TILENGA PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Volume VI(b)

Submitted to:
National Environment Management Authority

February 2019

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2019

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Appendix J Soils and Geology

J.1 Summary of Soil Samples

Location ID	Sample ID	Date	Sample Interval (cm below ground)	Description
S1	S1-170611-T1	11 June 2017	0 - 5	Characterise soil quality in vicinity of natural oil seep
	S1-170611-B1		5- 20	
S2	S2-170611-T1	11 June 2017	0 - 5	Characterise soil quality in vicinity of natural oil seep
	S2-170611-B1		5- 20	
S3	S3-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad JBR-02 and flowline in MFNP north of Nile River
	S3-170611-B1		5- 20	
S4	S4-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed Industrial Area
	S4-170611-B1		5- 20	
S5	S5-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad NSO-03 and flowline in LA-2 near Ngwedo Village
	S5-170611-B1		5- 20	
S6	S6-170610-T1	10 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad KW-02 and flowline near Kisansya Village
	S6-170610-B1		5- 20	
S7	S7-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad NSO-04 and flowline in uncultivated area south of Ngwedo Village
	S7-170611-B1		5- 20	
S8	S8-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad KGG-04 and flow line near edge of cultivated area
	S8-170611-B1		5- 20	
S9	S9-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed well pad KGG-06 and flowline
	S9-170611-B1		5- 20	
S10	S10-170612-T1	12 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed Industrial Area
	S10-170612-B1		5- 20	
S11	S11-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate pollution runoff and erosion risk from proposed Industrial Area
	S11-170611-B1		5- 20	
S12	S12-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate pollution run-on to Industrial Area
	S12-170611-B1		5- 20	
S13	S13-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed production well pad NSO-01 and flowline
	S13-170611-B1		5- 20	
S14	S14-170611-T1	11 June 2017	0 - 5	Define background soil quality and gather

Location ID	Sample ID	Date	Sample Interval (cm below ground)	Description
	S14-170611-B1		5- 20	data to evaluate erosion risk near proposed production well pad KGG-03 and flowline
S15	S15-170610-T1	10 June 2017	0 - 5	Define background soil quality and gather data to evaluate erosion risk near proposed production well pad KW-01 and flowline
	S15-170610-T1		5- 20	

J.2 Seismic Events near Project Area 2000 - 2017

Date of the event	Coordinates of the epicentre (UTM Zone 36N)		Depth of the earthquake starting point (km)	Magnitude (Mb)
	Easting (m)	Northings (m)		
2/25/2017	290450	156231	10	4.7
2/18/2017	246886	161237	10	4.2
11/24/2015	285980	160891	10	4.2
9/12/2015	128584	43966	18.36	4.5
7/17/2015	196511	129058	10.08	4.4
6/29/2015	303261	305013	10	4.5
10/31/2014	165488	54434	10	4.5
9/21/2014	193222	83415	10	4.4
10/8/2013	229694	168866	24.95	4.6
8/5/2013	253389	183442	10	4.1
8/5/2013	282937	180469	10	4.7
8/5/2013	282703	180215	9.93	4.6
7/30/2013	184972	49246	15.3	4.4
7/3/2013	257227	171226	10	5.1
7/3/2013	274814	171098	11.2	4.4
7/3/2013	265686	170001	10.1	5.7
7/2/2013	267140	177631	10	5.2
4/20/2013	262677	166354	10	4.8
10/2/2012	165142	52907	10	4.4
3/15/2011	303214	193079	10	5
1/17/2011	251667	176984	10	4.8
12/27/2010	537166	19343	10	4.5
12/12/2010	129281	89018	10	4.9
10/8/2010	227913	137404	26.2	4.6
10/18/2009	182193	62306	10	4.9
7/30/2009	221349	142942	10	4.6
8/26/2008	267677	251404	10	4.4
5/11/2008	120451	52928	10	4.4
6/15/2007	259028	190138	24	5.9
4/29/2007	254264	208285	10	4.5
2/21/2007	245004	190708	10	0
2/19/2007	250573	193577	19	5.6
5/29/2006	178729	37960	23.9	4.9
4/27/2006	172490	36855	10	4.4
4/27/2006	174718	37408	10	5.2
3/13/2005	152985	21032	10	4.5
12/13/2004	184880	85766	18.7	4.8
12/13/2004	185094	71933	20	4.3
6/7/2004	335807	377148	4.2	3.7
3/18/2004	322166	231542	30	4.7
2/5/2004	216305	105883	10	4.8
11/2/2003	184751	52345	10	3.8
5/3/2003	128590	56688	10	4.5
1/19/2003	160159	101723	10	4.5
8/10/2002	428679	367208	10	4
1/27/2002	134405	85803	10	4.7
6/29/2001	162906	32320	10	5.3
1/31/2001	109637	51604	27.7	4.9
10/23/2000	232063	166828	21.2	4.8

Date of the event	Coordinates of the epicentre (UTM Zone 36N)		Depth of the earthquake starting point (km)	Magnitude (Mb)
	Easting (m)	Northings (m)		
2/25/2017	290450	156231	10	4.7
2/18/2017	246886	161237	10	4.2
11/24/2015	285980	160891	10	4.2
9/12/2015	128584	43966	18.36	4.5
7/17/2015	196511	129058	10.08	4.4
6/29/2015	303261	305013	10	4.5
10/31/2014	165488	54434	10	4.5
9/21/2014	193222	83415	10	4.4
10/8/2013	229694	168866	24.95	4.6
8/5/2013	253389	183442	10	4.1
8/5/2013	282937	180469	10	4.7
8/5/2013	282703	180215	9.93	4.6
7/30/2013	184972	49246	15.3	4.4
7/3/2013	257227	171226	10	5.1
7/3/2013	274814	171098	11.2	4.4
7/3/2013	265686	170001	10.1	5.7
7/2/2013	267140	177631	10	5.2
4/20/2013	262677	166354	10	4.8
10/2/2012	165142	52907	10	4.4
3/15/2011	303214	193079	10	5
1/17/2011	251667	176984	10	4.8
12/27/2010	537166	19343	10	4.5
12/12/2010	129281	89018	10	4.9
10/8/2010	227913	137404	26.2	4.6
10/18/2009	182193	62306	10	4.9
7/30/2009	221349	142942	10	4.6
8/26/2008	267677	251404	10	4.4
5/11/2008	120451	52928	10	4.4
6/15/2007	259028	190138	24	5.9
4/29/2007	254264	208285	10	4.5
2/21/2007	245004	190708	10	0
2/19/2007	250573	193577	19	5.6
5/29/2006	178729	37960	23.9	4.9
4/27/2006	172490	36855	10	4.4
4/27/2006	174718	37408	10	5.2
3/13/2005	152985	21032	10	4.5
12/13/2004	184880	85766	18.7	4.8
12/13/2004	185094	71933	20	4.3
6/7/2004	335807	377148	4.2	3.7
3/18/2004	322166	231542	30	4.7
2/5/2004	216305	105883	10	4.8
11/2/2003	184751	52345	10	3.8
5/3/2003	128590	56688	10	4.5
1/19/2003	160159	101723	10	4.5
8/10/2002	428679	367208	10	4
1/27/2002	134405	85803	10	4.7
6/29/2001	162906	32320	10	5.3
1/31/2001	109637	51604	27.7	4.9
10/23/2000	232063	166828	21.2	4.8

J.3 Soils Laboratory Results

AECOM Uganda

Rwenzori Towers, 5th Floor, Nakasero ---
-- KAMPALA
UGANDA

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Date: 12-Jul-2017

Please find enclosed the analytical results of the test carried out for the project.

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Your project name	AECOM Uganda
Your order number	Soils
Samples received on	03-Jul-2017

This Certificate of Analysis shall not be reproduced except in full, without written approval of the laboratory. Interpretations and opinions are outside the scope of our accreditation, and all results relate only to samples supplied.

Soil samples will be stored for a period of 4 weeks and water samples for a period of 2 weeks after receipt of the samples at our laboratory. Without any additional request, samples will be disposed when the above mentioned periods have expired. If you require Eurofins Analytico to store the samples for a longer period, please complete this page and return it to Eurofins Analytico at least one businessday before the period is due to expire.
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Yours sincerely,

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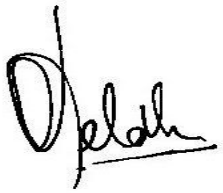

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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	1/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	1	2	3	4	5
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	99.3	98.2	99.5	98.5	99.8
Q	Moisture residue	% (w/w)	0.7	1.8	0.5	1.5	0.2
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	0.9	<0.7	0.7	0.7	0.9
Q	Residue on ignition	% (w/w) dm	98.8	98.9	99.0	98.9	98.8
Q	Carbonates (CaCO3)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	97.1	96.5	96.1	95.4	95.5
Q	Fraction < 63 µm	% (w/w) dm	12.5	14.4	14.4	16.3	14.0
Q	Fraction < 45 µm	% (w/w) dm	9.1	10.3	9.5	12.2	9.5
Q	Fraction < 16 µm	% (w/w) dm	6.4	7.8	5.7	8.3	5.6
Q	Fraction < 2 µm	% (w/w) dm	4.9	6.2	3.7	5.9	3.8
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	17	<15	<15	19
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	34	<15	16	15	25
Q	Cobalt (Co)	mg/kg dm	4.7	4.5	3.5	4.4	3.7
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	0.95	0.82	0.80	0.96	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	<10	<10	10	<10
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
1	S8-170611-T1	11-Jun-2017	9612056
2	S8-170611-B1	11-Jun-2017	9612079
3	S9-170611-T1	11-Jun-2017	9612080
4	S9-170611-B1	11-Jun-2017	9612081
5	S5-170611-T1	11-Jun-2017	9612082

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	2/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	1	2	3	4	5
Q	Calcium (Ca)	mg/kg dm	100	63	180	150	230
Q	Potassium (K)	mg/kg dm	220	190	250	250	200
Q	Magnesium (Mg)	mg/kg dm	100	98	150	160	130
Q	Sodium (Na)	mg/kg dm	31	19	<10	17	59
Q	Phosphorus total (P)	g/kg dm	0.075	0.065	0.078	0.072	0.080
Q	Phosphorus total (P04)	g/kg dm	0.23	0.20	0.24	0.22	0.24
Q	Phosphorus total (P205)	g/kg dm	0.17	0.15	0.18	0.16	0.18
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	<6.0	<6.0	<6.0	6.3	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	20	21	21	20	21
Q	Acidity (pH-CaCl2)		5.3	4.7	5.3	4.7	5.6
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
1	S8-170611-T1	11-Jun-2017	9612056
2	S8-170611-B1	11-Jun-2017	9612079
3	S9-170611-T1	11-Jun-2017	9612080
4	S9-170611-B1	11-Jun-2017	9612081
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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	3/18
Sample matrix	Soil, Sediment		

Analysis	Unit	1	2	3	4	5
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
1	S8-170611-T1	11-Jun-2017	9612056
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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	4/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	6	7	8	9	10
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	99.0	99.5	98.4	99.7	98.5
Q	Moisture residue	% (w/w)	1.0	0.5	1.6	0.3	1.5
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	0.7	0.8	0.7	<0.7	<0.7
Q	Residue on ignition	% (w/w) dm	98.9	98.9	98.9	99.0	99.0
Q	Carbonates (CaCO3)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	97.2	94.2	95.9	98.5	96.4
Q	Fraction < 63 µm	% (w/w) dm	15.9	20.4	20.8	11.0	12.3
Q	Fraction < 45 µm	% (w/w) dm	11.3	11.4	14.0	8.7	9.5
Q	Fraction < 16 µm	% (w/w) dm	7.4	5.5	8.1	5.3	7.2
Q	Fraction < 2 µm	% (w/w) dm	5.6	3.9	5.9	3.7	5.6
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	15	<15	<15	18	17
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	16	16	<15	<15	<15
Q	Cobalt (Co)	mg/kg dm	4.3	1.8	2.4	3.1	3.4
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	<0.70	0.91	<0.70	0.95	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	<10	<10	12	12
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
6	S5-170611-B1	11-Jun-2017	9612083
7	S7-170611-T1	11-Jun-2017	9612084
8	S7-170611-B1	11-Jun-2017	9612085
9	S10-170611-T1	11-Jun-2017	9612086
10	S10-170611-B1	11-Jun-2017	9612087

Q: Dutch Accreditation Council (RvA) accredited test
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BNP Paribas S.A. 227 9245 25
IBAN: NL71BNPA0227924525
BIC: BNPANL2A
KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	5/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	6	7	8	9	10
Q	Calcium (Ca)	mg/kg dm	220	160	240	130	100
Q	Potassium (K)	mg/kg dm	230	210	310	160	160
Q	Magnesium (Mg)	mg/kg dm	120	110	140	84	96
Q	Sodium (Na)	mg/kg dm	42	19	50	27	62
Q	Phosphorus total (P)	g/kg dm	0.065	0.067	0.071	0.061	0.052
Q	Phosphorus total (P04)	g/kg dm	0.20	0.21	0.22	0.19	0.16
Q	Phosphorus total (P205)	g/kg dm	0.15	0.15	0.16	0.14	0.12
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	21	20	22	21	21
Q	Acidity (pH-CaCl2)		5.1	4.9	4.6	5.8	4.8
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
6	S5-170611-B1	11-Jun-2017	9612083
7	S7-170611-T1	11-Jun-2017	9612084
8	S7-170611-B1	11-Jun-2017	9612085
9	S10-170611-T1	11-Jun-2017	9612086
10	S10-170611-B1	11-Jun-2017	9612087

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KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	6/18
Sample matrix	Soil, Sediment		

Analysis	Unit	6	7	8	9	10
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
6	S5-170611-B1	11-Jun-2017	9612083
7	S7-170611-T1	11-Jun-2017	9612084
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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	7/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	11	12	13	14	15
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	99.6	98.7	90.4	91.2	100.0
Q	Moisture residue	% (w/w)	0.4	1.3	9.6	8.8	<0.1
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	0.8	0.8	1.3	2.0	1.0
Q	Residue on ignition	% (w/w) dm	99.0	98.9	98.2	97.4	98.8
Q	Carbonates (CaCO3)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	95.0	92.2	96.6	94.2	97.5
Q	Fraction < 63 µm	% (w/w) dm	14.3	17.4	14.0	68.8	11.5
Q	Fraction < 45 µm	% (w/w) dm	8.8	11.5	10.5	12.0	9.0
Q	Fraction < 16 µm	% (w/w) dm	4.4	6.8	8.6	10.1	6.7
Q	Fraction < 2 µm	% (w/w) dm	2.5	4.7	7.3	9.0	4.2
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	<15	<15	<15	<15
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	<3.0	3.8	5.4	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	<15	<15	20	25	22
Q	Cobalt (Co)	mg/kg dm	2.7	3.2	3.2	4.1	4.6
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	0.96	1.1	1.1	1.4	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	11	13	20	<10
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
11	S11-170611-T1	11-Jun-2017	9612088
12	S11-170611-B1	11-Jun-2017	9612089
13	S3-170611-T1	11-Jun-2017	9612090
14	S3-170611-B1	11-Jun-2017	9612091
15	S4-170611-T1	11-Jun-2017	9612092

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BNP Paribas S.A. 227 9245 25
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BIC: BNPANL2A
KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	8/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	11	12	13	14	15
Q	Calcium (Ca)	mg/kg dm	130	100	350	360	280
Q	Potassium (K)	mg/kg dm	190	230	490	450	210
Q	Magnesium (Mg)	mg/kg dm	120	140	250	340	160
Q	Sodium (Na)	mg/kg dm	25	30	32	37	51
Q	Phosphorus total (P)	g/kg dm	0.060	0.055	0.098	0.11	0.11
Q	Phosphorus total (P04)	g/kg dm	0.18	0.17	0.30	0.33	0.35
Q	Phosphorus total (P205)	g/kg dm	0.14	0.13	0.23	0.25	0.26
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	<6.0	<6.0	<6.0	13	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	21	22	21	21	21
Q	Acidity (pH-CaCl2)		4.9	4.5	5.8	4.6	5.6
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
11	S11-170611-T1	11-Jun-2017	9612088
12	S11-170611-B1	11-Jun-2017	9612089
13	S3-170611-T1	11-Jun-2017	9612090
14	S3-170611-B1	11-Jun-2017	9612091
15	S4-170611-T1	11-Jun-2017	9612092

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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	9/18
Sample matrix	Soil, Sediment		

Analysis	Unit	11	12	13	14	15
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
11	S11-170611-T1	11-Jun-2017	9612088
12	S11-170611-B1	11-Jun-2017	9612089
13	S3-170611-T1	11-Jun-2017	9612090
14	S3-170611-B1	11-Jun-2017	9612091
15	S4-170611-T1	11-Jun-2017	9612092

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Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	10/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	16	17	18	19	20
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	99.3	97.6	96.9	99.7	98.3
Q	Moisture residue	% (w/w)	0.7	2.4	3.1	0.3	1.7
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	0.7	1.1	0.8	<0.7	<0.7
Q	Residue on ignition	% (w/w) dm	99.0	98.5	98.6	98.9	98.9
Q	Carbonates (CaCO3)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	97.6	95.7	96.3	95.2	98.8
Q	Fraction < 63 µm	% (w/w) dm	11.5	12.5	16.1	12.2	11.5
Q	Fraction < 45 µm	% (w/w) dm	9.2	9.0	12.9	8.4	9.5
Q	Fraction < 16 µm	% (w/w) dm	6.8	6.6	10.2	6.8	7.7
Q	Fraction < 2 µm	% (w/w) dm	4.6	5.1	8.4	5.7	6.3
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	<15	<15	<15	<15
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	<3.0	3.1	<3.0	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	26	15	<15	<15	<15
Q	Cobalt (Co)	mg/kg dm	4.7	5.4	6.1	5.7	6.1
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	<0.70	1.5	1.6	<0.70	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	<10	12	<10	12
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
16	S4-170611-B1	11-Jun-2017	9612093
17	S14-170611-T1	11-Jun-2017	9612094
18	S14-170611-B1	11-Jun-2017	9612095
19	S13-170611-T1	11-Jun-2017	9612096
20	S13-170611-B1	11-Jun-2017	9612097

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IBAN: NL71BNPA0227924525
BIC: BNPANL2A
KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

Certificate of analysis

Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	11/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	16	17	18	19	20
Q	Calcium (Ca)	mg/kg dm	290	320	240	230	140
Q	Potassium (K)	mg/kg dm	180	220	210	160	150
Q	Magnesium (Mg)	mg/kg dm	130	140	140	85	80
Q	Sodium (Na)	mg/kg dm	50	36	24	39	76
Q	Phosphorus total (P)	g/kg dm	0.092	0.090	0.070	0.081	0.078
Q	Phosphorus total (P04)	g/kg dm	0.28	0.28	0.22	0.25	0.24
Q	Phosphorus total (P205)	g/kg dm	0.21	0.21	0.16	0.19	0.18
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	6.2	<6.0	<6.0	<6.0	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	20	21	21	21	22
Q	Acidity (pH-CaCl2)		5.3	6.2 [1)]	5.4	5.4	4.7
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
16	S4-170611-B1	11-Jun-2017	9612093
17	S14-170611-T1	11-Jun-2017	9612094
18	S14-170611-B1	11-Jun-2017	9612095
19	S13-170611-T1	11-Jun-2017	9612096
20	S13-170611-B1	11-Jun-2017	9612097

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Your project number	NGSB2017003401	Certificate number/Version	2017086572/2
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	12/18
Sample matrix	Soil, Sediment		

Analysis	Unit	16	17	18	19	20
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
16	S4-170611-B1	11-Jun-2017	9612093
17	S14-170611-T1	11-Jun-2017	9612094
18	S14-170611-B1	11-Jun-2017	9612095
19	S13-170611-T1	11-Jun-2017	9612096
20	S13-170611-B1	11-Jun-2017	9612097

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Certificate of analysis

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Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	13/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	21	22	23	24	25
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)	92.2	91.1	96.2	93.0	99.8
Q	Moisture residue	% (w/w)	7.8	8.9	3.8	7.0	0.2
Q	Total Organic Carbon (TOC)	g/kg dm	21	9.2	6.7	<5.0	<5.0
Q	Organic matter	% (w/w) dm	5.0	3.9	2.7	2.2	<0.7
Q	Residue on ignition	% (w/w) dm	93.3	94.5	96.4	95.7	99.0
Q	Carbonates (CaCO3)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	91.7	87.8	87.9	100.0	96.3
Q	Fraction < 63 µm	% (w/w) dm	31.8	30.9	23.3	40.2	15.7
Q	Fraction < 45 µm	% (w/w) dm	30.0	28.6	18.9	36.4	10.7
Q	Fraction < 16 µm	% (w/w) dm	27.6	25.7	15.8	33.3	5.9
Q	Fraction < 2 µm	% (w/w) dm	24.5	23.0	13.7	30.2	3.9
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	42	47	50	88	<15
Q	Copper (Cu)	mg/kg dm	12	13	12	20	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	16	17	15	27	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	30	28	<17	25	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	110	110	140	200	<15
Q	Cobalt (Co)	mg/kg dm	8.8	9.4	13	21	3.0
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	3.3	3.8	<0.70	4.0	0.86
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	41	43	42	70	<10
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
21	S1-170611-T1	11-Jun-2017	9612098
22	S1-170611-B1	11-Jun-2017	9612099
23	S2-170611-T1	11-Jun-2017	9612100
24	S2-170611-B1	11-Jun-2017	9612101
25	SFD-170611-T1	11-Jun-2017	9612102

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Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	14/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	21	22	23	24	25
Q	Calcium (Ca)	mg/kg dm	2800	2300	1400	1200	120
Q	Potassium (K)	mg/kg dm	560	470	1200	1600	190
Q	Magnesium (Mg)	mg/kg dm	1600	1600	1300	2200	120
Q	Sodium (Na)	mg/kg dm	68	73	52	89	23
Q	Phosphorus total (P)	g/kg dm	0.23	0.13	0.15	0.11	0.058
Q	Phosphorus total (P04)	g/kg dm	0.70	0.41	0.46	0.32	0.18
Q	Phosphorus total (P205)	g/kg dm	0.52	0.30	0.34	0.24	0.13
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	18	9.8	6.1	<6.0	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	21	21	21	20	21
Q	Acidity (pH-CaCl2)		5.2	5.0	5.7	4.8	5.1
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
21	S1-170611-T1	11-Jun-2017	9612098
22	S1-170611-B1	11-Jun-2017	9612099
23	S2-170611-T1	11-Jun-2017	9612100
24	S2-170611-B1	11-Jun-2017	9612101
25	SFD-170611-T1	11-Jun-2017	9612102

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Certificate of analysis

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Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	15/18
Sample matrix	Soil, Sediment		

Analysis	Unit	21	22	23	24	25
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
21	S1-170611-T1	11-Jun-2017	9612098
22	S1-170611-B1	11-Jun-2017	9612099
23	S2-170611-T1	11-Jun-2017	9612100
24	S2-170611-B1	11-Jun-2017	9612101
25	SFD-170611-T1	11-Jun-2017	9612102

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Certificate of analysis

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Your order number	Soils	Report date	12-Jul-2017/11:00
		Annex	A,B,C,D
Sampled by		Page	16/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	26
	Sample Pre-treatment		
Q	Cryogenic grinding		Executed
	Characteristics		
Q	Dry matter	% (w/w)	98.8
Q	Moisture residue	% (w/w)	1.2
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0
Q	Organic matter	% (w/w) dm	<0.7
Q	Residue on ignition	% (w/w) dm	99.0
Q	Carbonates (CaCO3)	g/kg dm	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	97.0
Q	Fraction < 63 µm	% (w/w) dm	16.8
Q	Fraction < 45 µm	% (w/w) dm	12.6
Q	Fraction < 16 µm	% (w/w) dm	8.0
Q	Fraction < 2 µm	% (w/w) dm	5.8
	Metals		
Q	Arsenic (As)	mg/kg dm	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30
Q	Chromium (Cr)	mg/kg dm	<15
Q	Copper (Cu)	mg/kg dm	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0
Q	Lead (Pb)	mg/kg dm	<13
Q	Zinc (Zn)	mg/kg dm	<17
Q	Antimony (Sb)	mg/kg dm	<1.0
Q	Barium (Ba)	mg/kg dm	<15
Q	Cobalt (Co)	mg/kg dm	3.2
Q	Molybdenum (Mo)	mg/kg dm	<1.5
	Selenium (Se)	mg/kg dm	1.2
Q	Tin (Sn)	mg/kg dm	<6.0
Q	Vanadium (V)	mg/kg dm	11
Q	Beryllium (Be)	mg/kg dm	<1.0

No.	Sample description	Date sampling	Sample nr.
26	SFD-170611-B1	11-Jun-2017	9612103

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		Annex	A,B,C,D
Sampled by		Page	17/18
Sample matrix	Soil, Sediment		

	Analysis	Unit	26
Q	Calcium (Ca)	mg/kg dm	89
Q	Potassium (K)	mg/kg dm	210
Q	Magnesium (Mg)	mg/kg dm	130
Q	Sodium (Na)	mg/kg dm	22
Q	Phosphorus total (P)	g/kg dm	0.051
Q	Phosphorus total (P04)	g/kg dm	0.16
Q	Phosphorus total (P205)	g/kg dm	0.12
	Mono Aromatic Hydrocarbons		
Q	Benzene	mg/kg dm	<0.050
Q	Toluene	mg/kg dm	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050
Q	o-Xylene	mg/kg dm	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25
	Petroleum Hydrocarbons		
	EPH (C10-C12)	mg/kg dm	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0
	EPH (C21-C30)	mg/kg dm	<12
	EPH (C30-C35)	mg/kg dm	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38
	Physical and chemical analyses		
	Measuring temperature (pH)	°C	22
Q	Acidity (pH-CaCl2)		4.7
	Inorganic Compounds		
	Nitrite (N02-N)	mg/kg dm	<0.20
	Nitrite (N02)	mg/kg dm	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0

No.	Sample description	Date sampling	Sample nr.
26	SFD-170611-B1	11-Jun-2017	9612103

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Certificate of analysis

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		Annex	A,B,C,D
Sampled by		Page	18/18
Sample matrix	Soil, Sediment		

Analysis	Unit	26
Nitrate (N03)	mg/kg dm	<9.0

No.	Sample description	Date sampling	Sample nr.
26	SFD-170611-B1	11-Jun-2017	9612103

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BIC: BNPANL2A
KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

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Annex (A) concerning subsample information referring to certificate of analysis 2017086572/2

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9612056					0520038264	S8-170611-T1
9612056					0520038261	
9612079					0520038255	S8-170611-B1
9612079					0520038256	
9612080					0520038260	S9-170611-T1
9612080					0520038263	
9612081					0520038262	S9-170611-B1
9612081					0520038265	
9612082					0520077696	S5-170611-T1
9612082					0520077709	
9612083					0520077698	S5-170611-B1
9612083					0520077587	
9612084					0520027839	S7-170611-T1
9612084					0520027842	
9612085					0520027577	S7-170611-B1
9612085					0520027586	
9612086					0520038268	S10-170611-T1
9612086					0520038271	
9612087					0520077593	S10-170611-B1
9612087					0520077596	
9612088					0520077594	S11-170611-T1
9612088					0520077679	
9612089					0520077667	S11-170611-B1
9612089					0520077689	
9612090					0520038225	S3-170611-T1
9612090					0520038231	
9612091					0520038224	S3-170611-B1
9612091					0520038226	
9612092					0520077590	S4-170611-T1
9612092					0520077597	
9612093					0520077595	S4-170611-B1
9612093					0520077599	
9612094					0520038259	S14-170611-T1
9612094					0520039482	
9612095					0520038257	S14-170611-B1

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Annex (A) concerning subsample information referring to certificate of analysis 2017086572/2

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9612095					0520038258	S14-170611-B1
9612096					0520038253	S13-170611-T1
9612096					0520039501	
9612097					0520038254	S13-170611-B1
9612097					0520039480	
9612098					0520038221	S1-170611-T1
9612098					0520077692	
9612099					0520038220	S1-170611-B1
9612099					0520038219	
9612100					0520038230	S2-170611-T1
9612100					0520077588	
9612101					0520077706	S2-170611-B1
9612101					0520077708	
9612102					0520077682	SFD-170611-T1
9612102					0520077684	
9612103					0520077681	SFD-170611-B1
9612103					0520077688	

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Annex (B) concerning remarks referring to certificate of analysis 2017086572/2

General remark referring to certificate of analysis

This certificate replaces previous published certificate(s) with lower version numbers.

Remark 1)

Measuring value not stabel (pH/EC/Redox)

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Annex (C): method references belonging to certificate of analysis 2017086572/2

Analysis	Method	Technique	Method reference
Cryogenic Milling (max 250 g)	W0106	Crushing	I.a.w. NVN 7313
Dry matter	W0104	Gravimetry	In accordance with NEN-EN 15934 & CMA 2/II/A.1
Moisture residue	W6110	Gravimetry	In house method
Organic matter (loss of ignition)	W0109	Gravimetry	Cf. NEN 5754
TOC	W0594	Element analysis	I.a.w. ISO 10694
Calcite (CaC03)	W0177	Volumetric	Equivalent to NEN-EN-ISO 10693
Grainsize < 2000 µm	W0105	Sieving	I.a.w. NEN 5753
Grainsize < 63 µm	W0105	Sieving	I.a.w. NEN 5753
Grainsize < 45 Âµm (Sedimentation)	W0173	Sedimentation	I.a.w. NEN 5753
Grainsize < 16 µm (sedimentation)	W0173	Sedimentation	I.a.w. NEN 5753
Grainsize < 2 µm (clay) sedimentation	W0173	Sedimentation	I.a.w. NEN 5753
Metalen Royal degree	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Calcium (Ca)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Potassium (K)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Magnesium (Mg)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Sodium (Na)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
P	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Aromatics (BTEX)	W0254	HS-GC/MS	In accordance with NEN-ISO 22155
EPH (C10-C40)	W0202	GC/FID	Eq. NEN-EN-ISO 16703
Acidity (pH-CaCl2)	W0524	Potentiometry	In accordance with NEN-ISO 10390
Nitrite	W0566	Spectrometry	In house method
Nitrate	W0566	Spectrometry	In house method

Additional information about the applied methods as well as the classification of the accuracy, are listed in our supplement: "Specification of methods of analyses", version June 2016.

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Annex (D) remarks concerning the sampling and preservation period 2017086572/2

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	Sample nr.
The temperature of the samples received at the laboratory, exceded the limit.	9612056
	9612079
	9612080
	9612081
	9612082
	9612083
	9612084
	9612085
	9612086
	9612087
	9612088
	9612089
	9612090
	9612091
	9612092
	9612093
	9612094
	9612095
	9612096
	9612097
	9612098
	9612099
	9612100
	9612101
	9612102
	9612103

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Annex (D) remarks concerning the sampling and preservation period 2017086572/2

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

Analysis	Sample nr.
The preservation term for this parameter has been expired.	
Volatiles (HS weight)	9612056 9612079 9612080 9612081 9612082 9612083 9612084 9612085 9612086 9612087 9612088 9612089 9612090 9612091 9612092 9612093 9612094 9612095 9612096 9612097 9612098 9612099 9612100 9612101 9612102 9612103
Voorbeh NC Sp	9612056 9612079 9612080 9612081 9612082 9612083 9612084 9612085 9612086 9612087 9612088 9612089 9612090 9612091 9612092 9612093

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Annex (D) remarks concerning the sampling and preservation period 2017086572/2

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	9612094
	9612095
	9612096
	9612097
	9612098
	9612099
	9612100
	9612101
	9612102
	9612103
Pretreatment TPH	9612056
	9612079
	9612080
	9612081
	9612082
	9612083
	9612084
	9612085
	9612086
	9612087
	9612088
	9612089
	9612090
	9612091
	9612092
	9612093
	9612094
	9612095
	9612096
	9612097
	9612098
	9612099
	9612100
	9612101
	9612102
	9612103

AECOM Uganda

Rwenzori Towers, 5th Floor, Nakasero ---
-- KAMPALA
UGANDA

Certificate of analysis

Date: 12-Jul-2017

Please find enclosed the analytical results of the test carried out for the project.

Certificate number/Version	2017086646/3
Your project number	NGSB2017003401-3
Your project name	AECOM Uganda
Your order number	Soils and Sediments
Samples received on	03-Jul-2017

This Certificate of Analysis shall not be reproduced except in full, without written approval of the laboratory. Interpretations and opinions are outside the scope of our accreditation, and all results relate only to samples supplied.

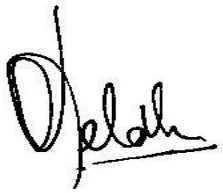
Soil samples will be stored for a period of 4 weeks and water samples for a period of 2 weeks after receipt of the samples at our laboratory. Without any additional request, samples will be disposed when the above mentioned periods have expired. If you require Eurofins Analytico to store the samples for a longer period, please complete this page and return it to Eurofins Analytico at least one businessday before the period is due to expire.
The costs of prolonged storage periods may be found in our pricelist.

Storage period:
Date: Name: Signature:

We are confident that we have performed the order in accordance with your expectations. If you have any remaining questions concerning this Certificate of Analysis, please don't hesitate to contact our Customer Service.

Yours sincerely,

Eurofins Analytico B.V.



Ing. A. Veldhuizen
Technical Manager

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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	1/6
Sample matrix	Soil, Sediment		

	Analysis	Unit	1	2	3	4	5
	Sample Pre-treatment						
Q	Cryogenic grinding		Executed	Executed	Executed	Executed	Executed
	Characteristics						
Q	Dry matter	% (w/w)			19.7		
Q	Dry matter	% (w/w)	99.4	91.9		99.7	99.0
Q	Moisture residue	% (w/w)	0.6	8.1	80.1	0.3	1.0
Q	Total Organic Carbon (TOC)	g/kg dm	5.2	<5.0	77	<5.0	<5.0
Q	Organic matter	% (w/w) dm	1.7	<0.7	16.6	<0.7	0.8
Q	Residue on ignition	% (w/w) dm	98.0	99.6	80.5	99.1	99.0
Q	Carbonates (CaC03)	g/kg dm	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	83.2	98.2	78.8	97.3	91.7
Q	Fraction < 63 µm	% (w/w) dm	11.4	6.9	69.0	10.0	9.1
Q	Fraction < 45 µm	% (w/w) dm	8.8	4.6	62.5	7.0	6.6
Q	Fraction < 16 µm	% (w/w) dm	5.9	3.2	52.1	5.1	4.6
Q	Fraction < 2 µm	% (w/w) dm	3.4	2.3	41.5	3.7	3.1
	Metals						
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	27	110	<15	<15
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	32	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	4.8	43	<3.0	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	14	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	55	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	<15	<15	230	<15	17
Q	Cobalt (Co)	mg/kg dm	3.2	2.4	21	3.6	4.4
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	0.82	1.0	8.9	<0.70	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	10	15	96	<10	<10

No.	Sample description	Date sampling	Sample nr.
1	S15-170610-T1	10-Jun-2017	9612580
2	SE5-170614 B/BN	14-Jun-2017	9612581
3	SE5-170614 B/BS	14-Jun-2017	9612582
4	S6-170610-T1	10-Jun-2017	9612583
5	S6-170610-B1	10-Jun-2017	9612584

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	2/6
Sample matrix	Soil, Sediment		

	Analysis	Unit	1	2	3	4	5
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Calcium (Ca)	mg/kg dm	330	650	4200	160	320
Q	Potassium (K)	mg/kg dm	330	100	2700	200	260
Q	Magnesium (Mg)	mg/kg dm	220	200	4600	120	150
Q	Sodium (Na)	mg/kg dm	23	40	210	11	48
Q	Phosphorus total (P)	g/kg dm	0.090	0.061	0.55	0.080	0.083
Q	Phosphorus total (P04)	g/kg dm	0.28	0.19	1.7	0.24	0.26
Q	Phosphorus total (P205)	g/kg dm	0.21	0.14	1.2	0.18	0.19
	Mono Aromatic Hydrocarbons						
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons						
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<12	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<20	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<24	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<48	<12	<12
	EPH (C30-C35)	mg/kg dm	6.2	<6.0	<24	6.9	10.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<24	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<150	<38	<38
	Physical and chemical analyses						
	Measuring temperature (pH)	°C	21	21	22	20	20
Q	Acidity (pH-CaCl2)		5.3	8.5 [1)]	5.5	5.4	4.8
	Inorganic Compounds						
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60	<0.60	<0.60

No.	Sample description	Date sampling	Sample nr.
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4	S6-170610-T1	10-Jun-2017	9612583
5	S6-170610-B1	10-Jun-2017	9612584

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Certificate of analysis

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Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	3/6
Sample matrix	Soil, Sediment		

Analysis	Unit	1	2	3	4	5
Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0	<2.0	<2.0
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
1	S15-170610-T1	10-Jun-2017	9612580
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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	4/6
Sample matrix	Soil, Sediment		

	Analysis	Unit	6	7	8
	Sample Pre-treatment				
Q	Cryogenic grinding		Executed	Executed	Executed
	Characteristics				
Q	Dry matter	% (w/w)	99.3	98.3	98.1
Q	Moisture residue	% (w/w)	0.7	1.7	1.9
Q	Total Organic Carbon (TOC)	g/kg dm	<5.0	<5.0	<5.0
Q	Organic matter	% (w/w) dm	1.0	0.9	0.8
Q	Residue on ignition	% (w/w) dm	98.7	98.6	98.8
Q	Carbonates (CaCO3)	g/kg dm	<5.0	<5.0	<5.0
Q	Fraction < 2000 µm	% (w/w) dm	95.8	91.5	95.8
Q	Fraction < 63 µm	% (w/w) dm	12.2	17.1	11.9
Q	Fraction < 45 µm	% (w/w) dm	8.8	12.6	9.4
Q	Fraction < 16 µm	% (w/w) dm	6.6	9.5	7.3
Q	Fraction < 2 µm	% (w/w) dm	5.0	6.7	5.6
	Metals				
Q	Arsenic (As)	mg/kg dm	<4.0	<4.0	<4.0
Q	Cadmium (Cd)	mg/kg dm	<0.30	<0.30	<0.30
Q	Chromium (Cr)	mg/kg dm	<15	<15	<15
Q	Copper (Cu)	mg/kg dm	<5.0	<5.0	<5.0
Q	Mercury (Hg)	mg/kg dm	<0.050	<0.050	<0.050
Q	Nickel (Ni)	mg/kg dm	<3.0	3.4	<3.0
Q	Lead (Pb)	mg/kg dm	<13	<13	<13
Q	Zinc (Zn)	mg/kg dm	<17	<17	<17
Q	Antimony (Sb)	mg/kg dm	<1.0	<1.0	<1.0
Q	Barium (Ba)	mg/kg dm	<15	15	<15
Q	Cobalt (Co)	mg/kg dm	2.2	4.3	2.5
Q	Molybdenum (Mo)	mg/kg dm	<1.5	<1.5	<1.5
	Selenium (Se)	mg/kg dm	<0.70	<0.70	<0.70
Q	Tin (Sn)	mg/kg dm	<6.0	<6.0	<6.0
Q	Vanadium (V)	mg/kg dm	<10	14	11
Q	Beryllium (Be)	mg/kg dm	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
6	S12-170611-T1	11-Jun-2017	9612585
7	S15-170610-B1	10-Jun-2017	9612586
8	S12-170611-B1	11-Jun-2017	9612691

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	5/6
Sample matrix	Soil, Sediment		

	Analysis	Unit	6	7	8
Q	Calcium (Ca)	mg/kg dm	270	500	91
Q	Potassium (K)	mg/kg dm	280	380	290
Q	Magnesium (Mg)	mg/kg dm	150	250	160
Q	Sodium (Na)	mg/kg dm	59	69	62
Q	Phosphorus total (P)	g/kg dm	0.079	0.064	0.066
Q	Phosphorus total (P04)	g/kg dm	0.24	0.20	0.20
Q	Phosphorus total (P205)	g/kg dm	0.18	0.15	0.15
	Mono Aromatic Hydrocarbons				
Q	Benzene	mg/kg dm	<0.050	<0.050	<0.050
Q	Toluene	mg/kg dm	<0.050	<0.050	<0.050
Q	Ethylbenzene	mg/kg dm	<0.050	<0.050	<0.050
Q	o-Xylene	mg/kg dm	<0.050	<0.050	<0.050
Q	m,p-Xylene	mg/kg dm	<0.050	<0.050	<0.050
Q	Xylenes (sum)	mg/kg dm	<0.10	<0.10	<0.10
Q	BTEX (sum)	mg/kg dm	<0.25	<0.25	<0.25
	Petroleum Hydrocarbons				
	EPH (C10-C12)	mg/kg dm	<3.0	<3.0	<3.0
	EPH (C12-C16)	mg/kg dm	<5.0	<5.0	<5.0
	EPH (C16-C21)	mg/kg dm	<6.0	<6.0	<6.0
	EPH (C21-C30)	mg/kg dm	<12	<12	<12
	EPH (C30-C35)	mg/kg dm	<6.0	<6.0	<6.0
	EPH (C35-C40)	mg/kg dm	<6.0	<6.0	<6.0
Q	EPH Sum (C10-C40)	mg/kg dm	<38	<38	<38
	Physical and chemical analyses				
	Measuring temperature (pH)	°C	20	22	21
Q	Acidity (pH-CaCl2)		5.8 [1)]	4.5	4.6
	Inorganic Compounds				
	Nitrite (N02-N)	mg/kg dm	<0.20	<0.20	<0.20
	Nitrite (N02)	mg/kg dm	<0.60	<0.60	<0.60
	Nitrate (N03-N)	mg/kg dm	<2.0	<2.0	<2.0

No.	Sample description	Date sampling	Sample nr.
6	S12-170611-T1	11-Jun-2017	9612585
7	S15-170610-B1	10-Jun-2017	9612586
8	S12-170611-B1	11-Jun-2017	9612691

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Certificate of analysis

Your project number	NGSB2017003401-3	Certificate number/Version	2017086646/3
Your project name	AECOM Uganda	Start date	03-Jul-2017
Your order number	Soils and Sediments	Report date	12-Jul-2017/10:58
		Annex	A,B,C,D
Sampled by		Page	6/6
Sample matrix	Soil, Sediment		

Analysis	Unit	6	7	8
Nitrate (N03)	mg/kg dm	<9.0	<9.0	<9.0

No.	Sample description	Date sampling	Sample nr.
6	S12-170611-T1	11-Jun-2017	9612585
7	S15-170610-B1	10-Jun-2017	9612586
8	S12-170611-B1	11-Jun-2017	9612691

Q: Dutch Accreditation Council (RvA) accredited test
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ASM
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Annex (A) concerning subsample information referring to certificate of analysis 2017086646/3

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9612580		S15-170610-T1				S15-170610-T1
9612580					0901991803	
9612581		SE5-170614 B/BN				SE5-170614 B/BN
9612581					0901991804	
9612582		SE5-170614 B/BS				SE5-170614 B/BS
9612582					0901991805	
9612583		S6-170610-T1				S6-170610-T1
9612583					0901991806	
9612584		S6-170610-B1				S6-170610-B1
9612584					0901991807	
9612585		S12-170611-T1				S12-170611-T1
9612585					0901991808	
9612586		S12-170611-T1				S15-170610-B1
9612586					0901991809	
9612691					0901991810	S12-170611-B1

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Annex (B) concerning remarks referring to certificate of analysis 2017086646/3

General remark referring to certificate of analysis

This certificate replaces previous published certificate(s) with lower version numbers.

Remark 1)

Measuring value not stabel (pH/EC/Redox)

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Annex (C): method references belonging to certificate of analysis 2017086646/3

Analysis	Method	Technique	Method reference
Cryogenic Milling (max 250 g)	W0106	Crushing	I.a.w. NVN 7313
Moisture residue	W6110	Gravimetry	In house method
Dry matter	W0104	Gravimetry	In accordance with NEN-EN 15934 & CMA 2/II/A.1
Dry matter	W0104	Gravimetry	In accordance with NEN-EN 15934 & CMA 2/II/A.1
TOC	W0594	Element analysis	I.a.w. ISO 10694
Organic matter (loss of ignition)	W0109	Gravimetry	Cf. NEN 5754
Calcite (CaC03)	W0177	Volumetric	Equivalent to NEN-EN-ISO 10693
Grainsize < 2000 µm	W0105	Sieving	I.a.w. NEN 5753
Grainsize < 63 µm	W0105	Sieving	I.a.w. NEN 5753
Grainsize < 45 Âµm (Sedimentation)	W0173	Sedimentation	I.a.w. NEN 5753
Grainsize < 16 µm (sedimentation)	W0173	Sedimentation	I.a.w. NEN 5753
Grainsize < 2 µm (clay) sedimentation	W0173	Sedimentation	I.a.w. NEN 5753
Metalen Royal degree	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Calcium (Ca)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Potassium (K)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Magnesium (Mg)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Sodium (Na)	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
P	W0423	ICP-MS	Cf. NEN-EN-ISO 17294-2
Aromatics (BTEX)	W0254	HS-GC/MS	In accordance with NEN-ISO 22155
EPH (C10-C40)	W0202	GC/FID	Eq. NEN-EN-ISO 16703
Acidity (pH-CaCl2)	W0524	Potentiometry	In accordance with NEN-ISO 10390
Nitrite	W0566	Spectrometry	In house method
Nitrate	W0566	Spectrometry	In house method

Additional information about the applied methods as well as the classification of the accuracy, are listed in our supplement: "Specification of methods of analyses", version June 2016.

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Annex (D) remarks concerning the sampling and preservation period 2017086646/3

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	Sample nr.
The temperature of the samples received at the laboratory, exceded the limit.	9612580 9612581 9612582 9612583 9612584 9612585 9612586 9612691

Analysis	Sample nr.
The preservation term for this parameter has been expired.	
Volatiles (HS weight)	9612580 9612581 9612582 9612583 9612584 9612585 9612586 9612691
Voorbeh NC Sp	9612580 9612581 9612582 9612583 9612584 9612585 9612586 9612691
Pretreatment TPH	9612580 9612581 9612582 9612583 9612584 9612585 9612586 9612691

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TILENGA ESIA – APPENDIX K: Hydrogeology

Feb 2019

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Annex 1: DWRM Groundwater Abstraction Permits - TEPU and TUOP

Annex 1: DWRM Groundwater Abstraction Permits - TEPU and TUOP

Geographic Location	Well Name	DWD BH Number	Permit Owner	Permit Issue Date	Permit Expiry Date	Eastings	Northings	Permitted Amount (m^3/day)	Well Status
CA1, North Nile									
	Tangi Camp	DWD 35670	TEPU	20-Jul-12	19-Jul-15			150	Capped
	Tangi Borehole 2	DWD 35646	TEPU	4-Jul-14	3-Jul-18			180	In use
	Jobi-2 BH	DWD 29473	TEPU	21-Jul-10	20-Jul-12	334326	261098	150	Capped
	Jobi-4 (C) BH	DWD 35657	TEPU	11-Oct-12	10-Oct-14	332964	258380	100	Capped
	Jobi-3 (D) BH	DWD 35655	TEPU	14-Jan-13	13-Jan-16	332594	253500	80	Capped
	Jobi-5 BH	DWD 35662	TEPU	31-Oct-12	30-Oct-14	332139	256025	60	Capped
	Jobi East-1	DWD 29459	TEPU	20-Jul-12	21-Jul-15	336318	260082	100	Capped
	Jobi East-3	DWD35655	TEPU			332594	253500		
	Jobi East-1 BH2	DWD 29460	TEPU	19-Jul-12	18-Jul-15	336399	260549	150	Capped
	Jobi East-2 BH1	DWD 29461	TEPU	20-Jul-12	19-Jul-14	337015	264731	150	Capped
	Mpyo-2	DWD 29468	TEPU	20-Jul-12	19-Jul-15	339131	245766	150	Capped
	Mpyo-4	DWD 40957	TEPU	14-Aug-13	13-Aug-15	338570	253878	150	Capped
	Raa-1	DWD 35668	TEPU	27-Feb-13	26-Feb-14	333050	269405	50	Capped
	Rii-2	DWD 40971	TEPU	6-Feb-14	5-Feb-15	329368	248179	75	Capped
	Til-1	DWD 35666	TEPU	18-Dec-12	17-Dec-13	342654	254394	100	Capped
EA IA North Nile									
	Lyec-1	DWD 35669	TEPU	27-Feb-13	26-Feb-14	338429	268206	100	Capped
CA1, South Nile									
	Bugungu Camp	DWD 29475	TEPU	25-May-16	24-May-21	336840	241907	100	In use
	Gunya-1	n/a	TEPU	28-Jun-11	27-Jun-16	334242	244154	60	Community
	Mpyo-1	DWD 29471	TEPU	20-Jul-12	19-Jul-15	337956	249446	150	Capped
	Mpyo-3 (C)	DWD 29470	TEPU	20-Jul-12	19-Jul-15	339518	249081	150	Capped
	Mpyo D	DWD 40959	TEPU	1-Oct-13	30-Sep-15	n/a	n/a	50	Capped
	Ngiri-1	DWD 21022	TEPU	27-Sep-12	26-Sep-17	326401	242120	100	In use
	Ngiri-2	DWD 29474	TEPU	25-May-13	24-May-16	326889	243526	150	Community
LA2, South Nile									
	Awaka-1	DWD 29905	TUOP	5-May-10	4-May-15	342732	229906	20	Abandoned

Geographic Location	Well Name	DWD BH Number	Permit Owner	Permit Issue Date	Permit Expiry Date	Eastings	Northings	Permitted Amount (m^3/day)	Well Status
	Awaka-1 Surface water		TUOP	5-May-10	4-May-15			40	Abandoned
	Karuka-2	DWD 21663	TUOP			322034	229591		Abandoned
	Kasamene-1	DWD 21665	TUOP	7/21/2011	7/20/2016	324055	236849	20	Community
	Kasamene-3/3A		TUOP	2/15/2011	2/14/2016	324055	236849		Abandoned
	Kasemene 3 Surface Water		TUOP	2/15/2011	2/14/2016			20	Abandoned
	Kigogole-1	DWD 25893	TUOP	9/1/2011	8/31/2016	313047.8	20912.5	20	Community
	Nsoga 5	DWD 25893	TUOP	9/2/2009	9/1/2011			20	Abandoned
	Kigogole-6/6A (Bugana)		TUOP	3/2/2012	3/1/2015	333972	228210	40	Abandoned
	Mputa-1	DWD 18688	TUOP	7/26/2011	7/25/2016	273307	159554	40	Abandoned
	Mputa-2	DWD 21654	TUOP	7/26/2006	7/26/2011	271413	161273		UWA wildlife support
	Mputa-3	DWD 21643	TUOP	8/30/2011	8/29/2016	274846	158680	30	Abandoned
	Mputa-4	DWD 21645	TUOP			274816	159509		Abandoned
	Mputa-5	DWD 18688	TUOP	7/26/2011	7/25/2016	273307	159554	40	Abandoned
	Ngara-1	DWD 29906	TUOP	1/14/2013	8/11/2015	336830	226905	100	Abandoned
	Ngassa-1		TUOP	10/23/2007	10/23/2008	N/A	N/A		Abandoned
	Ngassa-2		TUOP			N/A	N/A		Abandoned
	Ngege-1	DWD 21661	TUOP	6/21/2011	6/20/2016	322034	229591	389	Community
	Ngege-2/2A	DWD 25893	TUOP	9/2/2009	9/1/2011	313047.8	20912.5	20	Abandoned
	Ngege-5		TUOP			322034	229591		Abandoned
	Ngege-F	DWD 35656	TUOP	10/5/2012	10/4/2014	3133378	209456	100	Abandoned
	Nsoga-5	DWD 25893	TUOP	9/2/2009	9/1/2011	313047.8	20912.5	20	Abandoned
	Nsoga-3	CD2245	TUOP	2/3/2011	2/2/2016	332508	236820	40	Abandoned
	Nzizi-1	DWD 21659	TUOP	7/26/2011	7/25/2016	267750	157536		Abandoned
	Taitai-1	DWD 21660	TUOP	6/21/2011	6/20/2016			191	Abandoned
	Wahrindi-1		TUOP	9/2/2009	9/1/2014	N/A	N/A	20	Abandoned
	Buliisa Weatherford Camp	DWD 35633	TUOP	19-Apr-17	18-Dec-21			150	In use
	Lanya	DWD 21662	TUOP	6/21/2011	6/20/2016			382	Abandoned
	Kasurabanu		TUOP	1-Sep-11	31-Aug-16			20	

Geographic Location	Well Name	DWD BH Number	Permit Owner	Permit Issue Date	Permit Expiry Date	Eastings	Northings	Permitted Amount (m^3/day)	Well Status
	Bulisa Old Saracen Camp	DWD 21661	TUOP	19-Apr-17	28-Aug-20			25	In use
	Buliisa Seismic Camp	DWD 29942	TUOP	27-Nov-12	22-Mar-17			80	In use
	Ngara MW 1	DWD 35641	TUOP						In use
	Ngara MW 2	DWD 35641	TUOP						In use
	Ngara MW 3	DWD 35641	TUOP						In use

Annex 2: WHO 4th Edition Drinking Water Standards

Reference	ChemName	MatrixType	ActionLevelSource	ActionLevel	ActionLevel_Min	Units	Comments
79-06-1	Acrylamide	water	WHO 4th Edition Drinking Water	0.0005		mg/L	
15972-60-8	Alachlor	water	WHO 4th Edition Drinking Water	0.02		mg/L	
116-06-3	Aldicarb	water	WHO 4th Edition Drinking Water	0.01		mg/L	Applies to aldicarb sulfoxide and aldicarb sulfone
1646-87-3	aldicarb sulfoxide	water	WHO 4th Edition Drinking Water	0.01		mg/L	
1646-88-4	aldicarb sulfone	water	WHO 4th Edition Drinking Water	0.01		mg/L	
309-00-2 + 60-57-1	Aldrin and dieldrin	water	WHO 4th Edition Drinking Water	0.00003		mg/L	
7440-36-0	Antimony	water	WHO 4th Edition Drinking Water	0.02		mg/L	
7440-38-2	Arsenic	water	WHO 4th Edition Drinking Water	0.01		mg/L	A,T
1912-24-9+metabolite	Atrazine and its chloro-s-triazine metabolites	water	WHO 4th Edition Drinking Water	0.1		mg/L	
7440-39-3	Barium	water	WHO 4th Edition Drinking Water	0.7		mg/L	
71-43-2	Benzene	water	WHO 4th Edition Drinking Water	0.01		mg/L	
50-32-8	Benzo[a]pyrene	water	WHO 4th Edition Drinking Water	0.0007		mg/L	
7440-42-8	Boron	water	WHO 4th Edition Drinking Water	2.4		mg/L	
15541-45-4	Bromate	water	WHO 4th Edition Drinking Water	0.01		mg/L	A,T
75-27-4	Bromodichloromethane	water	WHO 4th Edition Drinking Water	0.06		mg/L	
75-25-2	Bromoform	water	WHO 4th Edition Drinking Water	0.1		mg/L	
7440-43-9	Cadmium	water	WHO 4th Edition Drinking Water	0.003		mg/L	
1563-66-2	Carbofuran	water	WHO 4th Edition Drinking Water	0.007		mg/L	
56-23-5	Carbon tetrachloride	water	WHO 4th Edition Drinking Water	0.004		mg/L	
14866-68-3	Chlorate	water	WHO 4th Edition Drinking Water	0.7		mg/L	D
57-74-9	Chlordane	water	WHO 4th Edition Drinking Water	0.0002		mg/L	
Total Chlorine	Chlorine	water	WHO 4th Edition Drinking Water	5		mg/L	
14998-27-7	Chlorite	water	WHO 4th Edition Drinking Water	0.7		mg/L	D
67-66-3	Chloroform	water	WHO 4th Edition Drinking Water	0.3		mg/L	
15545-48-9	Chlorotoluron	water	WHO 4th Edition Drinking Water	0.03		mg/L	
2921-88-2	Chlorpyrifos	water	WHO 4th Edition Drinking Water	0.03		mg/L	
7440-47-3	Chromium (Total)	water	WHO 4th Edition Drinking Water	0.05		mg/L	P
7440-50-8	Copper	water	WHO 4th Edition Drinking Water	2		mg/L	Staining of laundry and sanitary ware may occur below guideline value
21725-46-2	Cyanazine	water	WHO 4th Edition Drinking Water	0.0006		mg/L	
94-82-8	2,4-D (Free Acid)	water	WHO 4th Edition Drinking Water	0.03		mg/L	
94-82-6	2,4-DB	water	WHO 4th Edition Drinking Water	0.09		mg/L	
50-29-3(total)	DDT[d] and metabolites	water	WHO 4th Edition Drinking Water	0.001		mg/L	
3252-43-5	Dibromoacetonitrile	water	WHO 4th Edition Drinking Water	0.07		mg/L	
124-48-1	Dibromochloromethane	water	WHO 4th Edition Drinking Water	0.1		mg/L	
96-12-8	1,2-Dibromo-3-chloropropane	water	WHO 4th Edition Drinking Water	0.001		mg/L	
106-93-4	1-2 Dibromoethane	water	WHO 4th Edition Drinking Water	0.0004		mg/L	P
79-43-6	Dichloroacetate	water	WHO 4th Edition Drinking Water	0.05		mg/L	D
3018-12-0	Dichloroacetonitrile	water	WHO 4th Edition Drinking Water	0.02		mg/L	P
95-50-1	1,2-Dichlorobenzene	water	WHO 4th Edition Drinking Water	1		mg/L	C
106-46-7	1,4-Dichlorobenzene	water	WHO 4th Edition Drinking Water	0.3		mg/L	C
107-06-2	1,2-Dichloroethane	water	WHO 4th Edition Drinking Water	0.03		mg/L	
540-59-0	1,2-Dichloroethene	water	WHO 4th Edition Drinking Water	0.05		mg/L	
75-09-2	Dichloromethane	water	WHO 4th Edition Drinking Water	0.02		mg/L	
78-87-5	1,2-Dichloropropane	water	WHO 4th Edition Drinking Water	0.04		mg/L	P
542-75-6	1,3-Dichloropropene	water	WHO 4th Edition Drinking Water	0.02		mg/L	
120-36-5	Dichlorprop	water	WHO 4th Edition Drinking Water	0.1		mg/L	
117-81-7	Di(2-ethylhexyl)phthalate	water	WHO 4th Edition Drinking Water	0.008		mg/L	
60-51-5	Dimethoate	water	WHO 4th Edition Drinking Water	0.006		mg/L	
123-91-1	1,4-Dioxane	water	WHO 4th Edition Drinking Water	0.05		mg/L	
60-00-4	Edetic acid (Free Acid)	water	WHO 4th Edition Drinking Water	0.6		mg/L	

Reference	ChemName	MatrixType	ActionLevelSource	ActionLevel	ActionLevel_Min	Units	Comments
72-20-8	Endrin	water	WHO 4th Edition Drinking Water	0.0006		mg/L	
106-89-8	Epichlorohydrin	water	WHO 4th Edition Drinking Water	0.0004		mg/L	P
100-41-4	Ethylbenzene	water	WHO 4th Edition Drinking Water	0.3		mg/L	C
93-72-1	Fenoprop	water	WHO 4th Edition Drinking Water	0.009		mg/L	
16984-48-8	Fluoride	water	WHO 4th Edition Drinking Water	1.5		mg/L	Volume of water consumed and intake from other sources should be considered when setting national standards
87-68-3	Hexachlorobutadiene	water	WHO 4th Edition Drinking Water	0.0006		mg/L	
2163-68-0	Hydroxyatrazine	water	WHO 4th Edition Drinking Water	0.2		mg/L	Atrazine metabolite
34123-59-6	Isoproturon	water	WHO 4th Edition Drinking Water	0.009		mg/L	
7439-92-1	Lead	water	WHO 4th Edition Drinking Water	0.01		mg/L	A,T
58-89-9	Lindane	water	WHO 4th Edition Drinking Water	0.002		mg/L	
94-74-6	MCPA[e]	water	WHO 4th Edition Drinking Water	0.002		mg/L	
93-65-2	Mecoprop	water	WHO 4th Edition Drinking Water	0.01		mg/L	
7439-97-6	Mercury (inorganic)	water	WHO 4th Edition Drinking Water	0.006		mg/L	
72-43-5	Methoxychlor	water	WHO 4th Edition Drinking Water	0.02		mg/L	
51218-45-2	Metolachlor	water	WHO 4th Edition Drinking Water	0.01		mg/L	
101043-37-2	Microcystin-LR	water	WHO 4th Edition Drinking Water	0.001		mg/L	P:For total microcystin-LR (free plus cell-bound)
2212-67-1	Molinate	water	WHO 4th Edition Drinking Water	0.006		mg/L	
10599-90-3	Monochloramine	water	WHO 4th Edition Drinking Water	3		mg/L	
96-34-4	Monochloroacetate	water	WHO 4th Edition Drinking Water	0.02		mg/L	
7440-02-0	Nickel	water	WHO 4th Edition Drinking Water	0.07		mg/L	
14797-55-8	Nitrate (as NO3–)	water	WHO 4th Edition Drinking Water	50		mg/L	Short-term exposure
139-13-9	Nitrilotriacetic acid	water	WHO 4th Edition Drinking Water	0.2		mg/L	
14797-65-0	Nitrite (as NO2–)	water	WHO 4th Edition Drinking Water	3		mg/L	Short-term exposure
62-75-9	N-Nitrosodimethylamine	water	WHO 4th Edition Drinking Water	0.0001		mg/L	
40487-42-1	Pendimethalin	water	WHO 4th Edition Drinking Water	0.02		mg/L	
87-86-5	Pentachlorophenol	water	WHO 4th Edition Drinking Water	0.009		mg/L	P
7782-49-2	Selenium	water	WHO 4th Edition Drinking Water	0.04		mg/L	P
122-34-9	Simazine	water	WHO 4th Edition Drinking Water	0.002		mg/L	
2893-78-9	Sodium dichloroisocyanurate	water	WHO 4th Edition Drinking Water	50		mg/L	
2893-78-9(CA)	Sodium dichloroisocyanurate as cyanuric acid	water	WHO 4th Edition Drinking Water	40		mg/L	
100-42-5	Styrene	water	WHO 4th Edition Drinking Water	0.02		mg/L	C
93-76-5	2,4,5-T[f]	water	WHO 4th Edition Drinking Water	0.009		mg/L	
5915-41-3	Terbuthylazine	water	WHO 4th Edition Drinking Water	0.007		mg/L	
127-18-4	Tetrachloroethene	water	WHO 4th Edition Drinking Water	0.04		mg/L	
108-88-3	Toluene	water	WHO 4th Edition Drinking Water	0.7		mg/L	C
76-03-9	Trichloroacetate	water	WHO 4th Edition Drinking Water	0.2		mg/L	
79-01-6	Trichloroethene	water	WHO 4th Edition Drinking Water	0.02		mg/L	P
88-06-2	2,4,6-Trichlorophenol	water	WHO 4th Edition Drinking Water	0.2		mg/L	C
1582-09-8	Trifluralin	water	WHO 4th Edition Drinking Water	0.02		mg/L	
7440-61-1	Uranium	water	WHO 4th Edition Drinking Water	0.03		mg/L	P:Only chemical aspects of uranium addressed
75-01-4	Vinyl chloride	water	WHO 4th Edition Drinking Water	0.0003		mg/L	
1330-20-7	Xylenes	water	WHO 4th Edition Drinking Water	0.5		mg/L	C

Annex 3: Borehole logs for Surface Geology in the Study Area

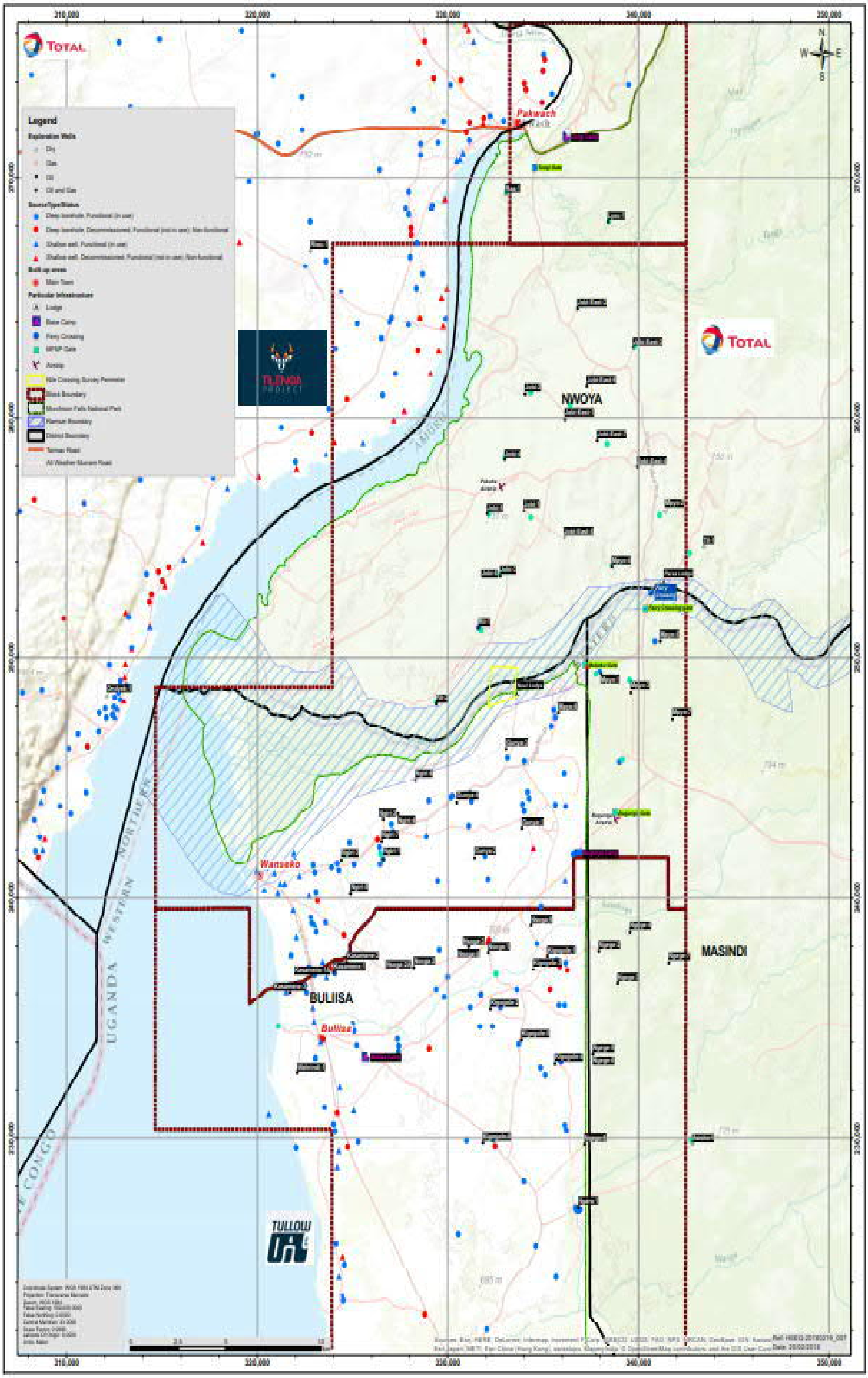
Annex 2: Borehole logs for Surface Geology in the Study Area

Name of oil or gas well	Depth	Lithological description
Block EA1		
Jobi C	0-12m	Red sand and gravel
	12-39m	Grey clay with fine sand
	39-48m	Course sand to fine sand
	48-60m	Brown grey clay
	60-75m	Dark brown clay and fine sand
	75-87m	Brown course sand with silt
	87-96m	Grey clay with fine sand
	96-115m	Dark grey clay with fine sand
Jobi East 3 DWD 35655	0-3m	Dark grey soil
	3-9m	Light brown clay
	9-24m	Yellowish clayey sand
	24-36m	Light brown clayey sand
	36-48m	Light grey clayey sand
	48-63m	Grey clay, sand and silt
	63-78m	Grey clay with some fine sand
	78-93m	Grey clayey sand
Jobi East 5	0-12m	Clay, brown
	12-18m	Cream sand
	18-30m	Brown clay and sand
	30-48m	Cream clayey sand
	48-60m	Cream clay and fine sand
	60-69m	Light grey sandy clay
	69-75m	Cream clayey sand
	75-78m	Sandy cream clay
	78-87m	Light grey sand , clayey
	87-93m	Cream sandy clay
	93-102m	Light grey sandy clay
Jobi East F	0-6m	Grey clay
	6-21m	Cream clay, some sand
	21-30m	Brown clay with sand
	30-33m	Brown sand clay
	33-39m	Grey sand, little clay
	39-48m	Sand and gravel, some silt
	48-60m	Grey clay and silt
	60-75m	Grey clay and fine sand

Name of oil or gas well	Depth	Lithological description
Mypo-F	0-6m	Grey clay
	6-21m	Cream clay, some sand
	21-30m	Brown clay with sand
	30-33m	Brown sand clay
	33-39m	Grey sand, little clay
	39-48m	Sand and gravel, some silt
	48-60m	Grey clay and silt
	60-75m	Grey clay and fine sand
Mypo –H	0-6m	Clay sandy, light grey
	6-18m	Brown yellowish sand
	18=39m	Brown sandy clay
	39-45m	Brown course sand
	45-57m	Brown clayey sand
	57-66m	Light Brown clayey sand
	66-72m	Course quartz sand
	72-75m	Dark grey clay
RAA	0-9m	Dark brown clay
	9-15m	Brown Clay and Course Sand
	15-24m	Brown Sand
	24-36m	Brown Clay
	36-69m	Light Grey clay
RII-B	0-3 m	Grey Soil
	3-9m	Brown Clayey sand
	9-15m	Light brown sandy clay
	15-36m	Grey course sand
	36 -45m	Grey Clayey sand
	45-54m	Grey Clay
TIL	0-6m	Brown clayey soil
	6-36m	Brown clay and sand
	36-42m	Grey Sand
	42-51m	Sandy
	51-60m	Clay and sand
	60-75m	Clayey sand
Block EA2		
Kasamene-1 DWD 21665	10-50m	Unconsolidated sand
	50-60m	Interbedded sand and claystone
Ngiri-1 DWD 21022	10-56m	Sand (predominantly very coarse to small pebble size; very porous)

Name of oil or gas well	Depth	Lithological description
	56-80m	Interbedded sand and clay
Nsoga-1	10-50m 50-70m	Unconsolidated sand sequence (predominantly medium to coarse; good inferred porosity) Interbedded sand and claystone
Kigogole-1 DWD 25893	10-60m 60-70m	Sand (medium – very coarse then fine to medium; fair to excellent inferred porosity) Interbedded clay and sand
Kigogole-3	10-20m 20-30m 30-40m	Sand with clay bands Sand (predominantly medium to coarse; highly porous) Interbedded clay and sand
Ngege-1 DWD 21661	10-15m 15-40m 40-45m 45-90m 90-100m	Clay Sand with clay bands Sand (medium-coarse; good inferred porosity) Clay with sand Sand
Ngara-1 DWD 29906	10-35m 35-45m 45-55m	Sand (medium-coarse; good inferred porosity) Sand with clay bands Sand
Awaka-1 DWD 29908	8-22m 22-75m	Clay and sand Sand (medium-coarse / medium; very porous)
EA-2 Notes: Only the uppermost geological layers are included here, these are underlain by low permeability tuff, claystone, clay, sometimes interbedded with further minor sand and sandstone. The first 10m is not recorded; depths are recorded as metres below rotary table elevation which is approximately 5m above ground level.		

Sources: EA 1 Boring Completion Reports prepared by Watertech; EA2 - Atkins Albertine Rift Development Project Injection Water Supply Study Groundwater Review, May 2010.
Note: Data from borehole I.D DWD16551 (Ugandan national borehole database)



Legend
Pakwach
NWOYA
MASINDI
BULIISA
Buliisa
Wanseko
UGANDA
TILENGA PROJECT
TOTAL
TULLOW

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 1 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
0.00-1.50			91					(0.45) 0.45	0.00 - 0.45 Brown slightly silty SAND with abundant rootlets (1-15mm). TOPSOIL.	T	
									0.45 - 2.80 Light orange brown with increased light grey blotches with depth silty SAND.		
1.50-2.29			82					(2.35)			
2.29-3.79			99					2.80	2.80 - 8.10 Light orange brown blotched light grey gravelly clayey silty SAND. Note: Gravels are fine to medium sub-angular and of mixed origin but predominately ferricrete nodules and quartz grains.		
3.79-5.29			93								
5.29-6.79			85					(5.30)			
6.79-8.29			80						7.00-8.00m Increase in fine to medium sub-angular gravels of quartz.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 2 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
8.29-8.73			0					8.10	8.10 - 11.69 Light grey speckled light orange clayey silty fine to medium SAND. 8.29-8.73m Core loss.		
8.73-10.19			75					(3.59)			
10.19-11.69			0					11.69	10.19-11.69m Core loss.		
11.69-13.19			0						11.69 - 21.45 Light greenish grey silty CLAY with widely spaced thin lenses of clayey sand. 11.69-13.19m Core loss.		
13.19-13.69			100								
13.69-15.19			0						13.69-20.37m Core loss - may indicate a zone of increased sandy material.		
15.19-16.69			0								

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 3 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
16.69-17.37			0					(9.76)			
17.37-18.87			0								
18.87-20.37			0								
20.37-21.87			77						20.80m Pocket Penetrometer: 0.40MPa, 0.35MPa, 0.30MPa.		
21.87-23.37			0					21.45	21.45 - 27.80 Light greenish grey fine to coarse sandy CLAY with widely interbedded thinly bedded (40-100mm) clay and/or clayey sand. 21.87-23.37m Core loss.		
23.37-25.02									23.60m Pocket Penetrometer: 0.25MPa, 0.26MPa, 0.25MPa.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
20.37	14-10-17	07.00	9.50	126						End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 4 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
			77					(6.35)			
25.02-26.46									25.02-26.35m Contaminated wash material.		
			76								
26.46-27.96											
			36					27.80			
27.96-29.79									27.80 - 29.90 Light greenish grey slightly clayey fine sandy SILT with widely spaced thinly to medium bedded clay.		
			85					(2.10)			
29.79-31.29								29.90			
			67						29.90 - 36.69 Light greenish grey silty fine SAND with widely spaced thin (10-50mm) beds of clay. Note: Lenses of thin (5-30mm) fine to medium sand lenses.		
31.29-32.11											
			76								

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
27.96	15-10-17	07.00	9.50	126						End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 5 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
32.11-33.81			0					(6.79)	32.11-33.81m Core loss.		
33.81-36.19			0						33.81-36.19m Core loss.		
36.19-36.69			0					36.69	36.19-36.69m Core loss.		
36.69-38.02			100					(1.41) 38.10	36.69 - 38.10 Light greenish grey fine sandy SILT. 37.20m Pocket Penetrometer: 0.30MPa.		
38.02-39.69			68					(1.52) 39.62	38.10 - 39.62 Light yellowish brown slightly silty fine to coarse SAND.		
39.69-40.87									39.62 - 41.30 Light grey with minor light orange staining fine SAND with abundant micaceous		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
32.11	16-10-17	07.00	9.50	126						End of Borehole 55.15m.
38.02	16-10-17	17.00	9.50	126						
38.02	17-10-17	07.00	9.50	126						

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No: Total Project	Date: 12-10-17 18-10-17	Ground Level (m):	Co-Ordinates (): E 328 837.0 N 242 377.0	
Contractor: GEOMECHANICS				Sheet: 6 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
			69					(1.68)	minerals observed.		
40.87-42.64								41.30			
			92					(1.40)	41.30 - 42.70 Light greenish grey fine sandy SILT.		
42.64-44.34								42.70			
			78						42.70 - 45.93 Closely sheared light greenish grey fine to medium sandy CLAY with widely spaced thin (60-120mm) fine to medium sand beds. Note: Polished/ striated surfaces observed. 42.70m Pocket Penetrometer: 0.45MPa, 0.50MPa, 0.40MPa.		
44.34-45.93								(3.23)			
			100					45.93			
45.93-47.22									45.93 - 50.67 Light greenish grey slightly silty fine to medium SAND with micaceous minerals observed.		
			75								
47.22-48.70											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW1
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	12-10-17 18-10-17		E 328 837.0 N 242 377.0	
Contractor				Sheet
GEOMECHANICS				7 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
			58					(4.74)			
48.70-50.37			94						48.70-49.90m Thin (50-70mm) medium spaced beds of hard silt.		
50.37-52.02			88	U1				50.67	50.67 - 55.15 Closely sheared/jointed grey slightly organic slightly fine sandy clayey SILT with widely spaced (60-150mm) lenses of fine to medium sand. Note: Pocket penetrometer readings indicate material is borderline extremely weak and very weak rock strength. 51.90m Pocket Penetrometer: 0.7MPa. 52.50m Pocket Penetrometer: >1.0MPa, >1.0MPa.		
52.02-53.49			80	U2				(4.48)			
53.49-55.15			56	U3				55.15			

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
48.70	18-10-17	07.00	9.50	126						End of Borehole 55.15m.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
GEOMECHANICS				1 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.00-1.74			89					(0.40) 0.40	0.00 - 0.40 Greyish brown slightly silty fine to medium SAND with abundant roots (1-5mm diameter). (TOPSOIL).	T	
									0.40 - 3.20 Light orangey brown silty fine to medium SAND.		
1.74-3.24			100					(2.80)			
								3.20			
3.24-4.49			82						3.20 - 7.35 Light greyish brown streaked light orange clayey fine to medium SAND.		
4.49-6.00			81					(4.15)			
6.00-7.50			100						6.35-7.20m Abundant iron leaching and the presence of abundant fine to medium sub-angular to sub-rounded ferricrete nodules.		
								7.35			
7.50-9.00				U1					7.35 - 11.00 Light grey mottled light orange and brown very fine to medium sandy CLAY with widely spaced thin beds of clayey sand. 7.52-7.70m Pocket Penetrometer 0.3MPa.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No: Total Project	Date: 20-10-17 / 23-10-17	Ground Level (m):	Co-Ordinates (): E 330 332.0 N 242 233.0	
Contractor: GEOMECHANICS				Sheet: 2 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument / Backfill
			100						0.3MPa, 0.35MPa. 7.75m Pocket Penetrometer 0.6MPa, 0.6MPa. 8.40-8.50m Abundant fine to medium sub-rounded quartz gravels encountered.		
9.00-10.60			100					(3.65)			
10.60-12.10			65					11.00	11.00 - 12.95 Light greenish grey slightly sandy CLAY. 11.55m Pocket Penetrometer 1.0MPa, 0.6MPa, 0.9MPa.		
12.10-13.60			100					(1.95) 12.95	12.85-12.95m Hardpan ferricrete exhibiting extremely weak rock strength. (Engineer's Estimate).		
13.60-15.10			95					(2.15) 15.10	12.95 - 15.10 Light greyish green slightly clayey silty fine to coarse SAND with numerous fine to medium sub-angular to sub-rounded gravel of predominantly quartz.		
15.10-16.60			85						15.10 - 17.10 Light greenish grey silty fine SAND with medium spaced thin beds of silt.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0_GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
GEOMECHANICS				3 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
16.60-17.10			76					(2.00) 17.10			
17.10-18.76			95					(1.50) 18.60	17.10 - 18.60 Light greenish grey fine sandy clayey SILT.		
18.76-20.45			80						18.60 - 23.58 Light yellowish to light greenish grey clayey silty fine to medium SAND.		
20.45-22.01			100					(4.98)			
22.01-23.51			65								
23.51-24.56								23.58	23.58 - 26.30 Light yellowish grey silty fine to medium SAND with widely spaced thin beds of		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
17.10	21-10-17	07.00	3.00	126						End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No: Total Project	Date: 20-10-17 / 23-10-17	Ground Level (m):	Co-Ordinates (): E 330 332.0 N 242 233.0	
Contractor: GEOMECHANICS				Sheet: 4 of 7

SAMPLES & TESTS								STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument / Backfill
			87						slightly silty sand.		
24.55-25.05			100					(2.72)			
25.05-26.05			100								
26.05-27.69			72					26.30			
									26.30 - 30.32 Light grey fine tyo coarse SAND with medium spaced very thin to thin interbeds of silty fine sand. 26.30-28.43m Occasional fine to medium sub-rounded quartz gravel observed.		
27.69-28.43			100					(4.02)			
28.43-29.82			48								
29.82-30.32			100					30.32			
30.32-31.21			93						30.32 - 35.20 Light greenish grey clayey fine to coarse SAND. 30.45-30.60m Very stiff to hard (engineer's estimate) clay bed. 30.45m Pocket Penetrometer 0.85MPa, 0.75MPa, 0.70MPa.		
31.21-32.30			84								

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
27.69	22-10-17	07.00	3.00	126						End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
GEOMECHANICS				5 of 7

SAMPLES & TESTS								STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
32.30-33.76									32.30-32.48m Very stiff to hard (engineer's estimate) clay bed.		
			100					(4.88)			
33.76-35.20									33.40-33.56m Very stiff to hard (engineer's estimate) clay bed.		
			100								
								35.20			
35.20-36.35									35.20 - 38.19 Light grey slightly silty fine to medium SAND with widely spaced very thin beds of coarse sand and the occasional fine to medium sub-rounded quartz gravel.		
			72								
36.35-37.53								(2.99)			
			34								
37.53-38.19											
			100								
								38.19			
38.19-39.59									38.19 - 43.70 Greenish grey slightly fine sandy closely sheared silty CLAY with medium spaced thinly laminated fine sand.		
			93								
				U2					39.30m Pocket Penetrometer 1.0MPa, >1MPa (Small tip: 0.70MPa x 2 = 1.4MPa and 0.65MPa x 2 = 1.3MPa).		
39.59-41.32											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
36.35	23-10-17	07.00	3.00	126						End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No: Total Project	Date: 20-10-17 / 23-10-17	Ground Level (m):	Co-Ordinates (): E 330 332.0 N 242 233.0	
Contractor: GEOMECHANICS				Sheet: 6 of 7

SAMPLES & TESTS								STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument / Backfill
			81	U3				(5.51)	40.00m Pocket Penetrometer 0.6MPa, 0.58MPa 41.26-41.51m Thin bed (250mm) of silty fine sand. 41.57-41.59m Thin lamination (1-2mm) of orange to dark reddish brown iron-stained sandy silt.		
41.32-42.71			91								
42.71-44.32			100					43.70	42.71-43.10m Orange iron staining. 42.71-43.46m Medium bed (600mm) of slightly silty fine to coarse sand.		
44.32-45.59			100	U4				(3.61)	43.70 - 47.31 Greenish grey slightly clayey silty fine SAND with medium spaced thinly laminated (2-5mm) fine sand. 44.60m Pocket Penetrometer 0.65MPa, 0.85MPa. 44.64-44.86m Bed of sheared fine sandy silty CLAY.		
45.59-47.31			27					47.31	47.27-47.31m Orange iron staining.		
47.31-48.66									47.31 - 55.01 Light greenish grey with dark grey streaks fine to medium SAND. 47.31-48.66m Core loss.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 520 Rig No. P100	Logged By: Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW2
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	20-10-17 23-10-17		E 330 332.0 N 242 233.0	
Contractor				Sheet
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SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
			0								
48.66-50.23			16								
50.23-51.83			0					(7.70)	50.23-51.83m Core loss.		
51.83-53.41			70								
53.41-55.01			0					55.01	53.41-55.01m Core loss.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
55.01	25-10-17	07.00	3.00	126						End of Borehole 55.01m. No ground water encountered in borehole.

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 520 Rig No. P100	Logged By Spha Luthuli

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 / 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 1 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
0.00-1.50			82					(1.50) 1.50	0.00 - 1.50 Light brown slightly silty fine to medium grained SAND.		
1.50-3.00			40						1.50 - 5.00 Light greyish brown fine to coarse grained SAND with minor isolated zones of silty sand.		
3.00-4.50			33					(3.50)			
4.50-6.00			47					5.00	5.00 - 7.60 Light grey blotched light orange gravelly clayey SAND. Note: Gravels are fine to coarse sub-angular fragments of mixed origin predominately quartz.		
6.00-7.50			92					(2.60)	6.60-6.85m: Gravel rich lens.		
7.50-8.50								7.60	7.30-7.40m: Gravel rich lens. 7.55-7.60m: Gravel rich lens. 7.60 - 10.60 Light grey blotched and stained light		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 2 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
			85						orange sandy CLAY with occasional fine to medium sub-angular to sub-rounded gravel fragments of mixed origin (predominately quartz).		
8.50-10.00			61					(3.00)			
10.00-11.50			100					10.60	10.45-10.50m: Occasional gravel rich lenses.		
									10.60 - 12.90 Light grey blotched and stained orange slightly sandy silty CLAY with isolated narrow bands of silt.		
11.50-13.00			95					(2.30)	11.40-11.45m: Narrow band of hardpan ferricrete.		
13.00-14.50			0					12.90 (2.30) 15.20	12.90 - 15.20 Light greenish grey with minor light orange blotches slightly silty fine to medium grained SAND with interbedded closely spaced thin beds of silty clay. Note: Material characterized in places as randomly very closely spaced, mixed patches of sand, silt and clay. 13.00-14.50m Core loss.		
14.50-16.00			100					(0.80) 16.00	15.20 - 16.00 Light greenish grey silty CLAY.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL_2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 3 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
16.00-17.50			27						16.00 - 29.00 Light greenish grey silty fine to medium grained SAND with interbedded closely to widely spaced thin beds of silty clay. Note: Fine to medium sub-angular to sub-rounded quartz gravels present.		
17.50-19.00			25								
19.00-20.50			47								
20.50-22.00			80								
22.00-23.50			70					(13.00)			
23.50-25.00									23.50-25.60m: Lenses of fine to medium grained sand.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
22.00	07-10-17	17.00	3.00	126						End of Borehole 55.00m.
22.00	08-10-17	08.00	3.00	126						

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 4 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
25.00-26.50			37						25.00-26.50m Core loss.		
			0								
26.50-28.00			21								
28.00-29.50			32								
								29.00			
29.50-31.00			100					(1.80)	29.00 - 30.80 Greenish grey silty CLAY with occasional beds of silty fine grained sand.		
								30.80			
31.00-32.50			40						30.80 - 38.50 Light greenish grey with minor orange staining clayey silty fine grained SAND with the occasional thinly bedded widely spaced clay lenses.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 / 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 5 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
32.50-34.00			37								
34.00-35.50			73					(7.70)			
35.50-37.00			0						35.50-37.00m Core loss.		
37.00-38.50			33						38.20-38.50m: Lens of silt.		
38.50-40.00			100					38.50 (1.90)	38.50 - 40.40 Closely sheared light greenish grey silty CLAY interbedded with widely spaced thinly bedded (50-500mm) sandy material.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No: Total Project	Date: 07-10-17 / 10-10-17	Ground Level (m):	Co-Ordinates (): E 329 326.0 N 241 137.0	
Contractor: GEOMECHANICS				Sheet: 6 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
40.00-41.50			60					40.40			
									40.40 - 46.00 Very light grey with minor streaks of heavy minerals slightly silty fine grained SAND with minor thin beds of silty and clayey material.		
41.50-43.00			0						41.50-43.00m Core loss.		
43.00-44.50			17					(5.60)			
44.50-46.00			0						44.50-46.00m Core loss.		
								46.00			
46.00-47.50			100						46.00 - 55.00 Light greenish grey speckled and blotched orange and dark grey slightly sandy clayey SILT interbedded with medium clay beds.		
									46.95m: Slightly undulating smooth and clean shear zone.		
47.50-49.00											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No. P243	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017 CPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW3
Job No	Date	Ground Level (m)	Co-Ordinates ()	
Total Project	07-10-17 10-10-17		E 329 326.0 N 241 137.0	
Contractor				Sheet
GEOMECHANICS				7 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
			57						48.40-48.60m: Zone of orange stained silty sand.		
49.00-50.50			100								
50.50-52.00			0					(9.00)	50.40-50.50m: Zone of orange stained silty sand. 50.50-52.00m: Core loss.		
52.00-53.50			0						52.00-53.50m: Core loss.		
53.50-55.00			0						53.50-55.00m: Core loss.		
								55.00			

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
55.00	10-10-17	08.00	3.00	126						End of Borehole 55.00m.
55.00	10-10-17	15.00	3.00	126						

All dimensions in metres Scale 1:50	Client TOTAL	Method/ Plant Used DB 525 Rig No. P243	Logged By Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 1 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
0.00-1.50			47					(0.40) 0.40	0.00 - 0.40 Light orange brown silty fine to medium grained SAND.		
									0.40 - 6.00 Orange brown becoming increasingly mottled light grey with orange staining slightly clayey silty SAND. Note: Horizon is characterized by pockets of clayey sand (4-18mm) and zones/lenses of sub-angular to sub-rounded fine to occasionally coarse grained gravel.		
1.50-3.00			0						1.50-3.00m Core loss.		
3.00-4.50			0					(5.60)	3.00-4.50m Core loss.		
4.50-5.50			90								
5.50-6.00			0						5.50-6.00m Core loss.		
6.00-7.50			80					6.00	6.00 - 11.50 Light grey stained orange clayey silty SAND. Note: Material is characterized by numerous sporadic pockets and lenses of silty clayey and sandy material. Note: Random zones of sub-angular to sub-rounded fine to medium grained gravel present.		
7.50-8.50											

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 2 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
8.50-10.10			95					(5.50)			
			100								
10.10-11.50			87					11.50			
11.50-13.00			97					(0.70) 12.20	11.50 - 12.20 Light orange grey streaked pink gravelly silty fine to coarse grained SAND.		
13.00-14.50			100						12.20 - 20.10 Light bluish grey with zones of yellowish orange staining slightly sandy clayey SILT. 13.05-13.32m Lens of silty fine sandy material.		
14.50-16.00			80						14.60-14.80m Lens of silty fine sandy material. 14.80-14.87m Hardpan ferricrete zone.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 3 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
16.00-17.10			100					(7.90)			
17.10-18.60			93								
18.60-20.10			55					20.10			
20.10-21.60			86						20.10 - 23.10 Light greenish grey with minor blotches of orange staining silty CLAY.		
21.60-22.10			86					(3.00)			
22.10-24.60			40					23.10	22.05-23.10m Alternating lenses/pockets of fine sandy silty material.		
									23.10 - 33.60 No Core recovery - indicates sandy material.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 4 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
24.60-26.10			0						24.60-26.10m Core loss.		
26.10-27.60			0						26.10-27.60m Core loss.		
27.60-29.10			0					(10.50)	27.60-29.10m Core loss.		
29.10-30.60			0						29.10-30.60m Core loss.		
30.60-32.10			0						30.60-32.10m Core loss.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 5 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
32.10-33.60			0					33.60	32.10-33.60m Core loss.		
33.60-35.10			100					(4.50)	33.60 - 38.10 Very closely sheared light greenish grey clayey SILT.		
35.10-36.60			0						35.10-36.60m Core loss.		
36.60-38.10			93					38.10			
38.10-39.60			0						38.10 - 45.60 No Core recovery - drilling issues on sandy material. 38.10-39.60m Core loss.		
39.60-41.10									39.60-41.10m Core loss.		

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
36.60	23-09-17	17.00	16.50	126						End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.
36.60	24-09-17	07.00	16.50	126						
38.10	24-09-17	17.00	16.50	126						
38.10	25-09-17	08.20	16.50	126						

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 6 of 7

SAMPLES & TESTS									STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
			0								
41.10-42.60			0					(7.50)	41.10-42.60m Core loss.		
42.60-44.10			0						42.60-44.10m Core loss.		
44.10-45.60			0						44.10-45.60m Core loss.		
45.60-47.10			100					45.60	45.60 - 50.10 Light greenish grey with zones of orange staining clayey SILT. Note: Closely spaced laminae of heavy minerals and mica (muscovite) grains. 45.85-46.15m Silty sand zone.		
47.10-50.10								(4.50)			

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

BOREHOLE LOG

Project				BOREHOLE No
CPF AND NILE CROSSING				CPF-MW4
Job No: Total Project	Date: 22-09-17 / 26-09-17	Ground Level (m):	Co-Ordinates (): E 328 439.0 N 241 781.0	
Contractor: GEOMECHANICS				Sheet: 7 of 7

SAMPLES & TESTS								STRATA		
Depth	Type No	Test Result	TCR (%)	Sampling	Water	Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instruments/ Backfill
			27					50.10			
50.10-53.10			0					(4.90)	50.10 - 55.00 Light grey blotched and stained yellow and orange silty fine grained SAND. Note: Due to low core recovery actual material between 50.10-55.00m cannot be defined. 50.10-53.10m Core loss.		
53.10-55.00			11					55.00			

Boring Progress					Chiselling			Water Added		GENERAL REMARKS
Depth	Date	Time	Casing Depth	Casing Dia. mm	From	To	Hours	From	To	
55.00	25-09-17	17.00	16.50	126						End of Borehole 55.00m. Piezometer installed with response zone from 35-55m.

All dimensions in metres Scale 1:50	Client: TOTAL	Method/ Plant Used: DB 525 Rig No.	Logged By: Daniel Miller

Report ID: CPF & NILE WITH SAMPLING || Project: TOTAL 2017.GPJ || Library: GINT STD AGS 4_0.GLB || Date: 5 December 2017

Annex 4: Groundwater laboratory datasheets: 2014

Appendix 6B

Groundwater Results 2014

This section presents the results from analysis of samples collected at each ground water sampling location. All ground water samples were analyzed by Eurofins Analytico BV (Analytico) in the Netherlands. Ground water samples were analyzed for a broad range of chemical constituents including metals, other inorganic compounds (i.e., nitrate, nitrite, ammonia, major cations/anions), and organic compounds (PAHs, BTEX, and petroleum hydrocarbons).

Table 6B-1: Groundwater results - North Nile

	Regulatory Standard or Criteria			Location															
				GW01				GW02				GW03				GW04			
				Description															
				Borehole at Tangi gate to MFNP				Borehole BH-2 at Jobi East-1 well pad in MFNP				Borehole at Jobi-3 in MFNP				Borehole at Jobi East-3 in MFNP			
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	Sample ID															
				GW01	GW01	GW01	GW01	GW01D	GW02	GW02	GW02	GW03	GW03	GW03	GW03	GW04	GW04	GW04	GW04
				Sample Date															
				10-Feb-14	23-Apr-14	28-Jun-14	30-Sep-14	30-Sep-14	10-Feb-14	26-Apr-14	29-Jun-14	10-Feb-14	25-Apr-14	29-Jun-14	28-Sep-14	10-Feb-14	26-Apr-14	29-Jun-14	28-Sep-14
				Sample Type															
				Primary	Primary	Primary	Primary	Duplicate	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Field Parameters:																			
pH	6.5-8.5	-	-	6.83	6.87	6.85	6.93	6.93	6.84	6.65	6.62	6.88	7.55	7.48	7.49	6.87	6.53	6.5	6.54
Temperature, C	-	-	-	30.92	31.21	31.48	31.85	31.85	28.49	29.25	28.66	31.34	31.94	31.58	31.72	27.27	29.17	27.98	27.66
EC, uS/cm	2,500	-	-	1,491	2,318	2,347.8	2,325.4	2,325.4	572	902.1	835.1	467	689.3	721.6	735.2	303	469	470.1	464.7
ORP, mV	-	-	-	-110.8	-91.6	-70.7	-57.5	-57.5	-253	-51	-44.3	-132.7	-127.3	-118.5	-105.1	-89.8	-43.7	-31.1	-27.3
Diss. O_2, mg/L	-	-	-	1.05	2.30	1.21	2.29	2.29	0.01	0.76	1.51	1.19	0.38	0.77	2.14	0.16	0.49	1.15	1.25
Resistivity, Ω-cm	-	-	-	700	386	379	380	380	1800	1025	1119	2100	1281	1231	1,206	3,300	1,975	2,013	2,048
Salinity, PSU	-	-	-	0.74	1.2	1.2	1.2	1.2	0.27	0.4	0.4	0.22	0.3	0.4	0.4	0.14	0.2	0.2	0.2
TDS, mg/L	1,500-mg/L	-	-	746	1507	1526	1512	1512	286	586	543	234	448	469	478	151	305	306	302
PAHs: µg/L																			
Acenaphthene	-	-	940	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Acenaphthylene	-	-	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Anthracene	-	-	4,700	< 0.0050	< 0.005	< 0.005	< 0.0050	< 0.0050	< 0.0050	< 0.005	< 0.005	< 0.0050	< 0.005	< 0.005	< 0.0050	0.0059	0.0095	0.0071	< 0.0050
Benzo(a)anthracene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(a)pyrene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(b)fluoranthene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(g,h,i)perylene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(k)fluoranthene	-	-	0.29	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Chrysene	-	-	2.9	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Dibenz(a,h)anthracene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluoranthene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	0.015	0.014	< 0.010
Fluorene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Indeno(1,2,3-cd)pyrene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Naphthalene	-	-	0.14	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020
Phenanthrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	0.018	< 0.010
Pyrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
PAH 10 VROM (sum)	-	-	-	< 0.10	< 0.105	< 0.105	< 0.10	< 0.10	< 0.10	< 0.105	< 0.105	< 0.10	< 0.105	< 0.105	< 0.10	< 0.10	< 0.105	< 0.105	< 0.10
PAH 16 EPA (sum)	-	-	470	< 0.20	< 0.205	< 0.205	< 0.20	< 0.20	< 0.20	< 0.205	< 0.205	< 0.20	< 0.205	< 0.205	< 0.20	< 0.20	< 0.205	< 0.205	< 0.20
BTEX: µg/L																			
Benzene	1	5	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Ethylbenzene	300	700	-	< 0.20	< 0.2	0.25	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Toluene	700	1,000	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	0.72	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
m-Xylene & p-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	0.48	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
o-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Xylenes, total	500	10,000	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	0.48	< 0.4	< 0.4	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
BTEX, summation	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons: µg/L																			
C10-C12	-	-	-	< 4.0	< 4	< 4	< 4.0	< 4.0	< 4.0	< 4	-	< 4.0	< 4	7.2	< 4.0	< 4.0	< 4	4.8	< 4.0
C12-C16	-	-	-	< 5.0	8.5	< 5	21	13	< 5.0	< 5	5.7	< 5.0	< 5	10	< 5.0	< 5.0	< 5	6.4	5.6
C16-C21	-	-	-	< 6.0	< 6	< 6	< 6.0	< 6.0	< 6.0	< 6	12	< 6.0	< 6	< 6	< 6.0	< 6.0	< 6	< 6	< 6.0
C21-C30	-	-	-	17	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10

	Regulatory Standard or Criteria			Location															
				GW01				GW02				GW03				GW04			
				Description															
				Borehole at Tangi gate to MFNP				Borehole BH-2 at Jobi East-1 well pad in MFNP				Borehole at Jobi-3 in MFNP				Borehole at Jobi East-3 in MFNP			
	Uganda Class II Potable Standard	USEPA MCL[A]	USEPA Tap Water RSL[A]	Sample ID															
				GW01	GW01	GW01	GW01	GW01D	GW02	GW02	GW02	GW03	GW03	GW03	GW03	GW04	GW04	GW04	GW04
				Sample Date															
				10-Feb-14	23-Apr-14	28-Jun-14	30-Sep-14	30-Sep-14	10-Feb-14	26-Apr-14	29-Jun-14	10-Feb-14	25-Apr-14	29-Jun-14	28-Sep-14	10-Feb-14	26-Apr-14	29-Jun-14	28-Sep-14
				Sample Type															
				Primary	Primary	Primary	Primary	Duplicate	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
C30-C35	-	-	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	**5.5**	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	5.5
C35-C40	-	-	-	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0
Total Petroleum Hydrocarbons	-	-	-	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38
Metals: µg/L																			
Arsenic	50	10	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Barium	1,000	2,000	-	410	400	420	410	420	1,600	1,700	1,600	350	360	380	380	100	100	1,700	110
Cadmium	3	5	-	2.1	1.7	1.3	0.75	0.77	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
Chromium	50	100	-	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1.0	< 1	< 1	< 1.0	< 1	< 1	< 1.0	< 1.0	< 1	< 1	< 1.0
Cobalt	-	-	4.7	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0
Copper	2,000	1,300	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Lead	10	15	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Mercury	1	2	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Nickel	20	-	310	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Zinc	-	-	4,700	750	750	530	340	340	< 10	66	< 10	< 10	< 10	< 10	< 10	< 10	33	< 10	< 10
Metals: mg/L																			
Calcium	-	-	-	38	35	43	38	38	120	110	110	23	27	29	27	7.5	7.1	7.2	7
Iron	1	-	11	3.4	3.4	3.6	3.5	3.6	1.5	1	1.7	0.22	0.29	0.28	0.29	1.4	1.5	1.4	1.5
Magnesium	150	-	-	11	11	11	12	12	19	19	18	5.4	5.8	6.2	6.2	2.4	2.3	2.4	2.4
Manganese	0.1	-	0.38	0.44	0.42	0.43	0.48	0.48	0.48	0.49	0.51	0.015	0.013	0.015	0.016	0.058	0.05	0.054	0.06
Potassium	100	-	-	10	11	11	11	11	6.4	6.9	6	3	3.5	3.6	3.4	4.8	4.6	4.7	4.5
Sodium	400	-	760	390	380	400	400	410	61	62	58	120	130	140	140	99	96	97	100
Uranium	-	0.03	-	-	< 0.0002	< 0.0002	< 0.0002	< 0.0002	-	0.003	0.0021	-	< 0.0002	< 0.0002	< 0.0002	-	< 0.0002	< 0.0002	< 0.0002
General Chemistry: mg/L (unless otherwise noted)																			
Ammonium (NH_4-N)	-	-	-	2.8	2.8	2.7	3	2.8	0.11	0.071	< 0.05	0.56	0.54	0.5	< 0.050	0.91	0.87	0.79	< 0.050
Ammonia (NH_4)	-	-	-	3.6	3.6	3.5	3.8	3.5	0.14	0.091	< 0.065	0.71	0.70	0.64	< 0.065	1.2	1.1	1	< 0.065
Bromide	-	-	-	< 6.0	< 0.3	4	3.9	< 30	< 0.30	< 0.3	< 0.3	0.33	< 0.3	0.31	< 0.30	0.33	< 0.3	< 0.3	< 0.30
Chloride, dissolved	500	-	-	350	670	670	700	690	15	15	14	20	18	18	18	19	17	17	18
Fluoride, dissolved	1.5	-	0.62	0.11	0.13	0.15	0.14	0.19	0.18	0.2	0.19	0.22	0.20	0.19	0.19	0.25	0.22	0.23	0.25
Sulfate, dissolved	-	-	-	< 0.5	< 0.5	< 0.5	1.6	1.8	3.3	3.8	2.8	0.52	0.52	0.98	0.8	0.62	2	< 0.5	0.53
Nitrate (NO_3)	50	-	-	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.90	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.90	< 0.9000	< 0.9	< 0.90
Nitrate (as N)	-	10	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Nitrite (NO_2)	0.2	-	-	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030
Nitrite (as N)	-	1	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Ortho Phosphate (PO_4)	-	-	-	< 0.060	< 0.0600	< 0.06	< 0.060	< 0.060	< 0.060	< 0.0600	< 0.06	< 0.060	< 0.0600	< 0.06	< 0.060	4.4	3.7	3.8	4
Ortho Phosphate (PO_4-P)	-	-	-	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.02	< 0.02	< 0.020	1.4	1.2	1.2	1.3

Notes:
[A] MCL - Maximum Contaminant Level; RSL - Regional Screening Level
[B] Exceeds Uganda Class II Potable Standard:
Exceeds USEPA RSL & Uganda Class II Standard:

Table 6B–2: Groundwater results (GW05/GW06/GW07) - South Nile

	Regulatory Standard or Criteria			Location										
				GW05			GW06				GW07			
				Description										
				Borehole near Mpyo 5 (D) in MFNP			Community borehole near Mpyo 6				Water supply borehole in Bugungu Camp			
				Sample ID										
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	GW05	GW05	GW05	GW06	GW06	GW06	GW06	GW07	GW07	GW07	GW07
				Sample Date										
				13-Feb-14	26-Apr-14	30-Jun-14	13-Feb-14	28-Apr-14	1-Jul-14	25-Sep-14	11-Feb-14	26-Apr-14	1-Jul-14	25-Sep-14
				Sample Type										
				Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Field Parameters:														
pH	6.5-8.5	-	-	6.88	7.33	7.1	6.89	6.89	6.65	5.56	6.87	6.06	6.15	6.4
Temperature, C	-	-	-	28.11	29.37	28.75	29.59	31.02	29.87	28.99	29.56	29.8	30	30.24
EC, uS/cm	2,500	-	-	707	1,108.2	1,089.7	319	2,331.9	460.4	54.2	236	377.5	379	413
ORP, mV	-	-	-	-122.8	-89.9	-91.4	-80.8	-87.7	-39.8	127.6	106.3	120.3	103.2	29.7
Diss. O_2, mg/L	-	-	-	0.34	5.16	0.84	2.15	2.07	2.62	3.83	4.42	4.54	4.86	3.64
Resistivity, Ω-cm	-	-	-	1,400	833	856	3,100	385	1,988	17146	4,200	2,427	2,408	2,199
Salinity, PSU	-	-	-	0.34	0.6	0.5	0.15	1.2	0.2	0	0.11	0.2	0.2	0.2
TDS, mg/L	1,500-mg/L	-	-	353	720	708	160	1516	299	35	120	245	246	268
PAHs: µg/L														
Acenaphthene	-	-	940	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Acenaphthylene	-	-	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Anthracene	-	-	4,700	< 0.0050	< 0.005	< 0.005	< 0.0050	< 0.005	< 0.005	0.025	< 0.0050	< 0.005	< 0.005	< 0.0050
Benzo(a)anthracene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(a)pyrene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(b)fluoranthene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(g,h,i)perylene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(k)fluoranthene	-	-	0.29	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Chrysene	-	-	2.9	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Dibenz(a,h)anthracene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluoranthene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluorene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	0.023	< 0.010	< 0.01	< 0.01	< 0.010
Indeno(1,2,3-cd)pyrene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Naphthalene	-	-	0.14	< 0.020	< 0.02	< 0.02	< 0.020	< 0.02	< 0.02	0.1	< 0.020	< 0.02	0.022	< 0.020
Phenanthrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	0.02	< 0.010	< 0.01	< 0.01	< 0.010
Pyrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
PAH 10 VROM (sum)	-	-	-	< 0.10	< 0.105	< 0.105	< 0.10	< 0.105	< 0.105	0.15	< 0.10	< 0.105	< 0.105	< 0.10
PAH 16 EPA (sum)	-	-	470	< 0.20	< 0.205	< 0.205	< 0.20	< 0.205	< 0.205	< 0.20	< 0.20	< 0.205	< 0.205	< 0.20
BTEX: µg/L														
Benzene	1	5	-	0.24	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Ethylbenzene	300	700	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Toluene	700	1,000	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
m-Xylene & p-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
o-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Xylenes, total	500	10,000	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
BTEX, summation	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons: µg/L														
C10-C12	-	-	-	< 4.0	< 4	< 4	< 4.0	4.9	< 4	< 4.0	< 4.0	< 4	4.4	< 4.0
C12-C16	-	-	-	< 5.0	< 5	5.5	< 5.0	< 5	< 5	16	< 5.0	< 5	< 5	< 5.0
C16-C21	-	-	-	< 6.0	< 6	< 6	< 6.0	< 6	< 6	< 6.0	< 6.0	< 6	< 6	6.4
C21-C30	-	-	-	13	< 10	< 10	< 10	< 10	< 10	< 10	18	< 10	< 10	< 10

	Regulatory Standard or Criteria			Location										
				GW05			GW06				GW07			
				Description										
				Borehole near Mpyo 5 (D) in MFNP			Community borehole near Mpyo 6				Water supply borehole in Bugungu Camp			
	Uganda Class II Potable Standard	USEPA MCL[A]	USEPA Tap Water RSL[A]	Sample ID										
				GW05	GW05	GW05	GW06	GW06	GW06	GW06	GW07	GW07	GW07	GW07
				Sample Date										
				13-Feb-14	26-Apr-14	30-Jun-14	13-Feb-14	28-Apr-14	1-Jul-14	25-Sep-14	11-Feb-14	26-Apr-14	1-Jul-14	25-Sep-14
				Sample Type										
				Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
C30-C35	-	-	-	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	8.1	< 5	< 5	< 5.0
C35-C40	-	-	-	< 8.0	< 8	< 8	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0
Total Petroleum Hydrocarbons	-	-	-	< 38	< 38	< 38	< 38	< 38	< 38	< 38	44	< 38	< 38	< 38
Metals: µg/L														
Arsenic	50	10	-	< 5.0	< 5	< 5	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Barium	1,000	2,000	-	1,800	1,800	1,800	410	630	420	120	200	200	210	270
Cadmium	3	5	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
Chromium	50	100	-	< 1.0	< 1	< 1	< 1.0	< 1	1.3	11	1.6	3.6	1.8	< 1.0
Cobalt	-	-	4.7	< 3.0	< 3	< 3	< 3.0	< 3	< 3	3	< 3.0	< 3	< 3	< 3.0
Copper	2,000	1,300	-	< 5.0	31	< 5	< 5.0	< 5	< 5	37	< 5.0	< 5	< 5	< 5.0
Lead	10	15	-	< 5.0	< 5	< 5	< 5.0	< 5	< 5	17	< 5.0	< 5	< 5	< 5.0
Mercury	1	2	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Nickel	20	-	310	< 5.0	< 5	< 5	< 5.0	< 5	< 5	6.2	< 5.0	< 5	< 5	< 5.0
Zinc	-	-	4,700	< 10	54	< 10	1900	1400	920	2300	12	28	12	< 10
Metals: mg/L														
Calcium	-	-	-	36	42	46	27	50	32	5.3	29	31	35	31
Iron	1	-	11	0.54	0.87	1.1	1.4	3.5	2.4	3.7	0.13	0.071	< 0.05	0.57
Magnesium	150	-	-	19	21	21	9.1	14	10	1.1	9.4	9.4	10	12
Manganese	0.1	-	0.38	0.078	0.073	0.087	0.52	0.7	0.57	0.16	< 0.010	< 0.01	0.041	0.18
Potassium	100	-	-	3.7	4.4	4.3	3.5	5.3	4.1	1.4	3.6	4	4.1	4.4
Sodium	400	-	760	170	190	190	48	34	49	7.5	23	24	25	34
Uranium	-	0.03	-	-	< 0.0002	0.0003	-	< 0.0002	< 0.0002	0.0013	-	< 0.0002	< 0.0002	-
General Chemistry: mg/L (unless otherwise noted)														
Ammonium (NH_4-N)	-	-	-	0.92	0.93	0.84	0.34	0.12	0.32	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Ammonia (NH_4)	-	-	-	1.2	1.2	1.1	0.43	0.16	0.4	< 0.065	< 0.065	< 0.0650	< 0.065	< 0.065
Bromide	-	-	-	< 0.30	< 0.3	< 0.3	< 0.30	0.32	< 0.3	< 0.30	< 0.30	0.33	0.57	0.34
Chloride, dissolved	500	-	-	6.7	6.8	6.4	41	52	39	3.1	47	49	49	45
Fluoride, dissolved	1.5	-	0.62	0.40	0.38	0.38	0.053	0.12	0.12	0.16	0.16	0.21	0.19	0.27
Sulfate, dissolved	-	-	-	0.86	4.8	0.74	1.3	0.89	9.7	6.8	29	27	25	11
Nitrate (NO_3)	50	-	-	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.9000	< 0.9	< 0.90	20	20	17	3.8
Nitrate (as N)	-	10	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.2	< 0.20	4.5	4.5	3.9	0.86
Nitrite (NO_2)	0.2	-	-	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.0300	< 0.03	0.082	< 0.030	< 0.0300	< 0.03	< 0.030
Nitrite (as N)	-	1	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01	< 0.01	0.025	< 0.010	< 0.01	< 0.01	< 0.010
Ortho Phosphate (PO_4)	-	-	-	< 0.060	< 0.0600	< 0.06	0.34	< 0.0600	0.1	0.25	0.43	0.43	0.5	0.8
Ortho Phosphate (PO_4-P)	-	-	-	< 0.020	< 0.02	< 0.02	0.11	< 0.02	0.034	0.083	0.14	0.14	0.16	0.26

Notes:
[A] MCL - Maximum Contaminant Level; RSL - Regional Screening Level
[B] Exceeds Uganda Class II Potable Standard:
Exceeds USEPA RSL & Uganda Class II Standard:

Table 6B–3: Groundwater results (GW08/GW09/GW10) - South Nile

	Regulatory Standard or Criteria			Location												
				GW08				GW09					GW10			
				Description												
				Community borehole between CPF AOIs				Community borehole near Ngiri2					Community borehole in Wanseco village			
				Sample ID												
	Uganda Class II Potable Standard	USEPA MCL[(A)]	USEPA Tap Water RSL[(A)]	GW08	GW08	GW08	GW08	GW09	GW09	GW09D	GW09	GW09	GW10	GW10	GW10	GW10
				Sample Date												
				13-Feb-14	20-Apr-14	1-Jul-14	29-Sep-14	13-Feb-14	20-Apr-14	20-Apr-14	1-Jul-14	27-Sep-14	13-Feb-14	27-Apr-14	1-Jul-14	29-Sep-14
				Sample Type												
				Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary		
Field Parameters:																
pH	6.5-8.5	-	-	6.89	7.03	6.13	6.35	6.88	6.38	---	6.56	6.51	6.87	6.94	7.01	7.03
Temperature, C	-	-	-	29.81	29.3	29.95	30.07	36.87	30.45	---	30.57	30.24	30.03	28.25	30.75	28.62
EC, uS/cm	2,500	-	-	305	510	459.2	309.2	211	333.8	---	423	324.6	623	960.8	963.3	962.1
ORP, mV	-	-	-	-46.4	21.8	61.7	51.2	-92.7	-37.5	---	-45.6	-29.7	-70.7	87.8	37.8	55.3
Diss. O_2, mg/L	-	-	-	1.91	2.94	2.81	4.16	1.97	2.34	---	2.68	2.81	2.9	2.81	3.6	6.47
Resistivity, Ω-cm	-	-	-	3300	1972	1990	2950	4700	2713	---	2135	2801	1600	980	936	972
Salinity, PSU	-	-	-	0.14	0.2	0.2	0.1	0.1	0.2	---	0.2	0.2	0.3	0.5	0.5	0.5
TDS, mg/L	1,500-mg/L	-	-	153	332	298	201	106	217	---	275	211	312	625	626	625
PAHs: µg/L																
Acenaphthene	-	-	940	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Acenaphthylene	-	-	-	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Anthracene	-	-	4,700	< 0.0050	< 0.005	< 0.005	< 0.0050	< 0.0050	< 0.005	< 0.005	< 0.005	< 0.0050	< 0.0050	< 0.005	< 0.005	< 0.0050
Benzo(a)anthracene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(a)pyrene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(b)fluoranthene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(g,h,i)perylene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Benzo(k)fluoranthene	-	-	0.29	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Chrysene	-	-	2.9	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Dibenz(a,h)anthracene	-	-	0.0029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluoranthene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Fluorene	-	-	630	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Indeno(1,2,3-cd)pyrene	-	-	0.029	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Naphthalene	-	-	0.14	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020
Phenanthrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
Pyrene	-	-	-	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010
PAH 10 VROM (sum)	-	-	-	< 0.10	< 0.105	< 0.105	< 0.10	< 0.10	< 0.105	< 0.105	< 0.105	< 0.10	< 0.10	< 0.105	< 0.105	< 0.10
PAH 16 EPA (sum)	-	-	470	< 0.20	< 0.205	< 0.205	< 0.20	< 0.20	< 0.205	< 0.205	< 0.205	< 0.20	< 0.20	< 0.205	< 0.205	< 0.20
BTEX: µg/L																
Benzene	1	5	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Ethylbenzene	300	700	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Toluene	700	1,000	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
m-Xylene & p-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
o-Xylene	-	-	3,100	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20
Xylenes, total	500	10,000	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
BTEX, summation	-	-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons: µg/L																
C10-C12	-	-	-	5.6	6.3	< 4	< 4.0	< 4.0	< 4	< 4	6.6	< 4.0	< 4.0	< 4	< 4	< 4.0
C12-C16	-	-	-	< 5.0	< 5	< 5	< 5.0	< 5.0	5	< 5	8.3	< 5.0	< 5.0	< 5	5	20
C16-C21	-	-	-	< 6.0	< 6	< 6	7.9	< 6.0	6.1	< 6	< 6	8.8	< 6.0	< 6	< 6	< 6.0
C21-C30	-	-	-	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10

	Regulatory Standard or Criteria			Location												
				GW08				GW09					GW10			
				Description												
				Community borehole between CPF AOIs				Community borehole near Ngiri2					Community borehole in Wanseco village			
	Uganda Class II Potable Standard	USEPA MCL[A]	USEPA Tap Water RSL[A]	Sample ID												
				GW08	GW08	GW08	GW08	GW09	GW09	GW09D	GW09	GW09	GW10	GW10	GW10	GW10
				Sample Date												
				13-Feb-14	20-Apr-14	1-Jul-14	29-Sep-14	13-Feb-14	20-Apr-14	20-Apr-14	1-Jul-14	27-Sep-14	13-Feb-14	27-Apr-14	1-Jul-14	29-Sep-14
				Sample Type												
				Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary		
C30-C35	-	-	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
C35-C40	-	-	-	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0
Total Petroleum Hydrocarbons	-	-	-	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38
Metals: µg/L																
Arsenic	50	10	-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Barium	1,000	2,000	-	330	370	360	99	210	250	270	260	260	150	160	170	180
Cadmium	3	5	-	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40
Chromium	50	100	-	< 1.0	3.2	< 1	1.4	< 1.0	1.3	< 1	< 1	< 1.0	< 1.0	< 1	< 1	< 1.0
Cobalt	-	-	4.7	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0
Copper	2,000	1,300	-	< 5.0	14	< 5	9.4	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Lead	10	15	-	< 5.0	7.1	< 5	8.9	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Mercury	1	2	-	< 0.050	0.06	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050
Nickel	20	-	310	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0
Zinc	-	-	4,700	78	470	90	530	720	320	330	470	410	110	28	28	20
Metals: mg/L																
Calcium	-	-	-	28	40	42	25	16	19	20	20	18	60	87	93	91
Iron	1	-	11	2.3	11	1.2	4.1	2.7	4.6	4.7	4.3	4.8	0.11	0.094	0.11	< 0.050
Magnesium	150	-	-	8.8	10	11	6.2	5.1	5.7	6.1	5.9	5.9	25	28	29	29
Manganese	0.1	-	0.38	0.072	0.12	0.074	0.025	0.52	0.55	0.57	0.57	0.61	0.74	1	0.98	1.1
Potassium	100	-	-	4.3	5.2	5.4	4.3	5.1	6	6.4	6.2	6.4	4.1	5	5.1	4.9
Sodium	400	-	760	25	29	29	26	35	39	41	38	40	80	90	90	90
Uranium	-	0.03	-		< 0.0002	< 0.0002	0.0004	-	< 0.0002	< 0.0002	< 0.0002	< 0.0002	-	0.005	0.006	0.0068
General Chemistry: mg/L (unless otherwise noted)																
Ammonium (NH_4-N)	-	-	-	< 0.050	< 0.05	< 0.05	< 0.050	0.94	1.1	0.98	1	< 0.050	0.15	0.25	0.1	< 0.050
Ammonia (NH_4)	-	-	-	< 0.065	< 0.0650	< 0.065	< 0.065	1.2	1.4	1.3	1.3	< 0.065	0.19	0.32	0.13	< 0.065
Bromide	-	-	-	0.57	0.45	0.74	< 0.30	< 0.30	< 0.3	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30
Chloride, dissolved	500	-	-	83	76	80	23	5.0	4.8	4.8	5.3	4.7	28	28	30	31
Fluoride, dissolved	1.5	-	0.62	0.11	0.2	0.25	0.34	0.13	0.23	0.076	0.23	0.27	0.69	0.68	0.67	0.7
Sulfate, dissolved	-	-	-	15	14	20	31	0.73	6.8	2.4	4.8	< 0.50	60	65	56	52
Nitrate (NO_3)	50	-	-	7	4.9	7.4	1.4	< 0.90	< 0.9000	< 0.9000	< 0.9	< 0.90	2.9	3.5	3.9	4.6
Nitrate (as N)	-	10	-	1.6	1.1	1.7	0.31	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	0.67	0.8	0.89	1
Nitrite (NO_2)	0.2	-	-	0.21	0.15	0.092	< 0.030	< 0.030	< 0.0300	< 0.0300	< 0.03	< 0.030	< 0.030	0.066	< 0.03	0.11
Nitrite (as N)	-	1	-	0.063	0.045	0.028	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010	0.02	< 0.01	0.032
Ortho Phosphate (PO_4)	-	-	-	< 0.060	< 0.0600	< 0.06	< 0.060	0.95	0.3	0.38	0.31	0.98	0.20	0.17	0.16	0.22
Ortho Phosphate (PO_4-P)	-	-	-	< 0.020	< 0.02	< 0.02	< 0.020	0.31	0.099	0.12	0.1	0.32	0.065	0.055	0.052	0.072

Notes:
[A] MCL - Maximum Contaminant Level; RSL - Regional Screening Level
[B] Exceeds Uganda Class II Potable Standard:
Exceeds USEPA RSL & Uganda Class II Standard:
Exceed USEPA RSL:

Annex 5: Photographs of ESIA Campaigns 1 & 2 Groundwater Survey Locations: 2016 and 2017

Photographs of ESIA Campaigns 1 & 2 Groundwater Survey Locations

GW01 07/11/2016		GW02 07/11/2016	
GW03 07/11/2016		GW04 08/11/2016	
GW05 08/11/2016		GW06 08/11/2016	

GW10 06/11/2016	
GW11 06/11/2016	
GW12 06/11/2016	
GW 13 08/11/2016	

Annex 6: Groundwater Quality analyses 2016/2017

		Certificate number Sample Date	2016138562/123/11/2016	2017083857 15/06/2017	2016138562/123/11/2016	2016138562/123/11/2016	2017083857 15/06/2017	2016138562/123/11/2016	2017083857 16/06/2017	2016138562/123/11/2016	2016138562/123/11/2016	2017083857 16/06/2017	2016138562/123/11/2016	2017083857 16/06/2017	2016138562/123/11/2016	2016138562/123/11/2016	2017083857 16/06/2017	2016138562/123/11/2016	2017083857 17/06/2017	2016138562/123/11/2016	2017083857 16/06/2017
			Jobi East-2 water supply borehole		Jobi-4 water supply borehole	Rii-1 water supply borehole		Kilyango community borehole		Murchison River Lodge	Kirama community borehole		Kijumbya community borehole		Community borehole near Ngwedo Primary	Kisansya West community borehole		Kichoke community borehole		Bakers Lodge	
Analysis	Unit	Sample I.D	GW1-161107	(GW1-1706-15)	GW2-161107	GW3-161107	(GW3-1706-15)	GW4-161108	(GW4-1706-16)	GW5-161108	GW6-161108	(GW6-1706-16 FD)	GW10-161106	(GW10-1706-16)	GW11-161106	GW11ALT-161109	(GW11-ALT-1706-16)	GW12-161106	(GW12-1706-17)	GW13-161109	(GW13-1706-16)
			GW1		GW2	GW3		GW4		GW5	GW6		GW10		GW11	GW11-ALT		GW12		GW13	
Metals		EAS 12:2014																			
Aluminum (Al)	mg/L	0.2	<0.10	<0.10	0.1	<0.10	<0.10	0.1	<0.10	<0.10	0.1	<0.10	0.1	<0.10	0.1	0.1	<0.10	0.1	<0.10	0.1	<0.10
Arsenic (As)**	mg/L	0.01	<0.005	<0.005	0.016	0.025	0.028	0.005	<0.005	<0.025	0.005	<0.005	0.005	<0.005	0.005	0.005	<0.005	0.005	<0.005	0.019	0.025
Barium (Ba)	mg/L	0.7	0.64	0.6	0.078	0.37	0.4	0.16	0.19	0.39	0.2	0.27	0.14	0.2	0.07	0.05	<0.05	0.05	0.052	0.68	0.85
Uranium (U)	µg/L	-	<5.0	<5.0	5	<5.0	<5.0	5	<5.0	<5.0	5	<5.0	5	<5.0	5	5	<5.0	5	<5.0	5	<5.0
Cadmium (Cd)**	mg/L	0.003	-	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.00057	<0.40	0.4	0.4	<0.40	0.001	<0.0004	<0.0004	<0.0004
Cobalt (Co)	µg/L	-	-	<3.0	3	<3.0	<3.0	3	<3.0	<3.0	3	<3.0	3	<3.0	3	3	<3.0	3	<3.0	3	<3.0
Chromium (Cr)**	mg/L	0.05	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0029	0.0015	<0.001	<0.001
Copper (Cu)**	mg/L	1	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0055	0.0054	<0.005	<0.005	<0.005	<0.005
Iron (Fe)	mg/L	0.3	-	0.98	0.16	0.53	0.56	0.29	0.21	2.9	8.3	14	0.68	5.9	2.3	1.9	2.3	0.42	10	1	1.3
Mercury (Hg)**	mg/L	0.001	-	<0.00005	<0.00008	<0.00005	<0.00005	<0.05000	<0.00005	<0.00005	<0.05000	<0.00005	<0.05000	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Manganese	mg/L	0.1	-	0.055	0.01	0.039	0.039	0.046	0.047	0.42	0.56	0.64	0.67	0.85	0.5	0.089	0.087	0.043	0.13	0.81	0.68
Nickel (Ni)**	mg/L	0.02	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005	0.005	<0.005	0.005	<0.005
Lead (Pb)**	mg/L	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.012	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc (Zn)**	mg/L	5	<0.014	<0.010	<0.010	<0.010	<0.010	0.051	0.025	0.01	0.97	0.92	9.2	0.055	1.6	0.2	0.57	4	0.12	0.01	<0.010
Mono Aromatic Hydrocarbons																					
Benzene	µg/L	10	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	0.2	<0.20	0.2	0.2	<0.20	0.2	<0.20	0.2	<0.20
Toluene	µg/L	700	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	0.2	<0.20	0.2	0.2	<0.20	0.2	<0.20	0.2	<0.20
Ethylbenzene	µg/L	-	<0.32	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.44	0.4	<0.20	0.2	<0.20	0.3	0.2	<0.20	0.2	0.76	0.2	<0.20
o-Xylene	µg/L	-	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	0.2	<0.20	0.2	0.2	<0.20	0.2	<0.20	0.2	<0.20
m,p-Xylene	µg/L	-	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	0.2	<0.20	0.2	0.2	<0.20	0.2	<0.20	0.2	<0.20
Xylenes (sum)	µg/L	500	<0.40	<0.40	0.4	<0.40	<0.40	0.4	<0.40	<0.40	0.4	<0.40	0.4	<0.40	0.4	0.4	<0.40	0.4	<0.40	0.4	<0.40
BTEX (sum)	µg/L	-	<1.0	<1.0	1	<1.0	<1.0	1	<1.0	<1.0	1	<1.0	1	<1.0	1	1	<1.0	1	<1.0	1	<1.0
Petroleum Hydrocarbons																					

		Certificate number Sample Date	2016138562/123/11/2016	2017083857 15/06/2017	2016138562/123/11/2016	2016138562/123/11/2016	2017083857 15/06/2017	2016138562/123/11/2016	2017083857 16/06/2017	2016138562/123/11/2016	2016138562/123/11/2016	2017083857 16/06/2017	2016138562/123/11/2016	2017083857 16/06/2017	2016138562/123/11/2016	2016138562/123/11/2016	2017083857 16/06/2017	2016138562/123/11/2016	2017083857 17/06/2017	2016138562/123/11/2016	2017083857 16/06/2017
			Jobi East-2 water supply borehole		Jobi-4 water supply borehole	Rii-1 water supply borehole		Kilyango community borehole		Murchison River Lodge	Kirama community borehole		Kijumbya community borehole		Community borehole near Ngwedo Primary	Kisansya West community borehole		Kichoke community borehole		Bakers Lodge	
Analysis	Unit	Sample I.D	GW1-161107	(GW1-1706-15)	GW2-161107	GW3-161107	(GW3-1706-15)	GW4-161108	(GW4-1706-16)	GW5-161108	GW6-161108	(GW6-1706-16 FD)	GW10-161106	(GW10-1706-16)	GW11-161106	GW11ALT-161109	(GW11-ALT-1706-16)	GW12-161106	(GW12-1706-17)	GW13-161109	(GW13-1706-16)
			GW1		GW2	GW3		GW4		GW5	GW6		GW10		GW11	GW11-ALT		GW12		GW13	
TPH (C10-C12)	µg/L		<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH (C12-C16)	µg/L	-	<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH (C16-C21)	µg/L	-	<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH (C21-C30)	µg/L	-	<15	<15	<15	<15	<15	15	<15	<15	15	<15	15	<15	15	15	<15	15	<15	15	<15
TPH (C30-C35)	µg/L	-	<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH (C35-C40)	µg/L	-	<10	<10	<10	<10	<10	10	<10	<10	10	<10	10	<10	10	10	<10	10	<10	10	<10
TPH Sum (C10-C40)	µg/L	-	<38	<38	<38	<38	<38	38	<38	<38	38	<38	38	<38	38	38	<38	38	<38	38	<38
Physical and chemical analyses																					
Total suspended solids	mg/L	-	10	15	2.9	<2.0	<3.8	2	<3.8	5.8	22	17	2.2	12	9.4	5.4	7.4	2	20	6.2	7.4
Inorganic Compounds																					
Bromide	mg/L	0.01	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	0.31	0.48	0.43	0.54	<0.30	0.43	0.49	<0.30	0.7	0.63	0.44	0.38
Chloride	mg/L	250	16	22	11	12	12	12	12	45	80	74	85	27	52	70	13	97	95	13	12
Fluoride	mg/L	1.5	0.05	0.062	0.28	0.05	0.057	0.05	<0.050	0.16	0.16	0.18	0.21	0.19	0.26	0.22	<0.050	0.24	0.21	0.3	0.36
Sulphate	mg/L	400	1.5	1.2	0.58	0.6	1.1	0.57	0.7	0.79	18	19	88	30	69	38	180	22	18	1	0.7
Inorganic Compounds																					
Ortho-phosphate (PO4-P)	mgP/L	2.2	<0.200	<0.020	0.2	0.09	0.1	0.078	0.079	<0.098	0.15	<0.020	0.076	0.024	0.5	0.2	0.034	0.1	<0.020	0.02	0.021
Ortho-phosphate (PO4)	mgPO4/L		<0.060	<0.060	0.06	0.28	0.31	0.24	0.24	<0.300	0.47	<0.060	0.23	0.074	1.5	0.62	0.1	0.32	<0.060	0.06	0.064
Nitrate equivalent NO3-N	mgN/L		<0.20	<0.20	0.2	<0.20	<0.20	0.2	<0.20	<0.81	0.2	<0.20	0.36	<0.20	0.2	0.52	<0.20	0.23	<0.20	0.2	<0.20
Nitrate (NO3)	mg/L	45	<0.90	<0.90	0.9	<0.90	<0.90	0.9	<0.90	<3.60	0.9	<0.90	1.6	<0.90	0.9	2.3	<0.90	1	<0.90	0.9	<0.90
Nitrite as NO2-N	mgN/L		<0.010	<0.010	0.01	<0.017	<0.010	0.046	<0.010	<3.200	0.01	<0.010	0.01	<0.010	0.39	0.01	<0.010	0.01	<0.010	0.01	<0.010

		Certificate number Sample Date	20161385 62/1 23/11/2016	20170857 15/06/2017	20161385 62/1 23/11/2016	20161385 62/1 23/11/2016	20170857 15/06/2017	20161385 62/1 23/11/2016	20170857 16/06/2017	20161385 62/1 23/11/2016	20161385 62/1 23/11/2016	20170857 16/06/2017	20161385 62/1 23/11/2016	20170857 16/06/2017	20161385 62/1 23/11/2016	20161385 62/1 23/11/2016	20170857 16/06/2017	20161385 62/1 23/11/2016	20170857 17/06/2017	20161385 62/1 23/11/2016	20170857 16/06/2017
			Jobi East-2 water supply borehole		Jobi-4 water supply borehole	Rii-1 water supply borehole		Kilyango community borehole		Murchison River Lodge	Kirama community borehole		Kijumbya community borehole		Community borehole near Ngwedo Primary	Kisansya West community borehole		Kichoke community borehole		Bakers Lodge	
Analysis	Unit	Sample I.D	GW1-161107	(GW1-1706-15)	GW2-161107	GW3-161107	(GW3-1706-15)	GW4-161108	(GW4-1706-16)	GW5-161108	GW6-161108	(GW6-1706-16 FD)	GW10-161106	(GW10-1706-16)	GW11-161106	GW11ALT-161109	(GW11-ALT-1706-16)	GW12-161106	(GW12-1706-17)	GW13-161109	(GW13-1706-16)
			GW1		GW2	GW3		GW4		GW5	GW6		GW10		GW11	GW11-ALT		GW12		GW13	
Nitrite (NO2)	mg/L	0.003	<0.030	<0.030	0.03	<0.056	<0.030	0.15	<0.030	11.00	0.03	<0.030	0.03	<0.030	1.3	0.03	<0.030	0.03	<0.030	0.03	<0.030
Ammonia*	mg/L	0.5		0.22			2.05		1.53			1.37		0.74			0.26		0.07		0.8
miscellaneous research																					
Turbidity	NTU	25		<1.0			<1.0		<1.0			<1.0		3.1			<1.0		5.5		<1.0
Micro-Biology																					
Coliforms*		Absent		14			78		0			0		14			0		30		4

*EnviroServ analysis 29/06/2017

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

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AECOM Middle East Limited
Att. Muirhead, Gail
Liwa Centre Building, Level 1
POBox 1419 AL AIN
UNITED ARAB EMIRATES

Certificate of analysis

Date: 30-Nov-2016

Please find enclosed the analytical results of the test carried out for the project.

Certificate number/Version	2016138562/1
Your project number	Buliisa
Your project name	Buliisa
Your order number	
Samples received on	23-Nov-2016

This Certificate of Analysis shall not be reproduced except in full, without written approval of the laboratory. The results only relate to the items tested.

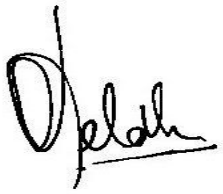
Soil samples will be stored for a period of 4 weeks and water samples for a period of 2 weeks after receipt of the samples at our laboratory. Without any additional request, samples will be disposed when the above mentioned periods have expired. If you require Eurofins Analytico to store the samples for a longer period, please complete this page and return it to Eurofins Analytico at least one businessday before the period is due to expire. The costs of prolonged storage periods may be found in our pricelist.

Storage period:
Date: Name: Signature:

We are confident that we have performed the order in accordance with your expectations. If you have any remaining questions concerning this Certificate of Analysis, please don't hesitate to contact our Customer Service.

Yours sincerely,

Eurofins Analytico B.V.



Ing. A. Veldhuizen
Technical Manager

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Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016138562/1
Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:51
		Annex	A,B,C,D
Sampled by		Page	1/8
Sample matrix	Water; Groundwater		

	Analysis	Unit	1	2	3	4	5
	Metals		GW1	GW2	GW3	GW4	GW5
Q	Aluminum (Al)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Q	Arsenic (As)	µg/L	<5.0	16	25	<5.0	25
Q	Barium (Ba)	µg/L	640	78	370	160	390
	Uranium (U)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Cadmium (Cd)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	Cobalt (Co)	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0
Q	Chromium (Cr)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Copper (Cu)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Iron (Fe)	mg/L	0.95	0.16	0.53	0.29	2.9
Q	Mercury (Hg)	µg/L	<0.050	0.081	<0.050	<0.050	<0.050
Q	Manganese (Mn)	mg/L	0.080	0.010	0.039	0.046	0.42
Q	Nickel (Ni)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Lead (Pb)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Zinc (Zn)	µg/L	14	<10	<10	51	<10
	Mono Aromatic Hydrocarbons						
Q	Benzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Ethylbenzene	µg/L	0.32	<0.20	<0.20	<0.20	0.44
Q	o-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
	TPH						
	TPH (C10-C12)	µg/L	<10	<10	<10	<10	<10
	TPH (C12-C16)	µg/L	<10	<10	<10	<10	<10
	TPH (C16-C21)	µg/L	<10	<10	<10	<10	<10
	TPH (C21-C30)	µg/L	<15	<15	<15	<15	<15
	TPH (C30-C35)	µg/L	<10	<10	<10	<10	<10
	TPH (C35-C40)	µg/L	<10	<10	<10	<10	<10
Q	TPH Sum (C10-C40)	µg/L	<38	<38	<38	<38	<38

No.	Sample description	Date sampling	Sample nr.
1	GW1-161107	07-Nov-2016	9288029
2	GW2-161107	07-Nov-2016	9288030
3	GW3-161107	07-Nov-2016	9288031
4	GW4-161108	07-Nov-2016	9288032
5	GW5-161108	07-Nov-2016	9288033

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Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:51
		Annex	A,B,C,D
Sampled by		Page	2/8
Sample matrix	Water; Groundwater		

	Analysis	Unit	1	2	3	4	5
	Physical and chemical analyses						
Q	Total suspended solids	mg/L	10	2.9	<2.0	<2.0	5.8
	Inorganic Compounds						
Q	Bromide	mg/L	<0.30	<0.30	<0.30	<0.30	0.31
Q	Chloride	mg/L	16	11	12	12	45
Q	Fluoride	mg/L	<0.050	0.28	<0.050	<0.050	0.16
Q	Sulphate	mg/L	1.5	0.58	0.60	0.57	0.79
	Inorganic Compounds						
Q	Ortho-phosphate (P04-P)	mg P/L	<0.020	<0.020	0.090	0.078	0.098
Q	Ortho-phosphate (P04)	mg P04/L	<0.060	<0.060	0.28	0.24	0.30
Q	Nitrate equivalent N03-N	mg N/L	<0.20	<0.20	<0.20	<0.20	0.81
Q	Nitrate (N03)	mg/L	<0.90	<0.90	<0.90	<0.90	3.6
Q	Nitrite as N02-N	mg N/L	<0.010	<0.010	0.017 [1)]	0.046	3.2
Q	Nitrite (N02)	mg/L	<0.030	<0.030	0.056	0.15	11

No.	Sample description	Date sampling	Sample nr.
1	GW1-161107	07-Nov-2016	9288029
2	GW2-161107	07-Nov-2016	9288030
3	GW3-161107	07-Nov-2016	9288031
4	GW4-161108	07-Nov-2016	9288032
5	GW5-161108	07-Nov-2016	9288033

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Your order number		Report date	30-Nov-2016/14:51
		Annex	A,B,C,D
Sampled by		Page	3/8
Sample matrix	Water; Groundwater		

	Analysis	Unit	6	7	8	9	10
	Metals		GW6	GW10	GW11	GW11alt	GW12
Q	Aluminum (Al)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Q	Arsenic (As)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Barium (Ba)	µg/L	200	140	70	<50	<50
	Uranium (U)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Cadmium (Cd)	µg/L	<0.40	0.57	<0.40	<0.40	1.0
Q	Cobalt (Co)	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0
Q	Chromium (Cr)	µg/L	<1.0	<1.0	<1.0	<1.0	2.9
Q	Copper (Cu)	µg/L	<5.0	<5.0	<5.0	5.5	<5.0
Q	Iron (Fe)	mg/L	8.3	0.68	2.3	1.9	0.42
Q	Mercury (Hg)	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Manganese (Mn)	mg/L	0.56	0.67	0.50	0.089	0.043
Q	Nickel (Ni)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Lead (Pb)	µg/L	<5.0	12	<5.0	<5.0	<5.0
Q	Zinc (Zn)	µg/L	970	9200	1600	200	4000
	Mono Aromatic Hydrocarbons						
Q	Benzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Ethylbenzene	µg/L	0.40	<0.20	0.30	<0.20	<0.20
Q	o-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
	TPH						
	TPH (C10-C12)	µg/L	<10	<10	<10	<10	<10
	TPH (C12-C16)	µg/L	<10	<10	<10	<10	<10
	TPH (C16-C21)	µg/L	<10	<10	<10	<10	<10
	TPH (C21-C30)	µg/L	<15	<15	<15	<15	<15
	TPH (C30-C35)	µg/L	<10	<10	<10	<10	<10
	TPH (C35-C40)	µg/L	<10	<10	<10	<10	<10
Q	TPH Sum (C10-C40)	µg/L	<38	<38	<38	<38	<38

No.	Sample description	Date sampling	Sample nr.
6	GW6-161108	07-Nov-2016	9288034
7	GW10-161106	07-Nov-2016	9288035
8	GW11-161106	07-Nov-2016	9288036
9	GW11ALT-161109	07-Nov-2016	9288037
10	GW12-161106	07-Nov-2016	9288038

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Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016138562/1
Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:51
		Annex	A,B,C,D
Sampled by		Page	4/8
Sample matrix	Water; Groundwater		

	Analysis	Unit	6	7	8	9	10
	Physical and chemical analyses						
Q	Total suspended solids	mg/L	22	2.2	9.4	5.4	<2.0
	Inorganic Compounds						
Q	Bromide	mg/L	0.48	0.54	0.43	0.49	0.70
Q	Chloride	mg/L	80	85	52	70	97
Q	Fluoride	mg/L	0.16	0.21	0.26	0.22	0.24
Q	Sulphate	mg/L	18	88	69	38	22
	Inorganic Compounds						
Q	Ortho-phosphate (P04-P)	mg P/L	0.15	0.076	0.50	0.20	0.10
Q	Ortho-phosphate (P04)	mg P04/L	0.47	0.23	1.5	0.62	0.32
Q	Nitrate equivalent N03-N	mg N/L	<0.20	0.36	<0.20	0.52	0.23
Q	Nitrate (N03)	mg/L	<0.90	1.6	<0.90	2.3	1.0
Q	Nitrite as N02-N	mg N/L	<0.010	<0.010	0.39	<0.010	<0.010
Q	Nitrite (N02)	mg/L	<0.030	<0.030	1.3	<0.030	<0.030

No.	Sample description	Date sampling	Sample nr.
6	GW6-161108	07-Nov-2016	9288034
7	GW10-161106	07-Nov-2016	9288035
8	GW11-161106	07-Nov-2016	9288036
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Sampled by		Page	5/8
Sample matrix	Water; Groundwater		

	Analysis	Unit	11	12	13	14	15
	Metals		GW13	GWRB	GWFB	TB2	TB3
Q	Aluminum (Al)	mg/L	<0.10	<0.10	<0.10		
Q	Arsenic (As)	µg/L	19	<5.0	<5.0		
Q	Barium (Ba)	µg/L	680	<50	<50		
	Uranium (U)	µg/L	<5.0	<5.0	<5.0		
Q	Cadmium (Cd)	µg/L	<0.40	<0.40	<0.40		
Q	Cobalt (Co)	µg/L	<3.0	<3.0	<3.0		
Q	Chromium (Cr)	µg/L	<1.0	<1.0	7.2		
Q	Copper (Cu)	µg/L	<5.0	<5.0	<5.0		
Q	Iron (Fe)	mg/L	1.0	<0.050	<0.050		
Q	Mercury (Hg)	µg/L	<0.050	<0.050	<0.050		
Q	Manganese (Mn)	mg/L	0.81	<0.010	<0.010		
Q	Nickel (Ni)	µg/L	<5.0	<5.0	<5.0		
Q	Lead (Pb)	µg/L	<5.0	<5.0	<5.0		
Q	Zinc (Zn)	µg/L	<10	<10	<10		
	Mono Aromatic Hydrocarbons						
Q	Benzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Ethylbenzene	µg/L	<0.20	0.31	0.20	<0.20	<0.20
Q	o-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
	TPH						
	TPH (C10-C12)	µg/L	<10	<10	<10		
	TPH (C12-C16)	µg/L	<10	<10	<10		
	TPH (C16-C21)	µg/L	<10	<10	<10		
	TPH (C21-C30)	µg/L	<15	<15	<15		
	TPH (C30-C35)	µg/L	<10	<10	<10		
	TPH (C35-C40)	µg/L	<10	<10	<10		
Q	TPH Sum (C10-C40)	µg/L	<38	<38	<38		

No.	Sample description	Date sampling	Sample nr.
11	GW13-161109	07-Nov-2016	9288039
12	GWRB-161108	07-Nov-2016	9288040
13	GWFB-161109	07-Nov-2016	9288041
14	TB2-161107	07-Nov-2016	9288042
15	TB3-161106	07-Nov-2016	9288106

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		Annex	A,B,C,D
Sampled by		Page	6/8
Sample matrix	Water; Groundwater		

	Analysis	Unit	11	12	13	14	15
	Physical and chemical analyses						
Q	Total suspended solids	mg/L	6.2				
	Inorganic Compounds						
Q	Bromide	mg/L	0.44	<0.30	<0.30		
Q	Chloride	mg/L	13	<0.20	<0.20		
Q	Fluoride	mg/L	0.30	<0.050	<0.050		
Q	Sulphate	mg/L	1.0	<0.50	0.78		
	Inorganic Compounds						
Q	Ortho-phosphate (P04-P)	mg P/L	<0.020	<0.020	<0.020		
Q	Ortho-phosphate (P04)	mg P04/L	<0.060	<0.060	<0.060		
Q	Nitrate equivalent N03-N	mg N/L	<0.20	<0.20	<0.20		
Q	Nitrate (N03)	mg/L	<0.90	<0.90	<0.90		
Q	Nitrite as N02-N	mg N/L	<0.010	<0.010	<0.010		
Q	Nitrite (N02)	mg/L	<0.030	<0.030	<0.030		

No.	Sample description	Date sampling	Sample nr.
11	GW13-161109	07-Nov-2016	9288039
12	GWRB-161108	07-Nov-2016	9288040
13	GWFB-161109	07-Nov-2016	9288041
14	TB2-161107	07-Nov-2016	9288042
15	TB3-161106	07-Nov-2016	9288106

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VAT/BTW No. NL 8043.14.883.B01
KvK No. 09088623
IBAN: NL71BNPA0227924525
BIC: BNPANL2A

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Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016138562/1
Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:51
		Annex	A,B,C,D
Sampled by		Page	7/8
Sample matrix	Water; Groundwater		

	Analysis	Unit	16
			GWFD
	Metals		
Q	Aluminum (Al)	mg/L	<0.10
Q	Arsenic (As)	µg/L	28
Q	Barium (Ba)	µg/L	470
	Uranium (U)	µg/L	<5.0
Q	Cadmium (Cd)	µg/L	<0.40
Q	Cobalt (Co)	µg/L	<3.0
Q	Chromium (Cr)	µg/L	<1.0
Q	Copper (Cu)	µg/L	<5.0
Q	Iron (Fe)	mg/L	3.0
Q	Mercury (Hg)	µg/L	<0.050
Q	Manganese (Mn)	mg/L	0.49
Q	Nickel (Ni)	µg/L	<5.0
Q	Lead (Pb)	µg/L	<5.0
Q	Zinc (Zn)	µg/L	<10
	Mono Aromatic Hydrocarbons		
Q	Benzene	µg/L	<0.20
Q	Toluene	µg/L	<0.20
Q	Ethylbenzene	µg/L	0.39
Q	o-Xylene	µg/L	<0.20
Q	m,p-Xylene	µg/L	<0.20
Q	Xylenes (sum)	µg/L	<0.40
Q	BTEX (sum)	µg/L	<1.0
	TPH		
	TPH (C10-C12)	µg/L	<10
	TPH (C12-C16)	µg/L	<10
	TPH (C16-C21)	µg/L	<10
	TPH (C21-C30)	µg/L	<15
	TPH (C30-C35)	µg/L	<10
	TPH (C35-C40)	µg/L	<10
Q	TPH Sum (C10-C40)	µg/L	<38

No.	Sample description	Date sampling	Sample nr.
16	GWFD-161108	07-Nov-2016	9292906

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

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Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016138562/1
Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:51
		Annex	A,B,C,D
Sampled by		Page	8/8
Sample matrix	Water; Groundwater		

	Analysis	Unit	16
	Physical and chemical analyses		
Q	Total suspended solids	mg/L	6.7
	Inorganic Compounds		
Q	Bromide	mg/L	<0.30
Q	Chloride	mg/L	44 1)
Q	Fluoride	mg/L	0.22
Q	Sulphate	mg/L	0.52
	Inorganic Compounds		
Q	Ortho-phosphate (P04-P)	mg P/L	0.089
Q	Ortho-phosphate (P04)	mg P04/L	0.27
Q	Nitrate equivalent N03-N	mg N/L	0.51
Q	Nitrate (N03)	mg/L	2.2
Q	Nitrite as N02-N	mg N/L	3.3
Q	Nitrite (N02)	mg/L	11

No.	Sample description	Date sampling	Sample nr.
16	GWFD-161108	07-Nov-2016	9292906

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

Verified
ASM
FZ

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TESTING
RvA L010

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Annex (A) concerning subsample information referring to certificate of analysis 2016138562/1

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9288029					0610145943	GW1-161107
9288029					0691713580	
9288029					0625006443	
9288029					0805030014	
9288029					0675075877	
9288030					0610145939	GW2-161107
9288030					0691713548	
9288030					0625006424	
9288030					0805029951	
9288030					0675075947	
9288031					0610145902	GW3-161107
9288031					0691713563	
9288031					0625006444	
9288031					0805030126	
9288031					0675075908	
9288032					0610146096	GW4-161108
9288032					0691713578	
9288032					0625007136	
9288032					0805030066	
9288032					0675075940	
9288033					0610146156	GW5-161108
9288033					0691713554	
9288033					0625007144	
9288033					0805030144	
9288033					0675075967	
9288034					0610146152	GW6-161108
9288034					0691713589	
9288034					0625007143	
9288034					0805030098	
9288034					0675075968	
9288035					0610146105	GW10-161106
9288035					0691713583	
9288035					0625006416	
9288035					0805030101	
9288035					0675075962	
9288036					0610146111	GW11-161106
9288036					0691713569	

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Annex (A) concerning subsample information referring to certificate of analysis 2016138562/1

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9288036					0625006409	GW11-161106
9288036					0805032934	
9288036					0675075896	
9288037					0610146117	GW11ALT-161109
9288037					0691713565	
9288037					0625006419	
9288037					0805030047	
9288037					0675075933	
9288038					0610146114	GW12-161106
9288038					0691713573	
9288038					0625006418	
9288038					0805032899	
9288038					0675075914	
9288039					0610146148	GW13-161109
9288039					0691713577	
9288039					0625006415	
9288039					0805029979	
9288039					0675075912	
9288040					0691713559	GWRB-161108
9288040					0805029973	
9288040					0675075911	
9288040					0625006448	
9288041					0691713576	GWFB-161109
9288041					0625006403	
9288041					0805030082	
9288041					0675075866	
9288042					0670179678	TB2-161107
9288106					0670179682	TB3-161106
9292906					0610146095	GWFD-161108
9292906					0691713579	
9292906					0625007134	
9292906					0805030113	
9292906					0675075935	

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Annex (B) concerning remarks referring to certificate of analysis 2016138562/1

Remark 1)

Indicative value(s) due to interfering matrix.

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Annex (C): method references belonging to certificate of analysis 2016138562/1

Analysis	Method	Technique	Method reference
Copper (Cu)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Manganese (Mn)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Aluminium (Al)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Arsenic (As)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Barium (Ba)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
ICP-MS Uranium (U)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Cadmium (Cd)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Cobalt (Co)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Chromium (Cr)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Iron (Fe)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Mercury (Hg)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Nickel (Ni)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Lead (Pb)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Zinc (Zn)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Aromatics (BTEX)	W0254	HS-GC/MS	In accordance with ISO 11423-1 / CMA 3/E
TPH (GC) (C10 - C40)	W0215	LVI-GC-FID	Cf. NEN EN ISO 9377-2
Total suspended solids (TSS)	W0552	Gravimetry	I.a.w. NEN 6499 & NEN 6484
Bromide (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Chloride (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Fluoride (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Sulphate	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Ortho-phosphate	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Nitrate	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Nitrite	W0566	Spectrometry	In accordance with NEN-ISO 15923-1

Additional information about the applied methods as well as the classification of the accuracy, are listed in our supplement: "Specification of methods of analyses", version June 2016.

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Annex (D) remarks concerning the sampling and preservation period 2016138562/1

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	Sample nr.
The temperature of the samples received at the laboratory, exceded the limit.	9288029
	9288030
	9288031
	9288032
	9288033
	9288034
	9288035
	9288036
	9288037
	9288038
	9288039
	9288040
	9288041
	9288042
	9288106
	9292906

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Annex (D) remarks concerning the sampling and preservation period 2016138562/1

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

Analysis	Sample nr.
The preservation term for this parameter has been expired.	
Nitrate (N03)	9288029
	9288030
	9288031
	9288032
	9288033
	9288034
	9288035
	9288036
	9288037
	9288038
	9288039
	9288040
	9288041
	9292906
Nitrite (N02)	9288029
	9288030
	9288031
	9288032
	9288033
	9288034
	9288035
	9288036
	9288037
	9288038
	9288039
	9288040
	9288041
	9292906
Suspended solids	9288029
	9288030
	9288031
	9288032
	9288033
	9288034
	9288035
	9288036
	9288037
	9288038
	9288039
	9292906

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Annex (D) remarks concerning the sampling and preservation period 2016138562/1

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

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BIC: BNPANL2A

AECOM Uganda
Att. Gail Muirhead
Rwenzori Towers, 5th Floor, Nakasero ---
-- KAMPALA
UGANDA

Certificate of analysis

Date: 12-Jul-2017

Please find enclosed the analytical results of the test carried out for the project.

Certificate number/Version	2017083857/2
Your project number	Groundwater
Your project name	Groundwater
Your order number	
Samples received on	27-Jun-2017

This Certificate of Analysis shall not be reproduced except in full, without written approval of the laboratory. Interpretations and opinions are outside the scope of our accreditation, and all results relate only to samples supplied.

Soil samples will be stored for a period of 4 weeks and water samples for a period of 2 weeks after receipt of the samples at our laboratory. Without any additional request, samples will be disposed when the above mentioned periods have expired. If you require Eurofins Analytico to store the samples for a longer period, please complete this page and return it to Eurofins Analytico at least one businessday before the period is due to expire.
The costs of prolonged storage periods may be found in our pricelist.

Storage period:
Date: Name: Signature:

We are confident that we have performed the order in accordance with your expectations. If you have any remaining questions concerning this Certificate of Analysis, please don't hesitate to contact our Customer Service.

Yours sincerely,

Eurofins Analytico B.V.

Ing. A. Veldhuizen
Technical Manager

Eurofins Analytico B.V.

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Certificate of analysis

Your project number	Groundwater	Certificate number/Version	2017083857/2
Your project name	Groundwater	Start date	27-Jun-2017
Your order number		Report date	12-Jul-2017/11:05
		Annex	A,B,C,D
Sampled by		Page	1/5
Sample matrix	Groundwater		

	Analysis	Unit	1	2	3	4	5
	Metals						
Q	Aluminum (Al)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Q	Arsenic (As)	µg/L	<5.0	28	<5.0	<5.0	<5.0
Q	Barium (Ba)	µg/L	600	400	190	270	200
	Uranium (U)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Cadmium (Cd)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	Cobalt (Co)	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0
Q	Chromium (Cr)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Q	Copper (Cu)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Iron (Fe)	mg/L	0.98	0.56	0.21	14	5.9
Q	Mercury (Hg)	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Manganese (Mn)	mg/L	0.055	0.039	0.047	0.64	0.85
Q	Nickel (Ni)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Lead (Pb)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Zinc (Zn)	µg/L	<10	<10	25	920	55
	Mono Aromatic Hydrocarbons						
Q	Benzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Ethylbenzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	o-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
	Petroleum Hydrocarbons						
	TPH (C10-C12)	µg/L	<10	<10	<10	<10	<10
	TPH (C12-C16)	µg/L	<10	<10	<10	<10	<10
	TPH (C16-C21)	µg/L	<10	<10	<10	<10	<10
	TPH (C21-C30)	µg/L	<15	<15	<15	<15	<15
	TPH (C30-C35)	µg/L	<10	<10	<10	<10	<10
	TPH (C35-C40)	µg/L	<10	<10	<10	<10	<10
Q	TPH Sum (C10-C40)	µg/L	<38	<38	<38	<38	<38

No.	Sample description	Date sampling	Sample nr.
1	GW1-1706-15	15-Jun-2017	9602250
2	GW3-1706-15	15-Jun-2017	9602251
3	GW4-1706-16	16-Jun-2017	9602252
4	GW6-1706-16 FD	16-Jun-2017	9602253
5	GW10-1706-16	16-Jun-2017	9602254

Q: Dutch Accreditation Council (RvA) accredited test
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Certificate of analysis

Your project number	Groundwater	Certificate number/Version	2017083857/2
Your project name	Groundwater	Start date	27-Jun-2017
Your order number		Report date	12-Jul-2017/11:05
		Annex	A,B,C,D
Sampled by		Page	2/5
Sample matrix	Groundwater		

	Analysis	Unit	1	2	3	4	5
	Physical and chemical analyses						
Q	Total suspended solids	mg/L	15	<3.8 [1)]	<3.8 [1)]	17	12
	Inorganic Compounds						
Q	Bromide	mg/L	<0.30	<0.30	<0.30	0.43	<0.30
Q	Chloride	mg/L	22	12	12	74	27
Q	Fluoride	mg/L	0.062	0.057 [2)]	<0.050	0.18	0.19
Q	Sulphate	mg/L	1.2	1.1	0.70	19	30
	Inorganic Compounds						
Q	Ortho-phosphate (P04-P)	mg P/L	<0.020	0.10	0.079	<0.020	0.024
Q	Ortho-phosphate (P04)	mg P04/L	<0.060	0.31	0.24	<0.060	0.074
Q	Nitrate equivalent N03-N	mg N/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Nitrate (N03)	mg/L	<0.90	<0.90	<0.90	<0.90	<0.90
Q	Nitrite as N02-N	mg N/L	<0.010	<0.010	<0.010	<0.010	<0.010
Q	Nitrite (N02)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030
	miscellaneous research						
	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	3.1

No.	Sample description	Date sampling	Sample nr.
1	GW1-1706-15	15-Jun-2017	9602250
2	GW3-1706-15	15-Jun-2017	9602251
3	GW4-1706-16	16-Jun-2017	9602252
4	GW6-1706-16 FD	16-Jun-2017	9602253
5	GW10-1706-16	16-Jun-2017	9602254

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BIC: BNPANL2A
KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

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Certificate of analysis

Your project number	Groundwater	Certificate number/Version	2017083857/2
Your project name	Groundwater	Start date	27-Jun-2017
Your order number		Report date	12-Jul-2017/11:05
		Annex	A,B,C,D
Sampled by		Page	3/5
Sample matrix	Groundwater		

	Analysis	Unit	6	7	8	9	10
	Metals						
Q	Aluminum (Al)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Q	Arsenic (As)	µg/L	<5.0	<5.0	25	<5.0	<5.0
Q	Barium (Ba)	µg/L	<50	52	850	<50	<50
	Uranium (U)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Cadmium (Cd)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	Cobalt (Co)	µg/L	<3.0	<3.0	<3.0	<3.0	<3.0
Q	Chromium (Cr)	µg/L	<1.0	1.5	<1.0	9.0	8.3
Q	Copper (Cu)	µg/L	5.4	<5.0	<5.0	<5.0	<5.0
Q	Iron (Fe)	mg/L	2.3	10	1.3	<0.050	<0.050
Q	Mercury (Hg)	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Q	Manganese (Mn)	mg/L	0.087	0.13	0.68	<0.010	<0.010
Q	Nickel (Ni)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Lead (Pb)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Zinc (Zn)	µg/L	570	120	<10	<10	<10
	Mono Aromatic Hydrocarbons						
Q	Benzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Ethylbenzene	µg/L	<0.20	0.76	<0.20	0.74	0.53
Q	o-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
	Petroleum Hydrocarbons						
	TPH (C10-C12)	µg/L	<10	<10	<10	<10	<10
	TPH (C12-C16)	µg/L	<10	<10	<10	<10	<10
	TPH (C16-C21)	µg/L	<10	<10	<10	<10	<10
	TPH (C21-C30)	µg/L	<15	<15	<15	<15	<15
	TPH (C30-C35)	µg/L	<10	<10	<10	<10	<10
	TPH (C35-C40)	µg/L	<10	<10	<10	<10	<10
Q	TPH Sum (C10-C40)	µg/L	<38	<38	<38	<38	<38

No.	Sample description	Date sampling	Sample nr.
6	GW11-ALT-1706-16	16-Jun-2017	9602255
7	GW12-1706-17	17-Jun-2017	9602256
8	GW13-1706-16	16-Jun-2017	9602257
9	GWFB-1706-17	17-Jun-2017	9602258
10	GWRB-0706-17	17-Jun-2017	9602259

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Certificate of analysis

Your project number	Groundwater	Certificate number/Version	2017083857/2
Your project name	Groundwater	Start date	27-Jun-2017
Your order number		Report date	12-Jul-2017/11:05
		Annex	A,B,C,D
Sampled by		Page	4/5
Sample matrix	Groundwater		

	Analysis	Unit	6	7	8	9	10
	Physical and chemical analyses						
Q	Total suspended solids	mg/L	7.4	20	7.4	<3.8 [1)]	
	Inorganic Compounds						
Q	Bromide	mg/L	<0.30	0.63	0.38	<0.30	<0.30
Q	Chloride	mg/L	13	95	12	<0.20	<0.20
Q	Fluoride	mg/L	<0.050	0.21	0.36	<0.050	<0.050
Q	Sulphate	mg/L	180	18	0.70	0.52	0.53
	Inorganic Compounds						
Q	Ortho-phosphate (P04-P)	mg P/L	0.034	<0.020	0.021	<0.020	<0.020
Q	Ortho-phosphate (P04)	mg P04/L	0.10	<0.060	0.064	<0.060	<0.060
Q	Nitrate equivalent N03-N	mg N/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Nitrate (N03)	mg/L	<0.90	<0.90	<0.90	<0.90	<0.90
Q	Nitrite as N02-N	mg N/L	<0.010	<0.010	<0.010	<0.010	<0.010
Q	Nitrite (N02)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030
	miscellaneous research						
	Turbidity	NTU	<1.0	5.5	<1.0	<1.0	

No.	Sample description	Date sampling	Sample nr.
6	GW11-ALT-1706-16	16-Jun-2017	9602255
7	GW12-1706-17	17-Jun-2017	9602256
8	GW13-1706-16	16-Jun-2017	9602257
9	GWFB-1706-17	17-Jun-2017	9602258
10	GWRB-0706-17	17-Jun-2017	9602259

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Certificate of analysis

Your project number	Groundwater	Certificate number/Version	2017083857/2
Your project name	Groundwater	Start date	27-Jun-2017
Your order number		Report date	12-Jul-2017/11:05
		Annex	A,B,C,D
Sampled by		Page	5/5
Sample matrix	Groundwater		

	Analysis	Unit	11	12	13
	Mono Aromatic Hydrocarbons				
Q	Benzene	µg/L	<0.20	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20	<0.20
Q	Ethylbenzene	µg/L	<0.20	<0.20	<0.20
Q	o-Xylene	µg/L	<0.20	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0	<1.0

No.	Sample description	Date sampling	Sample nr.
11	TB1	17-Jun-2017	9602260
12	TB2	17-Jun-2017	9602261
13	TB3	17-Jun-2017	9602262

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Annex (A) concerning subsample information referring to certificate of analysis 2017083857/2

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9602250					0655019070	GW1-1706-15
9602250					0655019071	
9602250					0695042217	
9602250					0625012277	
9602250					0805041855	
9602250					0675106912	
9602251					0655019069	GW3-1706-15
9602251					0655019068	
9602251					0695042816	
9602251					0625012305	
9602251					0805042670	
9602251					0675106917	
9602252					0675075899	GW4-1706-16
9602252					0805030125	
9602252					0625006407	
9602252					0691713556	
9602252					0655019191	
9602252					0655019179	
9602253					0675106909	GW6-1706-16 FD
9602253					0805041774	
9602253					0625012247	
9602253					0695042806	
9602253					0655019075	
9602253					0655019076	
9602254					0675106906	GW10-1706-16
9602254					0805042563	
9602254					0625012290	
9602254					0695042247	
9602254					0655019092	
9602254					0655019094	
9602255					0675106904	GW11-ALT-1706-16
9602255					0805041811	
9602255					0625012254	
9602255					0695042242	
9602255					0655019096	
9602255					0655019095	
9602256					0675106666	GW12-1706-17

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Annex (A) concerning subsample information referring to certificate of analysis 2017083857/2

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9602256					0805042894	GW12-1706-17
9602256					0625012267	
9602256					0695043032	
9602256					0655019188	
9602256					0655019499	
9602257					0675075915	GW13-1706-16
9602257					0805030122	
9602257					0625006445	
9602257					0691713551	
9602257					0655019176	
9602257					0655019497	
9602258					0675106693	GWFB-1706-17
9602258					0805042833	
9602258					0625012246	
9602258					0695042817	
9602258					0655019503	
9602258					0655019507	
9602259					0695042213	GWRB-0706-17
9602259					0625012291	
9602259					0805042535	
9602259					0675106908	
9602260					0670204206	TB1
9602261					0670204293	TB2
9602262					0670204265	TB3

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Annex (B) concerning remarks referring to certificate of analysis 2017083857/2

General remark referring to certificate of analysis

This certificate replaces previous published certificate(s) with lower version numbers.

Remark 1)

Reporting limit has been increased due to the fact that amount of supplied sample material is less than required.

Remark 2)

Indicative value(s) due to interfering matrix.

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Annex (C): method references belonging to certificate of analysis 2017083857/2

Analysis	Method	Technique	Method reference
Aluminium (Al)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Arsenic (As)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Barium (Ba)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Uranium (U)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Cadmium (Cd)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Cobalt (Co)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Chromium (Cr)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Copper (Cu)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Iron (Fe)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Mercury (Hg)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Manganese (Mn)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Nickel (Ni)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Lead (Pb)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Zinc (Zn)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Aromatics (BTEX)	W0254	HS-GC/MS	In accordance with ISO 11423-1 / CMA 3/E
EPH (C10-C40)	W0215	GC/FID	Cf. NEN EN ISO 9377-2
Total suspended solids (TSS) (NEN 6484)	W0552	Gravimetry	I.a.w. NEN 6499 & NEN 6484
Bromide (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Chloride (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Fluoride (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Sulphate (ionchromatografie)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Ortho phosphate	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Nitrate	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Nitrite	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Turbidity	W0511	Spectrometry	-

Additional information about the applied methods as well as the classification of the accuracy, are listed in our supplement: "Specification of methods of analyses", version June 2016.

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Annex (D) remarks concerning the sampling and preservation period 2017083857/2

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	Sample nr.
The temperature of the samples received at the laboratory, exceded the limit.	9602250
	9602251
	9602252
	9602253
	9602254
	9602255
	9602256
	9602257
	9602258
	9602259
	9602260
	9602261
	9602262

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KvK/CoC No. 09088623
BTW/VAT No. NL 8043.14.883.B01

Annex (D) remarks concerning the sampling and preservation period 2017083857/2

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

Analysis	Sample nr.
The preservation term for this parameter has been expired.	
Nitrate (NO3)	9602250 9602251 9602252 9602253 9602254 9602255 9602256 9602257 9602258 9602259
Nitrite (NO2)	9602250 9602251 9602252 9602253 9602254 9602255 9602256 9602257 9602258 9602259
Volatiles (HS) preparation	9602250 9602251 9602252 9602253 9602254 9602255 9602257
Suspended solids	9602250 9602251 9602252 9602253 9602254 9602255 9602256 9602257 9602258

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AECOM Middle East Limited
Att. Greg Somermeyer
Liwa Centre Building, Level 1
POBox 1419 AL AIN
UNITED ARAB EMIRATES

Certificate of analysis

Date: 23-Dec-2016

Please find enclosed the analytical results of the test carried out for the project.

Certificate number/Version	2016151234/1
Your project number	Buliisa
Your project name	Buliisa
Your order number	
Samples received on	16-Dec-2016

This Certificate of Analysis shall not be reproduced except in full, without written approval of the laboratory. The results only relate to the items tested.

Soil samples will be stored for a period of 4 weeks and water samples for a period of 2 weeks after receipt of the samples at our laboratory. Without any additional request, samples will be disposed when the above mentioned periods have expired. If you require Eurofins Analytico to store the samples for a longer period, please complete this page and return it to Eurofins Analytico at least one businessday before the period is due to expire. The costs of prolonged storage periods may be found in our pricelist.

Storage period:
Date: Name: Signature:

We are confident that we have performed the order in accordance with your expectations. If you have any remaining questions concerning this Certificate of Analysis, please don't hesitate to contact our Customer Service.

Yours sincerely,

Eurofins Analytico B.V.

Ing. A. Veldhuizen
Technical Manager

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Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016151234/1
Your project name	Buliisa	Start date	16-Dec-2016
Your order number		Report date	23-Dec-2016/14:18
		Annex	A,C,D
Sampled by		Page	1/2
Sample matrix	Groundwater		

	Analysis	Unit	1	2
	Metals			
Q	Aluminum (Al)	mg/L	4.1	0.22
Q	Arsenic (As)	µg/L	<5.0	<5.0
Q	Barium (Ba)	µg/L	500	96
	Uranium (U)	µg/L	<5.0	<5.0
Q	Cadmium (Cd)	µg/L	<0.40	<0.40
Q	Cobalt (Co)	µg/L	17	4.3
Q	Chromium (Cr)	µg/L	4.4	<1.0
Q	Copper (Cu)	µg/L	23	<5.0
Q	Iron (Fe)	mg/L	9.8	9.6
Q	Mercury (Hg)	µg/L	<0.050	<0.050
Q	Manganese (Mn)	mg/L	1.2	0.60
Q	Nickel (Ni)	µg/L	11	<5.0
Q	Lead (Pb)	µg/L	15	<5.0
Q	Zinc (Zn)	µg/L	17	<10
	Mono Aromatic Hydrocarbons			
Q	Benzene	µg/L	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20
Q	Ethylbenzene	µg/L	<0.20	<0.20
Q	o-Xylene	µg/L	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0
	TPH			
	TPH (C10-C12)	µg/L	<10	<10
	TPH (C12-C16)	µg/L	<10	<10
	TPH (C16-C21)	µg/L	<10	<10
	TPH (C21-C30)	µg/L	<15	<15
	TPH (C30-C35)	µg/L	<10	<10
	TPH (C35-C40)	µg/L	<10	<10
Q	TPH Sum (C10-C40)	µg/L	<38	<38

No.	Sample description	Date sampling	Sample nr.
1	SW8-1612	16-Dec-2016	9328988
2	SW12-1612	16-Dec-2016	9328989

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

Eurofins Analytico B.V.

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BNP Paribas S.A. 227 9245 25
VAT/BTW No. NL 8043.14.883.B01
KvK No. 09088623
IBAN: NL71BNPA0227924525
BIC: BNPANL2A

Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016151234/1
Your project name	Buliisa	Start date	16-Dec-2016
Your order number		Report date	23-Dec-2016/14:18
		Annex	A,C,D
Sampled by		Page	2/2
Sample matrix	Groundwater		

	Analysis	Unit	1	2
	Physical and chemical analyses			
Q	Total suspended solids	mg/L	2800	120
	Inorganic Compounds			
Q	Bromide	mg/L	<0.30	<0.30
Q	Chloride	mg/L	0.54	0.89
Q	Fluoride	mg/L	0.19	0.15
Q	Sulphate	mg/L	1.1	0.89
	Inorganic Compounds			
Q	Ortho-phosphate (P04-P)	mg P/L	0.036	0.11
Q	Ortho-phosphate (P04)	mg P04/L	0.11	0.33
Q	Nitrate equivalent N03-N	mg N/L	<0.20	<0.20
Q	Nitrate (N03)	mg/L	<0.90	<0.90
Q	Nitrite as N02-N	mg N/L	<0.010	<0.010
Q	Nitrite (N02)	mg/L	<0.030	<0.030

No.	Sample description	Date sampling	Sample nr.
1	SW8-1612	16-Dec-2016	9328988
2	SW12-1612	16-Dec-2016	9328989

Q: Dutch Accreditation Council (RvA) accredited test
A: AP04 accredited test
S: AS3000 recognized test
V: VLAREL recognized test
M: MCERTS accredited

Verified
ASM
FZ

Eurofins Analytico B.V. is ISO 14001: 2004 certified by TÜV and qualified by the Flemish Region (OVAM and Dep. LNE), the Brussels Region (IBGE/BIM), the Walloon Region (DGRNE-OWD) and by the Government of Luxembourg (MEV).

TESTING
RvA L010

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BIC: BNPANL2A

Annex (A) concerning subsample information referring to certificate of analysis 2016151234/1

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9328988					0610145901	SW8-1612
9328988					0691713587	
9328988					0805029965	
9328988					0625006431	
9328989					0610145905	SW12-1612
9328989					0691713586	
9328989					0805030062	
9328989					0625006406	
9328989					0675075909	

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Annex (C): method references belonging to certificate of analysis 2016151234/1

Analysis	Method	Technique	Method reference
Nitrate	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Copper (Cu)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Manganese (Mn)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Aluminium (Al)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Arsenic (As)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Barium (Ba)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Uranium (U)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Cadmium (Cd)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Cobalt (Co)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Chromium (Cr)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Iron (Fe)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Mercury (Hg)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Nickel (Ni)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Lead (Pb)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Zinc (Zn)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Aromatics (BTEX)	W0254	HS-GC/MS	In accordance with ISO 11423-1 / CMA 3/E
EPH (C10-C40)	W0215	LVI-GC-FID	Cf. NEN EN ISO 9377-2
Total suspended solids (TSS) (NEN 6484)	W0552	Gravimetry	I.a.w. NEN 6499 & NEN 6484
Bromide (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Chloride (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Fluoride (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Sulphate (ionchromatografie)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Ortho phosphate	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Nitrite	W0566	Spectrometry	In accordance with NEN-ISO 15923-1

Additional information about the applied methods as well as the classification of the accuracy, are listed in our supplement: "Specification of methods of analyses", version June 2016.

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Annex (D) remarks concerning the sampling and preservation period 2016151234/1

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

Analysis	Sample nr.
The preservation term for this parameter has been expired.	
Nitrate (N03)	9328988
	9328989
Nitrite (N02)	9328988
	9328989
Suspended solids	9328988
	9328989

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Head Office:
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Course View Towers
Plot 21, Yusuf Lule Rd.
Kampala

ENVIROSERV UGANDA LTD
NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GW1 2017615		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	16th/06/2017	**Report Number**	ESUR20170095
Date Analysed:	16th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0.22
Biological Oxygen Demand (BOD5)	mg/l	6.76
Chemical Oxygen Demand (COD5)	mg/l	8.07
Coliforms	CFU/100ml	14

Name & Surname	Signature	Designation	Date
Andrew Wedulo		Laboratory Technician	29th/06/2017

ENVIROSERV (U) Ltd
Reg Number: 167909
Reg Date 6 June 2013

This report relates only to test items specified herein and analysis was done on an as received basis. These tests do not apply to any other samples not tested for or of a similar nature

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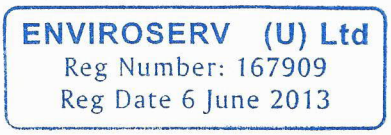
Kampala

ENVIROSERV UGANDA LTD
NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GW3 2017615		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	16th/06/2017	**Report Number**	ESUR20170096
Date Analysed:	16th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	2.05
Biological Oxygen Demand (BOD5)	mg/l	5.21
Chemical Oxygen Demand (COD5)	mg/l	3.64
Coliforms	CFU/100ml	78

Name & Surname	Signature	Designation	Date
Andrew Wedulo		Laboratory Technician	29th/06/2017



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ENVIROSERV UGANDA LTD
NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GW4 170616		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	17th/06/2017	**Report Number**	ESUR20170097
Date Analysed:	17th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	1.53
Biological Oxygen Demand (BOD5)	mg/l	8.82
Chemical Oxygen Demand (COD5)	mg/l	0.25
Coliforms	CFU/100ml	0

Name & Surname	Signature	Designation	Date
Andrew Wedulo	ENVIROSERV (U) Ltd Reg Number: 167909 Reg Date 6 June 2013	Laboratory Technician	29th/06/2017

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ENVIROSERV UGANDA LTD
NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GW 6 170616		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	17th/06/2017	**Report Number**	ESUR20170098
Date Analysed:	17th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	1.37
Biological Oxygen Demand (BOD5)	mg/l	4.10
Chemical Oxygen Demand (COD5)	mg/l	<0.1
Coliforms	CFU/100ml	0

Name & Surname	Signature	Designation	Date
Andrew Wedulo	ENVIROSERV (U) Ltd Reg Number: 167909 Reg Date 6 June 2013	Laboratory Technician	29th/06/2017

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ENVIROSERV UGANDA LTD
NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GWFD 170616		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	17th/06/2017	**Report Number**	ESUR20170099
Date Analysed:	17th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	1.55
Biological Oxygen Demand (BOD5)	mg/l	3.99
Chemical Oxygen Demand (COD5)	mg/l	<0.1
Coliforms	CFU/100ml	0

Name & Surname	Signature	Designation	Date
Andrew Wedulo	ENVIROSERV (U) Ltd Reg Number: 167909 Reg Date 6 June 2013	Laboratory Technician	29th/06/2017

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GW10 170616		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	17th/06/2017	**Report Number**	ESUR20170100
Date Analysed:	17th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	Analysis on Sample as received	
Ammonia	mg/l	0.74
Biological Oxygen Demand (BOD5)	mg/l	3.68
Chemical Oxygen Demand (COD5)	mg/l	<0.1
Coliforms	CFU/100ml	14

Name & Surname	Signature	Designation	Date
Andrew Wedulo		Laboratory Technician	29th/06/2017

ENVIROSERV (U) Ltd
Reg Number: 167909
Reg Date 6 June 2013

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ENVIROSERV UGANDA LTD
NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GW11 Alt 170616		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	17th/06/2017	**Report Number**	ESUR20170101
Date Analysed:	17th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0.26
Biological Oxygen Demand (BOD5)	mg/l	3.53
Chemical Oxygen Demand (COD5)	mg/l	<0.1
Coliforms	CFU/100ml	0

Name & Surname	Signature	Designation	Date
Andrew Wedulo	ENVIROSERV (U) Ltd Reg Number: 167909 Reg Date 6 June 2013	Laboratory Technician	29th/06/2017

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GW13 170616		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	17th/06/2017	**Report Number**	ESUR20170102
Date Analysed:	17th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0.80
Biological Oxygen Demand (BOD5)	mg/l	7.96
Chemical Oxygen Demand (COD5)	mg/l	12.7
Coliforms	CFU/100ml	4

Name & Surname	Signature	Designation	Date
Andrew Wedulo		Laboratory Technician	29th/06/2017

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	GW12 170616		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gail Muirhead		
Instructed By:	Client		
Date Received:	18th/06/2017	**Report Number**	ESUR20170103
Date Analysed:	18th/06/2017	**Date Report**	29th/06/2017

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0.07
Biological Oxygen Demand (BOD5)	mg/l	3.75
Chemical Oxygen Demand (COD5)	mg/l	1.81
Coliforms	CFU/100ml	30

Name & Surname	Signature	Designation	Date
Andrew Wedulo		Laboratory Technician	29th/06/2017

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Reg Date 6 June 2013

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Annex 7: Groundwater Quality analyses 2018

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E-mail: envochem.ug@gmail.com
TIN: 1007027899

CERTIFICATE OF ANALYSIS –BOREHOLE WATER SAMPLE

Client:	Teclab Ltd
Project:	CPINILE CROSSING (BORE HOLE WATER)
Contact Person:	NANCY
Mobile :	0771301622
Reception Date:	23.01.2018
Sampler:	Client

Ref: LCL 2/2/18
Issue Date: 2nd Feb 2018
Label: BH 9 & BH 11

PARAMETER	METHOD	UNITS	CPF BH 9	CPF BH 11	US EAS 12: 2014 LIMIT (Natural Potable Water)
pH	ISO 10523:2008		6.26	6.19	5.50-9.50
Conductivity	ISO 7888:1985	µscm^{-1}	328	543	2500
Colour (Apparent)	ISO 7887A: 2011	PtCo	>500	0	50
Turbidity	ISO 7027-1:2016	NTU	93	0	25
Total Suspended Solids	ISO 11923:1997	mg/L	92	<0.2	1
Sulphates	ISO 15923-1:2013	mg/L	2	8	400
Chlorides	ASTM D512	mg/L	48.83	104.35	250
Nitrites as NO_2^-	ISO 15923-1:2013	mg/L	<0.001	0.058	0.003
Nitrates as NO_3^-	ISO 15923-1:2013	mg/L	11.073	4.782	45
Bicarbonates	ECL-AM-004	mg/L	146.26	105.56	
Fluorides	Method 8029 (SPADNS Method)	mg/L	0.53	0.56	1.50
Total Hardness as $CaCO_3$	ISO 6059:1984	mg/L	42.11	77.66	600
Total Alkalinity as $CaCO_3$	ECL-AM-017	mg/L	120.93	87.57	
Calcium	ISO 7980:1986	mg/L	13.44	34.70	150
Magnesium	ISO 7980:1986	mg/L	6.38	10.31	100
Sodium	ISO 9964-1:1993	mg/L	23.56	34.81	200
Potassium	ISO 9964-2:1993	mg/L	7.16	8.32	
Cadmium	ISO 8288-1:1986	mg/L	<0.001	<0.001	0.003
Lead	ISO 8288-1:1986	mg/L	0.004	0.001	0.01
Chromium	ISO 9174:1998	mg/L	<0.001	0.005	0.05
Iron	ISO 8288-1:1986	mg/L	4.939	0.055	0.3
Zinc	ISO 8288-1:1986	mg/L	0.025	0.024	5
Copper	ISO 8288-1:1986	mg/L	<0.001	<0.001	1.000
Nickel	ISO 8288-1:1986	mg/L	0.014	0.02	0.02
Manganese	ISO 8288-1:1986	mg/L	0.542	0.100	0.1
Cobalt	ISO 8288-1:1986	mg/L	0.002	0.002	
Arsenic	ISO 11885:2003	mg/L	0.010	0.012	0.01
Aluminium	ISO 11885:2003	mg/L	0.263	0.357	0.2
Barium	ISO 11885:2003	mg/L	7.01	<0.10	0.7
Mercury	ISO 11885:2003	mg/L	<0.001	<0.001	0.001
Faecal coliforms		Cfu/100ml	00	00	Absent
$B.O.D_5$		mg/L	8.7	15.2	
Total Petroleum Hydrocarbons (TPH)	PQA/LIM/006	mg/L	<0.01	4.61	N/A
BTEX					
Benzene	APHA 6200B	mg/L	<0.01	0.11	0.010
Toluene	APHA 6200B	mg/L	<0.01	<0.01	0.700
Ethyl-benzene	APHA 6200B	mg/L	<0.01	<0.01	N/A
Xylene	APHA 6200B	mg/L	<0.01	0.02	0.500
PAH					0.001
Naphthalene	APHA 6440B	mg/L	<0.01	0.07	N/A
Acenaphthylene	APHA 6440B	mg/L	<0.01	<0.01	N/A

Excellent Analytical Laboratory Services and Hazardous Waste Management Consultants
Contact us on: envochem.ug@gmail.com

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Tel: 0778065015/ 0705956283
E-mail: envochem.ug@gmail.com
TIN: 1007027399

Acenaphthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Fluorene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Phenanthrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Anthracene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Pyrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (a) anthracene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Chrysene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (b) fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (k) fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (a) pyrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
ALIPHATIC HYDROCARBONS					
Total Aliphatic Hydrocarbons (C_4-C_{32})	APHA 6040B	mg/L	<0.01	<0.01	N/A

**********END**********

Please note;

**N/A is not available*

**Cfu is Coliform units*

**US EAS 12:2014 is the Uganda Standard as adapted from the East African Standard, it specifies the limits of contaminants in natural potable water unless advised otherwise (to apply a different protocol) we shall continue to use this as a reference in this monitoring.*

**Bold figures are outside the acceptable limits for potable natural water.*

**Under normal circumstances borehole water is supposed to be free of suspended solids and turbidity unless if the caging is damaged and/ or if sampling is done before purging (this should be done 12 hours before the time of sampling for clear water to sip in.*

**Petro-chemical contaminants, Faecal coliforms and B.O.D was sub-contracted to Polucon Services (K) Ltd and Government Analytical laboratory respectively, their test reports are therefore attached.*

ENVOCHEM CONSULTANTS (U) LIMITED
05 FEB 2018
P. O. BOX 40168, Kampala (U)

George Mugambwa
(QA- Coordinator)

Daniel Okwako
(Head of Laboratory)

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Plot 10, Nalubale Link Road, Bugolobi
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Tel: 0778065016/ 0705956283
E-mail: envochem.ug@gmail.com
TIN: 1007027399

CERTIFICATE OF ANALYSIS –BOREHOLE WATER SAMPLE

Client:	Teclab Ltd	Ref: ECL 31/1/18	
Project:	CPP/NILE CROSSING (BORE HOLE WATER)	Issue Date: 31st Jan 2018	
Contact Person:	NANCY		
Mobile :	0771301622	Label: CPP BH MW3	
Reception Date:	17.01.2018		
Samples:	Client		

PARAMETER	METHOD	UNITS	RESULTS	US EAS 12: 2014 LIMIT (Natural Potable Water)
pH	ISO 10523:2008		6.46	5.50-9.50
Conductivity	ISO 7888:1985	µscm^{-1}	281	2500
Colour (Apparent)	ISO 7887A: 2011	PtCo	335	50
Turbidity	ISO 7027-1:2016	NTU	60	25
Total Suspended Solids	ISO 11923:1997	mg/L	65	
Sulphates	ISO 15923-1:2013	mg/L	6	400
Chlorides	ASTM D512	mg/L	24.67	250
Nitrites as $NO2^-$	ISO 15923-1:2013	mg/L	0.007	0.003
Nitrates as NO_3^-	ISO 15923-1:2013	mg/L	0.04	45
Bicarbonates	ECL-AM-004	mg/L	2.47	
Fluorides	Method 8029 (SPADNS Method)	mg/L	0.74	1.50
Total Hardness as $CaCO_3$	ISO 6059:1984	mg/L	166.56	600
Total Alkalinity as $CaCO_3$	ECL-AM-017	mg/L	104.25	
Calcium	ISO 7980:1986	mg/L	15.97	150
Magnesium	ISO 7980:1986	mg/L	5.55	100
Sodium	ISO 9964-1:1993	mg/L	23.97	200
Potassium	ISO 9964-2:1993	mg/L	6.59	
Cadmium	ISO 8288-1:1986	mg/L	0.002	0.003
Lead	ISO 8288-1:1986	mg/L	0.009	0.01
Chromium	ISO 9174:1998	mg/L	<0.001	0.05
Iron	ISO 8288-1:1986	mg/L	0.217	0.3
Zinc	ISO 8288-1:1986	mg/L	0.003	5
Copper	ISO 8288-1:1986	mg/L	<0.001	1.000
Nickel	ISO 8288-1:1986	mg/L	<0.001	0.02
Manganese	ISO 8288-1:1986	mg/L	0.066	0.1
Cobalt	ISO 8288-1:1986	mg/L	<0.001	
Arsenic	ISO 11885:2003	mg/L	<0.001	0.01
Aluminium	ISO 11885:2003	mg/L	0.288	0.2
Barium	ISO 11885:2003	mg/L	0.003	0.7
Mercury	ISO 11885:2003	mg/L	<0.001	0.001
Faecal coliforms		Cfu/100ml	00	Absent
$B.O.D_5$		mg/L	13.1	
Total Petroleum Hydrocarbons (TPH)	EQA/LIM/006	mg/L	<0.01	N/A
BTEX				
Benzene	APHA 6200B	mg/L	<0.01	0.010
Toluene	APHA 6200B	mg/L	<0.01	0.700
Ethyl-benzene	APHA 6200B	mg/L	<0.01	N/A
Xylene	APHA 6200B	mg/L	<0.01	0.500
PAH				0.001
Naphthalene	APHA 6440B	mg/L	<0.01	N/A
Acenaphthylene	APHA 6440B	mg/L	<0.01	N/A

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TIN: 1007027399

Acenaphthene	APHA 6440B	mg/L	<0.01	N/A
Fluorene	APHA 6440B	mg/L	<0.01	N/A
Phenanthrene	APHA 6440B	mg/L	<0.01	N/A
Anthracene	APHA 6440B	mg/L	<0.01	N/A
Fluoranthene	APHA 6440B	mg/L	<0.01	N/A
Pyrene	APHA 6440B	mg/L	<0.01	N/A
Benzo (a) anthracene	APHA 6440B	mg/L	<0.01	N/A
Chrysene	APHA 6440B	mg/L	<0.01	N/A
Benzo (b) fluoranthene	APHA 6440B	mg/L	<0.01	N/A
Benzo (k) fluoranthene	APHA 6440B	mg/L	<0.01	N/A
Benzo (a) pyrene	APHA 6440B	mg/L	<0.01	N/A
ALIPHATIC HYDROCARBONS				
Total Aliphatic Hydrocarbons (C_4-C_{32})	APHA 6040B	mg/L	<0.01	N/A

**********END**********

Please note:

**N/A is not available*

**Cfu is Coliform units*

**US EAS 12:2014 is the Uganda Standard as adopted from the East African Standard, it specifies the limits of contaminants in natural potable water unless advised otherwise (to apply a different protocol) we shall continue to use this as a reference in this monitoring.*

**Bold figures are values above the acceptable limits of potable natural water.*

**Under normal circumstances borehole water is supposed to be free of suspended solids and turbidity unless if the caging is damaged and/ or if sampling is done before purging (this should be done 12 hours before the time of sampling for clear water to slp in.*

**Petro-chemical contaminants, Faecal coliforms and B.O.D was sub-contracted to Polucon Services (K) Ltd and Government Analytical laboratory respectively, their test reports are therefore attached.*

George Mugambwa
(QA- Coordinator)

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05 DEC 2018
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In any Correspondence on this subject please quote No.....

GE 019/2018

THE REPUBLIC OF UGANDA

MINISTRY OF INTERNAL AFFAIRS
DIRECTORATE OF GOVERNMENT ANALYTICAL LABORATORY
Plot No. 2 Lourdel Road
Wandegeya,
P.O.BOX 2174
Kampala - Uganda

22nd January 2018

Envochem Consultants (U) Ltd
Nalubale Link Road
P.O Box 40168,
Kampala, Uganda

REPORT OF ANALYSIS

Description of Sample
One (1) clear borehole water sample in a 1000ml amber glass bottle labelled **'CPFBHMW3'** was received from Envochem Consultants (U) Ltd C/o Mr. Okwako Daniel on 18th January 2018.

Analysis Requested
Total Plate Count, Total coliforms and E.coli.

Methods of Analysis
Faecal coliforms was determined by the Membrane Filtration Technique at 44°C. The determinations were done in duplicate.

Results of Analysis
The mean analysis values are as below;

[illegible]	Results	US EAS 12:2014 Limits
Faecal coliforms as E.coli in 100ml	00	Absent

Remarks
1. The sample was analysed against the microbiological limits of the US EAS 12:2014 standard for Potable water.
2. The sample was found to comply with the microbiological specifications of the standard for the parameter analysed.
3. The results relate to sample submitted and are reported as on received basis.

Christine Zawedde
Government Analyst

"Go Scientific for a Safe and Just Society"

Polucon
At your service

ENVOCHEM CONSULTANTS (U) LTD
P.O. BOX 40168
KAMPALA, UGANDA

TEST REPORT N0: 2018/ENV/0034			
SAMPLE	WATER		
DATE & PLACE SUBMITTED	22-January-2018 at Polucon Laboratory, Nyali		
SAMPLING METHOD	N/A		
MARK	CPF BH MW3		
Test	Method	Results	Clients Specifications
BTEX			
Benzene, mg/L	APHA 6200B	<0.01	-
Toluene, mg/L	APHA 6200B	<0.01	-
Ethyl benzene, mg/L	APHA 6200B	<0.01	-
Xylene, mg/L	APHA 6200B	<0.01	-
TPH			
Total Petroleum Hydrocarbons, TPH, mg/L	PQA/LIM/006	<0.01	-
PAH			
Naphthalene, mg/L	APHA 6440B	<0.01	-
Acenaphthylene, mg/L	APHA 6440B	<0.01	-
Acenaphthene, mg/L	APHA 6440B	<0.01	-
Fluorene, mg/L	APHA 6440B	<0.01	-
Phenanthrene, mg/L	APHA 6440B	<0.01	-
Anthracene, mg/L	APHA 6440B	<0.01	-
Fluoranthene, mg/L	APHA 6440B	<0.01	-
Pyrene, mg/L	APHA 6440B	<0.01	-
Benzo (a) anthracene, mg/L	APHA 6440B	<0.01	-
Chrysene, mg/L	APHA 6440B	<0.01	-
Benzo (b) fluoranthene, mg/L	APHA 6440B	<0.01	-
Benzo (k) fluoranthene, mg/L	APHA 6440B	<0.01	-
Benzo (a) pyrene, mg/L	APHA 6440B	<0.01	-
ALIPHATIC HYDROCARBONS			
Total Aliphatic Hydrocarbons, (C_6-C_{32}),mg/L	APHA 6040B	<0.01	-

**********End of test results**********

Mombasa Lab
26th January, 2018

Analyst
Pascal Mbithi – Chemist

Technical signatory
Jared Onsinyo – Laboratory Manager

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"Unless otherwise stated the results shown in this test report refer only to sample(s) tested and such sample(s) are retained for 90 days only (if non-perishable)."

NB: This report refers to submitted samples. The source and markings have not been verified or confirmed.

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1/1

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Tel: 0778065015/ 0705956283
E-mail: envochem.ug@gmail.com
TIN: 1007027399

CERTIFICATE OF ANALYSIS –BOREHOLE WATER SAMPLE

Client:	Teclab Ltd	**Ref:**	ECL 16/3/18
Project:	CPF/NILE CROSSING (BORE HOLE WATER)	**Issue Date:**	16th Mar 2018
Contact Person:	NANCY		
Mobile :	0771301622	**Label:**	MW1 & MW 04
Reception Date:	26.02.2018		
Sampler:	Client		

PARAMETER	METHOD	UNITS	MW 1	MW 04	US EAS 12: 2014 LIMIT (Natural Potable Water)
pH	ISO 10523:2008		6.49	6.79	5.50-9.50
Conductivity	ISO 7888:1985	μscm^{-1}	360	1707	2500
Colour (Apparent)	ISO 7887A: 2011	PtCo	**161**	**>500**	50
Turbidity	ISO 7027-1:2016	NTU	21	157	25
Total Suspended Solids	ISO 11923:1997	mg/L	17	153	-
Sulphates	ISO 15923-1:2013	mg/L	4	1	400
Chlorides	ASTM D512	mg/L	34.44	**318.70**	250
Nitrites as $NO2^-$	ISO 15923-1:2013	mg/L	<0.001	**0.027**	0.003
Nitrates as NO_3^-	ISO 15923-1:2013	mg/L	0.089	0.487	45
Bicarbonates	ECL-AM-004	mg/L	16.534	48.330	
Fluorides	Method 8029 (SPADNS Method)	mg/L	0.6	0.4	1.50
Total Hardness as $CaCO_3$	ISO 6059:1984	mg/L	57.33	251.53	600
Total Alkalinity as $CaCO_3$	ECL-AM-017	mg/L			
Calcium	ISO 7980:1986	mg/L	30.12	120.9	150
Magnesium	ISO 7980:1986	mg/L	6.53	31.35	100
Sodium	ISO 9964-1:1993	mg/L	32.670	175.6	200
Potassium	ISO 9964-2:1993	mg/L	3.08	13.06	
Cadmium	ISO 8288-1:1986	mg/L	**0.024**	**0.034**	0.003
Lead	ISO 8288-1:1986	mg/L	<0.001	<0.001	0.01
Chromium	ISO 9174:1998	mg/L	0.020	0.026	0.05
Iron	ISO 8288-1:1986	mg/L	**2.462**	**22.40**	0.3
Zinc	ISO 8288-1:1986	mg/L	0.022	0.086	5
Copper	ISO 8288-1:1986	mg/L	<0.001	<0.001	1.000
Nickel	ISO 8288-1:1986	mg/L	0.018	0.020	0.02
Manganese	ISO 8288-1:1986	mg/L	**0.417**	**3.808**	0.1
Cobalt	ISO 8288-1:1986	mg/L	0.002	0.001	
Arsenic	ISO 11885:2003	mg/L			0.01
Aluminium	ISO 11885:2003	mg/L			0.2
Barium	ISO 11885:2003	mg/L	4.00	0.3	0.7
Mercury	ISO 11885:2003	mg/L			0.001
Faecal coliforms		Cfu/100ml	16	09	Absent
$B.O.D_5$		mg/L	84.9	8.7	
C.O.D		mg/L	30	146	
Total Petroleum Hydrocarbons (TPH)	PQA/LIM/006	mg/L	<0.01	<0.01	N/A
BTEX					
Benzene	APHA 6200B	mg/L	<0.01	<0.01	0.010
Toluene	APHA 6200B	mg/L	<0.01	<0.01	0.700
Ethyl-benzene	APHA 6200B	mg/L	<0.01	<0.01	N/A
Xylene	APHA 6200B	mg/L	<0.01	<0.01	0.500
PAH					**0.001**
Naphthalene	APHA 6440B	mg/L	<0.01	<0.01	N/A

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TIN: 1007027399

Acenaphthylene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Acenaphthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Fluorene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Phenanthrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Anthracene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Pyrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (a) anthracene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Chrysene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (b) fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (k) fluoranthene	APHA 6440B	mg/L	<0.01	<0.01	N/A
Benzo (a) pyrene	APHA 6440B	mg/L	<0.01	<0.01	N/A
ALIPHATIC HYDROCARBONS					
Total Aliphatic Hydrocarbons (C_4-C_{12})	APHA 6040B	mg/L	<0.01	<0.01	N/A

**********END**********

Please note:

**N/A is not available*

**Cfu is Coliform units*

**US EAS 12:2014 is the Uganda Standard as adopted from the East African Standard, it specifies the limits of contaminants in natural potable water unless advised otherwise (to apply a different protocol) we shall continue to use this as a reference in this monitoring.*

**Bold figures are outside the acceptable limits for potable natural water.*

**Under normal circumstances borehole water is supposed to be free of suspended solids and turbidity unless if the caging is damaged and/ or if sampling is done before purging (this should be done 12 hours before the time of sampling for clear water to sip in.*

**Petro-chemical contaminants, Faecal coliforms and B.O.D was sub-contracted to Polucon Services (K) Ltd and Government Analytical laboratory respectively, their test reports are therefore attached.*

**C.O.D was not requested for but was done for our quality control purposes*

George Mugambwa
(QA- Coordinator)

Daniel Okwako
(Head of Laboratory)

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TILENGA ESIA – APPENDIX L: Surface Water

2019

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Table of Contents

Annex 01: Photographs Of Surface Water and Sediment Sampling Locations

Annex 01: Photographs of Surface Water and Sediment Sampling Locations

SW01 Nov. 2016 June 2017 	SW02 Nov. 2016 and June 2017 
SW06 Nov. 2016 June 2017 	SW07 Nov. 2016 and June 2017 
SW08 Nov. 2016 and June 2017 	SW09 Nov. 2016 and June 2017 

SW10
Nov. 2016 and
June 2017

SW12
Nov. 2016 and June 2017

SW 13
June 2017

SW14S
June 2017

SW14N
June 2017

SE1
Sampled only in Nov. 2016

SE2
Sampled only in Nov. 2016

SE3
Sampled only in Nov 2016

SE4
Sampled only in Nov. 2016

SE5_BB/N
Sampled only in June 2017

SE5_BB/S
Sampled only in June 2017

Annex 02: Surface Water Quality Analysis Results From 2014 to 2017 ESIA Field Campaigns

Annex 02: Surface Water Quality Analysis Results From 2014 To 2017 ESIA Field Campaigns

Sample Location						SW01		SW02		SW06		SW07		SW08	
Certificate number						337545	2017083843	331947	2017083843	320948	2017083843	320579	2017083843	322595	2017083843
Date sampling						04/11/2016	12-06-2017	04/11/2016	12-06-2017	05/11/2016	14-06-2017	05/11/2016	14-06-2017	16/12/2016	12-06-2017
Location descritpion						Wetland in North Nile MFNP		Watering hole in North Nile		Lake Albert near shore		Lake Albert offshore		Watercourse near JBR09	
Analysis	Unit	USEPA Water Quality Human Health Criteria	USEPA Water Quality Aquatic Life Criteria	WHO Guidelines (4th Edition 2011)	EAS 12:2014	SW1-161104	SW1-1706-12	SW2-161104	SW2-1706-12	SW6-161105	SW6-1706-14	SW7-161105	SW7-1706-14	SW8-1612	SW8-1706-12
Metals															
Aluminum (Al)	mg/L	-		0.2	0.2	0.15	15	5	5.9	0.27	<0.10	0.18	<0.10	4.1	2.2
Arsenic (As)**	mg/L	0.018	0.15	0.01	0.01	<0.005	0.0078	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium (Ba)**	mg/L	0.1		0.7	0.7	0.08	2	0.081	0.35	0.087	0.078	0.084	0.077	0.5	0.29
Uranium (U)	µg/L	-		0.03	-	< 5	<5.0	< 5	<5.0	< 5	<5.0	< 5	<5.0	< 5	<5.0
Cadmium (Cd)**	mg/L	0.005	0.00025	1.003	0.003	< 0.0004	0.00055	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Cobalt (Co)	µg/L	-		-	-	< 3	170	6.4	29	< 3	<3.0	< 3	<3.0	17	5.2
Chromium (Cr)**	mg/L	0.01	0.0074	0.05	0.05	<0.001	0.023	0.016	0.015	<0.001	<0.001	<0.001	<0.001	0.0044	0.0037
Copper (Cu)**	mg/L	1.3		2	1	<0.005	0.22	0.01	0.033	<0.005	<1.6	<0.005	<1.6	0.023	0.013
Iron (Fe)	mg/L	-	1	-	0.3	4.2	110	7.5	43	0.39	<0.050	0.26	<0.050	9.8	9.6
Mercury (Hg)**	mg/L	-	0.00077	0.006	0.001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Manganese	mg/L	50		-	0.1	0.14	8.8	0.18	1.1	0.016	<0.010	< 0.01	<0.010	1.2	0.17
Nickel (Ni)**	mg/L	0.61	0.0052	0.07	0.02	<0.005	0.075	0.009	0.019	<0.005	<0.005	<0.005	<0.005	0.011	<0.005
Lead (Pb)**	mg/L	-	0.0025	0.01	0.01	0.25	0.094	0.0051	0.028	<0.005	<0.005	<0.005	<0.005	0.015	0.014
Zinc (Zn)**	mg/L	7.4	0.12	-	5	< 0.01	0.088	0.015	0.021	< 0.01	<0.005	< 0.01	<0.005	0.017	0.0083
Mono Aromatic Hydrocarbons															
Benzene	µg/L	2.2		10	10	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20
Toluene	µg/L	1300		700	700	< 0.2	0.79	< 0.2	<0.20	0.33	<0.20	< 0.2	<0.20	< 0.2	<0.20
Ethylbenzene	µg/L	530		300	-	< 0.2	0.96	< 0.2	0.55	0.29	0.46	< 0.2	1.3	< 0.2	1.6
o-Xylene	µg/L	-		-	-	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20
m,p-Xylene	µg/L	-		-	-	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20
Xylenes (sum)	µg/L	-		500	500	< 0.4	<0.40	< 0.4	<0.40	< 0.4	<0.40	< 0.4	<0.40	< 0.4	<0.40
BTEX (sum)	µg/L	-		-	-	< 1	1.8	< 1	<1.0	< 1	<1.0	< 1	1.3	< 1	1.6
Petroleum Hydrocarbons															
TPH (C10-C12)	µg/L	-				< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH (C12-C16)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH (C16-C21)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH (C21-C30)	µg/L	-			-	< 15	<15	< 15	<15	< 15	<15	< 15	<15	< 15	<15
TPH (C30-C35)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH (C35-C40)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	< 10	<10	< 10	<10
TPH Sum (C10-C40)	µg/L	-			-	< 38	<38	< 38	<38	< 38	<38	< 38	<38	< 38	<38
Physical and chemical analyses															
Total suspended solids	mg/L	-			-	27	5200	430	2500	37	<3.8	18	<3.8	2800	960
Inorganic Compounds															
Bromide	mg/L	-				< 0.05	0.14	< 0.05	<0.050	0.051	0.068	0.058	0.068	< 0.3	<0.050
Chloride	mg/L	-	230		250	0.31	24	1.3	1.6	20	19	20	19	0.54	0.45
Fluoride	mg/L	-		1.5	1.5	0.4	0.3	0.093	0.21	0.78	0.76	0.78	0.76	0.19	0.42
Sulphate	mg/L	-			400	0.75	15	4.2	3.3	12	11	12	10	1.1	2.1
Inorganic Compounds		-													
Ortho-phosphate (PO4-P)	mg P/L	-		-	2.2	< 0.06	0.13	0.38	0.16	0.061	<0.020	0.086	<0.020	0.11	0.021
Ortho-phosphate (PO4)	mg PO4/L	-		-		< 0.02	0.39	0.12	0.49	0.02	<0.060	0.028	<0.060	0.036	0.064
Nitrate equivalent NO3-N	mg N/L	10		-		0.44	<0.20	0.85	<0.20	0.21	<0.20	< 0.2	<0.20	< 0.2	<0.20
Nitrate (NO3)	mg/L			50	45	1.9	<0.90	3.8	<0.90	0.93	<0.90	< 0.9	<0.90	< 0.9	<0.90
Nitrite as NO2-N	mg N/L			-		0.013	<0.010	0.02	0.012	0.14	<0.010	0.097	<0.010	< 0.01	0.036
Nitrite (NO2)	mg/L			3	0.003	0.043	<0.030	0.066	0.039	0.46	<0.030	0.32	<0.030	< 0.03	0.12
miscellaneous research															
Turbidity	NTU				25	20.8	35.2	685	514	19	<1.0	13.7	<1.0		129.8
Total coliforms	cfu/100ml					-	-	-	-	-	-	-	-	-	-

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Exceedance of USEPA

Note: USEPA standard applied where no EAS12:2014 standard exists

Sample Location						SW09		SW10		SW12		SW13	SW14
Certificate number						332984	2017083843	317858	2017083843	333863	2017083843	2017083843	2017083843
Date sampling						05/11/2016	14-06-2017	05/11/2016	14-06-2017	16/12/2016	13-06-2017	12-06-2017	14-06-2017
Location descritpion						Nile River		Nile River at Lake Albert		Waiga River		Wildlife watering hole in north of Nile	
Analysis	Unit	USEPA Water Quality Human Health Criteria	USEPA Water Quality Aquatic Life Criteria	WHO Guidelines (4th Edition 2011)	EAS 12:2014	SW9-161105	SW9-1706-14	SW10-161105	SW10-1706-14	SW12-1612	SW12-1706-13	SW13-1706-12	SW14-1706-14
Metals													
Aluminum (Al)	mg/L	-		0.2	0.2	0.48	<0.10	0.16	<0.10	0.22	0.31	1.2	<0.10
Arsenic (As)**	mg/L	0.018	0.15	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium (Ba)**	mg/L	0.1		0.7	0.7	< 0.05	<0.05	< 0.05	<0.05	0.096	0.087	0.24	<0.05
Uranium (U)	µg/L	-		0.03	-	< 5	<5.0	< 5	<5.0	< 5	<5.0	<5.0	<5.0
Cadmium (Cd)**	mg/L	0.005	0.00025	1.003	0.003	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Cobalt (Co)	µg/L	-		-	-	< 3	<3.0	< 3	<3.0	4.3	3.3	14	<3.0
Chromium (Cr)**	mg/L	0.01	0.0074	0.05	0.05	0.0016	<0.001	<0.001	<0.001	<0.001	<0.001	0.0017	<0.001
Copper (Cu)**	mg/L	1.3		2	1	<0.005	<1.6	<0.005	<0.0016	<0.005	0.027	0.069	<0.0016
Iron (Fe)	mg/L	-	1	-	0.3	0.82	0.27	0.38	0.27	9.6	5.8	17	0.3
Mercury (Hg)**	mg/L	-	0.00077	0.006	0.001	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Manganese	mg/L	50		-	0.1	0.036	0.027	0.026	0.027	0.6	0.39	1.7	0.028
Nickel (Ni)**	mg/L	0.61	0.0052	0.07	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0051	<0.005
Lead (Pb)**	mg/L	-	0.0025	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0098	<0.005
Zinc (Zn)**	mg/L	7.4	0.12	-	5	< 0.01	0.0051	< 0.01	0.0065	< 0.01	<0.005	0.0065	<0.005
Mono Aromatic Hydrocarbons													
Benzene	µg/L	2.2		10	10	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	<0.20	<0.20
Toluene	µg/L	1300		700	700	< 0.2	0.52	< 0.2	<0.20	< 0.2	<0.20	<0.20	<0.20
Ethylbenzene	µg/L	530		300	-	< 0.2	0.96	< 0.2	1.1	< 0.2	0.72	0.81	0.51
o-Xylene	µg/L	-		-	-	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	<0.20	<0.20
m,p-Xylene	µg/L	-		-	-	< 0.2	<0.20	< 0.2	<0.20	< 0.2	<0.20	<0.20	<0.20
Xylenes (sum)	µg/L	-		500	500	< 0.4	<0.40	< 0.4	<0.40	< 0.4	<0.40	<0.40	<0.40
BTEX (sum)	µg/L	-		-	-	< 1	1.5	< 1	1.1	< 1	<1.0	<1.0	<1.0
Petroleum Hydrocarbons													
TPH (C10-C12)	µg/L	-				< 10	<10	< 10	<10	< 10	<10	<10	<10
TPH (C12-C16)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	<10	<10
TPH (C16-C21)	µg/L	-			-	< 10	<10	11	<10	< 10	<10	<10	<10
TPH (C21-C30)	µg/L	-			-	< 15	<15	27	<15	< 15	<15	<15	<15
TPH (C30-C35)	µg/L	-			-	< 10	<10	12	<10	< 10	<10	<10	<10
TPH (C35-C40)	µg/L	-			-	< 10	<10	< 10	<10	< 10	<10	<10	<10
TPH Sum (C10-C40)	µg/L	-			-	< 38	<38	61	<38	< 38	<38	<38	<38
Physical and chemical analyses													
Total suspended solids	mg/L	-			-	92	15	12	14	120	86	450	14
Inorganic Compounds													
Bromide	mg/L	-				< 0.05	<0.050	< 0.05	<0.050	< 0.3	<0.050	<0.050	<0.050
Chloride	mg/L	-	230		250	4.8	4.6	5	4.6	0.89	0.28	2.3	4.7
Fluoride	mg/L	-		1.5	1.5	0.33	0.32	0.34	0.31	0.15	0.16	0.25	0.32
Sulphate	mg/L	-			400	1.4	2.7	1.5	2.4	0.89	1.4	1	2
Inorganic Compounds		-											
Ortho-phosphate (PO4-P)	mg P/L	-		-	2.2	< 0.06	<0.020	< 0.06	<0.020	0.33	0.082	0.029	<0.020
Ortho-phosphate (PO4)	mg PO4/L	-		-		< 0.02	<0.060	< 0.02	<0.060	0.11	0.25	0.089	<0.060
Nitrate equivalent NO3-N	mg N/L	10		-		0.33	0.31	0.33	0.33	< 0.2	<0.20	<0.20	<0.20
Nitrate (NO3)	mg/L			50	45	1.5	1.4	1.5	1.5	< 0.9	<0.90	<0.90	<0.90
Nitrite as NO2-N	mg N/L			-		< 0.01	<0.010	< 0.01	<0.010	< 0.01	<0.010	0.015	<0.010
Nitrite (NO2)	mg/L			3	0.003	< 0.03	<0.030	< 0.03	<0.030	< 0.03	<0.030	0.049	<0.030
miscellaneous research													
Turbidity	NTU				25	37.5	<1.0	6.93	<1.0		35.9	17.6	<1.0
Total coliforms	cfu/100ml					-	-	-	-	-	-	-	-

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Exceedance of USEPA

Note: USEPA standard applied where no EAS12:2014 standard exists

Sample Location						SW07	SW07	SW07	SW07	SW08	SW08	SW08	SW08	SW09	SW09	SW09	SW09	SW14	SW14	SW14	SW14	SW14	SW16
Certificate number																							
Date sampling						13-Feb-14	27-Apr-14	02-Jul-14	25-Sep-14	13-Feb-14	27-Apr-14	02-Jul-14	25-Sep-14	13-Feb-14	27-Apr-14	01-Jul-14	29-Sep-14	13-Feb-14	28-Apr-14	30-Jun-14	30-Jun-14	29-Sep-14	29-Sep-14
Location descritpion						Victoria Nile downstream of Murchison				Victoria Nile near Murchison Falls Lodge				Victoria Nile at Wanseco village inside				Seasonal stream in MFNP next to road					
Analysis	Unit	USEPA Water Quality Human Health Criteria	USEPA Water Quality Aquatic Life Criteria	WHO Guidelines (4th Edition 2011)	EAS 12:2014																		
Physical and chemical analyses																							
pH		5.0 - 9.0	6.5-9		5.5-8.5	6.85	7.94	8.06	7.58	6.86	7.8	7.44	7.17	6.87	6.88	6.28	7.01	6.86	6.71	6.53	6.53	6.31	5.33
Temperature, C						25.91	28.67	27.74	27.7	26.17	29.14	27.14	27.17	26.06	28.55	26.71	30.15	24.74	28.81	31.09	31.09	23.7	29.38
EC, uS/cm					2500	81	116.1	118.2	116.4	82	115.9	117.9	117.3	89	126.2	131.2	126.5	98	68	84.7	84.7	84.3	54
ORP, mV						-15	68.8	47.8	68.1	9.7	70.7	52	80.9	-70.9	54.8	73	65.5	-8.7	10.1	47.1	47.1	-18.8	221.5
Diss. O_2, mg/L						8.37	9.51	9.2	9.7	8.7	8.95	8.72	8.77	0.34	0.55	0.59	4.57	3.35	3.64	10.13	10.13	0.45	1.75
Resistivity, Ω-cm						12,400	8,051	8,042	8,173	12,200	8,000	8,147	8,189	11,200	7,422	7,384	7,197	10,200	13,705	10,580	10,580	12,168	17,095
Salinity, PSU						0.06	0.1	0.1	0.1	0.06	0.1	0.1	0.1	0.04	0.1	0.1	0.1	0.04	0	0	0	0	0
TDS, mg/L					1500	40	75	77	76	42	75	77	76	45	82	85	82	49	44	55	55	55	35
Metals																							
Arsenic (As)**	mg/L	0.018	0.15	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium (Ba)**	mg/L	0.1		0.7	0.7	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.17	0.11	0.13	0.14	0.15	0.073
Uranium (U)	µg/L	-		0.03	-		< 0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	< 0.0002		< 0.0002	< 0.0002	< 0.0002	0.0003	< 0.0002
Calcium	mg/L			-	150	5.6	8.4	8.9	8	6.7	7.5	9	8.5	6.3	8.3	9.9	10	7.7	6.4	8.2	8.1	5.9	3.5
Cadmium (Cd)**	mg/L	0.005	0.00025	0.003	0.003	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040
Cobalt (Co)	µg/L	-		-	-	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0	8.2	8.3	9.7	11	8.5	5.9
Chromium (Cr)**	mg/L	0.01	0.0074	0.05	0.05	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0011	< 0.001	< 0.001	< 0.001	< 0.001
Copper (Cu)**	mg/L	1.3		2	1	< 0.005	< 0.005	< 0.005	0.0054	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.0053	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Iron (Fe)	mg/L	-	1	-	0.3	0.1	0.31	0.56	0.41	0.18	0.68	0.35	0.34	0.58	0.7	0.75	0.5	9.6	9.9	11	14	13	0.7
Mercury (Hg)**	mg/L	-	0.00077	0.006	0.001	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050
Magnesium	mg/L				100	3	3.1	3.4	3.3	3	3.1	3.3	3.3	3.3	3.4	3.5	3.5	3.9	2.2	2.8	2.8	1.9	0.99
Manganese	mg/L	50		-	0.1	0.019	0.026	0.032	0.037	0.019	0.031	0.033	0.037	0.038	0.045	0.045	0.037	1.6	1.3	1.6	1.6	1.2	0.33
Nickel (Ni)**	mg/L	0.61	0.0052	0.07	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0087
Lead (Pb)**	mg/L	-	0.0025	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Potassium	mg/L			-	-	3.2	3.7	4	3.5	3.3	3.7	3.9	3.5	3.2	4.3	3.7	3.8	6.5	5.8	3.5	3.5	1.7	1.4
Sodium	mg/L			-	200	11	13	13	12	12	12	12	12	13	13	13	13	9.4	2.5	4.8	4.9	4.4	4.4
Zinc (Zn)**	mg/L	7.4	0.12	-	5	0.011	0.011	< 0.01	< 0.01	0.016	< 0.01	< 0.01	< 0.01	< 0.01	0.095	< 0.01	< 0.01	< 0.01	0.059	< 0.01	< 0.01	< 0.01	< 0.01
Mono Aromatic Hydrocarbons																							
Benzene	µg/L	2.2		10	10	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20
Toluene	µg/L	1300		700	700	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20
Ethylbenzene	µg/L	530		300	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.55	0.3	< 0.2	< 0.20	< 0.20	0.69	< 0.2	< 0.2	5.4	< 0.20
o-Xylene	µg/L	-		-	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20
m,p-Xylene	µg/L	-		-	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	0.74	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	< 0.20
Xylenes (sum)	µg/L	-		500	500	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.4	< 0.40	< 0.40
BTEX (sum)	µg/L	-		-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	5.4	< 1.0
Petroleum Hydrocarbons																							
TPH (C10-C12)	µg/L	-			-	6.1	< 4	< 4	< 4.0	32	< 4	< 4	< 4.0	< 4.0	< 4	4.1	< 4.0	< 4.0	5.6	< 4	< 4	< 4.0	< 4.0
TPH (C12-C16)	µg/L	-			-	< 5.0	< 5	< 5	< 5.0	16	< 5	< 5	< 5.0	< 5.0	< 5	5.9	16	< 5.0	11	< 5	< 5	10	< 5.0
TPH (C16-C21)	µg/L	-			-	6.8	6.2	< 6	< 6.0	19	< 6	< 6	< 6.0	7.4	< 6	< 6	< 6.0	< 6.0	6.5	< 6	< 6	< 6.0	< 6.0
TPH (C21-C30)	µg/L	-			-	16	< 10	< 10	12	30	< 10	< 10	12	40	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
TPH (C30-C35)	µg/L	-			-	13	< 5	< 5	< 5.0	37	< 5	< 5	< 5.0	11	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5	< 5.0	< 5.0
TPH (C35-C40)	µg/L	-			-	< 8.0	< 8	< 8	18	15	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8	< 8.0	< 8.0
TPH Sum (C10-C40)	µg/L	-			-	49	< 38	< 38	38	150	< 38	< 38	< 38	69	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38
Inorganic Compounds																							
Bromide	mg/L	-			0.01	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.3	< 0.30	< 0.30
Chloride	mg/L	-	230		250	5.5	5.3	5	4.9	5.6	5.1	4.9	4.7	5.3	5.5	4.8	5.3	0.96	1.3	0.33	0.35	0.28	4.4
Fluoride	mg/L	-		1.5	1.5	0.36	0.38	0.29	0.39	0.37	0.38	0.32	0.38	0.37	0.38	0.32	0.4	0.17	0.15	0.13	0.11	0.13	< 0.050
Sulphate	mg/L	-			400	1.1	9.7	1.3	1.1	3.3	2.3	11	1.4	0.79	5.4	2.9	1.6	<0.50	3.4	2.1	2	< 0.50	6.1
Inorganic Compounds		-																					
Ortho-phosphate (PO4-P)	mg P/L	-		-	2.2	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	0.23	< 0.0600	< 0.0600	0.1	< 0.060
Ortho-phosphate (PO4)	mg PO4/L	-		-		< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	0.074	< 0.02	< 0.02	0.033	< 0.020
Nitrate equivalent NO3-N	mg N/L	10.000		-		1.8	1.5	1.7	1.5	1.6	1.3	5.2	1.5	< 0.90	< 0.9000	< 0.9	< 0.90	< 0.90	< 0.9000	< 0.9	< 0.9	< 0.90	4.8
Nitrate (NO3)	mg/L			50	45	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.01	< 0.010	< 0.010
Nitrite as NO2-N	mg N/L			-		0.41	0.35	0.39	0.33	0.37	0.28	1.2	0.33	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.2	< 0.20	1.1
Nitrite (NO2)	mg/L			3	0.003	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.03	< 0.030	< 0.030
Ammonium (NH_4-N)	mg/L				0.5	< 0.050	0.065	< 0.05	< 0.050	< 0.050	0.051	< 0.05	< 0.050	0.4	0.11	0.13	< 0.050	0.069	< 0.05	< 0.05	0.068	< 0.050	< 0.050
Ammonia (NH_4)	mg/L					< 0.065	0.084	< 0.065	< 0.065	< 0.065	0.066	< 0.065	< 0.065	0.52	0.14	0.17	< 0.065	0.089	< 0.0650	< 0.065	0.087	< 0.065	< 0.065
miscellaneous research																							
Turbidity	NTU				25																		
Total coliforms	cfu/100ml																						

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Determinands not analysed in 2016/2017

Note: USEPA standard applied where no EAS12:2014 standard exists

Sample Location						SW01	SW01	SW01	SW01	SW2	SW02	SW02	SW03	SW03	SW03	SW04	SW04	SW04	SW04	SW05	SW05D	SW05	SW05	SW05	SW06	SW06	SW06	SW06	SW12	SW12[A]	SW12	SW12	SW17
Certificate number																																	
Date sampling						10-Feb-14	23-Apr-14	28-Jun-14	30-Sep-14	10-Feb-14	24-Apr-14	26-Jun-14	10-Feb-14	27-Jun-14	28-Sep-14	10-Feb-14	24-Apr-14	28-Jun-14	30-Sep-14	11-Feb-14	11-Feb-14	26-Apr-14	29-Jun-14	25-Sep-14	13-Feb-14	27-Apr-14	02-Jul-14	25-Sep-14	10-Feb-14	21-Apr-14	28-Jun-14	26-Sep-14	26-Jun-14
Location description						Tangi River near MFNP entrance				Opengor/Ajai River in MFNP			Kituna river in MFNP			Victoria Nile, near delta, MFNP				Victoria Nile at Paraa Ferry, MFNP					Victoria Nile 4 km upstream of Paraa Ferry, MFNP				Albert Nile at Pakwach village				Small pool near Tangi River in MFNP
Analysis	Unit	USEPA Water Quality Human Health Criteria	USEPA Water Quality Aquatic Life Criteria	WHO Guidelines (4th Edition 2011)	EAS 12:2014																												
Physical and chemical analyses																																	
pH		5.0 - 9.0	6.5-9		5.5-8.5	6.84	7.53	7.62	7.59	6.86	7.93	8.43	6.88	6.61	7.52	6.85	7.58	7.7	7.16	6.86	6.86	7.46	8.01	7.33	6.85	7.99	7.88	7.47	6.84	8.05	8.96	8.02	6.87
Temperature, C						28.33	32.61	26.73	27.89	24.4	29.89	31.69	27.72	26.36	33.71	29.29	28.71	30.52	29.02	26.48	26.48	28.83	28.74	29.11	26.28	29.25	27.83	27.81	28.63	29.13	29.35	28.68	26.33
EC, uS/cm					2500	278	240	378.7	204.3	375	243.7	403	141	74.3	0.2	81	113	120.8	122.5	79	79	117.3	119	117	81	115.6	118.2	118	196	281.1	264.4	187.2	1,187.30
ORP, mV						-107.9	59.6	47.4	59.3	-6.3	50.9	46.7	-24.8	126.9	41.2	3	128.8	45.5	71.8	21.5	21.5	57.5	39.8	90	44.1	68.6	43.5	68.1	-49	45.7	31.8	38.6	-91.7
Diss. O_2, mg/L						5.32	5.16	3.59	6.62	5.7	6.92	7.16	2.92	1.34	6.84	6.35	7.3	7.99	5.39	8.02	8.02	8.72	10.3	9.33	8.99	9.39	8.94	8.55	4.59	6.9	9.69	7.15	0.02
Resistivity, Ω-cm						3,600	4,220	2,556	4,641	2,700	3,752	2,200	7,100	13,119	4,012,066	12,400	8,260	7,486	7,585	12,600	12,600	7,941	7,842	7,927	12,300	8,001	8,028	8,043	5,100	3,298	3,492	4,978	821
Salinity, PSU						0.13	0.1	0.2	0.1	0.18	0.1	0.2	0.06	0	0	0.04	0.1	0.1	0.1	0.04	0.04	0.1	0.1	0.1	0.06	0.1	0.1	0.1	0.09	0.1	0.1	0.1	0.6
TDS, mg/L					1500	935	156	246	133	188	158	262	70	48	0	40	73	79	80	40	40	76	77	76	41	75	77	77	98	183	172	122	772
Metals																																	
Arsenic (As)**	mg/L	0.018	0.15	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Barium (Ba)**	mg/L	0.1		0.7	0.7	0.17	0.16	0.19	0.23	0.11	0.08	0.078	0.17	0.53	0.2	<0.050	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.057	0.13	0.053	<0.050	0.31
Uranium (U)	µg/L	-		0.03	-	-	< 0.0002	0.0008	0.0034	-	< 0.0002	0.0004	-	< 0.0002	0.0007	-	< 0.0002	< 0.0002	< 0.0002	-	-	< 0.0002	< 0.0002	< 0.0002	-	< 0.0002	< 0.0002	< 0.0002	-	0.0002	0.0002	< 0.0002	0.0005
Calcium	mg/L			-	150	40	18	40	21	30	15	30	16	22	9.5	7.5	7.6	9.4	8.6	8.3	8.2	8.8	9.4	8.3	7.8	7.8	9.5	8.5	10	83	11	8.8	34
Cadmium (Cd)**	mg/L	0.005	0.00025	0.003	0.003	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040	< 0.00040
Cobalt (Co)	µg/L	-		-	-	< 3.0	3	< 3	4.3	< 3.0	< 3	< 3	5.1	5.1	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0	< 3.0	< 3	< 3	< 3.0	9
Chromium (Cr)**	mg/L	0.01	0.0074	0.05	0.05	< 0.001	0.0036	0.0015	0.0017	< 0.001	0.0071	0.0021	< 0.001	0.0034	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0062
Copper (Cu)**	mg/L	1.3		2	1	< 0.005	0.0056	< 0.005	0.0067	< 0.005	0.0052	< 0.005	< 0.005	0.016	0.0062	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.015
Iron (Fe)	mg/L	-	1	-	0.3	0.93	2.6	1.1	2.5	0.82	4	0.67	1.9	5	1.8	0.44	0.55	0.41	1.1	0.22	0.23	0.59	0.53	0.56	0.28	0.4	0.44	0.58	0.23	0.58	0.18	0.28	9.5
Mercury (Hg)**	mg/L	-	0.00077	0.006	0.001	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050
Magnesium	mg/L				100	17	7.6	15	9.4	12	7.2	12	5.5	5.4	2.9	3.2	3.1	3.4	3.5	3.7	3.7	3.2	3.3	3.4	3.2	3.1	3.4	3.4	12	42	10	6.6	15
Manganese	mg/L	50		-	0.1	0.22	0.2	0.37	0.26	0.12	0.079	0.032	0.53	0.31	0.07	0.027	0.039	0.025	0.086	0.024	0.025	0.035	0.037	0.05	0.023	0.03	0.033	0.043	0.026	< 0.01	0.016	0.025	0.79
Nickel (Ni)**	mg/L	0.61	0.0052	0.07	0.02	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0088	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.018
Lead (Pb)**	mg/L	-	0.0025	0.01	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0053
Potassium	mg/L			-	-	6	7.7	5.7	4.2	7.7	6.8	5.8	5.5	6.1	6.5	3.3	3.7	3.8	3.8	3.9	3.9	3.8	3.7	3.4	3.3	3.7	3.9	3.5	19	5	16	9	10
Sodium	mg/L			-	200	33	14	29	13	77	25	45	28	7.6	4	12	11	13	13	13	13	12	12	12	12	12	13	12	32	83	28	19	190
Zinc (Zn)**	mg/L	7.4	0.12	-	5	0.017	0.09	< 0.01	< 0.01	< 0.01	0.037	< 0.01	0.012	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	0.011	0.056	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.38	< 0.01	< 0.01	0.018
Mono Aromatic Hydrocarbons																																	
Benzene	µg/L	2.2		10	10	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.34	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
Toluene	µg/L	1300		700	700	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
Ethylbenzene	µg/L	530		300	-	< 0.20	0.22	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	1.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.71	0.25	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
o-Xylene	µg/L	-		-	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.36	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
m,p-Xylene	µg/L	-		-	-	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	< 0.2
Xylenes (sum)	µg/L	-		500	500	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.40	< 0.4	< 0.4	< 0.40	< 0.4
BTEX (sum)	µg/L	-		-	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Petroleum Hydrocarbons																																	
TPH (C10-C12)	µg/L	-			-	5.4	< 4	4.6	< 4.0	< 4.0	< 4	< 4	< 4.0	< 4	< 4.0	< 4.0	< 4	< 4	< 4.0	5.4	< 4.0	< 4	< 4	< 4.0	< 4.0	< 4	< 4	4.2	< 4.0	< 4	< 4	4	< 4
TPH (C12-C16)	µg/L	-			-	< 5.0	< 5	< 5	10	< 5.0	15	< 5	< 5.0	< 5	5.4	< 5.0	< 5	< 5	6.8	< 5.0	9.3	< 5	< 5	< 5.0	< 5.0	< 5	< 5	5.1	7.5	12	< 5	10	< 5
TPH (C16-C21)	µg/L	-			-	< 6.0	< 6	7.9	< 6.0	< 6.0	< 6	6.1	< 6.0	< 6	7.9	< 6.0	8.9	6.9	< 6.0	< 6.0	19	< 6	< 6	< 6.0	< 6.0	< 6	< 6	8.5	6.9	< 6	< 6	< 6.0	< 6
TPH (C21-C30)	µg/L	-			-	12	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	13	< 10	< 10	13	40	< 10	< 10	< 10	13	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
TPH (C30-C35)	µg/L	-			-	< 5.0	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0	8.3	17	5.1	< 5	< 5.0	11	< 5	< 5	< 5.0	< 5.0	< 5	< 5	< 5.0	< 5
TPH (C35-C40)	µg/L	-			-	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8.0	< 8	< 8	< 8.0	< 8
TPH Sum (C10-C40)	µg/L	-			-	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	93	< 38	< 38	< 38	38	< 38	< 38	< 38	< 38	< 38	< 38	< 38	< 38
Inorganic Compounds																																	
Bromide	mg/L	-			0.01	< 0.30	< 0.3	< 0.3	< 0.30	< 0.60	< 0.3	< 0.3	< 0.30	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.30	< 0.3	< 0.3	< 0.30	< 0.3
Chloride	mg/L	-	230		250	13	4.9	< 0.2	2	48	13	22	1.5	2.6	1.7	5.7	5	5	5.5	5.6	5.6	5	4.9	4.8	5.5	5.3	5	4.8	12	9.1	9.4	7.1	220
Fluoride	mg/L	-		1.5	1.5	0.82	0.39	< 0.05	0.3	2	0.72	1.1	0.39	0.22	0.22	0.43	0.3	0.3	0.39	0.38	0.4	0.38	0.31	0.37	0.38	0.39	0.3	0.38	0.57	0.19	0.7	0.43	0.63
Sulphate	mg/L	-			400	13	8	1.5	2.8	53	16	24	4.1	3.6	1.1	0.71	1.7	2.9	1.3	0.9	1.3	1.9	1.3	1.5	1	8.6	2.7	1.9	4.9	46	28	2.9	27
Inorganic Compounds																																	
Ortho-phosphate (PO4-P)	mg P/L	-		-	2.2	0.4	0.59	0.36	0.34	0.28	0.41	0.4	< 0.060	0.34	0.26	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.060	< 0.0600	< 0.0600	< 0.060	< 0.0600
Ortho-phosphate (PO4)	mg PO4/L	-		-	-	0.13	0.19	0.12	0.11	0.093	0.13	0.13	< 0.020	0.11	0.086	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.020	< 0.02	< 0.02	< 0.020	< 0.02
Nitrate equivalent NO3-N	mg N/L	10.000		-	-	0.97	1.2	< 0.9	< 0.90	< 0.90	< 0.9000	< 0.9	< 0.90	4.1	< 0.90	1.2	1.1	0.93	< 0.90	1.6	2.5	1.1	1.3	1.4	1.5	1.4	1.6	1.4	2.3	1.2	1.1	1.2	< 0.9
Nitrate (NO3)	mg/L			50	45	< 0.010	0.031	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	0.01	0.011	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.010	< 0.01	< 0.01	< 0.010	< 0.01
Nitrite as NO2-N	mg N/L			-	-	0.22	0.26	< 0.2	< 0.20	< 0.20	< 0.2	< 0.2	< 0.20	0.92	< 0.20	0.28	0.26	0.21	< 0.20	0.37	0.57	0.25	0.28	0.31	0.34	0.32	0.35	0.32	0.53	0.26	0.24	0.27	< 0.2
Nitrite (NO2)	mg/L			3	0.003	< 0.030	0.1	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	0.033	0.046	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.030	< 0.0300	< 0.03	< 0.030	< 0.03
Ammonium (NH_4-N)	mg/L				0.5	< 0.050	0.067	0.06	< 0.050	0.11	0.053	< 0.05	0.14	< 0.05	< 0.050	< 0.050	< 0.05	0.082	< 0.050	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050	< 0.050	< 0.05	< 0.05	< 0.050	0.1	< 0.05	< 0.05	< 0.050	0.051
Ammonia (NH_3)	mg/L					< 0.065	0.086	0.077	< 0.065	0.14	0.068	< 0.065	0.18	< 0.065	< 0.065	< 0.065	< 0.0650	0.11	< 0.065	< 0.065	< 0.065	< 0.0650	< 0.065	< 0.065	< 0.065	< 0.0650	< 0.065	< 0.065	< 0.065	0.13	< 0.0650	< 0.065	< 0.065	0.066
miscellaneous research																																	
Turbidity	NTU				25																												
Total coliforms	cfu/100ml																																

** Results converted µg/L to mg/L

Exceedance of EAS 12:2014

Determinands not analysed in 2016/2017

Note: USEPA standard applied where no EAS12:2014 standard exists

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POBox 1419 AL AIN
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Certificate of analysis

Date: 30-Nov-2016

Please find enclosed the analytical results of the test carried out for the project.

Certificate number/Version	2016138581/1
Your project number	Buliisa
Your project name	Buliisa
Your order number	
Samples received on	23-Nov-2016

This Certificate of Analysis shall not be reproduced except in full, without written approval of the laboratory. The results only relate to the items tested.

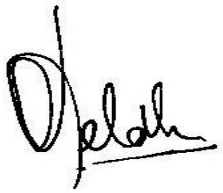
Soil samples will be stored for a period of 4 weeks and water samples for a period of 2 weeks after receipt of the samples at our laboratory. Without any additional request, samples will be disposed when the above mentioned periods have expired. If you require Eurofins Analytico to store the samples for a longer period, please complete this page and return it to Eurofins Analytico at least one businessday before the period is due to expire. The costs of prolonged storage periods may be found in our pricelist.

Storage period:
Date: Name: Signature:

We are confident that we have performed the order in accordance with your expectations. If you have any remaining questions concerning this Certificate of Analysis, please don't hesitate to contact our Customer Service.

Yours sincerely,

Eurofins Analytico B.V.



Ing. A. Veldhuizen
Technical Manager

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Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016138581/1
Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:52
		Annex	A,B,C,D
Sampled by		Page	1/4
Sample matrix	Water; Surface water		

	Analysis	Unit	1	2	3	4	5
	Metals		SW1	SW2	SW6	SW7	SW9
Q	Aluminum (Al)	mg/L	0.15	5.0	0.27	0.18	0.48
Q	Arsenic (As)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Barium (Ba)	µg/L	80	81	87	84	<50
	Uranium (U)	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Q	Cadmium (Cd)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	Cobalt (Co)	µg/L	<3.0	6.4	<3.0	<3.0	<3.0
Q	Chromium (Cr)	µg/L	<1.0	16	<1.0	<1.0	1.6
Q	Copper (Cu)	µg/L	<5.0	10	<5.0	<5.0	<5.0
	Iron (Fe)	mg/L	4.2	7.5	0.39	0.26	0.82
Q	Mercury (Hg)	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
	Manganese (Mn)	mg/L	0.14	0.18	0.016	<0.010	0.036
Q	Nickel (Ni)	µg/L	<5.0	9.0	<5.0	<5.0	<5.0
Q	Lead (Pb)	µg/L	250	5.1	<5.0	<5.0	<5.0
Q	Zinc (Zn)	µg/L	<10	15	<10	<10	<10
	Mono Aromatic Hydrocarbons						
Q	Benzene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20	0.33	<0.20	<0.20
Q	Ethylbenzene	µg/L	<0.20	<0.20	0.29	<0.20	<0.20
Q	o-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
	TPH						
	TPH (C10-C12)	µg/L	<10	<10	<10	<10	<10
	TPH (C12-C16)	µg/L	<10	<10	<10	<10	<10
	TPH (C16-C21)	µg/L	<10	<10	<10	<10	<10
	TPH (C21-C30)	µg/L	<15	<15	<15	<15	<15
	TPH (C30-C35)	µg/L	<10	<10	<10	<10	<10
	TPH (C35-C40)	µg/L	<10	<10	<10	<10	<10
Q	TPH Sum (C10-C40)	µg/L	<38	<38	<38	<38	<38

No.	Sample description	Date sampling	Sample nr.
1	SW1-161104	04-Nov-2016	9288107
2	SW2-161104	04-Nov-2016	9288108
3	SW6-161105	04-Nov-2016	9288109
4	SW7-161105	04-Nov-2016	9288110
5	SW9-161105	04-Nov-2016	9288111

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Your project number	Buliisa	Certificate number/Version	2016138581/1
Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:52
		Annex	A,B,C,D
Sampled by		Page	2/4
Sample matrix	Water; Surface water		

	Analysis	Unit	1	2	3	4	5
	Physical and chemical analyses						
Q	Total suspended solids	mg/L	27	430	37	18	92
	Inorganic Compounds						
Q	Bromide	mg/L	<0.050	<0.050	0.051	0.058	<0.050
Q	Chloride	mg/L	0.31	1.3	20 [1)]	20	4.8
	Fluoride	mg/L	0.40	0.093	0.78	0.78	0.33
Q	Sulphate	mg/L	0.75	4.2	12	12	1.4
	Inorganic Compounds						
Q	Ortho-phosphate (P04-P)	mg P/L	<0.020	0.12	0.020	0.028	<0.020
Q	Ortho-phosphate (P04)	mg P04/L	<0.060	0.38	0.061	0.086	<0.060
Q	Nitrate equivalent N03-N	mg N/L	0.44	0.85	0.21	<0.20	0.33
Q	Nitrate (N03)	mg/L	1.9	3.8	0.93	<0.90	1.5
Q	Nitrite as N02-N	mg N/L	0.013	0.020	0.14	0.097	<0.010
Q	Nitrite (N02)	mg/L	0.043	0.066	0.46	0.32	<0.030

No.	Sample description	Date sampling	Sample nr.
1	SW1-161104	04-Nov-2016	9288107
2	SW2-161104	04-Nov-2016	9288108
3	SW6-161105	04-Nov-2016	9288109
4	SW7-161105	04-Nov-2016	9288110
5	SW9-161105	04-Nov-2016	9288111

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Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016138581/1
Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:52
		Annex	A,B,C,D
Sampled by		Page	3/4
Sample matrix	Water; Surface water		

	Analysis	Unit	6	7	8	9
	Metals					
Q	Aluminum (Al)	mg/L	0.16	0.17		<0.10
Q	Arsenic (As)	µg/L	<5.0	<5.0		<5.0
Q	Barium (Ba)	µg/L	<50	<50		<50
	Uranium (U)	µg/L	<5.0	<5.0		<5.0
Q	Cadmium (Cd)	µg/L	<0.40	<0.40		<0.40
Q	Cobalt (Co)	µg/L	<3.0	<3.0		<3.0
Q	Chromium (Cr)	µg/L	<1.0	<1.0		16
Q	Copper (Cu)	µg/L	<5.0	<5.0		<5.0
	Iron (Fe)	mg/L	0.38	0.39		<0.050
Q	Mercury (Hg)	µg/L	<0.050	<0.050		<0.050
	Manganese (Mn)	mg/L	0.026	0.028		<0.010
Q	Nickel (Ni)	µg/L	<5.0	<5.0		<5.0
Q	Lead (Pb)	µg/L	<5.0	<5.0		<5.0
Q	Zinc (Zn)	µg/L	<10	<10		<10
	Mono Aromatic Hydrocarbons					
Q	Benzene	µg/L	<0.20	<0.20	<0.20	<0.20
Q	Toluene	µg/L	<0.20	<0.20	<0.20	<0.20
Q	Ethylbenzene	µg/L	<0.20	<0.20	<0.20	0.43
Q	o-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20
Q	m,p-Xylene	µg/L	<0.20	<0.20	<0.20	<0.20
Q	Xylenes (sum)	µg/L	<0.40	<0.40	<0.40	<0.40
Q	BTEX (sum)	µg/L	<1.0	<1.0	<1.0	<1.0
	TPH					
	TPH (C10-C12)	µg/L	<10	<10		<10
	TPH (C12-C16)	µg/L	<10	<10		<10
	TPH (C16-C21)	µg/L	11	<10		<10
	TPH (C21-C30)	µg/L	27	<15		<15
	TPH (C30-C35)	µg/L	12	<10		<10
	TPH (C35-C40)	µg/L	<10	<10		<10
Q	TPH Sum (C10-C40)	µg/L	61	<38		<38

No.	Sample description	Date sampling	Sample nr.
6	SW10-161105	04-Nov-2016	9288112
7	SWFD-161105	04-Nov-2016	9288113
8	TB1-161104	04-Nov-2016	9288114
9	SWRB-161105	04-Nov-2016	9292916

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Certificate of analysis

Your project number	Buliisa	Certificate number/Version	2016138581/1
Your project name	Buliisa	Start date	23-Nov-2016
Your order number		Report date	30-Nov-2016/14:52
		Annex	A,B,C,D
Sampled by		Page	4/4
Sample matrix	Water; Surface water		

	Analysis	Unit	6	7	8	9
	Chromatogram		See annex			
	Physical and chemical analyses					
Q	Total suspended solids	mg/L	12	16		
	Inorganic Compounds					
Q	Bromide	mg/L	<0.050	<0.050		<0.050
Q	Chloride	mg/L	5.0	5.0		<0.10
	Fluoride	mg/L	0.34	0.34		<0.050
Q	Sulphate	mg/L	1.5	1.6		0.46
	Inorganic Compounds					
Q	Ortho-phosphate (P04-P)	mg P/L	<0.020	<0.020		<0.020
Q	Ortho-phosphate (P04)	mg P04/L	<0.060	<0.060		<0.060
Q	Nitrate equivalent N03-N	mg N/L	0.33	0.34		<0.20
Q	Nitrate (N03)	mg/L	1.5	1.5		<0.90
Q	Nitrite as N02-N	mg N/L	<0.010	<0.010		<0.010
Q	Nitrite (N02)	mg/L	<0.030	<0.030		<0.030

No.	Sample description	Date sampling	Sample nr.
6	SW10-161105	04-Nov-2016	9288112
7	SWFD-161105	04-Nov-2016	9288113
8	TB1-161104	04-Nov-2016	9288114
9	SWRB-161105	04-Nov-2016	9292916

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Annex (A) concerning subsample information referring to certificate of analysis 2016138581/1

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9288107					0610146153	SW1-161104
9288107					0691714016	
9288107					0805033038	
9288107					0625006404	
9288107					0675075953	
9288108					0610146154	SW2-161104
9288108					0691714036	
9288108					0625006411	
9288108					0805030130	
9288108					0675075929	
9288109					0610145945	SW6-161105
9288109					0691713572	
9288109					0805033112	
9288109					0625006459	
9288109					0675075948	
9288110					0610145949	SW7-161105
9288110					0691713588	
9288110					0805033041	
9288110					0625006412	
9288110					0675075955	
9288111					0610145946	SW9-161105
9288111					0691713590	
9288111					0625006462	
9288111					0805030018	
9288111					0675075886	
9288112					0610145941	SW10-161105
9288112					0691713585	
9288112					0625006433	
9288112					0805030145	
9288112					0675075869	
9288113					0610145950	SWFD-161105
9288113					0691713582	
9288113					0625006450	
9288113					0805030161	
9288113					0675075885	
9288114					0670179722	TB1-161104
9292916					0691713547	SWRB-161105

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Annex (A) concerning subsample information referring to certificate of analysis 2016138581/1

Sample nr.	Drill-#	Description	From	To	Barcode	Sample description
9292916					0805032919	SWRB-161105
9292916					0625006458	
9292916					0675075879	

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Annex (B) concerning remarks referring to certificate of analysis 2016138581/1

Remark 1)

Indicative value(s) due to interfering matrix.

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Annex (C): method references belonging to certificate of analysis 2016138581/1

Analysis	Method	Technique	Method reference
Copper (Cu)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Manganese (Mn)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Aluminium (Al)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Arsenic (As)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Barium (Ba)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
ICP-MS Uranium (U)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Cadmium (Cd)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Cobalt (Co)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Chromium (Cr)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Iron (Fe)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Mercury (Hg)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Nickel (Ni)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Lead (Pb)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Zinc (Zn)	W0421	ICP-MS	Acc. NEN-EN-ISO 17294-2 / CMA2/I/B.5
Aromatics (BTEX)	W0254	HS-GC/MS	In accordance with ISO 11423-1 / CMA 3/E
TPH (GC) (C10 - C40)	W0215	LVI-GC-FID	In house method
Chromatogram oil (GC)	W0215	LVI-GC-FID	In house method
Total suspended solids (TSS)	W0552	Gravimetry	I.a.w. NEN 6499 & NEN 6484
Bromide (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Chloride (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Fluoride (ion chromatography)	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Sulphate	W0504	Ion Chromatography	I.a.w. NEN-EN-ISO 10304-1
Ortho-phosphate	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Nitrate	W0566	Spectrometry	In accordance with NEN-ISO 15923-1
Nitrite	W0566	Spectrometry	In accordance with NEN-ISO 15923-1

Additional information about the applied methods as well as the classification of the accuracy, are listed in our supplement: "Specification of methods of analyses", version June 2016.

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Annex (D) remarks concerning the sampling and preservation period 2016138581/1

Non compliance(s) of the criteria is(are) observed that may have influenced the accuracy of the test results of samples mentioned below.

	Sample nr.
The temperature of the samples received at the laboratory, exceded the limit.	9288107 9288108 9288109 9288110 9288111 9288112 9288113 9288114 9292916

Analysis	Sample nr.
The preservation term for this parameter has been expired.	
Nitrate (N03)	9288107 9288108 9288109 9288110 9288111 9288112 9288113 9292916
Nitrite (N02)	9288107 9288108 9288109 9288110 9288111 9288112 9288113 9292916
Suspended solids	9288107 9288108 9288109 9288110 9288111 9288112 9288113

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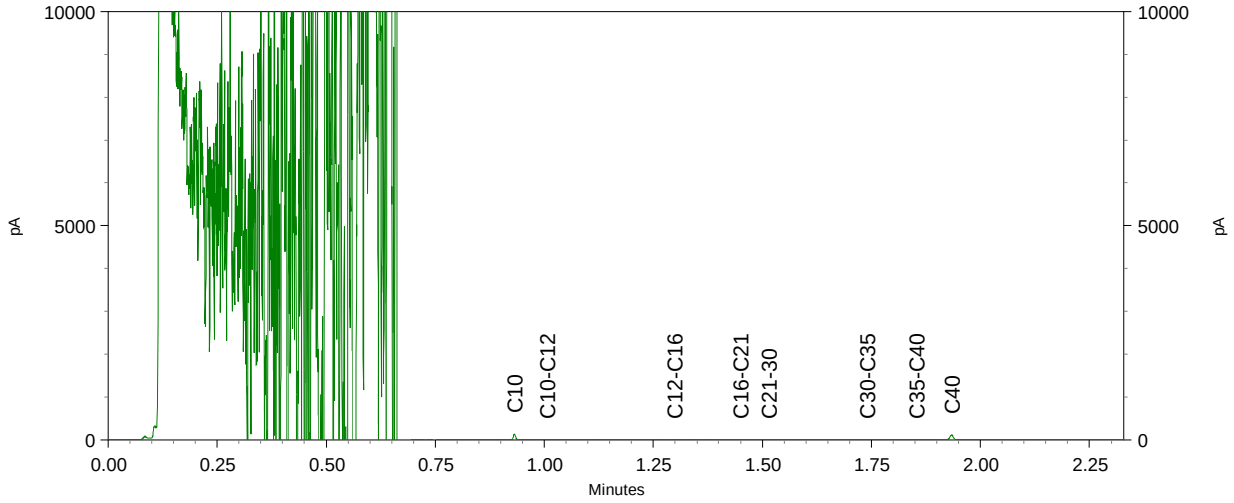
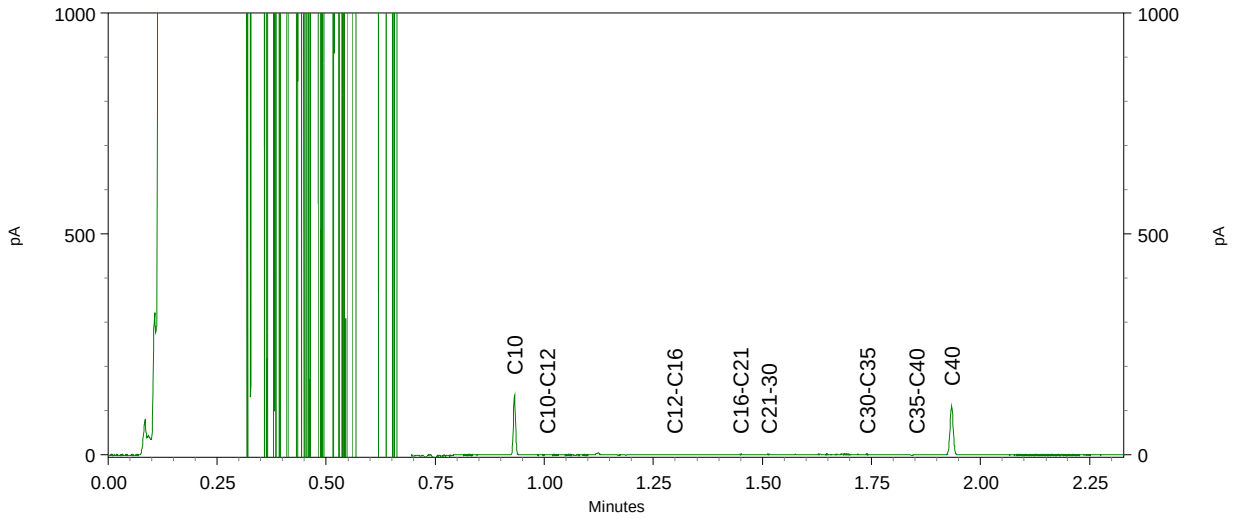
BNP Paribas S.A. 227 9245 25
VAT/BTW No. NL 8043.14.883.B01
KvK No. 09088623
IBAN: NL71BNPA0227924525
BIC: BNPANL2A

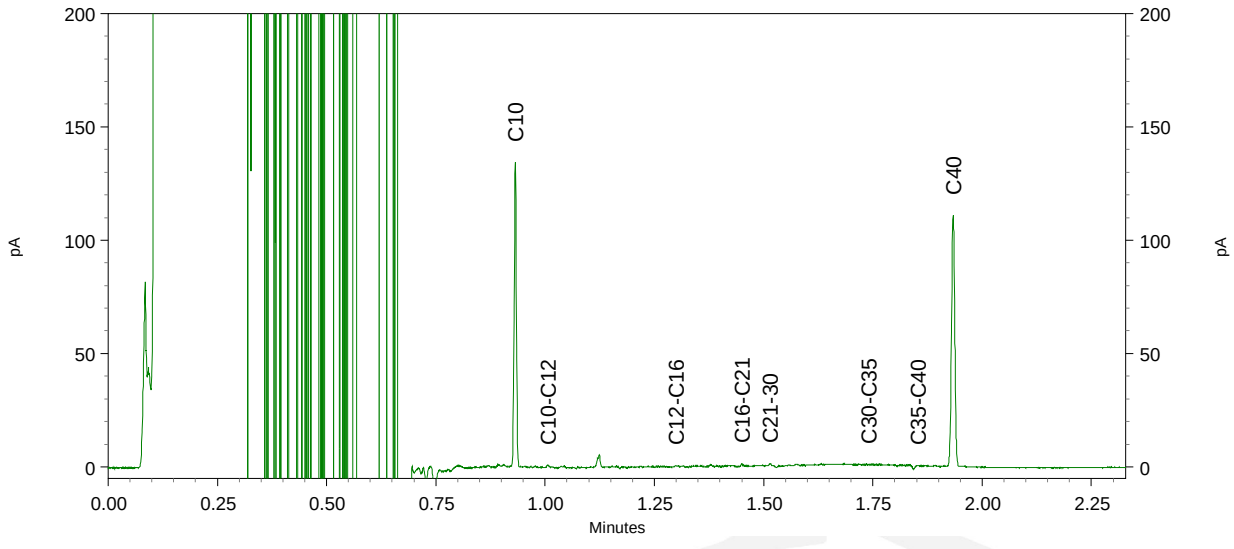
eurofins | analytico®

Chromatogram TPH/ Mineral Oil

Sample ID.: 9288112
Certificate no.: 2016138581
Sample description.: SW10-161105
V







Annex 03: Sediment Samples Analysis Results From 2016 – 2017 ESIA Field Campaigns

Sample Location			SE1	SE2	SE3	SE4	SE5	SE5 B/BN
Certificate number			SE2-1612	SE3-1612	SE1-1612	SE4-161106	SE5-170614 B/BS	SE5-170614 B/BN
Date sampling			16/12/2016	16/12/2016	16/12/2016	06/11/2016	14-06-2017	14-06-2017
Location descritpion			Victoria Nile central channel	Victoria Nile 8 m from south bank	Victoria Nile 10 m from north bank	Lake Albert near shore	Bridge Barge crossing on the north bank of the Nile	Bridge Barge crossing on the south bank of the Nile
Analysis	Units	TEC (McDonald et al)						
Metals								
Arsenic (As)	mg/kg	9.8	<3.0	<3.0	<3.0	<3.0	<4.0	<4.0
Antimony (Sb)	mg/kg	2	<3.0	<3.0	<3.0	<3.0	<1.0	<1.0
Barium (Ba)	mg/kg		11	29	140	58	230	<15
Beryllium (Be)	mg/kg		<1.0	<1.0	1.2	<1.0	<1.0	<1.0
Cadmium (Cd)	mg/kg	0.99	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chromium (Cr)	mg/kg	43	7.8	9.1	50	15	110	27
Cobalt (Co)	mg/kg		<2.0	<2.0	11	2.1	21	2.4
Copper (Cu)	mg/kg	32	<3.0	<3.0	13	<3.0	32	<5.0
Mercury (Hg)	mg/kg	0.18	<0.050	<0.050	<0.050	<0.050	0.05	<0.050
Lead (Pb)	mg/kg	36	<3.0	<3.0	7.5	<3.0	14	<13
Molybdenum (Mo)	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.5	<1.5
Nickel (Ni)	mg/kg	23	2.3	2.3	22	2.1	43	4.8
Selenium (Se)	mg/kg		<5.0	<5.0	<5.0	<5.0	8.9	1
Tin (Sn)	mg/kg		<5.0	<5.0	<5.0	<5.0	<6.0	<6.0
Vanadium (V)	mg/kg		3.9	4.2	41	18	96	15
Zinc (Zn)	mg/kg	120	<10	<10	30	<10	55	<17
Total Petrolem Hydrocarbons								
C10-C12 Petroleum Hydrocarbons	mg/kg		<3.0	<3.0	<3.0	<3.0	<12	<3.0
C12-C16 Petroleum Hydrocarbons	mg/kg		<5.0	<5.0	<5.0	<5.0	<20	<5.0
C16-C21 Petroleum Hydrocarbons	mg/kg		<6.0	<6.0	<6.0	<6.0	<24	<6.0
C21-C30 Petroleum Hydrocarbons	mg/kg		<12	<12	<12	<12	<48	<12
C30-C35 Petroleum Hydrocarbons	mg/kg		6.4	6	8.9	<6.0	<24	<6.0
C35-C40 Petroleum Hydrocarbons	mg/kg		<6.0	<6.0	<6.0	<6.0	<24	<6.0
Total Petroleum Hydrocarbons	mg/kg		<38	<38	<38	<38	<150	<38
Mono Aromatic Hydrocarbons								
Benzene	mg/kg	57	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Toluene	mg/kg	890	<0.050	<0.050	0.13	<0.050	<0.050	<0.050
Ethylbenzene	mg/kg	25	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
m-Xylene & p-Xylene	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
o-Xylene	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Xylenes, total	mg/kg	25	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
BTEX, summation	mg/kg		<0.25	<0.25	<0.25	<0.25	<0.25	<0.25

Sample Location			SE1	SE2	SE3	SE4	SE5	SE5 B/BN
Certificate number			SE2-1612	SE3-1612	SE1-1612	SE4-161106	SE5-170614 B/BS	SE5-170614 B/BN
Date sampling			16/12/2016	16/12/2016	16/12/2016	06/11/2016	14-06-2017	14-06-2017
Location descritpion			Victoria Nile central channel	Victoria Nile 8 m from south bank	Victoria Nile 10 m from north bank	Lake Albert near shore	Bridge Barge crossing on the north bank of the Nile	Bridge Barge crossing on the south bank of the Nile
Analysis	Units	TEC (McDonald et al)						
Polycyclic Aromatic Hydrocarbons, PAH								
Naphthalene	mg/kg	176	<0.010	<0.010	<0.010	<0.010	-	-
Acenaphtylene	mg/kg	5.9	<0.010	<0.010	<0.010	<0.010	-	-
Acenaphtene	mg/kg	6.7	<0.010	<0.010	<0.010	<0.010	-	-
Fluorene	mg/kg	77.4	<0.010	<0.010	0.012	<0.010	-	-
Phenanthrene	mg/kg	204	<0.010	0.022	0.018	<0.010	-	-
Anthracene	mg/kg	57.2	<0.010	0.017	<0.010	<0.010	-	-
Fluoranthene	mg/kg	423	<0.010	0.012	0.015	<0.010	-	-
Pyrene	mg/kg	195	<0.010	<0.010	0.011	<0.010	-	-
Benzo(a)anthracene	mg/kg	108	<0.010	<0.010	<0.010	<0.010	-	-
Chrysene	mg/kg	166	<0.010	<0.010	0.011	<0.010	-	-
Benzo(b)fluoranthene	mg/kg	240	<0.010	<0.010	0.012	<0.010	-	-
Benzo(k)fluoranthene	mg/kg	240	<0.010	<0.010	<0.010	<0.010	-	-
Benzo(a)pyrene	mg/kg	150	<0.010	<0.010	<0.010	<0.010	-	-
Dibenzo(ah)anthracene	mg/kg	108	<0.010	<0.010	<0.010	<0.010	-	-
Benzo(ghi)perylene	mg/kg	170	<0.010	<0.010	<0.010	<0.010	-	-
Indeno(123cd)pyrene	mg/kg	200	<0.010	<0.010	<0.010	<0.010	-	-
PAH 10 VROM (sum)	mg/kg		<0.10	<0.10	<0.10	<0.10	-	-
PAH 16 EPA (sum)	mg/kg	1,610	<0.16	<0.16	<0.16	<0.16	-	-
Physical and chemical analyses								
Acidity (pH-CaCl2)	Std units		7.6	8	5.2		5.5	8.5
Calcium (Ca)	mg/kg	-	-	-	-	-	4200	650
Potassium (K)	mg/kg	-	-	-	-	-	2700	100
Magnesium (Mg)	mg/kg	-	-	-	-	-	4600	200
Sodium (Na)	mg/kg	-	-	-	-	-	210	40
Phosphorus total (P)	mg/kg	-	-	-	-	-	0.55	0.061
Phosphorus total (PO4)	mg/kg	-	-	-	-	-	1.7	0.19
Phosphorus total (P2O5)	mg/kg	-	-	-	-	-	1.2	0.14
Inorganic Compounds	mg/kg	-	-	-	-	-		
Nitrite (NO2-N)	mg/kg	-	-	-	-	-	<0.20	<0.20
Nitrite (NO2)	mg/kg	-	-	-	-	-	<0.60	<0.60
Nitrate (NO3-N)	mg/kg	-	-	-	-	-	<2.0	<2.0
Nitrate (NO3)	mg/kg	-	-	-	-	-	<9.0	<9.0

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL1 S1		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160056
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	69.3
Biological Oxygen Demand – BOD5	mg/l	2.86

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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Reg Date 6 June 2013

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Client:	**AECOM**		
Description of Sample:	AL1 S2		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160057
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	72.6
Biological Oxygen Demand – BOD5	mg/l	2.66

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL2 S1		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160058
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	70.2
Biological Oxygen Demand – BOD5	mg/l	1.72

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL2 S2		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160059
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	72.1
Biological Oxygen Demand – BOD5	mg/l	2.10

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL1 4 S1		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160060
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0.01
Chemical Oxygen Demand - COD	mg/l	70.2
Biological Oxygen Demand – BOD5	mg/l	1.94

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL1 4 S2		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160061
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	68.6
Biological Oxygen Demand – BOD5	mg/l	1.82

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL1 4B S1		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160062
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	74.7
Biological Oxygen Demand – BOD5	mg/l	2.2

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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Client:	**AECOM**		
Description of Sample:	AL1 4B S2		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160063
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	67. 6
Biological Oxygen Demand – BOD5	mg/l	2.68

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL1 4B S2		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160063
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	67. 6
Biological Oxygen Demand – BOD5	mg/l	2.68

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL7 S1		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160064
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	65.3
Biological Oxygen Demand – BOD5	mg/l	2.39

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL7 S2		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160065
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	66.4
Biological Oxygen Demand – BOD5	mg/l	2.24

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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NYAMASOGA LABORATORY TEST REPORT

Client:	**AECOM**		
Description of Sample:	AL7 S3		
Condition of Sample:	Liquid Sample		
Sample Supplied By:	Gregg Somermeyer		
Instructed By:	Client		
Date Received:	06TH/12/2016	**Report Number**	ESUR20160066
Date analysis Started:	07TH/12/2016	**Date Report**	13/12/2016

Test Parameter	Units	Test Results
Basis of Test:	**Analysis on Sample as received**	
Ammonia	mg/l	0
Chemical Oxygen Demand - COD	mg/l	68.7
Biological Oxygen Demand – BOD5	mg/l	1.16

Name & Surname	Signature	Designation	Date
Andrew Wedulo		**Laboratory Technician**	**13/12/2016**

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TILENGA ESIA - APPENDIX M: Landscape and Visual

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Table of Contents

Figures

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Appendix M Landscape and Visual

M.1. Zone of Theoretical Visibility (ZTV)

A series of ZTVs have been prepared to illustrate the potential spread of visibility from each of the well pads in the north MFNP, individually and in-combination, shown on figures M.1-1 to M.1-11. ZTVs have been considered within the north MFNP to illustrate the theoretical visibility of long term change within the most sensitive part of this designated landscape. The production of ZTVs is one of the tools used to provide an indicative understanding of the potential spread of visibility, it is accepted that some short term operations would be more prominent such as drilling.

The ZTVs have been generated by analysis of a 3D digital elevation model (DEM) of the surrounding terrain and the Scheme using the following parameters:

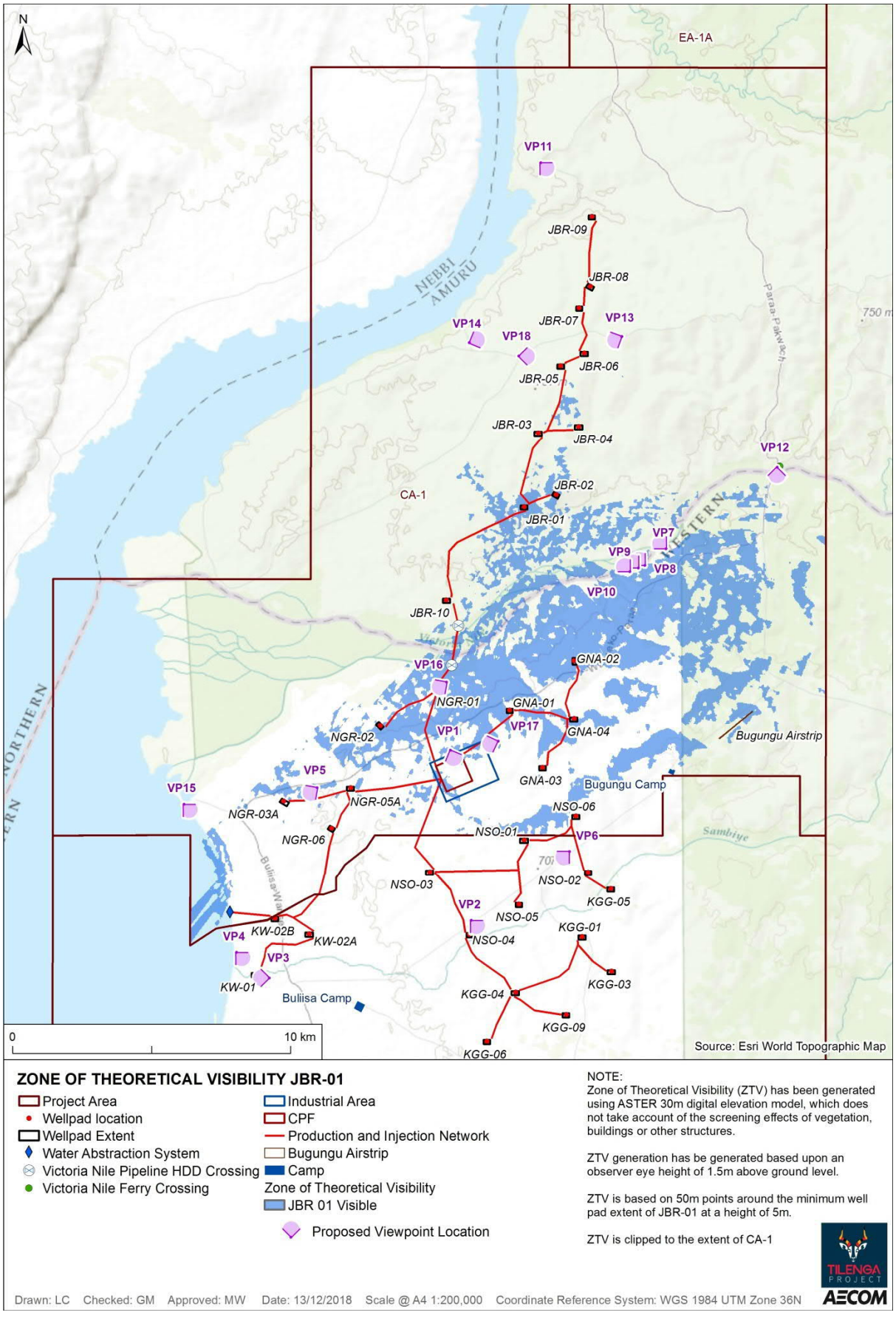
- Terrain model based on ASTER 30 metre (m) DEM dataset;
- Eye height of viewer set at 1.5 m; and
- Visibility assessed on the proposed well pad block height assumed at 5 m[1].

The output provides a graphical representation of the computer calculated inter-visibility between a viewer (at 1.5 m height) and the top of the 5 m block height.

M.1.1. Limitations

The ZTV is for illustrative purposes only and does not take into account the vegetation and micro topography between the 30 m DEM survey points. At the time of undertaking the ESIA, specific heights and dimensions of permanent Project components within the well pad sites were not available, however it is anticipated that no individual component would be greater than 5 m in height. Therefore ZTV is based on a block of 5 m rather than the individual Project component dimensions. The ZTV maps do not take account of the likely orientation of a viewer, such as the direction of travel and there is no allowance for reduction of visibility with distance, weather or light.
These limitations mean that the ZTV maps tend to overestimate the extent of the visibility, both in terms of the area from which the Project is visible and the extent of the Project, which is visible. It should be considered as a tool to assist in assessing the theoretical visibility of the Development and not a measure of the visual effect.

[1] It is accepted that some short term operations would be more prominent in height such as drilling however these are not permanent.



ZONE OF THEORETICAL VISIBILITY JBR-01

- Project Area
- Wellpad location
- Wellpad Extent
- Water Abstraction System
- Victoria Nile Pipeline HDD Crossing
- Victoria Nile Ferry Crossing
- Industrial Area
- CPF
- Production and Injection Network
- Bugungu Airstrip
- Camp
- Zone of Theoretical Visibility
- JBR 01 Visible
- Proposed Viewpoint Location

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using ASTER 30m digital elevation model, which does not take account of the screening effects of vegetation, buildings or other structures.

ZTV generation has be generated based upon an observer eye height of 1.5m above ground level.

ZTV is based on 50m points around the minimum well pad extent of JBR-01 at a height of 5m.

ZTV is clipped to the extent of CA-1

Drawn: LC Checked: GM Approved: MW Date: 13/12/2018 Scale @ A4 1:200,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT
AECOM

Figure M.1-1 Zone of Theoretical Visibility: JBR-01

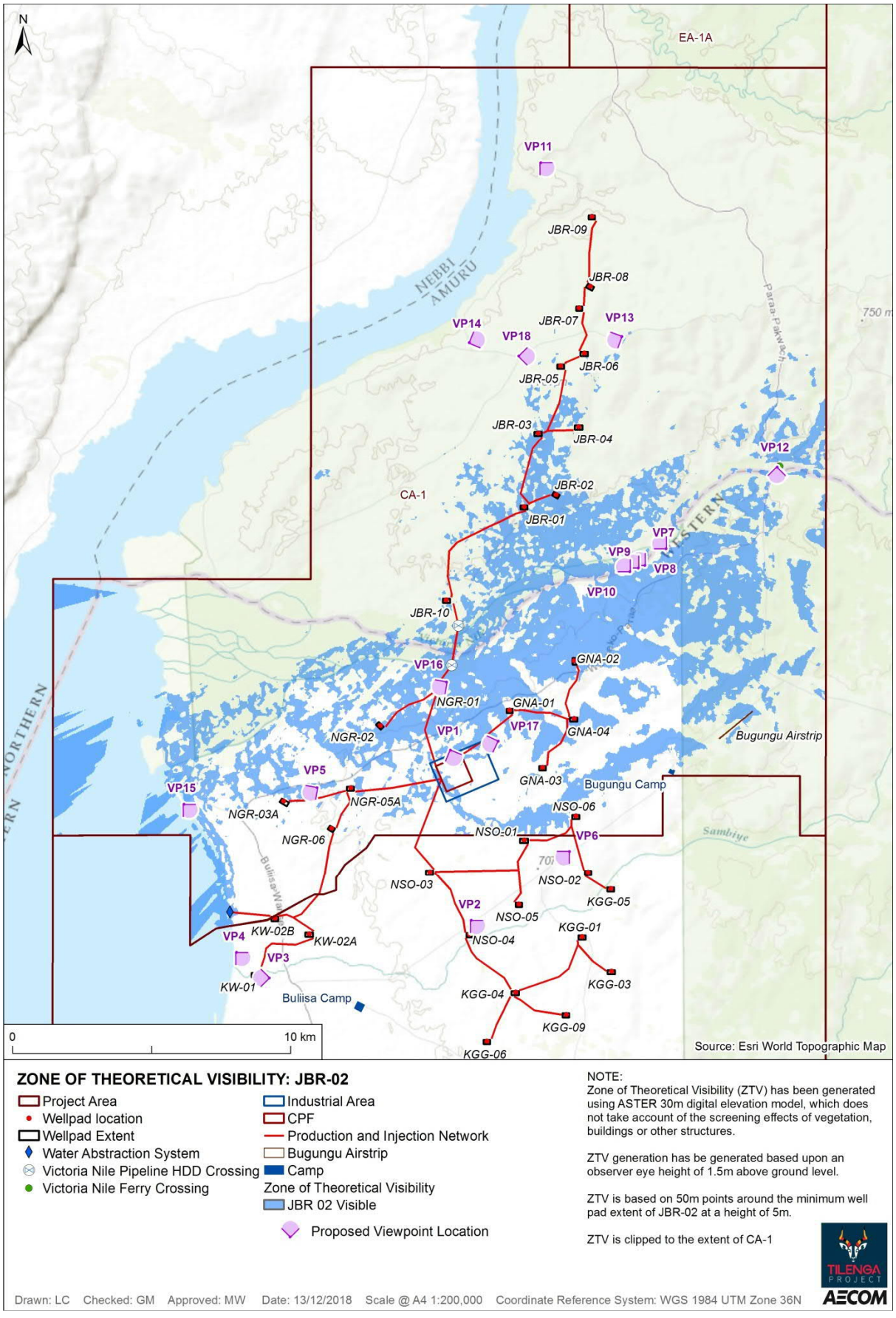


Figure M.1-2 Zone of Theoretical Visibility: JBR-02

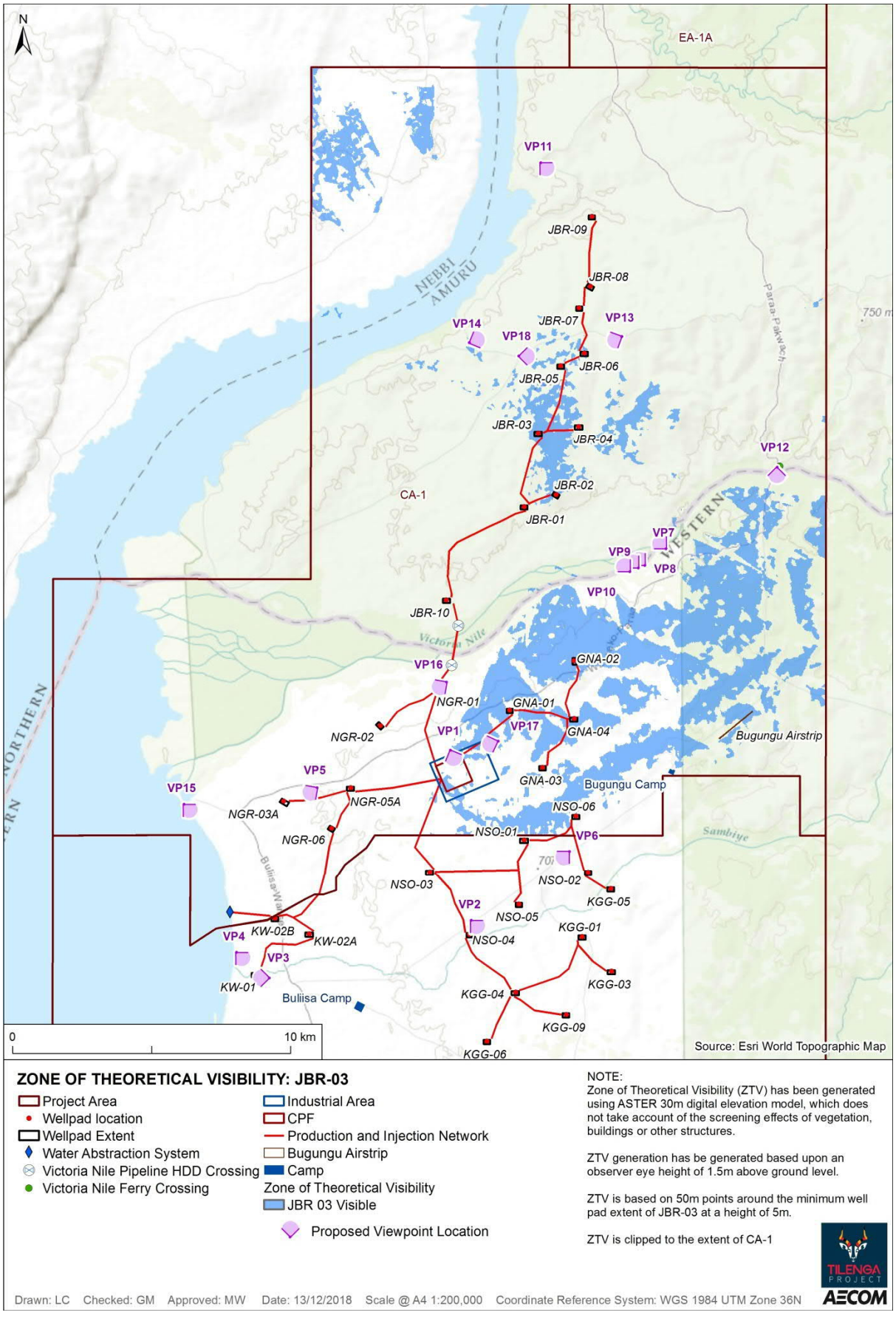


Figure M.1-3 Zone of Theoretical Visibility: JBR-03

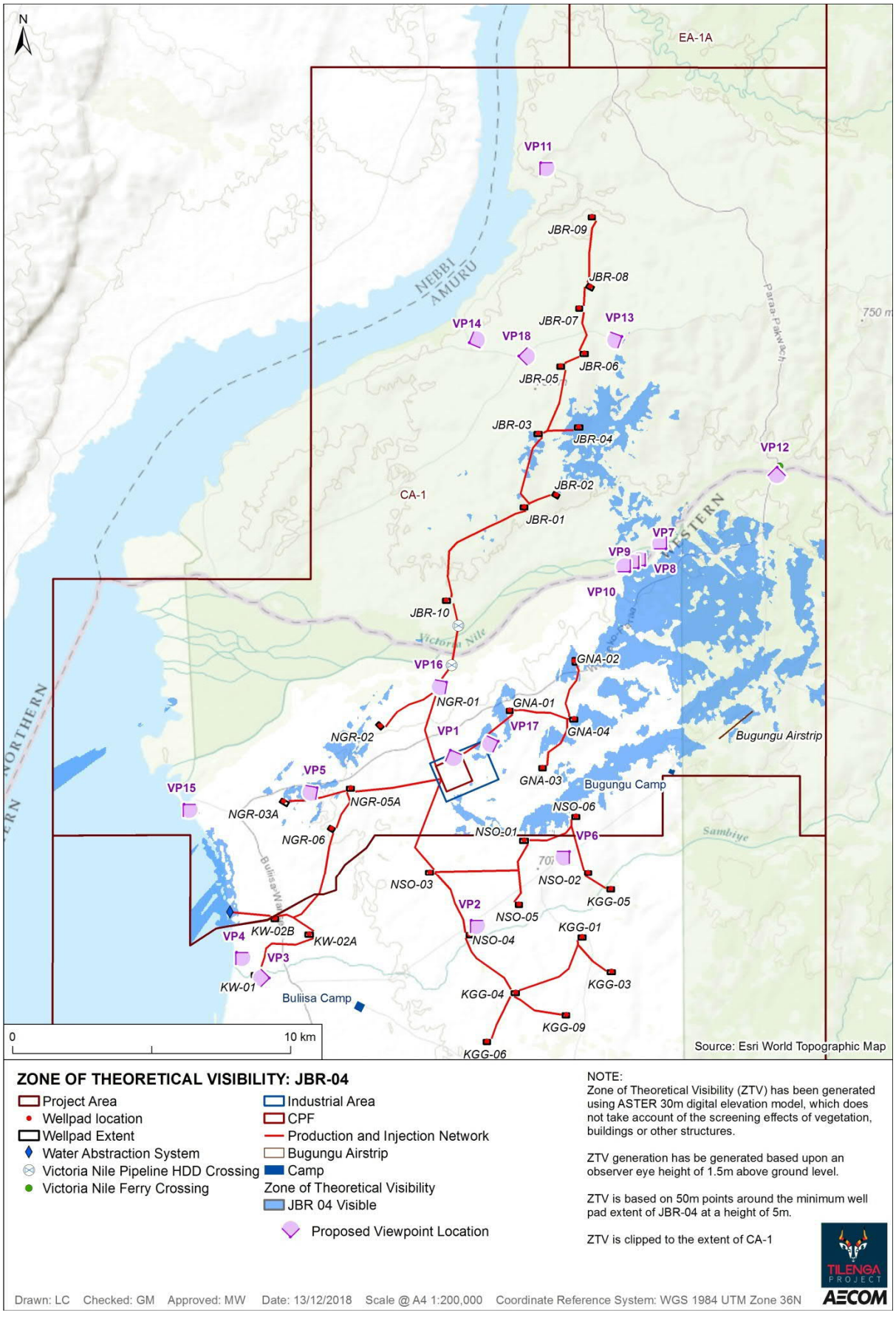
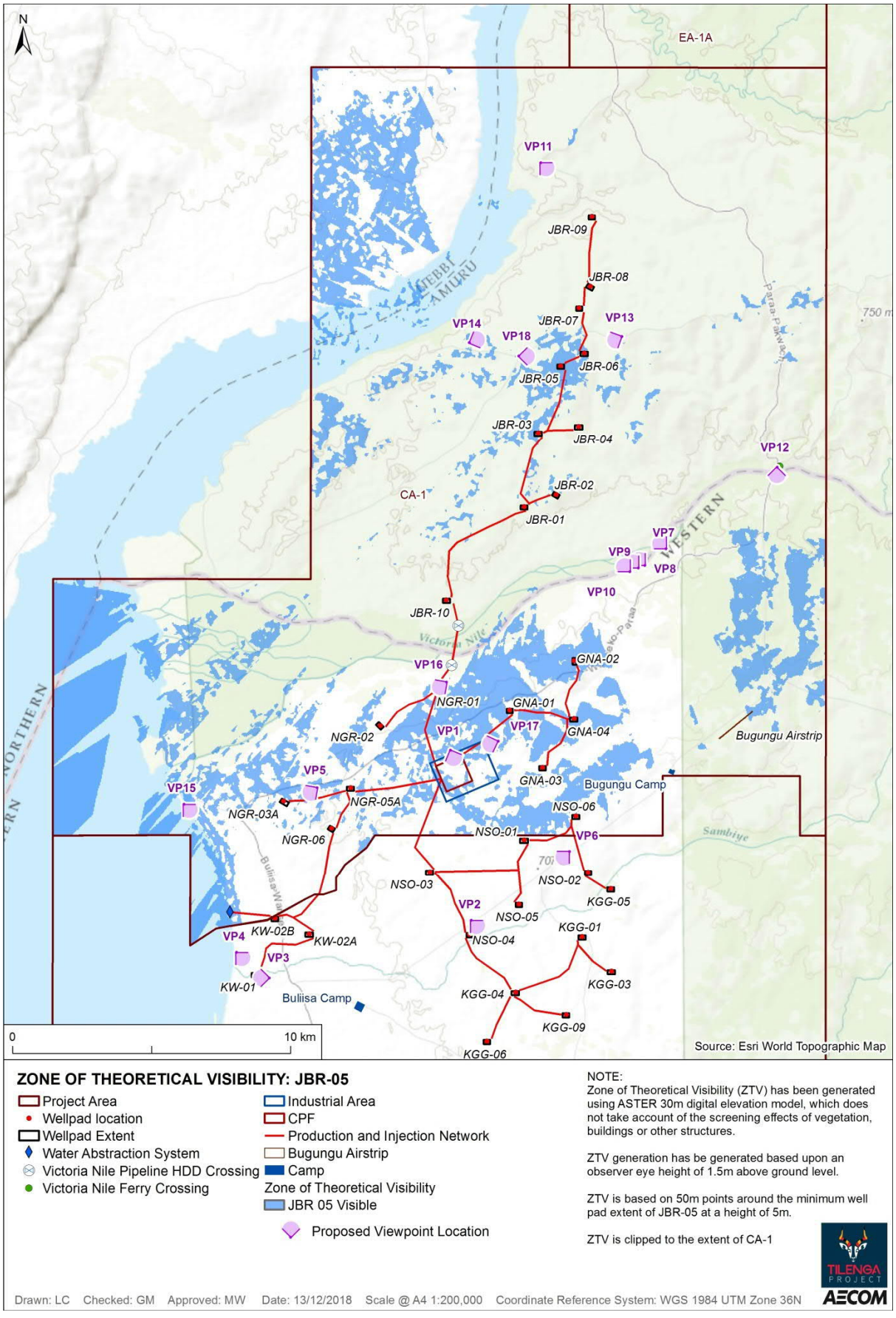


Figure M.1-4 Zone of Theoretical Visibility: JBR-04



ZONE OF THEORETICAL VISIBILITY: JBR-05

- Project Area
- Wellpad location
- Wellpad Extent
- Water Abstraction System
- Victoria Nile Pipeline HDD Crossing
- Victoria Nile Ferry Crossing
- Industrial Area
- CPF
- Production and Injection Network
- Bugungu Airstrip
- Camp
- Zone of Theoretical Visibility
- JBR 05 Visible
- Proposed Viewpoint Location

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using ASTER 30m digital elevation model, which does not take account of the screening effects of vegetation, buildings or other structures.

ZTV generation has be generated based upon an observer eye height of 1.5m above ground level.

ZTV is based on 50m points around the minimum well pad extent of JBR-05 at a height of 5m.

ZTV is clipped to the extent of CA-1

Drawn: LC Checked: GM Approved: MW Date: 13/12/2018 Scale @ A4 1:200,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT
AECOM

Figure M.1-5 Zone of Theoretical Visibility: JBR-05

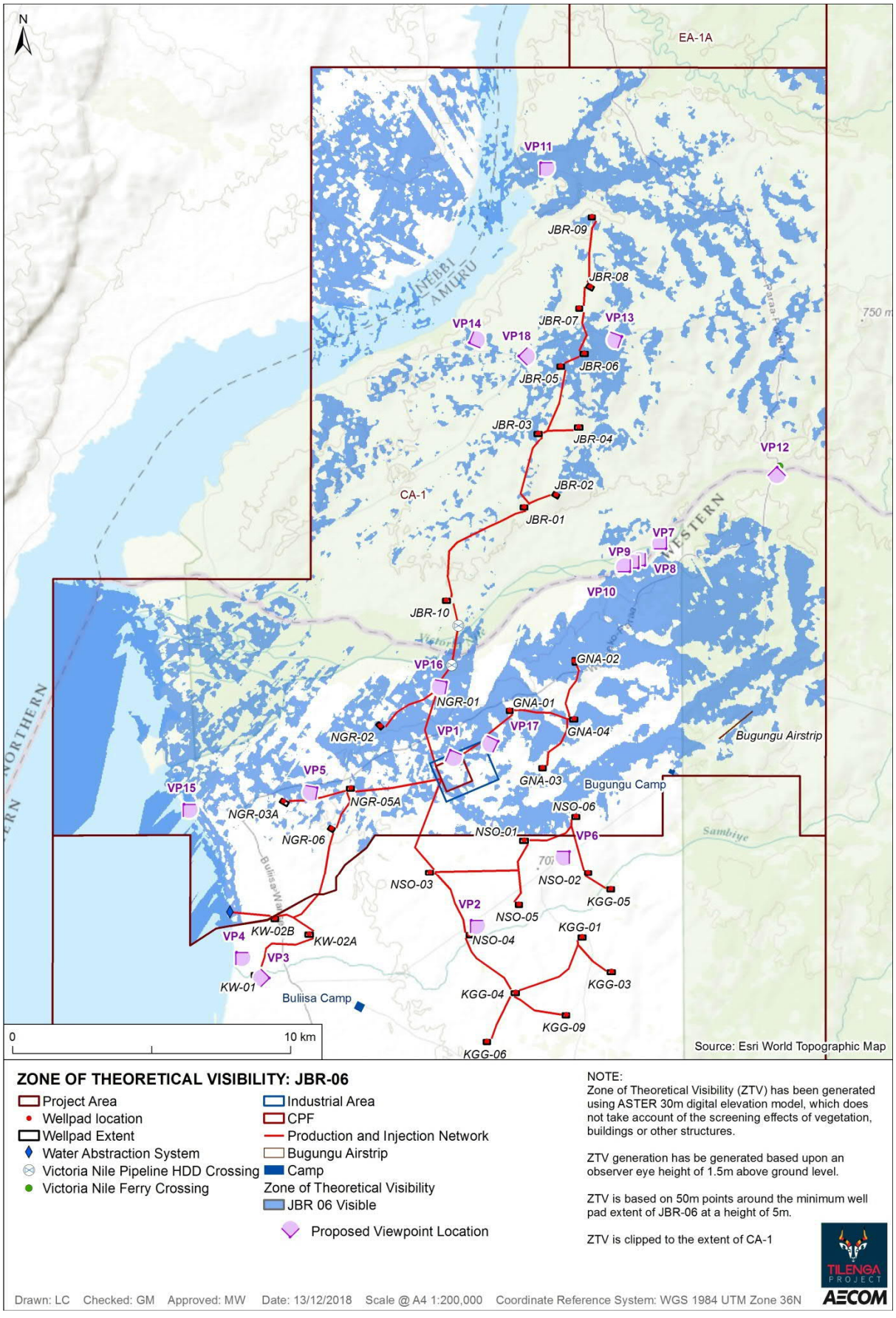
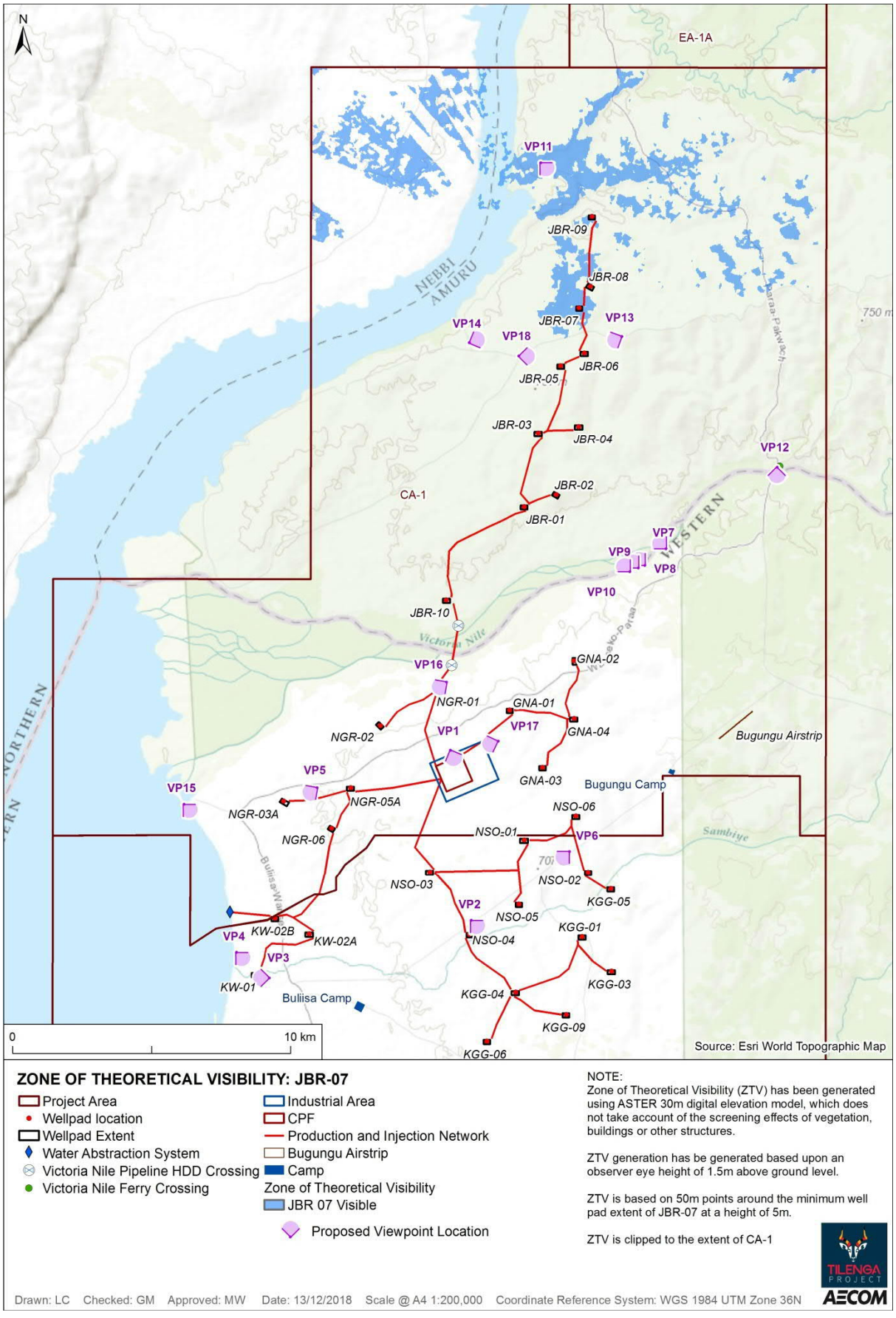


Figure M.1-6 Zone of Theoretical Visibility: JBR-06



ZONE OF THEORETICAL VISIBILITY: JBR-07

- Project Area
- Wellpad location
- Wellpad Extent
- Water Abstraction System
- Victoria Nile Pipeline HDD Crossing
- Victoria Nile Ferry Crossing
- Industrial Area
- CPF
- Production and Injection Network
- Bugungu Airstrip
- Camp
- Zone of Theoretical Visibility
- JBR 07 Visible
- Proposed Viewpoint Location

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using ASTER 30m digital elevation model, which does not take account of the screening effects of vegetation, buildings or other structures.

ZTV generation has be generated based upon an observer eye height of 1.5m above ground level.

ZTV is based on 50m points around the minimum well pad extent of JBR-07 at a height of 5m.

ZTV is clipped to the extent of CA-1

Drawn: LC Checked: GM Approved: MW Date: 13/12/2018 Scale @ A4 1:200,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

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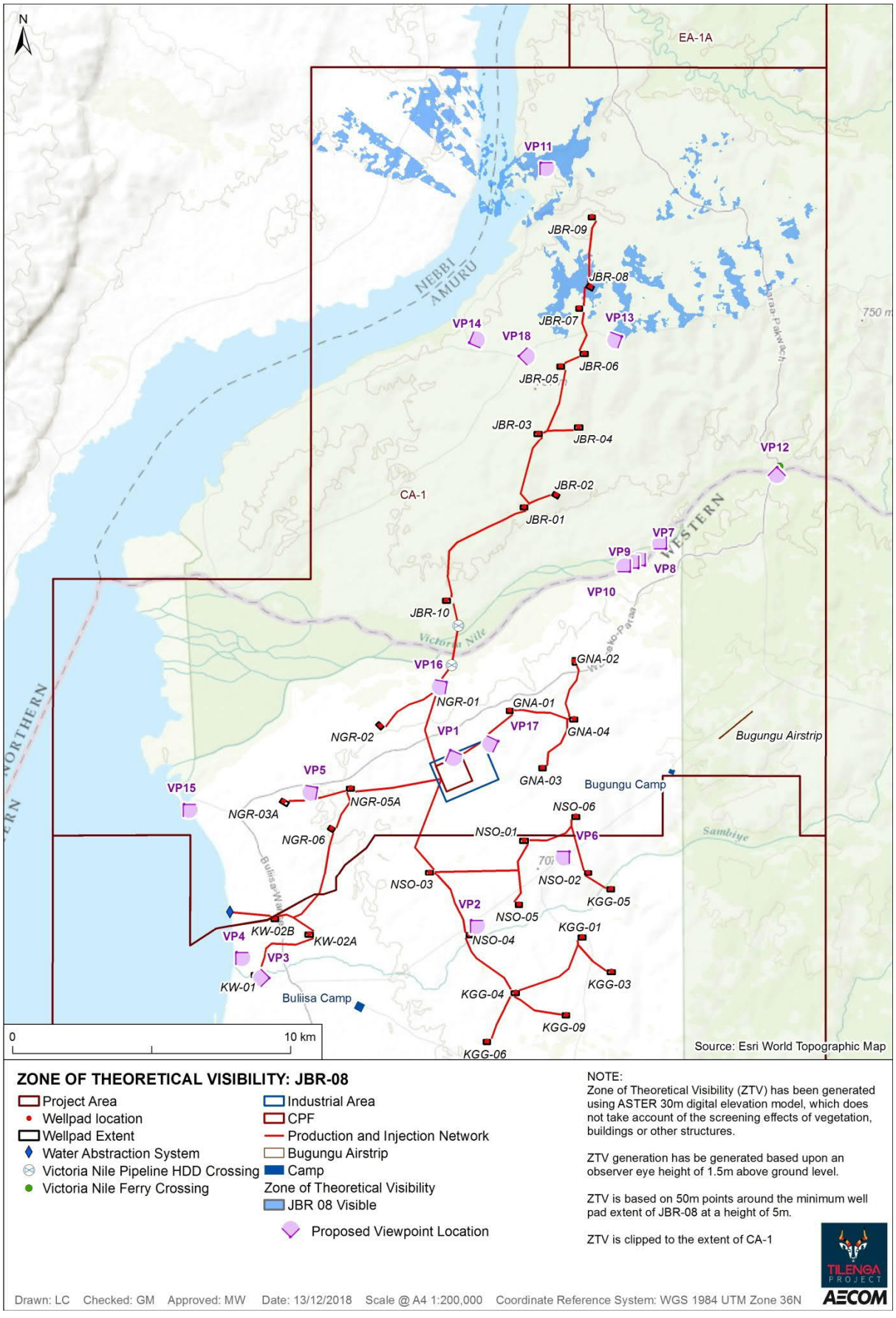
Figure M.1-7 Zone of Theoretical Visibility: JBR-07



ZONE OF THEORETICAL VISIBILITY: JBR-08

- Project Area
- Wellpad location
- Wellpad Extent
- Water Abstraction System
- Victoria Nile Pipeline HDD Crossing
- Victoria Nile Ferry Crossing
- Industrial Area
- CPF
- Production and Injection Network
- Bugungu Airstrip
- Camp
- Zone of Theoretical Visibility
- JBR 08 Visible
- Proposed Viewpoint Location

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using ASTER 30m digital elevation model, which does not take account of the screening effects of vegetation, buildings or other structures.

ZTV generation has be generated based upon an observer eye height of 1.5m above ground level.

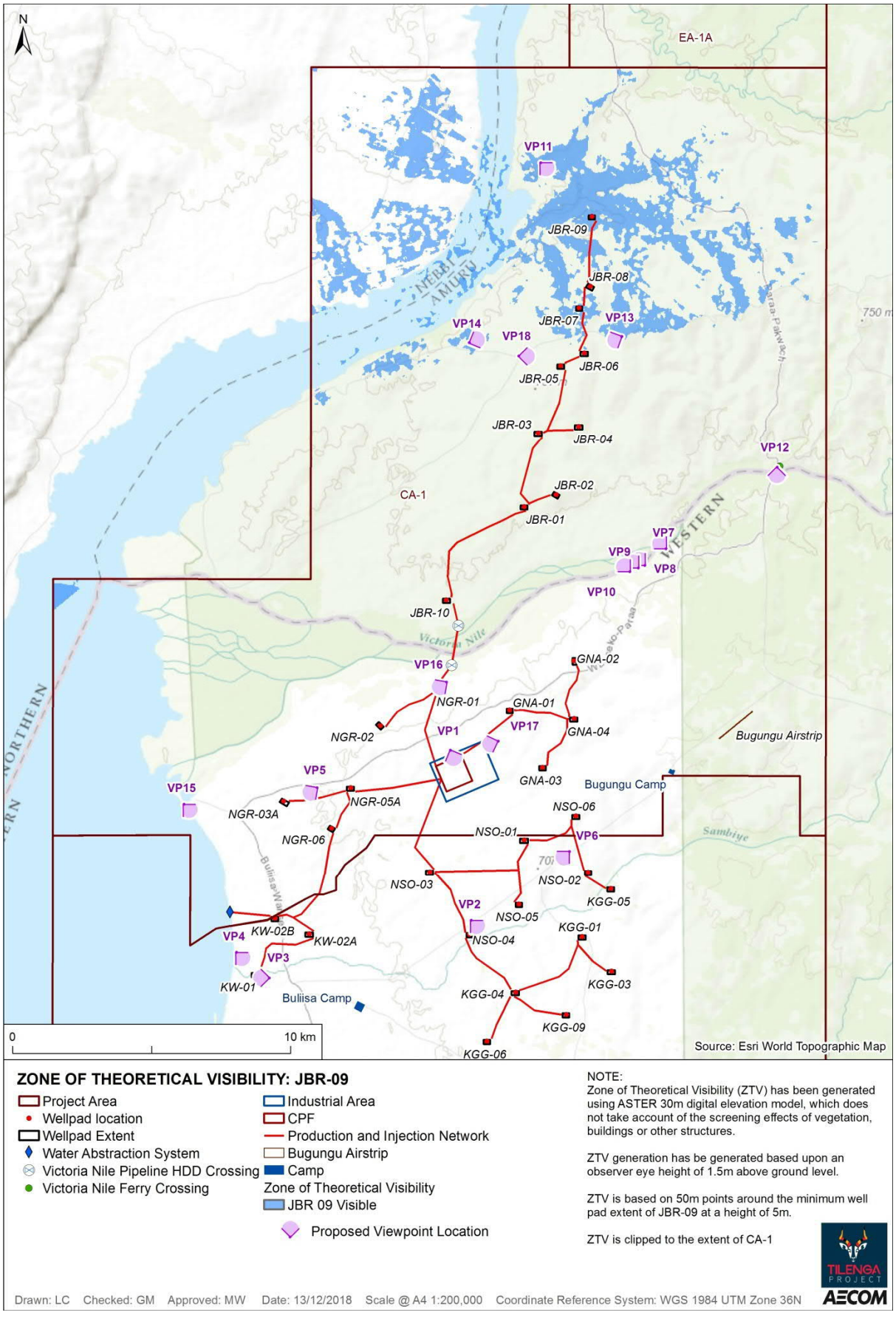
ZTV is based on 50m points around the minimum well pad extent of JBR-08 at a height of 5m.

ZTV is clipped to the extent of CA-1

Drawn: LC Checked: GM Approved: MW Date: 13/12/2018 Scale @ A4 1:200,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT
AECOM

Figure M.1-8 Zone of Theoretical Visibility: JBR-08



ZONE OF THEORETICAL VISIBILITY: JBR-09

- Project Area
- Wellpad location
- Wellpad Extent
- Water Abstraction System
- Victoria Nile Pipeline HDD Crossing
- Victoria Nile Ferry Crossing
- Industrial Area
- CPF
- Production and Injection Network
- Bugungu Airstrip
- Camp
- Zone of Theoretical Visibility
- JBR 09 Visible
- Proposed Viewpoint Location

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using ASTER 30m digital elevation model, which does not take account of the screening effects of vegetation, buildings or other structures.

ZTV generation has be generated based upon an observer eye height of 1.5m above ground level.

ZTV is based on 50m points around the minimum well pad extent of JBR-09 at a height of 5m.

ZTV is clipped to the extent of CA-1

Drawn: LC Checked: GM Approved: MW Date: 13/12/2018 Scale @ A4 1:200,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT
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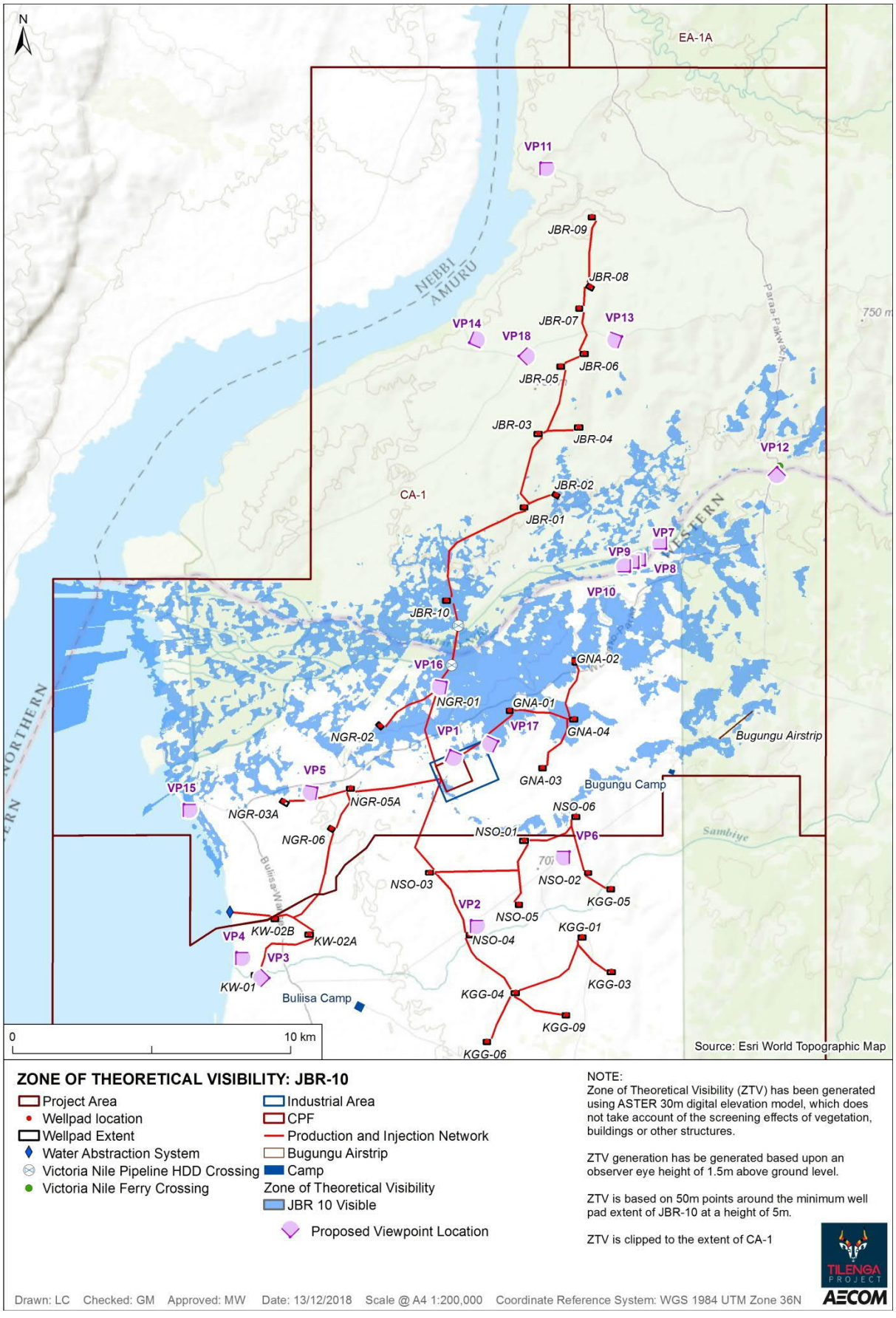
Figure M.1-9 Zone of Theoretical Visibility: JBR-09



ZONE OF THEORETICAL VISIBILITY: JBR-10

- Project Area
- Wellpad location
- Wellpad Extent
- Water Abstraction System
- Victoria Nile Pipeline HDD Crossing
- Victoria Nile Ferry Crossing
- Industrial Area
- CPF
- Production and Injection Network
- Bugungu Airstrip
- Camp
- Zone of Theoretical Visibility
- JBR 10 Visible
- Proposed Viewpoint Location

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using ASTER 30m digital elevation model, which does not take account of the screening effects of vegetation, buildings or other structures.

ZTV generation has be generated based upon an observer eye height of 1.5m above ground level.

ZTV is based on 50m points around the minimum well pad extent of JBR-10 at a height of 5m.

ZTV is clipped to the extent of CA-1

Drawn: LC Checked: GM Approved: MW Date: 13/12/2018 Scale @ A4 1:200,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT
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Figure M.1-10 Zone of Theoretical Visibility: JBR-10

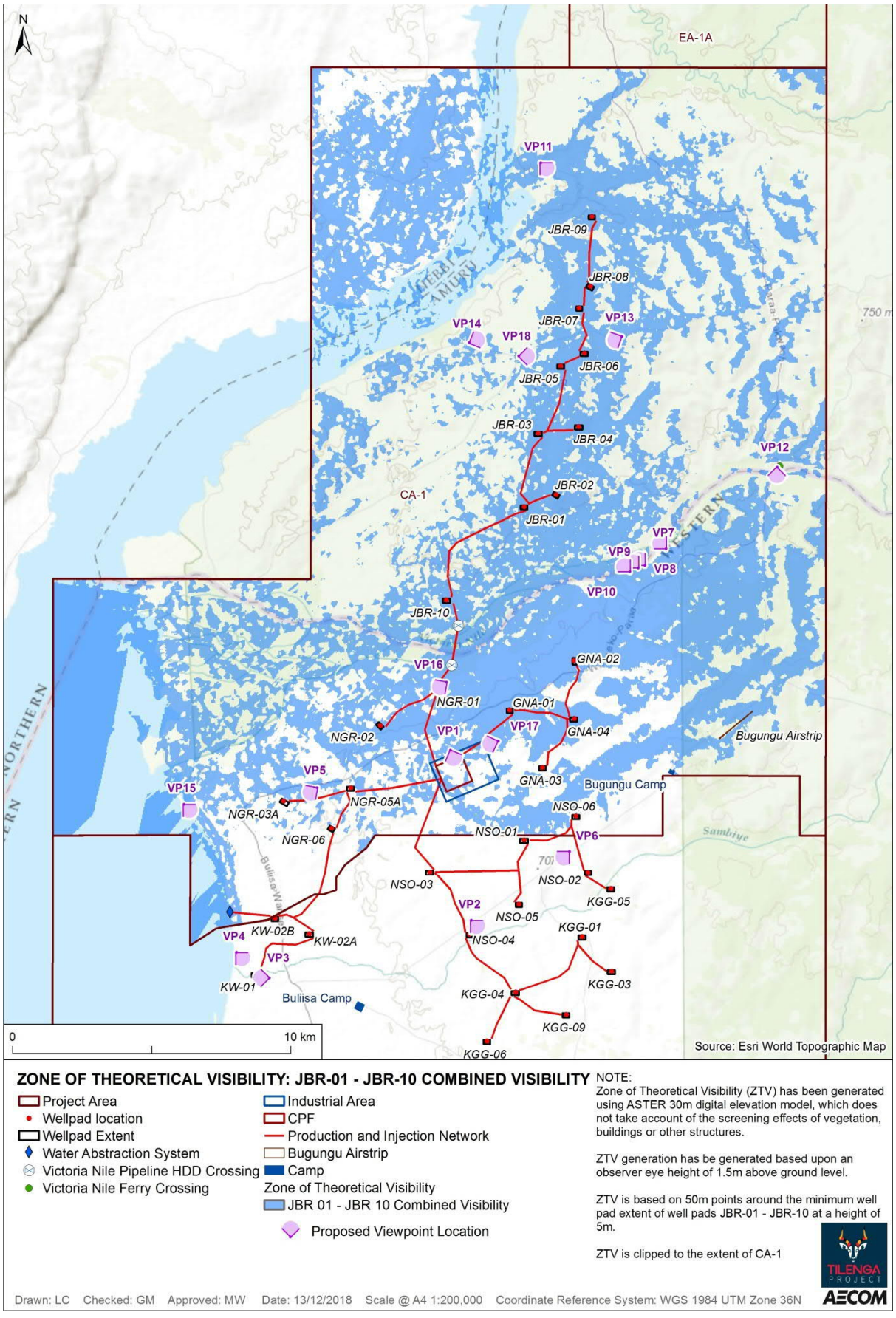

Figure M.1-11 Zone of Theoretical Visibility: JBR-1-10 Combined

M.2. Assessment of Impacts: Decommissioning

M.2.1. LCA 01 - Buliisa Lowland Pastoral Farmland

Sensitivity to Change**: Low**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated.

Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

It is anticipated that most of the Project components would be removed and land reinstated, however some Project infrastructure would remain. As such, impacts would not be completely reversible. Access roads would remain as would below ground pipelines limiting the potential for established or mature trees above.

There is the potential network of flat expanses at former well pad sites and the Industrial Area may lead to other further forms of development given their access to infrastructure.

Although decommissioning would be disruptive across pockets of this LCA once decommissioning activities and reinstatement is complete, the extent of change across this LCA would be less noticeable and as such the magnitude is considered to be **Low**.

Impact significance

Impact Significance: **Low Significance**

M.2.2. LCA 02 - Buliisa Lowland Rolling Farmland

Sensitivity to Change: **Low**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated.

Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

It is anticipated that most of the Project components would be removed and land reinstated, however some Project infrastructure would remain. As such impacts would not be completely reversible. Access roads would remain as would below ground pipelines limiting the potential for established vegetation above. Furthermore the network of flat expanses at former well pads sites and the Industrial Area may lead to other further forms of development given their access to infrastructure.

However, in the long term once decommissioning activities and reinstatement is complete the extent of change across this LCA would be less noticeable and as such the impact magnitude is considered to be **Low**.

Impact significance

Impact Significance: **Low Significance**

M.2.3. LCA 03 - Lake Albert Coastal Fringe

Sensitivity to Change: **Moderate**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated.

Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

It is anticipated that most of the Project components would be removed and land reinstated, however some Project infrastructure would remain. Remaining pipelines would limit the potential for mature tree vegetation to establish above. As such impacts would not be completely reversible. Given the limited footprint of the Project components in this LCA, once decommissioning has been completed the scale and extent of change would be barely perceptible, therefore the impact magnitude is considered to be Negligible.

Impact significance

Impact Significance: **Insignificant**

M.2.4. LCA 04 - River Nile Corridor

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated. Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

Careful reinstatement of vegetation and topography within Murchison Falls National Park (MFNP) at well pad JBR-10 would be required to fully integrate into the landscape. Vegetation above pipeline would be reinstated such that any change to the key characteristics of this LCA would be barely perceptible.

In the short term, during decommissioning operations, the impact magnitude would be Low. Once decommissioning and reinstatement is completed the magnitude of impact would be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.2.5. LCA 05 - Lake Albert-Victoria Nile Delta

Sensitivity to Change**: High**

Impact Magnitude:

Decommissioning activities are not anticipated within this LCA and activities in the neighboring LCA would not affect the setting and quality of this LCA. Therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.2.6. LCA 06 - MFNP South, Rolling Woodland

Sensitivity to Change**: High**

Impact Magnitude:

Decommissioning activities at the Bugungu Airstrip have the potential to reduce the levels of use. As such any change to the character of this LCA would barely discernible and the impact magnitude would be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.2.7. LCA 07 – MFNP North, Savanna Plateau

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning the majority of the Project infrastructure would be removed and reinstated. Much of the activity and decommissioning operations would be similar to those experienced during construction, and as such the scale and extent of change would be similar. However the duration of activities would be reduced.

It is anticipated that most of the Project components would be removed and land reinstated, however some Project infrastructure would remain. As such impacts would not be completely reversible. Remaining pipelines would limit the potential for mature trees to establish above.

The profiling of landform would go some way to reinstate the areas covered by well pads and would help re-assimilate this into the landscape. However, in the long term once decommissioning activities and reinstatement is complete the extent of change across this LCA would be less noticeable and as such the impact magnitude is considered to be **Low**.

Impact significance

Impact Significance: **Low Significance**

M.3. Potential Visual Impacts

M.3.1. Viewpoint 1- Kilomi

Sensitivity to Change**: Moderate**

Impact Magnitude:

The predicted extent of change would be similar to that experienced during construction. However, the duration of activity would be compressed into a shorter duration, and therefore the impact magnitude would reduce. The open clearings extending over the Industrial Area to the south would eventually be re-established with vegetation (or new facilities agreed and introduced), whilst buried pipelines to the southeast would remain void of mature trees. On balance the impact magnitude would reduce to **Low**.

Impact significance

Impact Significance: **Low Significance**

M.3.2. Viewpoint 2 - Kibambura

Sensitivity to Change**: Low**

Impact Magnitude:

At decommissioning, the predicted extent of change would be similar to that experienced during construction. However the duration of activity would be compressed into a shorter duration, as such the impact magnitude would reduce. The change in view would then be limited to open clearings in vegetation extending along the pipeline corridor and the impact magnitude would reduce to **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.3. Viewpoint 3 - Buliisa (West)

Sensitivity to Change**: Moderate**

Impact Magnitude:

Once the well pad site is reinstated, the change in view would be small, and although a flat expanse would remain, uncharacteristic infrastructure would be removed, some vegetation reinstated and the fundamental character of existing views re-established. Therefore the impact magnitude would be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.4. Viewpoint 4 - Kisimo

Sensitivity to Change**: Low**

Impact Magnitude:

Once the well pad site is reinstated, the change in view would be barely perceptible from this distance and although a flat expanse would remain at the footprint of the well pad, uncharacteristic infrastructure would be removed. The impact magnitude would be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.5. Viewpoint 5 - Kirama

Sensitivity to Change: **Moderate**

Impact Magnitude:

Once the well pad site is reinstated, the change in view would be barely perceptible from this distance and although a flat expanse would remain at the footprint of the well pad, uncharacteristic infrastructure would be removed. In the longer term once decommissioning is complete, the Project would result in a barely perceptible change in views therefore the impact magnitude is considered to be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.6. Viewpoint 6 - Ngwedo Farm

Sensitivity to Change**: Low**

Impact Magnitude:

In the longer term once decommissioning is complete, the visible extent of change would be barely perceptible, therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.7. Viewpoint 7 - Baker's Lodge

Sensitivity to Change**: High**

Impact Magnitude:

In the longer term once decommissioning is complete, the visible extent of change would be barely perceptible, therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.8. Viewpoint 8 - Kabalega Wilderness Lodge

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. However the duration of activity would be compressed into a shorter duration, and therefore the impact magnitude would reduce.

In the longer term once decommissioning is complete, the visible extent of change would be barely perceptible, therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.9. Viewpoint 9 - Murchison River Lodge

Sensitivity to Change: **High**

Impact Magnitude:

In the longer term once the well pad site is reinstated and decommissioning is complete, the visible extent of change would be barely perceptible, therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Insignificant**

M.3.10. Viewpoint 10- Nile River Lodge

Sensitivity to Change**: High**

Impact Magnitude:

In the longer term once decommissioning is complete, and vegetation has been established, there would be no discernible change, therefore the impact magnitude is considered to be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.11. Viewpoint 11 - Pakubu Safari lodge

Sensitivity to Change: **High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. In the longer term, once decommissioning is complete the composition of the view would return to the existing state. Therefore the impact magnitude is considered to be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.12. Viewpoint 12 - Paraa Ferry Crossing

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. After decommissioning is complete, there would be no discernible change in the view therefore the impact magnitude would **Negligible**.

Impact significance

Impact Significance: **Negligible**

M.3.13. Viewpoint 13 - Buligi Track, Delta Track Jct

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. In the longer term once reinstatement earthworks have been re-integrated, the visible extent of change would be limited to the flat expanses of the three well pad sites and gaps in trees along buried pipeline routes; however, this would be barely perceptible from this location. Therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Negligible**

M.3.14. Viewpoint 14 - Albert Track

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. However the duration of activity would be less than the construction period, therefore the impact magnitude would reduce.

Once activities have been completed, the extent of change in views would be limited to the land above buried pipelines, where trees appear in the existing view. As pipelines are likely to remain in situ, mature trees are unlikely to establish in similar locations. The flat expanses of the former well pads would not be discernible from this location.

Overall given the distance to the former Project components, the overall extent of change would be barely perceptible. As such the impact magnitude would be **Negligible**.

Impact significance

Impact Significance: **Negligible**

M.3.15. Viewpoint 15 - Wanseko Beach

Sensitivity to Change: **Moderate**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. The overall extent of change in the view would be barely discernible. As such the impact magnitude would be **Negligible**.

Impact significance

Impact Significance: **Negligible**

M.3.16. Viewpoint 16 - Kasinyi (West)

Sensitivity to Change: **Moderate**

Impact Magnitude:

Once the well pad site is reinstated, the change in view would be barely perceptible from this distance and although a flat expanse would remain at the footprint of the well pad, uncharacteristic infrastructure would be removed. In the longer term, once decommissioning is complete the impact magnitude is considered to be **Negligible.**

Impact significance

Impact Significance: **Insignificant**

M.3.17. Viewpoint 17 - Kasinyi (East)

Sensitivity to Change: **Moderate**

Impact Magnitude:

The predicted extent of change would be similar to that experienced during construction. However the duration of activity would be compressed into a shorter duration, and therefor the impact magnitude would reduce.

The open clearings extending over the Industrial Area at the background of views west would eventually be re-established with vegetation (or new facilities agreed and introduced), whilst the road corridor would remain at the greater 10 m width .The impact magnitude would reduce to **Low**.

Impact significance

Impact Significance: **Low Significance**

M.3.18. Viewpoint 18 - Buligi Track (Pakuba Airfield)

Sensitivity to Change**: High**

Impact Magnitude:

At decommissioning, activities would be similar to those experienced during construction. In the longer term, once reinstatement earthworks have been re-integrated, the visible extent of change would be limited to the flat expanses of the three well pad sites and gaps in trees along buried pipeline routes; however, this would be barely perceptible from this location. Therefore the impact magnitude is considered to be **Negligible**.

Impact significance

Impact Significance: **Negligible**

TILENGA ESIA – APPENDIX N: Terrestrial Vegetation

February
2019

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N1 – Field Survey Report

N2 – Flora Mapping Sources

N2.1 – Vegetation Cover – well pads

N2. 3 – Avoidance Key

N2.4 – Avoidance maps – well pads

N2.5 – Avoidance maps - Flowlines

APPENDIX N1

Tilenga Project

VEGETATION AND FLORA FULL ECOLOGICAL SURVEY REPORT

2019

VEGETATION AND FLORA FULL ECOLOGICAL SURVEY REPORT

TILENGA PROJECT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Report Prepared for AECOM Uganda Limited (Registration Number: 170146)

By

James Kalema

Derick Serunjogi

Kennedy Mukasa

BACKGROUND

In this report we provide a summary of the results of survey work undertaken during both the first and second Vegetation and Flora survey campaigns in the area of Blocks CA-1 and LA-2 North. These surveys were carried out between 28th March and 22nd April 2017, and later between 12 June and 5th July 2017. The areas surveyed were:

- Selected CA-1 well pads in Murchison Falls National Park (JBR, Jobi Riii sites)
- Victoria Nile Pipeline HDD Crossing (North)
- North and South Victoria Nile Ferry Crossing areas
- Bugungu Airstrip extension area
- Selected LA-2 North well pads in community areas (Kasemene-Wahrindi (KW), Kigogole (KGG), Ngiri (NGR), Nsoga (NSO) sites)
- Victoria Nile Pipeline HDD Crossing (South)
- Water Abstraction System (WAS)

The survey locations for these Vegetation and Flora campaigns are shown in the Figures in Appendix N2.1 of the ESIA report.

A reconnaissance visit had earlier been made to the study area between 18 and 23 July 2016 to identify the locations that would later be used for the surveys, based on preliminary habitat mapping. The purpose was to select the survey points that would provide good coverage of the main vegetation types in their full variation so that a complete and representative picture of the flora and fauna baseline across the Project Area might be presented.

The surveys were conducted in both the dry and the wet seasons of the year in order to collect data on the species composition and vegetation communities as they vary between seasons. This variation is more pronounced on the non-woody species. Different species of plants have different phenological and life cycles. The sampling regime was therefore staggered to have a repeat visit made to the study area so that each was visited once in the dry and once in the wet season of the year. This is important given that during the dry season several parts of the project area were either too dry or burnt, making identification of plants in the herb layer nearly impossible. The available climatic data covering the site was used to identify these seasons and the field surveys were scheduled accordingly (often wet during April-May and August-November periods, and drier during the December-March and June-July in Murchison Falls National Park – Uganda Government 1967). However, there were notable changes in weather in the area and rains did not come as expected.

The results of these field surveys presented here provide a basis for description of baseline conditions in the study area for the Environmental and Social Impact Assessment (ESIA).

SCHEDULE AND LIST OF PARTICIPANTS

A total of 25 sites were surveyed in a range of vegetation types. Each of the sites was surveyed once in the dry and once in the wet season. The dry season surveys were carried out from 28th March to 22nd April 2017 and the wet season surveys from 12th June to 5th July 2017. Daily Reports were prepared and provided to TEPU.

The surveys were managed and supervised by AECOM personnel:

- Dr. Brian Cuthbert
- Gail Muirhead

The surveys were conducted by the following team:

Table 1: Flora Survey Team Composition

First, Last Name	Responsibility
James Kalema	Makerere University, Vegetation and Flora: Lead
Derick Serunjogi	Makerere University, Vegetation and Flora: Assistant 1
Kennedy Mukasa	Makerere University, Vegetation and Flora: Assistant 2

METHODS

Literature review

Prior to the actual field surveys, a desk-based approach was employed to review existing sources of data and information about the vegetation and flora of the Project Area.

The known vegetation mapping products for Uganda were reviewed. Of particular importance is the land cover classification information for Uganda by Langdale-Brown *et al.* (1964) and Oneka (1996) who prepared a vegetation map of the Murchison Falls area using vegetation types adapted from Langdale-Brown *et al.* (1964). Information on the flora of the area was sought from such sources as Plumptre *et al.* (2003) who provide a broad overview on biodiversity of the Albertine Rift region, Kalema (2005) who assessed the flora of MFNP, reporting up to 450 species of plants.

Red Lists were obtained from IUCN (2016), Kalema & Beentje (2012) on conservation status of Uganda trees and WCS (2016) on the National Redlist of plants. A number of ecological studies on ESIA and related works in the areas were also reviewed, e.g. Air water Earth (2011a,b), Air Water Earth (2012a, b), AECOM (2014), AECOM (2017), ERM/BIMCO (2014), WCS & eCountability (2016a) on critical habitat analysis.

Field surveys

The approach used in this task was conducting targeted surveys to cover the footprint of the proposed infrastructure and the area within a 500 m buffer around the infrastructure footprint. Prior to these detailed surveys preliminary “avoidance” surveys were undertaken across the entire Project Area,

covering all Project components including well pads and flowlines. The findings for these surveys are shown on the Figures in Appendices N2.4 and N2.5.

Based on the findings of these avoidance surveys the locations for the detailed surveys discussed in this report were determined. The detailed findings from this survey are shown on Figures N2.1 and N2.3.

For the detailed surveys, at a given site, design of 30 x 30 m plots was used to survey for vegetation and flora within the 500 x 500 m buffer. At least five such quadrats were used, one being the actual location of the infrastructure, and four at each of the corners of the 500 x 500 polygon (Fig. A). Description of the vegetation types was done from direct observations of the plant community features of tree cover, shrub cover, herbaceous cover and community height and species composition (Tzoulas & James 2010).

A record was made of species present, and the abundance of each species assessed from its percentage cover. This relative abundance was to be used to define the vegetation type and to provide information on the phytosociological structure of the different vegetation types. A sample data sheet for recording the necessary data can be found at the end of this report. The sheet includes a record of dominant woody and non-woody species; altitude, tree cover, shrub cover, herbaceous cover, bare ground cover.

Fig. A Illustration of the design of placement of quadrats within the 500 x 500 m buffer zone

The structural features of the vegetation recorded were:

- total tree cover
- total shrub cover
- bare ground and/or open water cover

- total herb cover
- tree mean height
- shrub mean height
- herbaceous mean height

Vegetation characterization was based on the dominant woody and non-woody floristic composition and landscape features observed in the general area at the site. The top three dominant species for both woody and non-woody species were recorded. Other common species of plants at the site and their percentage cover were also estimated.

Cover is an estimate of a species' or group of plants' quantitative contribution to the vegetation. It is a measure of the vertical projection on to the ground of the extent of the living parts of a species or group of plants (Rodwell 2006). This cover was visually estimated by all the three surveyors from the central point of the plot if the vegetation was open with little obstruction to the surveyors' view, or by walking round some obstacles e.g. in dense Bushland and Thicket communities.

The mean of the three estimates was taken and recorded. General details recorded included surveyor information, date, locality and geographical coordinates, slope and altitude. The general soil type was also recorded depending on the proportions of sand, clay and silt. A map to describe the vegetation communities from basic phytosociological characteristics was prepared from the dominant species within the buffer area.

Plant identification

The Angiosperm Phylogeny Group (APG 2009) system of classification was followed for taxonomic treatment of angiosperms for this study. Species of plant important for this survey that were not easy to identify in the field even with field guides were collected as voucher specimens for subsequent identification and deposition at the Makerere University Herbarium Uganda.

Biodiversity Value and Identification of Critical Habitats

The biodiversity value of sites was assessed though presence of species of conservation concern, e.g. threatened species and ecosystems, IUCN red data listed species, endemic taxa, CITES listed species and nationally threatened ones, culturally important biodiversity features, ecological processes necessary for maintaining critical habitats. Such species, when encountered, were recorded and geo-referenced and their habitats noted. Also of interest and concern was the occurrence of invasive species in or near the project area as these reduce the biodiversity value of a site.

The criteria proposed under the International Finance Corporation (International Finance Corporation 2012) were followed in identification of Critical Habitats in the project area. Guidance Note 54 (GN54), under Performance Standard 6, which defines a Critical Habitat as:

"… areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes…"

GN55 provides the criteria for qualifying a Critical Habitat, thus presence of:

- Criterion 1: Critically Endangered (CR) and/or Endangered (EN) species
- Criterion 2: Endemic and/or restricted-range species
- Criterion 3: Migratory and/or congregatory species
- Criterion 4: Highly threatened and/or unique ecosystems
- Criterion 5: Key evolutionary processes

Further criteria are suggested under GN56. These include

- Habitats used during periods of stress (e.g., flood, drought or fire)
- Concentrations of Vulnerable (VU) species in cases where there is uncertainty regarding the listing, and the actual status of the species may be EN or CR
- Areas of primary/old-growth/pristine forests and/or other areas with especially high levels of species diversity
- Landscape and ecological processes (e.g., water catchments, areas critical to erosion control, disturbance regimes (e.g., fire, flood) required for maintaining critical habitat)
- Habitat necessary for the survival of keystone species
- Areas of high scientific value such as those containing concentrations of species new and/or little known to science.

Different sites within the project area were assessed against the criteria above for identification of Critical Habitats.

Photography

A photographic record of the vegetation type and any features of interest was made. Other landscape features such as topography, general soil description and indications of drainage were also recorded. Proximity to important features such as river and streams was noted.

Equipment list:

2x Handheld GPS
Plant presses,
Pairs of secateurs,
Ivy tags,
Measuring tapes,
Old newsprint,
Voucher collecting bags
2x Camera
Field ID books

Limitations owing to weather changes

At the time of the first campaign, several parts of the block were only still recovering from the previous burning regime and/or dry season conditions (Photo 1). This made identification of some of the herbaceous species in the field layer difficult or virtually impossible in instances. The wet season also delayed a bit, so the vegetation was not as luxuriant as was expected even by July 2017.

Photo 1: JBR-01 in April 2017

FINDINGS

1. Bridge Barge North

HABITATS

This site is along the Victoria Nile River just by the jetty used by the current Paraa Ferry, thus making it have much bare ground with gravely sandy soils (Photo A-JK-170624-746). The vegetation is Riverine *Kigelia* woodland with *Harrisonia* thicket. Along the Victoria Nile is *Vossia-Cyperus* marsh. *Kigelia africana*; *Acacia sieberiana*; *Crateva adansonii* are the dominant species in the woody layer while *Sporobolus pyramidalis* and *Setaria sphacelata* dominate the herb layer.

Photos A-JK-170624-746 and A-JK-170624-744 of Victoria Nile Ferry Crossing North site with bare ground (left) and narrow vegetation belt along the Victoria Nile (right)

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species was recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

- At least two invasive species of plant occur in the site, viz: *Salvinia molesta* and *Eichhornia crassipes* (Photo Photos A-JK-170704-334 and A-JK-170704-335) at low abundance along the Nile. These are both aquatic species that will remain at the edges of the river unless carried out deliberately or inadvertently to the away from the river. These species have the potential to spread with disturbance. Construction activity of the bridge may cause siltation into the river proliferating the incidence of the two species


Photos A-JK-170704-334 and A-JK-170704-335 of alien invasive *Eichhornia crassipes* (left) and *Salvinia molesta* (right) at Victoria Nile Ferry Crossing North

2. Victoria Nile Ferry Crossing South

HABITATS

This, too, is along the Victoria Nile River just a few tens of meters from the jetty on the south end of the Victoria Nile at the existing Paraa Ferry crossing point. There is less bare ground. The vegetation is *Phragmites-Vossia-Cyperus* swamp fringed by *Acacia-Combretum* bushland *Sesbania sesban* and floating *Salvinia molesta* on the edge of the River. *Sesbania sesban*; *Acacia senegal*; *Kigelia africana* are dominant in the woody layer of the Bushland while *Phragmites mauritianum*; *Vossia cuspidata*; *Cyperus papyrus* are the dominant herbaceous species.

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species was recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

- Three invasive species of plant were recorded in the site, viz: *Salvinia molesta* and *Eichhornia crassipes* (Photo A-JK-170419-545) at low abundance and *Mimosa pigra* (Photo A-JK-170419-561) at moderate level of abundance. The first two species are purely aquatic species that will not grow on dry ground but the later may survive in environments that are only hygrophic but not dry. These species have the potential to spread with disturbance. Construction activity of the Victoria Nile Ferry Crossing point may cause siltation into the river proliferating the incidence of the three species.


Photo A-JK-170419-545 *Salvinia molesta* (left) and *Eichhornia crassipes* (right, in flower)

Photo A-JK-170419-561 of invasive *Mimosa pigra*

3. Bugungu Airstrip

HABITAT

This site is located within well wooded vegetation with moderate to tall grass. There is hardly any bare ground owing to a very good cover of the ground by grass (Photo A-JK-170419-524). The vegetation is Woodland dominated by *Albizia*, *Acacia* and *Philenoptera* in the tree layer with *Combretum molle*, *Securidaca longipedunculata* and *Stereospermum kunthianum* in the shrub layer and *Brachiaria*, *Hyperthelia* and *Hyparrhenia* in the herbaceous layer forming a dense cover with moderate height; on sandy soil. *Albizia grandibracteata*, *Acacia sieberiana* and *Philenoptera laxiflora* are dominant in the woody layer of the woodland while *Brachiaria brizantha*, *Hyperthelia dissoluta* and *Hyparrhenia filipendula* are the dominant grass species.

Photo A-JK-170419-524 of Woodland with dense ground grass cover

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species was recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

- One invasive species of plant was recorded in the site, viz: *Chromolaena odorata* at very low abundance. This species grows on dry ground but is still in very abundance. It tends to proliferate with disturbance, spreading to cover large areas with creation of gaps. Construction activity during extension of the air strip may cause its spread into areas it does not occur at the present
- The site is well stocked with woody species and hence extension activity is very likely to cause reduction in the woody biomass which takes a long time to be re-assembled even with restoration

4. • Victoria Nile Pipeline HDD Crossing (North)

HABITATS

This site is located by the northern bank of the Victoria Nile on generally flat or gently sloping ground with patches of bare ground (see Photos A-JK-180114-731 - A-JK-180114-732). The habitat is 'natural' and vegetation type is mainly Grassland, Grassed Bushland with a predominance of Dense Bushland with *Acacia* in the tree layer with *Capparis*, *Acacia* and *Vepris* in the shrub layer with the herbaceous layer dominated by *Sansevieria nilotica* on sandy soil. There are scattered patches of seasonal wetland. It is variably dominated by *Acacia sieberiana, Maytenus undata*, *Harrissonia abyssinica* with occasional *Kigelia africana*; *Vepris nobilis* and *Jasminum* sp., *Capparis fascicularis*; *Crateva adansonii*; *Acacia senegal* in the shrub layer. The tree layer is sparse to moderate, mainly composed of *Acacia sieberiana*. The herbaceous layer is dominated by *Sansevieria nilotica* and *Sporobolus pyrimidalis*.

Photos A-JK-180114-731 - A-JK-180114-732 showing areas of seasonal wetland within the extensive Bushland-Bushed Grassland mosaic

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species was recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

- Whereas no species of conservation concern were recorded at this site, reference should be made to the avoidance maps (Appendix N2.4 and N2.5 prepared to check for any possible features such as the mature large trees of *Acacia sieberiana*, *Balanites aegyptiaca*, *Crateva adansonii*, *Kigelia africana* and the seasonal wetland patches, mainly in wallows.
- Though not recorded from any plot, two invasive species were encountered along the Victoria Nile – *Eichhornia crassipes* and *Salvinia molesta*. Both are aquatic species that may proliferate with disturbance as they propagate vegetatively.
- *Suddia sagittifolia*, which is an aquatic grass species of restricted range (known only from the Nile by the Lake Kyoga area in Uganda as the southern-most limit of its geographical range (Kalema 2005) to South Sudan (Renvoize *et al*. 1984)), was not recorded but is likely to occur along the Victoria Nile around the site. It grows in *Cyperus papyrus* mats at the river margins with *Typha domingensis* and *Vossia cuspidata* and *Phragmites mauritianum* (Photo X2)

Photo X2 *Suddia sagittifolia* recorded from the Victoria Nile margins

5. Victoria Nile Pipeline HDD Crossing (South)

HABITATS

This site is located by the southern shores of the Victoria Nile on generally flat or gently sloping ground with patches of cultivation on sandy soil. The vegetation is mainly Grassed Bushland and Bushland with some areas of Cultivation and patches of Permanent Swamp. The habitat type overall is 'transitional'.

The tree layer is composed of Lannea scheweinfurthii, Euphorbia candelabrum, *Acacia sieberiana*, Crateva adansonii, with occasional *Albizia grandibracteata*, *Kigelia africana*, *Tamarindus indica* and *Ficus* sp. A single example of *Dalbergia melanoxylon* was recorded. The shrub layer is dominated by *Vepris nobilis*, *Maytenus undata*, *Ziziphus pubescens*. The herbaceous layer is dominated by *Sansevieria nilotica* and *Sporobolus pyrimidalis*. In places farther away from the river, open grassland patches occur with *Hyperthelia dissoluta* as the dominant grass species.

Photos of permanent swap with *Suddia sagittifolia,* a restricted range species, A-JK-180117-769 and A - JK-180117-77.

Photos of Papyrus swamp (permanent swamp) photos A-JK-180117-772 and A-JK-180117-774.

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

Dalbergia melanoxylon, a Globally Threatened species (VU - IUCN 2017) was recorded at the site at very low abundance. The restricted range *Suddia sagittifolia* found in permanent swamp was also recorded.

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

- *Dalbergia melanoxylon,* a globally threatened species, may be damaged or even depleted from the site as it often occurs in low abundance.
- Whereas no species of conservation concern were recorded at this site, reference should be made to the avoidance report prepared to check for any possible features such as the mature large trees of *Acacia sieberiana*, *Balanites aegyptiaca*, *Crateva adansonii*, *Kigelia africana* and the seasonal wetland patches, mainly in wallows.
- Though not registered during these surveys, invasive species *Mimosa pigra*, *Eichhornia crassipes* and *Salvinia molesta* are also likely to be within the site

6. JBR-01

HABITATS AND THEIR CONDITION

This site is located on gently to moderately sloping ground on sandy soil. The vegetation is mainly Open Grassland (Photos A-JK-170409-275 and A-JK-170627-793) with *Acacia-Balanites* Open Wooded Grassland along the vale with Acacia *sieberiana* and *Harrisonia abyssinica* in the shrub layer with short grass.

There are also areas of open Bushed grassland patches. The grass layer may be virtually absent during the dry season, having been burnt. The sparse tree layer is dominated by *Acacia sieberiana*, and *Balanites aegyptiaca*. The shrub layer is dominated by *Acacia sieberiana*. The herbaceous layer is variably dominated by *Hyperthelia dissoluta*, *Sporobolus stapfianus, Chamaecrista kirkii* and *Bulbostylis* sp.


Photos A-JK-170409-275 and A-JK-170627-793 of Bushed Grassland and Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species was recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, the avoidance data revealed presence of mature large trees of *Acacia sieberiana*, *Balanites aegyptiaca*, *Crateva adansonii*, and the seasonally flooded wetland patches, as wallows that need to be avoided where possible.

7. JBR-010

HABITATS AND THEIR CONDITION

This site is located on flat ground (Photos A-JK-170417-438 and A-JK-170625-749) on sandy soil. The vegetation is mainly a Bushland-Bushed grassland mosaic dominated by *Acacia sieberiana* trees (Photos A-JK-170417-438 and A-JK-170625-749). In places, the vegetation becomes Dense *Acacia* bushland with *Vepris* and *Capparis* in the shrub layer with a sparse herbaceous layer. *Harrisonia abyssinica*, *Cadaba farinosa*, *Combretum aculeatum*, *Maytenus undata* and *Capparis fascicularis* are the commonest and dominant species in thicket and Bushed Grassland communities. The grass is short grass (under c.0.5 m).


Photos A-JK-170417-438 (left) and A-JK-170625-749 (right) with Bushland and Bushed Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Acacia sieberiana*. In addition, there are seasonally flooded grassland (wetland) areas with habitat-specific plant species such as *Echinochloa colona* that may be ecologically damaged.

8. JBR-02

HABITATS AND THEIR CONDITION

This site is located on moderately sloping ground with slope angle of 8-16° on sandy soil. The vegetation is composed of Open Grassland with Thicket and occasional trees of *Balanites aegyptiaca*. There is also open *Acacia* Wooded Grassland along the vale. In some places there is Bushed Grassland with *Harrisonia abyssinica* and *Acacia sieberiana* and occasional tree cover of *Balanites aegyptiaca* and *Acacia sieberiana* with virtually no grass layer in the dry season due to burning. The grass is short (under c.0.5 m) due to grazing. (Photos A-JK-170410-307 and A-JK-170623-735)


Photos A-JK-170410-307 and A-JK-170623-735 of Grassland with Thicket and Bushed Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. The avoidance features recorded from this site, particularly mature trees of *Balanites aegyptiaca* and *Acacia sieberiana* would be reduced in abundance if not circumvented.

9. JBR-03

HABITATS AND THEIR CONDITION

This site is located on well drained sandy soils sloping ground angle mostly 16-32° on sandy soil. The vegetation is mainly Open Grassland dominated by *Hyperthelia dissoluta*; *Bulbostylis* sp., *Chamaecrista kirkii* and *Sporobolus stafianus* with very sparse tree cover of *Crateva* and very short grass during drought periods and also due to burning. In the surrounding vales is Acacia Wooded Grassland.


Photo A-JK-170411-325 (left) and A-JK-170628-805 (right) of Open Grassland at JBR-03 in dry season (left) and in wetter season (right)

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. Notable avoidance features that were recorded from this site that would be directly affected include mature individual trees of *Acacia sieberiana*, *Balanites aegyptiaca*, *Crateva adansonii*. There are also azonal micro-habitats such as wallows with habitat-specific (wetland) flora such as *Ipomoea aquatica*, occurring in only very restricted places within the site.

10. JBR-04

HABITATS AND THEIR CONDITION

This site is located on gently sloping terrain (slope mostly 8-16°) on sandy soil. The vegetation is mainly Open grassland with very sparse tree cover of *Acacia* with short grass due to burning and drought (Photos A-JK-170412-338 and A-JK-170629-820). In the surrounding vale is Seasonally Flooded Open *Acacia* Wooded Grassland with sparse bushes of *Harrisonia abyssinica* and short grass during the dry season. The herb layer is dominated by *Hyperthelia dissoluta*, *Ctenium newtonii* and *Eragrostis* sp. fringed by *Acacia sieberiana* Open Wooded Grassland.

In places, the vegetation becomes Shrubland dominated by *Acacia* and *Harrisonia* with patches of bare gravelly ground fringed by *Acacia* Wooded Grassland with short grass on clayey sands with gravel.

Photos A-JK-170412-338 and A-JK-170629-820

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Acacia sieberiana* and *Balanites aegyptiaca*. In addition, there are seasonally flooded wetland areas (Wetland with seasonal water presence) with habitat-specific flora such as *Nymphaea lotus*, *Caldesia resinosa, Cyperus iria*, *Sphenoclea zeylanica* (Photo A-JK-161124-089) and riable soils with marginal plant species (Photo A-JK-170629-823). These are azonal habitats enhancing alpha and beta diversity.

Photo A-JK-161124-089 of seasonal wetland with habitat-specific flora (left) and A-JK-170629-823 with friable soils

11. JBR-05

HABITATS AND THEIR CONDITION

This site is located on flat ground, slope 0-8° on sandy soil. The vegetation is Open *Hyperthelia*, *Ctenium*, *Eragrostis* and *Bulbostylis* grassland with sparse *Crateva adansonii*, *Borassus aethiopum*, and *Acacia sieberiana* tree cover and short grass on sandy soil (Photo A-JK-170413-351 and A-JK-170630-843). In small patches are *Crateva* or *Borassus* Open Wooded areas.

Photo A-JK-170413-351 and A-JK-170630-843 of Open Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, a few mature individual trees, especially of *Crateva adansonii*, *Borasssus aethiopum* and *Acacia sieberiana* recorded during the avoidance survey may be felled down or damaged.

12. JBR-06

HABITATS AND THEIR CONDITION

This site is located on ground that is flat or gently sloping (4-8°) to moderate slope (16-32°) on sandy soil. The vegetation is Open Grassland dominated by *Hyperthelia dissoluta* and *Digitaria longiflora* with very sparse *Borassus aethiopum* and *Crateva adansonii* tree cover and very short grass on sandy soil (Photos A-JK-170413-375 and A-JK-170701-868). Open grassland dominated by bare eroded gullies fringed by *Acacia and Balanites* trees in vale and very sparse grass cover on gritty sandy soil. In the surrounding vale is sparse *Borassus* cover with *Hyperthelia* and *Sporobolus pyramidalis*.

Photos A-JK-170413-375 and A-JK-170701-868 of Open Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site. These are seasonal wetland with *Urochloa*, *Ludwigia* and *Cyperus* spp. (wetland areas with habitat-specific flora) and mature trees, particularly of *Crateva adansonii*, *Borassus aethiopum* and *Acacia sieberiana* as pointed out in the avoidance report.

13. JBR-07

HABITATS AND THEIR CONDITION

This site is located on sloping ground (slope 8-32°) on sandy soil. The vegetation is mostly Open Grassland with sparse *Borassus* tree and shrub and occasionally *Balanites aegyptiaca* and *Crateva adansonii* cover and very short grass due to drought and over grazing (Photos A-JK-170414-382 and A-JK-170703-892). The herb layer is dominated by *Hyperthelia dissoluta*, *Eragrostis* sp. and *Ctenium newtonii*.


Photos A-JK-170414-382 and A-JK-170703-892 of Open Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Borassus aethiopum* as pointed in the avoidance report. Besides, there are seasonally flooded grassland (wetland) areas with habitat-specific flora i.e. *Urochloa* sp., *Ludwigia* sp. and *Cyperus* spp.

14. JBR-08

HABITATS AND THEIR CONDITION

This site is located on gently to moderately sloping ground (slope ranging 8-32°) on sandy soil. The vegetation is mainly *Hyperthelia* Open Grassland with sparse *Borassus* and *Balanites* tree cover and occasional presence of mature *Acacia sieberiana* trees (Photos A-JK-170415-396 and A-JK-170704-915).

The shrub layer is dominated by *Borassus aethiopum* with short grass due to grazing. The herb layer is dominated by *Hyperthelia dissoluta*, *Ctenium newtonii* and *Eragrostis* sp.


Photos A-JK-170415-396 and A-JK-170704-915 of Open Grassland with *Borassus* and *Balanites*

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site. However, there are two invasive plant species, viz: *Salvinia molesta* and *Eichhornia crassipes* in a wetland (Photos A-JK-161129-193, A-JK-161129-195, A-JK-161129-196 that could proliferate with disturbance.


Photos A-JK-161129-193 (top left), A-JK-161129-195 (bottom) and A-JK-161129-196 (top right) of invasive *Salvinia molesta* and *Eichhornia crassipes*

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Borassus aethiopum*, *Crateva adadnsonii, Balanites aegyptiaca* and *Acacia sieberiana*. In addition, there is seasonally flooded *Urochloa* seasonal wetland with habitat-specific flora in a wallow at the site(Photo A-JK-161129-186).

Photo A-JK-161129-186 of seasonal wetland

15. JBR-09

HABITATS AND THEIR CONDITION

This site is located on flat ground (slope 4-8°) on sandy soil. The vegetation is *Borassus-Acacia-Balanites-Hyperthelia* Wooded Grassland with *Borassus* in the shrub layer and very short grass due to over grazing and burning at the well site (Photos A-JK-170416-412 and A-JK-170626-760). This is surrounded by Open *Borassus-Acacia* woodland with *Borassus-Crateva* shrub layer and short grass due to burning and over grazing. In places, the vegetation becomes Open *Acacia* woodland with occasional *Borassus* trees and *Borassus* in the shrub layer and very short grass. In the adjacent gulley is Open Riverine Woodland dominated by *Acacia* and *Borassus* in the tree layer with *Sporobolus* and *Setaria* in the herb layer with moderate grass height.

Photos A-JK-170416-412 and A-JK-170626-760 of *Borassus-Acacia* Wooded Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species was recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Acacia sieberiana* (Photos A-JK-161130-211 and A-JK-161130-212), *Borassus aethiopum* and *Balanites aegyptiaca*.

Photos A-JK-161130-211 and A-JK-161130-212 of large mature *Acacia* tree

16. KGG-03

HABITATS AND THEIR CONDITION

The well site is located on very gently sloping ground (slope 4-8°) on sandy soil. The whole environment is modified with cultivation, leaving only very few isolated mature trees. The vegetation at the well site itself is Bushed Grassland dominated by *Acacia hockii* and *Harrisonia abyssinica* with *Cyperus* sp., *Setaria sphacelata* and *Brachiaria brizantha* in the herb layer and partly cultivated with *Zea mays* (maize) and *Gossypium* (cotton) (Photos A-JK-170613-589 and A-JK-170613-590).

The surrounding area is mostly cultivated with *Manihot* gardens with relics of small trees and relics of *Lannea-Harrisonia-Ziziphus* thicket. There is occasional occurrence of *Musa* garden surrounded by Grevillea trees with weeds of cultivation such as *Digitaria ciliaris*, *Bidens pilosa*, *Commelina africana* and *Brachiaria scalaris* and Brachiaria *brizantha* in the herb layer. There are also Post-cultivation areas of *Manihot esculenta* and bushed grassland with *Albizia grandibracteata*, *Acacia hockii* and *Harrisonia abyssinica* with *Panicum maximum* in the herbaceous layer (Photos A-JK-170421-584 and A-JK-170421-585).


Photos A-JK-170613-589 and A-JK-170613-590 of Bushed Grassland with cultivation (above) and A-JK-170421-584 and A-JK-170421-585 (below) of Bushed Grassland relics in cultivation (below)

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

Dalbergia melanoxylon, a Globally Threatened species (VU - IUCN 2017) was recorded at the site at very low abundance.

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. There are only very few mature trees recorded during the avoidance surveys such as the planted or spared *Mangifera indica*. The invasive *Chromolaena odorata* was recorded at very low abundance.

17. KW-01

HABITATS AND THEIR CONDITION

This site is located on flat ground (slope 0-4°) which is poorly drained. The vegetation is Seasonally Flooded Bushed Grassland with Thicket dominated by *Euphorbia candelabrum*, *Azima tetracantha* (Photo A-JK-170110-608 and A-JK-170110-595). The grass layer is intermediate height of *Sporobolus pyramidalis* with an additional layer of short grass with *Sporobolus festivus*. There are shallow depressions that collect water seasonally. In places, the vegetation is Seasonally Flooded Open Grassland dominated by *Sporobolus pyramidalis*, *Setaria sphacelata*, *Panicum* sp. and *Sporobolus consimilis* with very sparse thicket dominated by *Azima tetracantha*, *Euphorbia candelabrum, Acacia sieberiana* and *Balanites aegyptiaca*.

There are small patches of Bushland dominated by *Opuntia* and *Azima tetracantha* with very little tree cover and very small pockets of *Sporobolus pyramidalis* grassland. Trees here are dominated by *Acacia sieberiana*, *Euphorbia candelabrum* with short grass owing to over grazing.

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species was recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. But, there are notable avoidance features recorded within the site that may be affected by the planned developments. Mature large trees, particularly of *Acacia sieberiana* and *Balanites aegyptiaca* may be cut down or damaged. There are also Seasonally Flooded Open Grassland (wetland) areas (Photo A-JK-170110-608) with habitat-specific species of plants such as *Cyperus articulatus* (Photo A-JK-170110-595). Exotic and invasive *Opuntia* sp. (Photos A-JK-170407-250 and A-JK-170621-702) was recorded at very high abundance and at very low abundance.


Photo A-JK-170110-608 and A-JK-170110-595 of Seasonally Flooded Grassland with habitat-specific flora


Photos A-JK-170407-250 and A-JK-170621-702 of *Opuntia* sp.

18. KW-02

HABITATS AND THEIR CONDITION

This site is located on flat ground (slope 0-4°) on sandy soil. The vegetation is Modified Grassland with Thicket dominated by *Azima tetracantha* and *Euphorbia candelabrum* with short grass and sparse tree cover (Photo A-JK-170622-704). The area is mostly settled in Bushed Grassland dominated by *Hyperthelia dissoluta* with thicket dominated by *Euphorbia* and *Azima*. The tree layer is

dominated by *Crateva* and *Azadirachta*. There are also planted Woodlot patches of *Cassia siamea* with very scattered *Azima* thicket and very sparse grass layer with large patches of bare ground.

Photo A-JK-170622-704 of Modified Bushed Grassland with Thicket

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

Milicia excelsa, assessed as Globally LR/NT by IUCN (2017) was recorded at seven locations within the site. It is also a 'Reserved Species' attracting national attention and concern in Uganda and also listed as NT by WCS (2016).

Invasive *Cassia siamea* was recorded in some areas in fairly high abundance and in other areas at very low abundance.

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Acacia sieberiana*, *Albizia coriaria*, *Azadirachta indica*, *Balanites aegyptiaca*, *Crateva adansonii*, *Kigelia africana*, *Lannea schweinfurthii*, *Mangifera indica*, *Milicia excelsa* and *Tamarindus indica*. In addition, there are seasonally flooded grassland (wetland) areas with habitat-specific flora.

19. NGR-02

HABITATS AND THEIR CONDITION

This site is located on flat ground (slope 4-8°) on sandy soil. The vegetation is Bushed Grassland with Thicket dominated by *Acacia*, *Ziziphus*, *Stereospermum* and very short herbaceous level owing to heavy grazing (Photo A-JK-170615-612). Within the buffer zone is also Bushed Grassland with thicket dominated by *Acacia hockii*, *A. brevispica*, A. *sieberiana* and very occasional small trees.

There is also Seasonally Flooded Grassland with shallow depressions of impeded drainage dominated by *Setaria sphacelata* and *Cynodon dactylon* and fringed by dense *Acacia* Bushland (Photo A-JK-170401-167). In the lower lying areas is Bushland dominated by *Acacia brevispica*,

Jasminum sp., *Ziziphus pubescens* and *Capparis* spp. forming a dense impenetrable cover with sparse bare patches (Photo A-JK-170401-166).

Photo A-JK-170615-612 of Bushed Grassland with Thicket (left) and A-JK-170401-167 of Seasonally Flooded Grassland fringed by Bushland (right)

Photo A-JK-170401-166 of Bushland with bare patches

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Acacia senegal*, *A. sieberiana*, *Balanites aegyptiaca*, *Crateva adansonii*, Lannea schweinfurthii, Sclerocarya birrera, Tamarindus indica and *Ziziphus pubescens*, with a high woody biomass.

20. NGR-03A

HABITATS AND THEIR CONDITION

This site is located on flat ground on sandy soil. The vegetation is Bushed Grassland with Thicket dominated by *Euphorbia*, *Crateva*, and *Ziziphus* with very short grass and sparse tree cover (Photos A-JK-170402-173 and A-JK-170616-623). There is also Grassland with Thicket dominated by *Euphorbia* and *Cadaba* and very sparse tree cover.

Photos A-JK-170402-173 and A-JK-170616-623 of Bushed Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Acacia sieberiana*, *Balanites aegyptiaca*, *Crateva adansonii*, *Euphorbia candelabrum*, *Lannea schweinfurthii*, and *Tamarindus indica*. The abundance of these could be reduced if not carefully avoided.

21. NGR-05A

HABITATS AND THEIR CONDITION

This site is located on gently sloping flat (slope 4-8°) on sandy soil. The vegetation is mainly Bushed Grassland with patches of Thicket dominated by *Euphorbia candelabrum*, *Acacia brevispica* and *Acalypha fruticosa* with very sparse trees dominated by *Lannea schweinfurthii* and very low grass layer due to over grazing and burning (Photo A-JK-170403-187 - A-JK-170403-188). There is also *Hyperthelia* Grassland with Thicket dominated by *Cadaba farinosa*, *Euphorbia candelabrum* and *Ziziphus pubescens* and very sparse tree cover of *Acacia sieberiana* and *Euphorbia candelabrum*.

In places there is Wooded Grassland dominated by *Acacia sieberiana*, *Tamarindus indica*, *Ziziphus pubescens* and *Euphorbia candelabrum* with thicket of *Cadaba farinosa* and *Ziziphus pubescens*.


Photos A-JK-170403-188 and A-JK-170617-634 of Bushed Grassland

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Acacia sieberiana*, *A. senegal*, *Albizia coriaria*, *Balanites aegyptiaca*, *Crateva adansonii*, *Euphorbia candelabrum*, *Lannea schweinfurthii*, *Sclerocarya birrea*, *Tamarindis indica* and *Ziziphus pubescens*.

22. NGR-06

HABITATS AND THEIR CONDITION

This site is located on flat ground with a slope of 0-4° on sandy soil. The vegetation is Bushed Grassland with Thicket dominated by *Capparis fascicularis*, *Cadaba farinosa*, *Acacia brevispica* and *Euphorbia candelabrum* with very short grass of *Hyperthelia dissoluta*, *Digitaria longiflora* in the herbaceous layer (Photos A-JK-170404-201 and A-JK-170618-648). There is also Grassland with sparse thicket dominated by *Cadaba farinosa* and sparse tree cover dominated by *Euphorbia candelabrum* and *Lannea schweinfurthii*.


Photos A-JK-170404-201 and A-JK-170618-648 of Bushed Grassland with Thicket

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species recorded at the site. There is however, *Cassia siamea*, an invasive tree species planted for firewood and building.

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

No species of conservation concern were recorded at this site. However, there are notable avoidance features recorded within the site as mature large trees, particularly of *Albizia coriaria*, *Balanites aegyptiaca*, *Crateva adansonii*, *Euphorbia candelabrum*, *Lannea schweinfurthii* and *Sclerocarya birrea*.

23. NSO-04

HABITATS AND THEIR CONDITION

This site is located on gently sloping ground with a slope angle of 8-16° on sandy soil. The vegetation is Bushed Grassland with Scattered Thicket of *Euphorbia candelabrum*, *Ziziphus pubescens* and very sparse tree cover of *Crateva adansonii* and *Acacia sieberiana* with very short grass (Photos A-JK-170406-224 and A-JK-170620-675). Some of the areas are Modified Bushed Grassland with patches of woodlots and sparse tree cover dominated by *Euphorbia candelabrum*, *Lannea schweinfurthii*.

There is also Wooded Grassland dominated by *Balanites aegyptiaca* and *Lannea schweinfurthii* with very short grass in settled areas. In the adjacent low-lying area is Seasonally Flooded Woodland with *Albizia coriaria*, *Ficus sycomorus* and *Sclerocarya birrea*. There is also Open Bushland with scattered Thicket dominated by *Acacia hockii*, *Euphorbia candelabrum* and *Ziziphus pubescens* and a sparse tree cover. There are also patches of planted *Cassia siamea* woodlots.


Photos A-JK-170406-224 and A-JK-170620-675 of Bushed Grassland with Thicket

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

Dalbergia melanoxylon (Photos A-JK-170120-925, A-JK-170120-930), a Globally Threatened species, was recorded at areas shown in the table below within the site. This is assessed as Globally LR/NT (IUCN 2017) and as nationally NT in Uganda by WCS (2016). *Thevetia peruviana* is an exotic recorded at very low abundance. Invasive *Cassia siamea* was also recorded from the site.


Photos A-JK-170120-925 (left) and A-JK-170120-930 (right) of Globally Threatened *Dalbergia melanoxylon* in the centre of each photo

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

Dalbergia melanoxylon, a globally threarened species, may be damaged or even depleted from the site as it often occurs in low abundance. There are also mature large trees, particularly of *Acacia sieberiana, Albizia coriaria, Balanites aegyptiaca, Crateva adansonii, Kigelia Africana, Lannea schweinfurthii* and *Trichilia emetica*.

24. Water Abstraction System (WAS)

HABITATS AND THEIR CONDITION

This site is located on the shores of Lake Albert on a flat (slope 0-4°) floodplain on sandy soil (Photo A-JK-170329-087). The vegetation is Seasonally Flooded Grassland with very short grass dominated by *Paspalidium geminatum*, *Cynodon dactylon* and in places with and *Sporobolus pyramidalis* and bare sandy patches. There is also Permanent wetland dominated by *Aeschynomene elaphroxylon*, *Typha latifolia*, *Phragmites mauritianum* with *Eichhornia crassipes* (Photos A-JK-170329-094 and A-JK-170329-096).

Photo A-JK-170329-087 of Floodplain on sandy soil

Photos A-JK-170329-094 and A-JK-170329-096 (below) of Permanent Wetland with *Aeschynomene elaphroxylon*

PRESENCE OF SPECIES OF CONSERVATION CONCERN (E.G. RED LIST SPECIES AND/OR CRITICAL HABITAT CRITERIA)

No threatened, rare or range-restricted species was recorded at the site. A couple of invasive species of plant were recorded: *Eichhornia crassipes* at low abundance and *Mimosa pigra* at very low abundance.

IMPLICATIONS FOR DIRECT/INDIRECT IMPACTS

The invasive *Eichhornia crassipes* (Photo A-JK-161218-531) may get introduced into the lake deliberately or inadvertently, rapidly increasing its abundance. Alteration of the physical conditions may compromise the survival of habitat-specific species such as *Cyperus articulatus*, *Leersia hexandra*, *Oryza*.

Photo A-JK-161218-531 of *Eichhornia crassipes* (left) and A-JK-161218-5 of 06 *Oryza* sp. (right)

SUMMARY

Table **2**: Summary of the site floral conditions

SITE	Habitat condition	Sensitive microhabitats	Species richness	Range-restricted species (endemism)	Threatened species	Invasive species
Victoria Nile Ferry Crossing (North)	Natural	i) River banks that may get silted ii) River edges with invasive species that may proliferate	63	None	None	i) Salvinia molesta ii) Eichhornia crassipes
Victoria Nile Ferry Crossing (South)	Natural	i) River banks that may get silted ii) River edges with invasive species that may proliferate	41	None	None	i) Salvinia molesta ii) Eichhornia crassipes iii) Mimosa pigra
Bugungu Airstrip	Natural	i) High woody biomass in entire area ii) Areas with invasive Chromolaena odorata	95	None	None	Chromolaena odorata
Victoria Nile Pipeline HDD Crossing (North)	Natural	i) Woody biomass of large trees ii) Seasonal wetlands	65	None	None	i) Eichhornia crassipes at river edge ii) Salvinia molesta
Victoria Nile Pipeline HDD Crossing (South)	Transitional	i) Woody biomass of large trees	40	None	Dalbergia melanoxylon, (Globally VU - IUCN 2017)	
JBR-01	Natural	Seasonally Flooded Grassland areas in the vicinity	126	None	None	None
JBR-02	Natural	Where mature trees grow	140	None	None	None
JBR-03	Natural	i) Wallows with habitat-specific	98	None	None	None

SITE	Habitat condition	Sensitive microhabitats	Species richness	Range-restricted species (endemism)	Threatened species	Invasive species
		flora ii) Mature trees in vale				
JBR-04	Natural	i) Mature trees in vale ii) Seasonally flooded wetland areas with habitat-specific flora	128	None	None	None
JBR-05	Natural	Small grooves of trees	68	None	None	None
JBR-06	Natural	i) Vale with sparse mature trees ii) Seasonal wetland areas with habitat-specific flora	94	None	None	None
JBR-07	Natural	i) Seasonally flooded areas with habitat-specific flora ii) Areas with mature Borassus trees	96	None	None	None
JBR-08	Natural	i) Areas with invasive species ii) Seasonally flooded areas with habitat-specific flora	122	None	None	i) Salvinia molesta ii) Eichhornia crassipes
JBR-09	Natural	Areas with high woody biomass	132	None	None	None
JBR-10	Natural	i) High woody biomass in dense Bushland ii) Wallows with habitat-specific flora	124	None	None	None
(KGG-03)	Modified	None	159	None	Dalbergia melanoxylon,	Chromolaena odorata

SITE	Habitat condition	Sensitive microhabitats	Species richness	Range-restricted species (endemism)	Threatened species	Invasive species
					(Globally VU - IUCN 2017)	
KW-01	Transitional	Seasonally flooded shallow depressions with habitat-specific flora	94	None	None	Opuntia sp.
KW-02	Transitional	Cassia siamea in woodlots	96	None	Milicia excelsa (Globally LR/NT by -IUCN (2017) and nationally NT (WCS 2016)	Cassia siamea
NGR-02	Transitional	High woody biomass around in bushland areas ii) Seasonal wetlands	106	None	None	None
NGR-03A	Transitional	Areas with mature trees	90	None	None	None
NGR-05A	Transitional	Areas with mature trees	88	None	None	None
NGR-06	Transitional	Areas with mature trees	80	None	None	Cassia siamea
NSO-04	Transitional	Seasonally flooded Open woodland with large mature trees	132	None	Dalbergia melanoxylon, (Globally VU - IUCN 2017)	Cassia siamea
WAS	Transitional	Permanent wetland with mature trees of Aeschynomene	60	None	None	Eichhornia crassipes, Mimosa pigra

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VEGETATION

AECOM

Record No.		Locality (West/North/South)	
Survey Site No.		Northing	
Date		Easting	
Time		Altitude (m)	
Surveyor(s)		Slope	
Temperature		Soil type and drainage	
Weather:		Wind Direction	
		Wind Speed	
Site and Vegetation Description:		Tree cover (%)	
		Shrub cover (%)	
		Herbaceous cover (%)	
		Bare ground cover %	
		Tree canopy mean height (m)	
		Shrub mean height (m)	
		Herbaceous mean height (m)	
		Dominant woody spp.: i) ii) iii)	
		Dominant herb. spp.: i) ii) iii)	
Photo Refs.			

SPECIES	**Cover (%)**	**DOMIN scale**	**SPECIES**	**Cover (%)**	**DOMIN scale**

SPECIES	Cover (%)	DOMIN scale	SPECIES	Cover (%)	DOMIN scale

Continue on additional sheet as necessary.

DOMINANT COVER/ABUNDANCE SCALE

1	<4% (few individuals)
2	<4% (several individuals)
3	<4% (many individuals)
4	4–10%
5	11–25%
6	26–33%
7	34–50%
8	51–75%
9	76–90%
10	91–100%

Due to overlapping, the whole can add up to >100%; especially in woodlands and papyrus which are multi-layered

For Trees Record:

- Age and Structure Assessment
- DBH measurement
- Signs of natural regeneration

For Aquatics and Emergent Species, Record:

- Water depth, flow, turbidity
- Open water, instead of Bare ground

In Woodland and Papyrus Record height and cover for:

- Canopy
- Understorey
- Field Layer

APPENDIX N2

Tilenga Project

VEGETATION AND SENSITIVITY MAPPING

2019

APPENDIX N2

Sources for Vegetation and Sensitivity Mapping

This appendix includes two sets of maps, comprising Vegetation Mapping (Appendices N2.1 to N2.2) and Sensitivity Mapping (Appendices N2.3 to N2.5), respectively.

Vegetation Mapping (Appendices N2.1 – N2.2)

A number of mapping exercises have been undertaken within MFNP and surrounding areas in relation to this project. The mapping shown here is the collated and interpreted mapping presented in WCS 2016[1]. This data has been used to inform the species association studies[2] and also habitat quality assessment[3]. The mapping is based on the following studies:

- Data[4] from the Phase I biodiversity surveys carried out for EA1
- Data collected to inform this ESIA, particularly focused on the Project footprint area (see Appendix N1 for field survey report)
- WCS data collected from MFPA in partnership with UWA and NEMA funded by the Norwegian Government under the Oil for Development fund
- WCS data during the Phase 2 biodiversity study funded by TUOP
- WCS collected for this study funded by TEPU
- Data received from the National Biodiversity Data Bank (NBDB) at Makerere University

The data was combined by WCS and used to finalise mapping and to define the landcover classification hierarchy as described in WCS 2016.

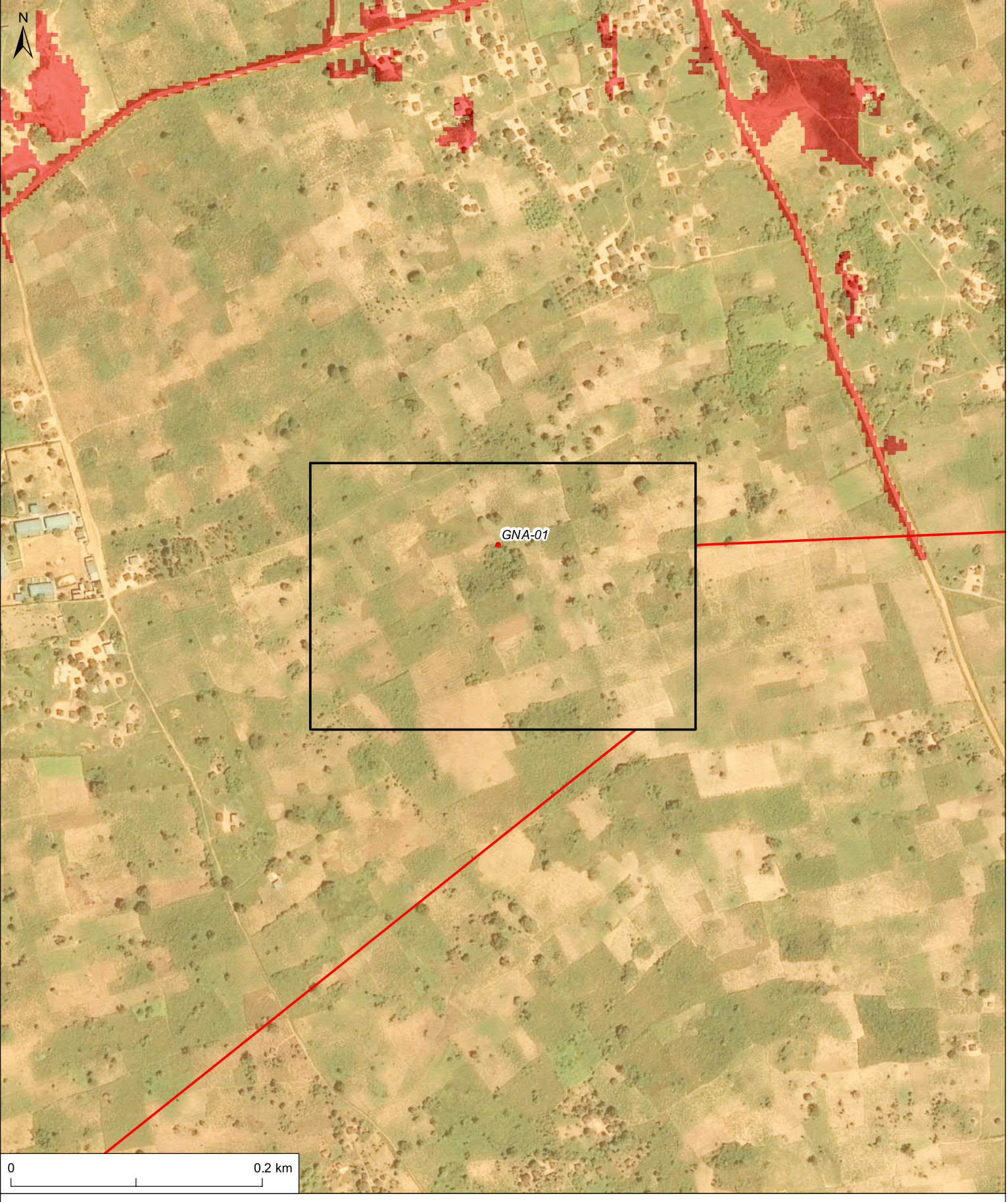
Sensitivity Mapping (Appendices N2.3 – N2.5)

The sensitivity mapping is based on extensive 'avoidance' surveys undertaken for this ESIA. The objective of the surveys was to visit each area where Project infrastructure would be placed and to record and map the presence of any features, within an appropriate buffer, which should be taken into account with regard to the FEED process, which would result in placement of infrastructure within the Project Area. The avoidance surveys were therefore the first stage in the avoidance hierarchy.

Initial field surveys were undertaken between November 2016 and February 2017, focussing mainly on the well-pad sites and Project components such as the CPF, WAS and river crossing points. Subsequently surveys were undertaken to include flowlines, access tracks and other features such as borrow pits as the locations of these features were developed and finalised. Changes to well-pad positions and other infrastructure were also covered. This second phase of surveys was undertaken between August 2017 and February 2018.

In addition, ESIA avoidance data was supplemented by avoidance surveys undertaken by TEPU during 2017. All of these data were merged to prepare the maps included in this appendix to the ESIA.

[1] WCS & eCountability (2016), Phase 2 Biodiversity Study: Volume 4, Land-Cover Mapping for the Albertine Rift Oil Development Basin, Exploration Areas EA-1-3 (Final Draft, February 2016)
[2] WCS (2017a), Critical Habitat Species Habitat associations and preferences. (Final Report September 2017)
[3] WCS (2017b) Critical Habitat Assessment: Habitat Quality and Condition (September 2017)
[4] AECOM Ltd (2015), Environmental Baseline Study for Exploration Block EA-1 in Uganda



VEGETATION COVER - GNA-01

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

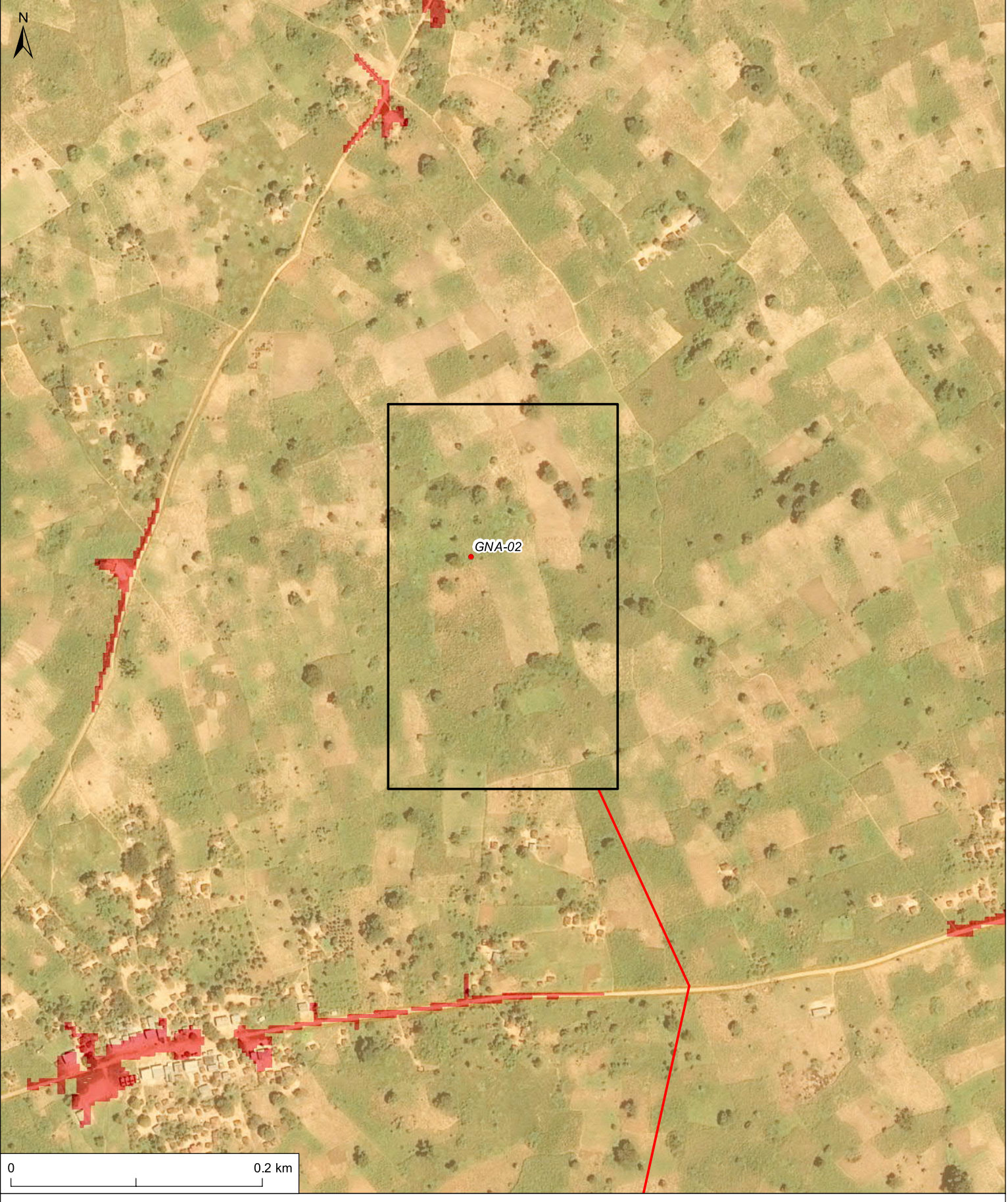
Land Cover Class (WCS 2017)

- Built-up Areas BU
- Small-scale Farming AG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - GNA-02

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

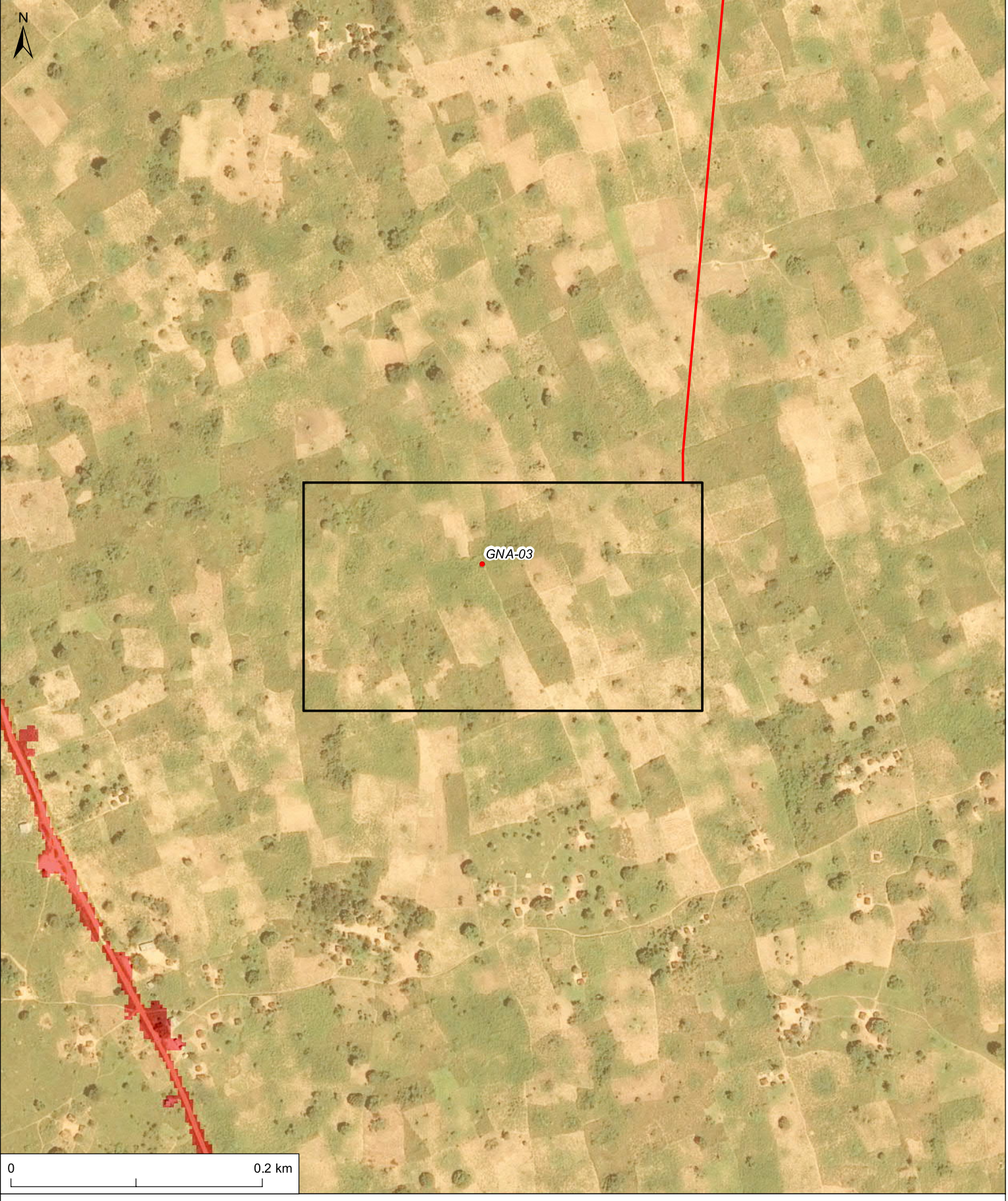
Land Cover Class (WCS 2017)

- Built-up Areas BU
- Small-scale Farming AG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - GNA-03

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

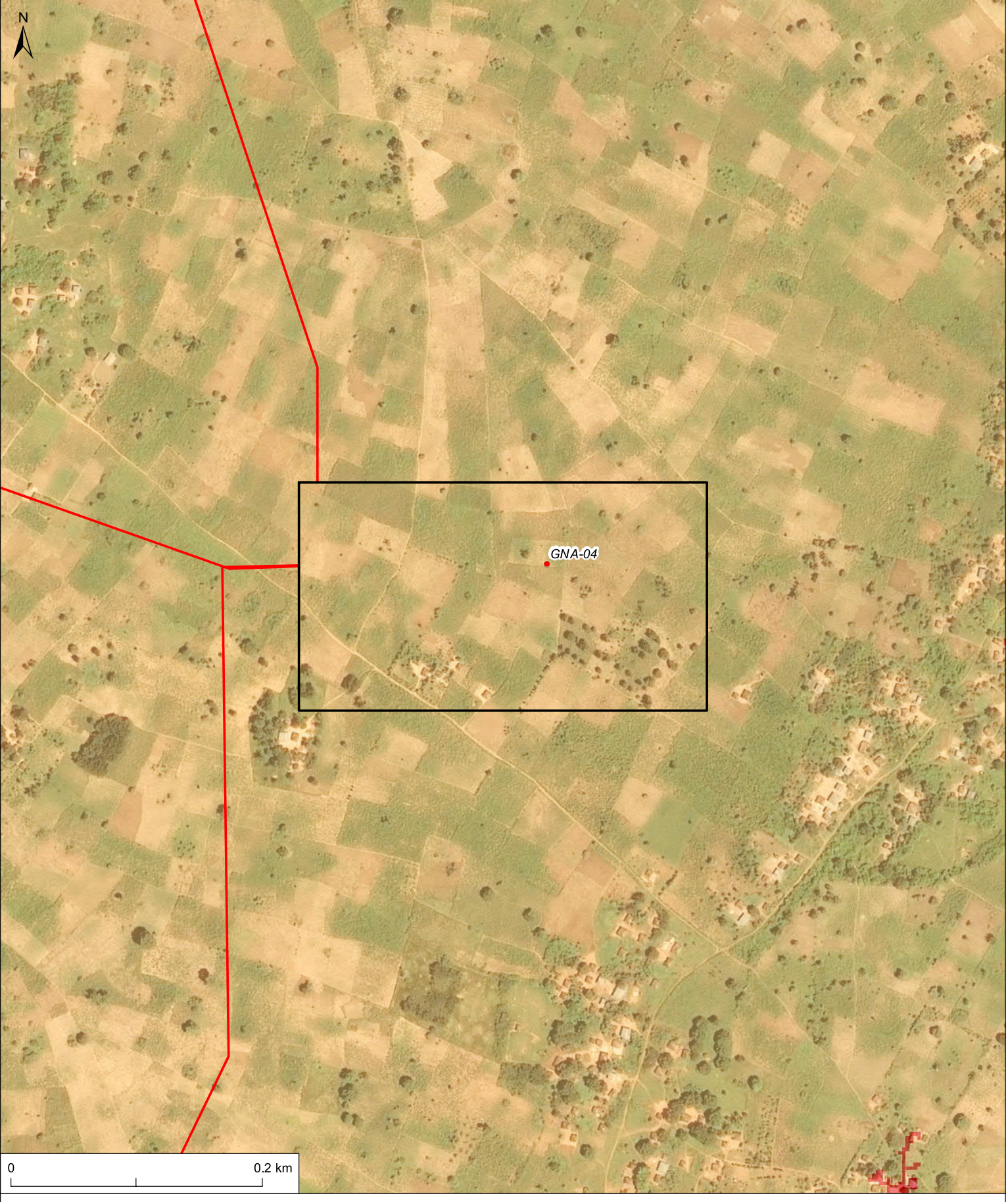
Land Cover Class (WCS 2017)

- Built-up Areas BU
- Small-scale Farming AG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - GNA-04

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Built-up Areas BU
- Small-scale Farming AG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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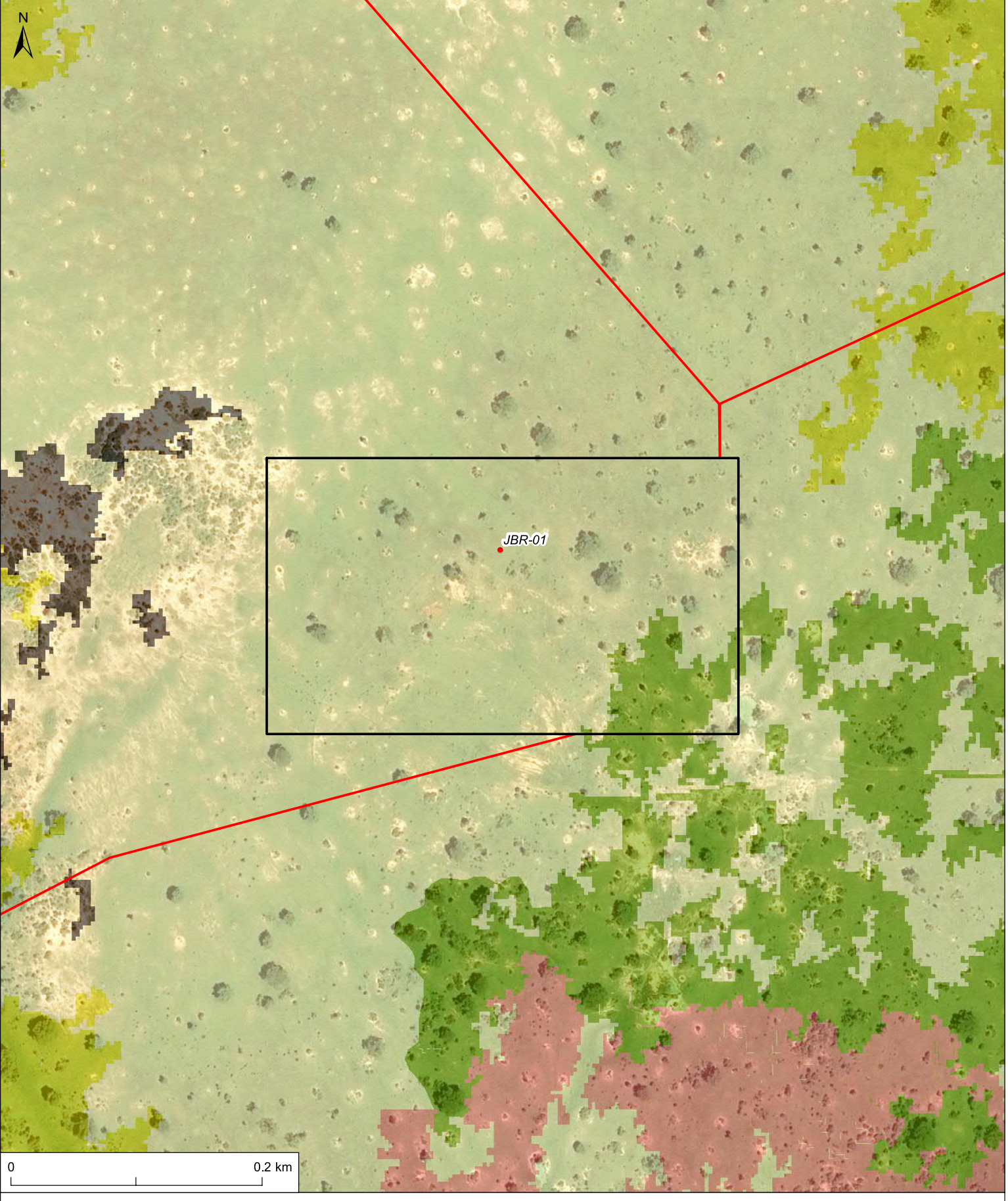


VEGETATION COVER - JBR-01

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

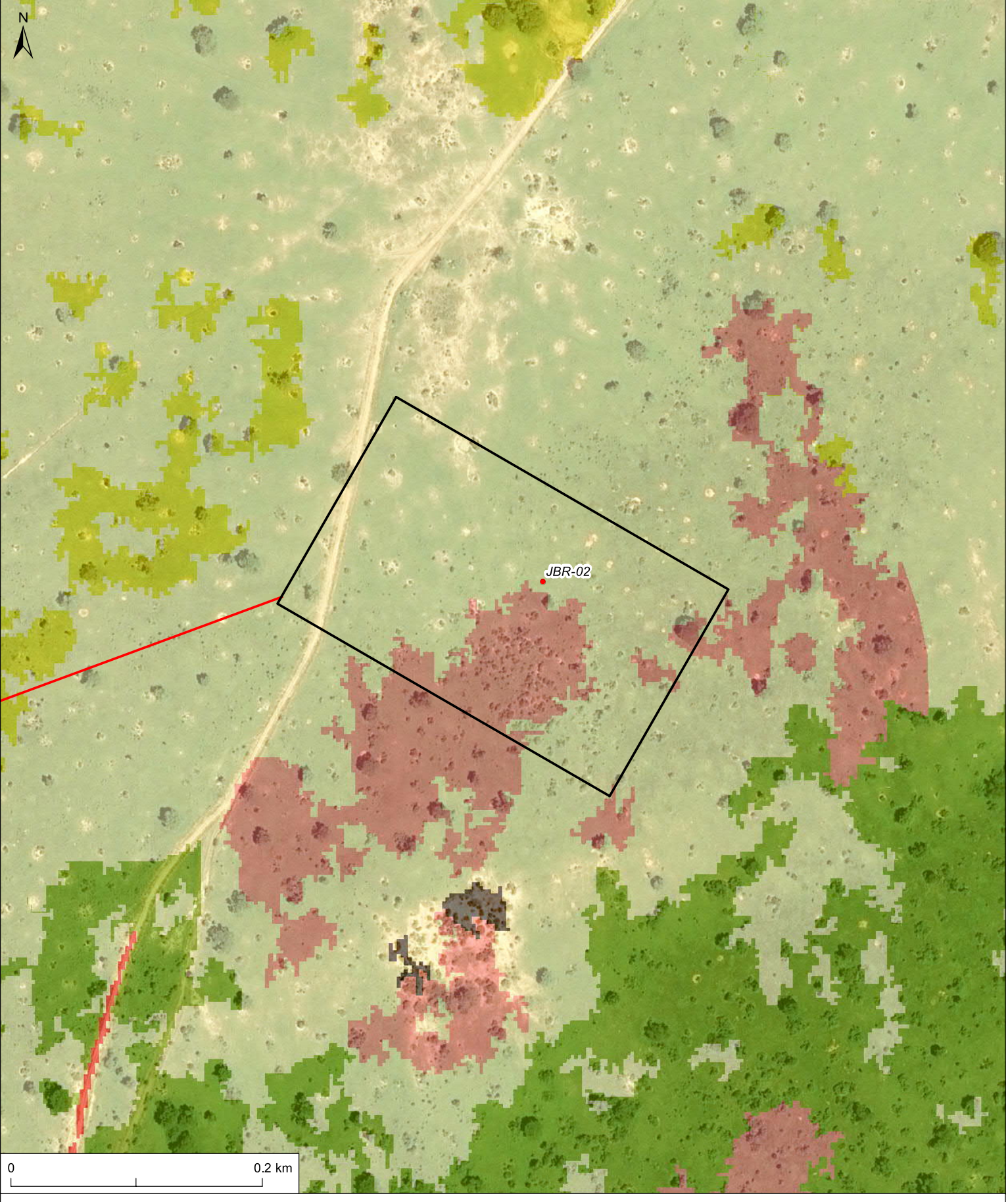
Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Bushlands SH2 (L-B T)
- Dry Grassland GR2
- Dry Wooded Grassland WG2
- Open Moist Woodlands WO1

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - JBR-02

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Built-up Areas BU
- Bushlands SH2 (L-B T)
- Dry Grassland GR2
- Dry Wooded Grassland WG2
- Open Moist Woodlands WO1

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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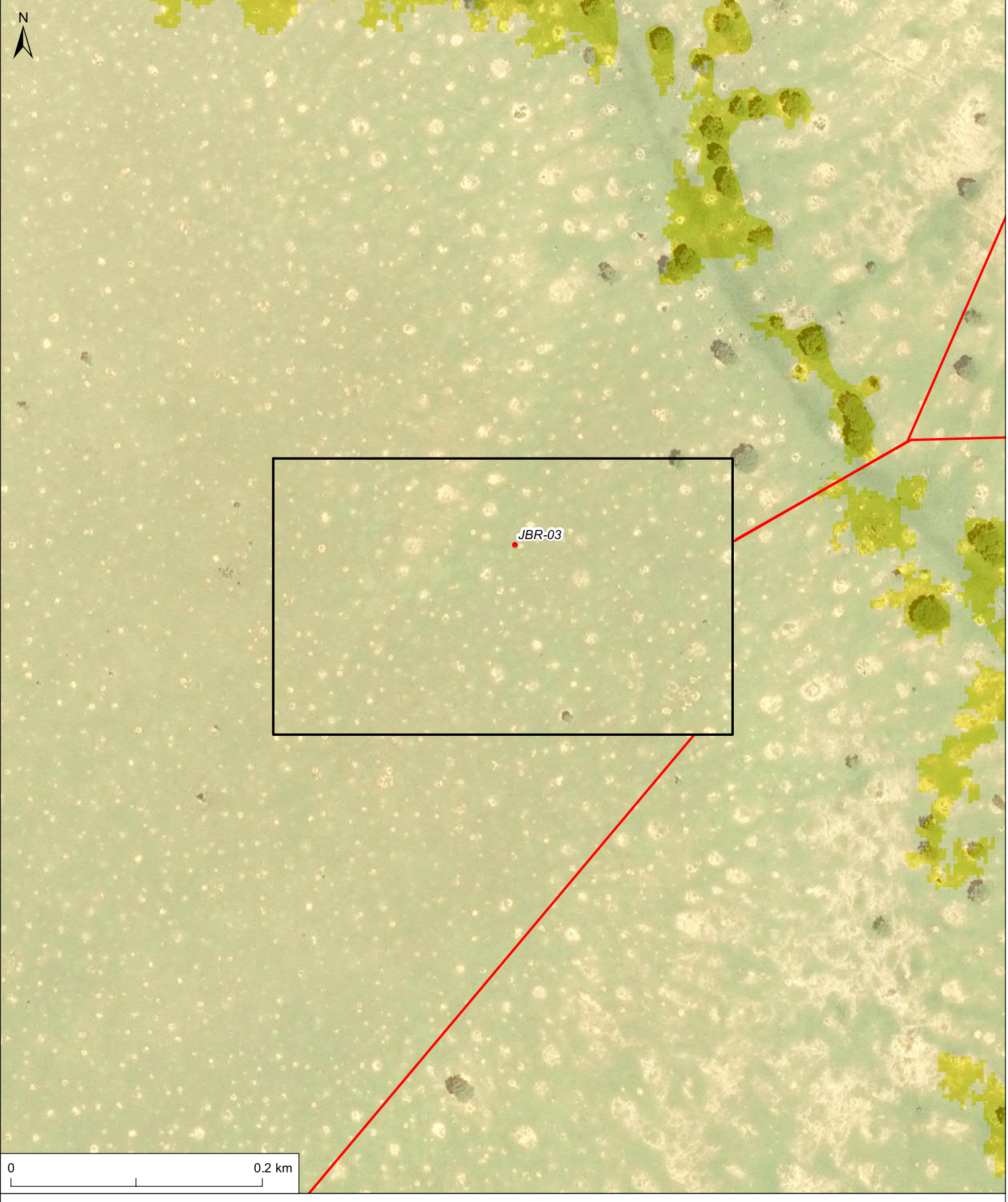

VEGETATION COVER - JBR-03

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Dry Grassland GR2
- Dry Wooded Grassland WG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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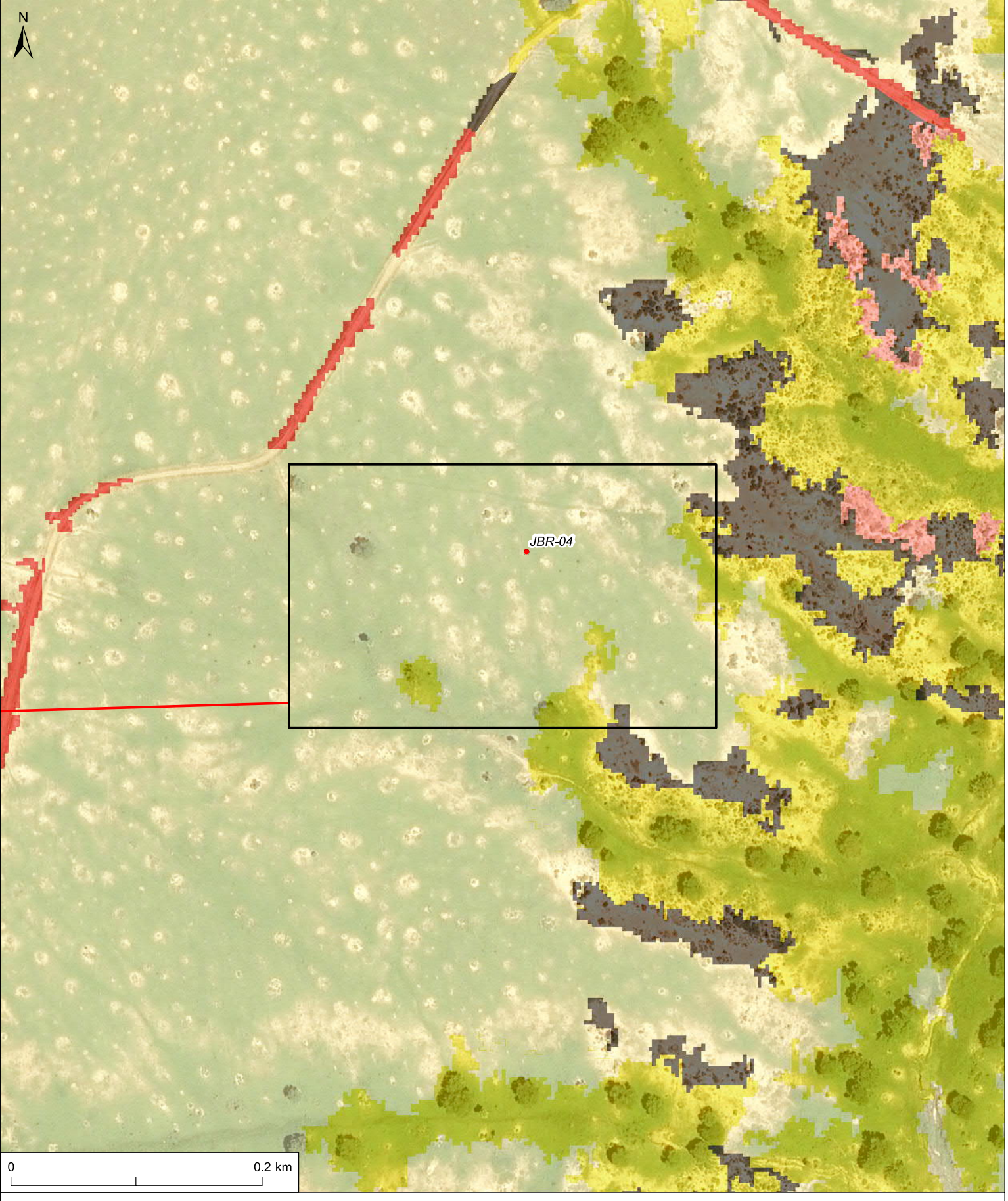


VEGETATION COVER - JBR-04

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

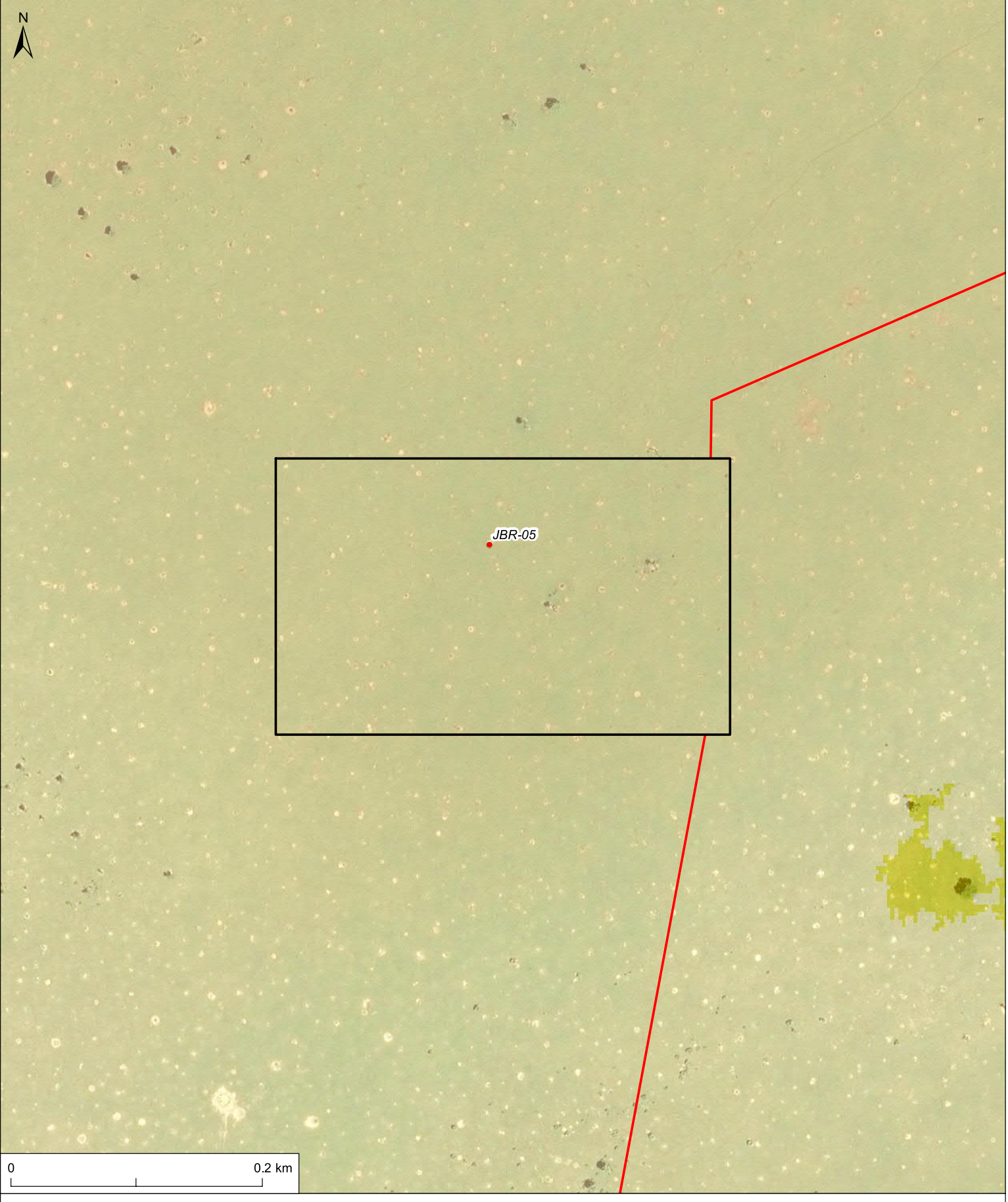
Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Built-up Areas BU
- Bushlands SH2 (L-B T)
- Dry Grassland GR2
- Dry Wooded Grassland WG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - JBR-05

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

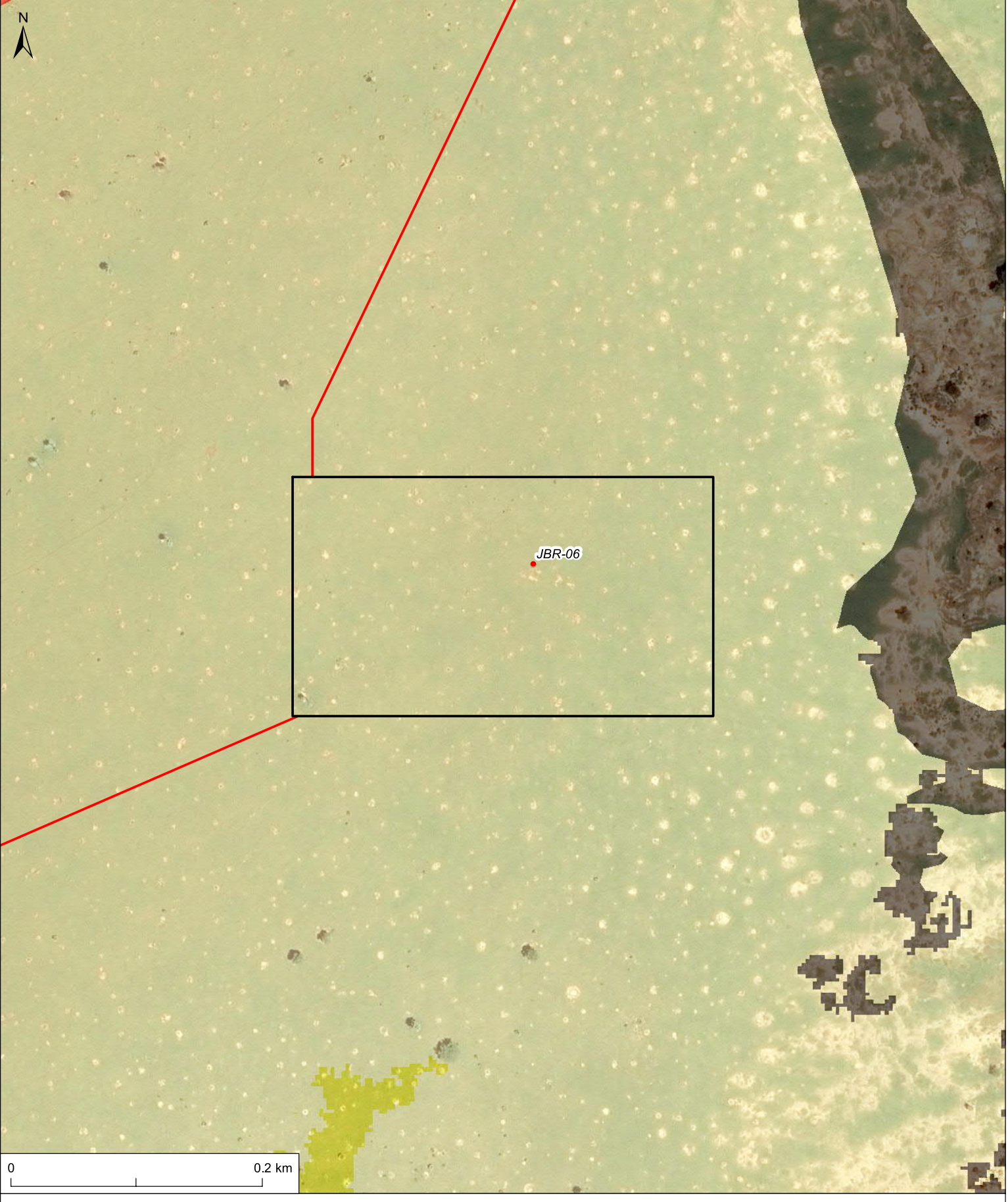
Land Cover Class (WCS 2017)

- Dry Grassland GR2
- Dry Wooded Grassland WG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - JBR-06

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Built-up Areas BU
- Dry Grassland GR2
- Dry Wooded Grassland WG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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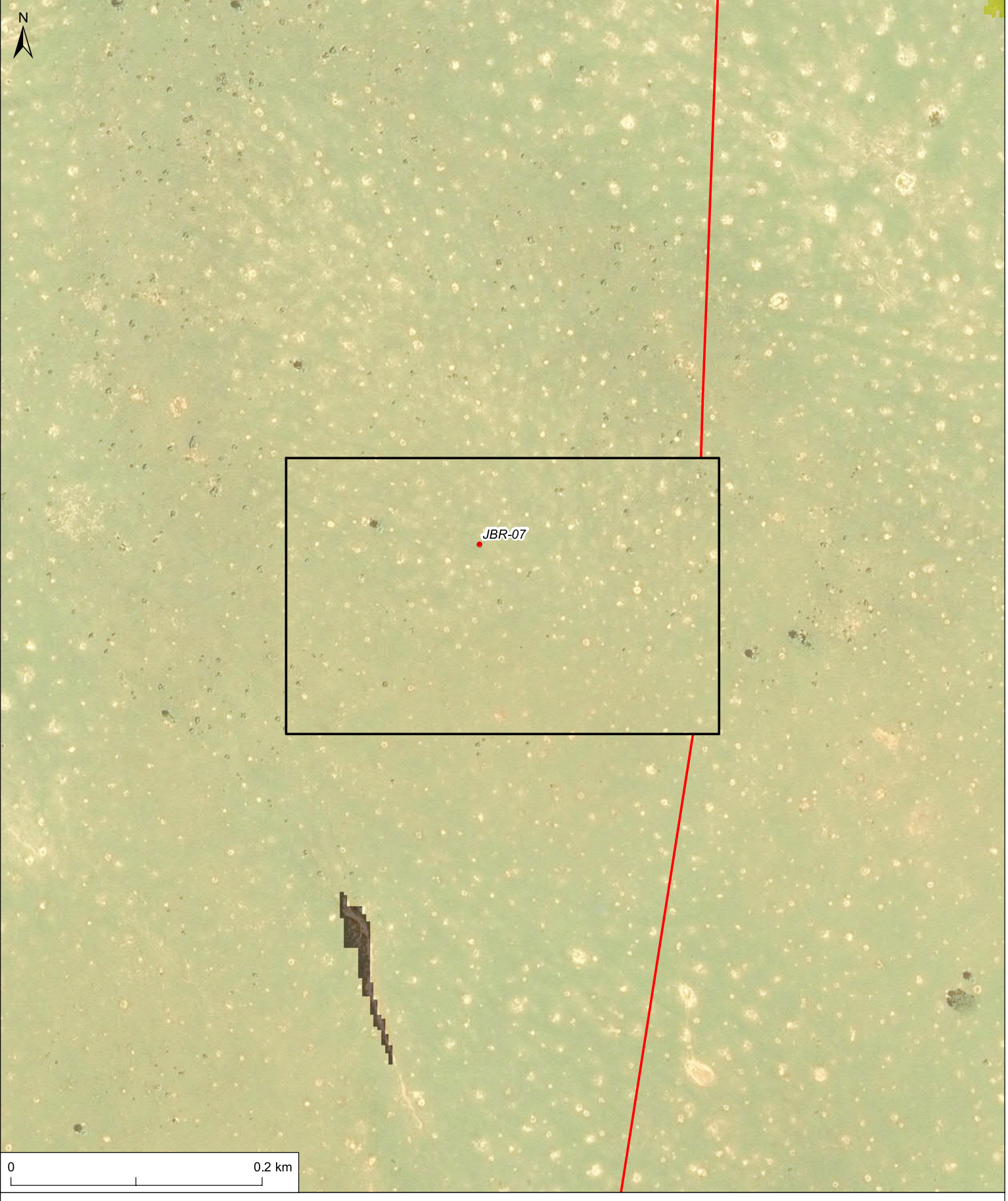

VEGETATION COVER - JBR-07

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Dry Grassland GR2
- Dry Wooded Grassland WG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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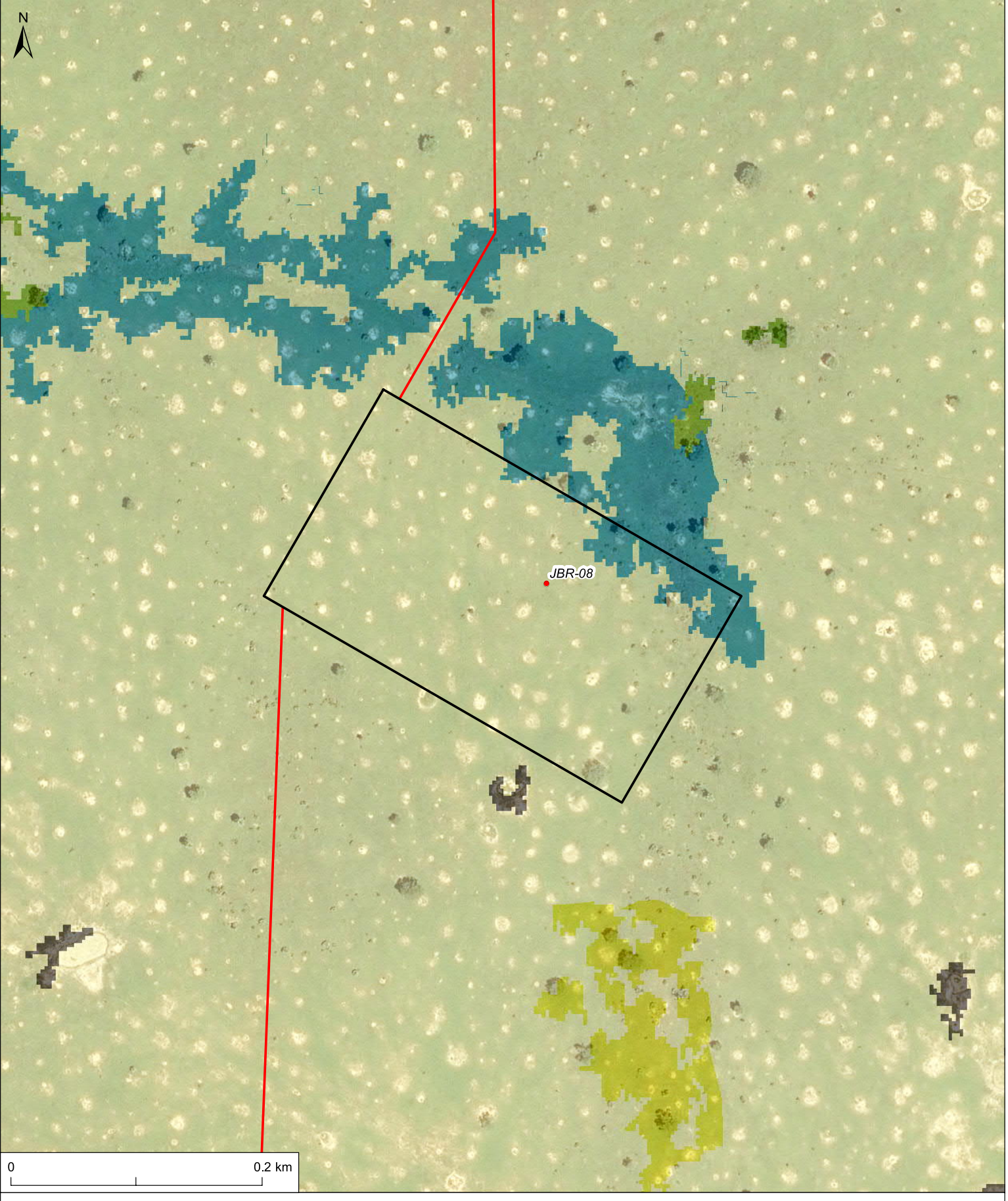

VEGETATION COVER - JBR-08

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Dry Grassland GR2
- Dry Wooded Grassland WG2
- Open Moist Woodlands WO1
- Swamps WE1 (L-B X)

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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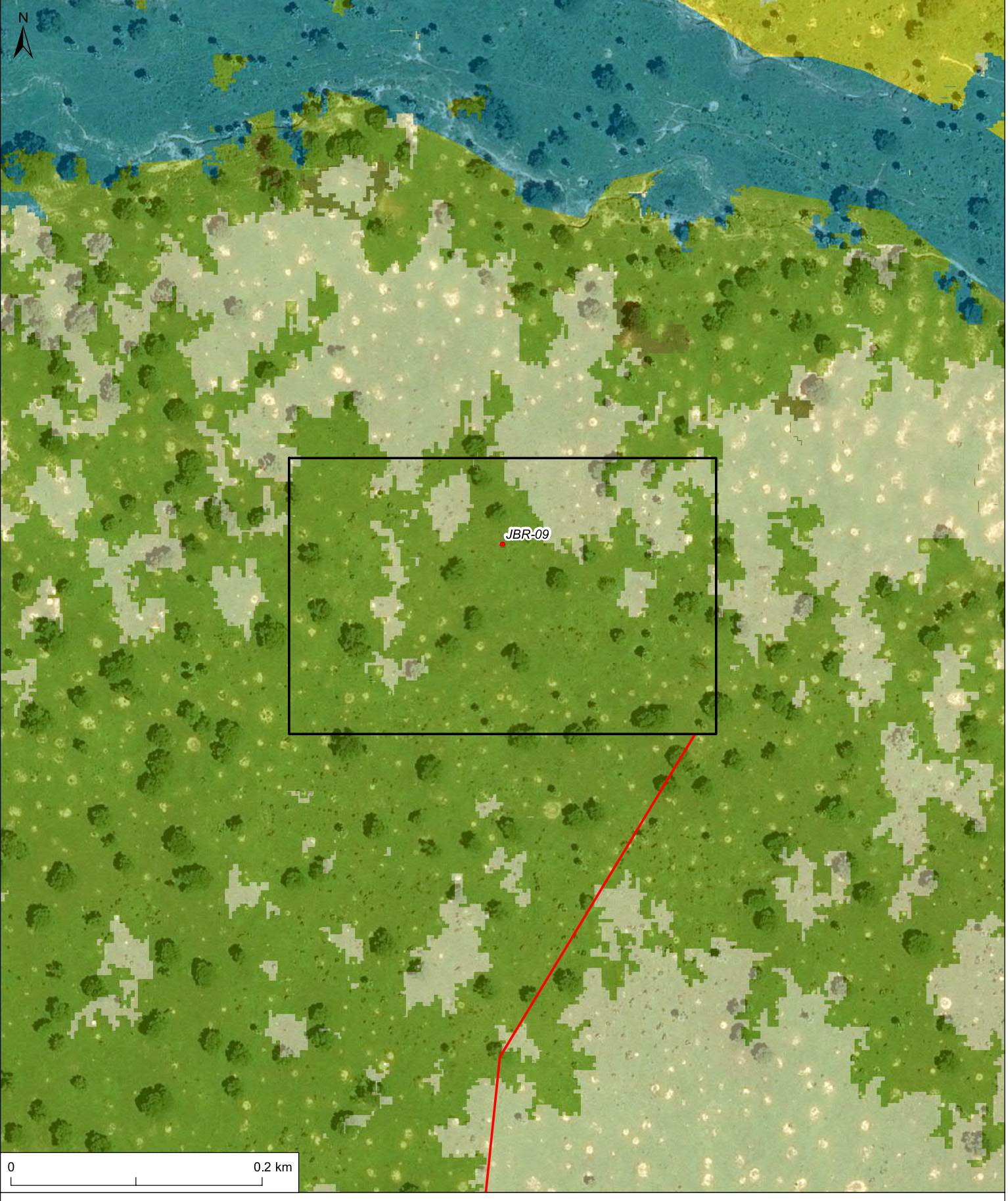

VEGETATION COVER - JBR-09

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Closed Moist Woodlands WO1
- Dry Grassland GR2
- Dry Wooded Grassland WG2
- Open Moist Woodlands WO1
- Swamps WE1 (L-B X)

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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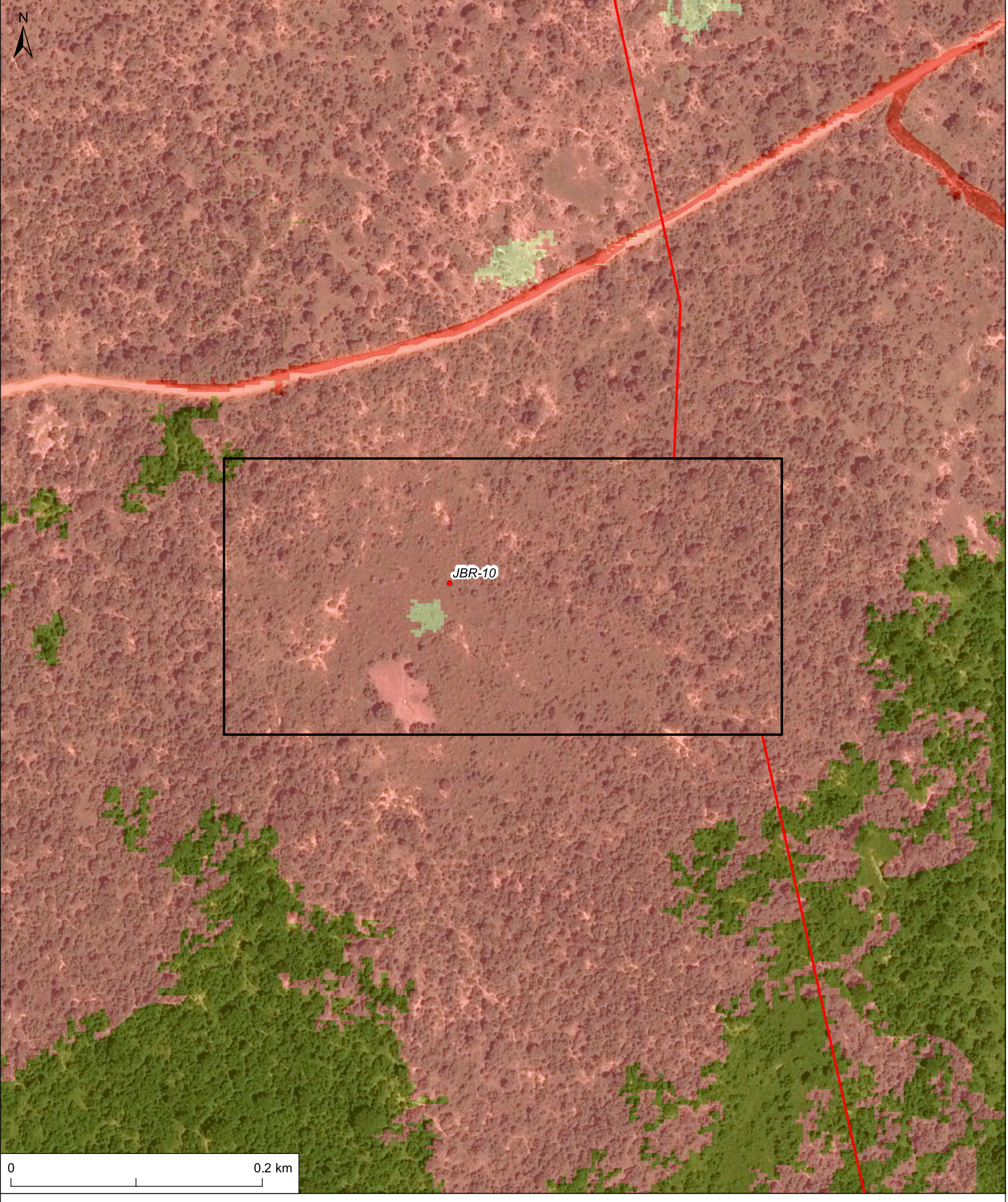

VEGETATION COVER - JBR-10

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Built-up Areas BU
- Bushlands SH2 (L-B T)
- Closed Moist Woodlands WO1
- Dry Grassland GR2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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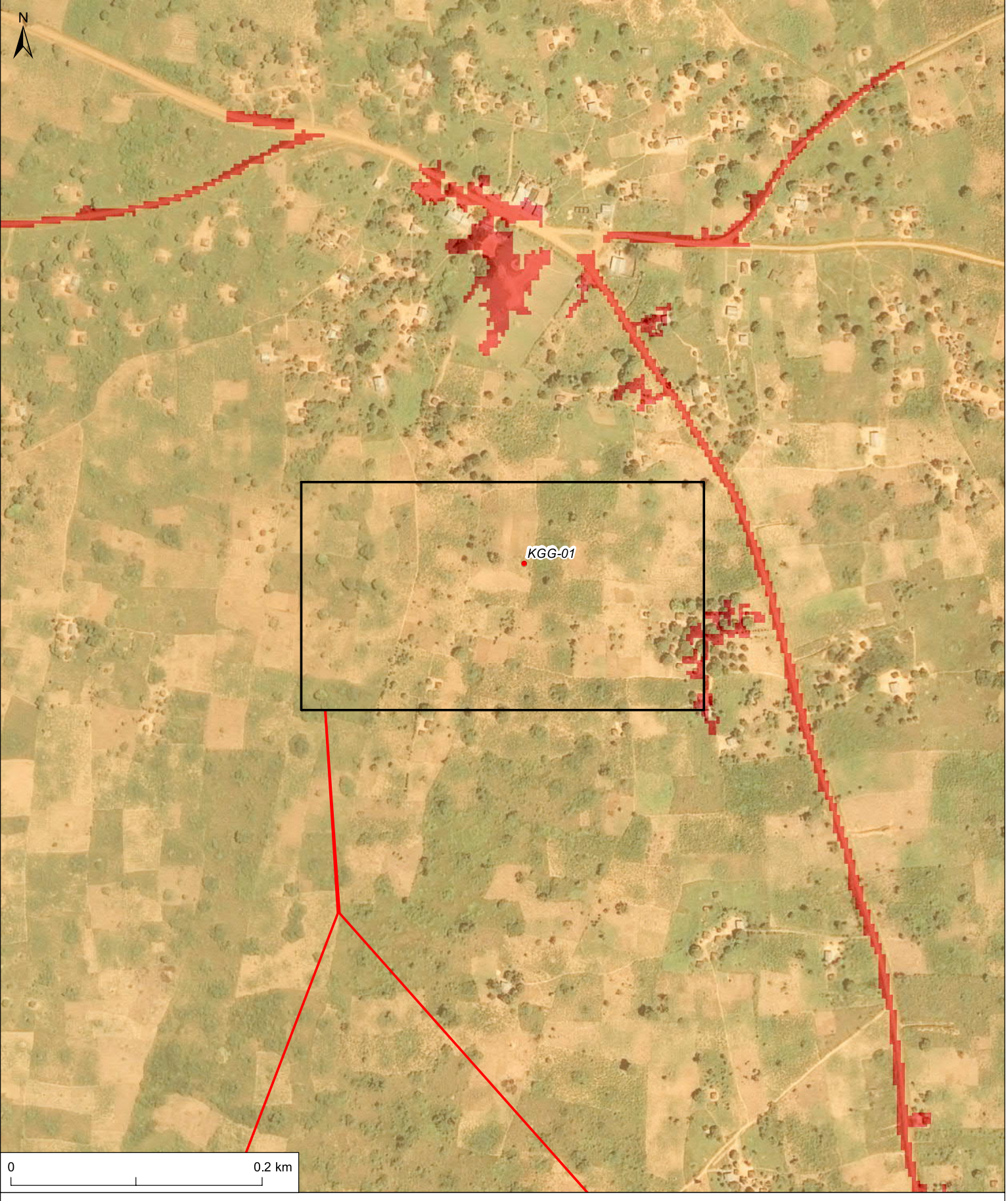

VEGETATION COVER - KGG-01

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Built-up Areas BU
- Small-scale Farming AG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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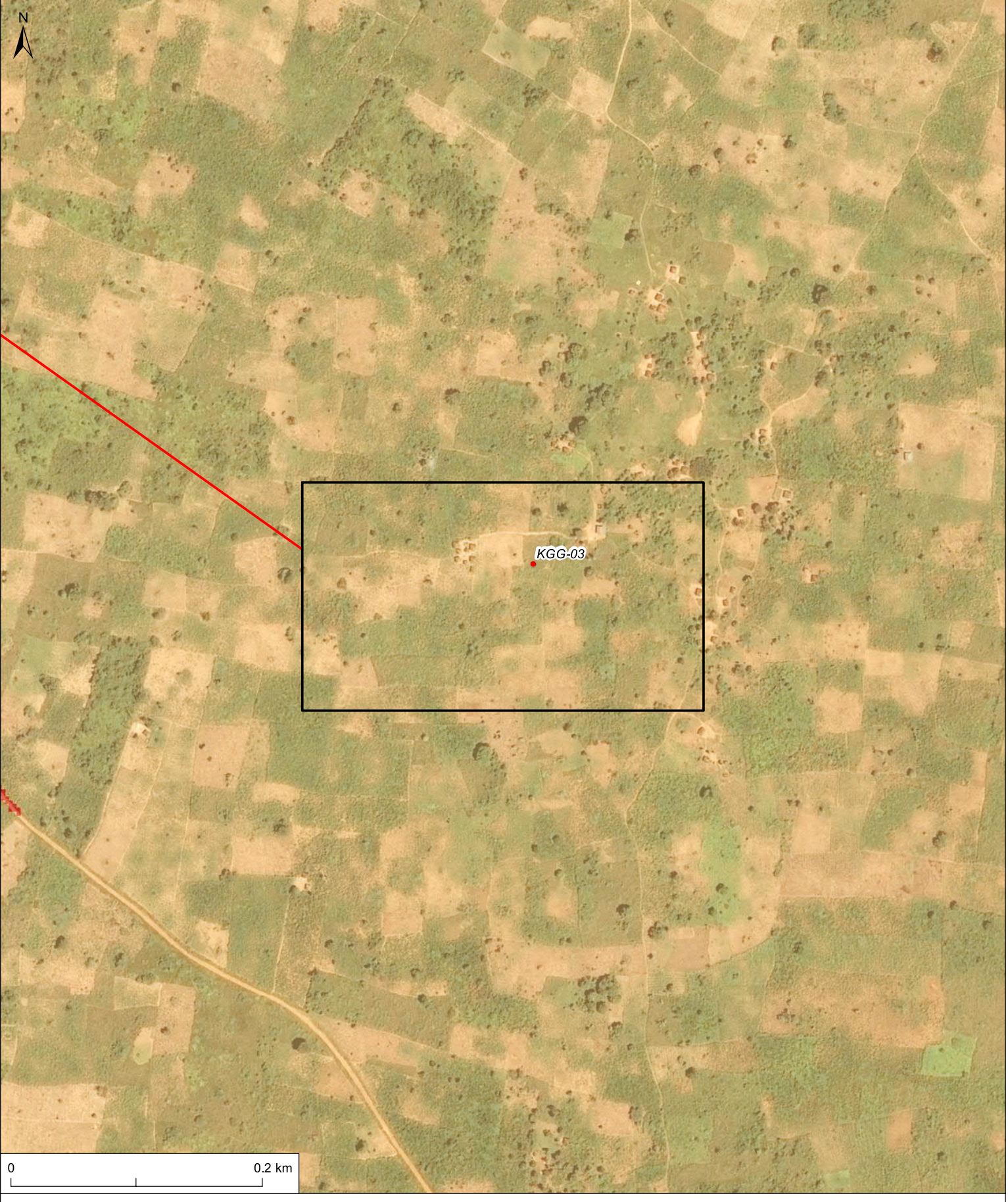

VEGETATION COVER - KGG-03

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Built-up Areas BU
- Small-scale Farming AG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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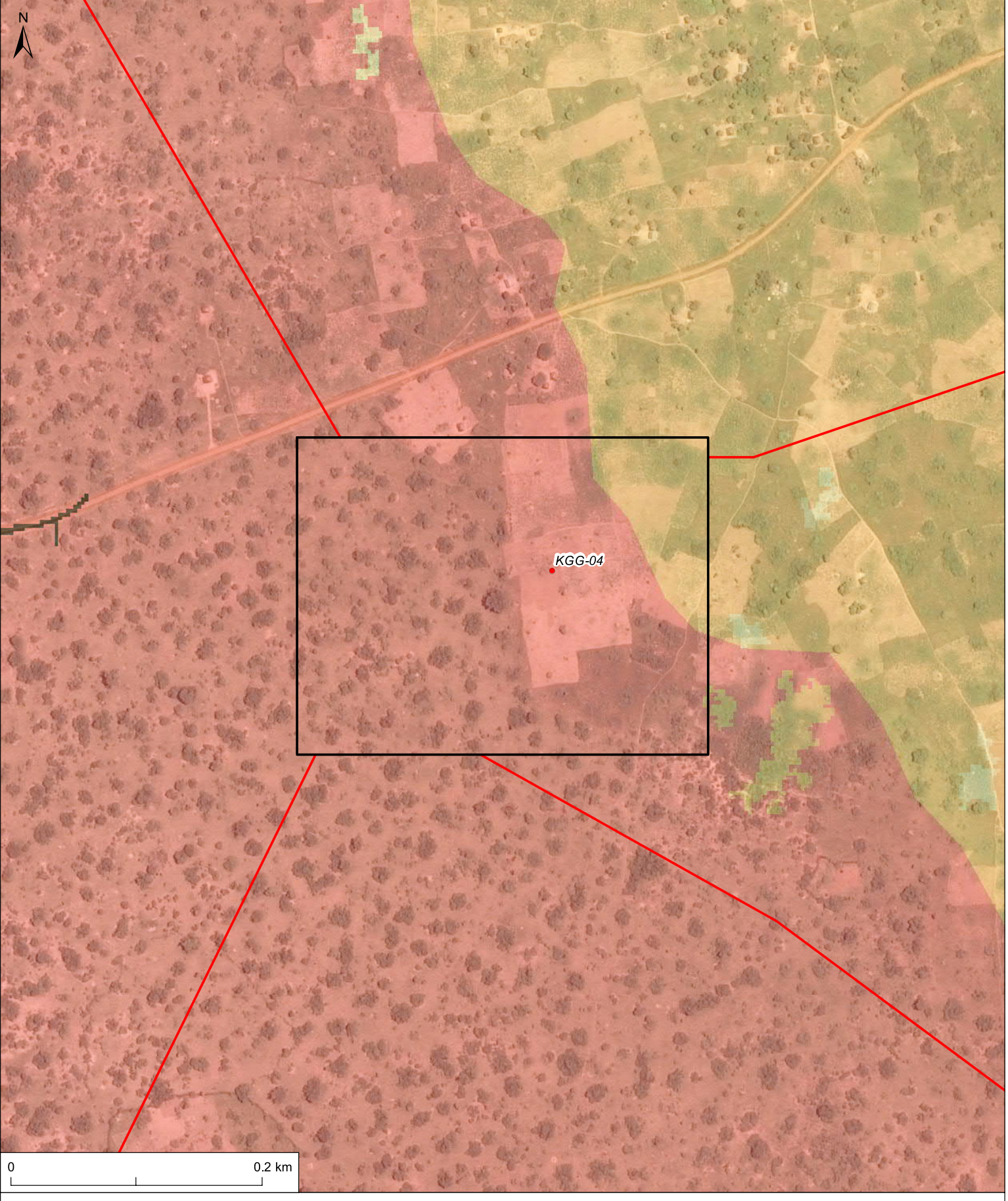

VEGETATION COVER - KGG-04

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Bushlands SH2 (L-B T)
- Dry Grassland GR2
- Small-scale Farming AG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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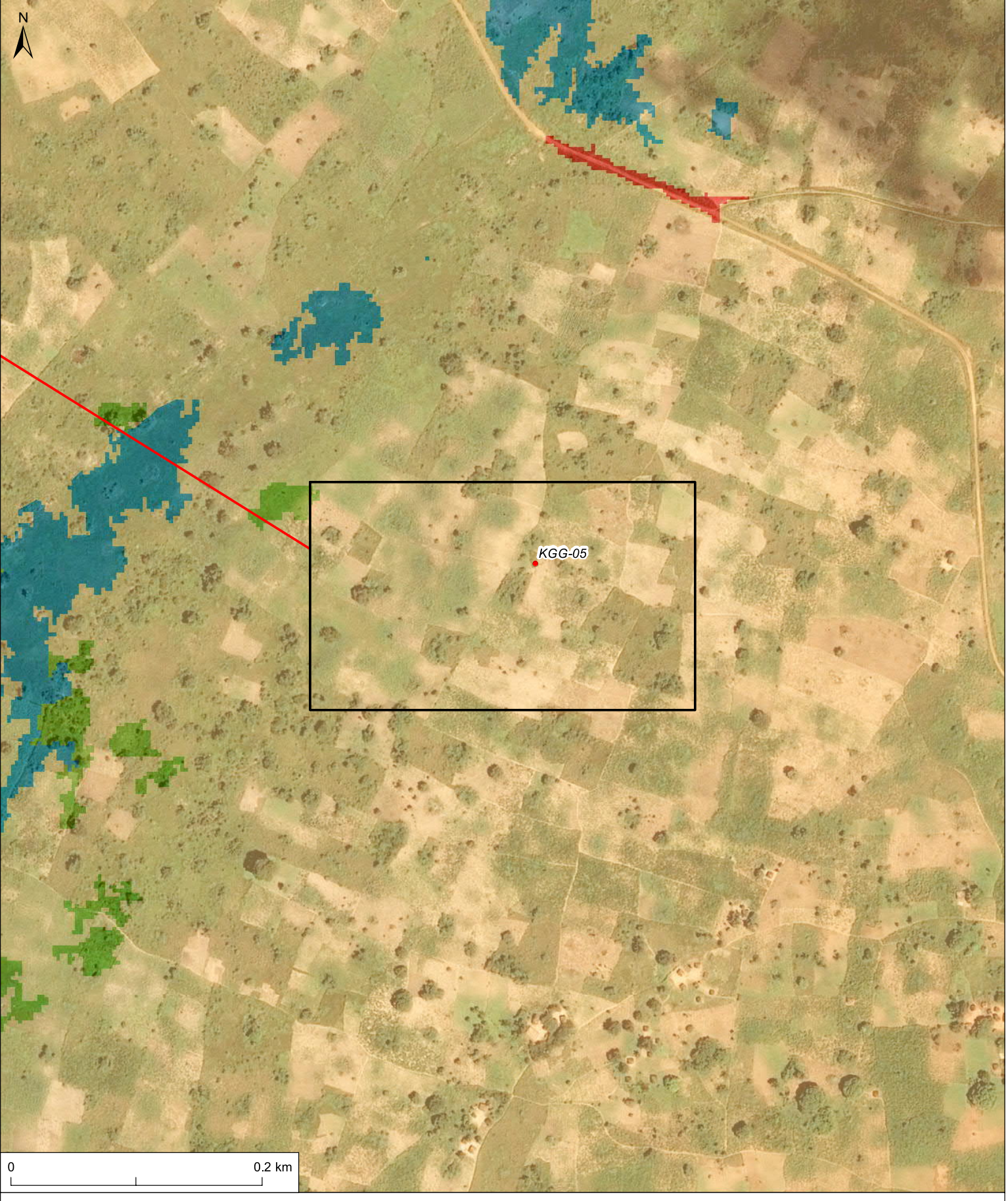


VEGETATION COVER - KGG-05

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

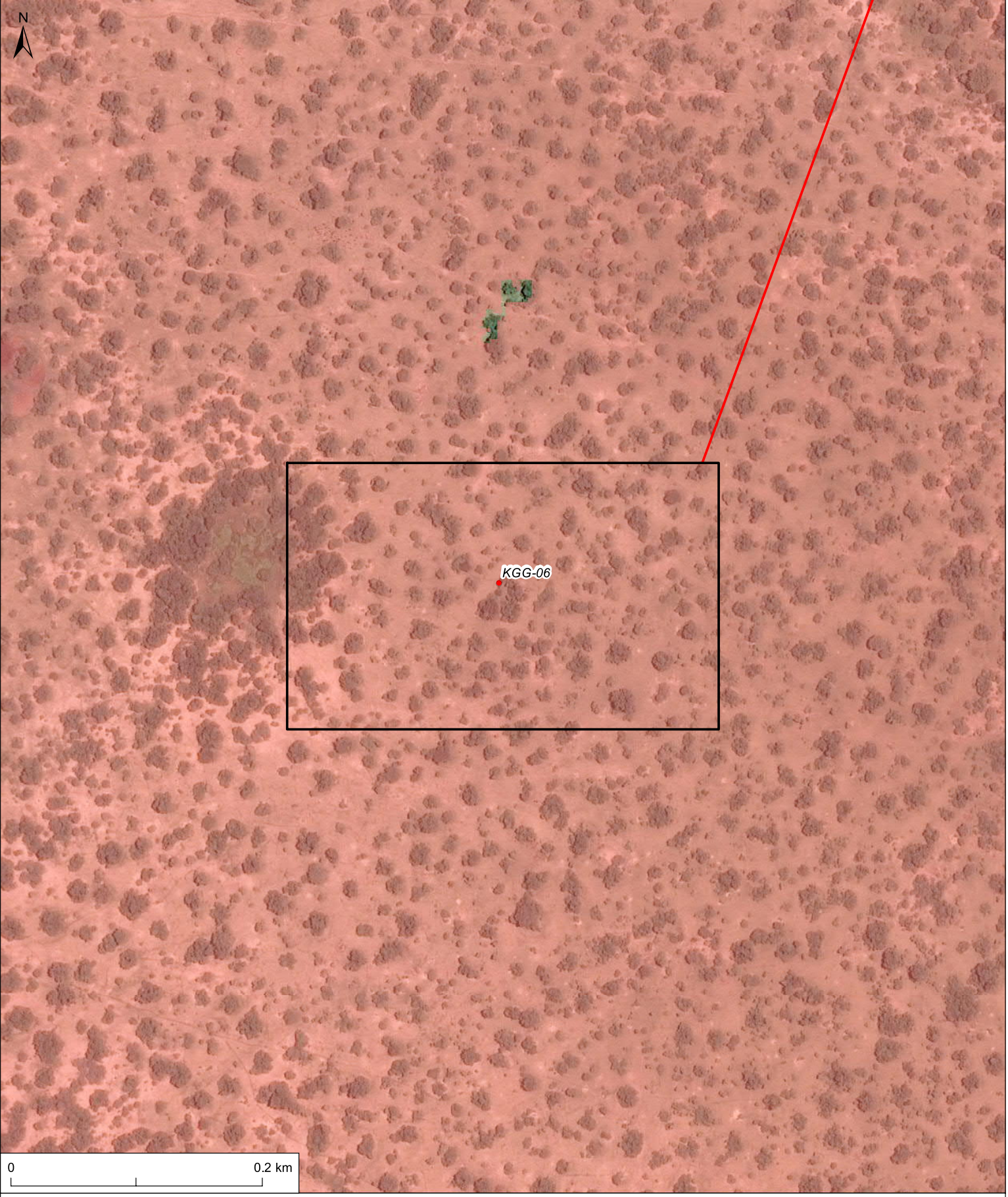
Land Cover Class (WCS 2017)

- Built-up Areas BU
- Open Moist Woodlands WO1
- Small-scale Farming AG2
- Swamps WE1 (L-B X)

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - KGG-06

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

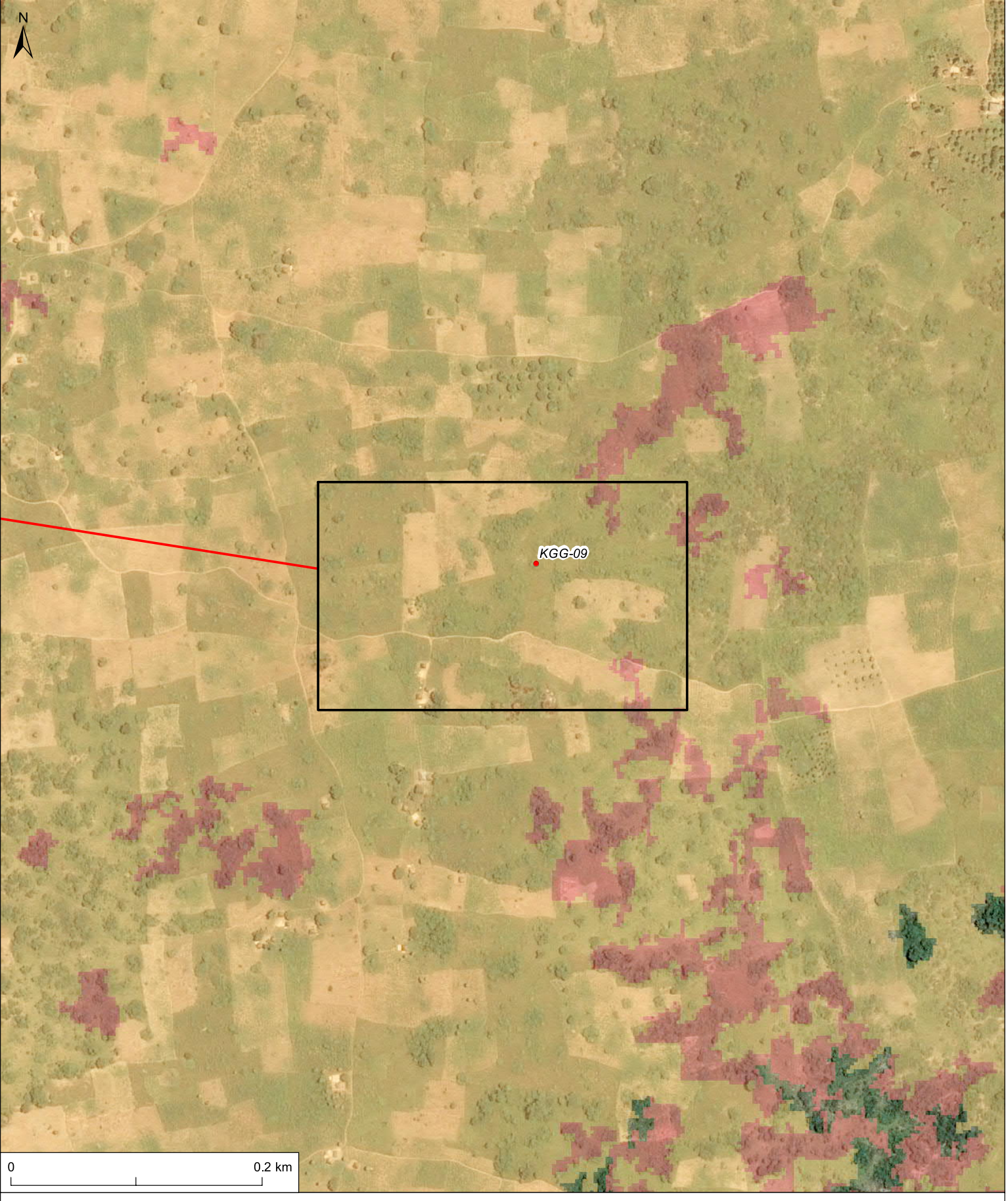
Land Cover Class (WCS 2017)

- Bushlands SH2 (L-B T)

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - KGG-09

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Bushlands SH2 (L-B T)
- Small-scale Farming AG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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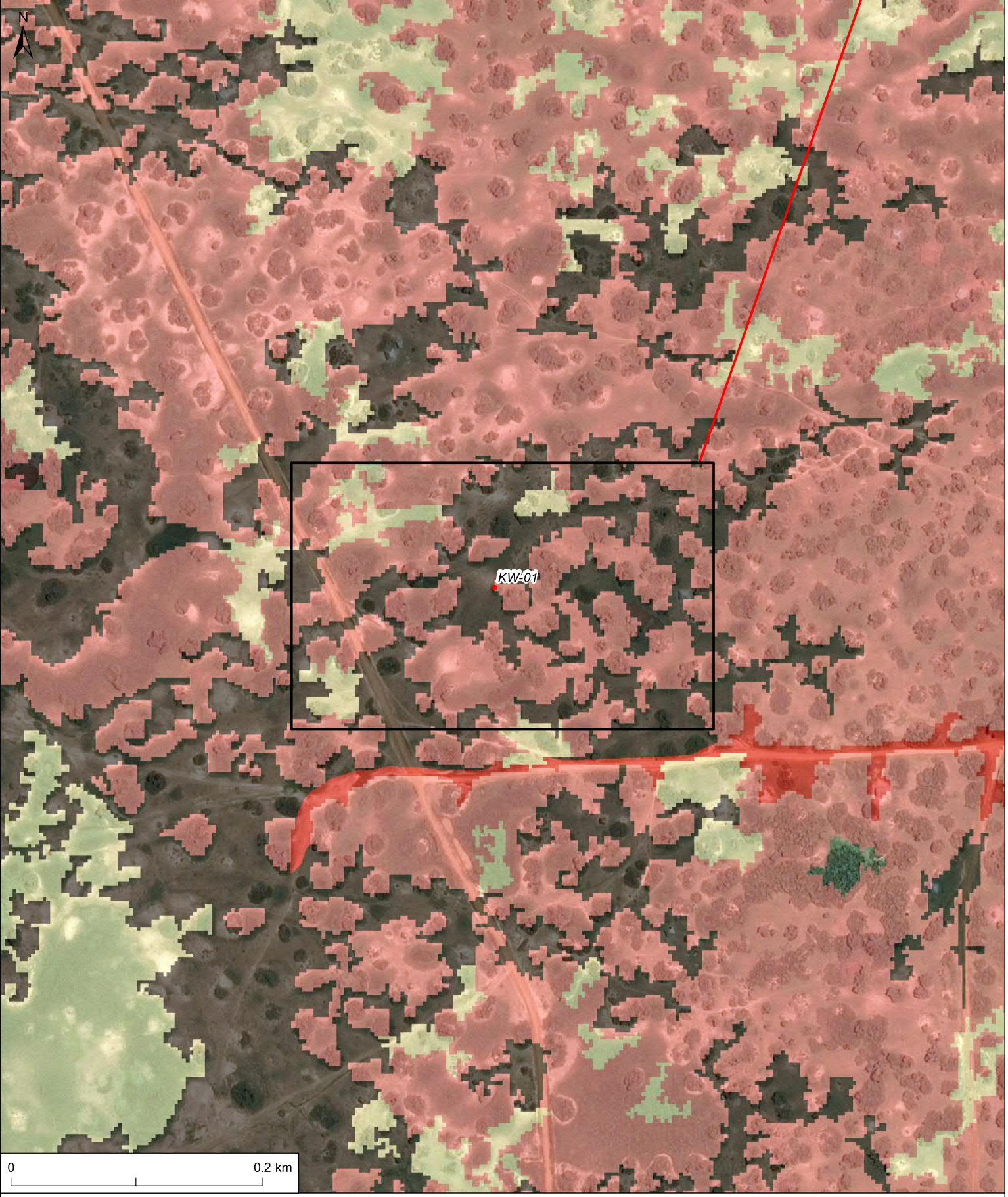

VEGETATION COVER - KW-01

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Built-up Areas BU
- Bushlands SH2 (L-B T)
- Dry Grassland GR2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

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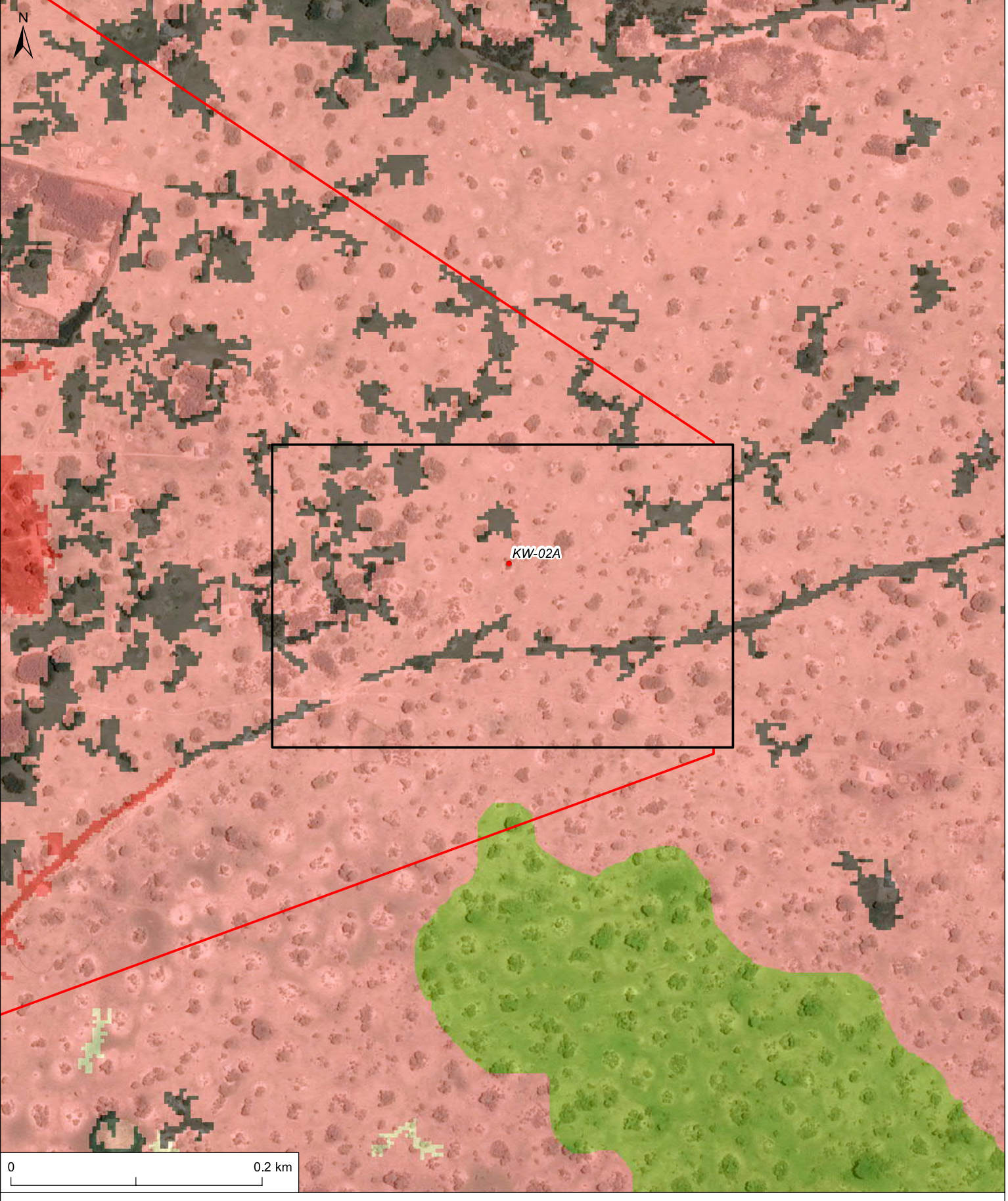


VEGETATION COVER - KW-02A

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

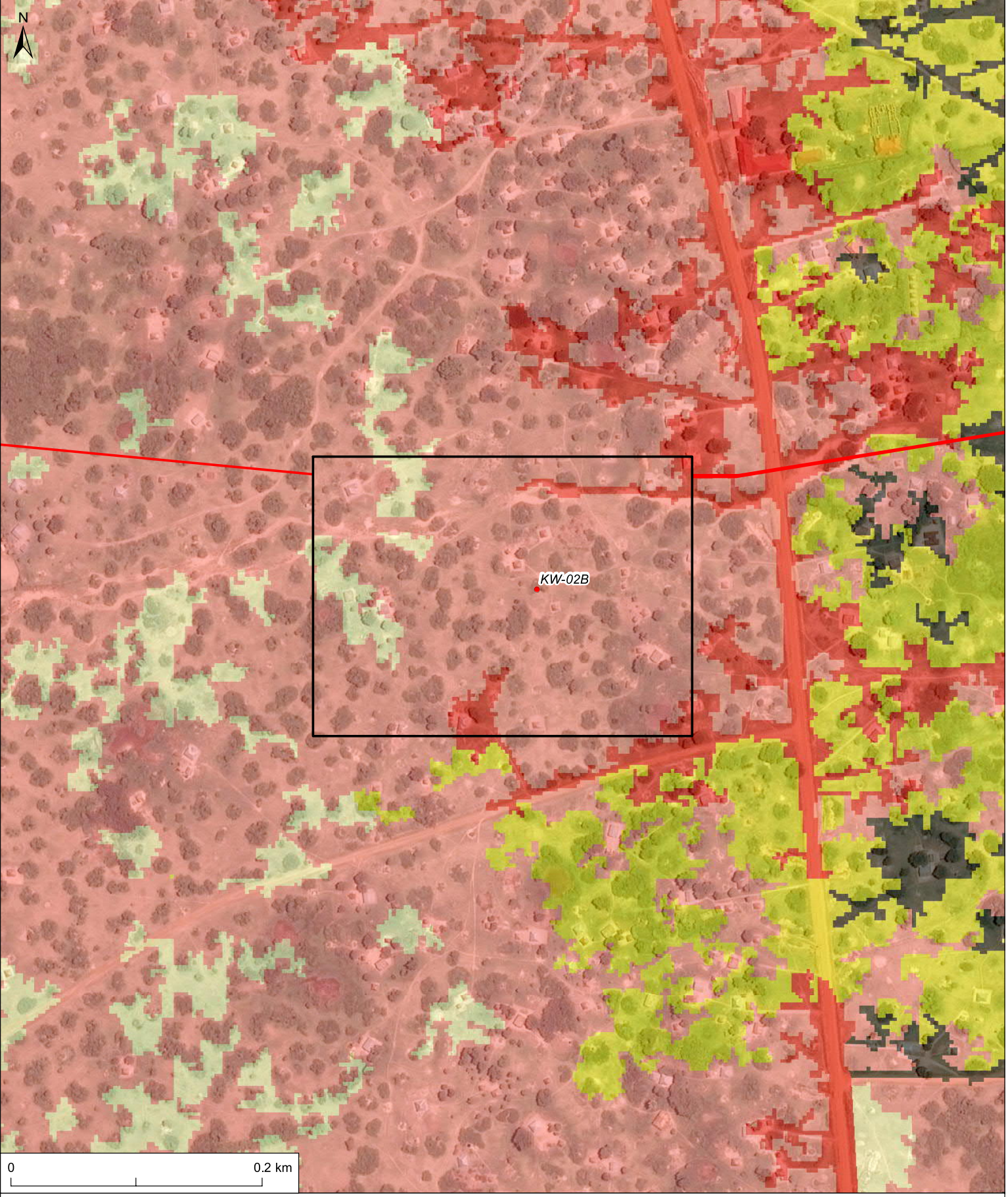
Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Built-up Areas BU
- Bushlands SH2 (L-B T)
- Dry Grassland GR2
- Open Moist Woodlands WO1

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM



VEGETATION COVER - KW-02B

- Wellpad location
- Wellpad Extent - Maximum
- Production and Injection Network

Land Cover Class (WCS 2017)

- Bare Soil (rural) IR3
- Built-up Areas BU
- Bushlands SH2 (L-B T)
- Dry Grassland GR2
- Dry Wooded Grassland WG2

Drawn: LC Checked: GM Approved: MW Date: 25/01/2019 Scale @ A4 1:5,000 Coordinate Reference System: WGS 1984 UTM Zone 36N

TILENGA PROJECT

AECOM