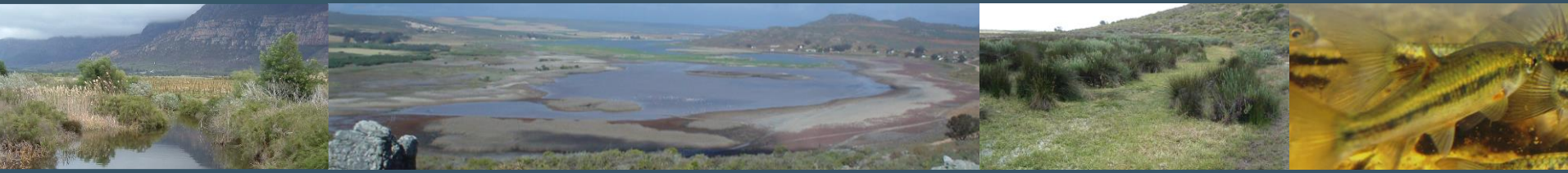


Reserve determination study for selected Surface Water, Groundwater, Estuaries and Wetlands in the F60 and G30 Catchment within the Berg-Olifants Water Management Area (WP11340):

Integration Workshop September 2022 EWR Sites

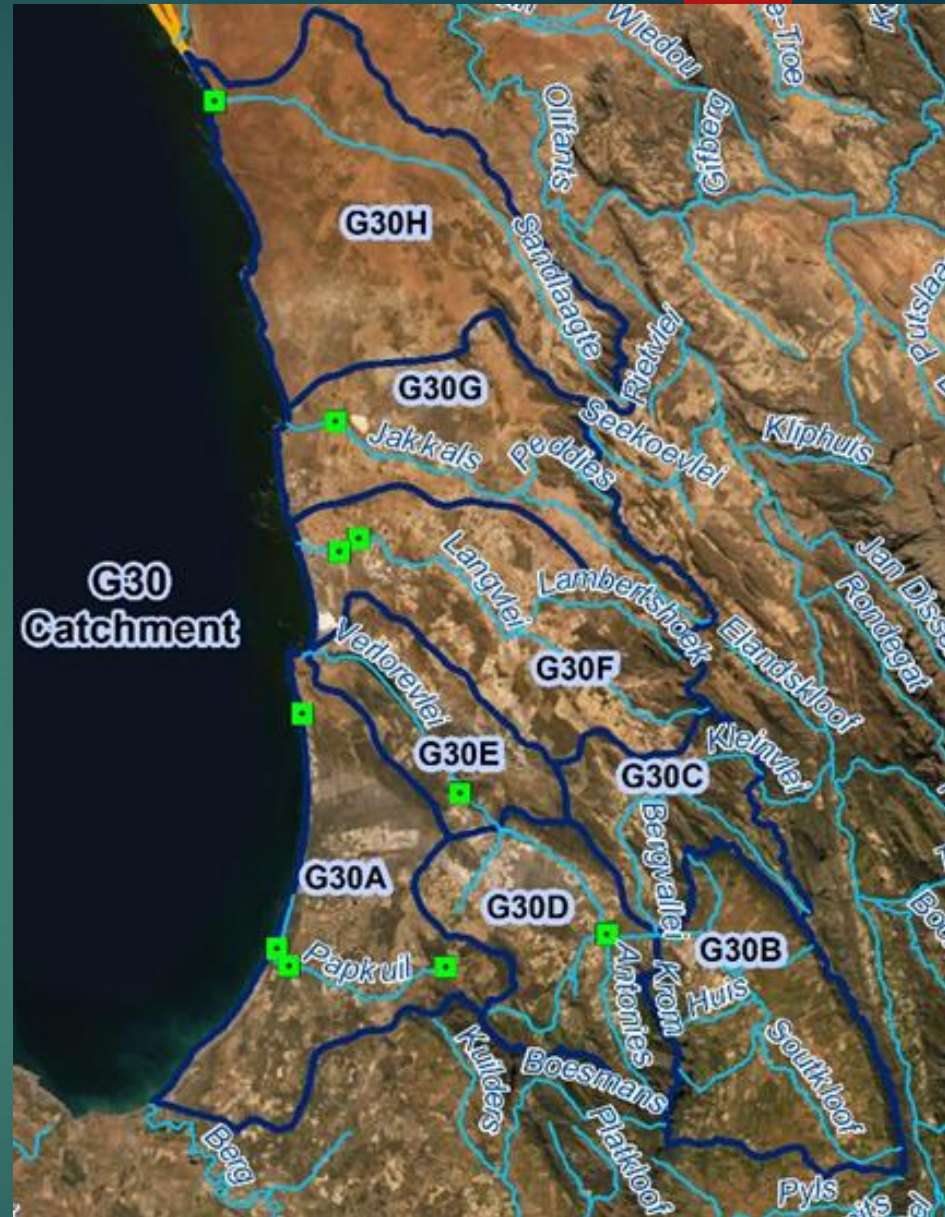


DEPARTMENT: WATER AND SANITATION



EWR sites

EWR Formal site names			Resource Unit
EWR7 KOOKF	RW-G30G JAKK		Jakkals River RU; Lower Jakkals River VB Wetland RU
EWR8 BRAND	RW-G30F LANG		Langvlei River RU; Lower Langvlei VB Wetland RU
EWR9 WAGEN	W-G30F WADR		Wadriif VB Wetland RU
EWR10 EENHE	RW-G30D KRUI		Upper Verlorenvlei River RU; Kruismans River VB Wetland RU
EWR11 GOERG	RW-G30D KROM		Krom Antonies River RU; Krom-Antonies River FP Wetland RU
EWR12	RW-G30E VERL WITTE		Lower Verlorenvlei River RU; Lower Verlorenvlei River FP Wetland RU
EWR13 FA277	W-G30A DUNE		West Strandveld duneslack Wetland RU
EWR14 FA272	W-G30A ROSH		Rocherpan Wetland RU
EWR15 BOOKR	RW-G30A PAPK		Papkuils River RU; Lower Papkuils FP Wetland RU
EWR16	W-G30A PAPK RIETF		Upper Papkuils seep Wetland RU



EWR 11: KROM ANTONIES

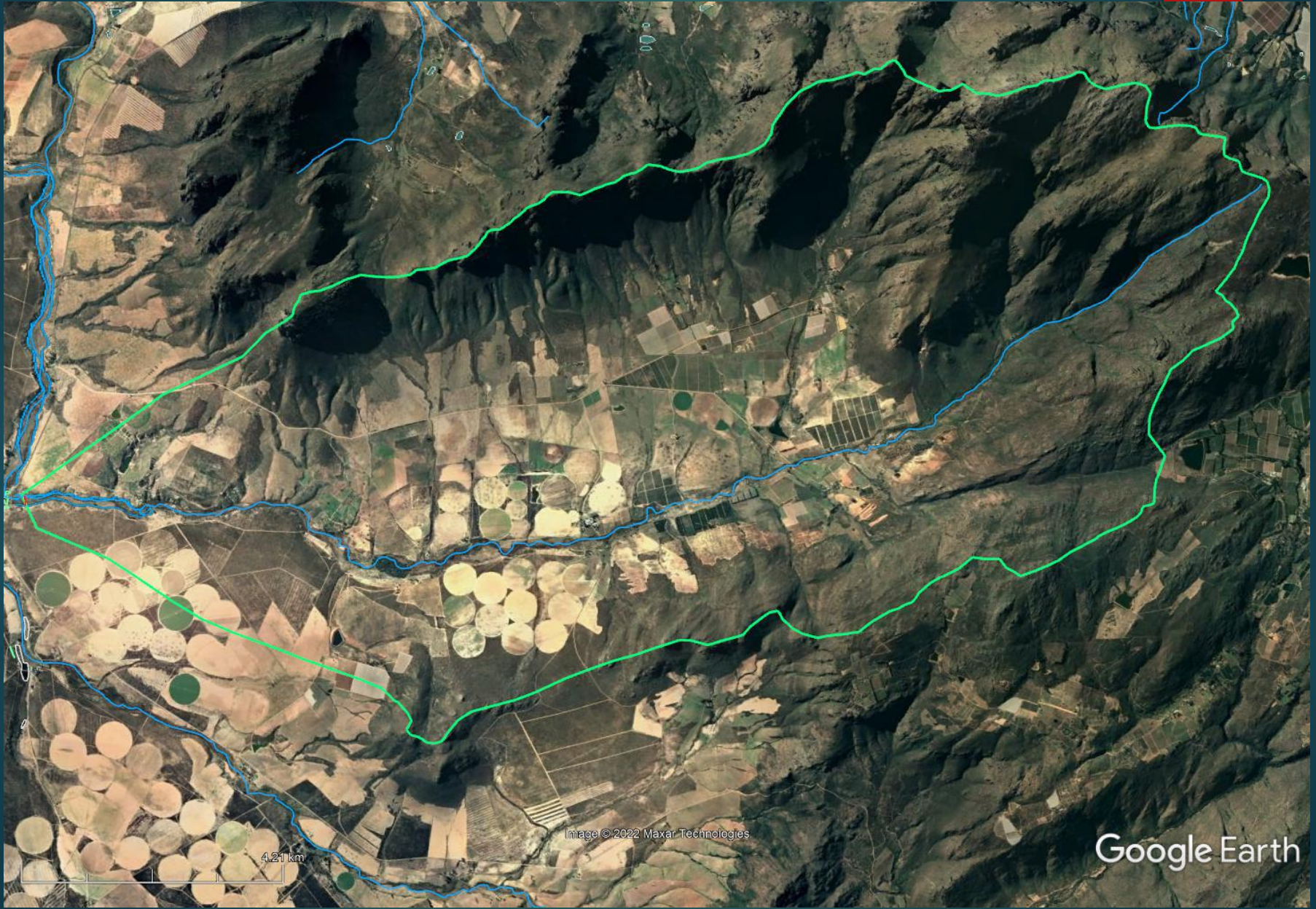




Image © 2022 Maxar Technologies

Google Earth

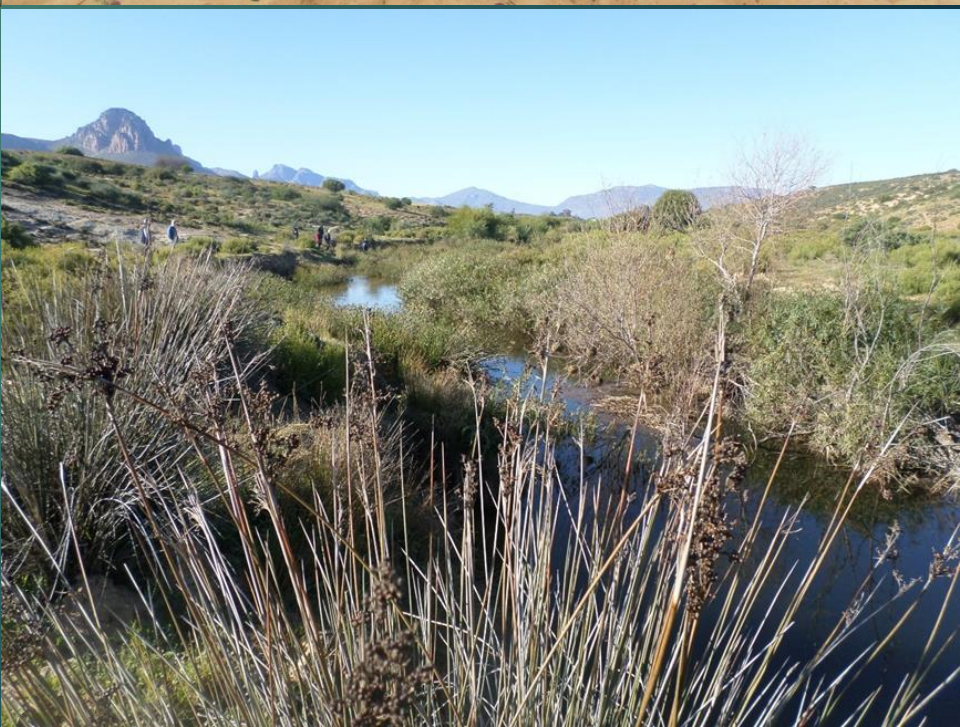


694 m

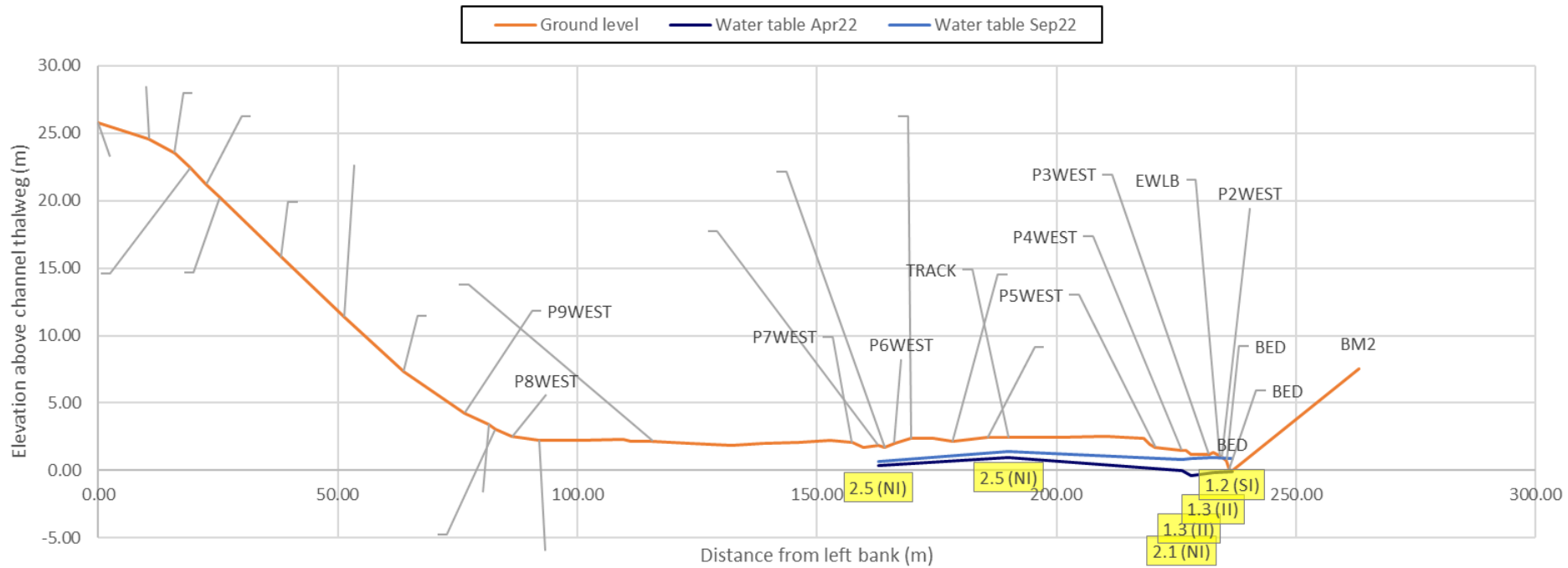
Image © 2022 Maxar Technologies

Google Earth





Cross-section: Krom-Antonies (water table)



Vegetation units identified

Widespread Species in the *Sporobolus virginicus*-*Phragmites australis* Sandveld Wetland Communities

1. *Cyperus textilis* - *Phragmites australis* Reed Wetland

1.1 *Cyperus textilis* - *Paspalum distichum* Reed Wetland

1.2 *Cyperus textilis* - *Acacia saligna* disturbed form of *Cyperus textilis* - *Phragmites australis* Reed Wetland

1.3 *Cynodon dactylon*-*Juncus acutus* Halophytic Meadow

2. *Sarcocornia pillansii*- *Frankenia repens* Salt marsh

2.1 Typicum

2.2 *Panicum maximum* - *Sarcocornia pillansii* Salt marsh

2.3 *Mesembryanthemum crystallinum* form of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.4 *Senecio burchellii* form of Disturbed *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.5 *Zygophyllum morskana* Sand Strandveld Shrubland

2.6 *Lycium tetrandrum* edge of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.7 *Nidorella foetida* - *Sarcocornia pillansii* Salt marsh Edge

2.8 *Ehrharta villosa* Transition Strandveld to *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

3. *Restio subverticillatus* Lowland Fynbos Wetland

4. Secondary *Searsia undulata* Strandveld Bushclump

5. *Typha capensis* Secondary Sandveld Wetland

6. *Restio* sp. - *Psoralea aphylla* Fynbos Wetland

HYDROPERIOD CATEGORIES

Inundation hydroperiod		Saturation hydroperiod	
Permanently inundated	PI	Permanently saturated	PS
Seasonally inundated	SI	Seasonally saturated	SS
Intermittently inundated	II	Intermittently saturated	IS
Not inundated (Dry)	NI	Not saturated (Dry)	NS

Macroinvertebrate Sampling for the Krom Antonies

SASS5 Results

April 2022 - Eighteen taxa (abundances):

Hydracarina (A), *Beatidae* 2 sp (B), *Coenagrionidae* (A), *Aeshnidae* (A), *Corduliidae*, (B) *Gomphidae* (1), *Libellulidae* (B), *Corixidae* (B), *Gerridae* (B), *Nedipae* (A), *Notonectidae* (A), *Pleidae* (A), *Veliidae*, *Dytiscidae* (A), *Chironomidae* (A), *Culicidae* (A), *Simulidae* (A) and *Lymnaeidae* (B)

September 2022- *Oligochaeta* (1), *Hydracarina* (B), *Beatidae* 2 sp (A), *Coenagrionidae* (A), *Corduliidae*, (A), *Libellulidae* (A), *Hydroptilidae* (1), *Leptoceridae* (B), *Dytiscidae* (A), *Chironomidae* (A), *Simulidae* (A)

Invertebrate Habitat Assessment System results 73%.

	SASS Score	No of Families	ASPT	Air Breather Families
2004/07/05	32	6	5.3	1
2005/07/28	38	7	5.4	1
2005/10/25	56	10	5.6	1
2009/05/13	43	11	3.9	3
2009/09/15	63	14	4.5	3
2022/04/06	83	18	4.6	8
2022/09/07	61	11	5.8	1
Reference	150		7	

MIRAI

Invertebrate EC: Based on Weights of Metric Groups			
Metric Group	Score	Weight	Weighted Score
Flow Modification	66	0	18
Habitat	48	0	13
Water Quality	66	0	15
Connectivity & Seasonality	72	0	16
Invertebrate EC			62
Invertebrate EC Category			C

EWR 10: KRUISMANS

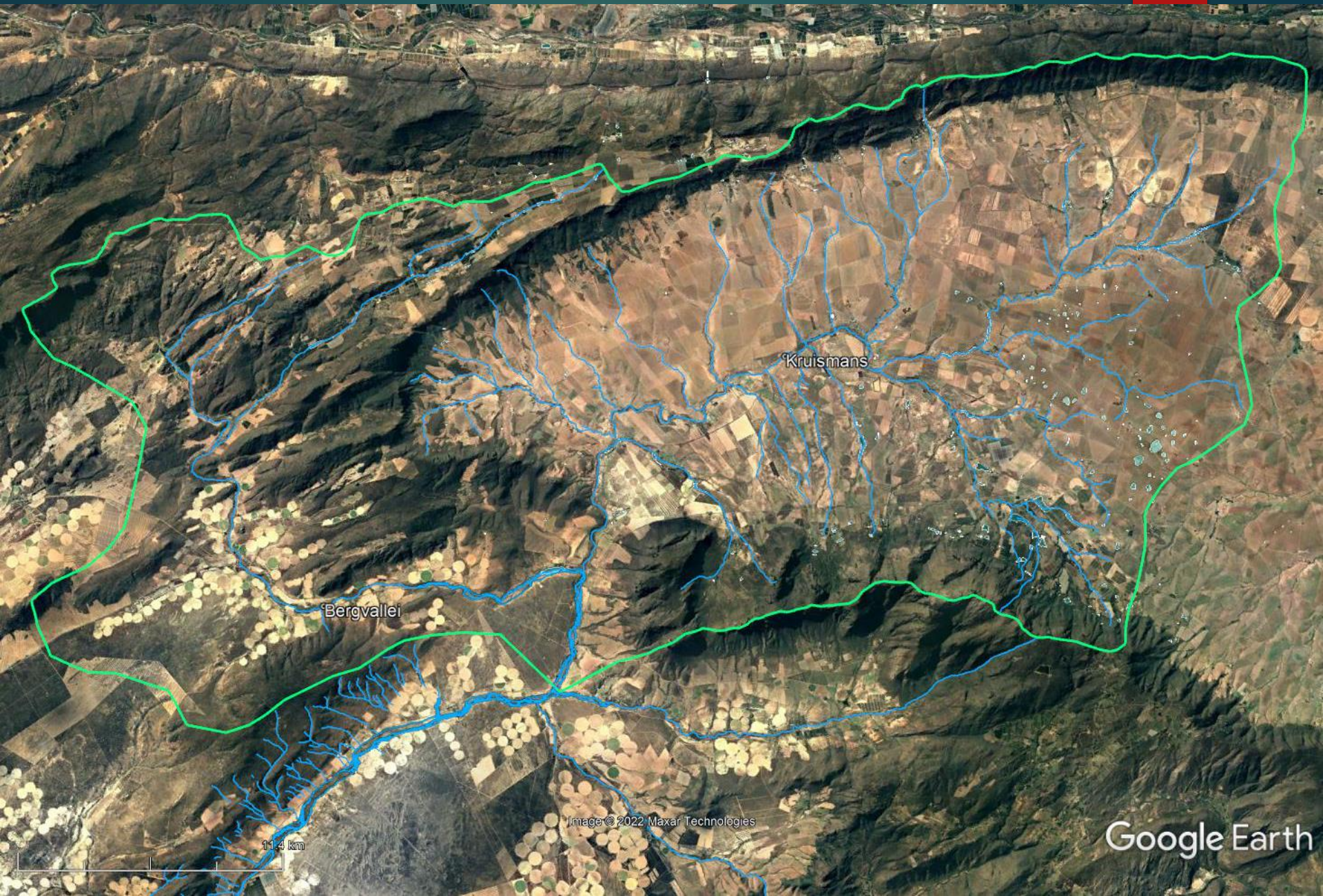




Image © 2022 Maxar Technologies

Google Earth

248 m



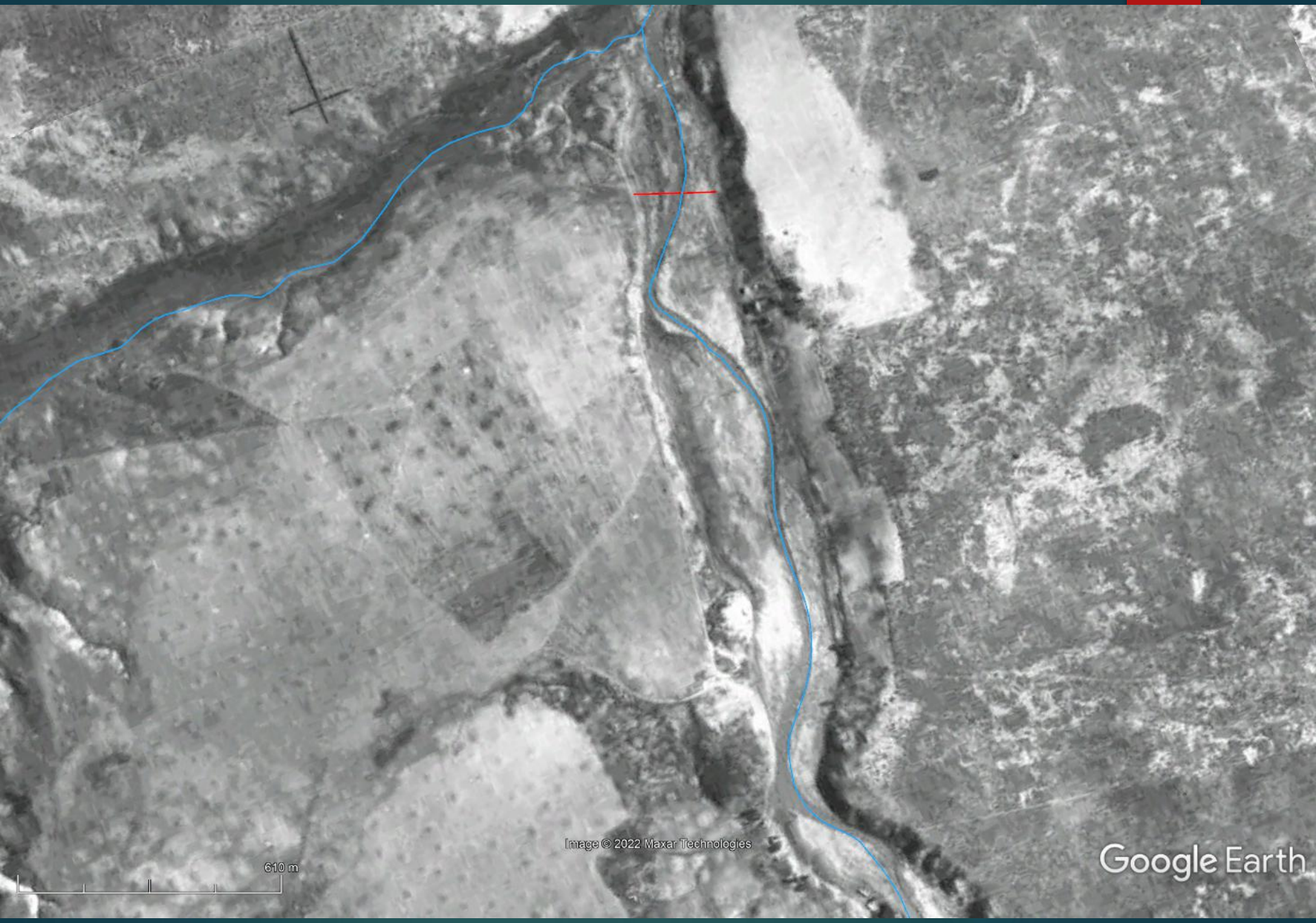


Image © 2022 Maxar Technologies

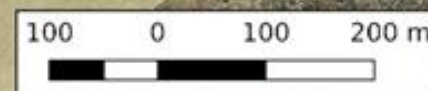
Google Earth

610 m



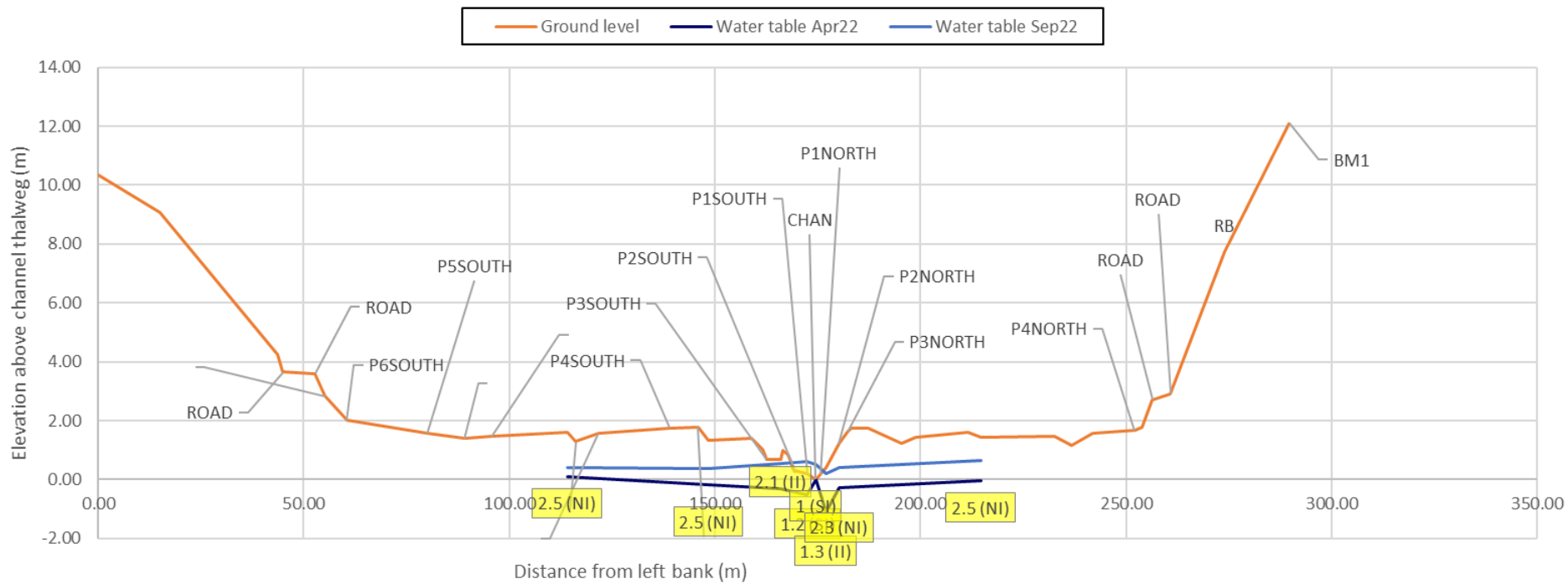
Legend

- Wetland assessment unit: Kruismans
- Transect points (plot end-points)
- Transect line





Cross-section: Kruismans (water table)



Vegetation units identified

Widespread Species in the *Sporobolus virginicus*-*Phragmites australis* Sandveld Wetland Communities

1. *Cyperus textilis* - *Phragmites australis* Reed Wetland

1.1 *Cyperus textilis* - *Paspalum distichum* Reed Wetland

1.2 *Cyperus textilis* - *Acacia saligna* disturbed form of *Cyperus textilis* - *Phragmites australis* Reed Wetland

1.3 *Cynodon dactylon*-*Juncus acutus* Halophytic Meadow

2. *Sarcocornia pillansii*- *Frankenia repens* Salt marsh

2.1 Typicum

2.2 *Panicum maximum* - *Sarcocornia pillansii* Salt marsh

2.3 *Mesembryanthemum crystallinum* form of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.4 *Senecio burchellii* form of Disturbed *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.5 *Zygophyllum morskana* Sand Strandveld Shrubland

2.6 *Lycium tetrandrum* edge of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.7 *Nidorella foetida* - *Sarcocornia pillansii* Salt marsh Edge

2.8 *Ehrharta villosa* Transition Strandveld to *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

3. *Restio subverticillatus* Lowland Fynbos Wetland

4. Secondary *Searsia undulata* Strandveld Bushclump

5. *Typha capensis* Secondary Sandveld Wetland

6. *Restio* sp. - *Psoralea aphylla* Fynbos Wetland

HYDROPERIOD CATEGORIES

Inundation hydroperiod		Saturation hydroperiod	
Permanently inundated	PI	Permanently saturated	PS
Seasonally inundated	SI	Seasonally saturated	SS
Intermittently inundated	II	Intermittently saturated	IS
Not inundated (Dry)	NI	Not saturated (Dry)	NS

Macroinvertebrate Sampling for the Kruismans:

SASS5 Results

April 2022 - No sampling of macroinvertebrates possible as the river was dry

September 2022 - *Turbellaria* (1), *Hydracarina* (B), *Beatidae* 2 sp (A), *Corixidae* (A), *Notonectidae* (A), *Leptoceridae* (A), *Dytiscidae* (B), *Ceratopogonidae* (1), *Chironomidae* (A), *Culicidae* (B), *Unionidae* (B)

Invertebrate Habitat Assessment System results 61%.

	SASS Score	No of Families	ASPT	Air Breather Families
2004/07/05	54	11	4.9	3
2005/07/28	44	9	4.9	2
2005/10/25	56	13	4.3	3
2009/05/13	46	10	4.6	1
2009/09/15	31	8	3.9	1
2011/05/11	67	12	5.6	5
2011/07/12	97	18	5.4	2
2011/11/02	56	13	4.3	2
2012/09/10	52	12	4.3	4
2013/10/07	42	11	3.8	2
2022/09/07	48	11	4.4	4
Reference	120		6.5	

MIRAI

Invertebrate EC: Based on Weights of Metric Groups			
Metric Group	Score	Weight	Weighted Score
Flow Modification	47	0.278	13
Habitat	58	0.278	16
Water Quality	61	0.222	13
Connectivity & Seasonality	49	0.222	11
Invertebrate EC			54
Invertebrate EC Category			D

Other biota observed: Common water fleas (*Daphnia* app.), Cape River Frogs (*Amietia fuscigula*)

EWR 12: VERLORENVLEI





Image © 2022 Maxar Technologies

Google Earth

281 m

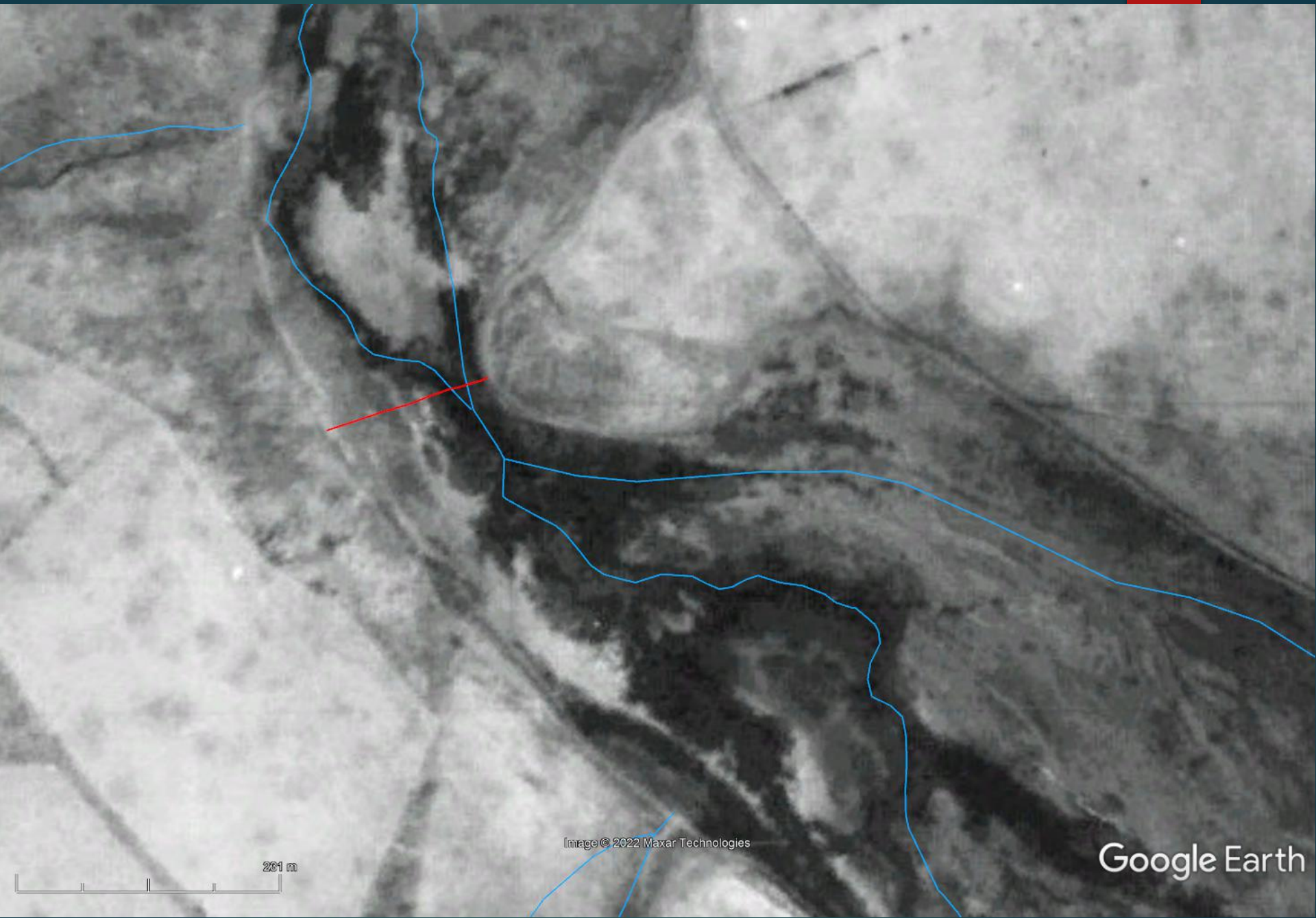


Image © 2022 Maxar Technologies

Google Earth

251 m





P0
P8S P5N

Legend

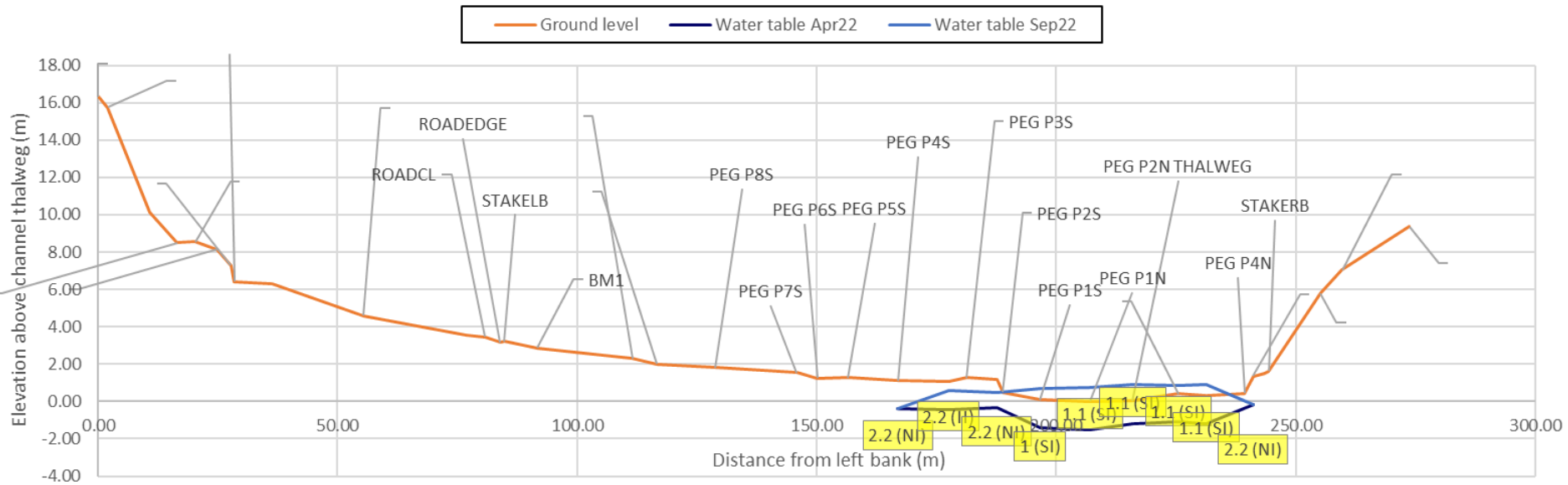
-  Wetland assessment unit: Verlorenvlei at Wittedrif
-  Transect points (plot end-points)
-  Transect line

250 0 250 500 m





Cross-section: Verlorenvlei @ Wittedrif (water table)



Vegetation units identified

Widespread Species in the *Sporobolus virginicus*-*Phragmites australis* Sandveld Wetland Communities

1. *Cyperus textilis* - *Phragmites australis* Reed Wetland

1.1 *Cyperus textilis* - *Paspalum distichum* Reed Wetland

1.2 *Cyperus textilis* - *Acacia saligna* disturbed form of *Cyperus textilis* - *Phragmites australis* Reed Wetland

1.3 *Cynodon dactylon*-*Juncus acutus* Halophytic Meadow

2. *Sarcocornia pillansii*- *Frankenia repens* Salt marsh

2.1 Typicum

2.2 *Panicum maximum* - *Sarcocornia pillansii* Salt marsh

2.3 *Mesembryanthemum crystallinum* form of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.4 *Senecio burchellii* form of Disturbed *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.5 *Zygophyllum morskana* Sand Strandveld Shrubland

2.6 *Lycium tetrandrum* edge of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

2.7 *Nidorella foetida* - *Sarcocornia pillansii* Salt marsh Edge

2.8 *Ehrharta villosa* Transition Strandveld to *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

3. *Restio subverticillatus* Lowland Fynbos Wetland

4. Secondary *Searsia undulata* Strandveld Bushclump

5. *Typha capensis* Secondary Sandveld Wetland

6. *Restio* sp. - *Psoralea aphylla* Fynbos Wetland

HYDROPERIOD CATEGORIES

Inundation hydroperiod		Saturation hydroperiod	
Permanently inundated	PI	Permanently saturated	PS
Seasonally inundated	SI	Seasonally saturated	SS
Intermittently inundated	II	Intermittently saturated	IS
Not inundated (Dry)	NI	Not saturated (Dry)	NS

Macroinvertebrate Sampling for the Verlorenvlei EWR site:

SASS5 Results

April 2022 - No sampling of macroinvertebrates was possible as the river was dry

September 2022 - *Turbellaria* (1), *Hydracarina* (B), *Beatidae* 2 sp (A), *Corixidae* (A), *Veliidae* (A), *Dytiscidae* (B), *Elmidae* (1), *Hydrophilidae* (b), *Chironomidae* (A), *Culicidae* (B), *Limnaeidae* (1), *Planorbinae* (1)

Invertebrate Habitat Assessment System results 56%.

	SASS Score	No of Families	ASPT	Air Breather Families
2004/07/05	71	16	4.4	5
2005/07/22	53	10	5.3	2
2005/10/24	96	20	4.8	8
2009/05/14	76	16	4.8	5
2009/09/15	44	9	4.9	2
2011/05/11	72	13	5.5	4
2011/07/12	75	14	5.4	4
2011/11/02	39	8	4.9	3
2013/10/07	72	17	4.2	1
2015/02/23	50	13	3.8	6
2022/09/08	68	13	5.2	8
Reference	120		6.5	

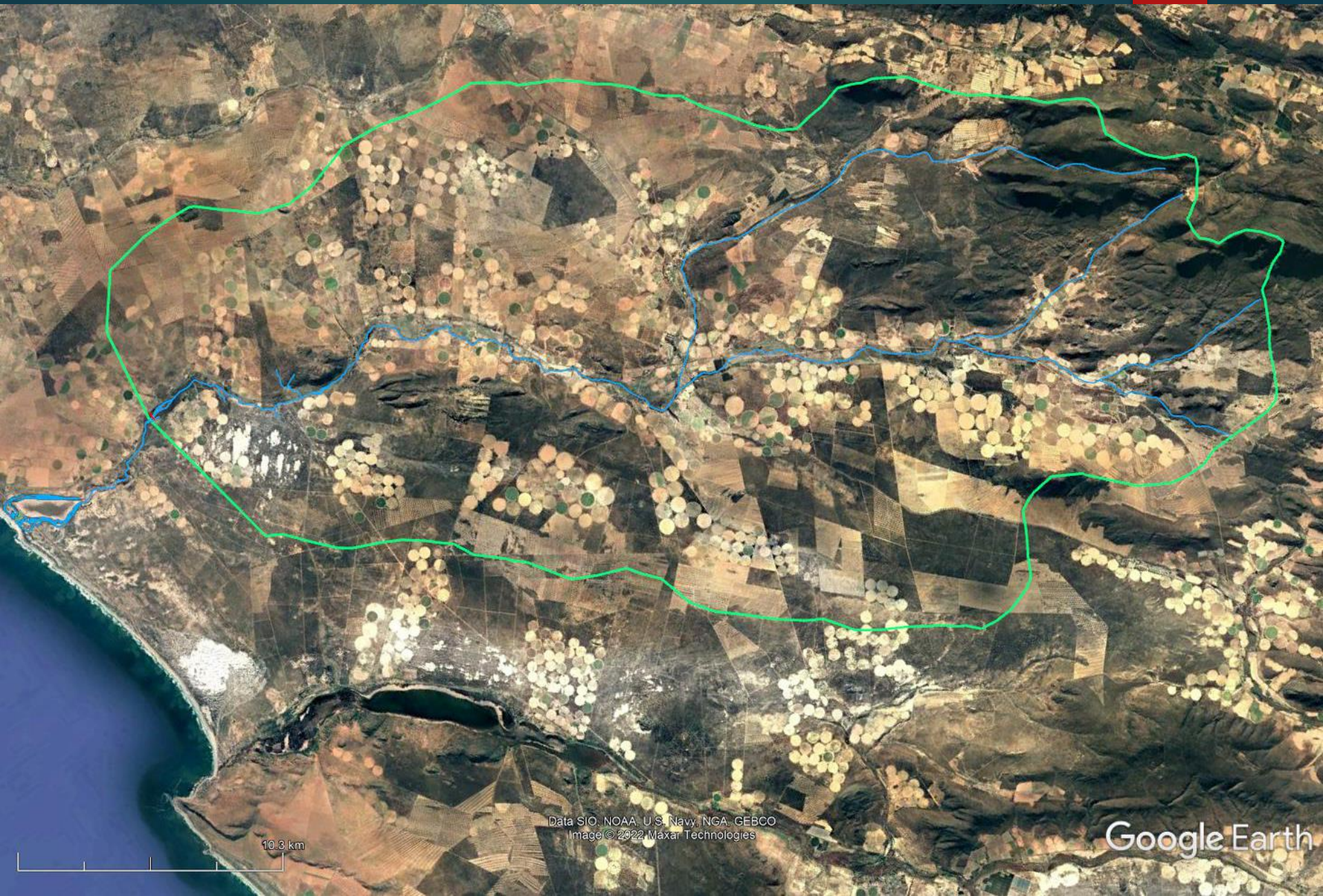
MIRAI

Invertebrate EC: Based on Weights of Metric Groups			
Metric Group	Score	Weight	Weighted Score
Flow Modification	42	0.278	12
Habitat	55	0.278	15
Water Quality	56	0.222	12
Connectivity & Seasonality	49	0.222	11
Invertebrate EC			50
Invertebrate EC Category			D

Other biota observed at the site were: Common water fleas (*Daphnia* spp.), *Ostracoda* spp. (Crustacea), Cape River Frogs (*Amietia fuscigula*)



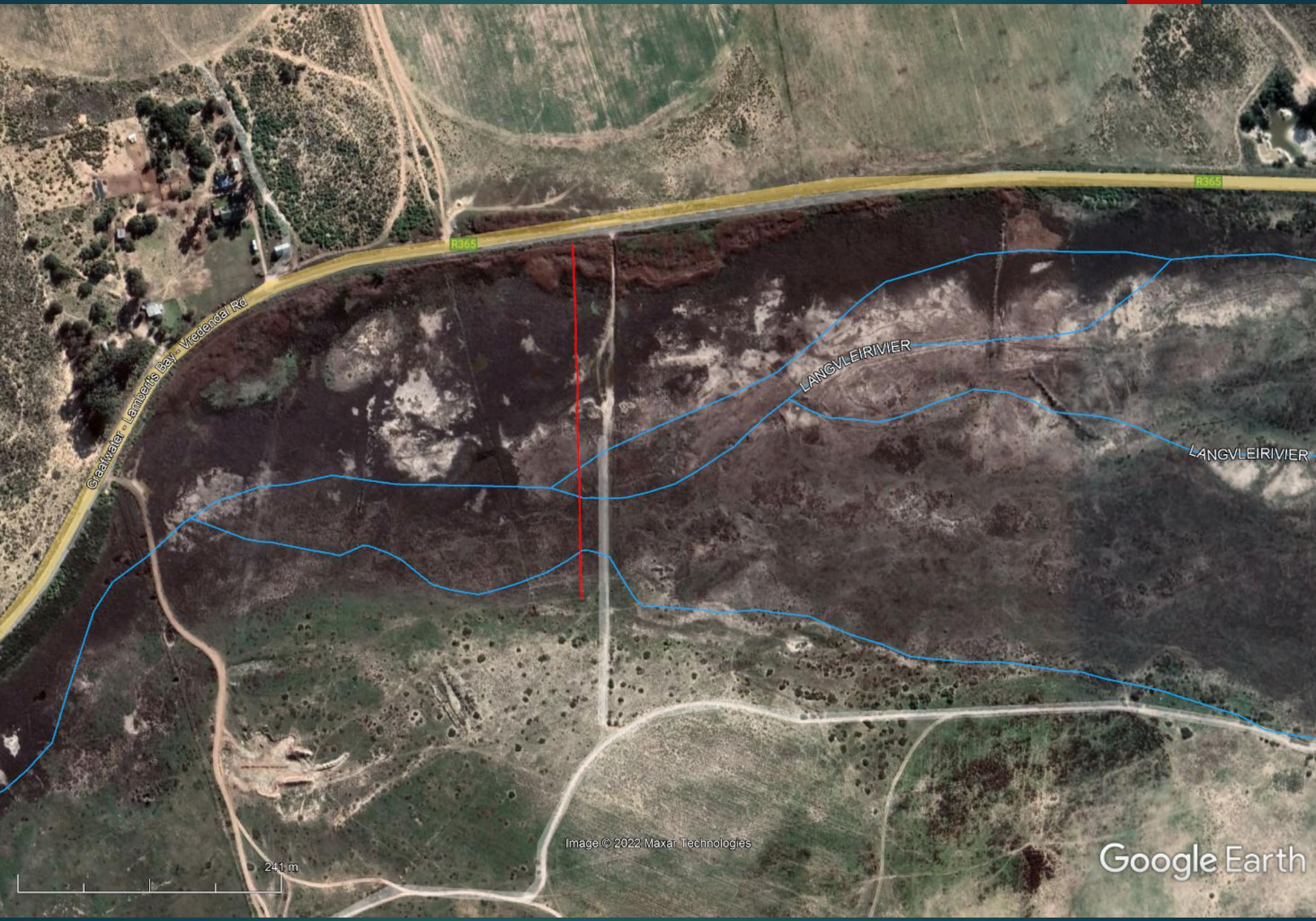
EWR 8: LANGVLEI



Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2022 Maxar Technologies

Google Earth

10.3 km



Glenwater - Lambert's Bay - Vredendal Rd

R365

R365

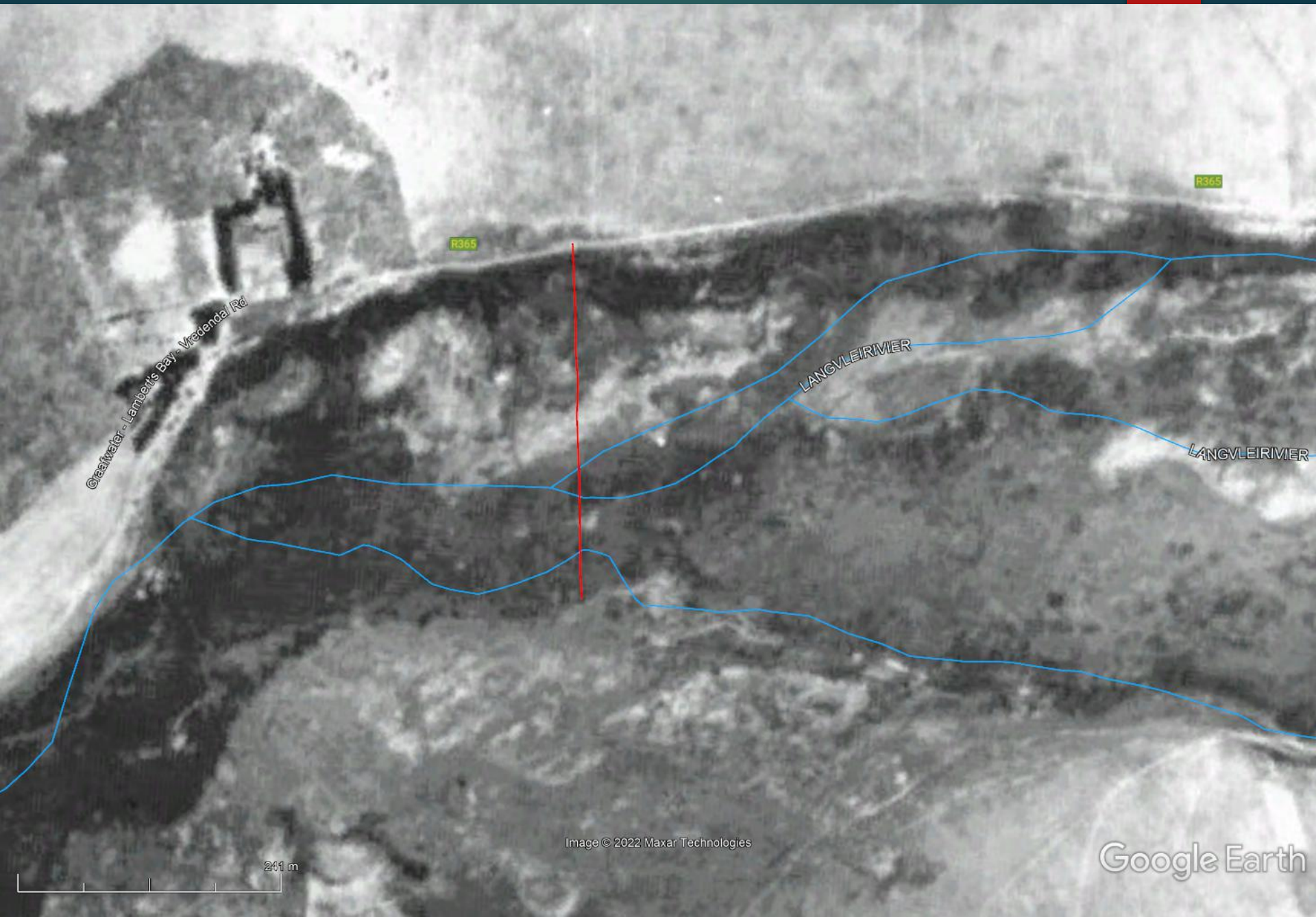
LANGVLEIRIVIER

LANGVLEIRIVIER

241 m

Image © 2022 Maxar Technologies

Google Earth



© 2022 Maxar - Lambert's Bay - Medendal Rd

R365

R365

LANGVLEIRIVIER

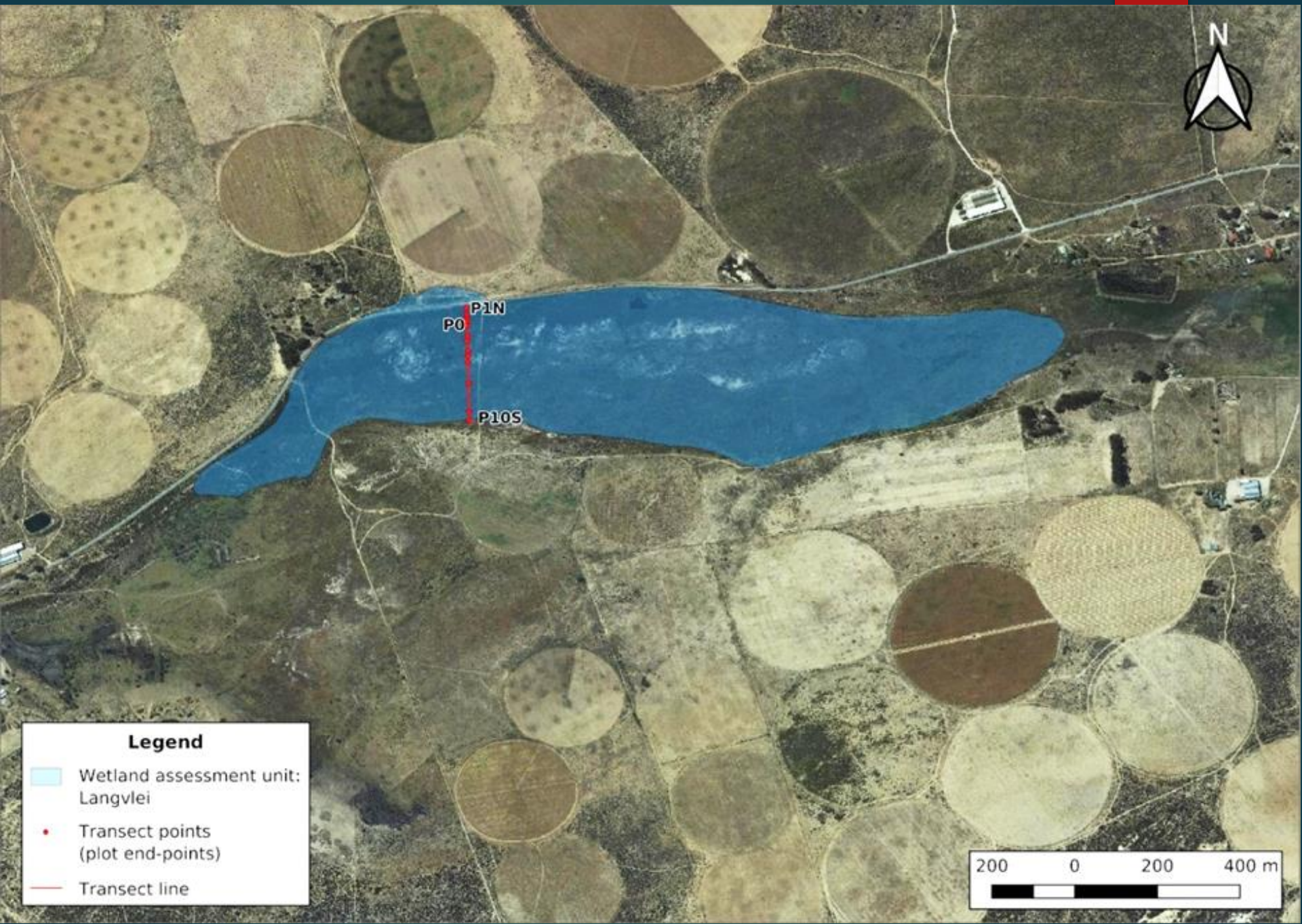
LANGVLEIRIVIER

Image © 2022 Maxar Technologies

Google Earth

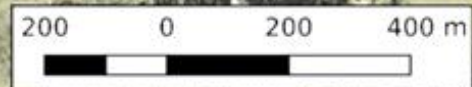
241 m





Legend

-  Wetland assessment unit: Langvlei
-  Transect points (plot end-points)
-  Transect line





Macroinvertebrate Sampling for the Langvlei EWR site:

SASS5 Results

April 2022: *Hydracarina* (B), *Beatidae 2 sp* (B), *Coenagrionidae* (A), *Gomphidae* (1), *Corixidae* (B), *Notonectidae* (A), *Dytiscidae* (A), *Chironomidae* (A), *Culicidae* (B), and *Muscidae* (A)

Invertebrate Habitat Assessment System results 43%.

The water was saline (20 260 mg/l TDS), the substrate anoxic mud and algae abundant in the vegetation.

September 2022 - No SASS5 sampling was undertaken in the September visit as the water was too shallow.

	SASS Score	No of Families	ASPT	Air Breather Families
2004/07/06	45	12	3.8	4
2005/07/22	36	9	4	4
2005/10/24	27	7	3.9	2
2009/05/14	45	10	4.5	4
2009/09/15	21	5	4.2	2
2011/11/02	34	9	3.8	4
2013/10/07	54	12	4.5	2
2022/04/07	9	3	3	3
Reference	120		6.5	

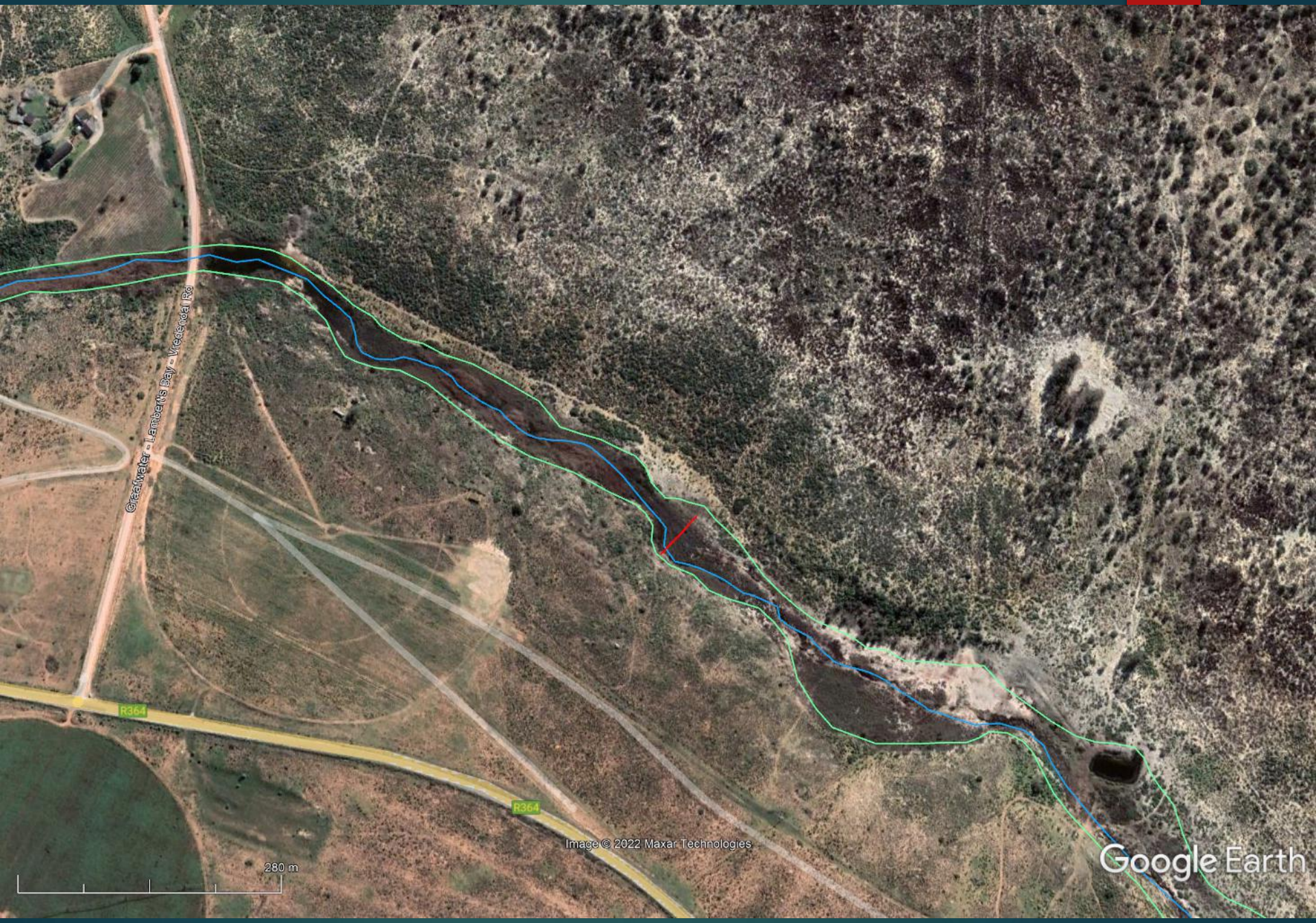
MIRAI

Invertebrate EC: Based on Weights of Metric Groups			
Metric Group	Score	Weight	Weighted Score
Flow Modification	32	0.278	9
Habitat	36	0.278	10
Water Quality	48	0.222	11
Connectivity & Seasonality	36	0.222	8
Invertebrate EC			37
Invertebrate EC Category			E

Other biota observed at the site were: *Ostracoda* spp. (Crustacea)

EWR 7: JAKKALS





Grainwater - Lamberts Bay - Vredenburg Rd

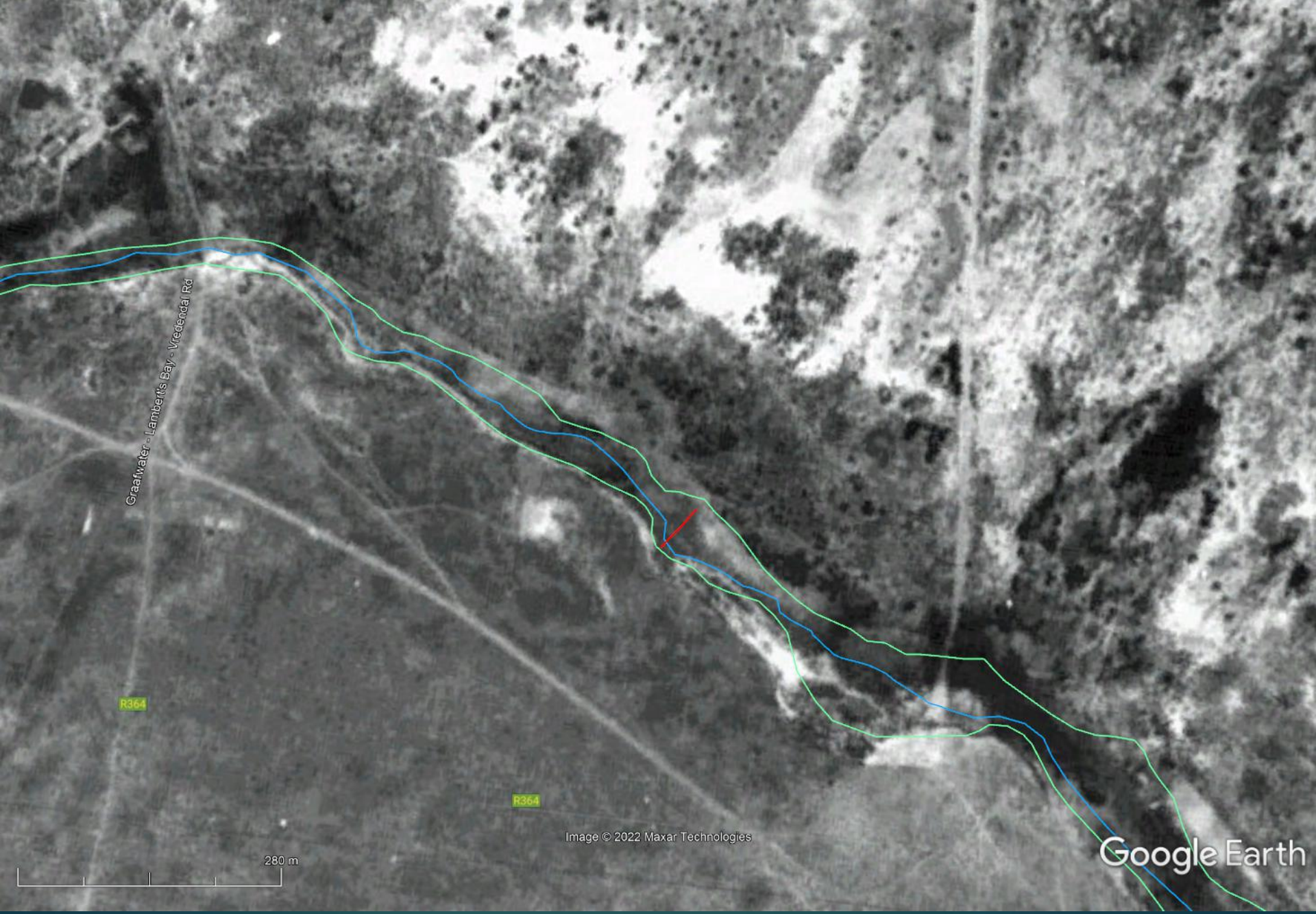
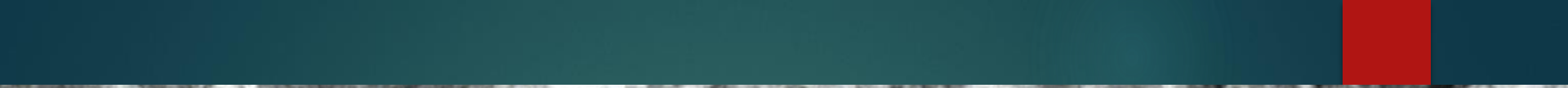
R364

R364

Image © 2022 Maxar Technologies

280 m

Google Earth



Graatwater - Lambert's Bay - Vredendal Rd

R364

R364

Image © 2022 Maxar Technologies

280 m

Google Earth



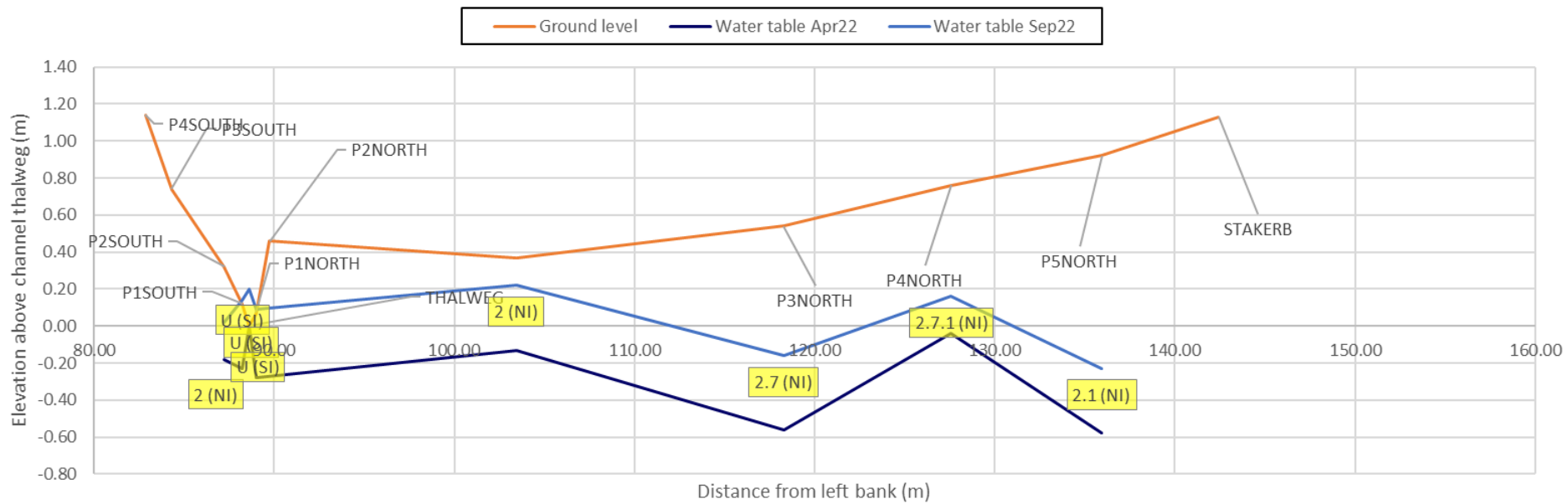
Legend

- Wetland assessment unit: Jakkalsvlei
- Transect points (plot end-points)
- Transect line

50 0 50 100 m



Cross-section: Jakkalsvlei (water table)



Vegetation units identified

Widespread Species in the *Sporobolus virginicus*-*Phragmites australis* Sandveld Wetland Communities

1. *Cyperus textilis* - *Phragmites australis* Reed Wetland

- 1.1 *Cyperus textilis* - *Paspalum distichum* Reed Wetland
- 1.2 *Cyperus textilis* - *Acacia saligna* disturbed form of *Cyperus textilis* - *Phragmites australis* Reed Wetland
- 1.3 *Cynodon dactylon*-*Juncus acutus* Halophytic Meadow

2. *Sarcocornia pillansii*- *Frankenia repens* Salt marsh

- 2.1 Typicum
- 2.2 *Panicum maximum* - *Sarcocornia pillansii* Salt marsh
- 2.3 *Mesembryanthemum crystallinum* form of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh
- 2.4 *Senecio burchellii* form of Disturbed *Sarcocornia pillansii* - *Frankenia repens* Salt marsh
- 2.5 *Zygophyllum morskana* Sand Strandveld Shrubland
- 2.6 *Lycium tetrandrum* edge of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh
- 2.7 *Nidorella foetida* - *Sarcocornia pillansii* Salt marsh Edge
- 2.8 *Ehrharta villosa* Transition Strandveld to *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

3. *Restio subverticillatus* Lowland Fynbos Wetland

4. Secondary *Searsia undulata* Strandveld Bushclump

5. *Typha capensis* Secondary Sandveld Wetland

6. *Restio* sp. - *Psoralea aphylla* Fynbos Wetland

HYDROPERIOD CATGORIES					
Inundation hydroperiod			Saturation hydroperiod		
Permanently inundated	PI		Permanently saturated	PS	
Seasonally inundated	SI		Seasonally saturated	SS	
Intermittently inundated	II		Intermittently saturated	IS	
Not inundated (Dry)	NI		Not saturated (Dry)	NS	

Macroinvertebrate Sampling for the Jakkals EWR site:

April 2022 - *Corixidae* (B), *Hydrophilidae* (A), and *Culicidae* (A)

The water was saline (14 443 mg/l TDS), the substrate anoxic mud and algae abundant in the vegetation.

September 2022 - *Oligochaeta* (1), *Hydracarina* (A), *Beatidae* >2 sp (C), *Coenagrionidae* (B), *Corduliidae* (A), *Libellulidae* (A), *Corixidae* (A), *Dytiscidae* (B), *Elmidae* (A), *Gyrinidae* (A), *Chironomidae* (A), *Culicidae* (B),

Invertebrate Habitat Assessment System results 44

Other biota observed at the site were: Common water fleas (*Daphnia* app.), Cape River Frogs (*Amietia fuscigula*)

	SASS Score	No of Families	ASPT	Air Breather Families
2004/07/05	47	11	4.3	4
2005/07/28	44	13	3.4	3
2005/10/25	60	12	5	3
2022/04/07	39	10	3.9	3
2022/09/06	61	12	5	4
Reference	120		6.5	

MIRAI

Invertebrate EC: Based on Weights of Metric Groups			
Metric Group	Score	Weight	Weighted Score
Flow Modification	56	0.278	16
Habitat	60	0.278	17
Water Quality	69	0.222	15
Connectivity & Seasonality	69	0.222	15
Invertebrate EC			62
Invertebrate EC Category			C

EWR 15: PAPKUILS

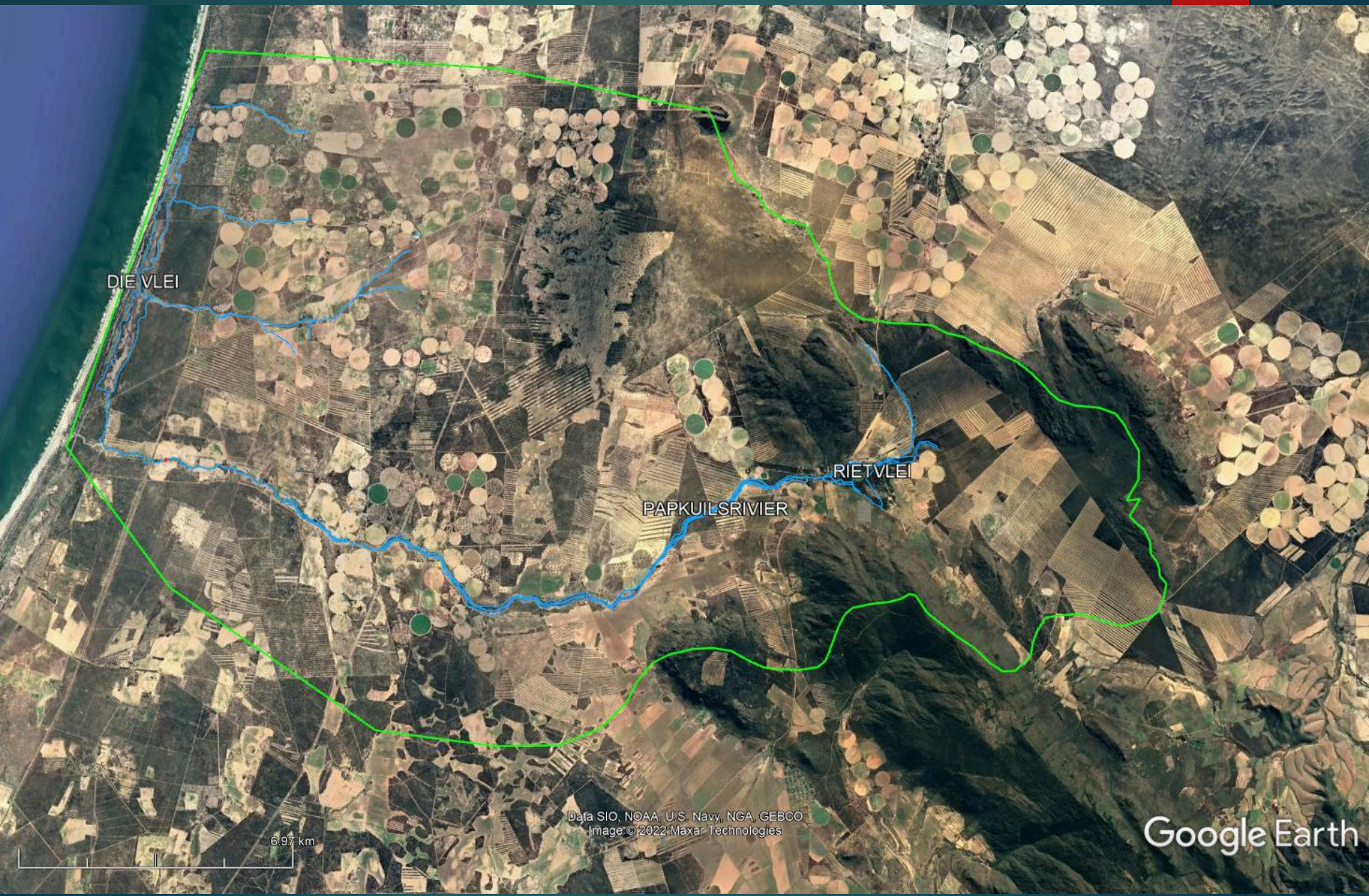




Image © 2022 Maxar Technologies

Google Earth

306 m

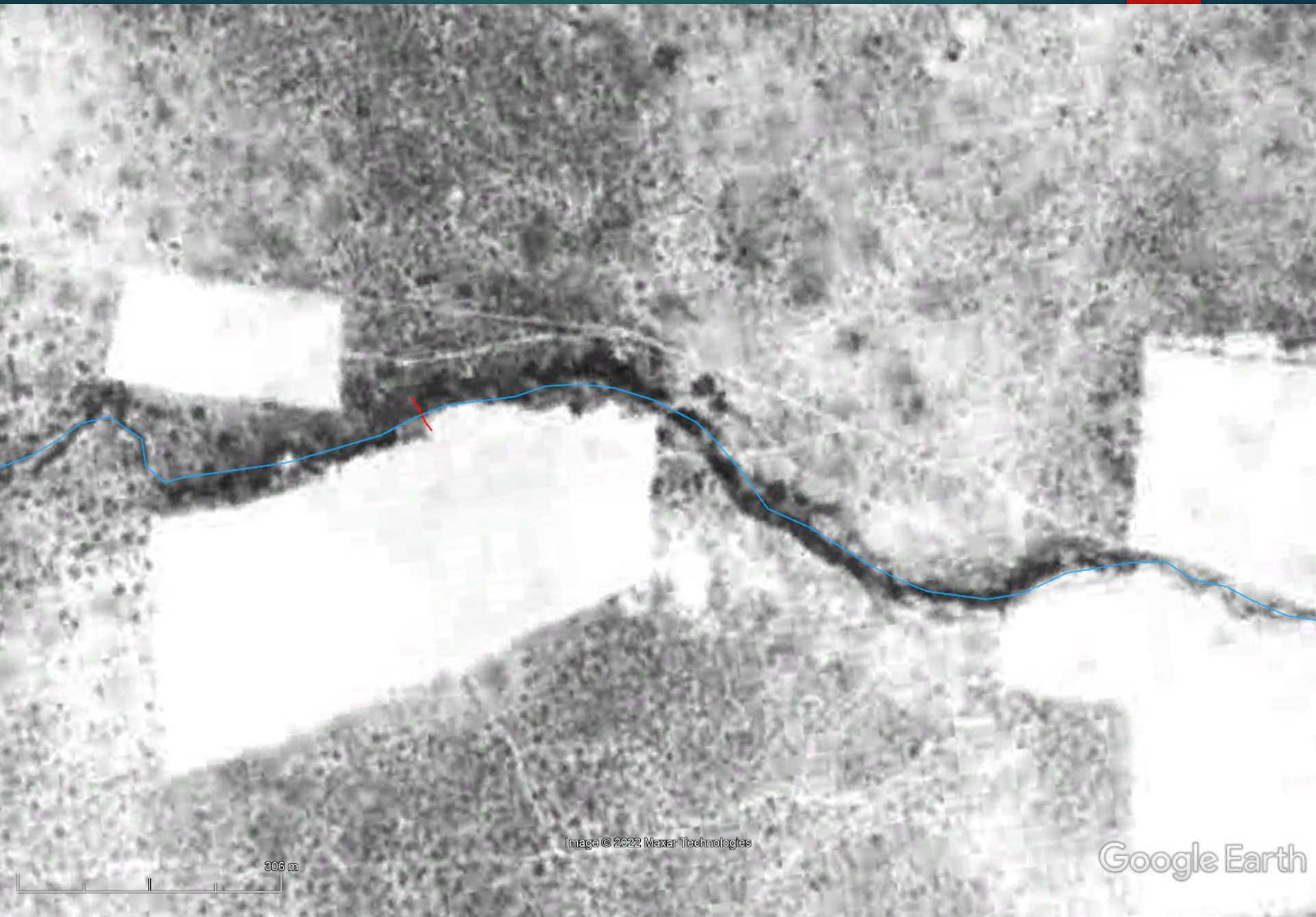


Image © 2022 Maxar Technologies

Google Earth

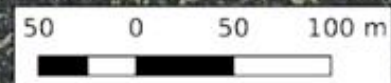
306 m





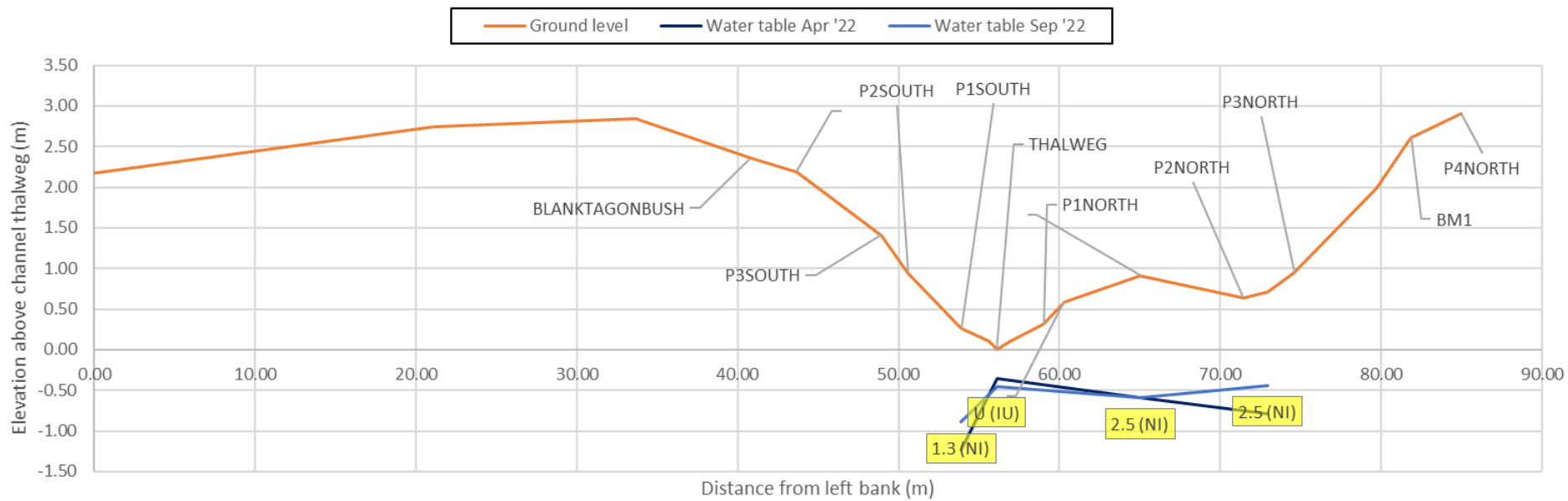
Legend

- Wetland assessment unit:
Lower Papkuils
- Transect points
(plot end-points)
- Transect line





Cross-section: Lower Papkuilsvlei (water table)



Vegetation units identified

Widespread Species in the *Sporobolus virginicus*-*Phragmites australis* Sandveld Wetland Communities

1. *Cyperus textilis* - *Phragmites australis* Reed Wetland

- 1.1 *Cyperus textilis* - *Paspalum distichum* Reed Wetland
- 1.2 *Cyperus textilis* - *Acacia saligna* disturbed form of *Cyperus textilis* - *Phragmites australis* Reed Wetland
- 1.3 *Cynodon dactylon*-*Juncus acutus* Halophytic Meadow

2. *Sarcocornia pillansii*- *Frankenia repens* Salt marsh

- 2.1 Typicum
- 2.2 *Panicum maximum* - *Sarcocornia pillansii* Salt marsh
- 2.3 *Mesembryanthemum crystallinum* form of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh
- 2.4 *Senecio burchellii* form of Disturbed *Sarcocornia pillansii* - *Frankenia repens* Salt marsh
- 2.5 *Zygophyllum morskana* Sand Strandveld Shrubland
- 2.6 *Lycium tetrandrum* edge of *Sarcocornia pillansii* - *Frankenia repens* Salt marsh
- 2.7 *Nidorella foetida* - *Sarcocornia pillansii* Salt marsh Edge
- 2.8 *Ehrharta villosa* Transition Strandveld to *Sarcocornia pillansii* - *Frankenia repens* Salt marsh

3. *Restio subverticillatus* Lowland Fynbos Wetland

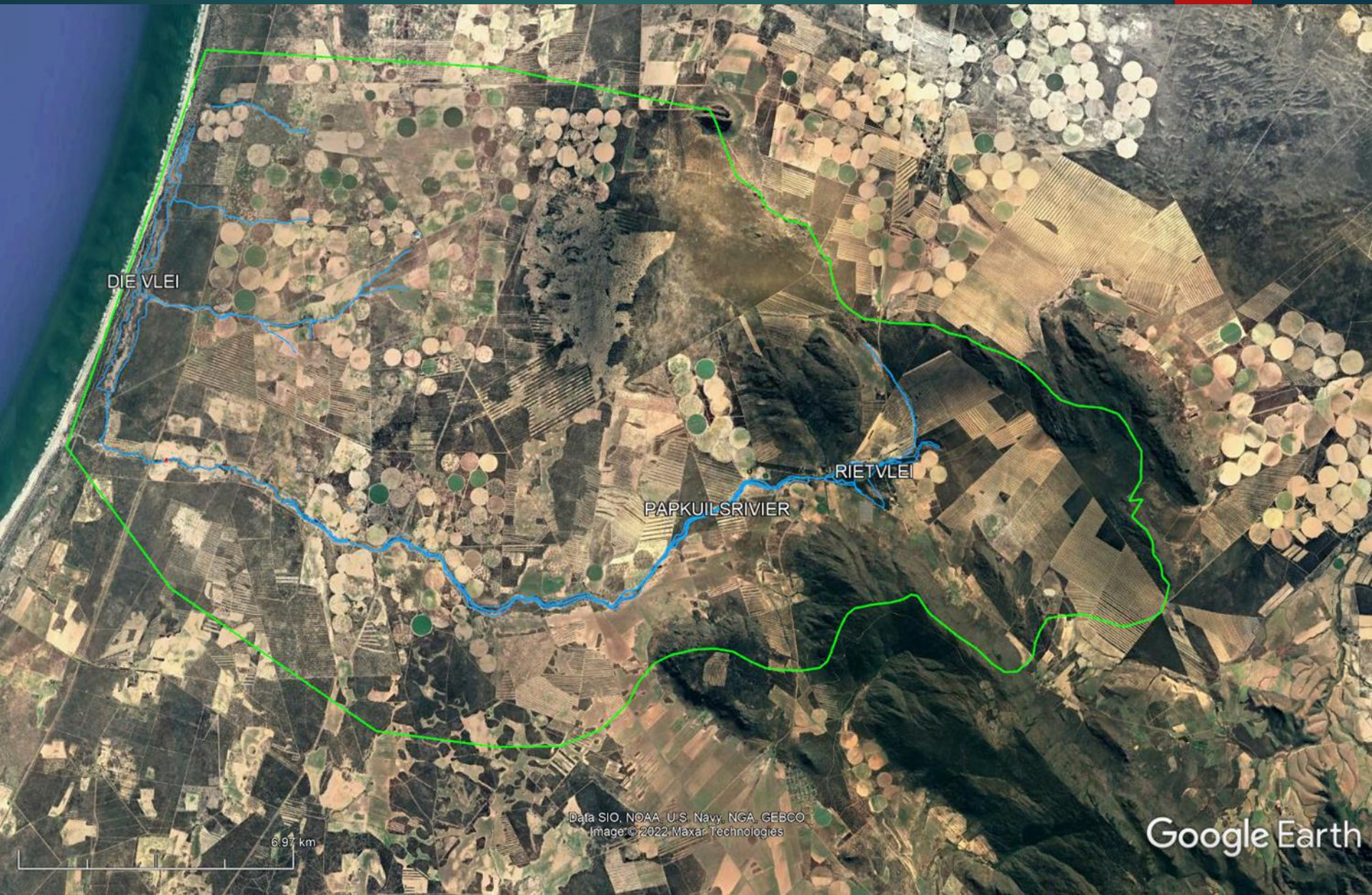
4. Secondary *Searsia undulata* Strandveld Bushclump

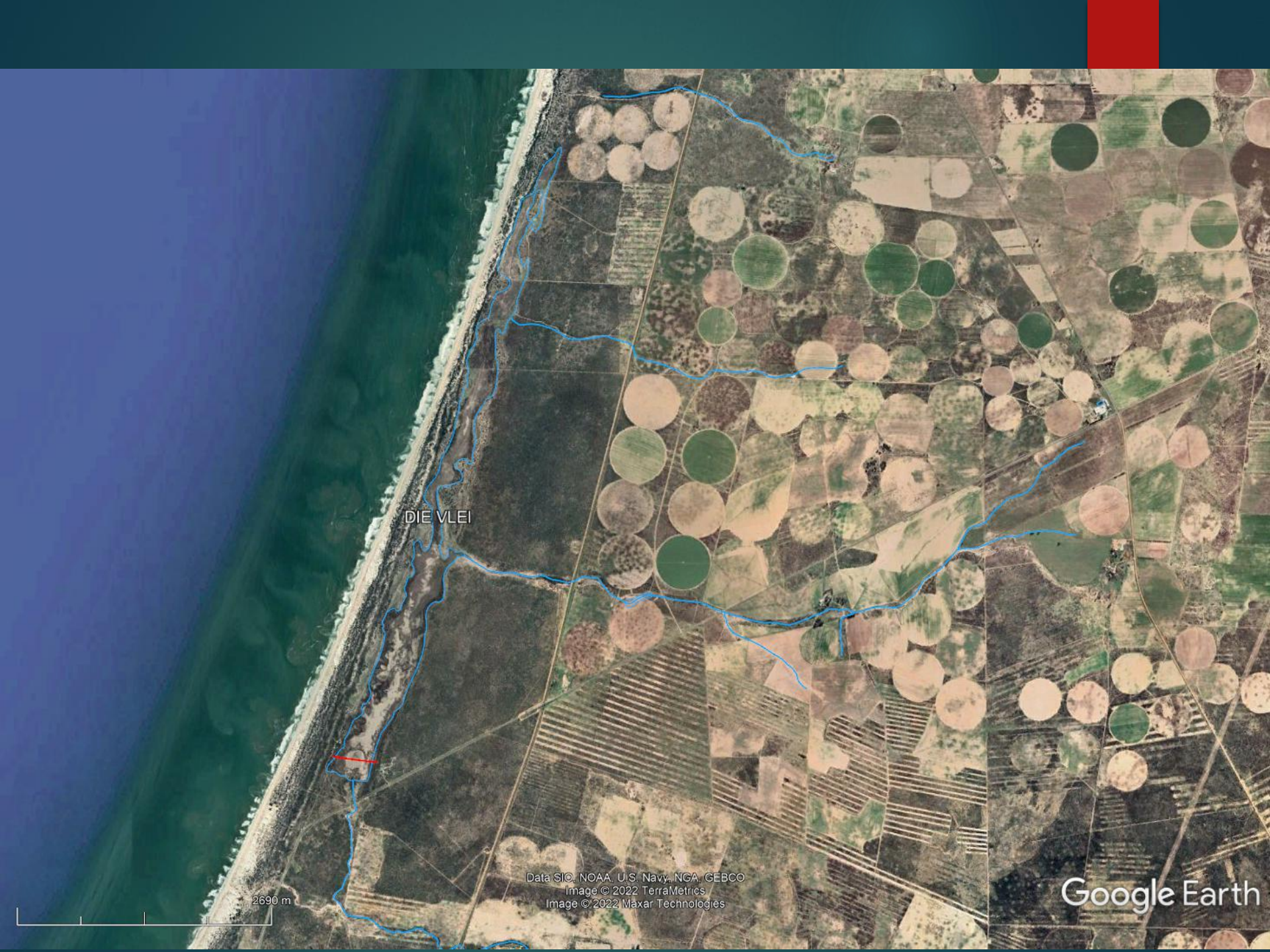
5. *Typha capensis* Secondary Sandveld Wetland

6. *Restio* sp. - *Psoralea aphylla* Fynbos Wetland

HYDROPERIOD CATEGORIES					
Inundation hydroperiod			Saturation hydroperiod		
Permanently inundated	PI		Permanently saturated	PS	
Seasonally inundated	SI		Seasonally saturated	SS	
Intermittently inundated	II		Intermittently saturated	IS	
Not inundated (Dry)	NI		Not saturated (Dry)	NS	

EWR 14: ROSHERPAN





DIE VLEI

2690 m

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2022 TerraMetrics
Image © 2022 Maxar Technologies

Google Earth



Image © 2022 TerraMetrics
Image © 2022 Maxar Technologies

Google Earth

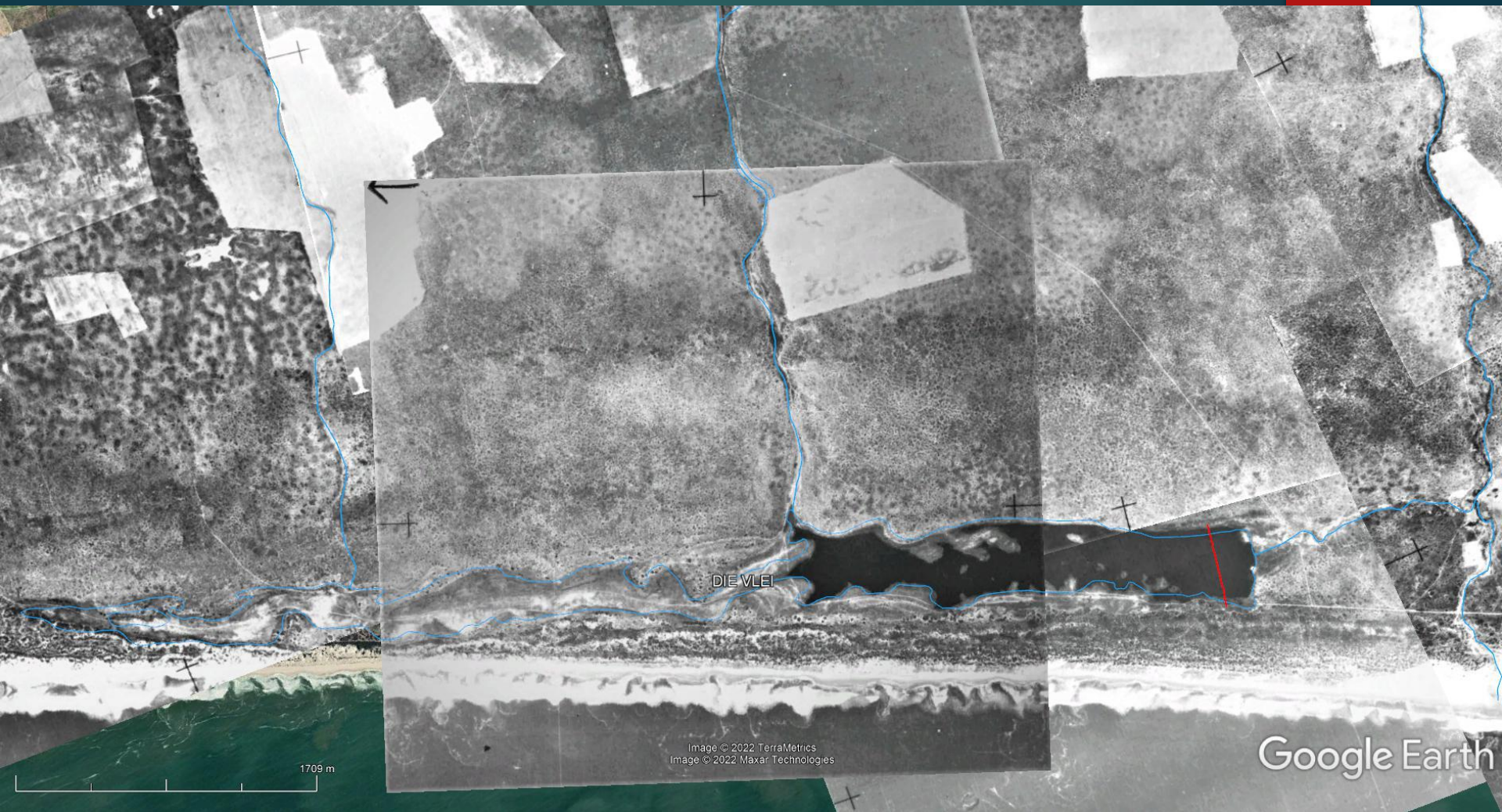


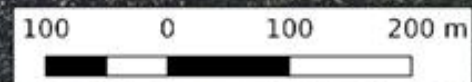
Image © 2022 TerraMetrics
Image © 2022 Maxar Technologies

Google Earth



Legend

- Wetland assessment unit: Rocherpan
- Transect points (plot end-points)
- Transect line





EWR 16: PAPKUILSVLEI

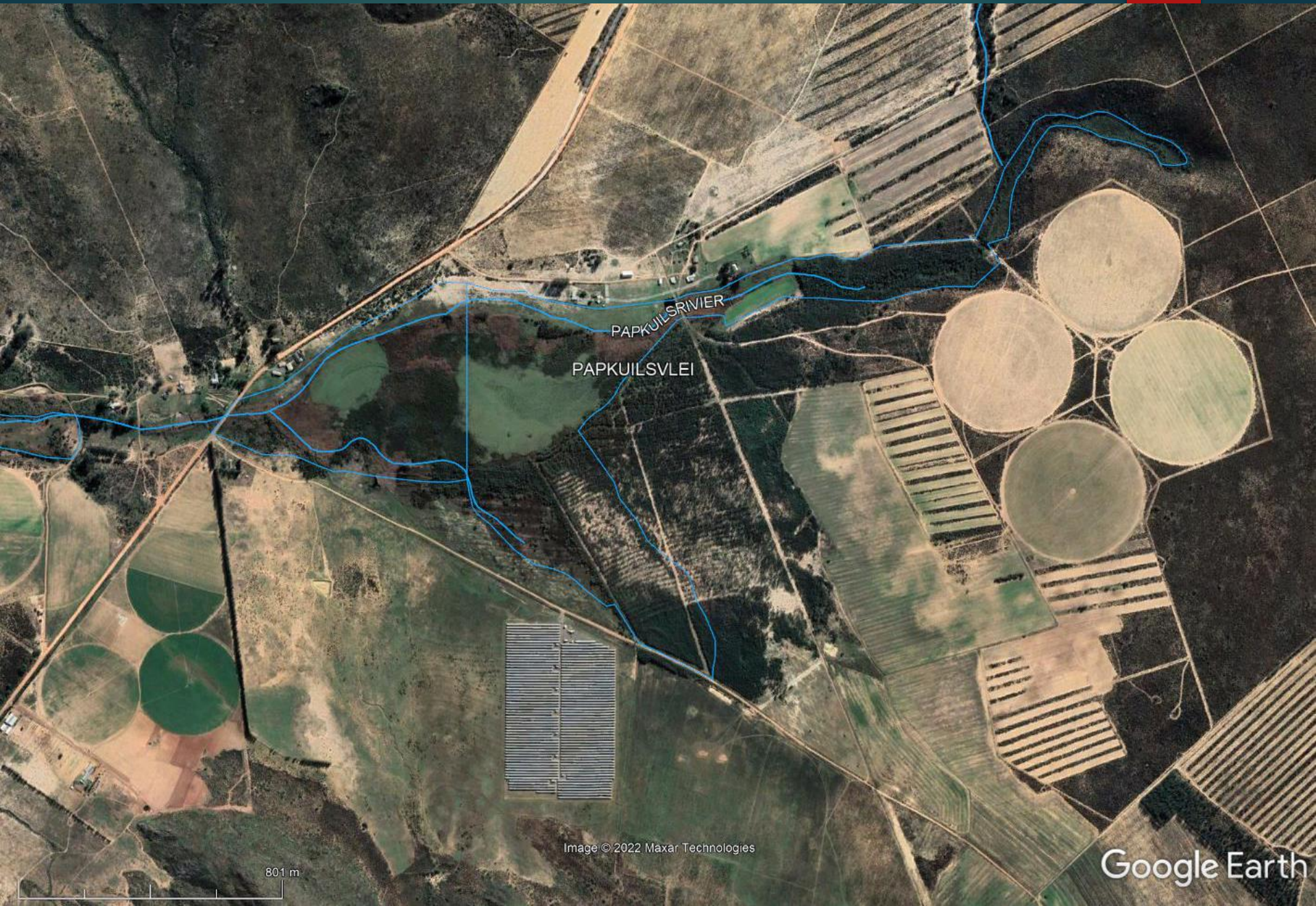


Image © 2022 Maxar Technologies

Google Earth

801 m



Image © 2022 Maxar Technologies

Google Earth



Legend

-  Wetland assessment unit:
Upper Papkuilsvlei
-  Sampling points
(Vegetation and soil)





EWR 13: G30A DEPRESSION



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Google Earth

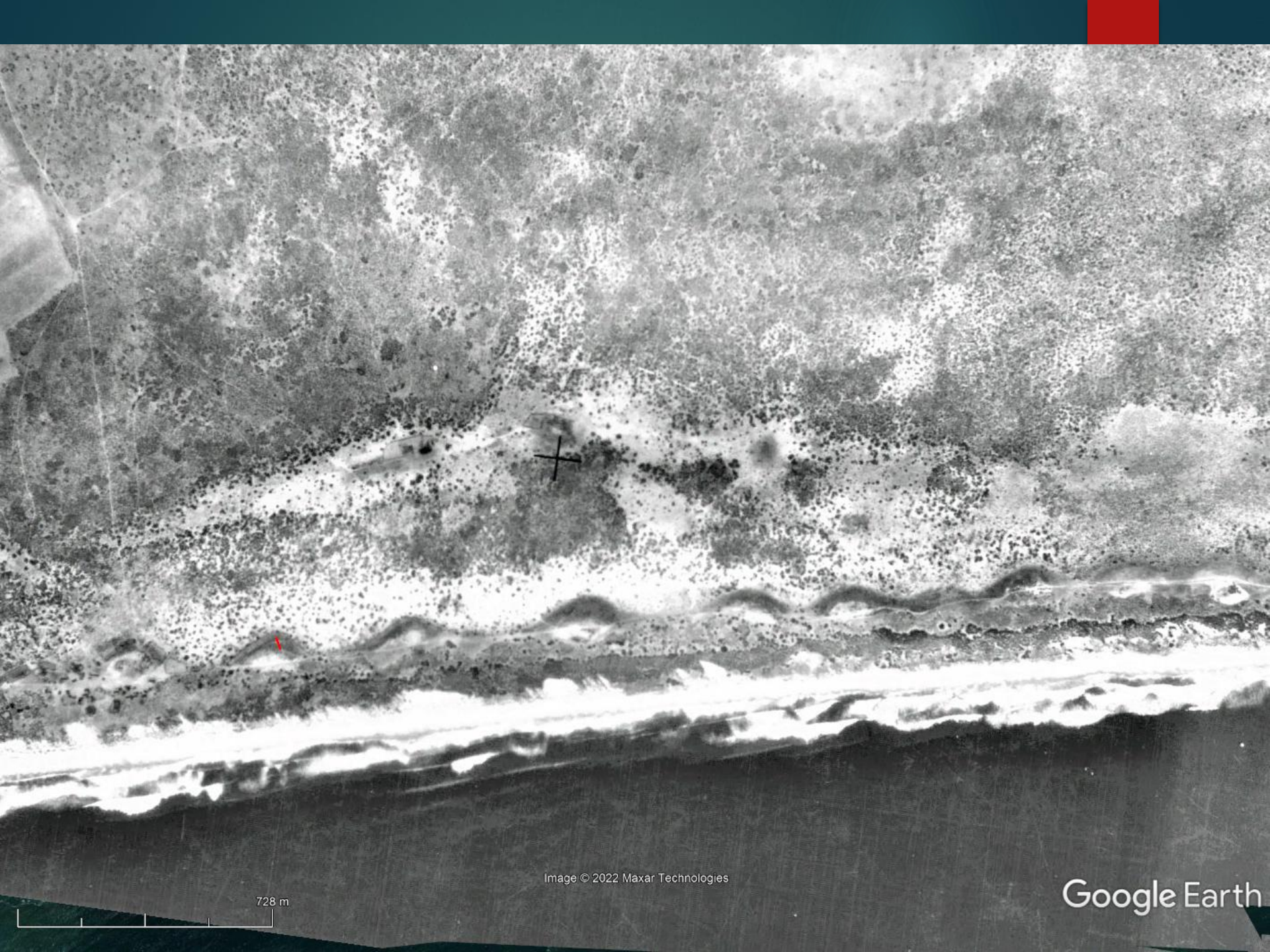


Image © 2022 Maxar Technologies

Google Earth

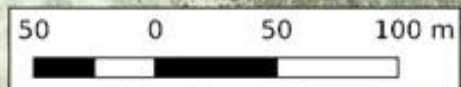
728 m





Legend

-  Wetland assessment unit: G30A dune-slack depression
-  Transect line
-  Transect points (plot end-points)







THANK YOU

