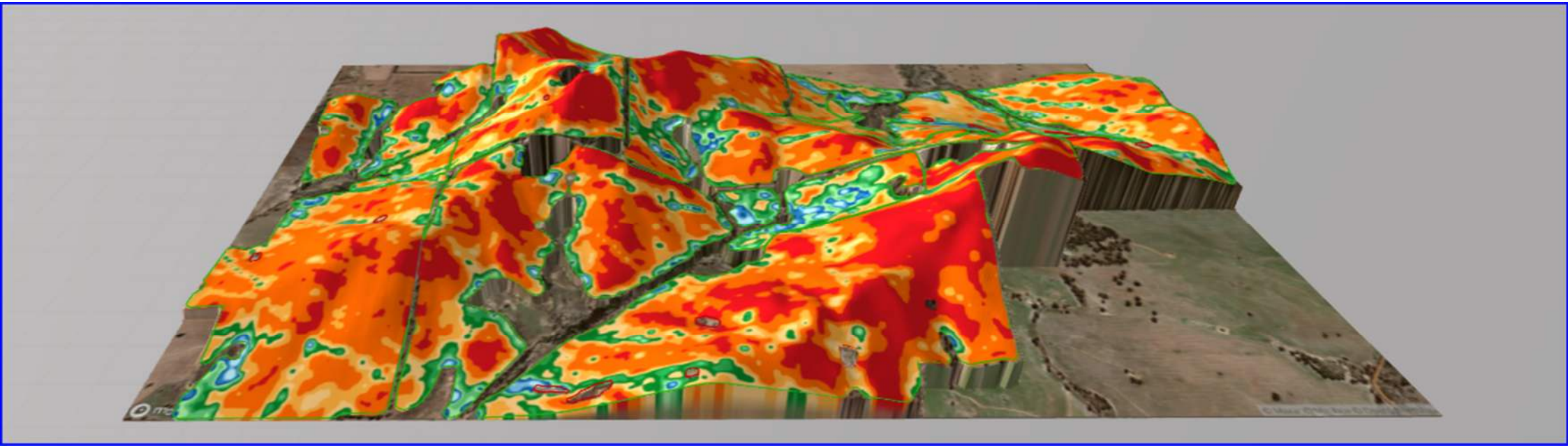


Role of EM and gamma radiometric surveys in WA agriculture

Aidan Sinnott

VRT SOLUTIONS

BACKGROUND

- EM and GR surveys conducted in WA since 2005
- Precision Agronomics pioneered soil surveys in WA
- VRT Solutions first acquired soil surveying equipment in 2019
- Each year increasing soil surveying equipment inventory

Equipment:

5 x dedicated soil survey vehicles
5 x Electromagnetic induction sensors
5 x Gamma Radiometric crystals
3 x dedicated soil sampling vehicles
John Deere GPS equipment
8 (?) x Christies Engineering soil sampling machines

Who

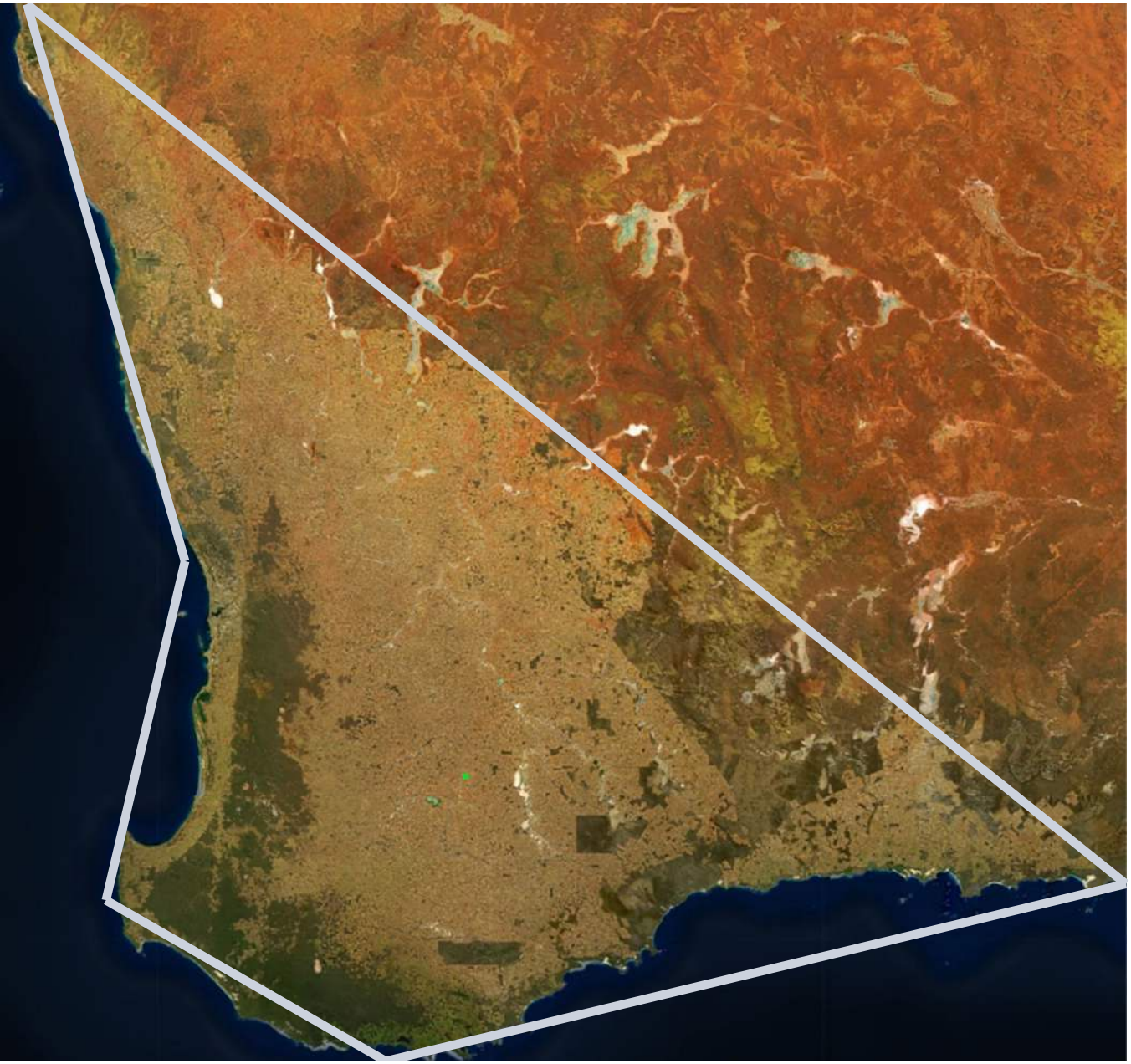
<u>“Core” team:</u>

David Caporn
Jordan White
Michael Milverton
Ari Milverton
Sacha Zaccaria
Brett Williamson
Aidan Sinnott

Ceres Agronomy (Nicky Tesoriero)
Esperance Private Agronomy (Sean Randall)

Connections with many agronomists around WA Wheatbelt

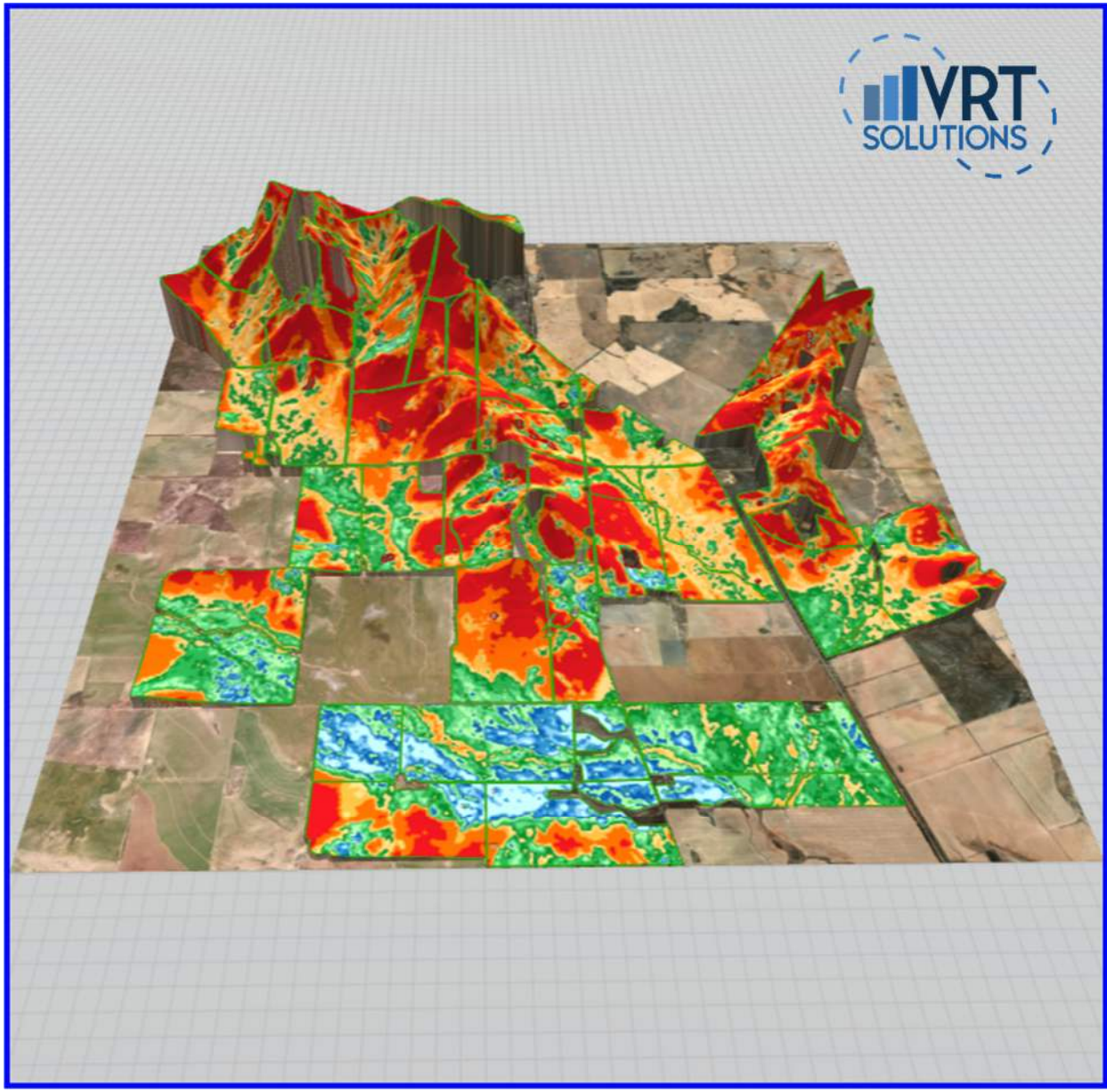
Core Business
Soil surveys - EM, gamma radiometrics
PA Consultancy
Yield data
Biomass
Soil sampling
Soil results interpretation
Nutritional / agronomic advice
VR Prescription development
VR Prescription implementation



Where?

Why?

- Scientific methodology
- Statistical - not emotional
- High resolution - soil variability management
- Deep soil sampling and testing
- Semi-permanent soil records to reference
- Reduces seasonality, risk limitation
- Optimises time / labour
- Optimises inputs
- Optimises resources – equipment / vehicles
- VR maps tractor ready, easy user utilisation



SOIL SENSORS : EM AND GAMMA RADIOMETRICS

EM – Electromagnetic induction

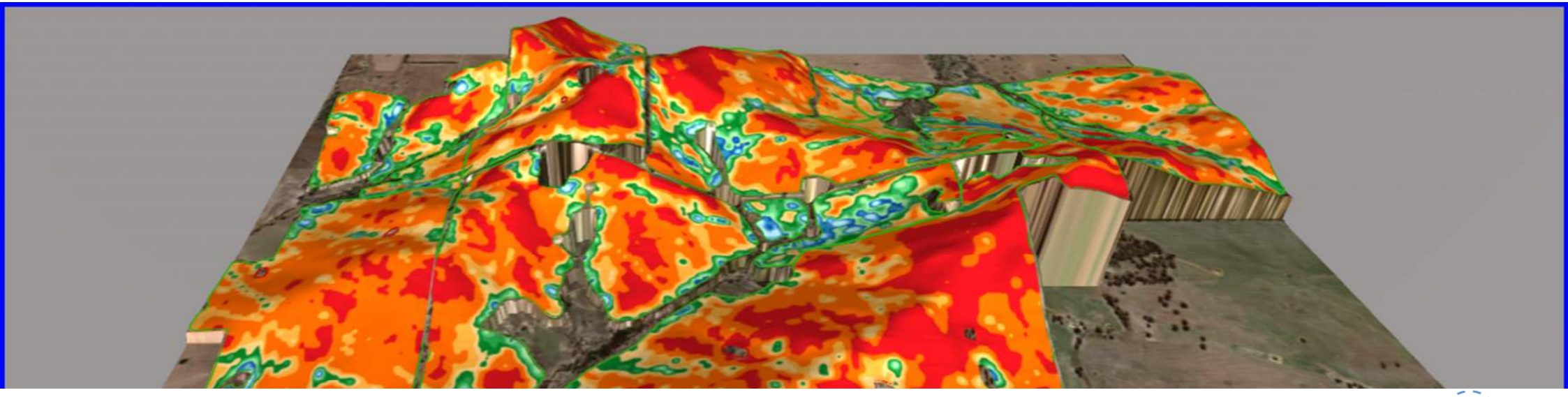
Influenced by:

- Salt concentration
- Clay content
- Moisture
- Metal

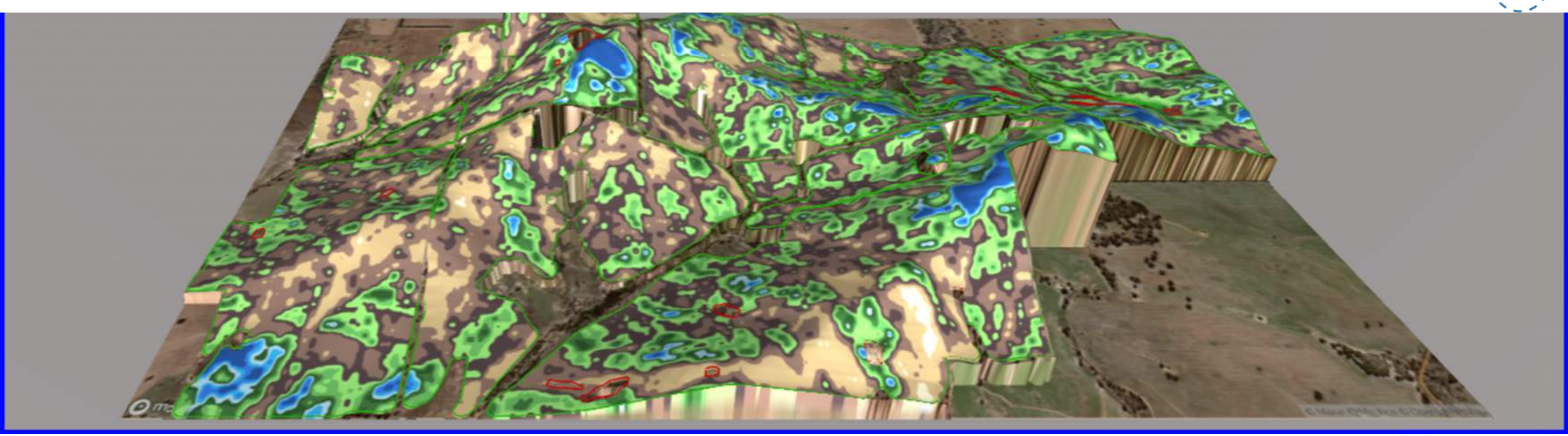
GR – Gamma radiometrics

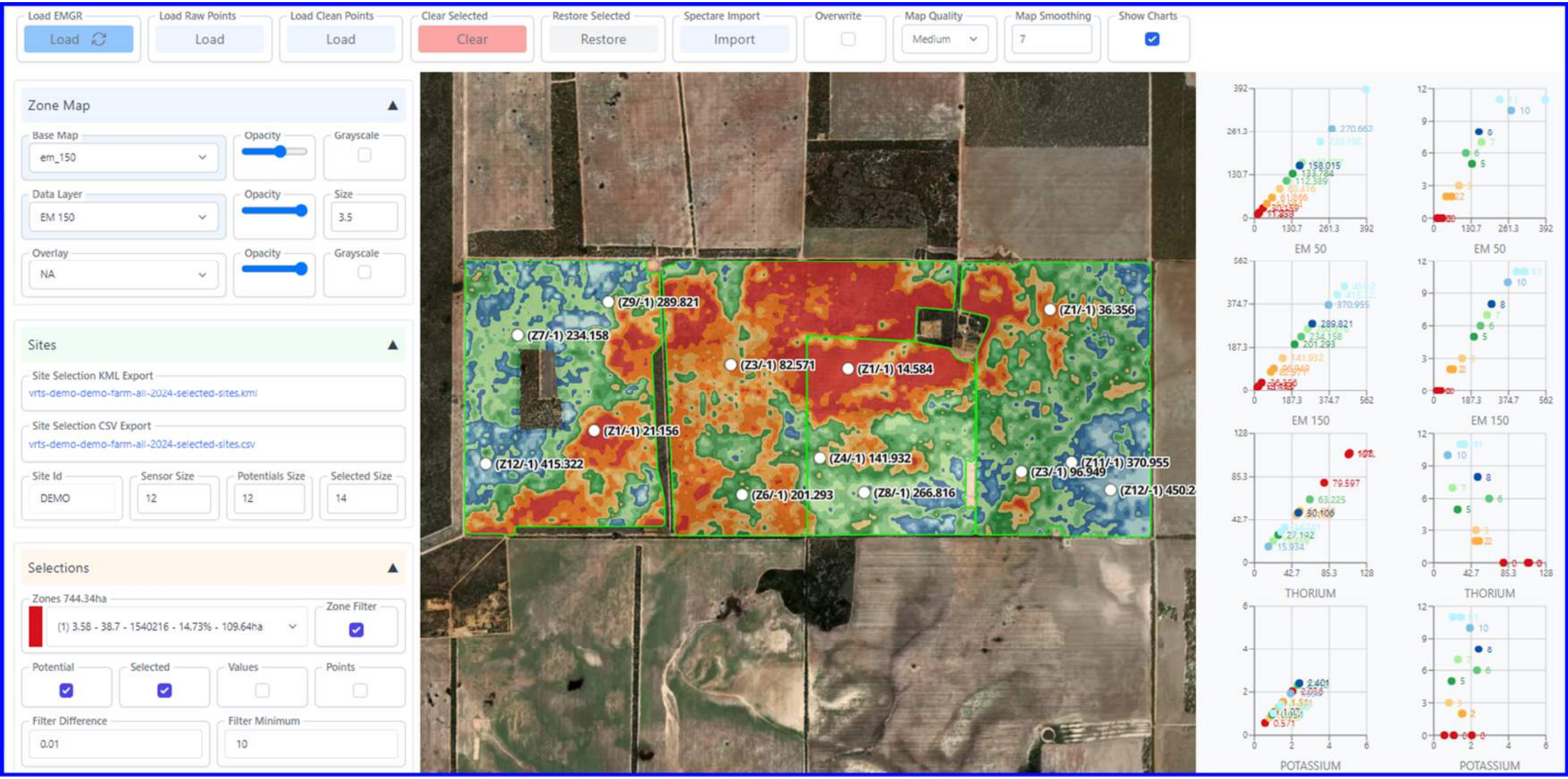
Influenced by:

- Moisture
- Gravel / rock concentrations
- Soil texture/ clay content
- Mineralogy



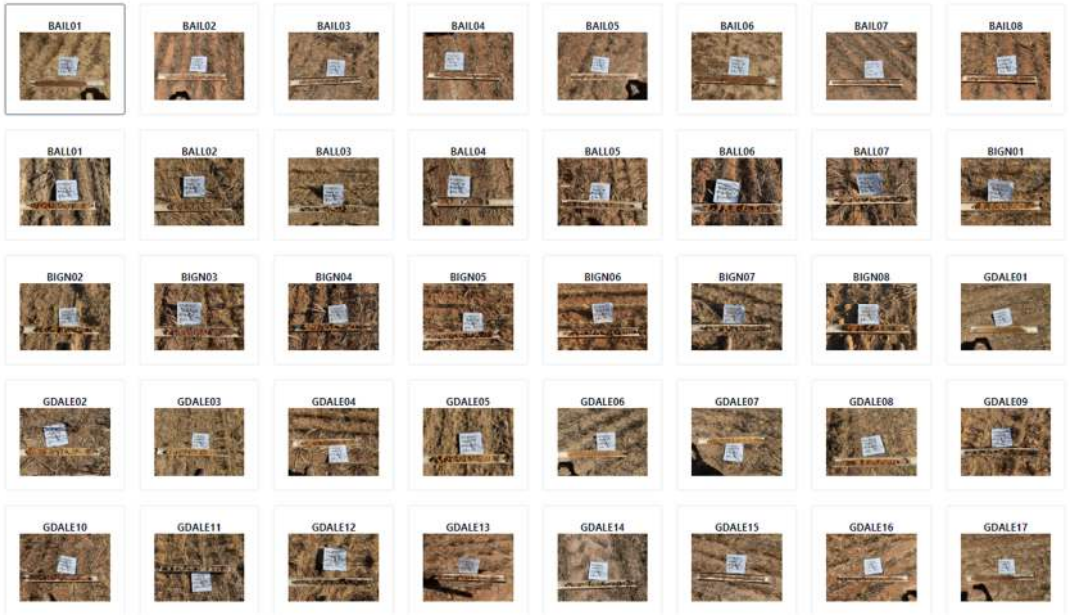
DATA PROCESSING

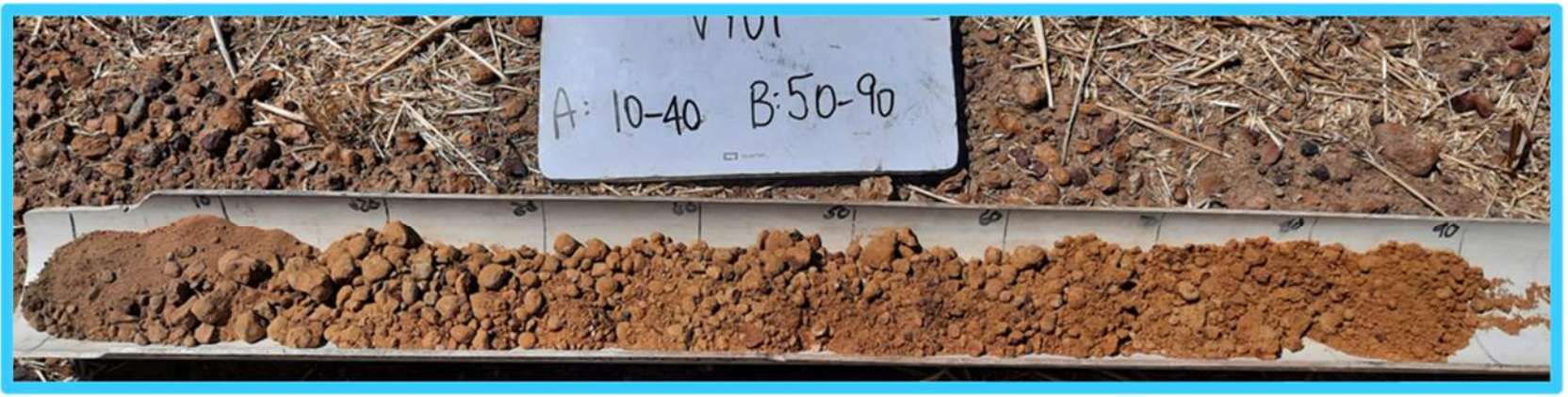


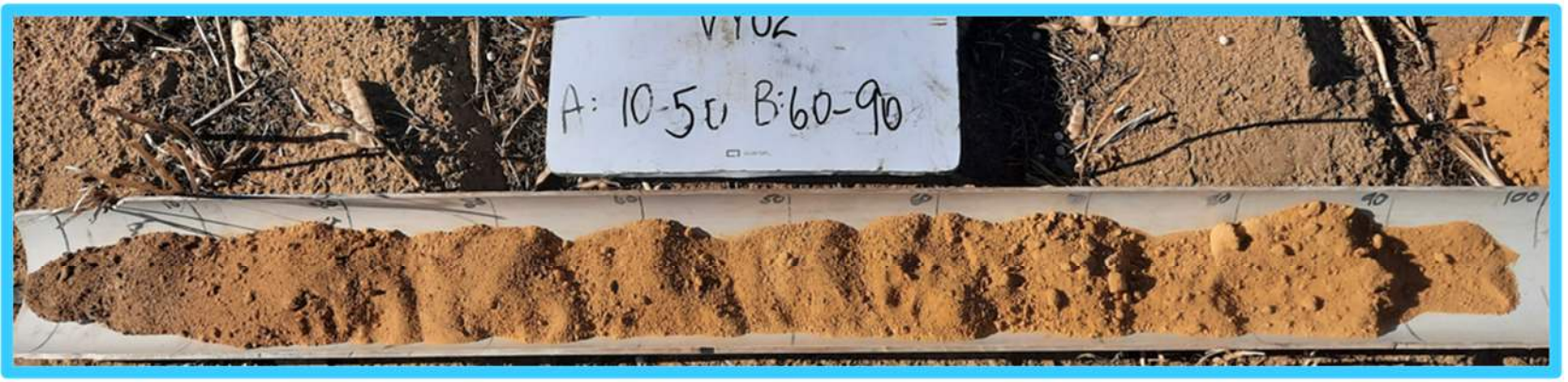


SOIL SITE SELECTION

SOIL SAMPLING







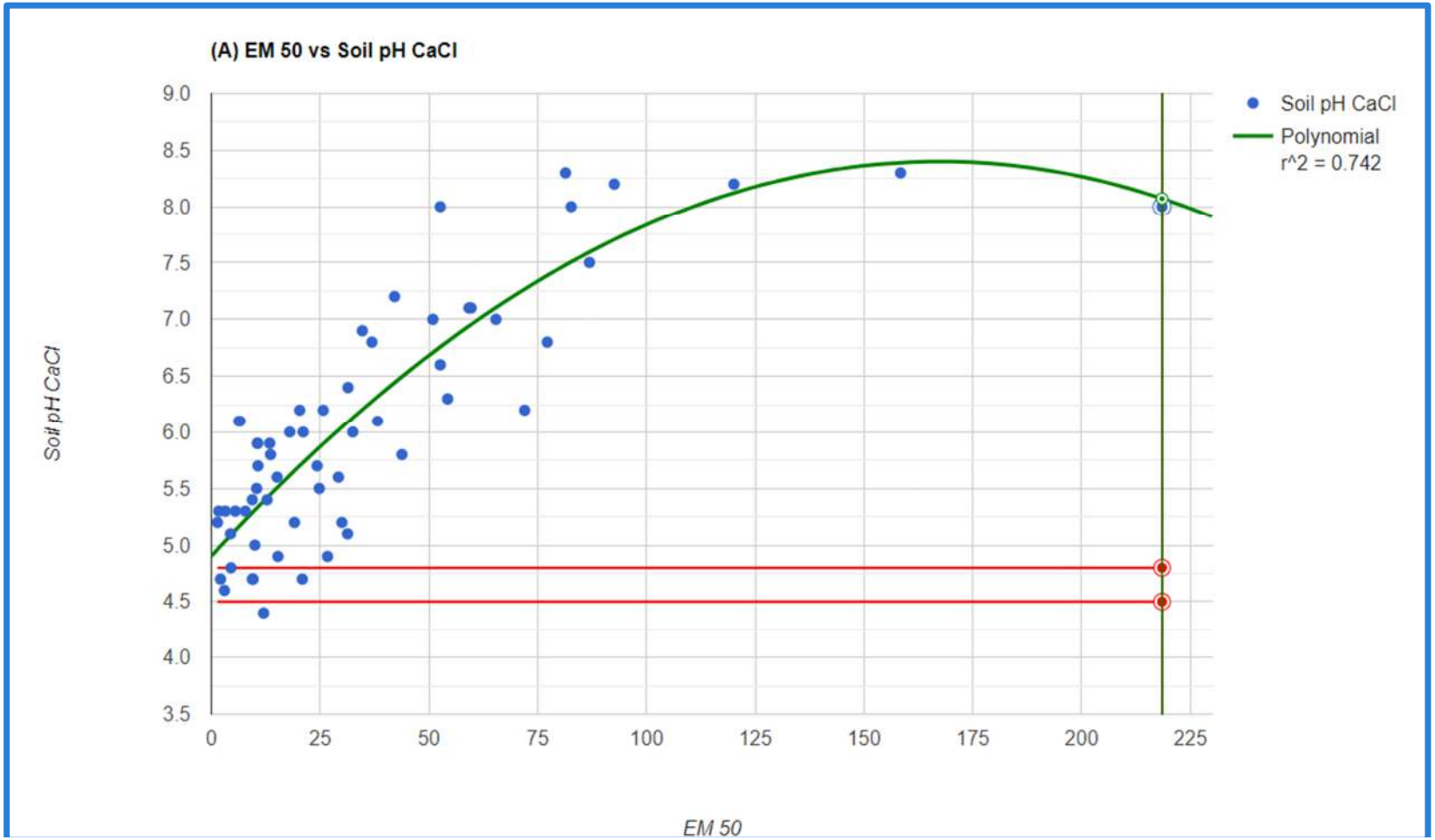
SOIL TESTING

VRT SOLUTIONS

SOIL TEST RESULTS

Sample ID	Sample Date	Depth Min[cm]	Depth Max[cm]	Soil Gravel %[%]	Soil Texture	Soil K Colwell[ppm]	Soil P Colwell[ppm]	Soil pH CaCl	Soil pH	EC	Soil Ca %[%]	Soil Mg %[%]	Soil K %[%]	Al	Ca	Mg	K	Na	S	Soil Na %[%]	Soil Al CaCl[ppm]	Soil Clay %[%]	Soil Sand %[%]	Soil Silt %[%]	S-OC-WB.12	Soil PBI
BAIL01	28/07/2023	0	10	10	3.0	556	19	7.3	7.8	0.207	75.95	10.67	12.51	0.024	9.11	1.28	1.5	0.08	3.3	0.667	0.2	22.03	60.43	17.54	0.78	47.5
BAIL02	28/07/2023	0	10	15	3.0	311	20	6.1	6.7	0.079	55.4	22.69	15.12	0.016	3.15	1.29	0.86	0.37	4.9	6.5072	0.2	22.87	65.45	11.68	0.68	28.0
BAIL03	28/07/2023	0	10	15	3.0	236	36	5.4	6.5	0.096	47.82	26.02	13.13	0.036	1.93	1.05	0.53	0.49	3.5	12.1407	0.23	16.53	70.34	13.13	0.55	21.2
BA	Satellite Source		10	5	3.0	408	52	5.6	6.5	0.097	50.83	27.25	13.83	0.037	3.75	2.01	1.02	0.56	7.4	7.5912	0.2	29.86	56.76	13.37	0.89	47.1
BA	Mapbox		10	10	3.0	426	31	5.4	6.6	0.081	52.74	24.53	15.31	0.043	3.72	1.73	1.08	0.48	2.1	6.8056	0.2	29.65	56.32	14.02	0.8	37.6
BA			10	5	3.0	306	30	5.5	6.4	0.1	53.54	21.46	15.24	0.037	2.67	1.07	0.76	0.45	5.6	9.0235	0.2	19.65	69.5	10.86	0.96	27.7
BAIL07	28/07/2023	0	10	5	3.0	303	24	5.3	5.9	0.358	47.93	23.76	10.64	0.04	3.47	1.72	0.77	1.24	20.7	17.1271	0.2	21.95	63.93	14.12	1.01	33.0
BAIL08	28/07/2023	0	10	5	3.0	405	40	5.3	6.5	0.058	46.1	29.12	18.6	0.042	2.85	1.8	1.15	0.34	1.7	5.4998	0.2	29.75	55.95	14.3	0.67	33.0
BALL01	28/07/2023	0	10	30	3.0	63	28	5.3	5.9	0.075	73.18	15.6	5.57	0.072	1.97	0.42	0.15	0.08	25.7	2.9718	0.25	19.74	70.05	10.21	0.54	25.1
BALL02	28/07/2023	0	10	30	3.0	88	21	5.4	6.1	0.052	75.61	13.24	7.67	0.04	2.17	0.38	0.22	0.06	6.8	2.0906	0.3	17.2	69.19	13.61	0.71	16.4
BALL03	28/07/2023	0	10	30	3.0	117	25	5.8	6.3	0.116	74.31	13.61	7.62	0.024	2.73	0.5	0.28	0.14	27.5	3.8106	0.2	14.18	72.72	13.1	1.21	13.5
BALL04	28/07/2023	0	10	30	3.0	84	32	5.6	6.3	0.057	75.39	14.03	6.2	0.024	2.31	0.43	0.19	0.11	4.6	3.5901	0.2	12.42	79.65	7.93	0.63	18.4
BALL05	28/07/2023	0	10	30	3.0	194	27	5.9	6.6	0.082	61.33	21.51	9.58	0.026	2.88	1.01	0.45	0.33	3.6	7.0273	0.2	19.49	65.28	15.23	0.71	24.2
BALL06	28/07/2023	0	10	30	3.0	139	26	4.9	5.7	0.119	57.35	19.12	11.21	0.054	1.74	0.58	0.34	0.32	29.5	10.5471	0.52	16.87	73.33	9.8	0.69	21.7
BALL07	28/07/2023	0	10	40	3.0	482	26	6.9	8.4	0.363	37.68	35.15	6.44	0.043	9.24	8.62	1.58	5.04	27.0	20.5521	0.2	38.71	46.59	14.7	0.94	106.6
BIGN01	28/07/2023	0	10	40	3.0	141	40	5.5	6.1	0.071	69.92	16.85	7.97	0.041	3.07	0.74	0.35	0.19	19.0	4.327	0.2	21.55	70.18	8.27	1.25	63.6
BIGN02	28/07/2023	0	10	5	2.0	41	24	6.0	6.7	0.059	78.46	13.3	4.43	0.036	1.77	0.3	0.1	0.05	4.9	2.2163	0.2	17.65	73.28	9.07	0.44	7.3
BIGN03	28/07/2023	0	10	30	3.0	459	23	7.3	8.6	0.162	77.83	11.53	8.92	0.021	12.22	1.81	1.4	0.25	2.6	1.5923	0.2	16.44	66.8	16.76	0.67	100.2
BIGN04	28/07/2023	0	10	30	3.0	107	30	6.2	6.7	0.138	67.58	18.57	5.33	0.021	3.42	0.94	0.27	0.41	16.7	8.1012	0.2	18.14	73.99	7.87	0.7	18.8
BIGN05	28/07/2023	0	10	30	3.0	380	36	6.1	6.9	0.074	56.04	27.91	10.45	0.035	5.36	2.67	1.0	0.5	3.8	5.2274	0.2	31.08	56.58	12.34	0.88	54.8
BIGN06	28/07/2023	0	10	30	3.0	516	24	7.7	8.2	0.206	75.59	13.55	6.9	0.024	17.63	3.16	1.61	0.9	1.5	3.8587	0.2	25.5	63.3	11.2	0.71	93.5
BIGN07	28/07/2023	0	10	30	3.0	461	20	7.8	8.6	0.197	71.25	18.18	5.88	0.026	17.09	4.36	1.41	1.1	2.3	4.586	0.2	37.76	50.53	11.71	0.79	117.7
BIGN08	28/07/2023	0	10	20	3.0	147	46	5.2	5.9	0.064	68.64	14.92	11.12	0.086	2.53	0.55	0.41	0.11	11.4	2.9843	0.2	18.5	79.59	1.91	0.99	44.6
GDALE01	28/07/2023	0	10	30	3.0	164	40	4.7	5.5	0.053	46.24	15.96	17.18	0.344	1.13	0.39	0.42	0.16	9.8	6.5466	1.85	18.98	75.14	5.88	1.18	49.3
GDALE02	28/07/2023	0	10	5	2.0	56	28	5.2	5.9	0.072	77.04	13.27	5.16	0.053	2.09	0.36	0.14	0.07	19.0	2.5802	0.77	15.62	79.07	5.31	0.94	26.3
GDALE03	28/07/2023	0	10	5	2.0	81	31	5.2	6.0	0.061	70.14	12.05	11.19	0.074	1.63	0.28	0.26	0.08	11.0	3.4423	0.32	17.02	75.31	7.66	0.67	22.6
GDALE04	28/07/2023	0	10	40	3.0	106	42	5.2	5.9	0.077	71.56	12.78	9.49	0.079	1.96	0.35	0.26	0.09	12.2	3.2859	0.2	17.81	72.46	9.73	0.88	43.8
GDALE05	28/07/2023	0	10	40	3.0	65	18	4.7	5.5	0.039	57.13	14.98	9.98	0.273	1.03	0.27	0.18	0.05	9.6	2.7732	0.7	14.74	73.64	11.63	0.81	34.9
GDALE06	28/07/2023	0	10	40	3.0	83	39	5.1	5.7	0.141	59.16	19.72	7.29	0.082	2.19	0.73	0.27	0.43	13.8	11.6153	0.67	21.66	66.4	11.94	1.06	51.8
GDALE07	28/07/2023	0	10	30	3.0	73	33	5.2	5.8	0.09	71.09	15.65	6.12	0.04	2.09	0.46	0.18	0.17	23.0	5.7823	0.46	16.46	70.48	13.06	0.95	29.9
GDALE08	28/07/2023	0	10	20	3.0	87	27	5.8	6.4	0.048	72.58	17.02	6.74	0.014	2.26	0.53	0.21	0.1	3.0	3.2113	0.2	12.54	82.56	4.9	0.61	20.3
GDALE09	28/07/2023	0	10	30	3.0	363	23	6.2	6.9	0.132	42.75	39.87	9.45	0.041	4.75	4.43	1.05	0.84	26.1	7.5601	0.2	29.03	60.74	10.22	1.07	55.9
GDALE10	28/07/2023	0	10	40	3.0	419	27	5.7	6.5	0.088	47.66	32.8	14.34	0.053	3.69	2.54	1.11	0.35	5.2	4.5202	0.29	28.39	64.69	6.92	1.35	34.5
GDALE11	28/07/2023	0	10	40	3.0	105	25	5.2	6.3	0.072	60.81	21.91	7.4	0.061	2.22	0.8	0.27	0.3	5.2	8.2169	0.27	15.11	74.78	10.11	0.76	14.4
GDALE12	28/07/2023	0	10	30	3.0	378	18	5.8	6.8	0.099	49.18	31.17	11.22	0.032	4.56	2.89	1.04	0.75	3.2	8.0889	0.2	26.88	56.0	17.13	1.25	33.2
GDALE13	28/07/2023	0	10	20	3.0	336	28	5.3	5.8	0.296	59.82	23.81	10.79	0.036	5.1	2.03	0.92	0.44	7.5	5.1607	0.2	29.91	56.22	13.88	1.13	45.9
GDALE14	28/07/2023	0	10	30	3.0	301	19	6.4	7.4	0.136	56.49	32.07	4.66	0.035	9.95	5.65	0.82	1.16	3.4	6.5853	0.2	27.3	58.35	14.35	0.9	51.6
GDALE15	28/07/2023	0	10	20	3.0	139	24	5.2	6.1	0.178	46.56	27.25	7.12	0.038	2.29	1.34	0.35	0.9	31.1	18.3001	0.22	15.76	80.17	4.07	0.7	17.8
GDALE16	28/07/2023	0	10	20	3.0	535	35	6.0	6.6	0.32	50.16	24.76	11.08	0.036	6.97	3.44	1.54	1.91	16.9	13.745	0.2	36.23	54.32	9.44	0.92	60.1
GDALE17	28/07/2023	0	10	40	3.0	363	32	5.8	6.1	2.551	27.24	26.26	4.65	0.051	5.8	5.59	0.99	8.86	305.3	41.6138	0.2	24.85	66.0	9.15	0.88	42.3
GDALE18	28/07/2023	0	10	30	3.0	284	27	5.6	6.1	0.592	44.03	28.09	6.64	0.059	4.64	2.96	0.7	2.18	41.9	20.6851	0.67	26.87	67.58	5.54	0.82	38.4
KURR01	28/07/2023	0	10	20	3.0	100	48	5.1	5.7	0.151	71.62	12.16	8.21	0.104	2.18	0.37	0.25	0.14	48.6	4.5992	0.59	21.63	66.4	11.97	1.13	42.8
KURR02	28/07/2023	0	10	10	2.5	93	24	5.2	5.8	0.074	76.04	12.38	6.19	0.072	1.72	0.28	0.14	0.05	20.1	2.2104	0.29	16.37	77.5	6.13	0.68	19.7
KURR03	28/07/2023	0	10	20	2.5	58	68	4.6	5.3	0.065	69.57	9.8	7.35	0.221	1.42	0.2	0.15	0.05	13.7	2.4498	1.45	19.52	71.21	9.28	1.08	34.1
KURR04	28/07/2023	0	10	20	2.5	50	23	5.3	5.8	0.131	76.27	14.75	4.71	0.046	2.43	0.47	0.15	0.09	61.4	2.8249	0.53	18.75	66.47	14.78	1.06	21.4
KURR05	28/07/2023	0	10	30	3.0	129	31	4.8	5.3	0.206	66.73	14.16	11.12	0.107	1.98	0.42	0.33	0.13	97.9	4.3815	0.7	22.49	69.72	7.79	0.93	20.8
KURR06	28/07/2023	0	10	40	3.0	108	35	5.0	5.7	0.116	72.11	13.02	7.62	0.098	2.27	0.41	0.24	0.13	40.4	4.1296	0.69	20.22	68.5	11.28	1.16	25.1

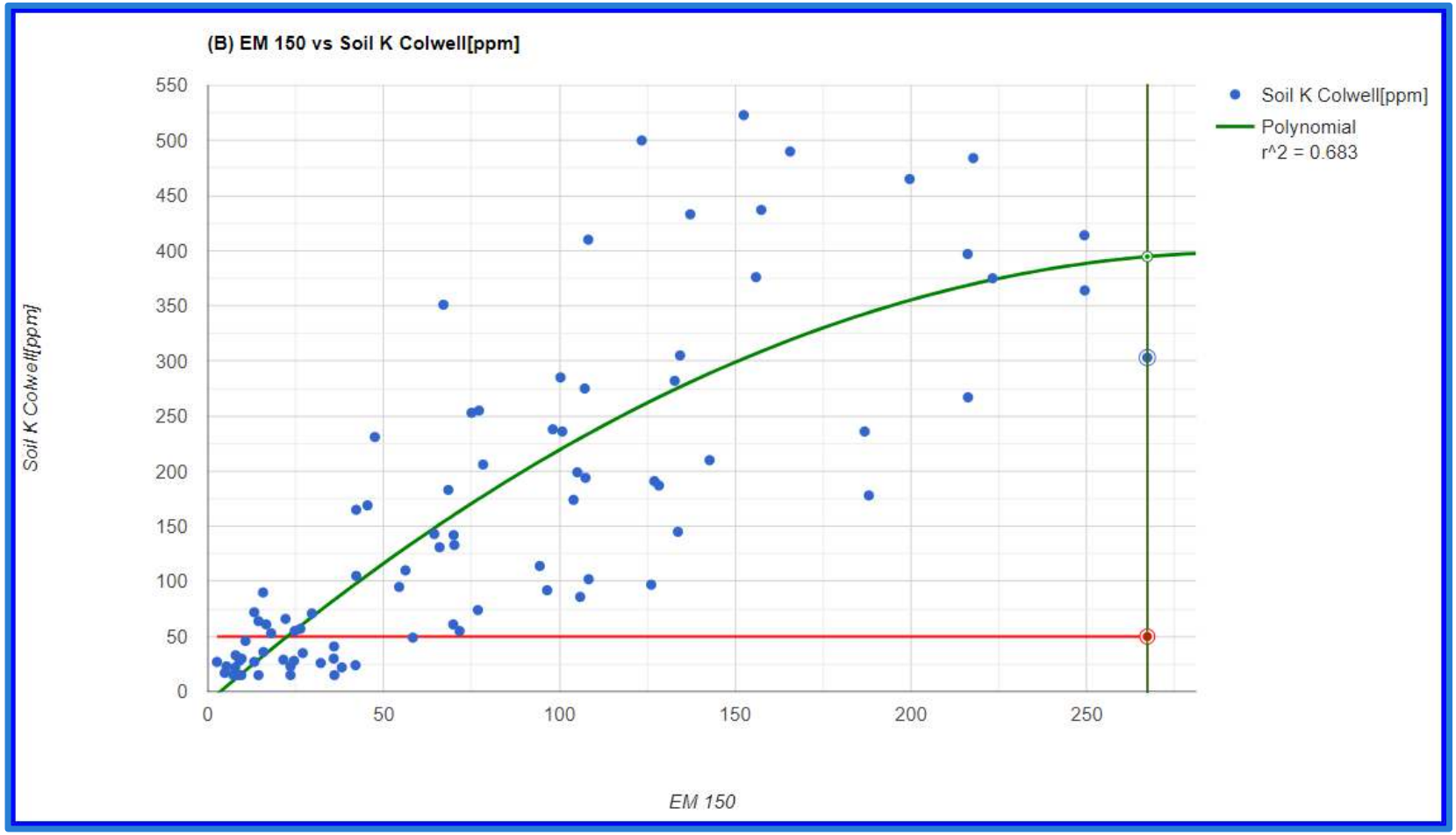
DATA INTERPRETATION – PRESCRIPTION DEVELOPMENT



Data from:

Dumbleyung 2023

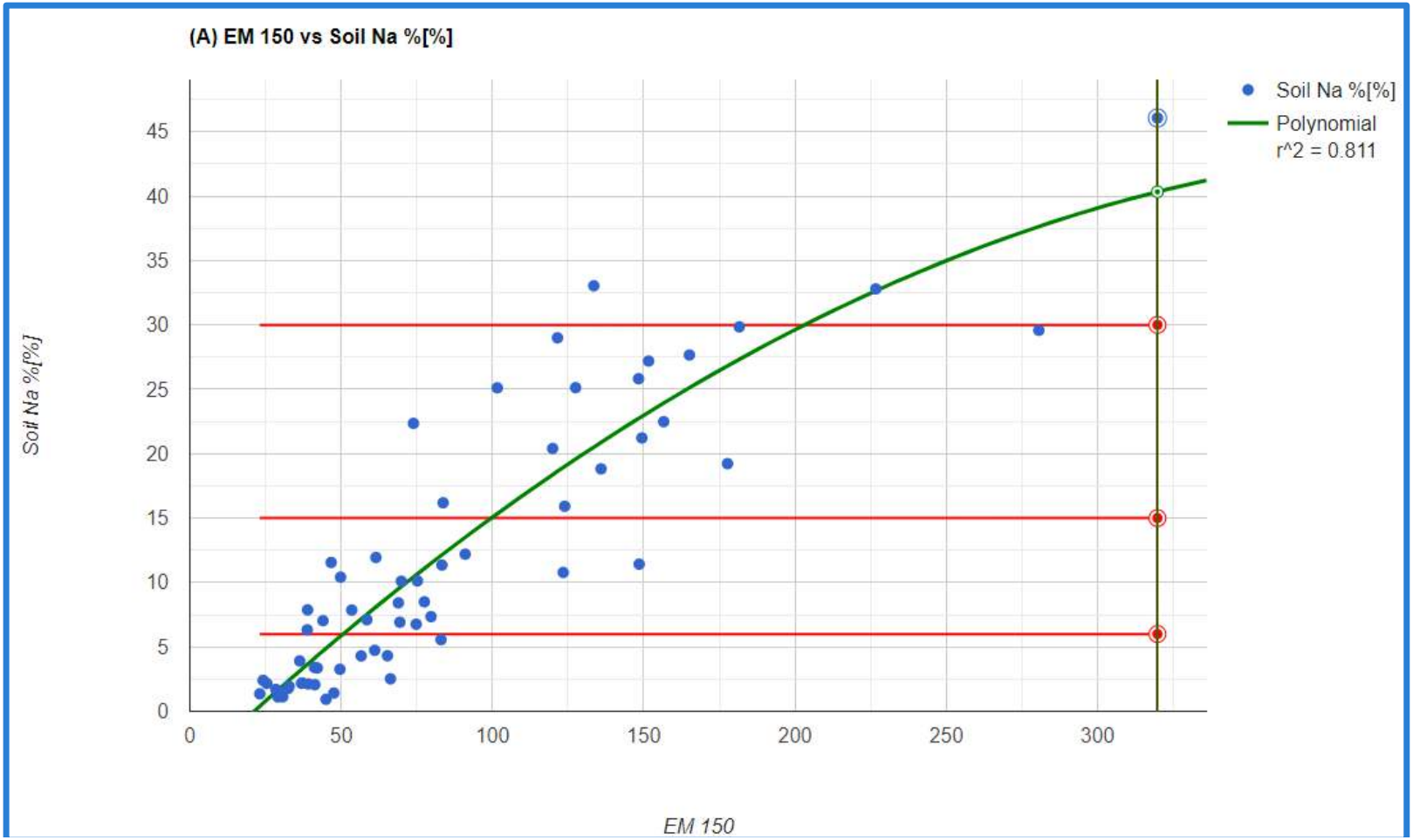
DATA INTERPRETATION – PRESCRIPTION DEVELOPMENT



Data from:

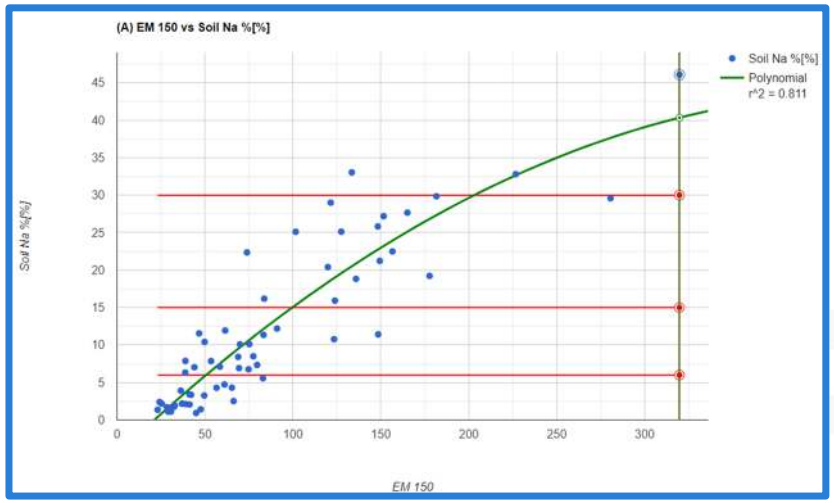
Merredin 2023

DATA INTERPRETATION – PRESCRIPTION DEVELOPMENT



Data from:

Wagin
2023



PRESCRIPTION DEVELOPMENT

	400.000 kg/ha	1690.79 ha	34.96 %
	800.000 kg/ha	1868.37 ha	38.63 %
	1,200.00 kg/ha	745.15 ha	15.41 %
	1,600.00 kg/ha	364.1 ha	7.53 %
	2,000.00 kg/ha	168.21 ha	3.48 %

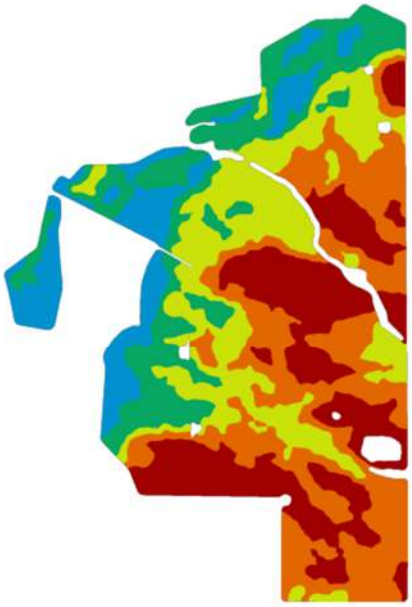
Activity Date:	08/02/2024
Min:	400.00 kg/ha
Max:	2,000.00 kg/ha
Mean:	823.75 kg/ha
Standard Deviation:	422.23 kg/ha
Mode:	800.00 kg/ha
Coefficient Of Variance:	51.26 %
Area:	4,836.78 ha
Total:	3,984,188.80 kg

PRESCRIPTIONS DEVELOPMENT – TRACTOR READY

TRACTOR READY - APPLIED

Rx Gypsum

Dealer:	VRTS
Grower:	Harwood Farms
Farm:	Harwood
Field:	Hillside



400.000 kg/ha	79.21 ha	22.45 %
800.000 kg/ha	96.07 ha	27.23 %
1,200.00 kg/ha	76.51 ha	21.69 %
1,600.00 kg/ha	61.02 ha	17.30 %
2,000.00 kg/ha	39.97 ha	11.33 %

Activity Date:	08/02/2024
Min:	400.00 kg/ha
Max:	2,000.00 kg/ha
Mean:	1,071.26 kg/ha
Standard Deviation:	520.46 kg/ha
Mode:	800.00 kg/ha
Coefficient Of Variance:	48.58 %
Area:	352.73 ha
Total:	377,923.04 kg

VRTS – Precision Ag cheatsheet

(based on over 10 years experience)

VR lime **(soils (EM and/or GR))**

VRTS – Precision Ag cheatsheet

VR lime **(soils (EM and/or GR))**

VR gypsum **(soils (EM))**

VRTS – Precision Ag cheatsheet

VR lime	**(soils (EM and/or GR))**
VR gypsum	**(soils (EM))**
VR K	**(soils / yield) - (80 / 20)**

VRTS – Precision Ag cheatsheet

VR lime	**(soils (EM and/or GR))**
VR gypsum	**(soils (EM))**
VR K	**(soils / yield) - (80 / 20)**
VR P	**(soils / yield) - (60 / 40)**

VRTS – Precision Ag cheatsheet

VR lime	**(soils (EM and/or GR))**
VR gypsum	**(soils (EM))**
VR K	**(soils / yield) - (80 / 20)**
VR P	**(soils / yield) - (60 / 40)**
VR N	**(opportunistic / biomass)**

VRTS – Precision Ag cheatsheet

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