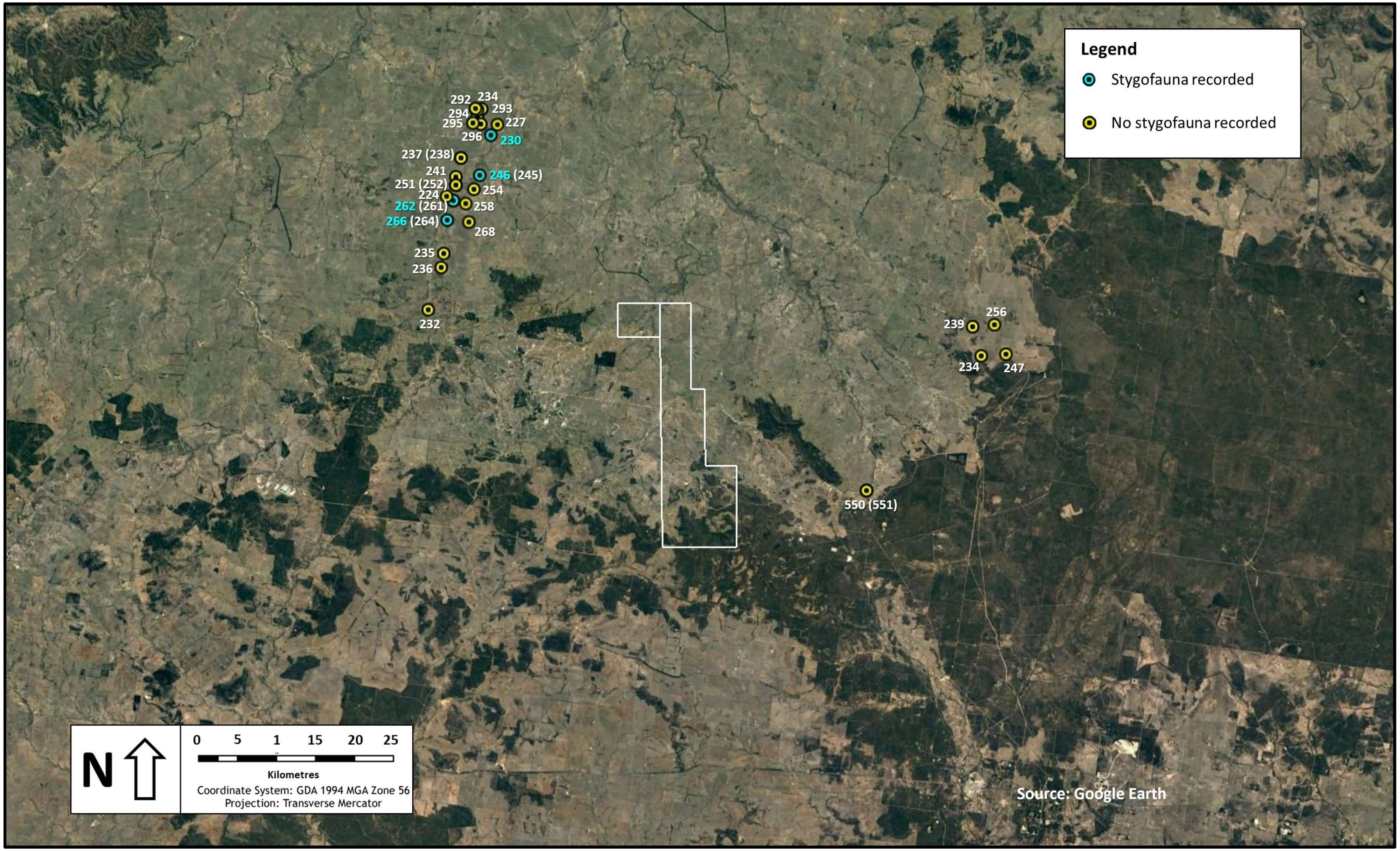

Figure 2: Historical stygofauna sampling within 50 kilometres of the Atlas 3 Project

In-situ groundwater quality monitoring results are presented in **Table 3** below. Except for bore numbers 14193 and 48837 (which were close to neutral), all the bores were slightly to moderately alkaline. The majority of the bores were also slightly saline (i.e. between 785 – 8,500 μS/cm) with only bore number 168351 considered to be very fresh (19.8 μS/cm). The water clarity extracted from the bores was clear to slightly turbid.

Table 3: *In situ* groundwater quality

Bore Code	**pH** (units)	**Dissolved Oxygen** (% satn)	**Conductivity** (μS/cm)	**Turbidity** (NTU)	**Temperature** (°C)	**Sample Volume** (L)
13884	8.3	31.1	8,500	82.9	20.1	1
58786	7.3	16.1	4,800	8.4	21.6	1
48818	8.4	16.8	3,200	2.3	22.9	8
14193	7.1	65.2	2,590	2.1	227	8
48837	6.9	16.8	2,370	4.3	22.6	8
15501	7.7	15.0	3,170	5.9	23.1	8
48836	7.4	60.3	5,590	23.7	22.8	8
43869	7.6	22.4	4,000	0.6	24.1	8
44001	8.3	28.9	785	12	23.8	1
168351	8.6	24.1	19.8	1	24.2	8
58495	7.9	28.9	3,020	3.9	24	8
48835	8.2	38.4	1,551	1.1	24.1	8

The quality of stygofauna samples collected across the 12 groundwater bores in June 2022 is summarised in **Table 4** below. Three bores were sampled with the netting method, one which produced a good sample, another which was fair (due to some blockages in the bore) and the third which was poor (only a single haul was possible due to coagulation of the water column following the first haul). The remaining bores were sampled using the pumping method using the existing solar pumping infrastructure on each bore. Eight of the pumping samples were of high quality, with one considered fair due to intermittent flow from cloud shading of the bore during sampling.

Table 4: Summary of stygofauna sampling effort and sample quality

Bore Code	No. hauls / volume of pumped water filtered	Sample Quality
13884	3 hauls	fair, some blockage after 3 hauls from algae at top of bore, bore flowing
58786	1 haul	poor, first haul went down well then subsequent hauls failed to penetrate the water that had been stirred up in the first haul, significant organic matter, H2S smell
48818	250L	good
14193	250L	fair, flow interrupted by shade on solar panel
48837	250L	good
15501	250L	good
48836	250L	good
43869	250L	good
44001	4 hauls	good
168351	250L	good
58495	250L	good, sampling from end of pipe
48835	250L	good

Results from the analysis of the groundwater samples for the presence of stygofauna are presented in **Table 5** below. Two specimens of copepod recorded in bore 48836 (transecting the Gubberamunda Sandstone) represented the only possible stygofauna (stygobiont or stygophile). The identification of this group to the genus level is beyond that which can be achieved by Dr Hancock and would require a microcrustacean specialist. Bore 48836 is located on a hill and largely covered by pumping infrastructure. Therefore, it is unlikely that the specimens collected would have arrived through flooding or have been windswept (in the cyst stage of development). As such, it is likely that these two specimens represent stygofauna.

The most abundant and commonly recorded fauna were formacidae (ants) and collembola (springtails), both of which were considered to be stygoexnes. Formacidae were recorded in half the samples collected and often in high abundance (both whole and in body parts). Formacidae are often recorded in stygofauna sampling as they source water from the bores to support their colonies in dry times. Collembola are typically abundant in soil and the specimens collected exhibited traits consistent with being terrestrial fauna (Dr Hancock pers. comm.). All other fauna recorded were considered stygoxenes (animals which had accidentally fallen into the bores).

Table 5: Analysis of groundwater samples for the presence of stygofauna

Bore Code	Date Sampled	Stygofauna Taxa	Non-Stygofauna Taxa
13884	15/06/2022	0	parts of formacidae
58786	11/06/2022	0	unidentifiable insect parts
48818	11/06/2022	0	7 oligochaeta, unidentifiable insect parts
14193	12/06/2022	0	3 collembolla, 3 acarina, 2 hemiptera, coleoptera larvae, diptera adult
48837	13/06/2022	0	100's formacidae, 100's of parts of ants, 3 collembola
15501	13/06/2022	0	0
48836	13/06/2022	0	100's of formacidae parts, 1 x isopoda, collembolla, acarina, copepoda, coleoptera
43869	14/06/2022	0	ants, coleoptera, 100's of collembolla and acarina
44001	14/06/2022	0	1 araneae, collembola
168351	14/06/2022	0	4 formacidae, coleoptera larvae, diptera adult, 100's of collembola, acarina
58495	16/06/2022	0	3 formacidae, 1 coleoptera, collembola, acarina
48835	13/06/2022	0	15 formacidae, 1 oligochaeta, 1,000's of ant parts, 3 oligochaetes

Table 6: Images of non-stygofauna taxa collected in samples (Photos: Chris Pietsch)

 **14193 – Acarina (mite)**	 **14193 – Collembola (springtails)**
 **14193 – Hemiptera (true bug)**	 **48836 – Isopoda (wood lice)**
 **48836 – Copeoda**	 **44001 – Collembola (springtail) and Araneae (spider)**

7. Conclusion

A stygofauna pilot survey was conducted on the 11th to 16th of June 2022 for the Atlas 3 Project. A total of 12 groundwater bores were sampled using either a netting or pumping method as bore infrastructure dictated.

Stygofauna sampling was conducted by Freshwater Ecology in accordance with the methods defined in Queensland Environment Protection (Water) Policy 2009 – Monitoring and Sampling Manual (DES 2018) and following established (standard) sampling procedures used elsewhere in Australia and overseas (DSITI 2015, Hancock & Boulton 2008, Dumas & Fontanini 2001, WA EPA Guidance Statements 54 and 54a 2003 & 2007). Sampling produced high quality samples from nine groundwater bores.

A desktop review was unable to find publicly available reports on stygofauna sampling within 50 kilometres of the Atlas 3 Project Area. However, an analysis of the Queensland subterranean fauna database identified 28 bores which have been sampled for stygofauna within 50 kilometres of the Project Area, several of which had been sampled on more than one occasion. Of the 28 bores confirmed stygofauna had only been recorded in four. These were all recorded in proximity to Horse Creek, approximately 25 kilometres north-west of the Atlas 3 Project Area.

In-situ groundwater quality was considered high and suitable for the presence of stygofauna. The bores sampled represented a range of locations and aquifers across the Atlas Stage 3 Project Area.

Only two specimens of one potential stygofauna (from a single bore) were recorded in the 12 samples collected. No stygofauna (stygobites or stygophiles) were recovered from the other 11 bores sampled, although large numbers of stygoxenes (both whole and heavily decomposed) were recorded from most bores.

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APPENDIX VIII

Terrestrial and Aquatic Groundwater Dependent Ecosystem Mapping and Characterisation

ERM

Level 4, 201 Leichhardt Street
Spring Hill QLD 4000

Telephone: +61 7 3007 8442

www.erm.com

Technical Note

To	Steve Fox
From	Matt Davis
Date	22 October 2022
Reference	0639876 Atlas Stage 3 Gas Project
Subject	Atlas Stage 3 Gas Project - Potential Groundwater Dependent Ecosystem mapping

INTRODUCTION AND SCOPE

Senex Energy Pty Ltd (Senex), on behalf of its subsidiaries Senex Assets Pty Ltd and Senex Assets 2 Pty Ltd, proposes to develop, operate, decommission and rehabilitate up to 151 new coal seam gas wells; gas and water gathering systems for the producing wells; access tracks for operational purposes; brine and produced water/irrigation storages; borrow pits; and ancillary supporting facilities on Authority to Prospect (ATP) 2059, Petroleum Lease (PL) 445, the northern portion of PL209 and parts of PL1037 in the central part of the Surat Basin, Queensland. The project is called the Atlas Stage 3 Gas Project (and in this technical note it is referred to as 'the Project'). The gas field will be progressively developed over a period of approx. 5–10 years.

Environmental Resources Management Australia Pty Ltd (ERM) has been engaged by Senex to coordinate terrestrial and aquatic ecology field surveys and assessments, to support the development of the layout and design for the proposed action as part of approval applications required under Queensland State legislation and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

To support the ecological and groundwater assessments required as part of the impact assessment and approvals phase of the proposed action, mapping of potential terrestrial and aquatic Groundwater Dependent Ecosystems (GDE) is required. To understand the extent of any potential impacts associated with changes to groundwater hydrology, these GDEs have been field verified within the Project Area and mapped using desktop sources in a 25km buffer area, as shown in **Figure 1**. The identification and mapping of potential GDEs will be used by a groundwater modelling specialist to identify locations where changes to groundwater hydrology because of the proposed action may impact on significant ecological features.

The proposed action is located in the Surat Basin, an area that covers approximately 327,000 km^2 of south-east Queensland and northern New South Wales and forms connecting aquifers with the Great Artesian Basin (Hayes, et al., 2020). Containing a sequence of both Jurassic and Cretaceous sediments, the Surat Basin contains a diverse system of aquifers that provide water discharge throughout south-eastern Queensland.

GDEs are defined as ecosystems that require access to groundwater on a permanent or regular basis in order to meet some or all of their water requirements. GDE's include aquifers, caves, lakes, palustrine wetlands, lacustrine wetlands, rivers and associated riparian vegetation communities. Groundwater plays an important ecological role in some terrestrial and aquatic ecosystems by supporting vegetation and providing discharge to waterways (Queensland Government, Queensland, 2022).

Dependency on groundwater is likely to fluctuate temporally and spatially depending on regional climatic conditions, geomorphology and topography of the site. In areas that experience seasonal variations in water availability, such as the Surat Basin, vegetation is known to exploit more than one source of water depending on the availability of above ground water (Mensforth, Thorburn, Tyerman, & Walker, 1994).

In addition to supporting vegetation health, subterranean wetlands such as aquifers and caves, as well as alluvial aquifiers, are also noted to support fauna species at various points throughout their life cycle. These include troglofauna, referring to air-breathing fauna that indirectly rely on groundwater, and stygofauna, referring to aquatic fauna relying on groundwater at various stages of their life cycle. The ecology and life histories of groundwater-dependant fauna is poorly understood, however can provide indications of surface water connectivity, water quality, the health of subterranean wetlands and the effectiveness and impacts of management interventions.

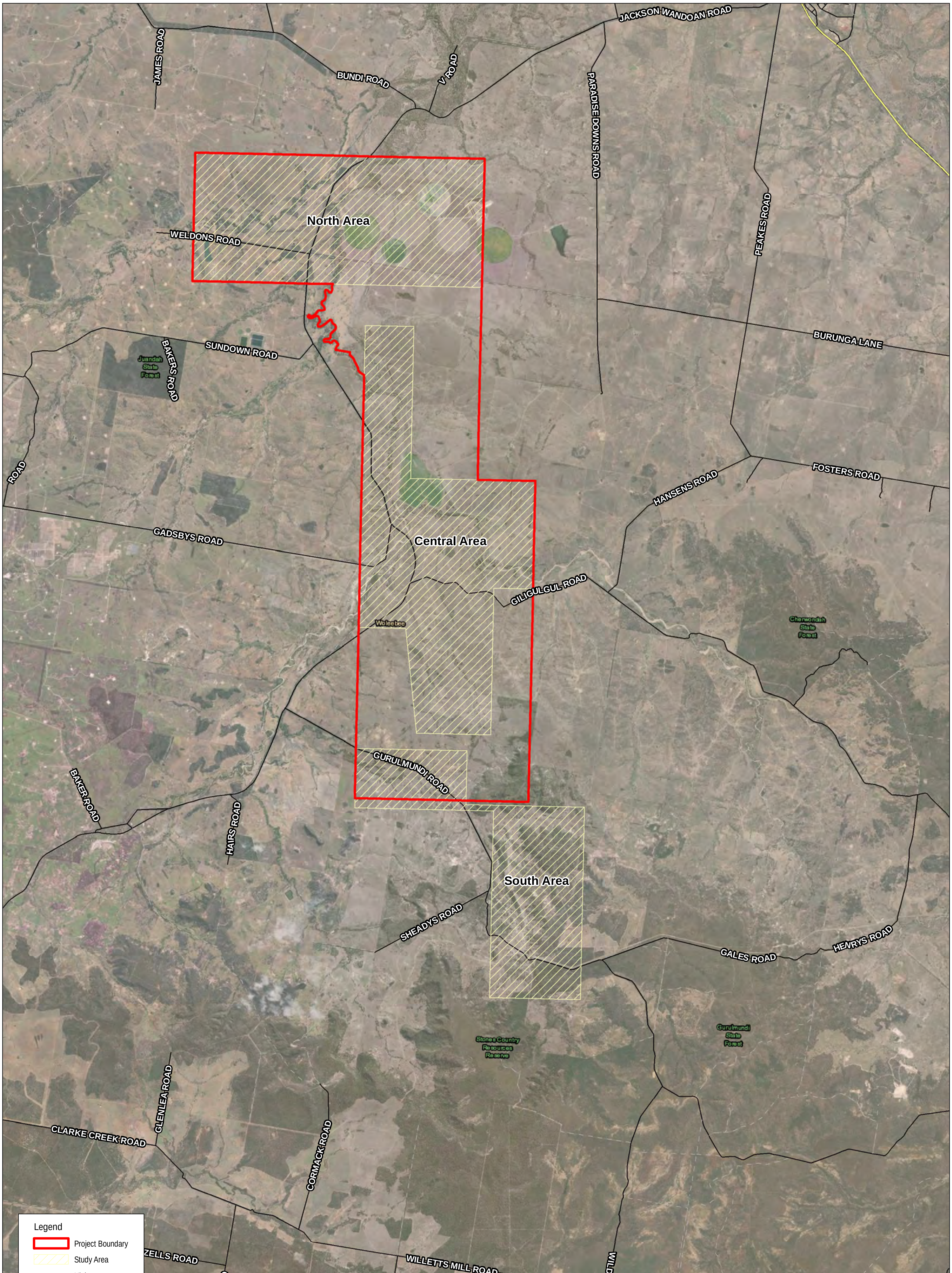
This technical note provides details on the potential GDEs within the Project Area, and accompanies a spatial dataset of field-verified ecological assessments, including:

- Assessment of the likelihood of field-verified vegetation communities being reliant on groundwater, based on their location in the landscape and the vegetation community types;
- Description of the flora species that are characteristic of each terrestrial and aquatic GDE area;
- Description of the general health of the vegetation present within each terrestrial and aquatic GDE area; and
- An estimate of likely deepest rooting depth for each terrestrial GDE area (based on literature review for relevant flora species).

This technical note provides a summary of the results of the GDE mapping for areas within the Atlas Stage 3 Project Area. A desktop assessment has also been completed separately for a landscape assessment area that consists of a buffer of 25km around the Atlas Stage 3 tenements. This landscape assessment area and the Project Area together are referred to as the Study Area in this technical note (**Figure 1**).

An additional division of the Project Area into northern, central and southern zones has also been developed for the groundwater assessment, as these locations have different surface water and groundwater hydrological conditions.. These three areas and their groundwater and vegetation community characteristic are described further below in this technical note, and include:

1. North: Wandoan and Woleebee Creeks;
2. Central: Woleebee and Conloi Creeks; and
3. South: Hellhole Creek



Study Area

F1

Drawing No: 0639876s_GDE_G001_R1.mxd	Potential Groundwater Dependent Ecosystem
Date: 21/10/2022 Drawing Size: A4	
Drawn By: VN Reviewed By: MD	Client: Senex Assets Pty Ltd
Coordinate System: GDA2020 MGA Zone 55 0 1 2km N	This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

METHODOLOGY

Summary of approach

A combination of desktop and field methods were used to develop the potential GDE map included in the shapefile 'PGDE-Atlas3-RevA.shp'. The Queensland Department of Environment and Science (DES) GDE mapping dataset (Version 1.5, April 2017) was reviewed and overlaid with a ground-truthed Regional Ecosystem (RE) mapping dataset collected from fieldwork completed between March and June 2022 by Boobook Ecological Consulting (Boobook). This mapping was also compared with Commonwealth GDE mapping accessed from the Groundwater Dependant Ecosystem Atlas from the Bureau of Meteorology.

Following the mapping process a list of potential GDEs was developed within the Project Area, described by RE and GDE type. The GDE types adopted terminology used in the Queensland GDE mapping rule sets, with the typical vegetation community composition in these areas derived from the RE description, modified from field observations on floristic species.

This process resulted in a field verified potential GDE map, through assessment of the vegetation community type and its location in the landscape. A review of publicly available literature has also been completed to identify potential root depth of the tree species that occur within the identified potential GDEs.

Ground-truthed vegetation survey

Baseline botanical surveys were undertaken by Boobook from March to June 2022, to describe dominant flora and vegetation community structure within the Project Area. Ground-truthing of the REs within the Project Area was undertaken using the quaternary level of data collection as described by Neldner et al. (2022). Field surveys were conducted by Michael Cunningham (Senior Ecologist), Courtney Andrew (Graduate Ecologist) and Rosamund Aisthorpe (Botanist) in the periods 14 – 18th March 2022, 22 – 25th March 2022; 30 April – 5th May 2022), and 9 – 13th June 2022.

Vegetation community assessments were undertaken within 50 m x 20 m plots (0.1 ha) within representative locations in all identified RE and regrowth vegetation types within the Project Area. Faunal habitat values were also assessed within these plots (see below). The locations of vegetation and habitat survey sites are shown in **Figure 2**. Vegetation community polygons were verified in accordance with Queensland RE description and biodiversity status as per the latest updates of the Regional Ecosystem Description Database (REDD) (DES 2021) and TEC criteria (DAWE 2022b; TSSC 2013, 2019).

RE polygons were assigned to remnant or non-remnant status as defined by the *Vegetation Management Act 1999* (VM Act), with reference to Version 3.2 of the Queensland Government BioCondition Benchmark Database (Queensland Herbarium 2021). Remnant vegetation had obtained a canopy cover more than 50% of the benchmark canopy layer and a height more than 70% of the benchmark height of minimally disturbed vegetation of a given RE (referred to below as the 50/70 rule).

The Project Area features long, narrow linear corridors of vegetation, these features were mapped down to a minimum width of 25 m (equivalent to the 1:25 000 scale in Neldner et al. 2022).

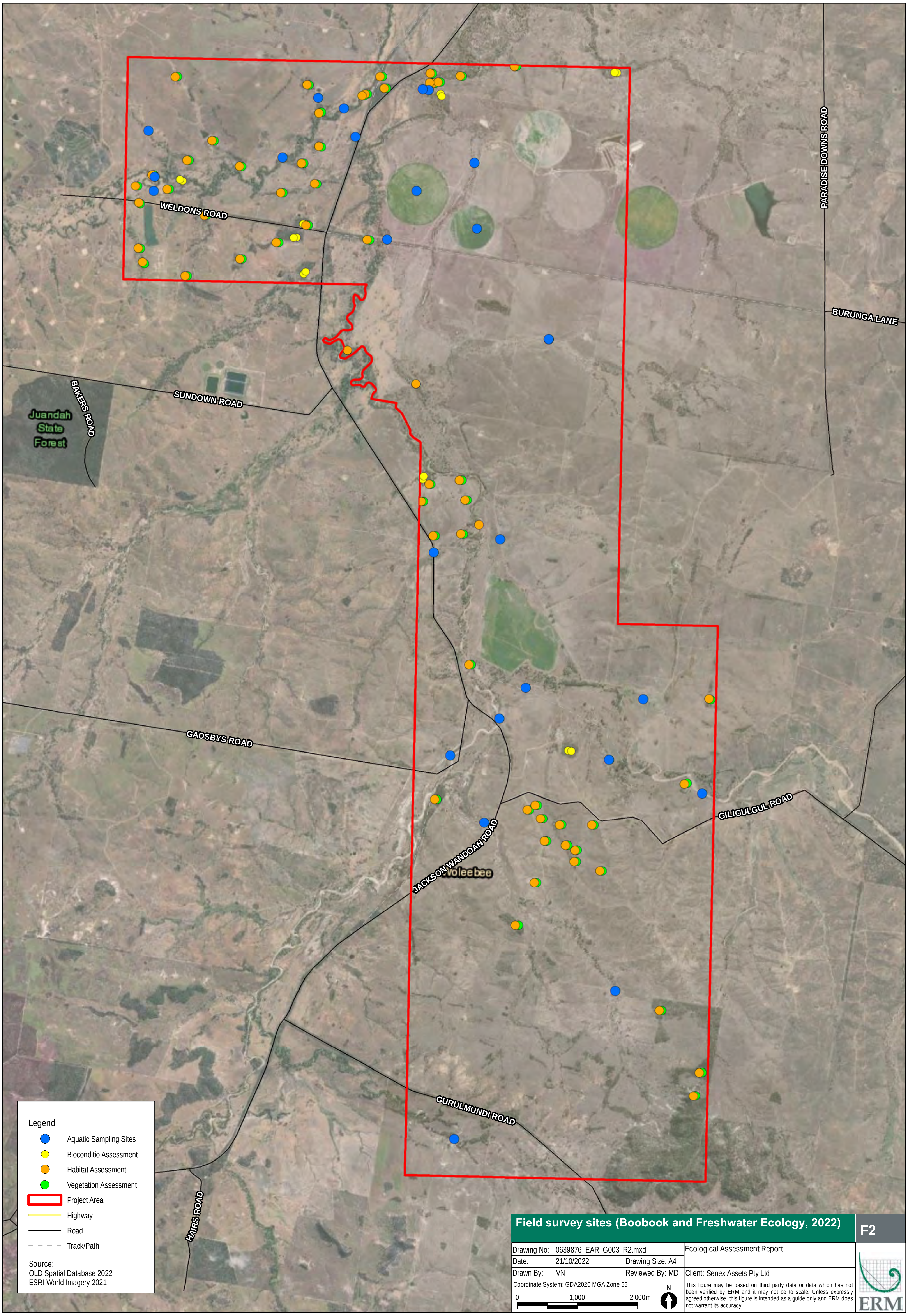
Aquatic ecology surveys and features

Details on the surface water ecology of the Project Area have been informed by field surveys and assessments. The aquatic ecology sampling was undertaken by Freshwater Ecology from the 14 - 21st of March 2022. Thirty-two sites assessed across the Project Area (**Figure 2**) and the sampling techniques used were in line with the *Monitoring and Sampling Manual: Environmental Protection (Water) Policy* (DES, 2018b). Assessments undertaken included:

- Aquatic habitat assessment (all 32 sites);
- *In situ* water quality assessment (24 sites);
- Macrophytes assessment (30 sites);
- Macroinvertebrate assessment (15 sites);
- Backpack electrofishing (13 sites);
- Fyke netting (large nets) (six sites); and
- Visual observation.

The waterways present within the Project Area are all ephemeral, with most waterways drying completely during dry periods. Very few of these waterways retaining pooling water during dry periods. At the time of the field surveys, the majority of waterways present in the Project Area had already ceased surface water flows with disconnected pools noted along the watercourses. There was some subsurface flow present at sites along most creeks that contained sandy substrates.

The gaps between water pools was often separated by open grasslands and poorly defined channels. Riparian vegetation was present and density of such vegetation varied from moderate to non-existent, with most surveys sites having relatively low vegetation present. The in-stream habitats present were concluded to be mostly of ‘fair’ condition across the majority of sites that were surveyed (17 of 24), with the remaining seven concluded to be of ‘poor’ condition.



Field survey sites (Boobook and Freshwater Ecology, 2022) F2

Drawing No: 0639876_EAR_G003_R2.mxd
Date: 21/10/2022 Drawing Size: A4
Drawn By: VN Reviewed By: MD
Coordinate System: GDA2020 MGA Zone 55

Ecological Assessment Report
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FIELD VERIFIED VEGETATION COMMUNITIES AND GROUNDWATER DEPENDENT ECOSYSTEMS

Within the Atlas Stage 3 Project Area, the majority of the terrestrial and aquatic GDEs are associated with watercourses and the adjacent alluvial plains. This includes the named creeks Woleebee Creek, Wandoan Creek, Conloi Creek and Hellhole Creek, as well as several unnamed creeks and hydrological features.

Using the terminology developed as part of the DES GDE mapping, the following potential terrestrial and aquatic GDE types have been identified as occurring within the Atlas 3 Project Area

1. Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow

2. Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow

Within the Atlas Stage 3 Project Area, these potential GDE types correspond with RE types that occur on alluvial landscapes, associated with watercourses and the adjacent floodplain areas. Based on the DES GDE mapping rule sets, these vegetation communities rely on alluvial aquifers that form from particles such as gravel, sand, silt and/or clay deposited by fluvial processes in river channels or on floodplains. These deposits store and transmit water to varying degrees through inter-granular voids, pore spaces, fractures and other weathered zones of the rock material. Typically groundwater moves laterally and is commonly discharged to the surface along the contact between two rock types.

In addition to the alluvial groundwater processes, the geology of the Surat Basin can produce significant water discharges into surrounding above ground wetlands, particularly in areas with heavy sandstone geology, notably the Precipice Sandstone in the basin’s north (Hayes, et al., 2020). The coarser grain size in these rock formations are considerably more permeable than bedrock material in surrounding geological formations and allows hydrological flows to move freely. Aquifer recharge is not uniform and is highly dependent on precipitation levels and flooding regimes. In ephemeral systems, such as those GDE’s identified in the Project Area, aquifer recharge will likely occur during alluvial inundation events, i.e. flooding.

Identified GDEs within the Project Area

The GDEs identified within the Project Area have been described in relation to three key areas (**Figure 3**), delineated based on general characteristics and condition within the Project Area :

1. North: Wandoan and Woleebee Creeks;
2. Central: Woleebee and Conloi Creeks; and
3. South: Hellhole Creeks

Field verified vegetation communities extent

All three areas are comprised of mosaics of remnant and regrowth REs of varying patch size and ecological condition. RE 11.3.25 (Forest Red Gum *Eucalyptus tereticornis* or River Red Gum *Eucalytpus camaldulensis* woodland fringing drainage lines) is the most widely abundant vegetation community identified that the potential to be a GDE, however interconnected patches of other REs are present. Historic land clearing is known to have occurred throughout the Project Area that has impacted the condition of terrestrial GDEs, particularly along creek lines and water courses. Grazing pressure is also likely to influence the ecological condition of RE patches and their value for maintaining biodiversity levels.

North: Wandoan and Woleebee Creeks

The northern section of the Project Area (Figure 3a) is dominated by RE 11.3.25 (Forest Red Gum *Eucalyptus tereticornis* woodland fringing drainage lines), however areas of RE 11.3.2 (Poplar Box *Eucalyptus populnea* woodland on alluvial plains), 11.3.27 (Freshwater wetlands: Coolabah *Eucalyptus coolabah* and/or Forest Red Gum) open woodland to woodland fringing swamps) and 11.3.17 (Poplar Box woodland with Brigalow *Acacia harpophylla* and/or Belah *Casuarina cristata* on alluvial plains) are also present in smaller more fragmented patches within a wider landscape of modified pastures, cropping and grazing land. In addition to exotic pastures, invasive species such as *Opuntia spp,* Mother-of-Millions *Bryophyllum delagoense* and Harrisia Cactus *Harrisia martini* were common throughout this section of the Project Area.

Dominant canopy tree species recorded during field surveys include *Eucalyptus spp.,* particularly Poplar Box, and Forest Red Gum. Other characteristic species associated with the RE such as Brigalow, Belah and an understory of False Sandalwood *Eremophila mitchellii* have also been confirmed to be present by field surveys and suggest at least some retention of ecological value. Average root depth for species of *Eucalyptus* present is known, based on literature reviews, to range from 9m to 22.6m, depending on the species and the interactions between geomorphology and plant physiological traits. Rooting depth of other associated species is poorly understood however assumed to be shallower than these measurements. A combination of remnant and advanced regrowth is present within the northern area with remnant vegetation dominating the REs within the northern areas.

Riparian zones within the Project Area were largely intact, with Woleebee Creek having the widest remnant, riparian zone in relation to the surrounding vegetation patches. It should be noted that many REs have been identified to be in degraded quality and situated adjacent to endangered vegetation communities. Although the relative reliance on groundwater could not be identified for some of these dominant species, it is likely that the *Eucalyptus* species present in these riparian zones are likely to be sensitive to changes in ground water availability. For other dominant flora species, such as Brigalow and Belah, at least an indirect reliance on groundwater availability through water discharge should be assumed.

Central: Woleebee Creeks and Conloi Creeks

The mapped GDEs within the central area (Figure 3b) are also dominated by RE 11.3.25 (Forest Red Gum woodland fringing drainage lines). These patches have been confirmed to largely be remnant communities although some regrowth is also present. Forest Red Gum woodlands fringing water courses are confirmed to be present following field surveys with other *Eucalyptus spp.* Such as Poplar Box and Silver-leaved Ironbark *Eucalyptus melanophloia* also present throughout the area.

Unlike the northern area, REs that occur in riparian zones and on alluvium in the centre of the Project Area are considerably smaller in size and influenced by increased fragmentation. This will place considerably higher pressures on ecosystem condition with grazing and exotic pasture species likely to negatively impact recruitment, species diversity and structural complexity..

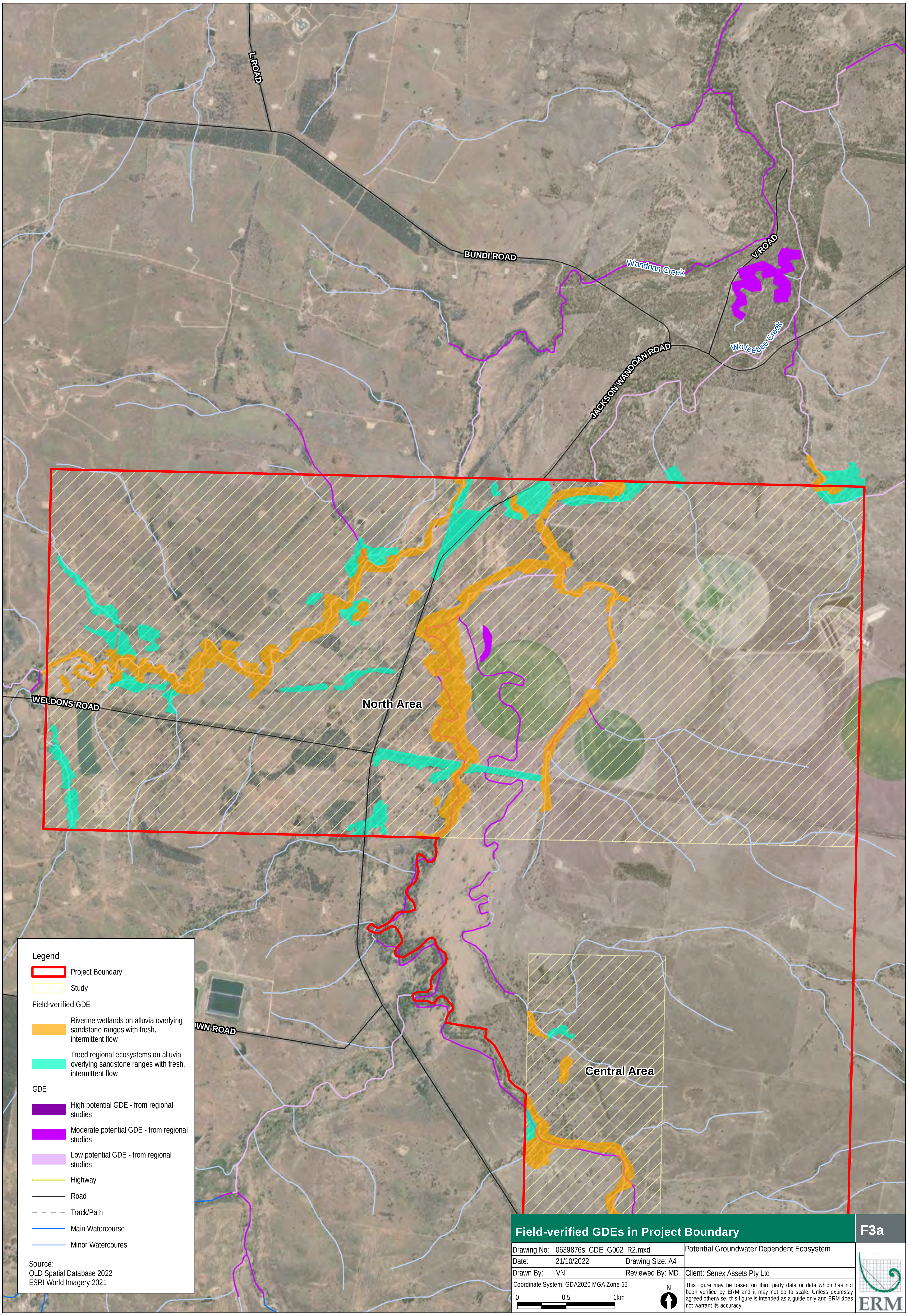
Riparian vegetation offers opportunities for landscape connectivity with Hinchley and Juandah State Forest to the west outside of the Project Area and Gurulmundi State Forest and Stones Country Resources Reserve located in the south of the Project Area. The existing riparian and alluvial vegetation communities in this area supports species dispersal throughout the landscape and provides connectivity between the State Forest areas.

The dominant tree species in this section of the Project Area are again *Eucalyptus spp.,* with Forest Red Gum, Poplar Box and Silver-leaved Ironbark the most common species. The known rooting depth for these species, as identified from literature reviews, has been identified at between 9m and 22.6m with a reliance on groundwater known for at least Forest Red Gum. High threat invasive species have also been observed that may threaten the long-term ecological condition if propagule pressure is too high.

Southern: Hellhole Creek

The southern area (Figure 3c) is dominated almost exclusively with RE 11.3.25 (Forest Red Gum woodland fringing drainage lines). A combination of regrowth and remnant vegetation is found in the southern area with the majority of patches confirmed to be remnant. Much like the central area, many patches found in the southern area are highly fragmented and restricted to thin bands of riparian vegetation. This likely increases sensitivity to ecological pressures and inhibits the functional capabilities and recruitment potential of the patch.

Those that remain connected with continuous vegetation were found to contain a higher flora species richness across all community structures and more closely aligned with species assemblages associated with the RE. Dominated by Forest Red Gum and Poplar Box, these patches will be highly reliant on the availability of groundwater, when above groundwater is not present, and sensitive to changes in its availability.


L ROAD
BUNDI ROAD
Wandoan Creek
V ROAD
Woleebee Creek
JACKSON WANDOAN ROAD
WELDONS ROAD
North Area
Central Area
DOWN ROAD
Legend
Project Boundary
Study
Field-verified GDE
Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow
Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow
GDE
High potential GDE - from regional studies
Moderate potential GDE - from regional studies
Low potential GDE - from regional studies
Highway
Road
Track/Path
Main Watercourse
Minor Watercoures
Source:
QLD Spatial Database 2022
ESRI World Imagery 2021
Field-verified GDEs in Project Boundary
F3a
Drawing No: 0639876s_GDE_G002_R2.mxd
Date: 21/10/2022
Drawing Size: A4
Drawn By: VN
Reviewed By: MD
Coordinate System: GDA2020 MGA Zone 55
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Potential Groundwater Dependent Ecosystem
Client: Senex Assets Pty Ltd
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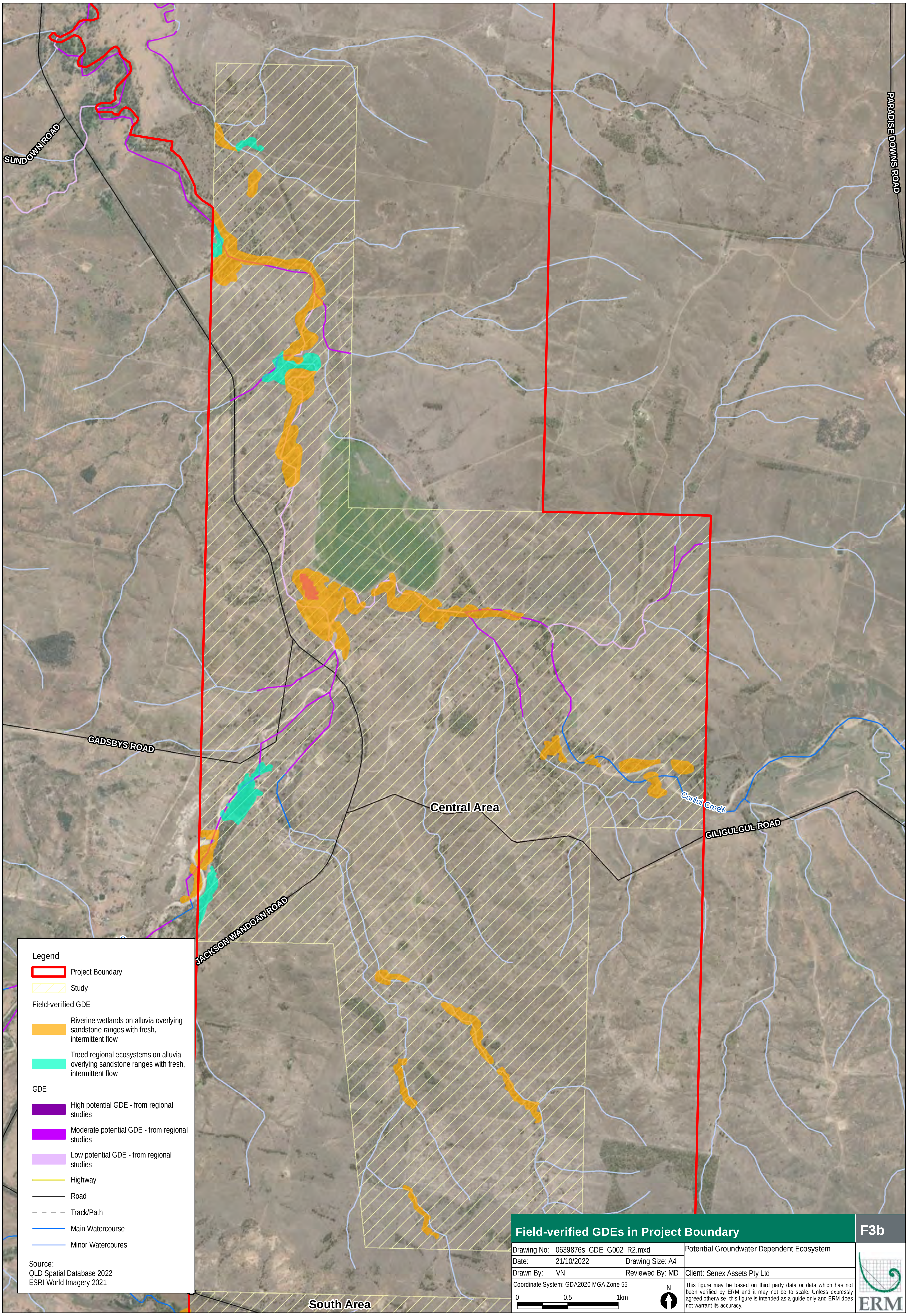
SUNDOWN ROAD
PARADISE DOWNS ROAD
GADSBYS ROAD
Central Area
Conloi Creek
GILIGULGUL ROAD
JACKSON WANDOAN ROAD
South Area
Legend
Project Boundary
Study
Field-verified GDE
Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow
Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow
GDE
High potential GDE - from regional studies
Moderate potential GDE - from regional studies
Low potential GDE - from regional studies
Highway
Road
Track/Path
Main Watercourse
Minor Watercoures
Source:
QLD Spatial Database 2022
ESRI World Imagery 2021
Field-verified GDEs in Project Boundary
F3b
Drawing No: 0639876s_GDE_G002_R2.mxd
Date: 21/10/2022
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Reviewed By: MD
Potential Groundwater Dependent Ecosystem
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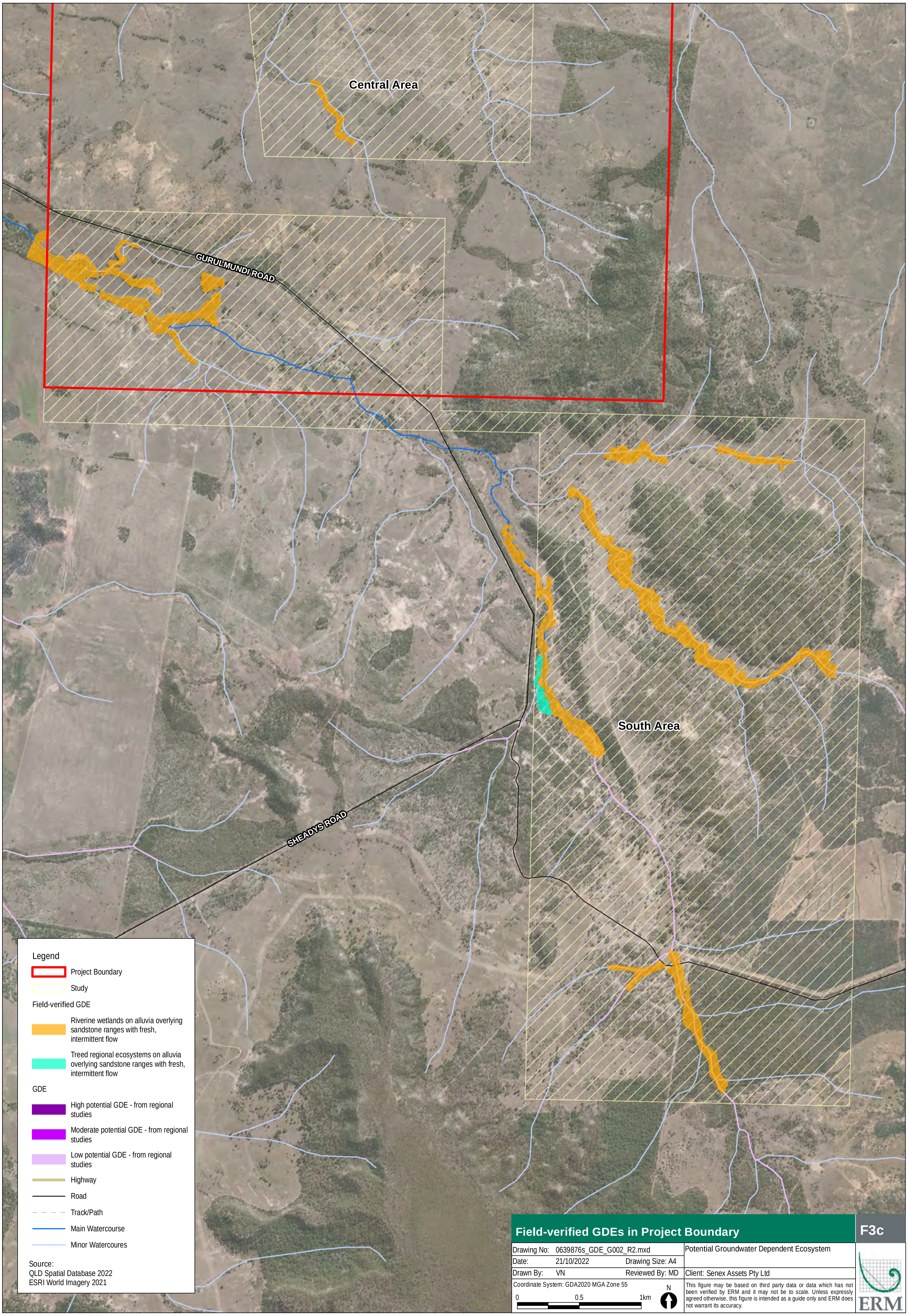
Central Area
GURULMUNDI ROAD
South Area
SHEADYS ROAD
Legend
Project Boundary
Study
Field-verified GDE
Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow
Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow
GDE
High potential GDE - from regional studies
Moderate potential GDE - from regional studies
Low potential GDE - from regional studies
Highway
Road
Track/Path
Main Watercourse
Minor Watercoures
Source:
QLD Spatial Database 2022
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Field verified GDE vegetation communities and condition

RE 11.3.2 Eucalyptus populnea woodland on alluvial plains

Regional Ecosystem 11.3.2 is listed as Of Concern under the QLD *Vegetation Management Act 1999* (Vegetation Management Act 1999, 2019) (VM Act) This vegetation community also meets the definition of the endangered threatened ecological community Poplar Box grassy woodland on alluvial plains, listed under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act).

The RE also provides potential habitat for threatened species including Belson's Panic *Homopholis belsonii*, Koala *Phascolarctos cinereus* and Greater Glider (*Petauroides volans*) (Smith & Smith, 2018; Sullivan, Norris, & Baxter, 2003). Poplar Box is the dominant flora species associated with Regional Ecosystem 11.3.2.

A secondary tree layer may occur in this RE with species such as Doolan *Acacia salicina,* False Sandalwood and Leichhardt Bean *Cassia brewsteri.* Tussock grasses dominate the ground layer with *Chloris, Enteropogon* and *Aristida* species common. Associated with alluvial plains and dryland ecosystems, Poplar Box and allied flora species are restricted to areas with more reliable water availability. Having been identified to produce an extensive root system and rely on the availability of groundwater reservoirs (Kath, et al., 2014), the health of this regional ecosystem is likely to be influenced by the availability of groundwater in the alluvial strata.

Photograph 1 Representative photographs of Regional Ecosystem 11.3.2

RE 11.3.17 Eucalyptus populnea woodland with Acacia harpophylla and/or Casuarina cristata on alluvial plain

Regional Ecosystem 11.3.17 is listed as Of Concern under the VM Act and also provides habitat for threatened species such as the Koala, Greater Glider and Belson's Panic (Smith & Smith, 2018).

The dominant flora species include Poplar Box, Brigalow) and Belah. A shrub layer and lower shrub layer are usually present of species such as False Sandalwood, Wilga *Geijera parviflora* and Yarran *Acacia melvillei.*

A ground layer is present dominated by tussock grasses including Red Grass *Bothriochloa decipiens,* Purple Wire Grass *Aristida ramosa* and Curly Windmill Grass *Enteropogon acicularis.* While Poplar Box has been identified as utilising groundwater sources, the rooting depth and subsequent groundwater dependence is unknown for both Brigalow and Belah. Suckering from extensive lateral root growth is a common habit in Brigalow, particularly in response to water scarcity, however it is unknown how these structural characteristics influence groundwater usage.

Other species of *Casuarina* are known to produce extensive root systems capable of accessing groundwater aquifers. Considering the physiological similarities and size in which Belah is known to reach, it is likely that similar evolutionary traits may be present.

Photograph 2 Representative photographs of regional ecosystem 11.3.17

RE 11.3.19 Callitris glaucophylla, Corymbia spp. and/or Eucalyptus melanophloia woodland on Cainozoic alluvial plains

Regional Ecosystem 11.3.19 is listed as Least Concern under the VM Act, however it can provide habitat for a number of threatened species such as the flora species *Fimbristylis vagans* and *Vittadinia decora.*

White Cypress Pine woodlands are usually codominant with *Eucalypts* such as Carbeen *Corymbia tessellaris* that form well-defined but discontinuous open forest to woodland canopies. Other trees such as Rough-barked Apple *Angophora melanoxylon* or Poplar Box may occur as emergent trees. Scattered tall shrubs such as Ironwood *Acacia excelsa,* Quinine Bush *Alstonia constricta* and White Cypress Pine are often present. A ground layer is sparse to dense in relation to the tree density and consists predominantly of grasses such as Black Spear-grass *Herteropogon contortus, Erichne helmsii* and Comet Grass *Perotis rara.* Forb diversity is relatively low but may become seasonally prominent. Occurring in deep soils on rises and the alluvial plains of major river systems there is likely to be at least some reliance on groundwater by Silver-leaved Ironbark and *Corymbia spp.* based on morphological similarities to closely related species such as River Red Gum. White Cypress Pine is known to have a concentrated root system restricted to surface soils that limits the species capacity to access deep aquifers (Thompson & Eldridge, 2005).

High soil permeability arising from sandstone geology establishes free draining conditions desired by the species. Intolerances of extended droughts and inundation suggest that this RE type is can be reliant on the availability of water from shallow underground aquifers, alluvium and above ground water.

RE 11.3.25 Eucalyptus tereticornis or E. camaldulensis woodland fringing drainage lines

Regional Ecosystem 11.3.25 is listed as Least Concern under the VM Act, however it can be associated with high fauna species richness and provides critical habitat for threatened fauna species such as the Koala and Greater Glider (Smith & Smith, 2018; Sullivan, Norris, & Baxter, 2003).

Both River Red Gum and Forest Red Gum provide critical habitat structures to fauna, such as tree hollows, and are important for regulating ecological functions in dryland and wetland systems. Other trees such as River Oak *Casuarina cunninghamiana* and Black Tea-tree *Melaleuca bracteata* may also occur. A tall shrub layer is usually present that includes species such as Doolan, River Myall *Acacia stenophylla* and Queensland Ebony *Lysiphyllum carronii.*

Lower shrubs are sometimes present but rarely form a distinctive layer. The ground layer is open to sparse and dominated by perennial grasses, sedges and forbs. Several vegetation communities make up this RE and species diversity is known to vary between communities. In addition to the two dominant canopy species, others such as *Melaleuca, Corymbia, Casuarina* species may also be present.

This RE can include both ephemeral and permanent wetlands and so aquatic vegetation will vary depending on the presence of permanent, open water however none of these areas were recorded and mapped within the Project Area. Both dominant flora species in this RE are known to produce deep root systems (See Table 3-1) and rely on groundwater aquifers for survival. In the case of River Red Gum, high tolerance to saline groundwater is particularly important (Mensforth, Thorburn, Tyerman, & Walker, 1994). *E. camaldulensis* is commonly found along ephemeral wetlands with variable flooding regimes. The availability of underground aquifers, particularly in alluvial layers are likely to be important for maintaining ecosystem health for areas RE 11.3.25.

Figure 3-3: Representative photographs of regional ecosystem 11.3.25

RE 11.3.27 Freshwater Wetlands

RE 11.3.27 is classified as freshwater palustrine wetlands that occur in a variety of situations including lakes, billabongs, oxbows and depressions on floodplains. It is listed as Least Concern under the VM Act. Vegetation structure and diversity is highly variable throughout the RE with a variety of associated vegetation communities, including open water aquatic species, fringing sedgelands and eucalypt woodlands. Species diversity also varies considerably between communities driven largely by the permanence of water bodies.

Eucalyptus species are common, and *Acacia, Melaleuca* and a range of other species may also be present. Species found in ground layers is variable however *Cyperus, Chloris* and *Phragmites australis* are common. Woodlands comprised of *E. camaldulensis* and/or *E. tereticornis* are likely to directly depend on groundwater at least seasonally, especially when situated along ephemeral drainage lines and creeks, or alluvial flood plains.

Aquatic vegetation in drainage channels in the Project Area are also likely to be indirectly reliant on groundwater systems that provide discharge to above ground wetlands and maintain soil moisture and hydrological flow. Aqautic macrophyte cover, including some floating species and emergent sedges was generally low across the Project Area, reflecting the ephemeral nature of the watercourses.

Vegetation communities dominated by *Eucalyptus* is likely to provide suitable habitat to threatened species such as the Koala and Greater Glider (Smith & Smith, 2018; Sullivan, Norris, & Baxter, 2003). Habitat structures, such as tree hollows, will also be a critical resources for hollow dependent fauna.

Photograph 3 Representative photographs of regional ecosystem 11.3.27

Tree rooting depth

A review of available literature on tree rooting depth for those dominant species present in each of the ground-truthed REs has been completed to understand how dependent these species may be on groundwater (Table 3-1).

The depth of root growth is not known for most native trees and estimates that have been presented are based on the literature referenced in Table 3-1. The depth of the root zone will be largely dependent on abiotic environmental conditions such as soil depth, fluctuations in seasonal rainfall and flooding regimes.

Table 0-1 Potential GDEs, vegetation description and tree rooting depth

Regional Ecosystem Code and name	GDE type	Dominant flora species	Field verified condition	Groundwater dependence and rooting depth
11.3.2 *Eucalyptus populnea* woodland on alluvial plains	Treed regional ecosystems on alluvial overlying sandstone ranges with fresh, intermittent flow	Poplar Box *Eucalyptus populnea*	Majority of this RE and potential GDE is in a remnant condition. Occurs on alluvial plains adjacent to riparian vegetation.	12.6 - 22.6m (Kath, et al., 2014) for Poplar Box
11.3.17 *Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plain	Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow	Poplar Box Brigalow *Acacia harpophylla* Belah *Casuarina cristata*	Identified as majority remnant vegetation and occurs on adjacent alluvial floodplains, usually connected to the adjacent riparian zone.	Poplar Box - 12.6-22.6m (Kath, et al., 2014) Brigalow - Unknown Belah - Unknown
11.3.19 *Callitris glaucophylla*, *Corymbia spp.* and/or *Eucalyptus melanophloia* woodland on Cainozoic alluvial plains	Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow	White Cypress Pine *Callitris glaucophylla*; *Corymbia spp.* And/or Silver-leaved Ironbark *Eucalypus melanophloia*	Occurs on alluvial floodplains adjacent to riparian zone	Up to 6m (*Callitris glaucophylla*) (Eberbach, 2003) Silver-leaved Ironbark - Unknown but likely potential to be similar to Forest Red Gum
11.3.25 *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow	Forest Red Gum	Largely confined to fringing riparian vegetation along watercourse and is the most common RE and GDE type within the Project Area. Varying condition, ranging from advanced regrowth to remnant.	At least 9m and assumed to reach groundwater reservoirs (Forest Red Gum) (Ausecology Pty Ltd, 2018) 12.1 - 22.6m (*E. camaldulensis*) (Jones, et al., 2020)

Regional Ecosystem Code and name	GDE type	Dominant flora species	Field verified condition	Groundwater dependence and rooting depth
11.3.27 Freshwater Wetlands	Riverine wetlands on alluvia overlying sandstone ranges with fresh, intermittent flow	Variable freshwater vegetation ranging from open water to fringing sedgelands and eucalypt woodlands. Forest Red Gum	Occurs largely in closed depressions or oxbows adjacent to watercourses or on adjacent alluvial plains.	*Eucalyptus camaldulensis*- 12.1-22.6m (Jones, et al., 2020) Forest Red Gum- at least 9m (Ausecology Pty Ltd, 2018) *Eucalyptus coolabah*- possibly at least 7-8m (Costelloe, 2016)

MAPPED POTENTIAL GDE WITHIN THE 25KM BUFFER ZONE

Desktop studies have identified a higher diversity of potential terrestrial GDE within the surrounding 25km buffer area with a total of 18 REs mapped as overlapping with the Queensland GDE mapping (**Figure 4**). These vegetation communities can be categorised into three broad groups based on functional ecosystem characteristics:

1. Deep rooted treed regional ecosystems
2. Riverine Wetlands
3. Treed regional ecosystems associated with intermittent flow

These GDE display a scattered distribution throughout the landscape and their presence will likely be influenced strongly by historic land use practices.

Deep rooted treed regional ecosystems

These GDE collectively cover the greatest area throughout the 25km buffer zone. With many being connected to aquifers, some of the deep rooted REs present are likely to be less reliant on riparian zone alluvium with many appearing to persist in the landscape between waterways. Currently these GDE are clustered towards the southern end of the project buffer zone and are prominent around nearby state forests and patches of continuous vegetation not mapped as GDE.

It is likely that these GDE were historically present across the landscape covered by the project boundary but historical impacts associated with grazing and land clearing have likely reduced their distribution throughout the buffer. Like those GDE within the project boundary, these GDE are likely to be dominated by *Eucalyptus spp* and highly valuable habitat for a range of species. With large patches still present in parts of the landscape, it can be expected that a higher species diversity and variable vegetation structure will have been retained.

Riverine Wetlands

Those GDE classified as riverine wetlands show a broader collective distribution throughout the project boundaries buffer zone, despite occupying smaller areas. As expected of wetland ecosystems, riverine wetlands are isolated along creek lines and are found throughout the 25km buffer zone. Riverine wetlands are virtually absent from the western side of the project boundary however this may simply be an indication of historic land clearing rather than unsuitable conditions for the GDE.

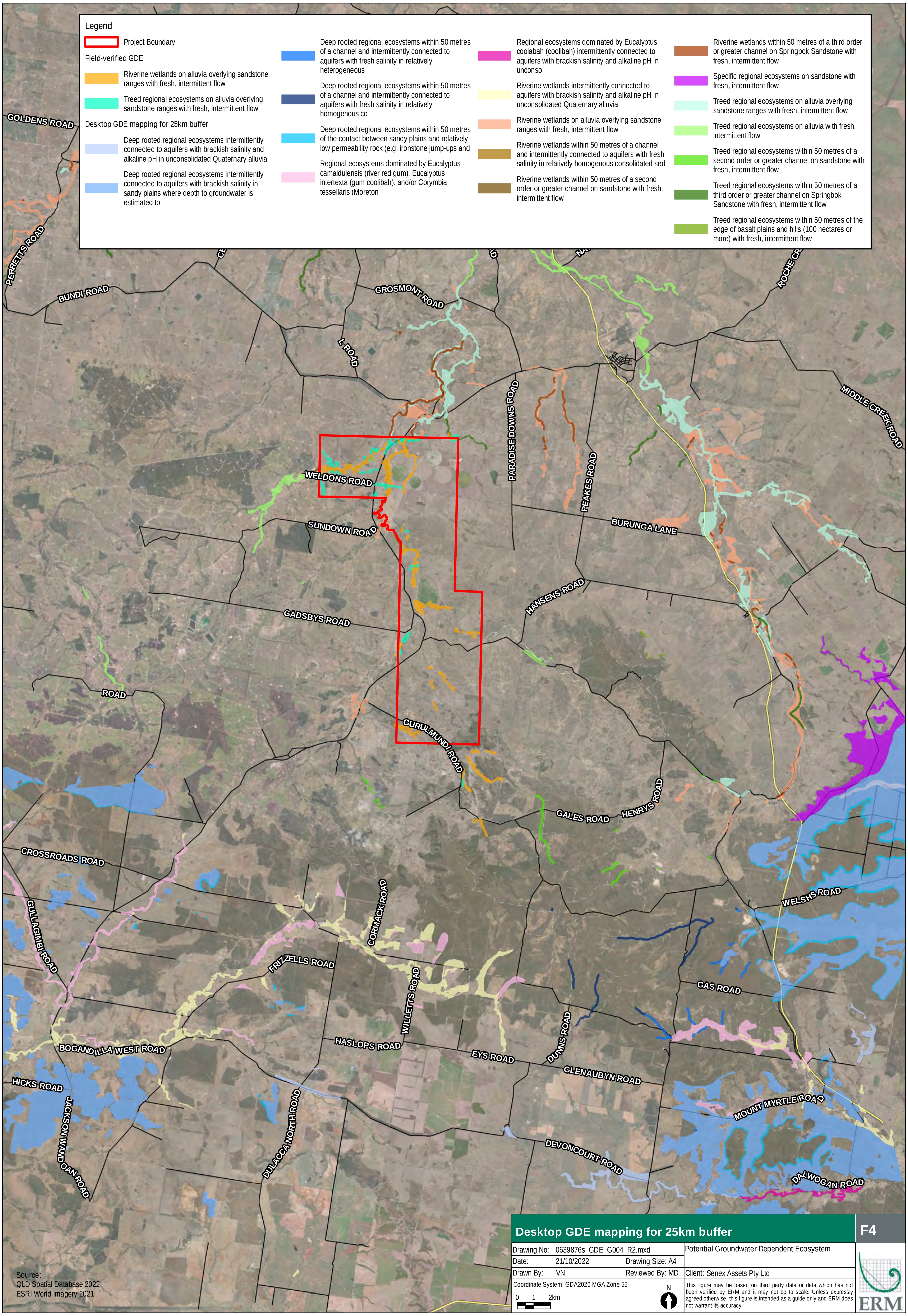
Intact riparian zones show evidence of good ecosystem health with large portions of riverine wetlands forming contiguous patches with relatively good connectivity. Treed regional ecosystems on alluvia overlying sandstone ranges with fresh, intermittent flow in particular appear to be connecting GDE in the north area to the surrounding landscape. With GDE within the project boundary known to potentially provide habitat for threatened species, such as the Koala and Greater Glider, any connectivity through cleared landscapes will likely hold disproportionately large benefits to biodiversity in comparison to patch size. While currently not confirmed with ground-truthing, these riparian zones are likely to be dominated by similar species found in those GDE surveyed within the project boundary. Thus it can be expected that Poplar Box, Rive rRed Gum and Silver-leaved Ironbark will be present in the canopy throughout these GDE.

Some fragmentation is still present within individual GDE, particularly those situated in the northern half of the buffer zone. These fragments are likely connected via creek lines, however the lack of continuous vegetation will likely decrease ecosystem function and, without regrowth or continued recruitment, patches may be at risk to the same disturbance processes known within the project boundary (Grazing, exotic species and limited recruitment potential). Although a largely intact canopy appears to be present, it is unclear to what extent recruitment or expected understory structure is present. With variable structural diversity known from GDE within the project boundary, it can be expected that similar conditions will be present.

Treed regional ecosystems associated with intermittent flow

The remaining GDE present are collectively the most fragmented vegetation communities present throughout the 25km buffer area. Small isolated patches can be found scattered throughout the southern half of the buffer zone. While multiple different GDEs are represented throughout the buffer zone, they are typically small in size with little to no other representative patches present throughout the buffer. The long term persistence of these patches is potentially impacted as a result of fragmentation however flooding regimes may assist populations in dispersal and downstream recruitment. Proximity to continuous vegetation, particularly in state forests, may buffer patches from continued decline. Much like the riverine wetland GDE, the highly fragmented nature of these GDE may not be a reflection of unsuitable conditions but rather a result of historic landscape disturbances associated with land use.

The largest patch of treed GDE can be found directly north of the project boundary and is dominated by treed regional ecosystems on alluvia with fresh intermittent flow. This extensive riparian zone connects two major clusters of GDE types one of which is the diverse vegetation communities found in the north area of the project boundary. Based on the predicted areas produced by state GDE mapping, these GDE appear to provide large areas of riparian zones and are the dominant clusters of dense vegetation in the immediate landscape. Some gaps appear along major water courses in state mapping however it is unclear if this is a reflection of ground-truthed changes in vegetation structure at the local scale or a limitation in the spatial layers sensitivity.



Desktop GDE mapping for 25km buffer

F4

Drawing No: 0639876s_GDE_G004_R2.mxd		Potential Groundwater Dependent Ecosystem
Date: 21/10/2022	Drawing Size: A4	
Drawn By: VN	Reviewed By: MD	Client: Senex Assets Pty Ltd
Coordinate System: GDA2020 MGA Zone 55		This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

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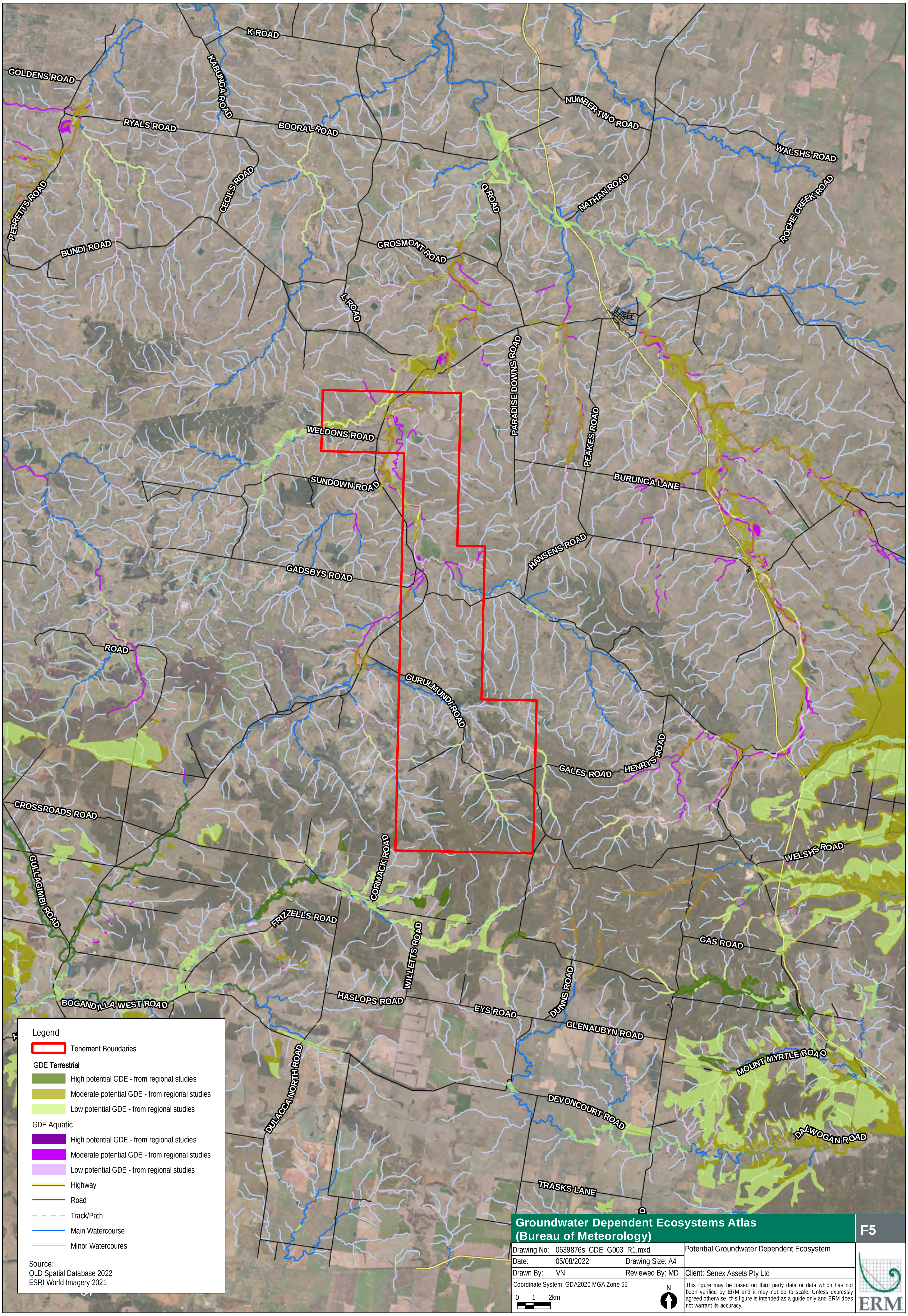
COMMONWEALTH MAPPING OF TERRESTRIAL AND AQUATIC GDE

Commonwealth mapping of aquatic and terrestrial GDE within the 25km buffer from the Atlas Stage 3 Gas Project tenements boundaries, shows that considerable overlapping with Queensland state mapping is present (**Figure 5**). GDE remain heavily associated with riparian zones and other waterways outside of protected state forests. Fragmentation is still apparent in Commonwealth mapping and is likely to result from a combination of historic disturbance regimes and natural geomorphological processes.


K ROAD
GOLDENS ROAD
KABUNGA ROAD
RYALS ROAD
BOORAL ROAD
NUMBER TWO ROAD
WALSHS ROAD
PERRETTS ROAD
CECILS ROAD
O ROAD
NATHAN ROAD
ROCHE CREEK ROAD
BUNDI ROAD
GROSMONT ROAD
L ROAD
PARADISE DOWNS ROAD
PEAKES ROAD
WELDONS ROAD
SUNDOWN ROAD
BURUNGA LANE
HANSENS ROAD
GADSBYS ROAD
ROAD
CURULMUNDI ROAD
GALES ROAD
HENRYS ROAD
CROSSROADS ROAD
CORMACK ROAD
WELSHS ROAD
GULLAGIMBI ROAD
FRIZZELLS ROAD
WILLETTS ROAD
GAS ROAD
DUNNS ROAD
BOGANDILLA WEST ROAD
HASLOPS ROAD
EYS ROAD
GLENAUBYN ROAD
DULACCA NORTH ROAD
MOUNT MYRTLE ROAD
DEVONCOURT ROAD
DALWOGAN ROAD
TRASKS LANE
Legend
Tenement Boundaries
GDE Terrestrial
High potential GDE - from regional studies
Moderate potential GDE - from regional studies
Low potential GDE - from regional studies
GDE Aquatic
High potential GDE - from regional studies
Moderate potential GDE - from regional studies
Low potential GDE - from regional studies
Highway
Road
Track/Path
Main Watercourse
Minor Watercoures
Source:
QLD Spatial Database 2022
ESRI World Imagery 2021
Groundwater Dependent Ecosystems Atlas
(Bureau of Meteorology)
F5
Drawing No: 0639876s_GDE_G003_R1.mxd
Date: 05/08/2022
Drawing Size: A4
Drawn By: VN
Reviewed By: MD
Potential Groundwater Dependent Ecosystem
Client: Senex Assets Pty Ltd
Coordinate System: GDA2020 MGA Zone 55
0 1 2km
N
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
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