

WCD Case Study

KARIBA DAM CASE STUDY

Zambia and Zimbabwe

Final Draft: September 2000
Annexes

Prepared for the WCD by:

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This is a working paper prepared for the World Commission on Dams as part of its information gathering activities. The views, conclusions, and recommendations contained in the working paper are not to be taken to represent the views of the Commission

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Annex 1: Important Milestones in the Evolution, Implementation and Operation of the Kariba Dam Project

- 1907** The beginning of Zambezi river flow data collection.
- 1927** The first official survey of Kariba for dam development purposes.
- 1946** Central African Council calls for an Inter-Territorial Hydro-Electric Power Commission to study the Kafue and Kariba projects.
- 1948** The Inter Territorial Hydropower Commission initiates a study to determine which of the two hydropower project, Kafue or Kariba, should be carried out first.
- 1948** Management of the Zambezi river. At this meeting, the first proposal is made for the establishment of the Zambezi River Authority. In addition, the meeting reaches an agreement on the minimum flow that would need to be maintained below Kariba dam in the event that Kariba dam is built.
- 1949** Central African Council recommends that there be an International Zambezi River Authority with basin wide responsibilities.
- 1950** The Central African Council, having reviewed the low flows on the Zambezi between 1946 – 1950 suggests that the life of a dam at Kariba is "at least 1,000 years".
- 1951** The Federation of Rhodesia and Nyasaland is formed after approval in a referendum in which only white citizens of the three countries participated.
- 1952** Federal Power Board with narrower dam and hydro-power generation responsibilities, than the Inter-Territorial Power Commission is formed.
- 1953** (December), Another independent report by Mr Andre Coyne is presented to the Federal Power Board, also recommending that Kariba should be constructed before Kafue.
- 1954** A report by an independent commission of French engineers is presented to the Federal Power Board. The report recommends that Kariba should be built before Kafue.
- 1954** The project report for the Kariba dam project is prepared. The first draft of this report was prepared in September 1955, and the final draft of the project document was produced in December of the same year.
- 1955** Preparatory work on the Kariba dam site is started before funding for the project is fully secured. Cementation Company constructs diversion tunnels at the dam site.
- 1956** World Bank Mission visits Kariba dam site to assess the project for funding by the bank. The mission report recommending funding by the bank to the tune of US\$ 80 million is presented to the board of the bank in June.
- 1956** June, after the British government obtained from the Portuguese Government its "agreement in principle to the execution of the Kariba scheme as planned" and after the Federal government raised loans from the mining companies to cover the additional costs, and after the World Bank approved the loan for Kariba Phase 1, funding for Kariba phase 1 was all in place.
- 1957** December, Kariba Lake Co-ordinating Committee (KLCC) was formed to deal with all non dam and hydro issues excluding resettlement which was a separate territorial and local government matter. The KLCC recommended and prepared the Memorandum and Articles of Association for a Kariba Lake Development Company (KLDC) with wide powers and an aim to involve "the natives" in development opportunities. The KLDC disappears from the files after 1961. Still the most comprehensive lake, shore and community development conception to date.
- 1960** January regular supplies of electricity from Kariba Phase 1 to the Copperbelt started, with a generation capacity of 300 MW. Later also to Zimbabwe. The Kariba dam project completed at Pounds 2 million below budget, despite an unanticipated additional expenditure on the south bank abutment. The additional cost was Pounds 8 million. Thus, the project would have been implemented at Pounds 10 million below budget if the additional expense had not occurred.

- 1963** Dissolution of the Central African Federation, Committee “B” set up in July to oversee its implications, formation of the Central African Power Corporation (CAPCO) with similar dam, hydro-power generation and distribution responsibilities. CAPCO overseen by the Higher Authority for Power, two Ministers each from Zambia and Zimbabwe.
- 1964** Zambia and Malawi gain their Independence.
- 1965** Unilateral Declaration of Independence (UDI) by Zimbabwe’s settler government. International sanctions imposed against Zimbabwe. The setting for growing difficulties in the bi-lateral relations between Zambia and Zimbabwe over Kariba and the Zambezi. The immediate cause of the Liberation War waged by African nationalist organisations operating from, amongst other countries, Zambia and then Mozambique.
- 1965** Consultants to CAPCO conclude that no other scheme matches Kariba Phase 2 (north Bank). The Higher Authority for Power becomes inoperable. Zambia decides to build the internal power schemes at Victoria Falls and Kafue 1.
- 1967** Angola and Mozambique gain their Independence.
- 1969** Zambia forms the Kariba North Bank Company. Appoints CAPCO as its agent.
- 1971** Kafue 1 begins to come on-stream.
- 1972** Zambia commissions Kafue 2 and Zimbabwe commissions Hwange rather than work together on further Zambezi river schemes.
- 1973** Kafue 2 construction begins
- 1976** Kariba Phase 2, north Bank, comes into operation.
- 1977** Kafue 2 begins to come into operation.
- 1980** Zimbabwe’s Independence granted by Britain.
- 1980** The Southern African Development Co-ordination Conference (SADCC) gains new momentum. The main aims are regional co-ordination (including energy) and to wrest reliance away from South Africa for rail and harbour traffic with the outside world.
- 1984** Zimbabwe’s Hwange coal fired station comes on stream after long financial delays raising the national price of electricity 70%.
- 1985** April UNEP Nairobi meeting to work toward an international programme for the environmental management of the Zambezi river.
- 1985** Zambezi Action Plan (ZACPLAN) initiated.
- 1986** Lesotho Highlands Water Project Treaty signed by two outlaw countries, Lesotho and South Africa – promises “to enable” the affected communities “to protect and improve their welfare”.
- 1987** ZACPLAN approved by SADC
- 1987** Zambezi River Authority replaces CAPCO with wider bi-lateral river and development aims but born within the established bi-polar operations of lake management that had evolved since 1961.
- 1990** SADCC formed Electricity Sub-Committee (ESC) which proved itself during the drought of 1991/92.
- 1995** SADC Protocol on Shared Water Course Systems, the first conceptual, political and legal framework for the allocation of water amongst the riparian states.
- 1995** SADCC sets up the Southern African Power Pool (SAPP) to provide reliable, and environmentally and economically efficient power to the region.
- 1999** There are reports that (the now southern African Development Community) SADC is to set up a body to optimise the joint regional development of power generation.

Annex 2: Kariba Hydropower Benefits

KARIBA HYDRO-ELECTRIC POWER STATION								
Year ending 30-June	OUTPUT		ACTUAL EXPENDITURE				INCOME	
	South	North	Operation & Maintenance				Sales Revenue	
	10 ⁶ kWh	10 ⁶ kWh	South P/Stn	North P/Stn	Dam Wall	Total	S&N P/Stns	
1960	378		£729,098		incl	£729,098	£1,174,533	445,435.00
1961	1637		£3,083,928		incl	£3,083,928	£4,981,850	1,897,922
1962	2524		£5,046,820		incl	£5,046,820	£7,267,748	2,220,928
1963	2949		£5,732,184		incl	£5,732,184	£8,326,403	2,594,219
1964	3398		£5,755,045		incl	£5,755,045	£8,774,122	3,019,077
1965	3708		£5,745,284		incl	£5,745,284	£9,015,614	3,270,330
1966	3911		£5,770,875		incl	£5,770,875	£9,260,310	3,489,435
1967	4105		£5,901,683		incl	£5,901,683	£10,355,913	4,454,230
1968	4692		£5,554,108		incl	£5,554,108	£12,115,028	6,560,920
1969	4996		£5,554,108		incl	£5,554,108	£11,882,042	6,327,934
1970	5169		Z\$10,985,345		incl	Z\$ 10,985,345	Z\$ 23,256,912	12,271,567
1971	5499		Z\$11,876,511		incl	Z\$ 11,876,511	Z\$ 24,228,825	12,352,314
1972	5404		Z\$11,979,708		incl	Z\$ 11,979,708	Z\$ 21,684,846	9,705,138
1973	5379		Z\$11,077,260		incl	Z\$ 11,077,260	Z\$ 19,497,756	8,420,496
1974	5480		Z\$ 11,013,837		incl	Z\$ 11,013,837	Z\$ 19,828,411	8,814,574
1975	5355		Z\$ 15,023,739		incl	Z\$ 15,023,739	Z\$ 19,342,825	4,319,086
1976	5383	117	Z\$ 16,474,696	incl	incl	Z\$ 16,474,696	Z\$ 21,718,166	5,243,470
1977	3917	2378	Z\$ 22,304,175	incl	incl	Z\$ 22,304,175	Z\$ 18,641,828	-3,662,347
1978	3725	3110	Z\$ 28,970,094	incl	incl	Z\$ 28,970,094	Z\$ 14,410,770	-14,559,324
1979	3564	3401	Z\$ 28,593,653	incl	incl	Z\$ 28,593,653	Z\$ 15,819,605	-12,774,048
1980	3743	3945	Z\$ 25,031,905	incl	incl	Z\$ 25,031,905	Z\$ 19,104,420	-5,927,485
1981	4099	3846	Z\$ 26,444,267	incl	incl	Z\$ 26,444,267	Z\$ 22,584,894	-3,859,373
1982	3768	3958	Z\$ 33,303,054	incl	incl	Z\$ 33,303,054	Z\$ 20,994,657	-12,308,397
1983	3885	3884	Z\$ 36,783,656	incl	incl	Z\$ 36,783,656	Z\$ 30,112,875	-6,670,781
1984	3325	3824	Z\$ 30,038,224	incl	incl	Z\$ 30,038,224	Z\$ 44,538,647	14,500,423
1985	3477	3773	Z\$ 35,658,917	incl	incl	Z\$ 35,658,917	Z\$ 55,617,661	19,958,744
1986	3129	3454	Z\$ 40,145,025		incl	Z\$ 40,145,025	Z\$ 135,172,800	95,027,775
1987	2701	3345	Z\$ 52,319,795		incl	Z\$ 52,319,795	Z\$ 123,975,900	71,656,105
1988	2666	2584			Z\$ 9,702,003	Z\$ 9,702,003	Z\$ 134,899,600	125,197,597
1989	3196	4688			Z\$ 4,211,000	Z\$ 4,211,000	Z\$ 175,460,400	171,249,400
1990	4369	2867			Z\$ 16,505,000	Z\$ 16,505,000	Z\$ 248,159,200	231,654,200
1991	3152	3342			Z\$ 15,102,000	Z\$ 15,102,000	Z\$ 206,456,000	191,354,000
1992	3161	2540	Z\$ 32,242,200		Z\$ 14,632,000	Z\$ 46,874,200	Z\$ 366,676,000	319,801,800
1993	2062	2324	Z\$ 33,198,200	?	Z\$ 20,356,000	Z\$ 53,554,200	Z\$ 422,710,000	369,155,800
1994	2096	2000	Z\$ 25,990,400	?	Z\$ 59,433,000	Z\$ 85,423,400	Z\$ 515,616,000	430,192,600
1995	2285	2460	Z\$ 39,027,012	?	Z\$ 56,751,000	Z\$ 95,778,012	Z\$ 562,110,000	466,331,988
1996	2163	1696	Z\$ 47,627,708	?	Z\$ 51,073,000	Z\$ 98,700,708	Z\$ 672,693,000	573,992,292
1997	2122	?	Z\$ 56,672,464	?	Z\$ 58,163,000	Z\$ 114,835,464	Z\$ 793,740,200	678,904,736
1998	1880	?	Z\$ 270,996,491	?	Z\$ 145,871,000	Z\$ 416,867,491	Z\$ 913,437,000	496,569,509

Annex 3: Conversion Tables**Conversion Table British Pound – US\$**

Instructions: fill in column B with average Kw/\$ for each year and Conversion Factor will be automatically calculated. Otherwise insert \$/Kw directly and CF will be calculated

Year	Exchange Rate (current)		CPI-USA	CPI-USA	IM	Conversion Factor
	(BP/\$)	ER (\$/BP)	(1982-84=100)	(1998=1.00)	(Curr\$/1998\$)	CF (1998\$/CurrentBP)
1955	0.357	2.800	26.80	0.16	6.08	17.02
1956	0.357	2.800	27.20	0.17	5.99	16.77
1957	0.357	2.800	28.10	0.17	5.80	16.23
1958	0.357	2.800	28.90	0.18	5.64	15.78
1959	0.357	2.800	29.10	0.18	5.60	15.67
1960	0.357	2.800	29.60	0.18	5.50	15.41
1961	0.357	2.800	29.90	0.18	5.45	15.25
1962	0.357	2.800	30.20	0.19	5.39	15.10
1963	0.357	2.800	30.60	0.19	5.32	14.91
1964	0.357	2.800	31.00	0.19	5.25	14.71
1965	0.357	2.800	31.50	0.19	5.17	14.48
1966	0.357	2.800	32.40	0.20	5.03	14.08
1967	0.361	2.767	33.40	0.21	4.88	13.49
1968	0.417	2.400	34.80	0.21	4.68	11.23
1969	0.417	2.400	36.70	0.23	4.44	10.65
1970	0.417	2.400	38.80	0.24	4.20	10.08
1971	0.411	2.434	40.50	0.25	4.02	9.79
1972	0.400	2.502	41.80	0.26	3.90	9.75
1973	0.408	2.452	44.40	0.27	3.67	9.00
1974	0.428	2.339	49.30	0.30	3.30	7.73
1975	0.450	2.222	53.80	0.33	3.03	6.73
1976	0.554	1.806	56.90	0.35	2.86	5.17
1977	0.573	1.746	60.60	0.37	2.69	4.69
1978	0.521	1.919	65.20	0.40	2.50	4.80
1979	0.471	2.122	72.60	0.45	2.24	4.76
1980	0.430	2.326	82.40	0.51	1.98	4.60
1981	0.493	2.028	90.90	0.56	1.79	3.63
1982	0.571	1.751	96.50	0.59	1.69	2.96
1983	0.659	1.517	99.60	0.61	1.64	2.48
1984	0.748	1.336	103.90	0.64	1.57	2.10
1985	0.771	1.296	107.60	0.66	1.51	1.96
1986	0.682	1.467	109.60	0.67	1.49	2.18
1987	0.610	1.639	113.60	0.70	1.43	2.35
1988	0.561	1.781	118.30	0.73	1.38	2.45
1989	0.610	1.640	124.00	0.76	1.31	2.15
1990	0.560	1.785	130.70	0.80	1.25	2.22
1991	0.565	1.769	136.20	0.84	1.20	2.12
1992	0.566	1.766	140.30	0.86	1.16	2.05
1993	0.666	1.502	144.50	0.89	1.13	1.69
1994	0.653	1.532	148.20	0.91	1.10	1.68
1995	0.634	1.578	152.40	0.94	1.07	1.69
1996	0.640	1.562	156.90	0.96	1.04	1.62
1997	0.611	1.638	160.50	0.99	1.01	1.66
1998	0.604	1.656	162.90	1.00	1.00	1.66

Conversion Table Zambian Kwacha-US\$

Instructions: fill in column B with average Kw/\$ for each year and Conversion Factor will be automatically calculated. Otherwise insert \$/Kw directly and CF will be calculated

Year	Exchange Rate (current)		CPI-USA	CPI-USA	IM	Conversion Factor
	(Kw/\$)	ER (\$/Kw)	(1982-84=100)	(1998=1.00)	(Curr\$/1998\$)	CF (1998\$/CurrentKw)
1955	0.714	1.400	26.80	0.16	6.08	8.5097
1956	0.714	1.400	27.20	0.17	5.99	8.3846
1957	0.714	1.400	28.10	0.17	5.80	8.1160
1958	0.714	1.400	28.90	0.18	5.64	7.8913
1959	0.714	1.400	29.10	0.18	5.60	7.8371
1960	0.714	1.400	29.60	0.18	5.50	7.7047
1961	0.714	1.400	29.90	0.18	5.45	7.6274
1962	0.714	1.400	30.20	0.19	5.39	7.5517
1963	0.714	1.400	30.60	0.19	5.32	7.4529
1964	0.714	1.400	31.00	0.19	5.25	7.3568
1965	0.714	1.400	31.50	0.19	5.17	7.2400
1966	0.714	1.400	32.40	0.20	5.03	7.0389
1967	0.714	1.400	33.40	0.21	4.88	6.8281
1968	0.714	1.400	34.80	0.21	4.68	6.5534
1969	0.714	1.400	36.70	0.23	4.44	6.2142
1970	0.714	1.400	38.80	0.24	4.20	5.8778
1971	0.714	1.400	40.50	0.25	4.02	5.6311
1972	0.714	1.400	41.80	0.26	3.90	5.4557
1973	0.652	1.533	44.40	0.27	3.67	5.6238
1974	0.643	1.554	49.30	0.30	3.30	5.1351
1975	0.643	1.555	53.80	0.33	3.03	4.7073
1976	0.701	1.427	56.90	0.35	2.86	4.0841
1977	0.790	1.266	60.60	0.37	2.69	3.4039
1978	0.801	1.249	65.20	0.40	2.50	3.1205
1979	0.793	1.261	72.60	0.45	2.24	2.8283
1980	0.789	1.268	82.40	0.51	1.98	2.5067
1981	0.870	1.150	90.90	0.56	1.79	2.0608
1982	0.929	1.077	96.50	0.59	1.69	1.8176
1983	1.259	0.794	99.60	0.61	1.64	1.2991
1984	1.813	0.552	103.90	0.64	1.57	0.8647
1985	3.140	0.319	107.60	0.66	1.51	0.4822
1986	7.788	0.128	109.60	0.67	1.49	0.1908
1987	9.519	0.105	113.60	0.70	1.43	0.1506
1988	8.266	0.121	118.30	0.73	1.38	0.1666
1989	13.814	0.072	124.00	0.76	1.31	0.0951
1990	30.289	0.033	130.70	0.80	1.25	0.0411
1991	64.640	0.015	136.20	0.84	1.20	0.0185
1992	172.214	0.006	140.30	0.86	1.16	0.0067
1993	452.763	0.002	144.50	0.89	1.13	0.0025
1994	669.371	0.001	148.20	0.91	1.10	0.0016
1995	864.119	0.001	152.40	0.94	1.07	0.0012
1996	1207.900	0.001	156.90	0.96	1.04	0.0009
1997	1314.498	0.001	160.50	0.99	1.01	0.0008
1998	1862.069	0.001	162.90	1.00	1.00	0.0005

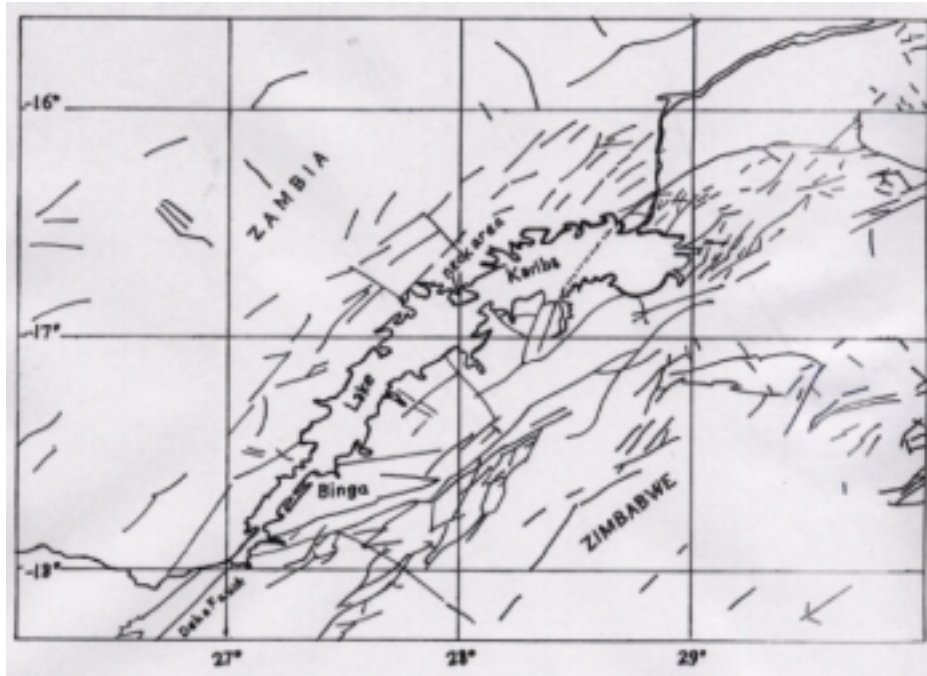
Conversion Table Zimbabwe\$-US\$

Instructions: fill in column B with average Kw/\$ for each year and Conversion Factor will be automatically calculated. Otherwise insert \$/Kw directly and CF will be calculated

Year	Exchange Rate (current)		CPI-USA	CPI-USA	IM	Conversion Factor
	(Z\$/\$)	ER (\$/Z\$)	(1982-84=100)	(1998=1.00)	(Curr\$/1998\$)	(1998\$/CurrentZ\$)
1955	0.714	1.400	26.80	0.16	6.08	8.51
1956	0.714	1.400	27.20	0.17	5.99	8.38
1957	0.714	1.400	28.10	0.17	5.80	8.12
1958	0.714	1.400	28.90	0.18	5.64	7.89
1959	0.714	1.400	29.10	0.18	5.60	7.84
1960	0.714	1.400	29.60	0.18	5.50	7.70
1961	0.714	1.400	29.90	0.18	5.45	7.63
1962	0.714	1.400	30.20	0.19	5.39	7.55
1963	0.714	1.400	30.60	0.19	5.32	7.45
1964	0.714	1.400	31.00	0.19	5.25	7.36
1965	0.714	1.400	31.50	0.19	5.17	7.24
1966	0.714	1.400	32.40	0.20	5.03	7.04
1967	0.714	1.400	33.40	0.21	4.88	6.83
1968	0.714	1.400	34.80	0.21	4.68	6.55
1969	0.714	1.400	36.70	0.23	4.44	6.21
1970	0.716	1.396	38.80	0.24	4.20	5.86
1971	0.710	1.409	40.50	0.25	4.02	5.67
1972	0.663	1.508	41.80	0.26	3.90	5.88
1973	0.585	1.710	44.40	0.27	3.67	6.28
1974	0.583	1.716	49.30	0.30	3.30	5.67
1975	0.570	1.754	53.80	0.33	3.03	5.31
1976	0.625	1.599	56.90	0.35	2.86	4.58
1977	0.628	1.591	60.60	0.37	2.69	4.28
1978	0.674	1.484	65.20	0.40	2.50	3.71
1979	0.680	1.471	72.60	0.45	2.24	3.30
1980	0.645	1.551	82.40	0.51	1.98	3.07
1981	0.690	1.449	90.90	0.56	1.79	2.60
1982	0.759	1.317	96.50	0.59	1.69	2.22
1983	1.013	0.987	99.60	0.61	1.64	1.61
1984	1.258	0.795	103.90	0.64	1.57	1.25
1985	1.614	0.620	107.60	0.66	1.51	0.94
1986	1.667	0.600	109.60	0.67	1.49	0.89
1987	1.662	0.602	113.60	0.70	1.43	0.86
1988	1.806	0.554	118.30	0.73	1.38	0.76
1989	2.119	0.472	124.00	0.76	1.31	0.62
1990	2.452	0.408	130.70	0.80	1.25	0.51
1991	3.621	0.276	136.20	0.84	1.20	0.33
1992	5.098	0.196	140.30	0.86	1.16	0.23
1993	6.483	0.154	144.50	0.89	1.13	0.17
1994	8.152	0.123	148.20	0.91	1.10	0.13
1995	8.665	0.115	152.40	0.94	1.07	0.12
1996	10.002	0.100	156.90	0.96	1.04	0.10
1997	12.111	0.083	160.50	0.99	1.01	0.08
1998	23.679	0.042	162.90	1.00	1.00	0.04

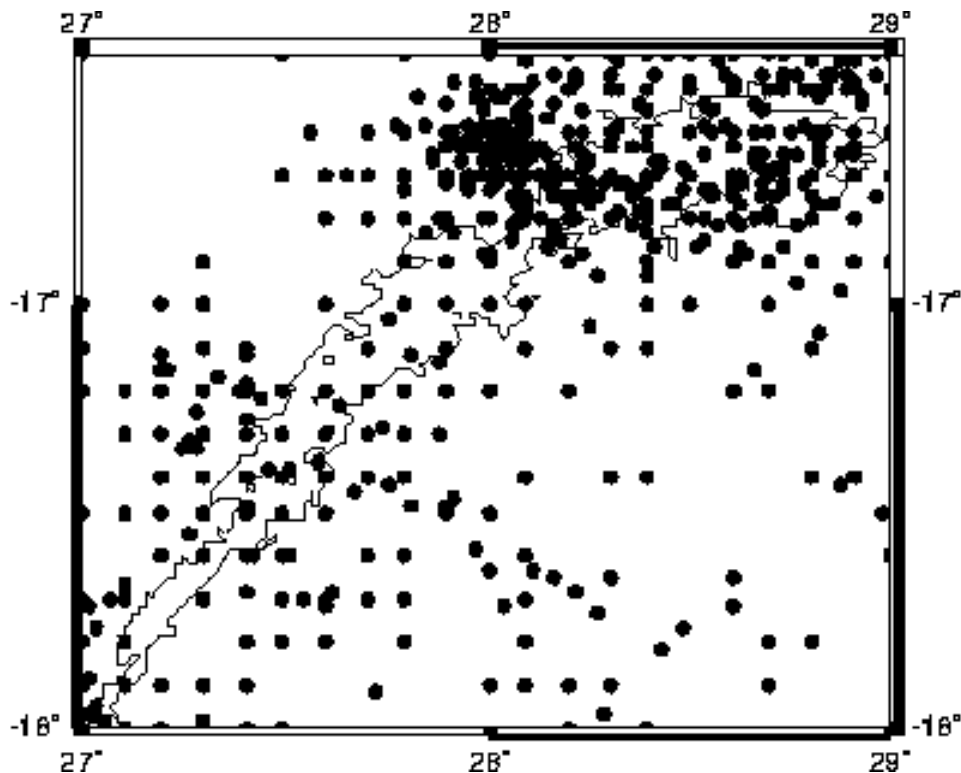
Annex 4: Faults and lineaments in the Lake Kariba area.

Faulting is complex with dominant NE - SW trending faults after Jonathan (1996).



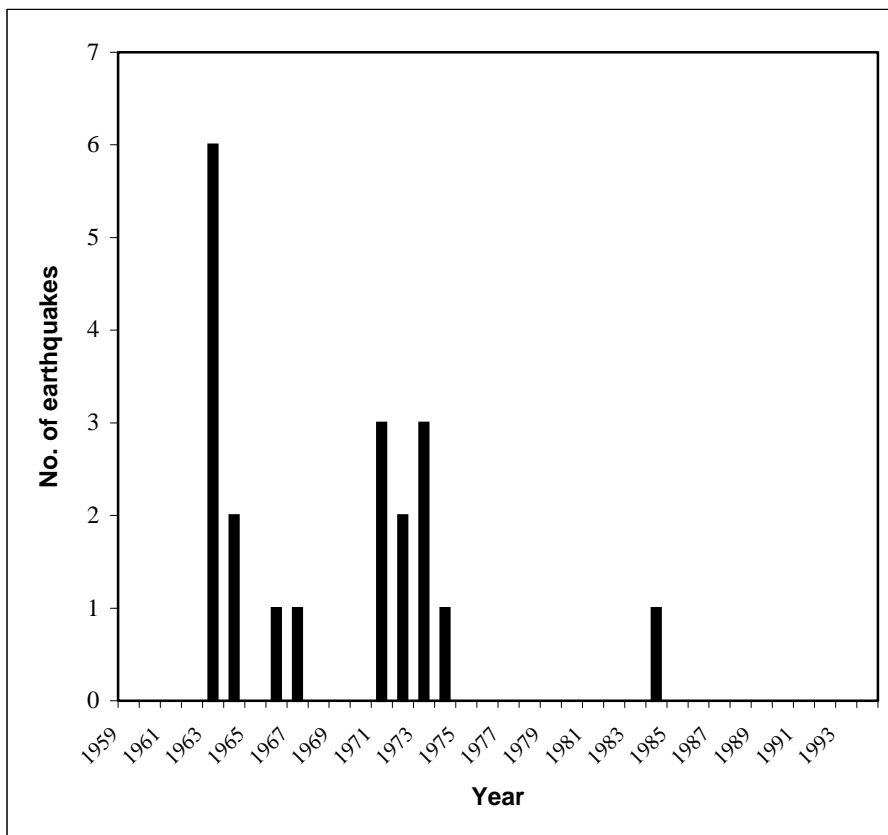
Annex 5. Spatial distribution of all known earthquakes that have occurred in and around Lake Kariba for the period 1959 to 1994.

Seismic activity in the northern part of the reservoir is higher than that in the rest of the reservoir area where the earthquakes are sparsely distributed. This means that the ground close to the dam wall experiences a lot of small ground movement that could weaken the dam wall with time.



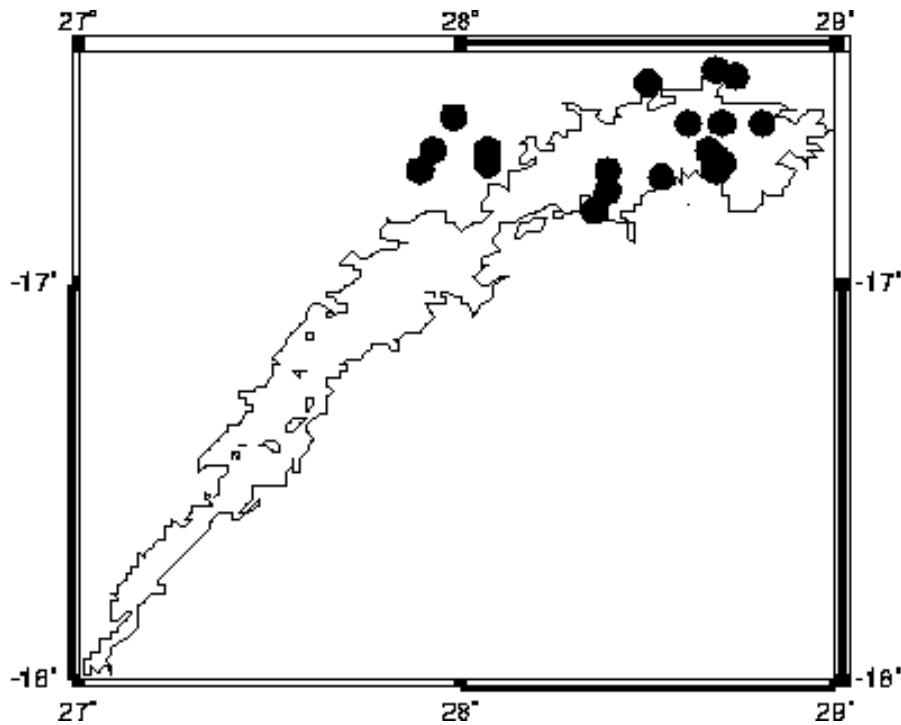
Annex 6. Earthquakes of magnitude 5.0 and larger that have occurred in the Kariba area since 1959

The year 1963 had more large earthquakes than any other year. During that year, seismic activity got to its peak and on the 23 September an earthquake of magnitude 6.1 occurred. Apparently this is the largest earthquake magnitude so far in Zimbabwe.



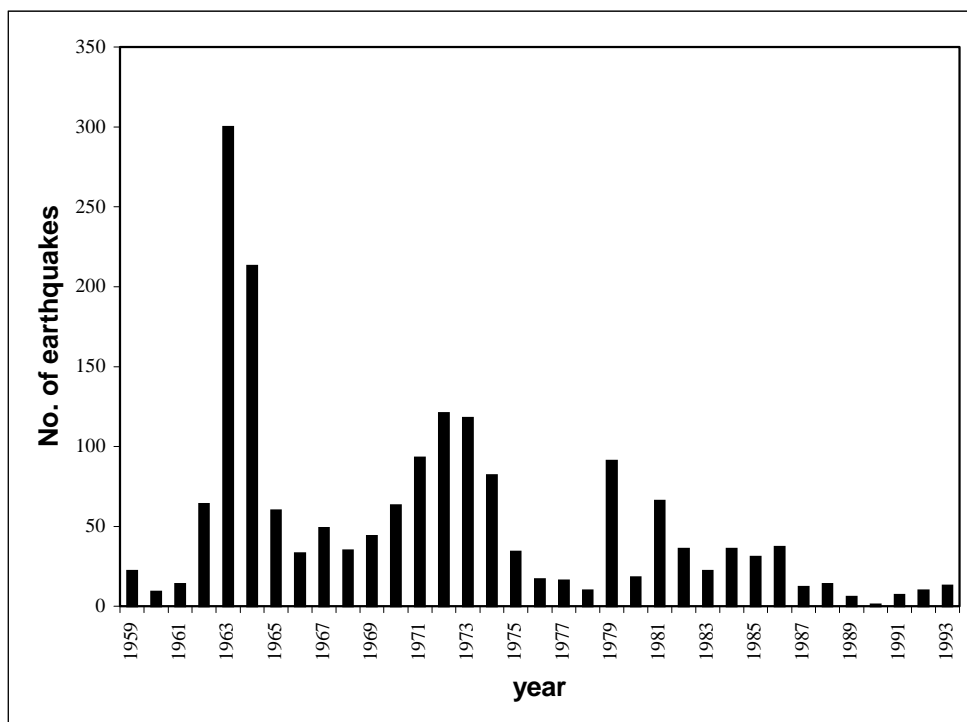
Annex 7. Earthquakes of magnitude 5.0 and higher that have occurred in and around Lake Kariba

It should be noted that these earthquakes have occurred at or close to the deepest part of the lake. Naturally this area carries a higher load in terms of the mass of the water. The largest earthquake is of magnitude 6.1.



Annex 8. Total number of earthquakes per year known to have occurred in the Kariba area during the period 1959 to 1994

Note total of 868 earthquakes occurred in 1963, the number has been changed in the figure for scaling purpose. Though the reservoir still displays seismic activity to this day, there is a general decline in the number of earthquakes from 1963 to 1994.



Annex 9. The Fish Families Found in Pre-Impoundment Survey

- **Family Lepisosteidae or Protopteridae**

The lungfishes are an important genus of this family found in the Middle Zambezi, and Lake Bangweulu area. Skelton (1993) identifies the species as *Protopterus annectent brieni*. It has not been reported in the Upper Zambezi or Kafue Rivers. The species has well developed lungs and can survive when swamps dry up by burying itself in the mud capturing atmospheric oxygen.

Members of this family are commonly known as snout fish because of their long snouts. In the Middle Zambezi, the family Mormyridae is represented by the following species: *Mormyrus lacerda*; *Mormyrus longirostris*; *Gnathonemus macrolepidotus* *Cyphomrus discorhynchus*; and *Petrocephalus catostoma*. *Mormyrus lacerda* is also found in the Upper Zambezi. This genus is heavily exploited by the artisanal fisheries. Where species of this genus occur they prefer flood plain lagoons with aquatic vegetation. The species is important in the small scale fisheries.

Momyrus longirostris is identified with a very long snout. It is common in the Middle Zambezi area, Bangweulu and Mweru system. Where it occurs, it is found in deep waters with soft muddy bottoms. The species feeds on invertebrates and insect larva. *Momyrus longirostris* is also important angling species.

Marcusenius macrolepidotus is another important species found in the middle Zambezi. The species is very common in the Kafue and the Zambezi Rivers. Where it occurs, it is common in well vegetated muddy bottomed habitats and feeds on a wide range of invertebrates and can be used as aquarium fish.

- **Family Characida**

Members of the family are characterised by sharp pointed teeth. Most important species of this group in the middle Zambezi include: Tiger fish *Hydrocynus vittatus*, *Brycinus lateralis*, *Brycinus imberi*, *Micralestes acutidens*.

The tiger fish, *Hydrocynus vittatus* is identified with large head with bonny cheeks and strong jaws. The fish is very common in the Middle Zambezi area, and is also abundant in the Upper Zambezi, Lake Mweru and Bangweulu and Lake Tanganyika. The species is prominently absent in the Kafue River. In fishery areas where the species is found, it is very popular in the recreational fishery attracting tourists from different parts of the world. It is also heavily exploited by artisanal fishermen.

Brycinus lateralis is a small characid very abundant in the Kafue River and the Upper Zambezi. The species is said to have colonised the Middle Zambezi area after the creation Lake Kariba (Balon 1973). The species has also been recorded in below the Kariba dam wall. As a small species, it is normally caught by artisanal fishermen because mesh sizes where it can be caught, with small meshes, are not commonly used in the gill net fisheries and are prohibited by law.

Brycinus imberi is also another small characid found in the Middle and Lower Zambezi River systems. Before the creation of Lake Kariba, it was very common Characid in the Middle Zambezi and appears to have been replaced by *Brycinus lateralis* (Balon 1971).

- **Family Cyprinidae**

Cyprinids are essentially riverine species of fish and have no distinct stomachs. They do not also have, distinct teeth on the jaws. Cyprinids are found in all the major fisheries of Zambia. Most prominent members of this family found in the Middle Zambezi include: *Distichodus mossambicus*,

Distichodus schenga, *Barbus barotseensis*, *Barbus marequensis*, *Barbus faciolutus*, *Labeo cylindricus*, *Labeo altivetis*, *Labeo congoro* and *Varicorhnus nastus*.

Due to the creation of Lake Kariba this taxonomic family is no longer dominant in the Middle Zambezi particularly in the lacustrine basins of the lake. It is however very dominant in rivers flowing into the lake.

Barbus paludinosus is commonly identified by a more punted head. The species is not heavily exploited due to its small size.

Labeo altivelis found in most of the fishery areas of Zambia and Zimbabwe and is very common in the Middle Zambezi. The species is famous for its upstream breeding migration.

Labeo cylindricus is found in the Kafue and Middle Zambezi areas where it is a significant part of the artisanal catch. On the Kafue River, it is most common Cyprinid. The species is moderately exploited by small scale fishermen.

- **Family Schilbeidae**

This taxonomic family is represented by two species in the Middle Zambezi: *Eutropius depressirotris* and *Schilbe mystus*. *Schilbe mystus* is widely distributed in most of the major fisheries of Zambia and Zimbabwe and is very common in the Kafue. It is not a preferred species of fish by fishermen due to soft flesh and rots fast. The fish is difficult to handle because of the spines. It is therefore heavily exploited as a result.

- **Family Clariidae**

This family is represented by four species in the Middle Zambezi. *Clarias gariepinus*; *Clarias ngamensis*. *Clarias theodore* and *Heterobranchus logifilis*, the Giant Catfish locally known as Vundu and *Leptoglanis rotundiceps*. In the water bodies of Zambia, fifteen species of this family have been reported. *Heterobranchus longifilis*, is a large fish and is recorded to attain weight of up to 55kg. It is an important angling species not heavily exploited by the artisanal fisheries. Radcliffe (1994) demonstrated potential for the development of a fishery based on the exploitation of the Giant Catfish using long lines in Lake Kariba.

The fish is an active predator and is found even in small streams. It is important in the small scale artisanal fisheries particularly in small streams.

Clarias ngamensis is distinguished from the Sharptooth Catfish by the short adipose behind the dorsal fin found in the Kafue Zambezi Lake Tanganyika and Mweru systems. The species is important in the artisanal fisheries. The degree of exploitation has not yet been accurately assessed in different fisheries but available information indicates that the species may be heavily exploited.

- **Family Mochokidae**

In the Middle Zambezi area, this family is represented by three species: *Synodontis zambezensis*; *Synodontis neblosa* and *Chilonganis neumanni*. In the nearby Kafue River, this Genus is represented by *Synodontis kafuensis*. The following species are confined to the upper Zambezi area *Synodontis nigromaculatus*, *Synodontis macrostoma*, *Synodontis lepardinus*, *Synodontis thamalakanesis*, *Synodontis vanderwali* (Skelton 1993).

- **Family Malapteruridae**

This family is represented by two species in Zambia, *Malapterurus electricus* and *Amphilius platyichir*. The species are found in Middle Zambezi, and Lake Tanganyika systems. They are sometimes caught in subsistence fisheries and by anglers, though not an important species in the artisanal sector.

- **Family Anguillidae**

Four species of this family have been recorded in Zambia and Zimbabwe and are confined to the Middle and Lower Zambezi: *Anguilla bicolor*, *Anguilla mossambica*, *Anguilla bengalensis labiata* and *Anguilla marmorata*. These are freshwater catadromous eels that spawn in the Indian Ocean and migrate into the Zambezi. The damming of Zambezi at Kariba, Caborra-bassa, and at Kafue Gorge has limited the range of these species. This genus is therefore expected to be eliminated from Zambia as a result of the construction of these dams. In the past, before the construction of these dams, the Victoria Falls was the natural barrier.

During the environmental impact assessment studies for the Batoka Gorge Dam, a 17 years old *Anguilla labiata* was caught in the Batoka Gorge area. Adult eels are reported to live for 20 years in freshwaters before migrating to the sea to spawn. The capture of the eel in the Batoka Gorge area suggests that some eel species may have the capacity to breed in freshwater.

- **Family Cichlidae**

Cichlids are well-represented group in Zambia and Zimbabwe with all water bodies having large numbers of species that are members of this family. The most common species of this family belong to the genera *Oreochromis*, *Tilapia*, *Sargochromis* and *Haplochromis*. Cichlids are identified by scales on the head and body. Fish belonging to the genera *Oreochromis* and *Tilapia* are primary consumers. The *Oreochromis* are mouth brooding and the genus *Tilapia*, both parents guard the young. Members of the genus *Sargochromis* tends to feed aquatic invertebrates, snails and aquatic insects.

The following are some of the common Cichlids of the Middle Zambezi: *Oreochromis andersoni*, *Oreochromis mossambicus*, *Oreochromis macrochir*, *Oreochromis mortimeri* and *Sargochromis codringtoni*.

Members of this family that are primary consumers are used in aquaculture particularly *Oreochromis andersoni*, *Oreochromis macrochir* and *Tilapia rendalli*. Aquaculture development in Zambia started through studies conducted at Chilanga using breeding stock collected from the Kafu River. From this area, aquaculture spread to different parts of the country. It is felt that the farmed *Oreochromis andersoni* from Kafue Flood Plains has through aquaculture expansion spread to other water bodies in the Bangweulu and Luapula basins and the Middle Zambezi.

Annex 10. Fishes of Lake Kariba

FAMILY	SCIENTIFIC NAME
ANGUILLIDAE	<i>Anguilla nebulosa labiata</i>
CLUPEIDAE	<i>Limnothrissa miodon</i>
MORMYRIDAE	<i>Hippopotamyrus discorhynchus</i> <i>Marcusenius macrolepidotus</i> <i>Mormyrops deliciosus</i> <i>Mormyrus longirostris</i>
CHARACIDAE	<i>Alestes imberi</i> <i>Alestes lateralis</i> <i>Hydrocynus vittatus</i> <i>Micralestes acutidens</i>
DISTICHODONTIDAE	<i>Distichodus mossambicus</i> <i>Distichodus schenga</i>
CYPRINIDAE	<i>Barbus fasciolatus</i> <i>Barbus lineomaculatus</i> <i>Barbus marequensis</i> <i>Barbus paludinosus</i> <i>Barbus poechii</i> <i>Barbus unitaeniatus</i> <i>Labeo altivelis</i> <i>Labeo congoro</i> <i>Labeo cylindricus</i>
SCHILBEIDAE	<i>Eutropius depresirostris</i> <i>Schilbe mystus</i>
CLARIIDAE	<i>Clarias gariepinus</i> <i>Heterobranchus longifilis</i>
MALAPTERURIDAE	<i>Malapterurus electricus</i>
MOCHOKIDAE	<i>Synodontis nebulosus</i> <i>Synodontis zambezensis</i>
CYPRINODONTIDAE	<i>Aplocheilichthys johnstonii</i>
CICHLIDAE	<i>Oreochromis andersoni</i> <i>Oreochromis macrochir</i> <i>Oreochromis mortimeri</i> <i>Pharyngochromis darlingi</i> <i>Pseudocrenilabrus philander</i> <i>Serranochromis macrocephalus</i> <i>Serranochromis robustus jallae</i> <i>Serranochromis carlottae</i> <i>Serranochromis codringtoni</i> <i>Serranochromis giardi</i> <i>Tilapia rendalli</i> <i>Oreochromis niloticus</i>

Annex 11. Systematic List of Mammals Recorded from the Kariba Basin before Impoundment.*Source: Child (1968).*

Common Name	Scientific Name	Abundance	Remarks on distribution
Short-snouted elephant shrew	<i>Nasilis brachyrhynchus</i> A. Smith	?	Kariba Umniati R., Binga, Sebungwe RR.
Four-toed elephant shrew	<i>Petrodromus teradactylus</i> Peters	?	Kariba area, Zambia
Nightape	<i>Galago senegalensis</i> E. Geoffroy	C	Throughout E. of Sengwa R.
Bush baby	<i>G. crassicaudatus</i> E. Geoffroy	R	One specimen caught --Bumi R. area, also known from Zambian waters.
Vervet monkey	<i>Cercopithecus aethiops</i> Linn	C	Throughout
Baboon	<i>Papio ursinus</i> Kerr	A	Throughout
Pangolin	<i>Manis temmincki</i> Smuts	R	Bumi/Umnati areas on both sides of Zambezi
Side-striped jackal	<i>Canis adustus</i> Sundevall	R	Bumi R. and Binga
Wild dog	<i>Lycaon pictus</i> Temminck	?	One pack recorded Sengwa R. (Rescue reports)
Honey badger	<i>Mellivora capensis</i> Schreber	?	Bumi R. and Sampakaruma area and Zambian waters in this area
Civet cat	<i>Viverra civetta</i> Schreber	R	Kariba, Bumi area, Binga area. Also in Zambia in this area
Genet cat	<i>Genetta sp.</i> (?all <i>tigrina</i> Schebe)	C	Throughout
Large grey mongoose	<i>Herpestes ichneumon</i> Linn	?	E. Umniati basin (Smithes, pes. Comm)
Slender mongoose	<i>H. Sanguineus</i> Rüppel	R	Kanchindu Mission area and opposite Sebungwe estuary.
Dwarf mongoose	<i>Helogale parvula</i> Sundevall	?	Umniati/Zambezi confluence. Sinazongwe, Zambia
White-tailed mongoose	<i>Ichneumia albicauda</i> G.Cuvier	R	Zambia, opp Bumi R., also Rhod. Island no locality recorded.
Selous' mongoose	<i>Paracynictis selousi</i> de Winton	?	Binga/Sebungwe R.area
Aardwolf	<i>Proteles cristatus</i> Sparman	?	Bumi R. Sinazongwe (Ansell 1964)
Spotted hyena	<i>Crocuta crocuta</i> Erxleben	C	Throughout
Wild cat	<i>Felis libyca</i> Forster	C	Throughout
Serval	<i>F. Serval</i> Schreber	?	Bumi R.
Caracal	<i>F. caracal</i> Schreber	R	Kota Kota area, Zambia.
Leopard	<i>Panthera pardus</i> Linn	C	Throughout
Lion	<i>P. leo</i> Linn	C	Throughout
Antbear	<i>Orycteropus afer</i> Pallas	C	Throughout
Elephant	<i>Loxodonta africana</i> Blumenbach	A	Throughout
Dassie	<i>Dendrohyax brucei</i> Gray	A	Throughout
Black rhinoceros	<i>Diceros bicornis</i> Linn	C	Between Mwenda and Umniati Rs. Rhod.
Zebra	<i>Equus burchelli</i> Gray	C	Between Sengwa and Umniati Rs. Sinazongwe area, Zambia.
Bushpig	<i>Potamochoerus porcus</i> Linn	?	Throughout
Warthog	<i>Phacochoerus aethiopicus</i> Pallas	C	Throughout E. of Masumo R.
Hippopotamus	<i>Hippopotamus amphibius</i> Linn	C	Throughout .
Duiker	<i>Sylvicapra grimmia</i> Linn	C	Throughout
Grysbuck	<i>Raphicerus sharpei</i> Thomas	A	Throughout
Klipspringer	<i>Oreotragus oreotragus</i> Zimmermann	C	Throughout
Waterbuck	<i>Kobus ellipsiprymnus</i> Ogilby	C	Throughout
Impala	<i>Aepyceros melampus</i> Lichtenstein	A	Throughout rare in meander zone
Roan	<i>Hippotagrus equinus</i> Desmarest	R	Bumi/Umnati areas Rhodesia; 10 miles W. Kariba Zongwe R. area, Zambia
Sable	<i>H. niger</i> Harris	C	Throughout E. of Masumo R.
Bushbuck	<i>Tragelaphus scriptus</i> Pallas	C	Throughout
Kudu	<i>T. strepsiceros</i> Pallas	C	Throughout
Eland	<i>Taurotragus oryx</i> Pallas	C	Chete to Umniati R.
Buffalo	<i>Syncerus caffer</i> Sparman	A	Throughout E. of Masumo R.
Hare	<i>Lepus sp.</i>	C	Throughout
Porcupine	<i>Hystix africaeustalis</i> Peters	C	Chete to Umniati R.
Cane rat	<i>Thryonomys swinderianus</i> Temminck	?	Kariba/Umnati areas.
Bush squirrel	<i>Paraxerus cepapi</i> A. Smith	A	Throughout.
Spring hare	<i>Pedetes capensis</i> Forster	R	Masumo R. and Binga Area
Redveld rat	<i>Aethomys chrysophilus</i> (i) de Winton	R	Throughout
Namaqua rock rat	<i>A. namaquensis</i> (i) A Smith	A	Kariba area
Multimammate	<i>Praomys</i> (ii) <i>natalensis</i> A. Smith	A	Throughout, especially settled areas*
Pygmy mouse	<i>Mus minutoides</i> A. Smith	?	Binga, Kariba.
Single-striped rat	<i>Lemniscomys griselda</i> Thomas	A	Binga area*
Spiny mouse	<i>Acomys spinosissimus</i> (iii) Peters	C	Kariba
Pouched rat	<i>Saccostomus campestris</i> Peters	C	Binga
Greater gerbil	<i>Tatera leucogaster</i> (i) Peters	A	Throughout

Ansell (1964. (ii) David (in press). (iii) Meester *et al.* (1964).

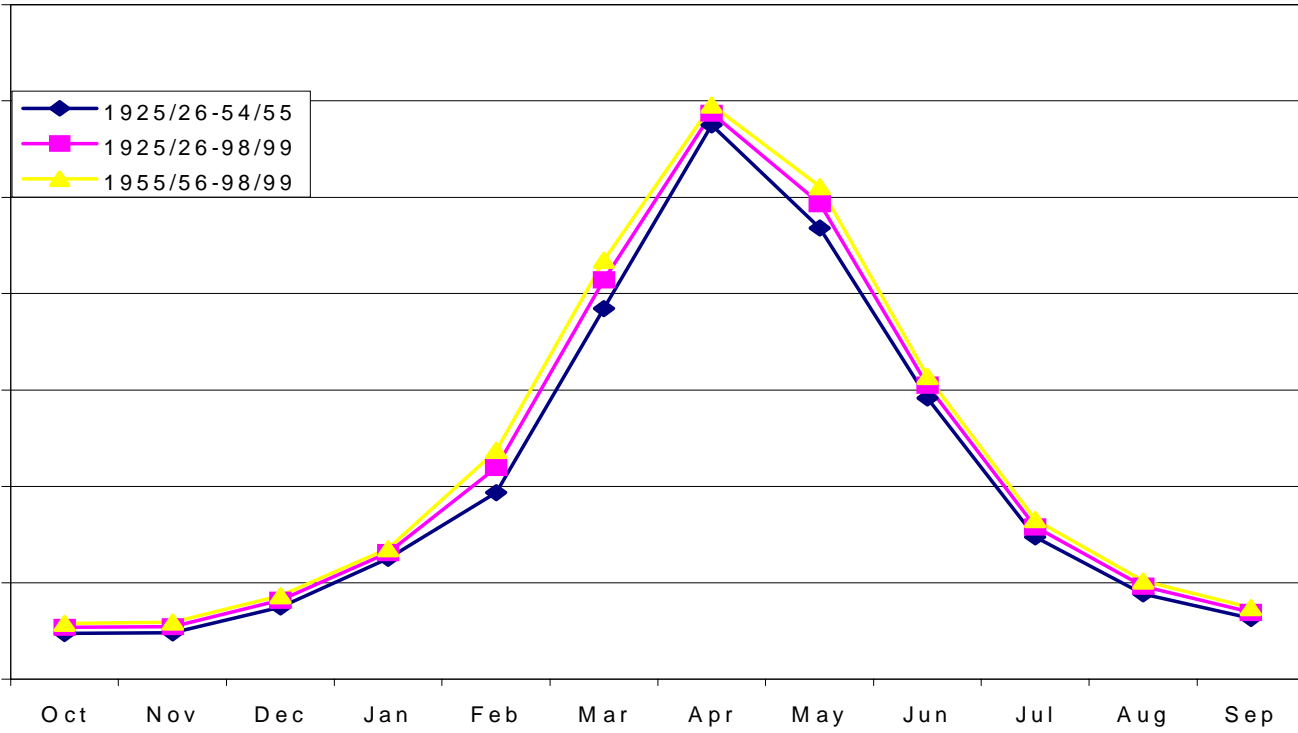
*Very abundant during rodent "eruption", mid 1959.

A= abundant. C=common. R=rare. ?=status not determined.

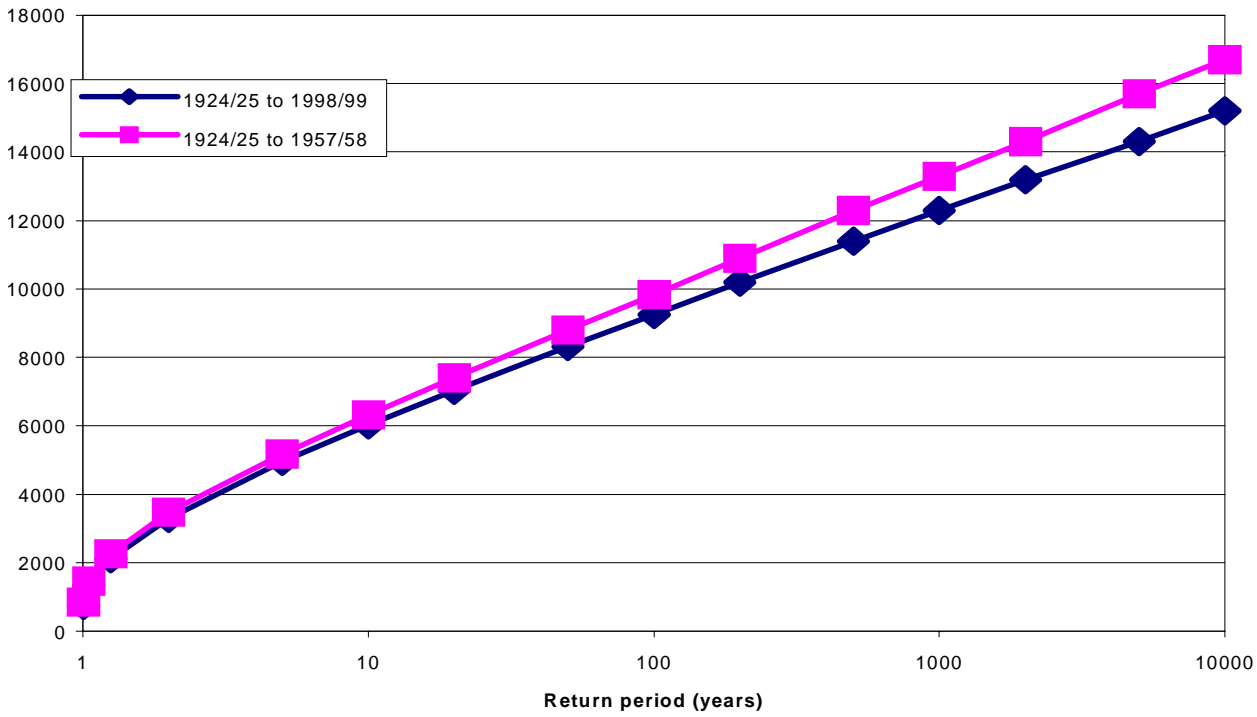
Annex 12. Animals rescued during Operation Noah in Southern Rhodesia. Source: Annual report of the Game Department, 1963

Species	Captured, driven or guided to safety	Died during capture	Net total saved	Destroyed, found dead, drowned or died during capture (total lost)
Antbear.....	50	2	48	11
Badger	12	—	12	—
Baboon	270	2	268	259
Blackfooted cat	1	—	1	—
Buffalo	88	10	78	100
Bush baby.....	1	—	1	—
Bush buck.....	360	40	320	66
Bush pig.....	48	4	44	9
Civet	5	—	5	—
Dassie.....	71	—	71	3
Duiker.....	262	5	257	20
Elephant	23	—	23	28
Genet	43	—	43	9
Grysbok.....	350	5	345	18
Hare.....	30	—	30	3
Hippopotamus	—	—	—	1
Hyena	3	—	3	—
Impala	2,048	182	1,866	243
Jackal	2	—	2	—
Wildcats	4	—	4	—
Klipspringer	28	—	28	2
Kudu.....	321	21	300	39
Leopard	1	1	—	2
Lion.....	10	—	10	3
Mongoose	14	—	14	4
Monkey	178	6	172	121
Night ape.....	11	1	10	2
Pangolin	7	1	6	4
Porcupine.....	47	—	47	2
Rhinoceros.....	54	10	44	14
Sable	114	9	105	17
Squirrel.....	6	—	6	2
Warthog	625	40	585	65
Waterbuck	124	4	120	6
Zebra.....	63	17	46	28
TOTALS	5,274	360	4,914	1,081

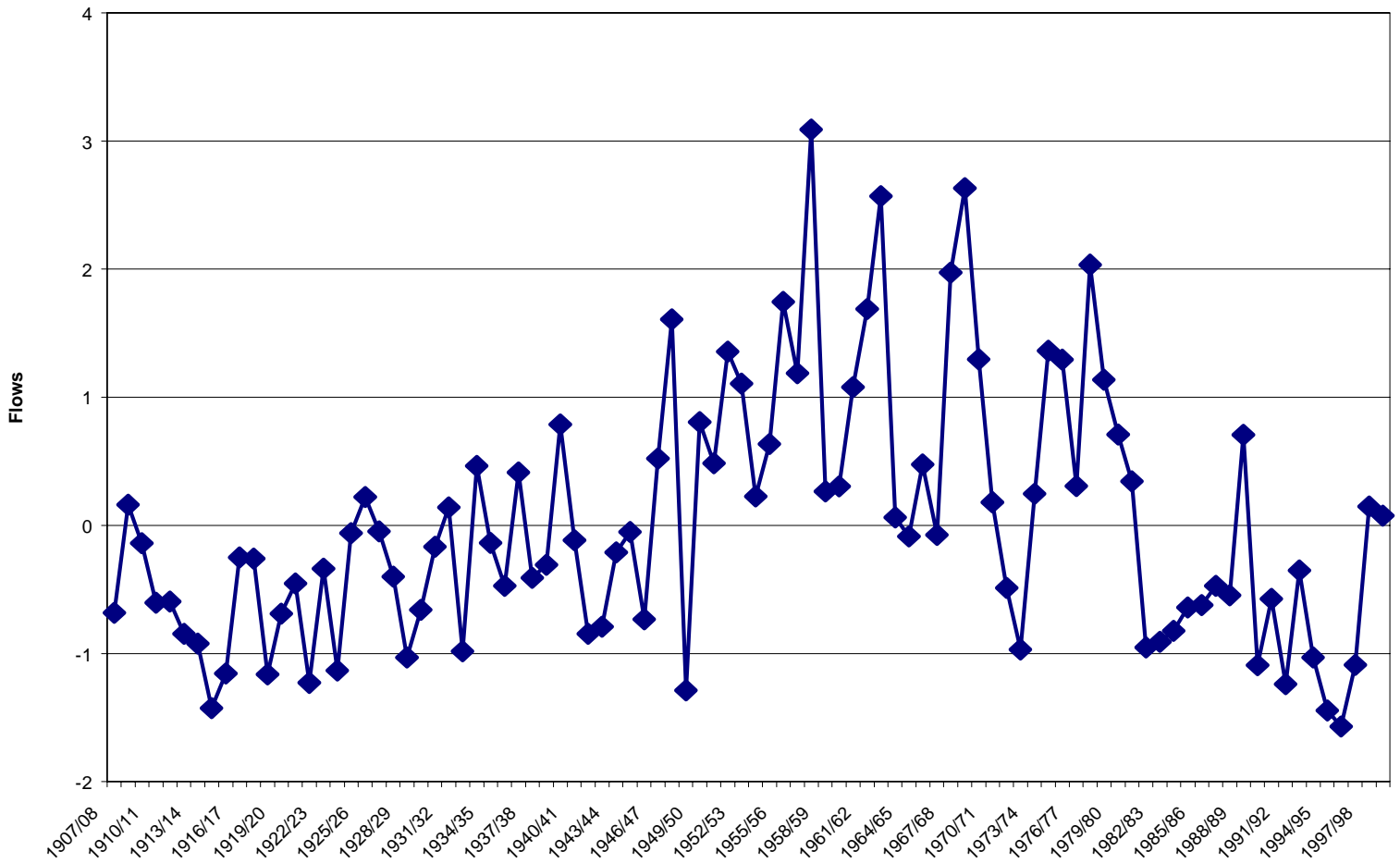
Annex 13. Victoria Falls Mean Monthly Flows



Annex 14: Victoria Falls Annual Maximum Flows



Annex 15. Victoria Falls Standardised Annual Flows



Annex 16. Health Impact Summary Table

Health hazard	Project phase	Vulnerable groups	Environmental factor	Capability of health protection agencies	Health risk attributable to project
Schistosomiasis	Preconstruction	<ul style="list-style-type: none"> - Construction workers exposed at work; - Job seekers exposed at water sources near squatter camps - Relocated local communities exposed in new habitats with stagnant water 	<ul style="list-style-type: none"> - Snails present upstream and likely to invade construction site 	<ul style="list-style-type: none"> - All incoming people were treated but no follow up - No vector control - No surveillance 	<ul style="list-style-type: none"> - High risk potential because of presence of parasite reservoirs in humans and invasion of construction site by intermediate host snails from upstream
	Construction	<ul style="list-style-type: none"> - Construction workers exposed at work; - Job seekers living in squatter camps exposed at water sources; - Relocated local communities exposed in new habitats with stagnant pools 	<ul style="list-style-type: none"> - Invasion of construction site by snails; - New snail habitats in borrow pits created 	<ul style="list-style-type: none"> - Kariba hospital was opened in 1959; Treatment emphasis placed on Africans; - Treatment mainly for construction workers; - No vector control; - No surveillance 	<ul style="list-style-type: none"> - Increased risk particularly for unofficial visitors, Europeans and relocated locals
	Post-construction phase	<ul style="list-style-type: none"> - Unofficial visitors, eg. spouses not treated - Europeans not routinely checked for infection 	<ul style="list-style-type: none"> - Salvinia auriculata introduced snails in 	<ul style="list-style-type: none"> - Systematic screening and treatment of all 	<ul style="list-style-type: none"> - Prevalence of schistosomiasis was significantly reduced by the control efforts. Control programme ended in the late

Health hazard	Project phase	Vulnerable groups	Environmental factor	Capability of health protection agencies	Health risk attributable to project
	Overall	<ul style="list-style-type: none"> - Maintenance team exposed at work - Children and women exposed in villages sited close to the harbours; - Tourists exposed at harbours fishermen exposed at work 	<p>protected harbours where wave action was limited;</p> <ul style="list-style-type: none"> - Human water contact activities created favourable conditions for snails, eg. gutting of fish and washing dishes - Decaying materials in the lake provided food for snails; - Discharge of sewage in dam contaminated water with schistosome eggs leading to high numbers of infected snails 	<p>workers in Kariba (more on Zimbabwean side) was done for a long period but has now been stopped;</p> <ul style="list-style-type: none"> - More health centres were opened to respond to growing health problems; - Vector control was introduced - Surveillance system was put in place; - Lake Kariba Area Coordinating Committee was formed to monitor the situation of schistosomiasis; - Kariba town council is responsible for schistosomiasis control in the area around Kariba town; - Apart from research surveys there has been no control programme in Siavonga 	<p>1980s and this has resulted in higher transmission</p> <p style="text-align: center;">Kariba Dam Project introduced and increased the problem of schistosomiasis on the Lake shores and on some fishing islands</p>

Health hazard	Project phase	Vulnerable groups	Environmental factor	Capability of health protection agencies	Health risk attributable to project
Malaria	Pre-construction phase	<ul style="list-style-type: none"> - Construction workers coming from non-endemic areas were exposed to malaria for the first time 	<ul style="list-style-type: none"> - Vector mosquitoes present in the area 	<ul style="list-style-type: none"> - All incoming construction workers were put on prophylaxis; - DDT was sprayed in the area to kill tsetse flies and mosquitoes 	<ul style="list-style-type: none"> - Risk of developing complicated malaria was high particularly for people coming from non-endemic area.
	Construction phase	<ul style="list-style-type: none"> - Construction workers were exposed to mosquito bites in their temporary shelters; - Job seekers living in squatter camps were exposed to mosquito bites; - Unofficial visitors, eg. spouses did not take prophylaxis 	<ul style="list-style-type: none"> - Borrow pits provided new habitats for vectors created 	<ul style="list-style-type: none"> - All construction workers continued on prophylaxis; - A health centre was established provide curative and malaria preventive measures; - A full time malaria control officer was employed in 1956 - vector control through spraying houses with DDT was done in the malaria season 	<ul style="list-style-type: none"> - Increased risk particularly for women and children
	Post-construction phase	<ul style="list-style-type: none"> - Maintenance team exposed to mosquito bites in their homesteads; - Children and women exposed to mosquito bites in their villages; 	<ul style="list-style-type: none"> - Increased number of mosquito breeding habitats close to human settlements; - Resistant <i>P. falciparum</i> was 	<ul style="list-style-type: none"> - More health centres were opened to respond to growing health problems; - Vector control with 	<ul style="list-style-type: none"> - Chloroquine resistant <i>P. falciparum</i> has increased the risk of complicated malaria.

Health hazard	Project phase	Vulnerable groups	Environmental factor	Capability of health protection agencies	Health risk attributable to project
		<ul style="list-style-type: none"> - Tourists were exposed to mosquito bites 	<ul style="list-style-type: none"> detected in the area 	<ul style="list-style-type: none"> DDT continued - Surveillance system was put in place. 	
	Overall				<p>The problem of malaria in the Kariba area was always there because the area falls within the 600-900m altitude zone. Creation of borrow pits during construction phase increased habitats of the vector mosquito and thus increased the risk of malaria during that phase. Overall, malaria transmission in Kariba cannot be attributed to creation of the Lake as the vector does not breed in large water bodies.</p>
<p>HIV/AIDS & STIs</p>	<p>Pre-construction & Construction phases</p> <p>Post construction phase</p>	<p>Camp followers and construction workers</p> <p>- Fishermen in fishing camps;</p>	<ul style="list-style-type: none"> - Increased immigration during the pre- and construction phases was observed. - Many tourists visit 	<ul style="list-style-type: none"> - There were no preventive measures taken - Infected cases were treated 	<p>High risk during these phases</p> <p>- Very high risk of contracting HIV and other STIs. This is</p>

Health hazard	Project phase	Vulnerable groups	Environmental factor	Capability of health protection agencies	Health risk attributable to project
	Overall	<ul style="list-style-type: none"> - Commercial sex workers; - Promiscuous groups 	<p>Kariba fishermen from fishing camps frequently visit Kariba town to replenish food supplies; Lack of employment has forced many women into commercial sex work</p>	<ul style="list-style-type: none"> - There are adequate health centres to attend to infected cases but drugs are in short supply; - There is no cure for HIV/AIDS and drugs that relieve suffering of patients are unaffordable to the patients - There is an active project involving commercial sex workers and people living with AIDS whose objective is to raise awareness of the problem and to provide support to those already infected 	<p>more linked with tourism and the fishing industry.</p> <p>Increased risk of HIV/AIDS is indirectly linked to the dam in that increased tourism and expansion of the fishing industries are because of the existence of the dam. The problem in Kariba is similar to that in other small towns such as Chiredzi where there are no dams. Therefore, the increased risk cannot be attributed to the dam without qualification</p>

Annex 17. Minutes of the Second Stakeholder Meeting -- Siavonga 19 – 21 February 2000

1. Background to the workshop

The second stakeholder meeting for the Kariba case study was held over the period 19-21 February 2000, at Siavonga, Zambia, to discuss the findings of the Kariba case study. Work on the case study had been carried out by consultants since April 1999, and the draft final report was produced in January 2000.

The WCD case study process requires that the draft final report should be widely circulated to all interested stakeholders to enable the latter to (a) read the report, (b) analyse the findings presented in the report (c) analyse the conclusions of the report in relation to the objectives of the WCD case study process; and (d) to contribute their comments on the report, and on the WCD case study process.

With respect to the Kariba case study a list of stakeholders was compiled to cover all known interest groups and communities. Invitations were sent to these stakeholders to attend the workshop. Copies of the draft final report were sent together with the invitations. Those who could not attend the workshop were asked to read the report and to submit written comments. A total of about 80 invitations were sent to institutions as well as individuals who had an interest in the Kariba case study.

Since the Kariba dam is jointly owned by the two countries of Zambia and Zimbabwe, participants to the workshop were drawn from both Zambia and Zimbabwe.

2. Workshop Objectives

The overall goal of the workshop was to afford the stakeholders (participants) an opportunity to express their views on the findings of the Kariba case study. The workshop was designed to gather all views on how effective the Kariba dam project has been in promoting local, national and regional development and to draw lessons for WCD on development of large dams in the future.

After the workshop, each participant was expected to:

- have a good understanding of the historical perspectives of the development of the Kariba dam project.
- have a good understanding of the projected versus actual impacts of the Kariba dam;
- to contribute to the debate on the distribution of costs and benefits of Kariba dam amongst the different categories of stakeholders.
- have a good understanding of the criteria and guidelines that were applied in making decisions on design and implementation of the Kariba dam; and
- to contribute to the derivation of lessons from the Kariba dam project for WCD.

3. Workshop Participants

The meeting was attended by a wide range of participants drawn from local residents, chiefs of surrounding areas, government departments, non-governmental organisations, representatives of the private sector, representatives of district authorities and observers from both WCD and other regional and international organisations. The participants came from the following countries: Zambia, Botswana, Mozambique, South Africa, Zimbabwe, the USA and Tanzania. Participants names and addresses appear at the end of this report.

4. Workshop Process

The consultants facilitated the workshop, using 3 methods as:

- summary presentations by consultants
- group discussions, and
- plenary discussions and report back sessions.

One of the main challenges of this workshop was the diversity of interests amongst the participants. While some of the participants were highly educated professionals with passionate interest in specific technical areas such as fish ecology or power plant performance, there were participants, who had been drawn from the local community, who were only concerned about the impact of the dam on the lives of the local community. Some of the participants in the latter group were not capable of reading or comprehending most of the technical material in the case study report. However, these latter participants were in a position to share their personal experiences with respect to the Kariba dam. The workshop was fortunate that some of the community representatives and some of the chiefs had lived through the Kariba resettlement and could give first hand accounts of some of the historical events associated with the dam, especially the resettlement of displaced people.

The workshop programme is presented in table 1. Each session began with a presentation by the consultants of all their report and findings. After each presentation the participants were allowed a short time for clarification questions that related to the preceding presentation by the consultants. Once all clarification questions had been answered, the consultants introduced a set of questions to guide the stakeholders in their group discussions. The stakeholders then broke up into groups to discuss the questions that had been set. After the group discussions, the participants reconvened into a plenary session to report the proceedings of the group discussions. For some issues, the local leaders preferred to report back in vernacular with translations into English by some of the consultants who could speak Tonga.

Four groups were created for the Kariba stakeholder workshop. To facilitate widespread discussions and the participation of all attending stakeholders, it was decided to create one discussion group consisting only of local level stakeholders, ie chiefs, district council personnel from both Zambia and Zimbabwe, and community representatives. Because some of these local level participants could not speak English it was also decided that for this group of local stakeholders, discussions would be conducted in the vernacular language of the Kariba basin – Tonga.

The comments that were made in the group discussions are summarised and presented later in this report.

Workshop Programme

Sunday 20 February 2000		
12:30 – 5:30 pm	Delegates arrive and check into hotel	
6:00 pm	DINNER	
Monday 21 Feb 2000		
8:30 am	Registration	
9:00 am	Introductions	
9:15 am	Introduction to the WCD Process	M. Niasse
9:45 am	Presentation of the Kariba Case Study Report	A. Hungwe
10:30 am	TEA	
11:00 am	Group Discussions on the Case Study Report	
11:45 am	Report Back Session	
12:30 pm	LUNCH	
14:00 pm	Presentation of the consultants' findings on the distribution of costs and benefits from the Kariba dam project.	J. Chileshe
14:10 pm	Special presentation by Chief Sinazongwe on the Impacts of Kariba dam as perceived by local	

	people in Zambia and Zimbabwe	
14:30 pm	Group Discussions on the Distribution of Costs and Benefits	
15:15 pm	TEA BREAK	
15:45 pm	Presentation of Group Reports on Distribution of Costs and Benefits	
16:30 pm	Presentation on the consultants' findings on "LESSONS LEARNT" from Kariba	A. Hungwe
17:00 am	Distribution of questionnaires on Development Effectiveness. END OF DAY 1	B. Aylward
Tuesday 22 Feb 2000		
8:30 am	Group Discussion on Lessons learnt	
9:15 am	Presentation of Group reports on Lessons learnt	
10:00 am	TEA BREAK	
10:30 am	Introduction to the issue of Development Effectiveness	B. Aylward
10:45 am	Group Discussion on Development Effectiveness	
11:45 am	Presentation of Group Reports on Development Effectiveness	
12:30 pm	CLOSING REMARKS	M. Niasse & Chief Sinazongwe
12:45 PM	END OF WORKSHOP	

5. Summary of Outputs from group discussions

5.1 First Group Session

The first discussion session followed the presentation of the Kariba case study report by A. Hungwe and was guided by the following the following three instructions:

- Comment on the content of the report
- Identify any gaps that are in the report
- Make suggestions on additional data sources that must be consulted in the preparation of the final report

The following comments were made by the participants in their group discussions:

Comments on the overall report

- The stakeholders pointed out that the consultants had done a commendable job and have covered a lot of ground. Some very useful material, providing key lessons, have been presented.
- There is need to be more elaborate on the methodology used. Could it be that adopting only a restricted participatory approach has affected the presentation of stakeholders perspective?
- The report should be very clear about the purpose of the study. Where does WCD take things from here and how will be results be used?
- The report should be checked for typographical errors.
- Some references that are in the text are not found in the bibliography
- Archeological evidence is not cited as source of information. Could be included in section 2.1
- The study seems to concentrate more on upstream impacts and ignores the downstream areas.

- The discussion of post-construction utilisation of the dam has failed to explore the multipurpose use of the development. There is need to consider alternate use of dams in the conceptualization and construction of the dams.
- Explore the impact of the dam on other countries. How have the other countries been affected by the dam?
- Check accuracy of years when events were implemented.
- Some tables do not cite sources of information-check on consistency
- The study/report fails to address the present economic/political context of the dam
- Gender as an issue is not adequately addressed by the report. It assumes all the segments of the community were homogenous with respect to social impacts. Women, youth and children were affected differently.
- The report is silent on people who were killed
- The study underplays the environmental value of impacts of the dam.
- Publications by Colson on social consequences of resettlement should be cited.

5.1.2 Summary of Comments on Report Outline

- The scope of the report is too wide

5.13 Summary of Comments on Report Content

Predicted Versus Actual

- There is a need to be consistent with the use of currencies .
- The discussion on the environmental effects of a hydro versus thermal stations is inadequate. The study should come up with clear pointers with respect to the experience of Kariba.
- Last third paragraph on page 28 underplays the social costs as felt by local people. It shows the inadequacies of the methodology used or more arrogance by the researchers.
- There are many repetitions and typing errors in the report that need to be rectified
- Perspectives of stakeholders need to be more clearly represented. Who is saying what needs to be clearly mentioned.
- There is no consistency on how the key issues are presented at the end of each section. A summary of key issues should be provided for each chapter
- The rate of siltation has not been adequately discussed in the report

5.2 Second group Discussion Session on Distribution of Costs and Benefits of the Kariba project.

- The participants were asked to comment on the distributional analysis presented in the report and to make suggestion or improvements where necessary

The participants came up with the following points:

Distributional Analysis

- Enlarge the stakeholders categories to include other social groups in the area and not only focus on areas around the dam.
- Enlarge the geographical scope and include other catchment areas (it is not fully clear which catchment area was talked about)
- Add time scale to the figure, possibly to include at least two time frames, as short term and long term.

- Emphasise the issue that it was the immediate catchment area that paid the highest cost and that the urban areas further away gained most from the dam.
- Illustrate the fact that local catchment people lost and the nation gained.
- Include other regional governments such as Malawi etc
- Add a new column on lost trade opportunities to the project impact list.
- Create a separate table dealing with intra-community changes
- Distribution of cost and benefits within the communities to be included.

This table should also include issues such as social changes such as impacts on culture etc.

In general the group thought that the table should be revised and explained much further.

The table should show how benefits were shared between countries

The Table is not comprehensive

- Develop 2 tables one for the biophysical environment and the other for the social environment
- Consider having a table for each of the countries of the Federation
- One column should consider down stream stakeholders
- Move settlement in areas to become an impact column
- Financiers should be included as a category in their own right
- Isolate industries into thermal, railways, mining etc
- Include the time dimension in the tables. Probably consider tables in sets of 20 years rather than 40 years to introduce the time dimension
- What were the different pieces of legislation in the different countries which existed at the time;

5.3 Third Group Discussion Session on Lessons Learnt

In this discussion session, the participants were asked to examine the following:

- To agree or disagree with the lessons suggested; and
- To suggest new lessons of possible

The participants raised the following points with respect to lessons learnt:

- The fact that the Kariba brought about urbanization should be recognised as a lesson for future dam projects.
- That urbanisation and lake shore planning should be an integral part of the Environmental Impact Assessment.
- The Legal Issues needs to be expanded to show that projects such as Kariba need to take into account the existing Laws of the countries involved. The Laws of these countries should be fair and just laws to facilitate equitable utilization of the resources
- As a lesson from Kariba, future dam projects need to take into account human right aspects of the countries where large dams are to be constructed.
- Institutional organisations are not effective in the absence of human rights. In the case of Kariba, they did not sufficiently support the case of the displaced communities in the Gwembe Valley
- National governments are generally not sufficiently motivated to address the issues of displaced citizens.
- There is apparently an international move to separate social & health impacts from the EIA process and deal with them separately. The group felt that this lesson should be expanded to

include EIA and SIA and HIA and the time frame expanded to planning and implementation of large dams projects.

- The stakeholders noted that there was a conflict between traditional land rights and land tenure as defined in Western law. Discussion was on whether the project should ensure that the laws of the country should not recognise these traditional land rights.
- People must participate in the planning process and must agree to any programmes that affect them in the project.
- There is need to have effective institutional structures to monitor and attend to all identified potential negative during and after the implementation
- One lesson in the draft report was with respect of the need to provide relocatees with appropriate agricultural skills for their new areas of settlement. The stakeholders felt that this training should not be confined to agricultural training only, but to all forms of training that may be useful for the relocatees
- The success of large dam projects that involve more than one country is dependent on the political stability of the governments of these countries. In the case of Kariba, the breakup of federation led to problems in the implementation of the project. If the federation had not broken up, the course of the history of Kariba dam would have been different.
- Project proposals must examine the full range of multiple use possibilities and maximize benefits - not just hydropower as was initially the case at Kariba

5.4 Fourth Group Discussions Session on Criteria for Assessing the Development Effectiveness of Kariba Dam

The participants were asked to list criteria that they believed should be considered in assessing the development effectiveness of large dams. The stakeholders engaged in intense debate on this issue. In the end, they agreed on a set of questions that must be asked in order to evaluate the development effectiveness of large dams. Following are some of the questions (the order of listing is of no significance) that the stakeholders believed should be used in assessing the development effectiveness of large dams:

- Was every possible development option considered and exploited in the in the planning and implementation of the dam project?
- Did the project increase regional co-operation?
- If people were displaced by the dam project, did these displaced people benefit from the dam project?
- Did the project meet the required rate of return?
- Did the project exceed original objectives?
- Was there an equitable distribution of benefits from the project?
- Did the living standards of the people improve as a result of the project?
- Did the affected people participate in the decisions that related to the project?
- Was an EIA carried out and was a costing of impacts carried out?
- Is the dam project multipurpose?
- Were efforts made to minimise the displacement of people?

There was a lot of discussion that could not be distilled into clear criteria.

The stakeholders for Kariba dam had divergent views on the different aspects of the development effectiveness of Kariba dam. Views were mainly divergent with respect to technical and economic issues, but there was general consensus on issues relating to social impacts of the dam. This consensus is not surprising when one considers the high awareness of the stakeholders with respect to these social issues.

When the stakeholders were asked to give their overall assessment of the development effectiveness of Kariba dam, 15.5 % rated Kariba very highly effective, 56% high, 13 % were neutral, while the remaining 15.5 % rated Kariba poor. None of the stakeholders rated Kariba in the lowest category of very poor. Therefore, overall, the negative social impacts notwithstanding, the Kariba stakeholders viewed Kariba dam as having been effective.

Workshop Participants

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Annex 18. Comments and Feedback

A. *Comments by Oliver S. Saasa¹ Director, Institute of Economic and Social Research, University of Zambia*

1. Overview

The Report reads well, generally, and it is evidently well researched. It provides some very insightful analysis of the various aspects of its mandate. It is, however, surprising that none of the great works of Elizabeth Colson on the Gwembe Tonga on the Zambian side are not cited (except once in the main report but not listed in the bibliography). Prof. Colson is one of, if not *the* authority on the behavioural aspects of Lake Kariba Dam and its impact on the socio-economic and cultural milieu of that region.

My University awarded Prof. Colson an honorary doctorate during its 50th Anniversary celebrations principally because of this living legend of the Gwembe Valley inhabitants and how their relocation/displacement to give way to the construction of Lake Kariba ignited untold human and environmental disruptions that she so carefully documented. Posterity shall judge the authors harshly if this aspect is overlooked. My Institute (formerly Institute for African Studies) has valuable data on Prof. Colson's works and these, of necessity, *must* be consulted, cited, and included in the bibliography. I also expected to see a bit more of Scuder's original works cited in the same vein.

Perhaps the main weakness of the draft is less its contents and more its structure. It is evident that various sections were contributed by different people and more effort is still required to synthesise and harmonise the various consultants' inputs in a manner that reduces overlaps, duplication, and inconsistencies. In my view, it is at this level that the Team leader needs to place higher premium as the team prepares the final report from an otherwise richly researched exercise. Considering the limited time I was asked to make my comments, I have concentrated more on the Report's structure although I am fully mindful of the importance of streamlining the large information generated in line with the TOR.

I shall confine my comments only to areas that need improvement. This should not be read to imply subtraction from the evident merits of the report for which the authors should be commended. My comments are confined to the *structure* and *content* of the various sections/chapters presented in the draft report.

2. Specific Comments

2.1. Structure of the Report

At the more general level, the report's layout could be improved if its chapters are divided into three parts, namely, Overview of Lake Kariba and the Project; Cost-Benefit Analysis; and Main Findings and Conclusions. Chapters may be grouped under these three Parts. Below is my proposal on how best I feel this could be done.

Part I: Overview of Lake Kariba and the Project:

This part may include the following information:

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- Brief contextual background of the two countries that are party to the Kariba Dam project (i.e. Zambia and Zimbabwe). In this background, the historical background to the two countries; the current economic importance of the dam to the countries; and any planned economic, technological/technical, and social initiatives around the dam and its people could be highlighted briefly in a manner that contextualises the analysis. The regional importance of the lake in Southern Africa could also be touched upon (e.g. the existing and potential exportation of electricity to regional countries). The SADC Energy Sector has valuable data/information on this.
- Overview of the WCD global initiative, in general, and this study, in particular (1.4 of the draft forms a good starting point here).
- The rationale of including Lake Kariba in the WCD world-wide study (1.1 provides some useful inputs to this).
- The Historical and current status of Lake Kariba Dam. This could include the following sub-sections of the draft: 1.2; 2.1; 2.2; 3.1; 3.2.6; 3.3.1; 3.3.2.
- Objectives of the Study (to include the unnumbered part immediately after the sub-heading “1. Introduction” but excluding 1.1 that comes after two and half pages.
- Analysis of the Decision-making Processes. This Chapter (that, in my view, should follow immediately after the one on contextual overview) should concentrate on two aspects of the TOR:
 - ◊ How were decisions made?
 - ◊ Did the project comply with the criteria and guidelines of the day?
 The Chapter should draw heavily on the information from the draft’s Chapter 5 and integrate that data with that from the 3.4.1.4.1; and 3.5.3.2.

Part II: Cost-Benefit Analysis

If my proposal is accepted, this part should cover the detailed analysis of the costs, benefits and impact derived from the construction of Kariba Dam. While Chapter/Section 3 provides very useful analysis of the real issues of concerns at this level, one gets the feeling that it is (a) wrongly titled and (b) not logically organised to give the reader a smoother flow of the various sub-categories of areas that are being and/or should be subjected to cost-benefit-impact analysis. Since I was not given the TOR for the study to enable me measure the presentations against the consultants’ mandate, I have depended on the outline of what the draft calls the “...*the foundations for the assessment of performance...*”, namely:

What were the projected versus actual benefits, costs and impacts?

What were the unexpected benefits, costs and impacts?

- What were the distribution of costs and benefits - and who gained and who lost?
- How were decisions made?
- Did the project comply with the criteria and guidelines of the day?
- What lessons can be learnt for today’s context?

Assuming that these are principally the Consultants’ main terms of reference, this part, which should capture much of the information from Chapter/Section 3, should focus on the costs of, and benefits derived from Kariba Dam on the following (presented and analysed as separate chapters):

1. Agriculture

Include under here the draft’s 3.5; 3.5.5; 3.5.6; 4.2.1

2. Resettlement patterns

Include under here the draft’s (Zambia): 3.4.1.1; 3.4.1.3.2; 3.4.2; 3.4.3; 3.4.4; 3.4.5; 3.4.1.4.2;

3.4.1.4.3; (Zimbabwe): 3.4.1.4; 3.4.3; (general):3.5.4; 3.5.3.2; 4.1.2; 4.5; 6.3.**3. Ecology**

Include under here the draft's 3.6; 3.7

4. Tourism and wildlife

Include under here the draft's 3.4.6.3; 3.10; 4.2.2; 4.4.1

5. Hydrology

Include under here the draft's 3.11; 6.2;

6. Fish and Fisheries

Include under here the draft's 3.4.6.4; 3.8; 3.9; 4.2.3;

7. Hydropower

Include under here the draft's 4.1.1;

8. Public health (including impact of water borne diseases)

Include under here the draft's 3.12;

9. Seismology**10. Broader impact (macro impact for Zambia and Zimbabwe individually and/or collectively).**

These could include the more cross-cutting economic and sociological and, quite importantly, environmental considerations that are not necessarily linked to any of the items (1) to (8) above. The section could include the current draft's 4.1.3; 4.1.4; 4.2.4; 4.3; 4.4.2; 6.4

For each one of the above components of the analysis, a look could be made of the costs, benefits and impact at the economic, social/sociological, and environmental levels. It would be noted from the above suggestion that separate sections on sociological and economic aspects are *not* being proposed since, save for the more macro and cross-cutting aspects, these two levels of analysis could better be handled under each one of the nine areas listed above. A decision also needs to be made regarding how best the analysis of respective data/information for the two countries could be handled. In the current draft, these are disjointed, resulting in interrupted flow of arguments and presentation. It might be more prudent for the final compiler of the report to use themes to cover data from both countries rather than present each country's data on the same theme separately.

Part III: Main Findings and Conclusions

This part could consist of only one chapter on the study's main findings and conclusions. This part is partially addressed by Chapter 7 in the current draft.

2.2. Content

- The study, in its introduction, should clearly specify the methodology used in data collection and analysis.
- The numbering of the sections and sub-sections should be carefully and logically sequenced. Whenever possible, excessive use of sub-titles should be avoided as this has weakened the current draft's flow of arguments since the report is crowded with sub-titles.
- 2.2 on the brief history of Kariba Dam contains too much detail of limited relevance to the present scope of the study. The section may be significantly reduced and integrated in the suggested section on country/project context.
- 2.3: Although the original objectives and components of the Kariba Dam project were exclusively power generation/supply as this section acknowledges, the other add-ons as stipulated in the mandate of the Kariba Development Co-ordination Committee (formed in 1957) ought to be briefly outlined and discussed at this stage (i.e. fisheries, tourism, wildlife management, industries, forestry, irrigation, and transport). Indeed, these additions give legitimacy to the

broader aim of this Study and must be captured and discussed in this chapter on ‘*Context and Scope of the Kariba Case Study*’.

- 2.4 can easily be merged with 2.3 since the discussion of these feasibility studies and reports are relevant as amplifications of 2.3.
- Chapter/Section 3 provides some detailed data whose direct relevance to the TOR is not clear:
 - The value of 3.1 (consisting of one sentence) is not evident. Table 3.1.1 too adds very little to the report.
 - The contents of 3.2.1 are not related to the section title.
 - The direct relevance of the contents of 3.2.2 and 3.2.3 is not clear and sources of the tables are not given. One gets the feeling that the TOR requirement to examine the ‘*costs*’ and benefits of Lake Kariba Dam project have been interpreted by the consultant(s) who prepared this section to mean ‘*monetary costs*’ of construction, hence, the detailed statistical presentation of figures related to construction costs. My interpretation is that ‘*costs*’ should be taken in broader context to mean disadvantages and negative results. If my interpretation is correct, then this section (up to 3.3.5.1) must be re-looked at and streamlined in the context of this meaning of ‘*cost*’ otherwise its relevance to the overall objectives of the study shall remain remote. The information also provides a lot of data whose source is not acknowledged. Moreover, much of the data is outdated even in sections that could have justified more current and less historical data (e.g. 3.3.3). Moreover, the sequencing of the sub-sections does not follow a predictable/logical order and there are too many sub-headings that weaken the flow of the consultant’s presentation.
- Section 3.4 on *Social Impacts* is better presented and captures an interesting background to the problems of the Gwembe Tonga, particularly with respect to their displacement /resettlement. Areas of improvement include (a) need to summarise some of the narration, albeit very interesting, regarding the historical background to what transpired; (b) bring in more information on what is currently happening in the areas on both sides of the lake. On the Zambian side, the World Bank-commissioned study by the Institute of Economic and Social Research (INESOR) gives quite useful information of the existing initiatives that the Zambian government, through its parastatal (ZESCO) and with World Bank funding, is doing to redress some of problems so ably presented in this section. The section, thus, needed to say much more than making reference to that study. For example, major initiatives are underway on the Zambian side in the field of infrastructure development, public health, agriculture development (including ‘*recession*’ farming), and the challenges of voluntary relocation that is an interesting noteworthy phenomenon on the Zambian side of the Dam (could be discussed as unanticipated impacts of the Dam).

It may be more interesting to merge the analysis of Zambia and Zimbabwe around thematic issues.

- The section on *Irrigation Development* makes interesting reading. The section could be improved by bringing in more recent data on irrigation on both sides of the Lake. It is also important to indicate the years the tables refer to - as well as the sources of the tables (which is a general weakness throughout the draft).
- The sections on the ecological impacts of Lake Kariba (3.6 and 3.7) are well laid out and make interesting reading. It would, nevertheless, benefit from updating and bringing in more current data sources. For example, there has been serious climatic impacts of recurrent droughts in the past decade and although the section makes reference to this, the reader would have liked to see more reference to how this has affected the Gwembe Valley people’s agriculture, including

livestock; and the actual direct impact of reduced water levels on power generation (the principal objective of the Dam Project).

- 3.8 also provides good, though brief, reading on fisheries. Section 3.8.6 on expected and unexpected impacts of Lake Kariba is too thin and needs to be expanded to include, for example, the entry of commercial fishing on the lake; the fish processing industry that has resulted from the activities on the lake and the challenges this has brought about; etc. No references made in the text to Table 3.8.3. The section on key issues with respect to fisheries at Kariba (3.8.1.1) is casually presented and contains little information. Its numbering also has no relationship to earlier sections.
- Section 3.9 on Impact of Lake Kariba on Wildlife is well presented. It could, nevertheless, minimise on historical account of what happened and bring out more current issues, particularly under 3.9.5 that cover issues of impact (expected and unexpected).
- The Tourism Impact of Kariba Dam (3.10) is well presented and, like 3.11 on hydrological impacts of the lake, brings out the more current realities in terms of statistics.
- 3.12 on Public Health, while providing useful historical data, is rather thin on the more current aspects of health conditions as they obtain presently in the Lake Kariba area. There are a number of recent studies on water borne diseases around the Lake that could have contributed to the generation of more current data. Moreover, much of the information is on the Zimbabwean side of the lake. A more balanced analysis would improve this section.
- Chapter/Section 4 seems to address issues that have already been addressed under other sections. It might make better reading if the contents of this chapter are integrated into the relevant sections of the report. The issues of who benefited and who lost could better be discussed in the context of the cost-benefit-impact analysis of the relevant sections/chapters of the report. As it is in the current draft, Chapter 4 seems to be ‘free standing’ in a rather unjustified manner.
- Chapter 5 on *Options Analysis and Decision-Making* seems to come rather too late in the Report since it provides the background to decisional issues surrounding the location, technological choices, finance, and relocation considerations. It is for this reason that I am proposing that this chapter could be put as one of the earlier chapters in the proposed Part I of the report (see above). When I looked at the contents of this chapter, it is evident that it is mainly background information and it would make sense to avoid putting it in the middle of the report.
- Chapter/Section 6 is informative save for the rather unnecessary (yet interesting) details under 6.1 regarding casualty rates during construction. Section 6.4 on environmental considerations is particularly insightful.
- Chapter/Section 7, while providing many useful conclusions, needs to go further than *lessons learnt*. In this chapter, a more focused analysis of project effectiveness should be made, drawing lessons from the existing current debate on aid impact and effectiveness in the context of sustainability considerations. Stakeholder involvement as an important consideration in project sustainability should come out clearly *vis-à-vis* the level of, for example, involvement of the Gwembe Valley people in the decisions that affected their lives from the time the Dam was constructed to the present day. The current debate on aid effectiveness and sustainability possesses useful insights that could provide ample ‘lessons learnt’ and recommendations.

Oliver S. Saasa (Prof.)

Lusaka, Monday 7 February 2000

B. Paying for Southern African Dams Socio-Economic-Environmental Financing Gaps. By Patrick Bond. Submission to Thematic Review: International Financing & Kariba Case Study

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FOR FULL REPORT -- SEE GENERAL WCD SUBMISSIONS

C. Comments by Reynold Duncan, World Bank

From Reynold Duncan, World Bank, AFTG1
03/29/2000 04:39 AM

To: Tor H. R. Ziegler
cc: Bthiam@Aol.Com, John Briscoe, Junhui Wu
Subject: Re: FW: World Bank - India and Kariba reports [Virus checked]
(Document link: Tor H. R. Ziegler)

Tor:

Sorry that I did not revert to you earlier on this. I have been on mission since you sent the report, but have managed to quickly read it during the flights and I hope it is not too late to comment. My comments are related mainly to the correctness of some of the information through my prior involvement in SAPP. As Jun works on Zambia and Zimbabwe, she may be in a better position to check out more of the information.

1. The report needs a great deal of editing to remove typos and repetitions, apparently due to the large number of individuals that have been involved in putting it together.
2. On page 2, the linear length of the lake (20,000 km for a surface area of 5,500 sq km) appears too long to me. Should it be 2,000 km?
3. On page 3, the Shire river does not flow through Tanzania but only Malawi and Mozambique. However, the source of the Shire, Lake Malawi, borders with Tanzania. In fact Tanzania claims ownership of part of the lake.
4. On page 25, the figure in the last column of the table should be: Projected/Actual and not Actual/Projected.
5. The statement from the ZESA Area Manager in Binga (page 51) regarding the provision of electricity to the rural population (i.e. "out of question") may not quite reflect ZESA or Government policy. I would suggest that the consultant seeks the views of ZESA management or Government.
6. In Sections 4.1 and 4.2, I feel that the benefits should include the provision of employment in other industries, throughout Northern and Southern Rhodesia, whose development was facilitated by the provision of adequate, reliable and lower cost power, and not only the industries mentioned. Furthermore, since this was a Federal project, how did the third member of the Federation, Nyasaland, benefit from it. There is no mention the report.
7. On page 155, I understand that the "price bonanza" is still being enjoyed by the copper mines in Zambia and other industries in Zimbabwe and this is destroying the power sectors of the two countries. Any comment on this?
8. On page 170, I do not think that Kariba pre-se was the force behind the establishment of SAPP. Just that with Kariba came one interconnection, between Zambia and Zimbabwe. There is much more than this behind the formation of SAPP. I would suggest that the consultant talks to a member of the Management committee of SAPP. Also, the operating members of SAPP include Namibia and Swaziland.

D. Comments from Donal O'Leary, Siemens

From: Donal.Oleary@notes.kwu.siemens.de

Sent: 22 March 2000 11:01 PM

Subject:WCD: ZAMBIA and ZIMBABWE - Kariba Dam Case Study, (Draft Final Report - February, 2000)

I would like to express my appreciation for the opportunity to review the above-captioned study as one of the inputs to the Industry Sector Workshop, which will convene in Cape Town during April 3 - 6, i.e. before the WCD Forum.

These comments are being made by me as a representative of Siemens AG to the Industry Sector Group. It bears noting that I was the Task Manager of the World Bank-financed ZAMBIA: Power Rehabilitation Project (which includes three Kariba-related components), which was appraised in July/August 1997. I moved to the Power Generation Group (KWU) of Siemens in October 1997 under the Siemens/World Bank Staff Exchange Program.

This note provides an introduction and summarises some of the report's, findings; provides overall, specific and detailed comments and suggests some next steps.

Introduction and Findings of the Report

The WCD selected the Kariba dam as one of 7 dams worldwide that would be studied to contribute to the current debate on the development effectiveness of large dams. The 1200 MW Kariba hydroelectric project (constructed during 1955-1959) straddles the Zambia-Zimbabwe border at Kariba Gorge on the Zambezi river about 300 kms downstream from Victoria Falls. It consists of a double curvature arch dam of 128 meters height and 617 meters crest length with 600 MW (Kariba Stage 1) capacity (operating at 705 MW. See below) on the right (Zimbabwe) bank of the river, which was commissioned over 1959-1962 and 600 MW (Kariba Stage 2) capacity on the left (Zambia) river bank, which was commissioned through 1976. Through the Zambezi River Authority (ZRA), the dam itself is jointly owned by the two countries, with power generation the responsibility of ZESCO and ZESA, the power utilities of Zambia and Zimbabwe respectively. With a storage capacity of 180 cubic kilometers, a length of about 280 kms and a maximum surface area of about 5577 square kilometers, Kariba was the largest man-made reservoir in the world, when it was commissioned.

During the period of dam construction (and for a considerable time thereafter), Northern Rhodesia (a British Protectorate- now Zambia) and Southern Rhodesia (a Settler Colony - now Zimbabwe) were very different in legal, political social and economic ways. These differences markedly affected how the social impacts of the project were handled and can still be noticed up to this day.

Some of the findings of the report included:

(a) Kariba Stage 1 was constructed under schedule and under budget. This was in spite of having to deal with the two largest floods (in 1957 and 1958) up to that time ever experienced at the Kariba Gorge site,

(b) Kariba Stage 2 suffered considerable cost overruns (the final cost was US\$ 147 million compared with the budgeted cost of US\$ 57.1 million). Using constant US\$, the cost overrun was approximately 12%. These were caused by the difficulties caused by the closed border between the two countries, the increases in OPEC oil prices from November 1973 onwards, the rapidly escalating prices for heavy machinery and the need to change the contractor. Commercial operation began 28 months after the originally scheduled date and 8 months after the revised date, with the change of contractor;

(c) Although no effort seems to have been made to calculate the project's internal rate of return (EIRR), the report paints a positive economic picture of the Kariba power project. Total operating capacity today is 1305 MW (of which 705 MW is at the South Bank Power Station) compared with the original projected output of 1200 MW. This is because each of the 100 MW units on the south bank achieves an output of 117.5 MW under operating conditions. The report mentions annual savings of up to BP 4 million using the full 1200 MW hydro capacity instead of coal. The World Bank estimated in its 1956 appraisal of the Kariba project that the following 'savings' would accrue in reduced investment in thermal power expansion by proceeding with Kariba: (a) BP 44 million in power station development; and (b) BP 40 million savings on rail expansion, of which BP 16 million would consist of rolling stock. The expansion costs of Hwange coal mine (estimated by the consultants at BP 17 million) were not included. Thus the total savings in thermal power expansion came to BP 101 million, which was the estimated cost of the 1200 MW Kariba project in 1956. The report also indicates that the average price of electricity dropped by 30% over the period 1961-1977, while the average price of other commodities and services rose by 75%;

(d) One of the important decisions that had to be taken was which of the two projects the Kafue hydroelectric project (of ultimate capacity of 900 MW in Zambia) or Kariba should be constructed first. The report hints that this decision may not have been made in the most transparent manner and that the mistrust engendered by these decisions lasted for many years (See (g) below),

(e) For Kariba, Stage 1, the project document and the World Bank appraisal report did not consider any environmental impacts of the dam;

(f) 57,000 members of the riverine Tonga people (34,000 in Zambia and 23,000 in Zimbabwe) were resettled by the project. It should be noted that while in Zambia a large portion of the population is Tonga (many of whom have played distinguished roles in the administrative and intellectual life of the country), in Zimbabwe the Tonga are a much smaller portion of the population. Treatment of the Tonga was skewed. In Northern Rhodesia, compensation would cover the 34,000 to be moved; resettlement costs; compensation to the individuals moved; tribal compensation in respect of hardship; inconvenience and loss of tribal lands and customary rights; loss of earnings while clearing new lands(and while building new huts; and loss of crops. In Southern Rhodesia, compensation covered the 23,000 people who were moved; food would be provided during the resettlement period, and adult males were exempted from the annual poll tax payment for two years. (report p.35). No compensation was paid to any of the Southern Rhodesia oustees. By the end of the project, nearly BP 4 million (i.e. about US\$ 11 million) had been spent on resettlement, although some observers put the actual amount much lower than that. The average expenditure was BP 134 per person moved in Northern Rhodesia and BP 59 per person moved in Southern Rhodesia (report, p.47). The general consensus was that the resettlement program was badly planned and grossly underfunded;

(g) Today, in Zimbabwe, only the Zambezi River Authority (ZRA) is interested in addressing the dam-induced grievances of the Tonga people (p.51). In Zambia, in addition to the ZRA, the Zambian Electricity Supply Corporation (ZESCO) is involved in a rehabilitation program for the formerly displaced communities (p.52)

(h) Land use policy along the Lake Kariba shoreline was also skewed and impacted the Tonga people. In Southern Rhodesia, the government decided to designate the whole southern lakeshore (up to 5 kms inland) either a protected national park or recreational park. This means that none of the displaced people could settle on the lakeshore and would need fishing permits to fish on Lake Kariba. In Northern Rhodesia, the government did not restrict the relocatees access to the lakeshore and the opportunity to exploit the water and fish resources of the lake (p.60);

(i) The institutional arrangements for preparing, implementing and managing this binational project are set out in pps 155/156 of the report. Two points may be made here. First, the Central African

Power Corporation (CAPC) was instituted in 1963, reporting to the Higher Authority for Power (consisting of two ministers each from Zambia and Zimbabwe). The CAPC took over the management of the Kariba dam and its generation and transmission facilities in 1963. In addition, the CAPC's general function was to supply electricity to (distribution) undertakings within Zambia and Zimbabwe; develop further the Kariba scheme; establish such additional undertakings for the bulk supply of electricity as the Higher Authority may direct; generate or acquire electricity, and determine the prices at which electricity was supplied to the distributing undertakings in the two countries. Partly as a result of the way decisions in the power sector had been made in the two countries over the years, Zambia and Zimbabwe formed the ZRA in 1997, replacing the CAPC. The functions of the ZRA include: (a) operate, monitor and maintain the Kariba complex, consisting of Kariba dam and reservoir, telemetering stations relating to the Kariba Dam and other installations owned by the Authority at Kariba; (b) collect, accumulate and process hydrological information and environmental data of the Zambezi river for the better performance of its functions; (c) subject to the approval of the Council of Ministers, operate and maintain any other dams on the Zambezi river (between Victoria Falls and the Zambian/Mozambican border; (d) make recommendations to the Council of Ministers to ensure the effective and efficient use of waters and other resources of the Zambezi river, and (e) liaise with the national electricity undertaking (ZESA and ZESCO) in the performance of its functions under the agreement. The ZRA reports to the Council of Ministers, consisting of two Ministers each from Zambia and Zimbabwe, who are responsible for energy and water respectively, as well as finance. The ZRA has power to charge fees for water used by ZESA and ZESCO, While the ZRA mandate is very well aligned with modern thinking on water resources management, it is a weaker organisation financially than CAPC because it has no responsibility for electricity generation and transmission, which has been taken over by ZESA and ZESCO respectively; and

(j) Chapter 7 sets out the "Views on Development Effectiveness and Lessons Learnt" Out of the twelve points made: 1 deals with the EIA process; 1 discusses the impact of law on assuring equitable treatment for people ousted by projects; 5 deal with resettlement (planning, consultation, compensation, familiarisation of relocatees with the agro-ecology of the new area of settlement, redress of past grievances); 1 deals with appropriate institutional structures to mitigate potential negative project impacts after implementation, 1 deals with dam safety, and 3 deal with power related issues(cost of hydroelectricity, its macroeconomic impacts and the projects role in the SAPP). In terms of this report, I think the balance is about right. I would suggest two additional points could be made: (a) the need for harmony in approaches for dealing with environmental and social issues in binational projects, and (b) decision- making between run-of-river projects (as Kafue originally was) and storage projects (Kariba)

Overall Comments

I believe that the report has done a particularly good job on setting out the negative impacts of resettlement of the Tonga people, carried out simultaneously in two countries - Northern Rhodesia (now Zambia) and Southern Rhodesia (now Zimbabwe) - with quite distinctive political systems. The report documents very clearly the lack of a harmonized approach to resettlement in both these countries, which persists even to today. In addition the sections on hydrology, and the last four chapters (Distributional Impacts of the Kariba Dam Project, Options Analysis and Decision-making; Criteria and guidelines: Policy Evolution and 'Compliance, and Views on Development Effectiveness and Lesson Learnt) were of themselves quite interesting.

However, while providing a lot of useful information, the report needs more work to enable an integrated picture of the Kariba project to emerge. It is not an easy report to read, even for somebody who is quite familiar with the project. In addition, extensive basic editing (to catch typos) as well as reducing repetition is needed. Perhaps, it would be most fruitful to concentrate on developing a good Executive Summary.

Specific Comments

Specific comments relate to the project economic analysis; the role of the ZAMBIA: Power Rehabilitation Project; and harmonisation of approaches to EIA and resettlement issues in binational projects.

Although the report provides a lot of information on the project's power economics, I believe further work needs to be done to tell the story more clearly and comprehensively;

(a) The approach taken today in a command and control economy to justify a large power generation project consists of three major steps: (I) the development of a load forecast typically of between 15-20 years duration; (II) demonstration that the project is part of the least cost generation expansion plan for the power sector. Generally, the robustness of the project (as part of the LCGEP) under different scenarios of load growth, cost, and commissioning date is shown; and (iii) evaluation of the EIRR power sector investment program (of which the present project is a part) typically now with risk analysis (and previously with sensitivity analysis),

(b) While back in the mid-50s, this approach had not been explicitly documented, the elements were there and need to be brought out more explicitly in the report. First, a write-up is needed on the demand forecast (see report, p.152) setting it out in numerical terms as well as the assumptions used in its preparation. Second, Chapter 5 (Options Analysis and Decision-Making) could be the basis for writing up the section on LCGEP analysis provided that the text would provide the numerical basis for the analysis. An important question that needs to be discussed is if we assigned 'reasonable' mitigation costs to addressing the environmental and resettlement costs at Kafue (small) and Kariba (larger), would it have had any influence on which project to develop first?

Finally we need to calculate the EIRR for the investment program and failing that for the project. THEN, we need to go back with the hindsight we have today and comment on the actual load growth, the actual costs (which we also have for Kafue) and recalculate the EIRR,

(c) According to the report (p.23), the Copper Companies (presumably in the then Northern Rhodesia) provided UK L 20 million for the project, which was the second highest source of funding after IBRD. If I remember correctly, the rate of exchange at that time was US\$ 2.8 = UK L 1.00 and assuming we multiply the resulting amount (US\$ 56 million) by 10 to convert it from 1995 into 2000 terms, we are talking about a commitment by the Copper Companies to the project of perhaps US\$ 500 million or more. This was an enormous commitment by the private sector; I know of no hydroelectric project today, where a developer would put in such a large amount of money. The questions arise: Was this project a good deal for the Copper Companies? What arrangements were made to repay the loan? Did they enjoy a special tariff and for how long? Who was interviewed in ZCCM to find out their views on the project; and

(d) The World Bank was involved in three separate appraisals of the Kariba Project (1956, 1970 and 1997). This gives a good opportunity to review the evolution of its methodology for project appraisal in its economic (including risk analysis), environmental, financial, institutional, socio-economic and technical (including safety) aspects. The 1997 appraisal inter alia involved one of the WCD Commissioners (Dr. Ted Scudder);

Since it has three components related to the Kariba project, I believe that the report could discuss in more detail than the four paragraphs on p.52 the ZAMBIA: Power Rehabilitation Project. As set out in the November 24 version of the Electricity Supply and Management Options Paper (p. 3-34), the scope of the Kariba component of this project includes:

- rehabilitation of some of the physical structures downstream of the Kariba dam; and technical assistance for the supervision of this work as well as the
- preparation of an energy preparedness plan;
- rehabilitation of the Kariba North Bank civil structures, refurbishment of the electromechanical equipment and technical assistance for supervising the implementation of the project; and
- a component aimed at addressing some of the unresolved social problems that affected the descendants of the original oustees (in Zambia), when the dam was commissioned in 1959. This component includes subcomponents in road construction; water resources development; improvement in land use; health; and RE.

In addition to undertaking the study "Development Strategies and Rehabilitation Programmes for the Peoples Affected by the construction of the Kariba Dam" Coyne et Bellier, one of the WCD industry supporters, produced two reports in conjunction with the Power Rehabilitation Project: "Kariba Dam Safety Assessment Study - Summarised Report " (July 1997) and " Kariba Dam Safety Assessment Study - Flood Hydrology Appraisal". Two further studies identified the rehabilitation needs of the Kariba North Power Station (including rehabilitation of the civil and electromechanical components and upgrading of the plant's safety features) as well as strengthening ZESCO's Environmental and Social Affairs Unit. All these studies have been listed in the PAD (Annex 8).

The report rightly highlights the need for carrying out a systematic EIA and a comprehensive resettlement action plan (p. v) as well as situates Kariba at the heart of the Southern African Power Pool (SAPP-p.167). Given the efforts that the SAPP is taking towards a harmonised approach towards EIA preparation for transmission and hydroelectric projects, the reports recommendations could be strengthened by emphasising the need for a harmonised approach to EIA and RAP preparation/implementation.

Detailed Comments

(a) p iii. it would be appropriate to add to the list of documents (to be reviewed) and in the bibliography the following World Bank report: ZAMBIA: Power Rehabilitation Project, Washington D.C. January 14,1998 as well as the other reports listed above under Specific Comments ;

(b) p14. Consideration should be given to adding data on the ZAMBIA: Power Rehabilitation Project to Table 1;

(c) p.20. Section 3.2.4. Add one sentence explaining where the additional funding for the cost overrun came from;

(d) p.28. Section 3.3.3.; par. 5. Instead of transporting coal by train, was there any consideration to using minemouth power plants and then transmitting the power to the load centers. This happened later with the Hwange (Wankie) power plant;

(e) p.28. Table 11. For the general reader, it would be more useful to quote these data in US c/kWh using the exchange rates prevailing at the time. It would also be useful to have a table at the beginning of the report with the exchange rates for Zambian and Zimbabwean currencies in relation to the US dollar over the period 1955 -2000;

(f) p.35, par. 4 is nearly identical to p.36, par. 2;

- (g) p.35, par. 5 has a lot of common text with p. 36, par. 4;
- (h) p.39, par 5 has a lot of overlap with p. 41 par 1;
- (i) p.51. The report says that 'Currently, people have to travel long distances from Binga to Kariba on private transport and this costs \$280 return'. I assume that we are talking about Zimbabwe dollars?
- (j) p.58. Figure 4. I am sure it is being put in.
- (k)p.61. Figure 5. This map needs to be upgraded.
- l) Appendix 3.3.1 (Kariba`s Hydropower Performance up to 1996) is not totally clear. Surely it is now possible to get output and expenditures information for both the North and South Bank Stations as well as for the Dam Wall through 1999. Under Income, we have two columns: (a) South and North Power Stations, and (b) no heading. What income are we measuring (is it tariff based?)? What does (b) mean? Why is there no information on the O&M expenditures for the North Bank P/Stn.?
- (m) It would be appropriate to document the List of People consulted in the preparation of this report. It would also be useful to have a glossary of terms for the more general reader (e.g. catch per unit effort - CPUE))

Note: Table of Contents does not refer to Appendix 3.3.1.

Next Steps

- (a) I would suggest that the Executive Summary be extended and rewritten to reflect more closely the work documented in the Main Report as well
- (b) If it has not already been done, I would suggest that this report be sent to Coyne et Bellier (the company responsible for designing and advising the ZRA on the dam safety aspects) for comment.

Please feel free to contact me if you have any questions.

Best Regards

Donal

E. Comments by Steve Rothert, IRN

Date: February 1, 2000

General Comments

1. The draft Kariba Dam Case Study (Study) shows a marked improvement in quality over the scoping document.
2. The social impacts and distributional issues sections are much stronger than in scoping document.
3. Several of the questions identified in the scoping phase in the tourism, ecological and hydrological impacts sections were not addressed.
4. Many of the “Conclusions and Findings” at the end of sections do not reflect the specific information provided in those sections. They read more like lessons learned.
5. The issue of Southern Rhodesia defaulting on portions of the project financing is not addressed. See submission from Patrick Bond which provides details.
6. The reader assumes the many typographical and grammatical errors will be corrected.

Specific Comments

1. Page iv, 4th bullet, “...this study found that the 57,000 people who were displaced were resettled in a manner that attracted a substantial amount of criticism.” This is a very weak characterization compared to text of study. This bullet should describe the resettlement process as the categorical failure and abuse of human rights that the document illustrates.
2. Same page, next bullet “the potential of such a large water body on the incidence of water borne diseases was not recognised...” I believe this is missing a verb after potential, such as “to greatly increase”.
3. Same page, “Distribution of Impacts”, should indicate that the main beneficiaries of the project were the copper mines primarily, and the national economy secondarily. The text of the Study says the main expressed purpose of the dam was to supply power to the copper mines – this section should acknowledge that.
4. Page v, “Lessons Learnt”, 6th bullet, a key part of this lesson should be that one of the first order goals in resettling should be to find land of equivalent quality and character. The goal of ensuring relocatees are given the skills and resources to adapt to new conditions should apply only if the goal of equivalency is unachievable.
5. Same page, final bullet, the Case Study shows only that project authorities have begun to consider these mechanisms in this case, but as the study says later, it is not clear yet whether these initiatives will succeed in redressing grievances. The Study must be careful not to cheer too enthusiastically for unproven efforts that could be considered the bare minimum of human decency.
6. Page vi, bullet two, Kariba only shows that *in this case* large hydro has provided relatively cheap power. One cannot extrapolate this into a general rule given the numerous examples detailed in other WCD documents where large hydro has not. This bullet should say “large hydro has the *potential* to provide cheap power”, or “Kariba has provided relatively cheap power.” But one still has to wonder whether how the incalculable losses borne by the Tonga factors into this conclusion.
7. Same page, next bullet. The study shows a correlation between the project and economic growth, not causation as is implied by this bullet. Unless the study can show causation, this should say there is a correlation.
8. Page 2, j), is the shoreline really 20,000 kilometers in length? The area is only 5500 km².
9. Page 10, beginning Section 2.3, Study says the project was in response to a “broad regional decision to move from thermal to hydropower.” Based on the history discussion, it sounds more like it was a decision of the federation of Northern and Southern Rhodesia, not necessarily the region.

10. Page 25, Table 8, the Overrun/Underrun percentages seem to be backwards, or counter-intuitive.
11. Page 26, Section 3.3. Table 9 shows that actual capacity and generation were below projected for late 60s and early 70s, but it is not mentioned in text anywhere. And what about after 1971?
12. Page 30, “Downstream Areas”, first para, I think you mean to say “the UNinhabitable environment....”
13. Page 32, discussion of peoples’ reflections on the past being more “nostalgia than reality” is not really backed up by evidence. The document should not discount or discard testimony without refuting evidence.
14. Page 33, last para before Section 3.4.3 says that the Tonga enjoyed the freedom of isolation before resettlement. This is a little off the point. What they enjoyed, rather, was their farms and gardens, fishing, water, social network, *I.e.*, their standard of living and lifestyle.
15. Page 35, “a. Planning process” section, first para says “The valley Tonga thus were simply not enthusiastic about abandoning their land and homes.” This is an understatement. It should be stated clearly that the Valley Tonga did not want to move at all, in fact resisted it.
16. Page 36, para 3, “they were contemptuous”, might want to read “they were incredulous.”
17. The resettlement section in general is very detailed and very good.
18. Page 40, last full para, last sentence says, “To a large degree, therefore, compensation contribution to the betterment of some individuals in the Gwembe Valley and to the general development of the area in the long run.” The fact that some men were able to buy two cows, or a boat, or a bicycle, does not rise to long-term general development, nor does it warrant saying “To a large degree..”
19. Good discussion of loss of agricultural/food security.
20. Page 43, “Conclusions and key findings”, third item should explicitly reflect the preceding text by saying the vast majority resettles experienced declining living standards, health, economics etc.
21. Page 49, the section “Development and resettlement process in Zimbabwe” is missing conclusions and findings section like the one for Zambian section.
22. Page 50, section 3.4.6, second to last sentence should read “..had LIMITED opportunity for employment, but were paid low wages or in salt” to more accurately reflect preceding text.
23. Page 53, fourth full para, “What counts ...is not so much the size of the fund, but the recognition...” While the recognition of suffering and gesture are important, the size of the fund IS important! People cannot climb out of poverty through gestures of goodwill.
24. Page 72, 5th bullet, the last sentence should read “... no way of telling *whether* or when that would have occurred” to reflect the fact that it was only a possibility as is stated in the previous sentence.
25. In general, the Ecological Impacts section seems more focused on various impacts *to* or *on* the Kariba dam or reservoir, as opposed to the ecological effects *resulting from* the dam – which is the intended purpose. There is clearly more research that has been done on the reservoir than on downstream stretches, but this huge shortcoming needs to be addressed more clearly, and less needs to be said about the vegetation, phytoplankton and zooplankton dynamics over time in the reservoir.
26. In general, the division impacts within section 3.2 needs some clarification, perhaps definitions of the various subsections to clarify what would or would not be addressed in each subsection.
27. Page 83, Ecological impacts of tourism section doesn’t tell the reader much. What about waste disposal from tourists, or oil/petrol from tourist boats getting in the water etc.
28. Page 80, “c) Upstream terrestrial” section, the issues of whether Harare residents burning wood or greenhouse gas emissions are not relevant to upstream terrestrial ecology.
29. Page 84, Downstream Impacts, doesn’t adequately address this important topic. What about effects on water quality, temperature, sediment/nutrient load, lifecycles or natural history of fish and other organisms, desiccation of floodplains, area of standing water, habitat loss?
30. Page 86, Conclusions are so general and non-valued that they do not tell the reader anything helpful. This should summaries the specific ecological impacts of this dam.
31. Page 89, the tectonic set up and anecdotal observations more suggest than prove the area was active before.
32. Section 3.8, Impacts of Lake Kariba doesn’t adequately address the following scoping issues:

- How has fishing benefited traditional fishermen and local communities?
 - Assess the overall contribution of large scale fishing to the economy.
 - How many jobs have been and who benefits?
 - Is kapenta affordable to its target market?
 - Can mechanisms to help fish migrations be applied?
 - What are the main impacts on downstream fish species and yields?
 - What has been the impact of silt free discharges on downstream fish?
33. Page 95, the 3000 tonnes from Zambia and Zimbabwe, is this total annual yields?
 34. Page 96, impact on downstream fisheries, only two fish are mentioned. What about the loss fish spawning/rearing grounds in floodplains? The loss of nutrients in sediment to fuel food chain? What are the implications of no longer having swampy conditions at Mana Pools? Are there other once-swampy areas that have also dried up? What about fish lifecycles and flood/dry season triggers etc? What fish occupy downstream, what is known about habitat needs, what do aerial photos or other information say about how the habitat has changed, what about fisheries in the delta and ocean?
 35. Page 99, the conclusion states that fisheries industries is one industry in which local people can participate, yet the preceding text suggests the local people have had a difficult time participating in the commercial fishery.
 36. Page 108, Tourism Impacts, does not address the distribution of tourism benefits adequately, as requested in scoping.
 37. Page 115, Hydrological Impacts does not address the scoping question, Is it possible to change the operating regime to minimize effects downstream?
 38. The hydrology section also does not address the volume of water evaporated each year from the reservoir. At an estimated 1.4 meters over the greater than 5000 km² surface area, it must be more than 5 billion cubic meters. This needs to be discussed.
 39. Page 120, discussion of drought impact mentions that the most severe drought occurred in the 1995/96 season, yet the conclusions are drawn from a study completed in 1993. This means we don't have a full picture of the impact of droughts. Moreover, the occurrence of the worst drought over the 100 year hydrological record will surely redefine the possible variation in flows, which would impact on longterm outlook and expectations of generation capacity.
 40. Page 122, Downstream impacts mentions that the minimum flow requirement of 283m³/s was always met, but is that flow level adequate for healthy river functions?
 41. Same section, the dry and wet season flows mentioned should specify if mean monthly flows or daily or whatever.
 42. Page 123, same section. Unless the river channel has been stabilized by reaching bedrock or loss of any gradient, one can expect the river to continue to scour the channel as long as sediment free water is released.
 43. Page 126, key findings and conclusions are not specific nor related to preceding data and analysis. The section reads more like general lessons learned, not findings.
 44. Table 44, page 138, does not list ecological or health impacts. Box on growth of mining should state degree/% of growth instead of "flourished".
 45. Page 143, Table 45. It is not clear from text that affected communities were positively affected by 1) gill net fishery, 2) recreational and tourism opportunities or 3) employment opportunities – salt for clearing trees? Also affected communities were negatively impacted in terms of domestic water supply – they lost access to the river. Also, doesn't seem appropriate to say they were impacted positively by compensation payments – the payments were grossly inadequate or non-existent in case of Zimbabwe. All of these "+" should be changed to "-" in the table.
 46. Page 144, Who lost, first sentence sounds like it is the fault of the resettleses for not adjusting to new conditions and developing. This should be changed to reflect the fact that they were not given the means nor opportunity to adjust or develop.

47. Page 156, last sentence reads “the resettlement programme was not innovative in nature...” This is a huge understatement. It was totally inadequate and inhumane, and there was not even a real commitment to “duplicating life before”. This sentence needs to change.
48. Page 169, 7.8, the lesson should be that the first goal should be similarity of areas, not familiarity with agro-ecology.
49. Same page, 7.10, should read that either that Kariba produced cheap power, or more generally that large hydro has the potential to. Not all large hydro produces cheap power!
50. Page 170, 7.11, the study showed that there is a correlation between Kariba power and growth, but it did not demonstrate that Kariba directly caused the growth.

F. Comments from Steve Rothert, IRN

Date: February 29, 2000-09-05

From: Steve Rothert [stever@info.bw]

Sent: 29 February 2000 06:27 PM

Subject: more comments on kariba paper/process

Just a couple more/reiterated comments on the study. Thanks for getting all the headmen to the meeting. Even though we did not manage to hold the original meeting as planned, I believe they were able to contribute/participate quite fine. This is largely due to the fact that the social impacts section is strong and clear in its findings.

Regards,

Steve

Further Comments on Kariba Dam Case Study

These comments are to reiterate verbal comments provided at the stakeholder meeting in Siavonga and certain written ones provided in previous comment paper.

The stakeholder meeting itself was a great improvement over the first meeting in that affected community representation and participation was much greater.

The draft Case Study represents an enormous amount of work and a great start.

The economic aspects of the project need further attention. While the study sufficiently compares the cost of hydro vs. coal, no discussion of the economic impacts is provided and yet the study leaps to the conclusion that the project facilitated rapid economic growth. This may well be true, but the study does not demonstrate that causation or at a minimum illustrate the correlation.

In a related point, the key beneficiaries of the project were of course the mines. This issue is neither addressed clearly nor analysed in relation to the "facilitating economic growth" argument.

Similarly, what were the implications of the collapse of the copper market in relation to economic growth and project benefits?

These are central questions to the study given that power production is the only regionally significant (i.e., Zimbabwe and Zambia) benefit of project.

Zimbabwe/Rhodesia's unilateral declaration of independence and subsequent defaulting on project loans needs to be addressed.

Downstream impacts need to be better addressed. For example, the number of and impacts on the people living downstream, including all the way to the Zambezi delta needs to be discussed. Even though Cabora Bassa clouds the issue of downstream affects, one can argue that impacts of Kariba were felt for the many years before Cabora Bassa was built, and also that project authorities would hardly have considered changing operation of Kariba to mitigate downstream impacts if Cabora Bassa were not there. The fact that other projects exist in the basin cannot deny the fact that Kariba was the first and remains the largest among them.

If the authors are looking for ways to shorten the text, the social impacts chapter could be reviewed for redundancy and excess without diminishing this important section.

The lesson that hydro provides cheap power compared to thermal alternatives is refuted by the WCD paper "Electricity Supply and Demand Management Options", which shows that only the very cheapest hydro options can compete with gas fired plants. Thus, this lesson should be dropped or changed to say that Kariba provided hydroelectricity that is cheaper than the coal alternative considered in project planning. If this lesson is to be broadened beyond this, the study must support it.

G. Comments by Norman Reynolds. Review draft final report Kariba Dam

Date: February 3rd. 2000

General

Writing the cover report of as complex a subject as this is difficult:-

- The WCD outline helps in shaping the document and yet it is so easy to become both mechanistic and repetitious if it is followed exactly like that ludicrous distribution section covering sections 4,5 and 6. Cut it drastically.
- The Scoping paper lays out another though less rigid set of questions to be answered which, if caught within a rigid application of the outline, makes the paper more bitty and more repetitive.
- The report *has to be written*. It cannot just be a précis of each sector report – why then bother to read those reports? And it must not be sets of sector paper materials dumped onto the page. Much of the report appears to be just this; bits of sector papers that fit headings but there is no sign of an author, of a story teller who takes the reader through the issues. Large passages of detail can be cut and reference made to the appendices.
- There is too much detail for a main text which makes it indigestible and not enough argument or speculation to keep the reader interested. The reader needs help, perhaps a commentator who takes him by the hand and walks him through all the exhibits and evidence and refers to the “technical” appendices. Some tables have headings and formulae that I cannot understand.
- It has to be written as an intellectual overview, pulling out the salient points, debating with itself and its reader as what really happened and why and to what effect. It is really an essay, painting in the parts of the big picture, looking for connections and reactions, encouraging the reader to look at the appendices to learn more, laying out the history, like a road map with its twists and turns, giving colour and life to what with Kariba is big story full of all the ingredients that make up big novels, even a detective story that has to be read to the last line to find out by whom and why the crime was committed.

The draft is too long. They always are! Above I have talked about style. If the text is cut dramatically to say 80 pages, about half, then that discipline would help to sort it out. Do not try and shorten it. Use surgery, it gives the person doing the task a quick sense of achievement, and add references to appendices in footnotes. Use summary tables rather than all or nothing of tables.

Names

The Scoping paper used current country names with a preface to explain that procedure and to give the past names, e.g. southern Rhodesia. There is also a need for a little historical table up front as the history is mostly the story. Copy that.

History

The Kariba story requires a good clear history at the very beginning of the report. (I thought that I had written that piece for Alois to use!) I have struggled to re-write the first sections of this draft which are poor and muddled and sometimes have the opposite, like under instead of overestimate etc.. Perhaps that was wrong as the reader needs more than that; he needs to be drawn into the story from the start). The Introduction is treated like an awful executive summary that tells you what you will read nor what you will read says!

There is a strange wilfulness to ignore the timetable of decision making. Yet, the excitement in the story is the build up of the need for this gigantic engineering feat to be decided upon and completed under a very tight timetable since the other option, more thermal, was rejected. Hydropower it was to be, but which project and under what conditions and to whose glory? It has to be a literary piece.

Problems in the document abound and are highly repetitive. For instance:-

- The authorities are proven guilty re resettlement several times because they underestimated the number of people to be moved. Not true. They might be guilty on other grounds but not this one. Do not demean the important arguments and state those clearly and boldly and only once or twice. The first estimate was low but was a best guess from field staff in that remote valley, no more. Once Kariba planning was underway, a survey was commissioned and conducted in the mid-1950's (it is quoted, ref. Tim Matthews, so the contradiction is there for the reader to see).
- We know little about the way the resettlement cost was reached except that it was the responsibility of the territorial governments. There are many incorrect, repetitive and polemical passages about the World Bank and the Power authorities ignoring resettlement and environment. Near the end of the long document, 9.1, the important KLCC is mentioned. It is so central to the whole story that it must come at the beginning since it illustrates the structures of the day and it achieved much before its demise with the federation. My piece, after several days of archival research, shows that the KLCC proposed and won support from the three governments for the most far reaching inclusion of those resettled in the new opportunities created by the dam. That report shows how the Company to be formed, not mentioned anywhere, went beyond anything done recently, some forty to fifty years later, to protect and advance the participation of those resettled in the advantages of the dam. It reports the futility of the legal agreements related to the large Lesotho highlands and the Swaziland Maguga projects.
- There are interesting and circular themes that are ignored that have to be extracted and written:-
 1. The governance of Kariba; the early concern for the Zambezi as an international waterway with excellent provisions for a river Authority now returning through the ZRA and SADC / SAPP after the fissure of UDI etc and the inability of Zam and Zim to behave themselves through the 1980s.
 2. The KLCC's development Company's aims re those relocated and the WCD meeting of affected people's own proposals which are amazingly close. How else can we judge the costs of political and civil breakdown. The report is almost ahistorical
- The dam was seen from the beginning of formal design by the Power Board as a viable hydro-scheme. That was what it was all about. The economy, as stated in the results, required more and cheaper electricity to allow it to keep growing. The issue was what was the best route?
- The main partner, the World Bank, in the mid 1950's was operationally still The International Bank for Reconstruction and Development as set up to rebuild Europe after the war. Paris, where Lord Malvern met the senior staff and the President, was its main field office! I do not think that the International Development Agency, the IDA, was yet set up to give grants and low 1% loans to poor countries. The IBRD was about capital through loans. India's First Economic Development Plan had just been published. It was very influential. It imbibed its thrust from Russia – massive state investment in heavy industry, like steel and electricity as the basis of rapid growth. The Indians, the newly independent and democratic idols of the west, would have loved Kariba! Today, the world has, rightly, abandoned them over the Narmada but that is a dam the misuses rich land and ignores very large numbers of tribals. It is not Kariba though today Kariba would have to accommodate those concerns more adequately. Comparison helps. It can illuminate. These WCD documents are very boring by being so straight-jacketed. The introduction is the place to win the reader.
- It was an era driven by the belief in capital investment and growth; in the stages of development. It was bold and brash but hard working and dedicated to improvement and modernisation after the horrors of the war and of several famines etc as reported in the Scoping paper! It had its economic god, its rationale. The talk was of capital to realise investment opportunities in economic infrastructure that would secure economic growth in the primary and secondary sectors. In the mid to late 1950s Zimbabwe was almost a “modern” country in that it had a percentage of adults more people in formal employment than ever before or since. Development was about people being drawn into the formal economy; leaving the bush for a modern life. Hence the belief by the Provincial Commissioner that resettlement could open the door for the Batonga to

“modernise”. That statement, in context (which has to be given to the reader) is not to be ridiculed. It is to be understood.

- Kariba was supported by a conviction, economic growth. Growth solved everything. With Kariba that was based upon high copper prices and a broadening industry and the new found tobacco of Zimbabwe. These two were linked by the Federation, itself a symbol of modernism, of the economies of scale of a united region that would bring the formal economy to all in a remote and poorly developed region.
- Within no time of building Kariba, two of its pillars collapsed - copper prices and the Federation. The settler and his tobacco remained. Zambia never recovered her promise at Independence as a land of milk and honey.
- Lord Malvern’s deceit, using Sir Arthur Benson’s idea to blackmail the copper companies into lending their piles of cash to finance the extra costs of the final report on a higher wall etc. is fascinating and important. It rivals the race for capital from Europe to control the diamond field at Kimberly of Barney Barnato (sp?) and Rhodes. That act did more to destroy the federation than anything else as it “filched” its copper monies and left Zambia with little prospect of finding abundant capital for its rural development programme.
- It is a nonsense to talk of Kariba as driven by settler interests. The Federation, yes, the settlers valued that larger market as they were producers. Zambia was, and still is, largely a consumer. Kariba had the settlers worried as the loans were very large; Zambia had Britain to guarantee them if things went wrong, the settler colony was far more exposed. Hence the determination of Lord Malvern to tap the copper companies. He could not raise a penny for Kariba in Zimbabwe.
- This raises the importance of the manner in which large dams are financed, particularly how domestic capital is raised. Sir Arthur had good ideas but they were aimed at the settler and so ignored in that emotional atmosphere.
- Lord Malvern as Sir Godfrey Huggins, then PM of Zimbabwe, did first back Kafue till persuaded by diligent consultants that Kariba first was the way to go. His story is that of many who lead change, here the move to hydropower and regional power markets. They often have to carry and resolve enormous resource issues alone – everyone else stands back. Development is frequently about one man left alone to fight for an idea. Why not tell it?
- The fact that the project only paid for resettlement cannot be treated as proof that it ignored it. That cost was part of the financing calculations to compensate the relevant authorities. This is repeated ad nauseam and is incorrect.
- I think that the report must weigh up the evidence in one place, up front, and say that without the KLCC company being put into effect, there was no vehicle to enable valley residents to participate in the new activities opened up by the dam. That the aims of the company for locals was not transposed to another programme or agency in either country until now must be explained: by the difference in confidence of mission and of resource access of the mid-1950’s compared to the post copper boom, post UDI world of the 1960s and 1970s and the partly wasted 1980s? And that the civil servants who drove the KLCC were very effective and disciplined and had an ability, a sense of doing “good”, that allowed them to be imaginative and magnanimous, something neither country has demonstrated since re the valley residents. This is another circular theme: the political failure that wasted time and cost, here those resettled.
- The manner in which Kariba was held intact through the collapse of Federation and during UDI does not appear. That story is in the sectoral reports.
- I cannot see any input from the lawyer(s).
- The issue of the natives and the land. I do not accept what is written, they had no rights. In both countries tribal land came under some Trusteeship of the Governors in both countries or of the state. And there was interest in British and responsibility. Was that not appealed to.

- I think that the setting aside of the zim shoreline fro parks and tourism has paid off over time. If the KLCC Company had existed and had brought residents into ownership that move, keeping the land use options open, would today be deemed a success. In Zam there would follow moves to consolidate villages, improve them as tourist destinations and separate out wildlife as a joint economy.

The sections re finance and operational costs and benefits rely too much on complex working tables. Stick those in the appendix, summarise the key results and write it up so that it is easy to find and clear from the start as to what it is saying. Was Kariba successful or not and how is it to be judged?

H. Comments by Prof. C.H.D. Magadza: Review of the Kariba Dam case Study Report

General

The report is very comprehensive with a lot of detail. It is well balanced in its presentation if not sometimes somewhat conservative in its interpretation of some of the historical events.

Thematic areas for further development.

There are however some thematic areas that may need some thought.

Time dimensions

The lesson from Kariba is that reservoirs, especially large reservoirs, offer new opportunities for various sectors of society. The profile of these opportunities evolves with time and create synergies and conflicts in the development of activities associated with the reservoir. Thus in the initial planning of a reservoirs and forecasting of the impacts it is necessary to have time dimension that go beyond immediate project cycle dimensions. If we consider the Tonga people one can trace the following

Displacement

Displacement trauma

Undernutrition

Economic marginalisation

Breakdown of societal mores

Invasion of valley by other ethnic groups

Kapenta

Social diseases

Tourism

Economic discounting of value of hydropower

Dams have fixed maximum power delivery capacity. At the time of their design their contribution to the energy budget would have been deemed substantial, but as the economy grows and more power is needed the proportional contribution of the dam must diminish, while the ecological cost, initially triggered by the dam construction, but later amplified by the synergy of new activities attracted by the reservoir, will escalate. Furthermore, where dams are built for a target market the relationship between supplier and consumer needs careful architecture otherwise the consumer can hold the supplier to ransom. In the economic analysis of Kariba it would be instructive to compare the value of goods and services generated by ancillary activities with the value of the hydropower, and discount these against the ecological cost.

The compensation framework.

When land is expropriated from tenured landowner, the compensation normally enables reinvestment in other economic activities that enable the recipient to maintain or improve their economic status above subsistence. In contrast when land is expropriated from so called peasants, as observed by the report in the case of Southern Rhodesia, a *pari parsu* (mud hut for mud hut) is deemed the most fair compensation, in other words it is seen as fair exchange.

In the mitigation protocol, the standard procedure is to relocate such communities on alternate land, land which invariably has a different ecological fabric to their ancestral home. Compensation is

usually evaluated at replacement value of their possessions and habitations, which normally comes to some paltry sum. On the other hand their former resource base is converted to higher level resource that benefits target communities, such as the urban and industrial communities, in perpetuity, while the displaced community is often not strategically positioned to benefit from such conversion. On Lake Kariba the Tonga are still a food deficit community struggling to eke an existence in a hostile climatic environment. In the Lesotho Highlands project the developers offered food subsidies for the displaced communities for a period of fifteen years, but there is no provision for the displaced persons to participate in the elevated value of the goods and service their environment was transformed to.

I have attempted to develop some guidelines for the compensation process (see Chapter 7 of *Planning and management of Lakes and Reservoirs: an integrated approach to eutrophication*. UNEP/ITEC 2000. Technical Publication Series (11).)

These are:

- That in designing the resettlement programme the project must at least empower the displaced persons to manage their new environment in a manner that gives them the self confidence and security of existence that they had in their former environment.
- That rather than compensate them *pari passu*, for the material goods the compensation profile must enable them to participate in the economic benefits arising from the transformation of their land resource.
- That in accordance with the United Nations principles on habitat, whatever the original condition of the displaced communities habitat amenities the new homes must meet basic human needs of comfort health and dignity.

Design paradigm

It is often said dams are self-edifying monuments of their architects, and that with some thought much smaller structures could perform the same function as large dams. I am reminded of the series of hydropower facilities on the River Soane in France.

On the Zambezi River the ZRA are considering another very high dam, but because of the low storage it can only be operated as run of the mill dam. On the other hand, the Zambezi from Kazungula through to Devils' Gorge would be ideal for a series of low-pressure turbines as on the Soane. Like the Kafue such designs would minimise displacements, but perhaps not create such a lucrative fishery. It would have been instructive if the report could give the reader such alternatives to large dams.

Treatment of the Tonga.

There is a moral issue, which the report diplomatically skirts round. While the lack of environmental impact assessment is neatly excused by the time context, the issue of the way the Tonga were treated is mollycoddled in niceties. The question of why a so called civilised people should have treated other human beings in the way they did needs to be openly discussed, otherwise, as in the case of Cabora Bassa, and Osborn Dam, such treatment is likely to be repeated as normal practice. It also engenders certain ideas seen in discussions on environmental economics where certain sectors of the world society put monetary values on lives of other human beings as substantially less than theirs, and, by inference, dispensable.

Apart from the way the Tonga were treated white workers were provided with decent family accommodation on the "heights" while black workers were provided with one small room per person in Mahombekombe. No family life was catered for. Consequently, this prejudice still haunts Kariba

now in the squalor of Mahombekombe. Kariba has a notorious record of sexually transmitted diseases among the blacks, an inevitable result of prostitution that develops wherever a large population of males lives away from their spouses. This malaise subsequently spread to the fishing camps.

One event the report does not evaluate but merely narrates, is the Operation Noah, when international indignity at the fate of the wild life raised large sums of money for their rescue. Why was there no such outcry for the people? The whole episode begs the question "development for whom".

The report would be very instructive if it compared the effort at rescuing wild animals to that of settling people, especially if the figures are presented in dollars per individual, as only about 5000 animals, mostly impala, were rescued.

I feel that it is these issues that make Kariba a "case" worth studying.

Comments in particular.

Page 10, para 3.

The report gingerly handles the politics surrounding the decision making process. It is well known that these decisions were made against very vocal opposition by Northern Rhodesia and Nyasaland on the Federation. Surely, that must have influenced the decisions that resulted in virtually the entire CAPCO facilities and initial hydro instalments all on the Rhodesian side.

Page 21, 3.3.3.1

The title of this section and the section content are not clear.

Page 23, para 2

I am not sure that this calculation, based on the vegetation of the Philippines, is applicable. Most of the above and below ground woody material that was submerged is still there, slowly fossilising. Thus only some part of that submerged biomass had decomposed and given off CO₂.

Page 23, para 4.

I thought one of the problems of the sharing of benefits was that all formerly CAPCO administered assets were equally owned by both governments, where ever they were, while the north bank was wholly owned by Zambia.

Page 24, Table 3.3,5

Do these costs include structural maintenance work, such as repair to the stilling pool after spill, prevention of weathering on the south bank etc?

Page 26 Para 4

Please give botanical names of crops.

Page 26. Para 5

My own information from Tonga people who remembered the Gwembe culture is that by the time of the translocation the Tonga were unfamiliar with tsetse, and that conflict with wild animals was rare. Cultivation and villagisation had substantially destroyed the tsetse and wildlife habitats, as happened

in Malawi where the tsetse control unit was disbanded in the late sixties. (See Magadza 1989 *Lake Kariba: case study in Survey of the State of World Lakes*, ILEC/UNEP FP/5201-87-02(2736)/Rev 2.

Page 36, para 4

What this report fails to capture were the emotional traumas of relocation. Colson cites cases of suicide among young wives who, separated from their peer support system in strange environment, simply could not cope with the day to day chores of house keeping. Uprooting people from their age-old homelands is more than losing a few huts. It involves possible family disruptions, and that unpriceable loss of "home" and the emotional security that goes with it.

Page 43-44, Nos 1-11

I think this needs quantifying and perhaps a distribution map of these facilities. After independence in Nymhunga, it was common site to see married men in primary school classes because they had grown up in school poor areas.

Page 45 para 2

There is some evidence that there was a crop switch from the traditional millet/sorghum mix to mainly maize soon after independence. This may have been due to the seed/fertiliser packages given by the Zimbabwe government. The result is that in some years the crop failure became more severe as the maize varieties were not adapted to the valley climate. (Magadza 1993. *Some insights into the relation between drought, food production and food consumption in the Omay Communal lands*. In H.G. Bohle (ed.). *Worlds of pain and Hunger*. Verlag breitenbach publishers, Saarbrucken.

Page 45 para 5

Please verify this. The kapenta industry is dominated by capital intensive antreprenaureship and chefs. The ethnic mix places the Tonga very much in the minority.

Page 46, para 1

These are material problems. They do not reflect social problems, such as young migrating to urban areas and coming back with AIDS.

Page 48 para.

This para has the paradigm fix I referred to earlier. Granted during the project cycle there was some employment. But what were the long term prospects? How, if at all, were the Tonga positioned to take advantage of employment opportunities that time would unflod? They needed skills, education, and access to capital. What percentage of workers in public and private sectors is Tonga?

Page 53, para 3.

If the authors see some of the squalor in which people live in Mahombekombe, and if the authors would feel comfortable in a "fishing camp" or glitter stone quarry, I am sure they would revise this conclusion. In fact, this para contradicts many of the observations made in the report.

Page 68 para 5.

There are some inaccuracies here. The National Parks estate begins on the 490m contour. It is not defined by distance from water. However, the difference between the Zimbabwe and Zambian

wildlife approach is that wildlife in Zambia is restricted to very small areas, and even then by repopulating. Generally, wildlife in Zambia has been almost eliminated.

Page 86 para 7

There is a popular belief that Kariba became oligotrophic after initial inundation, and remains so. Recent data by Magadza questions this view and warns of eutrophication problems. (see Chapter 7 of *Planning and management of Lakes and Reservoirs: an integrated approach to eutrophication*. UNEP/ITEC 2000. Technical Publication Series (11).)

The lake has now a permanent water hyacinth problem. The phosphorus level graph is reproduced here for ease of reference.

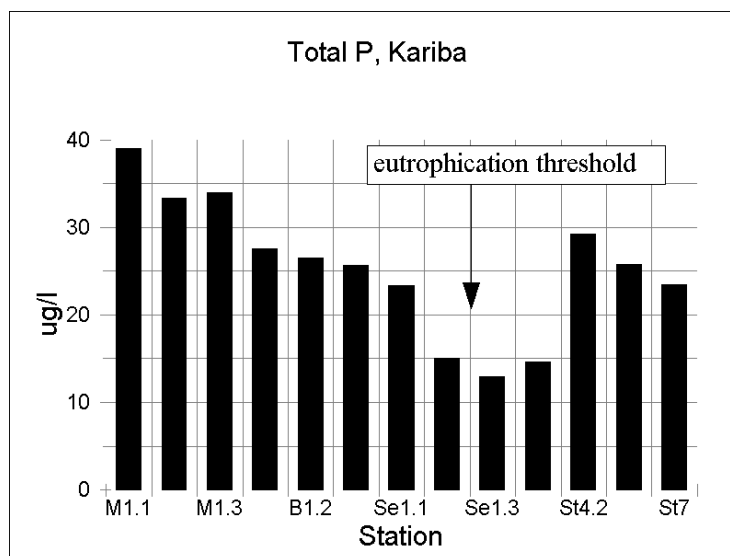


Figure 1

Page 88

This page is somewhat inadequate. A fuller list of littoral vegetation is in Magadza, 1970, *A preliminary survey of the shoreline vegetation of Lake Kariba*. *Kirkia*, 7(2): 253-268. There is also considerable work done on development of littoral communities following filling of the lake with particular reference to Collembola (Magadza, M. Phil Thesis, UZ). The dynamics of the crustacean population only becomes evident when they are examined from lower taxa, e.g. cyclopods vv calanoids, daphnids vv chydorids. These comparison reveal impacts of kapenta on planktonic fauna.

Page 91. para 1

The culture agar used was for human coliforms. The paper is published in *Lakes and Reservoirs; research and management*,

Magadza, C.H.D. & E.J. Dhlomo. 1996. Wet season incidence of coliform bacteria in Lake Kariba inshore waters in Kariba Town area. Lakes and Reservoirs: Research and Management. Vol 2(1): 89-96.

Page 93.

Somewhere in the report should be a discussion of the tsetse control program and its ecological impacts, since the rationale for this protracted DDT spray programme was to enable Tonga to rear cattle and work bigger fields to harvest sufficient for their needs. (See Douthwaite et. al. (DDT in the Tropics, INR) and Magadza 1997 (DDT in the Tropics: a review. Zambezi Society) These documents discuss the impact of tsetse spraying programme with DDT on the aquatic and terrestrial ecology of the L. Kariba environs. They do not however address the health issue. Recent surveys by UZ medical school reveal high levels of DDT in lactating mothers in Kariba. There is also suggestion sex imbalance in some fishes.

Page 101, para 4.

The tremors of L. Kariba are a popular concern, but the more serious concern is the geology of the south bank abutment, with respect to the weathering of the schist.

Page 105, para 5.

The major commercial breams were introduced from Kafue (Bell Cross 1971. Fisheries Research Bulletin of Zambia, 5. 1971).

Page 115. *Accumulation of DDT.*

See Magadza *DDT in the Tropics: a review.* Ibid.

Page 116. Para 7

There is no proof that CAMPFIRE has benefited the wildlife, at least not the rhino! This program is most vociferously promoted by the NGOs that run it. There is no evidence that CAMPFIRE villagers have been proactive in wildlife conservation. Indeed there are cases where villagers have harboured poachers. My experience of DDC meetings is dissuading villagers not to introduce livestock in CAMPFIRE areas. The rhino in the Zambezi valley was lost in spite of this being the CAMPFIRE country. The villager's participation in CAMPFIRE is no more than tolerating occasional losses for annual handouts of a few dollars.

Page 119. Para 4

Add safari hunting

Page 120 page 4

Add

Moth camp

Angler's Union

Seroti Lodges

Fothergill

Spurwing

Mrs Predy's luxury lodges.

Plus unknown number of private homes and houseboats.

Page 124

Issues not discussed in this section

Ribbon development on Kariba town vicinity shoreline and its impacts on wildlife and wildlife/humans relationship.

The almost disappearance of wildlife on Zambian side

Glitterstone extraction.

Habitat degradation in Charara/Urungwe safari area due to annual fires.

Page 133.

The climate change issue has been addressed at a more technical level by Hulme et. al. 1996. *Climate Change and Southern Africa*. UEA

Magadza 1996. Possible multiple impact of climate change in Zimbabwe. In Downing (ed.) *Climate Change and World Food Security*. NATO ASI Series. Series 1: Global Environmental Change, Vol. 37. Springer-Verlag.

Urbiztondo, R.J. 1992. *Modelling of Climate Change on the Upper Zambezi River Basin*. M. Sc. Thesis. University of Colorado (I have copy).

The authors are recommended to consult these works.

I. Comments by Mr T, Kabell, Chairman, ICOLD Zimbabwe Chapter

REF : IM/1

FACSIMILE

TO : Dr. A. Hungwe
Fax No. 758465

COPY TO : A. Steiner
Fax No. 2721-4260036

FROM : T.C. Kabell
263-4-722733

DATE : 29 February 2000

SUBJECT : **REVIEW OF WCD KARIBA DAM STUDY**

Thank you for the copy of the WCD Kariba Dam Case Study (draft of 12 February 2000. I have the following comments to make on the document.

(i) Page 4

“Minimum Retention Level” should read “Maximum Retention Level”.

(ii) Page 8, Fourth paragraph

“..... the basin includes two more countries....”. I think this should be “three more countries”, to bring the total number of basin states to nine, as given on Page 3. Possible the DRC was forgotten.

(iii) Page 11, Second paragraph

“The construction of a paved road”. The Kariba Dam project did not include a paved road, but a gravel road. Some realignment and surfacing of the road was carried out many years later, as a ‘transport’ exercise, not as part of the “Kariba” project.

(iv) Page 13, Last block

Reference to “contractor problems” is simplistic and perhaps unfair and unwise. (see fuller description of the various problems on Page 153). The wording could be changed just to “problems”

- 2 -

- (v) Page 14, (3.2.1.)

Kariba stage 2 – “900 MW Power Station”, should be “600 MW Power Station”.

- (vi) Page 16, Footnote

“Overrun/underrun calculated as actual divided by projected”. Not so. Figures given are percentage change from Initial Estimate.

- (vii) Page 19, Table 6

Final column should be headed Actual/Projected costs (See Table 4 on Page 18)

- (viii) Page 21, Table 8

In this case the final column is Projected/Actual costs (Tables 3;4;6;8 are done in different formats, and should be standardised).

- (ix) Page 26, First three paragraphs

The mathematics/wording here are confusing, 3 million tons of carbon emission have somehow been transformed into 1,4 million tons of carbon. (or was the 3 million tons not “carbon emission”, but tons of coal burnt/saved?).

The 265 tons of carbon per hectare, as assumed for a study in the Philippines, is probably not correct for the original vegetation at Kariba. Moreover, much of the vegetation is not transformed into atmospheric carbon-dioxide, but is taken up in other forms of biomass (Kariba weed and hippopotami).

I believe that these paragraphs are so vague and subjective that they are better omitted, lest they serve to reduce the credibility of the document.

- (x) Page 153, Paragraphs 3 – 5

The story of the North Bank power station construction is both complex and contentious. Without wanting to conceal any facts, I believe it best to remove these three paragraphs. Their exclusion will in no way compromise the quality of the report.

- 3 -

(xi) Page iv Executive Summary, First paragraph

“ --- problems were experienced with the contractor ---“ Better erase “with the contractor”.
(See above)

(xii) Page iv Executive Summary, last paragraph “--- mist of the costs of the projects are borne by the displaced people and local communities.” I know what you mean, _____ but it is not really true to say that “most of the costs” are borne by them. Including capital costs? Some rephrasing required.

(xiii) Seismic Effects

See page 88 and final paragraph on page 89.

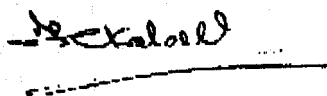
The risk of damage to Kariba Dam through future seismic activity (either tectonic or reservoir induced) is overstressed in a somewhat alarmist manner, but without factual evidence.

Whilst it may be true that seismic load was not considered during the original design, reservoir induced seismicity not having been known previously – has been taken into account in more recent safety evaluations of the dam structure.

It should be emphasised that the whole of the works at Kariba Dam are subjected to an intensive study by international Consulting Engineers every five years, and the Zambezi River Authority carries out inspections and reviews twice each year.

I hope that these comments are of use to you in the compilation of the final report on the Kariba Dam Case Study,

Yours sincerely



T.C. Kabell

CHAIRMAN-ZIMBABWE NATIONAL COMMITTEE ON LARGE DAMS

J. Comments by Eng. Mike J. Tumbare, Chief Executive Zambezi River Authority**ZAMBEZI RIVER AUTHORITY****COMMENTS ON THE DRAFT DOCUMENT(O1/02/00): WORLD COMMISSION ON DAMS: KARIBA DAM CASE STUDY****General**

This is a well-written and researched document which contains a wealth of information.

It is hoped that this case study will be made into a book to enable it reach as many people as possible.

The following are general comments:

- It is suggested that where applicable, the old names of countries and cities be used e.g "Salisbury" instead of "Harare", "Rhodesia" instead of "Zimbabwe" in order to ascribe responsibility and for clarity. New names can be put in brackets against the old ones.
- There are some sections which are too repetitive which can be trimmed down. Section 3.4.4 is a typical example.

The rest of specific comments are as follows:

1. Page (ii), third paragraph:
 - add the words "at full supply level" after "km2 " in the 2nd line
 - add "S" after "16.51222°" in 3rd line
2. Page Xiv, third paragraph:
 - Replace "Mr" with "Eng." in 2nd line
3. Page 8. first paragraph:
 - 1st and 5th lines; replace "2500" with "2650"
4. Page 20, Table 7:
 - Is the source correct in respect to costs for Kariba Project being reflected in the World Bank Audit Report for Kariba North Bank Project?
5. Page 23, Table 10:
 - Figures for both Kariba South and North for electricity generated do not tie up with Zambezi River Authority Annual reports.
 - What is the source for Table 10?

7. Section 3.4.4 (page 31 to page 46):

- There appears to be a lot of repetition in this section and it can easily be trimmed down

8. Section 3.10;

- Siavonga town has not been dealt with to the same extent as Kariba town

8. Page 115, first paragraph:

- Zambezi River Authority uses an average evaporation figure of 1500mm/year

9. Page 118, Table 39:

- Item (d), "(a + b + c)" should read "b + c"

10. Page 136, Table 45:

- Annotations in 2nd column have no key
- Shouldn't the title "Tonga-valley people" move from the 1st column to the 2nd column?

11. Page 150, last but one paragraph:

- The Water Tariff By-laws were gazetted in both Zambia and Zimbabwe and became effective on 01/10/99 hence ZESA and ZESCO/KNBC are now being charged for the water used for power generation monthly.

The Water Purchase Agreement was also signed between ZRA, ZESA and ZESCO and is currently effective in line with the Water Tariff By- Laws.

12. Page 155, fifth paragraph:

- Was it not the colonial attitude that prevailed and not the youthfulness of the two governments then?

13. Page 157, Section 7.1, third paragraph:

- Zambezi River Authority's efforts have not been acknowledged

14. References, Page 162 -176:

- ZRA Annual Reports have not been acknowledged.

15. Page 188, Appendix 3.8.2:

- It would add value if the common names of the fish were given.

18/02/00

Endnotes

¹ The location of the principal thermal power stations hundreds of miles away from their coal supplies had now become a major problem. With low electricity consumption the load on the railways in carrying powerhouse coal was very limited. In 1951 the Rhodesia railways carried 460,000 tonnes to power stations in Southern Rhodesia alone and by 1956 this figure was expected to double thus calling for a corresponding increase in railway capacity. Due to the fact that coal was placed low on the railway rates classification, the likely direct return from such railway development was very limited. (Thompson and Woodruff: 15)

² By today's environmental standards and concerns, this was clearly unsustainable. Even then, the cost of clearing forest has had negative impact on the future generation, though this is not quantifiable as in the present report.

³ Overrun/underrun calculated as actual divided by project.

⁴ "Project Performance Audit Report, Zambia, Kariba North Hydroelectric Project", World Bank

⁵ "The World Bank Audit Report: Kariba North Bank Hydroelectric Project

⁶ "At the exchange rate of k1=US\$1.4 used in the appraisal report

⁷ Average exchange rate obtained in each year is used to convert from kwacha

⁸ Annual Report and accounts No 5 for year ended 30th June 1960, Federal Power Board *generation data for Kariba North power station is difficult to obtain from ZESCO

generation data for Kariba North power station is difficult to obtain from ZESCO

⁹ Thayer Scudder and Elizabeth F. Colson, 'The Kariba Dam Project: Resettlement and Local Initiative' in H. Russell Bernard and Pertti J. Peltto (eds.) *Technology and Social Change* (New York: Macmillan, 1972), 48.

¹⁰ Northern Rhodesia, Department of Agriculture. *Annual Report for 1960* (Lusaka: Government Printer, 1961), 51.

¹¹ NAZ, SEC 5/454. H.A.D'Avray, District Commissioner, Gwembe Kariba Resettlement Tour Report, 1960.

¹² William Allan, *African Husbandman* (Edinburgh: Oliver and Boyd, 1965), 148-49.

¹³ Of the this budget, about 50% (12.3 millions USD) was secured in December 1999. Source: Limbwamba (1999)

¹⁴ *Claim on the Federal Power Board for the Arbitrator*, 1956, Northern Rhodesian Government.

¹⁵ The letter was referenced E.6130/3, dated 22nd November, 1958 addressed to "The Secretary, Office of the Prime Minister and External Affairs", Box 1403, Salisbury. It was signed by H.L. Jones, Administrative Secretary to the Government of Northern Rhodesia.

¹⁶ Peasant agriculture was perceived to be more advanced compared to the "primitive subsistence farming" which had obtained before dam construction.

¹⁷ The cattle would have to be protected from tsetse flies, wild animals, ignorance of their owners and disease. They would need to be supplied with adequate water points where natural ones - including Kariba Lake, were not available.

¹⁸ A rainy pentad is defined as the centre one of three five-day periods (pentads) which together receive more than 40mm rainfall and two of which receive at least 8 mm of rainfall.

¹⁹ Hirudinea & Oligochaeta

²⁰ Aspects of the effects of Lake Kariba on waterborne diseases are discussed elsewhere in this volume.

²¹ Banana Island Lodge is still under construction

²² "Report on Kariba Gorge and Kafue River Hydro-Electric Projects" by The Inter-Territorial Hydro-Electric Power Commission

²³ At a Technical Conference on the Zambezi and the use of its waters in 1950, the Power Commission reached agreement on water flows past Kariba with the Portuguese (Angola and Mozambique) and the respective authorities of the three territories (Zambia and Zimbabwe and Malawi).

²⁴ “Impartial” is the word used in the official documents; i.e. using a neutral party. The intent was to compare the two dams. The term “impartial” is today a point of contention in the large dam debate. Some parties hold that the impartiality of dam studies is itself a key issue.

²⁵ World Bank. 1983. Zambia: Kariba North Hydroelectric Project. Project Performance Audit Report. August. 12

²⁶ Information from David Morrell's book on *Indictment: Power and Politics in the Construction Industry*. Faber and Faber Ltd. London. 1987. Mr Morrell was head of the Mitchell firm, contractor for the Kariba North Bank project.

²⁷ World Bank., op, cit 1983, p. iv