

## **E. TECHNICAL REFERENCES & DATA**

**Wind Speed (m/sec)****1. Botswana Kasane****From Jan.1984 to Nov. 1998**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Monthly	1.4	1.2	1.4	1.7	1.5	1.7	2.0	2.2	2.2	2.4	1.7	1.5
Highest Mean Daily												

**2. Zambia Livingstone****From Nov.1986 to Jan. 2000**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Monthly	1.4	1.2	1.4	1.7	1.5	1.7	2.0	2.2	2.2	2.4	1.7	1.5
Highest Mean Daily	4.1	3.6	3.1	4.1	3.1	5.1	4.6	4.6	4.6	5.7	4.6	4.6

**3. Zambia Sesheke****From Feb. 1983 to May 2000**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Monthly	1.7	1.5	1.6	1.7	1.6	1.5	1.8	2.1	2.3	2.5	2.3	2.0
Highest Mean Daily	3.6	3.1	3.1	3.1	3.1	3.6	3.6	4.1	4.1	5.7	4.1	3.1

### Monthly Mean Temperature ( $^{\circ}\text{C}$ )

#### 1. Botswana Kasane

From Jul. 1982 to May 2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Max. Temp.	30. <sup>0</sup>	30. <sup>4</sup>	31. <sup>3</sup>	30. <sup>5</sup>	29. <sup>9</sup>	26. <sup>3</sup>	26. <sup>2</sup>	29. <sup>5</sup>	33. <sup>3</sup>	34. <sup>3</sup>	33. <sup>8</sup>	31. <sup>6</sup>
Min. Temp.	19. <sup>7</sup>	19. <sup>3</sup>	18. <sup>9</sup>	16. <sup>3</sup>	13. <sup>1</sup>	10. <sup>2</sup>	9. <sup>9</sup>	12. <sup>5</sup>	16. <sup>8</sup>	19. <sup>6</sup>	20. <sup>4</sup>	19. <sup>8</sup>

#### 2. Zambia Livingstone

From Jul. 1982 to May 2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Max. Temp.	30. <sup>5</sup>	30. <sup>3</sup>	31. <sup>1</sup>	30. <sup>6</sup>	28. <sup>7</sup>	26. <sup>5</sup>	25. <sup>9</sup>	29. <sup>0</sup>	33. <sup>0</sup>	34. <sup>3</sup>	33. <sup>7</sup>	31. <sup>7</sup>
Min. Temp.	19. <sup>2</sup>	18. <sup>6</sup>	18. <sup>0</sup>	14. <sup>9</sup>	10. <sup>8</sup>	7. <sup>2</sup>	6. <sup>9</sup>	9. <sup>8</sup>	14. <sup>6</sup>	18. <sup>6</sup>	19. <sup>5</sup>	19. <sup>3</sup>

#### 3. Zambia Sesheke

From Feb. 1982 to May 2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Max. Temp.	31. <sup>0</sup>	30. <sup>7</sup>	31. <sup>8</sup>	31. <sup>0</sup>	29. <sup>2</sup>	27. <sup>0</sup>	26. <sup>7</sup>	29. <sup>9</sup>	33. <sup>9</sup>	35. <sup>0</sup>	34. <sup>0</sup>	32. <sup>0</sup>
Min. Temp.	19. <sup>3</sup>	18. <sup>6</sup>	17. <sup>6</sup>	14. <sup>0</sup>	9. <sup>0</sup>	4. <sup>8</sup>	4. <sup>1</sup>	6. <sup>9</sup>	12. <sup>1</sup>	17. <sup>7</sup>	19. <sup>5</sup>	19. <sup>5</sup>

**Rainfall Totals (mm)****1. Zambia Livingstone****From Jul. 1980 to Jul. 2000**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Monthly	169.9	138.5	73.6	18.8	6.8	.0	.3	.0	2.2	22.9	71.0	123.9
Highest Monthly	274.3	299.0	187.7	109.2	63.0	.3	5.5	.0	30.3	148.1	227.7	297.0
Highest Daily	117.0	81.5	82.3	62.7	60.2	.3	5.5	.0	28.5	58.3	66.7	79.5

**2. Zambia Sesheke****From Feb. 1982 to May 2000**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Monthly	143.0	135.1	66.9	17.3	1.7	.0	.0	.0	2.3	26.1	67.0	120.7
Highest Monthly	232.5	241.9	144.2	100.2	13.3	.0	.0	.0	16.9	86.8	204.3	237.6
Highest Daily	67.9	71.4	54.3	55.5	10.1	.0	.0	.0	15.1	35.6	60.7	69.4

## EXPLANATION OF COLUMN HEADERS IN THE EARTHQUAKE LISTINGS

**yyyy** : Year of occurrence of earthquake.

**Mmdd**: Month and Day of occurrence of earthquake.

**Hhmn**: Hour and Minute of occurrence of earthquake.

**ss.s** : Seconds and decimal seconds of occurrence of earthquake.

**T** : earthquake Type; D=distant, R=regional, L=local.

*NOTE: Designation of earthquake type depends on the distance of the Locating Agency (LA) from the earthquake epicentre. Consider all the earthquakes in the listings as Local.*

**LAT** : Latitude of the earthquake epicentre.

**LON** : Longitude of the earthquake epicentre.

**DEP** : Depth to the earthquake hypocentre.

**LA** : earthquake Locating Agency.

**MAG**: earthquake Magnitude.

**TAGE**: earthquake magnitude Type and earthquake magnitude reporting Agency.

### 6.0 FIGURES

#### 6.1 Abbreviations:

**LUS** = Lusaka,

**LIV** = Livingstone,

**KAZ** = Kazungula

#### 6.2 Explanation:

**Bottom Depth Section** = East-West depth cross section showing the depth of occurrence of earthquakes.

**Right Depth Section** = North-South depth cross section showing the depth of occurrence of earthquakes.

The **magnitude and depth scales** are given in the bottom right corner of Figures 1 and 2.

Table 1: Earthquake Listing for the area around Lusaka

yyyy	mmdd	hhmn	ss.s	T	LAT	LON	DEP	LA	MAG	TAGE
1965	428	153	10.9	D	-15.22	28.64	33.0F	ISC		
1965	702	434	25	D	-15.7	27.8	0	BUL		
1966	504	1614	43	D	-15.7	27.6	0	BUL	2.9	BUL
1966	504	1630	21	D	-15.7	27.5	0	BUL	2.1	BUL
1966	504	2128	50	D	-15.7	27.6	0	BUL	2.6	BUL
1966	710	1849	44	D	-15.5	28.5	0	BUL	2.2	BUL
1966	721	1140	38	D	-15	29	0	BUL	2.3	BUL
1966	1105	839	55	D	-16	29	0	BUL	2.1	BUL
1966	1106	429	22	D	-16	29	0	BUL	2.3	BUL
1967	306	905	11	D	-16	28	0	BUL	2.7	BUL
1967	1203	1324	53	D	-15.9	28	0	BUL	2.5	BUL
1967	1204	1204	3	D	-15.8	28.1	0	BUL	2	BUL
1968	1208	726	53	D	-15.6	29	0	BUL	2.2	BUL
1969	328	820	20	D	-15.8	29	0	BUL	2.7	BUL
1971	1116	600	27.8	D	-15.828	28.853	0.0F	ISC		
1972	1213	703	59.4	D	-15.948	28.774	0.0F	ISC		
1973	313	334	15	D	-15.46	28.279	0.0F	ISC		
1973	403	1855	5.5	D	-15.096	28.415	0.0F	ISC		
1974	429	1014	22	D	-15.1	28.8	0	BUL	3.3	BUL
1974	621	139	21.2	D	-15.382	28.825	0	ISC		
1975	218	1721	25.5	D	-15.499	28.023	0	ISC		
1976	104	1111	5.6	D	-15.984	28.386	0	ISC		
1976	1217	101	17.1	D	-15.934	28.934	0.0F	ISC		
1978	1211	2200	0.1	D	-15.52	27.846	0.0F	ISC		
1979	807	2208	59.5	D	-15.524	28.687	0.0F	ISC		
1981	427	1859	41	D	-15.8	28.9	0	BUL	3.1	BUL
1982	324	549	58.4	D	-15.902	28.836	0.0F	ISC		
1984	828	312	3	D	-15.3	28.2	0	BUL	3.3	BUL
1984	1027	37	4	D	-15.2	28.3	0	BUL	2.8	BUL
1985	128	1819	19.2	D	-15.772	28.242	0.0F	ISC		
1987	726	1354	14	D	-15.7	29	0	BUL	3.4	BUL
1987	807	2006	51	D	-15.4	27.6	0	BUL	2.8	BUL
1988	203	921	5.5	D	-16	28.81	10	LSZ	2.7	LSZ
1988	805	1256	26.2	D	-16	28.8	10	LSZ	3.4	LSZ
1988	805	1804	18.7	D	-15.85	28.9	10	LSZ	3.1	LSZ
1988	809	2128	33.9	D	-15.94	28.69	10	LSZ	3	LSZ
1988	816	2328	42.1	D	-15.87	28.89	10	LSZ	3.3	LSZ
1988	817	309	7.6	D	-15.97	28.88	10	LSZ	3.6	LSZ
1988	826	430	52.8	D	-15.98	28.7	10	LSZ	3.7	LSZ
1988	829	1642	51.5	D	-15.91	28.82	10	LSZ	3.8	LSZ
1990	524	1628	46.8	D	-15.778	28.553	0.0F	ISC		

Fig. 1: Earthquake Epicentre Around Lusaka From 1965-1990

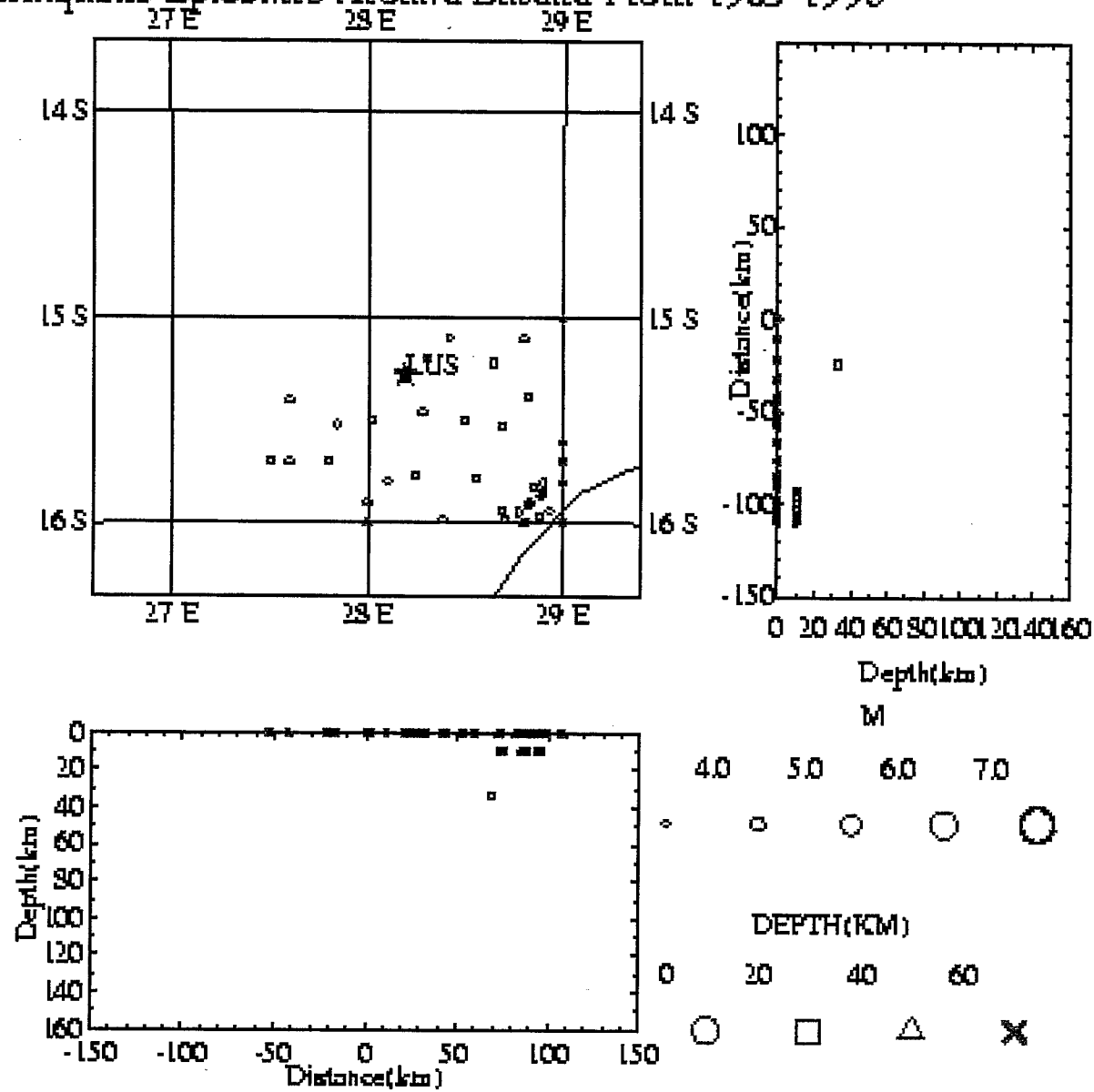


Table 2: Earthquake Listing for Livingstone and Kazungula Area

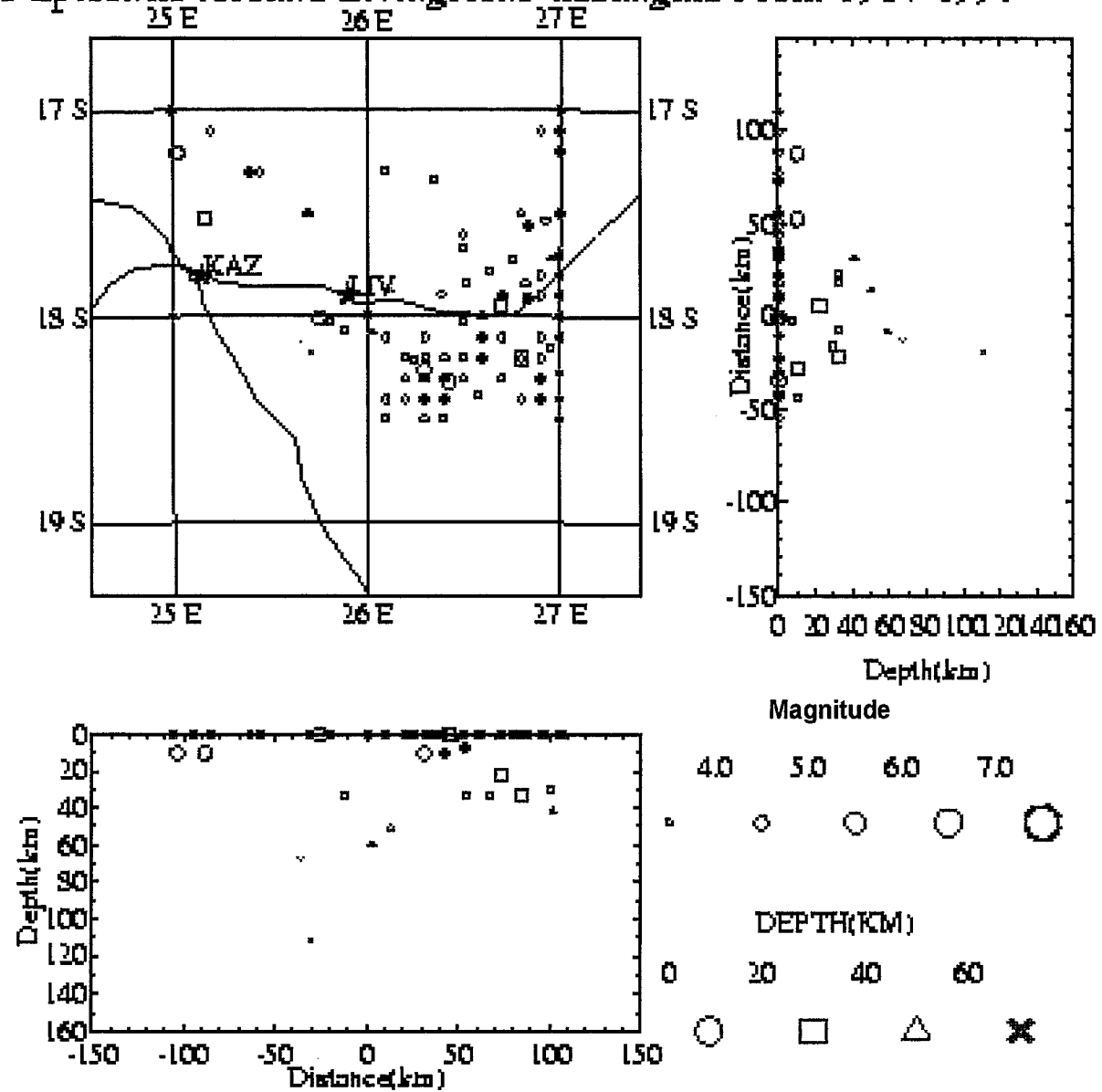
yyyy	mmdd	hhmn	ss.s	T	LAT	LON	DEP	LA	MAG	TAGE
1964	611	2101	19	D	-17.67	26.5	0	JOH		
1965	709	929	57	D	-18.2	26.6	0	BUL		
1966	202	2252	0	D	-17	25	0	BUL		
1966	217	1706	32	D	-18	25	0	CNG		
1966	402	400	31	D	-18.3	26.5	0	BUL	2	BUL
1966	519	312	32	D	-18	27	0	BUL	2.3	BUL
1966	823	1758	26	D	-18.3	26.3	0	BUL	3.2	BUL
1967	407	845	7	D	-17.8	27	0	BUL	2.6	BUL
1967	413	633	54	D	-17.7	27	0	BUL	2.6	BUL
1967	413	1008	8	D	-18.4	27	0	BUL	2	BUL
1967	608	1559	13	D	-17.1	27	0	BUL	2.3	BUL
1967	619	1448	18	D	-17.2	27	0	BUL	2.2	BUL
1967	621	1628	3	D	-17.2	27	0	BUL	2.5	BUL
1967	628	1611	11	D	-17.2	27	0	BUL	2.5	BUL
1967	707	1607	41	D	-17.1	26.9	0	BUL	2.6	BUL
1967	720	1604	57	D	-17.1	26.9	0	BUL	2.7	BUL
1967	1011	1516	38	D	-17.1	27	0	BUL	2.2	BUL
1968	129	157	5	D	-17.8	26.9	0	BUL	2.6	BUL
1968	223	615	12	D	-18.4	26.3	0	BUL	2.8	BUL
1968	726	1916	29	D	-17.5	27	0.0F	ISC		
1968	1012	1358	39	D	-18.4	26.4	10	CNG	2.8	CNG
1969	406	2208	35	D	-18.2	26.5	0	BUL	2.2	BUL
1969	407	1059	56	D	-18.3	26.4	0	BUL	2.4	BUL
1969	503	738	12	D	-18.2	26.3	0	BUL	2.3	BUL
1969	805	2301	26	D	-17.9	26.7	0	BUL	2.6	BUL
1969	1006	1333	58	D	-17.2	27	0	BUL	2.3	BUL
1969	1212	1855	0	D	-18.4	26.1	0	BUL	3.2	BUL
1970	122	316	41.8	D	-18.2	26.8	33	USC	4.7	BUSC
1970	621	1224	5	D	-18.1	26.9	0	BUL	2.1	BUL
1970	621	1329	20	D	-18.1	26.9	0	BUL	2	BUL
1970	622	2352	37	D	-18	26	0	BUL	2.1	BUL
1971	222	1915	20.2	D	-18.269	26.998	0	ISC		
1971	310	36	57	D	-18.5	26.3	0	BUL	2.5	BUL
1971	627	1515	0	D	-18.1	26.1	0	BUL	2.6	BUL
1971	1111	557	15.4	D	-18.145	26.948	30.0F	ISC		
1972	515	151	2	D	-17.713	26.957	41.3	ISC		
1972	607	1825	10.1	D	-17.559	26.834	0.0F	ISC		
1972	610	2125	10.4	D	-17.717	26.757	0.0F	ISC		
1972	924	1538	44.4	D	-17.917	26.826	0.0F	ISC		
1973	402	134	36.6	D	-18.382	26.578	0.0F	ISC		
1974	201	1549	29.6	D	-18.072	25.881	33.0F	ISC		
1974	515	1649	38	D	-18.1	26.7	0	BUL	3	BUL
1976	306	9	18	D	-18.2	26.5	0	BUL	3.2	BUL
1977	119	1103	31	D	-18.2	26.8	0	BUL	3	BUL
1977	119	1439	20	D	-18.3	26.7	0	BUL	2.9	BUL
1977	406	356	6.3	D	-17.338	26.351	0	ISC		
1977	728	407	12	D	-18.4	26.3	0	BUL	3	BUL
1977	730	1308	43	D	-18.2	26.2	0	BUL	3.1	BUL
1977	811	454	39	D	-17.8	25.1	0	BUL	3.1	BUL

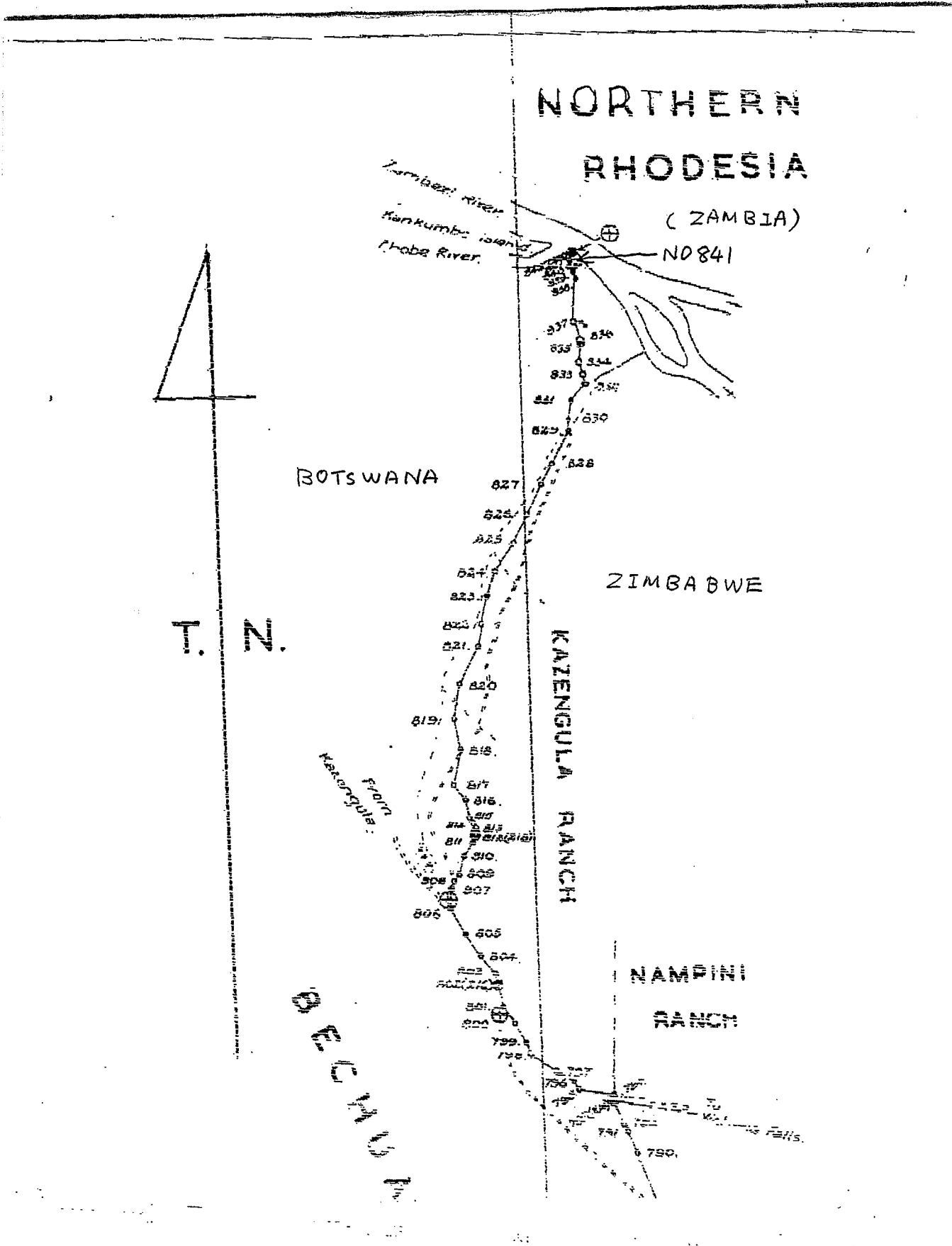


yyyy	mmdd	hhmn	ss.s	T	LAT	LON	DEP	LA	MAG	TAGE
1978	810	1739	43.9	D	-18.028	25.807	0.0F	ISC		
1978	819	1916	23	D	-17.6	26.5	0	BUL	3.1	BUL
1980	630	603	12.1	D	-18.011	25.757	0.0F	ISC	4.4	BISC
1980	718	37	55	D	-18.2	26.6	0	BUL	3.1	BUL
1980	1208	1352	52	D	-18.5	26.4	0	BUL	2.8	BUL
1981	303	2250	55	D	-18	27	0	BUL	2.8	BUL
1981	318	853	25.6	D	-18.211	26.249	0.0F	ISC		
1981	324	738	29.1	D	-17.894	26.385	0.0F	ISC		
1981	330	1027	25	D	-18	27	0	BUL	3.1	BUL
1981	331	2247	0	D	-18.2	26.9	0	BUL	3.2	BUL
1981	510	1616	17	D	-18	27	0	BUL	3.5	BUL
1981	520	222	35.1	D	-17.84	26.822	0.0F	ISC		
1981	530	2123	7	D	-18	27	0	BUL	3.2	BUL
1981	602	1837	49.5	D	-17.918	26.837	0.0F	ISC		
1981	603	316	23	D	-18	27	0	BUL	3	BUL
1981	612	1019	5	D	-18	27	0	BUL	2.9	BUL
1981	706	1757	58.5	D	-17.835	26.511	33.0F	ISC		
1981	710	2155	40	D	-17.5	25.7	0	BUL	3.5	BUL
1981	719	2017	30.4	D	-17.788	26.632	33.0F	ISC		
1981	913	1110	40	D	-17.9	26.9	0	BUL	3.1	BUL
1981	916	1639	44	D	-17.9	26.9	0	BUL	2.8	BUL
1981	922	1853	58	D	-17.9	27	0	BUL	3.2	BUL
1982	616	1611	14	D	-17.5	26.8	0	BUL	3.3	BUL
1982	1119	2007	17.4	D	-17.533	26.923	0.0F	ISC		
1982	1201	1537	45	D	-18.1	27	0	BUL	3.5	BUL
1983	608	1718	44	D	-17	27	0	BUL	2.8	BUL
1983	1017	1147	31	D	-18.5	26.1	0	BUL	3	BUL
1984	123	422	31	D	-17.1	25.2	0	BUL	3.3	BUL
1984	320	17	46.5	D	-18.315	26.425	0.0F	ISC	4.3	BISC
1985	322	641	36	D	-18.2	26.8	0	BUL	2.8	BUL
1985	602	1941	57	D	-18.2	26.6	0	BUL	3.1	BUL
1985	602	2025	3	D	-18.2	26.6	0	BUL	2.8	BUL
1986	329	625	30	D	-18.256	26.297	10.0F	ISC	4	BISC
1986	1025	749	56	D	-18.4	26.9	0	BUL	2.9	BUL
1987	109	818	34	D	-18.4	26.4	0	BUL	2.8	BUL
1987	217	1120	38.2	D	-17.207	25.023	10.0F	ISC	4.5	BISC
1987	918	204	56.9	D	-17.522	25.167	10.0F	ISC	4.1	BISC
1992	608	1529	43	D	-18.4	26.4	0	BUL	2.3	BUL
1992	903	730	31	D	-18	26.6	0	BUL	2.7	BUL
1992	916	1504	39	D	-17.3	26.1	0	BUL	2.6	BUL
1992	917	1504	5	D	-18.4	26.9	0	BUL	2.2	BUL
1992	1101	858	58	D	-18.1	26.3	0	BUL	2.8	BUL
1992	1102	1157	46	D	-18.3	26.5	0	BUL	2.4	BUL
1993	910	1132	33	D	-18.2	26.4	0	BUL	2.3	BUL
1993	1008	1430	23	D	-18.4	26.4	0	BUL	2.4	BUL
1993	1008	1523	24	D	-18.2	26.2	0	BUL	2.4	BUL
1993	1009	1446	12	D	-18.3	26.2	0	BUL	2.4	BUL
1993	1009	2323	23	D	-18.1	26.6	0	BUL	2.1	BUL
1993	1013	1219	51	D	-18.3	26.9	0	BUL	2.1	BUL
1993	1014	1054	37	D	-18.4	27	0	BUL	2	BUL
1993	1015	1128	12	D	-18.4	26.8	0	BUL	2	BUL

yyyy	mmdd	hhmn	ss.s	T	LAT	LON	DEP	LA	MAG	TAGE
1993	1016	1119	35	D	-18.3	26.5	0	BUL	2.1	BUL
1993	1102	1433	20	D	-18.4	26.2	0	BUL	2	BUL
1994	613	2158	57.7	D	-17.948	26.697	22.2F	ISC 16	4.3	BISC
1994	829	2023	29.1	R	-18.5	27	0	ISC 6		
1997	507	2146	37	L	-18.124	25.659	67.4	LSZ 3	3.4	CLSZ
1997	507	2146	42.5	L	-18.078	26.029	59.4	LSZ 3	2.9	CLSZ
1997	508	1540	23.4	L	-18.174	25.715	111.6	LSZ 4	3.6	CLSZ
1997	508	1730	30.8	L	-17.873	26.119	50.8	LSZ 3	3.4	CLSZ
1997	509	1321	53.7	L	-18.021	26.505	7.1	LSZ 4	3.4	CLSZ

Fig.2: Earthquake Epicenters Around Livingstone-kazungula From 1964-1997





COORDINATE TRANSFORMATIONS

DATE RUN 01/11/1967

OVERLAPS	LG	GAUSS CONFORM IN E FEET	LONGITUDE	LATITUDE	CM	U.T.M. IN METRES
	LO	GAUSS CONFORM IN E FEET	GAUSS CONFORM IN C ROADS		CM	U.T.M. IN METRES
		3060.4				
1725	835	25 - 91991.169 +6462611.699	25 15 52.07870	17 48 35.98447	27 +	316048.8945 + 8030154.7532
		3056.3				
1725	836	25 - 92032.300 +6462461.440	25 15 52.50736	17 48 34.49410	27 +	316061.0941 + 8030200.6855
		3055.1				
1725	837	25 - 91632.740 +6460767.880	25 15 48.34228	17 48 17.70840	27 +	315933.6504 + 8030715.5549
		3047.1				
1725	838	25 - 91784.930 +6458152.770	25 15 49.87923	17 47 51.77500	27 +	315971.5273 + 8031513.0960
		3045.4				
1725	839	25 - 91840.681 +6457877.410	25 15 50.45217	17 47 49.04708	27 +	315967.6236 + 8031597.2029
		3045.7				
1725	840	25 - 91506.351 +6457188.440	25 15 46.98224	17 47 42.22075	27 +	315883.4839 + 8031306.1031
		3046.8				
1725	841	25 - 91510.100 +6456916.990	25 15 47.01710	17 47 39.52932	27 +	315883.7439 + 8031288.6494
		<u>3050.8</u>				
1725	842	25 - 91528.430 +6456367.749	25 15 47.19861	17 47 34.08345	27 +	315887.5444 + 8032056.3053
		3043.1				

No 841 = 3050.8 (Feet) | foot = 0.3048 cm  
 = 929.88 (Meters) , Department of Survey and Land, Botswana.  
 1967

*Change*

*A. T. CHANAYA*

*-68- Surveyor General  
Zimbabwe*

SURVEYOR GENERAL'S  
OFFICE  
Telephone 27445  
28 JUN 1989  
P.O. Box 8079  
Causeway Zimbabwe


















*B. B. MOREBOSI*  
DIRECTOR OF SURVEYS AND LANDS  
BOTSWANA

# BOREHOLE LOG

Run No / Length (m)	Drilling Method	Core Recovery %	RQD %	Fracture Frequency	Water Level	Field Tests		Legend	Depth (m)	Description
						Type	Value			
1/1.0	NXC					SPT 1	8		1	Dark brown, fine, loose silty SAND as SOIL over brown-grey, slightly firm silty SAND becoming whitish grey, calcareous and blocky below 0.50m. Dry drilled.
2/1.0						SPT 2	17		2	Grey-white, ashy, very fine-grained, compacted, slightly firm calcareous silty SAND derived from CALCRETE
3/1.0						SPT 3	21		3	Grey-white, ashy, very fine-grained, compact dry drilled, firm calcareous silty SAND becoming blocky and friable containing dark brown gravelly fragments of chert
4/0.90	Cased TNW	58	10			SPT 4	106R		4	Off-white, very fine-grained sandy SILT with GRAVEL after CALCRETE Pale grey to pinkish, highly weathered to weathered, fine-grained siliceous SILCRETE with irregular voids and palaeosol structures. Hard and cored in places becoming more fractured above 4.00m on sub-horizontal cherty dislocations.
5/0.60		67							5	Yellow-brown, highly weathered, medium-grained washed calcareous and siliceous SAND derived from a fragmented silicified SANDSTONE.
6/0.50		56							6	Brownish yellow, highly weathered, medium-grained washed SAND from a silicified calcareous SANDSTONE
7/1.0		42							7	Brownish yellow, highly weathered, medium-grained washed SAND from sandy SILCRETE becoming a reddish orange to ash white, fragmented, partly calcareous silicified SANDSTONE to 6.00m
8/0.50		66							8	Continued as an ash white, weathered, fragmented partly calcareous SILCRETE with secondary quartz crystals in voids.
9/0.98		47							9	Darker brown, washed, highly weathered, medium to fine SAND over fragmented, weathered off-white siliceous material
10/0.52		67							10	Dark brown, highly weathered, washed, medium to fine SAND over fragments of grey-white, brecciated CHALCEDONY
11/0.96		25							11	Dark brown-grey, highly weathered, stained and fragmented partly silicified BASALT recovered as pebble-sized pieces.
12/1.04		52	0						12	Dark brown, highly to completely weathered, washed medium to fine-grained calcareous SAND derived from decomposing BASALT over highly weathered fragments of brown to grey brown, partly silicified BASALT
END OF HOLE 10.00m										

<p>Project : <b>BRIDGE SITE INVESTIGATIONS</b></p> <p><b>KAZUNGULA BRIDGE PROJECT</b></p>	<p><b>B.H. No. 1</b></p> <p>SHEET 1 OF 1</p>	<p><b>ZULU BURROW LIMITED</b></p> <p>Integrated Engineering and Development Consultants</p> <p><b>Lusaka - Zambia</b></p>
<p>Client : JICA STUDY TEAM - NIPPON KOEI JAPAN</p> <p>Contractor : Geotechnical Services Driller : A.Muntengwa Zimbabwe</p> <p>Drilled : 28-30/9/00 Machine : Boyles BBS18</p> <p>Logged : 5/10/00 By : T.J. BRODERICK</p>	<p>Location : Far left bank (Zambia)</p> <p>Orientation : -90</p> <p>Reduced Level :</p> <p>Drilling Medium : Dry/water</p> <p>Notes :</p> <p>Elevation: 929.25 m</p>	<p>Job No :</p>

# BOREHOLE LOG

Run No / Length (m)	Drilling Method	Core Recovery %	RQD %	Fracture Frequency	Water Level	Field Tests		Legend	Depth (m)	Description																														
						Type	Value																																	
1/0.50	NXC					SPT 1	N 15		1	Dark brown SAND and GRAVEL over a mauve, highly weathered, fragmented BASALT BOUL																														
2/0.50						SPT 2	16					1	Dark brown-mauve, highly weathered and fragmented BASALT BOULDERS																											
						SPT 3	90R								1	Dark brown-mauve, highly to completely weathered and fragmented to sandy BASALT BOUL																								
3/1.0						SPT 4	R											2	Dark brown, highly to completely weathered, medium-grained BASALT SAND with fragments of decomposing BASALT																					
4/0.50	SPT 5	R		3	Flushed BASALT SAND																																			
5/0.50	SPT 6	80R					3	Brownish to pale creamy yellow, fine and even grained, clean, loose siliceous alluvial SAND																																
6/0.50	TNW Reamed											SPT 7	23		4	Slightly darker yellow, fine and even grained, clean to slightly firm SAND with flecks of silt and a possible heavy metal content.																								
7/0.50												SPT 8	9					5	Creamy white, fine and even grained, loose, clean alluvial SAND																					
8/0.50			SPT 9	6								6	Off-white, fine to medium-grained, slightly firmer SAND																											
9/0.50			SPT 10	10			7	SPT no sample. Off-white, unconsolidated, loose, fine to medium-grained, clean siliceous SAND																																
10/0.50			SPT 11	12																	8	SPT no sample.																		
11/0.50			SPT 12	17																				9	Dark brown to black-brown, completely to highly weathered, soft decomposing BASALT recovered as flushed calcareous SAND															
12/0.50			SPT 13	14																							10	Dark brown to black-brown, completely to highly weathered, soft decomposing BASALT recovered as flushed calcareous SAND												
13/0.50			SPT 14	9																										10	Dark brown to black-brown, completely to highly weathered, soft decomposing BASALT recovered as flushed calcareous SAND									
14/0.50			SPT 15	10																													10	Dark brown to black-brown, completely to highly weathered, soft decomposing BASALT recovered as flushed calcareous SAND						
15/0.50			SPT 16	11																																10	Dark brown to black-brown, completely to highly weathered, soft decomposing BASALT recovered as flushed calcareous SAND			
16/0.50			SPT 17	23																																			10	Dark brown to black-brown, completely to highly weathered, soft decomposing BASALT recovered as flushed calcareous SAND
17/0.50			SPT 18	34																																				
18/0.50	Cased TNW	30	0																																					
19/0.50																38	0																							

<p>Project : <b>BRIDGE SITE INVESTIGATIONS</b></p> <p><b>KAZUNGULA BRIDGE PROJECT</b></p>	<p><b>B.H. No. 2</b></p> <p>SHEET 1 OF 2</p>	<p><b>ZULU BURROW LIMITED</b></p> <p>Integrated Engineering and Development Consultants</p> <p><b>Lusaka - Zambia</b></p> <p>Job No :</p>
<p>Client : JICA STUDY TEAM - NIPPON KOEI JAPAN</p> <p>Contractor : Geotechnical Services Driller : A.Muntengwa Zimbabwe</p> <p>Drilled : 21-23/9/00 Machine : Boyles BBS18</p> <p>Logged : 5/10/00 By : T.J. BRODERICK</p>	<p>Location : Immediate Left bank</p> <p>Orientation : -90</p> <p>Reduced Level :</p> <p>Drilling Medium : Water</p> <p>Notes : Elevation : 925.25 m</p>	



# BOREHOLE LOG

Run No / Length (m)	Drilling Method	Core Recovery %	RQD %	Fracture Frequency	Water Level	Field Tests			Depth (m)	Description
						Type	Value	Legend		
20/0.50		44	0						11	Green-mauve, white veined, highly weathered, calcite veined BASALT fragmented to pebble size.
21/0.50		46	0						11	Brown-mauve, weathered, fine-grained BASALT with non-calcareous amygdales of apparent zeolite. Close horizontal breaks at 1 to 2 cm spacing.
22/0.50		64	0						12	Brown-mauve, weathered to slightly weathered, fine-grained partly cored BASALT with some rounded zeolite amygdales and sub-horizontal calcite veins up to 1mm thick. Rock is more broken and weathered above 12.50m with a purple and white coating on sub-vertical to 60 degree dislocations which fragment the core.
23/0.50		53	12	v.high					13	Dark green, completely to highly weathered, flushed calcareous BASALT SAND
24/0.50		60	0						13	Grey-green, highly weathered to weathered, fine-grained, fractured and veined, partly amygdaloidal BASALT. Closely fragmented on rust stained dislocations to top.
25/0.50		78	0						14	Becomes more competent at 13.50m but core is broken on sub-horizontal chloritic and calcite. Weathered on amygdale concentrations where zeolite and green celadonite occur as secondary minerals.
26/0.65		93	0	v.high					14	
END OF HOLE 14.15m										

<b>Project :</b> BRIDGE SITE INVESTIGATIONS  <b>KAZUNGULA BRIDGE PROJECT</b>	<b>B.H. No. 2</b> SHEET 2 OF 2	<h2 style="margin: 0;">ZULU BURROW LIMITED</h2> <p style="margin: 5px 0 0 0;">Integrated Engineering and Development Consultants</p> <p style="margin: 10px 0 0 0;"><b>Lusaka - Zambia</b></p>
Client : JICA STUDY TEAM - NIPPON KOEI JAPAN  Contractor : Geotechnical Services Zimbabwe Driller : A.Muntengwa  Drilled : 21-23/9/00 Machine : Boyles BBS18  Logged : 5/10/00 By : T.J. BRODERICK	Location : Immediate left bank Orientation : -90 Reduced Level : Drilling Medium : Water  Notes : Elevation : 925.25 m	Job No :

# BOREHOLE LOG

Run No / Length (m)	Drilling Method	Core Recovery %	RQD %	Fracture Frequency	Water Level	Field Tests			Depth (m)	Description
						Type	Value	Legend		
1/1.0	NXC						N		1	DEPTH OF WATER 4.44m Creamy yellow, fine-grained, loose, unconsolidated aluvial SAND
2/0.5		SPT 1	6						2	Creamy yellow to off-white, fine-grained, loose, unconsolidated clean siliceous alluvial SA Becomes more compact above 5.00m
3/0.5		SPT 2	9							
4/0.5		SPT 3	9						3	
5/0.5										
6/0.5		SPT 4	9						4	
7/0.5										
8/0.5		SPT 5	12						5	
9/0.5										
10/1.0	Cased TNW	35					273R		6	
11/0.50		26							7	Grey-green, highly weathered to weathered, fine-grained, fragmented BASALT with minor coring above 7.42m and a few calcareous veins.
12/0.50		48								
13/0.42		86							8	Green-grey, weathered, largely fragmented, fine-grained, massive BASALT With some discrete coring and staining on dislocations.
14/0.58		43	0							
15/1.0		53	0						9	Dark green, highly weathered, decomposing soft calcareous BASALT represented as a sandy flush
16/0.50		48	0							
17/0.80		60	0						10	

<b>Project :</b> BRIDGE SITE INVESTIGATIONS  <b>KAZUNGULA BRIDGE PROJECT</b>	<b>B.H. No. 3</b> SHEET 1 OF 2	<b>ZULU BURROW LIMITE</b>  Integrated Engineering and Development Consultants  <b>Lusaka - Zambia</b>
<b>Client :</b> JICA STUDY TEAM - NIPPON KOEI JAPAN  <b>Contractor :</b> Geotechnical Service Zimbabwe Driller: A.Muntengwa  <b>Drilled :</b> 26-27/9/00 Machine: Boyles BBS18  <b>Logged :</b> 5/10/00 By: T.J. BRODERICK	<b>Location :</b> Left side of river <b>Orientation :</b> -90 <b>Reduced Level :</b> <b>Drilling Medium :</b> Water  <b>Notes :</b> Elevation: 920.3 m	Job No :

# BOREHOLE LOG

Run No / Length (m)	Drilling Method	Core Recovery %	RQD %	Fracture Frequency	Water Level	Field Tests			Depth (m)	Description
						Type	Value	Legend		
18/1.0		40	0						11	Green-grey, weathered, largely fragmented massive BASALT with a few thin veins. Some coring at 2 to 6 cm lengths with a few stained dislocations. Non-calcareous towards the end of hole.
END OF HOLE 11.30m										

<p><b>Project :</b> BRIDGE SITE INVESTIGATIONS</p> <p><b>KAZUNGULA BRIDGE PROJECT</b></p>	<p><b>B.H. No. 3</b></p> <p>SHEET 2 OF 2</p>	<p><b>ZULU BURROW LIMITED</b></p> <p>Integrated Engineering and Development Consultants</p> <p><b>Lusaka - Zambia</b></p>
<p><b>Client :</b> JICA STUDY TEAM - NIPPON KOEI JAPAN</p> <p><b>Contractor :</b> Geotechnical Service Driller : A.Muntengwa Zimbabwe</p> <p><b>Drilled :</b> 26-27/9/00      <b>Machine :</b> Boyles BBS18</p> <p><b>Logged :</b> 5/10/00      <b>By :</b> T.J. BRODERICK</p>	<p><b>Location :</b> Left side of river</p> <p><b>Orientation :</b> -90</p> <p><b>Reduced Level :</b></p> <p><b>Drilling Medium :</b> Water</p> <p><b>Notes :</b> Elevation: 920.3 m</p>	<p>Job No :</p>

# BOREHOLE LOG

Run No / Length (m)	Drilling Method	Core Recovery %	RQD %	Fracture Frequency	Water Level	Field Tests		Legend	Depth (m)	Description
						Type	Value			
1/0.86	NXC	41								DEPTH OF WATER 7.94m Pale brown-yellow, clean, fine-grained washed, loose alluvial SAND
						SPT 1	N 37		1	Blue-grey, highly weathered to weathered, closely fragmented carbonated BASALT Thinly veined with calcite
2/0.69	TNW	22							2	
3/0.50	Cased	36							3	
4/0.50		28							3	
5/0.60		94	0						3	
6/0.50		84	46	v.high					4	Blue-green, weathered BASALT with 1-2mm wide horizontal calcite veins and a few rounded amygdales.
7/1.0		70	45	high					5	Green-blue, weathered, closely fragmented veined, calcareous BASALT Mauve-green to reddish mauve, weathered to slightly weathered cored BASALT Rounded amygdales are partly calcareous. Later horizontal veins of calcite. Some of these are open and vughy.
8/1.0		100	80	6/m					6	Weathered, especially above 5.00m.
9/0.80		88	39	12/m					6	Grey-green, slightly weathered to weathered, fine-grained BASALT. Cut by horizontal calcite veins and one later 3mm-wide later vertical vein. Fragmented at the end of hole.
										END OF HOLE 6.80m

<p>Project : <b>BRIDGE SITE INVESTIGATIONS</b></p> <p><b>KAZUNGULA BRIDGE PROJECT</b></p>	<p><b>B.H. No. 4</b></p> <p>SHEET 1 OF 1</p>	<p><b>ZULU BURROW LIMITED</b></p> <p>Integrated Engineering and Development Consultants</p> <p><b>Lusaka - Zambia</b></p>
<p>Client : JICA STUDY TEAM - NIPPON KOEI JAPAN</p> <p>Contractor : Geotechnical Service Driller : A.Muntengwa Zimbabwe</p> <p>Drilled : 25/9/00 Machine : Boyles BBS18</p> <p>Logged : 5/10/00 By : T.J. BRODERICK</p>	<p>Location : River Bed Left Central</p> <p>Orientation : -90</p> <p>Reduced Level :</p> <p>Drilling Medium : Water</p> <p>Notes :</p> <p>Elevation: 916.8 m</p>	<p>Job No :</p>



# BOREHOLE LOG

Run No / Length (m)	Drilling Method	Core Recovery %	ROD %	Fracture Frequency	Water Level	Field Tests		Legend	Depth (m)	Description
						Type	Value			
20/0.58		93	17							Blue-mauve, weathered, partly friable and fragmented to cored veined and vesicular BASALT Some celadonite and calcite amygdaloids and veins.
21/1.50		59	16						11	Mauve, weathered to slightly weathered, fine-grained, largely cored, calcite veined and vesicular BASALT with a vertical vuggy vein above 13.03m.
22/1.0		91	54						12	
23/0.73		70	0						13	Mauve, weathered, fine-grained vesicular BASALT with calcite veins, some as a breccia. Core is more broken from 13.76 to 14.55m, this apparently representing the base of a flow.
24/0.79		32	0						14	
25/0.55		71	0						15	Pale mauve, weathered, highly fragmented more massive BASALT with rare veining contrasting with above.
26/0.64		100	0						16	Fragmented as above but with more calcite veins and with stained and coated dislocations Pale mauve, weathered to slightly weathered, fine-grained fractured BASALT with thin green coated dislocations at 25 and 90 degrees to the core and some horizontal calcite veins along which the core breaks at 1 to 5 cm intervals providing a biscuit-like break to the core.
27/0.88		100	0						17	
28/0.92		100	0						18	Greenish-mauve, weathered to highly weathered, fine-grained BASALT with some core loss. Closely fragmented on stained and coated horizontal and vertical dislocations giving a brittle, shale-like aspect to the core.
29/0.54		100	0						19	
30/0.80		60	0						20	
31/0.70		66	0							
32/0.50		100	0							Maroon, weathered, fine-grained, horizontally veined BASALT with calcite and an earthy fill.

<p><b>Project :</b> BRIDGE SITE INVESTIGATIONS</p> <p><b>KAZUNGULA BRIDGE PROJECT</b></p>	<p><b>B.H. No. 5</b></p> <p>SHEET 2 OF 3</p>	<p><b>ZULU BURROW LIMITED</b></p> <p>Integrated Engineering and Development Consultants</p> <p><b>Lusaka - Zambia</b></p>
<p><b>Client :</b> JICA STUDY TEAM - NIPPON KOEI JAPAN</p> <p><b>Contractor :</b> Geotechnical Service Zimbabwe Driller: A. Muntengwa</p> <p><b>Drilled :</b> 18-20/9/00 <b>Machine :</b> Boyles BBS18</p> <p><b>Logged :</b> 5/10/00 <b>By :</b> T.J. BRODERICK</p>	<p><b>Location :</b> Immediate right bank</p> <p><b>Orientation :</b> -90</p> <p><b>Reduced Level :</b></p> <p><b>Drilling Medium :</b> Water</p> <p><b>Notes :</b> <b>Elevation :</b> 926.75 m</p>	<p>Job No :</p>


# BOREHOLE LOG

Run No / Length (m)	Drilling Method	Core Recovery %	RQD %	Fracture Frequency	Water Level	Field Tests			Depth (m)	Description
						Type	Value	Legend		
33/1.03		100	0						21	The core is closely broken at 1 to 3 cm intervals giving it a biscuit-like shaly aspect to the end of hole.
END OF HOLE 21.11m										

<p><b>Project :</b> BRIDGE SITE INVESTIGATIONS</p> <p><b>KAZUNGULA BRIDGE PROJECT</b></p>	<p><b>B.H. No. 5</b></p> <p>SHEET 3 OF 3</p>	<p><b>ZULU BURROW LIMITED</b></p> <p>Integrated Engineering and Development Consultants</p> <p><b>Lusaka - Zambia</b></p> <p>Job No :</p>
<p><b>Client :</b> JICA STUDY TEAM - NIPPON KOEI JAPAN</p> <p><b>Contractor :</b> Geotechnical Service Zimbabwe     <b>Driller :</b> A.Muntengwa</p> <p><b>Drilled :</b> 18-20/9/00                                     <b>Machine :</b> Boyles BBS18</p> <p><b>Logged :</b> 5/10/00     <b>By :</b> T.J. BRODERICK</p>	<p><b>Location :</b> Immediate right bank</p> <p><b>Orientation :</b> -90</p> <p><b>Reduced Level :</b></p> <p><b>Drilling Medium :</b> Water</p> <p><b>Notes :</b></p> <p><b>Elevation:</b> 926.75 m</p>	

# BOREHOLE LOG

7

Run No / Length (m)	Drilling Method	Core Recovery %	RQD %	Fracture Frequency	Water Level	Field Tests			Depth (m)	Description
						Type	Value	Legend		
1/1.0	NXC					SPT 1	N 15		1	Dark brown to dark yellow-brown, loose, becoming partly compact, fine silty SAND as SOIL. Dry drilled.
2/1.0						SPT 2	4		2	Dark brown silty SAND, non-calcareous.
3/1.0						SPT 3	15		3	Yellow-brown, very fine-grained, loose silty calcareous SAND Becomes compact to base
4/1.0						SPT 4	13		4	Brown-yellow, fine-grained, slightly firm calcareous silty SAND
5/1.0						SPT 5	12		5	Brownish yellow, fine-grained, loose to slightly firm calcareous silty SAND
6/1.0						SPT 6	15		6	Yellow, fine-grained, loose, calcareous silty SAND
7/0.50	Cased TNW	42						7	Pale yellow to off-white, fine-grained loose to slightly firm calcareous SAND over SAND with angular siliceous and basaltic gravel above 6.00m	
8/0.50		52				8	Grey, hard, vughy CHALCEDONY forming contact with basalt surface.			
9/0.60		60				9	Dark brown, completely to highly weathered decomposing BASALT as a sandy flush			
10/0.75		45				10	Bluish mauve, weathered, partly friable, densely calcite-veined BASALT			
11/0.95		45				13	Dark mauve, weathered to slightly weathered, closely calcite veined, partly vesicular cored BASALT continues to the end of hole. An open vugh at 9.50m. Rough horizontal breaks in core at 5 to 30cm spacing.			
12/0.70		100	79					11		
		100	64					12		
END OF HOLE 10.00m										

<p><b>Project :</b> BRIDGE SITE INVESTIGATIONS</p> <p><b>KAZUNGULA BRIDGE PROJECT</b></p>	<p><b>B.H. No. 6</b></p> <p>SHEET 1 OF 1</p>	<p><b>ZULU BURROW LIMITED</b></p> <p>Integrated Engineering and Development Consultants</p> <p><b>Lusaka - Zambia</b></p>
<p><b>Client :</b> JICA STUDY TEAM - NIPPON KOEI JAPAN</p> <p><b>Contractor :</b> Geotechnical Services Zimbabwe</p> <p><b>Driller :</b> A. Muntengwa</p> <p><b>Machine :</b> Boyles BBS18</p> <p><b>Drilled :</b> 28/9/00</p> <p><b>Logged :</b> 5/10/00</p> <p><b>By :</b> T.J. BRODERICK</p>	<p><b>Location :</b> Up on right Bank (Botswana)</p> <p><b>Orientation :</b> -90</p> <p><b>Reduced Level :</b></p> <p><b>Drilling Medium :</b> Dry/water</p> <p><b>Notes :</b> Elevation: 930.25 m</p>	<p>Job No :</p>