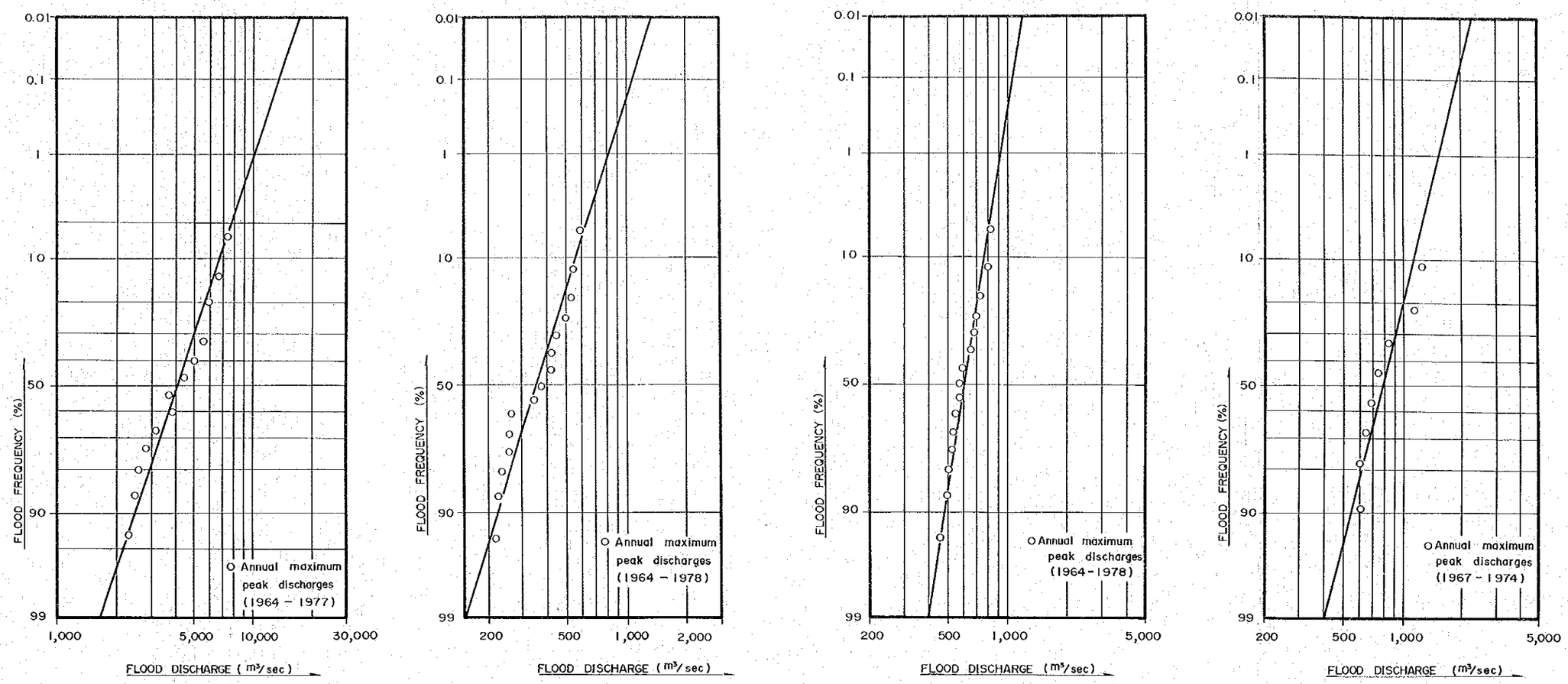
FIG- C.9



i) G.S. 420 ON THE KALI GANDAKI RIVER
(C.A. = 11,400 Km²)

ii) G.S. 430 ON THE SETI RIVER
(C.A. = 582 Km²)

iii) G.S. 445 ON THE BURHI GANDAKI RIVER
(C.A. = 4,270 Km²)

iv) G.S. 447 ON THE TRISULI RIVER
(C.A. = 4,110 Km²)

FIG- C.9 : APPLICATION OF LOG NORMAL DISTRIBUTION FOR FLOOD RECORDS IN THE BASIN

HIS MAJESTY'S GOVERNMENT OF NEPAL
SAPT GANDAKI HYDROELECTRIC
POWER DEVELOPMENT PROJECT
FEASIBILITY REPORT
JAPAN INTERNATIONAL COOPERATION AGENCY

FIG-C.10

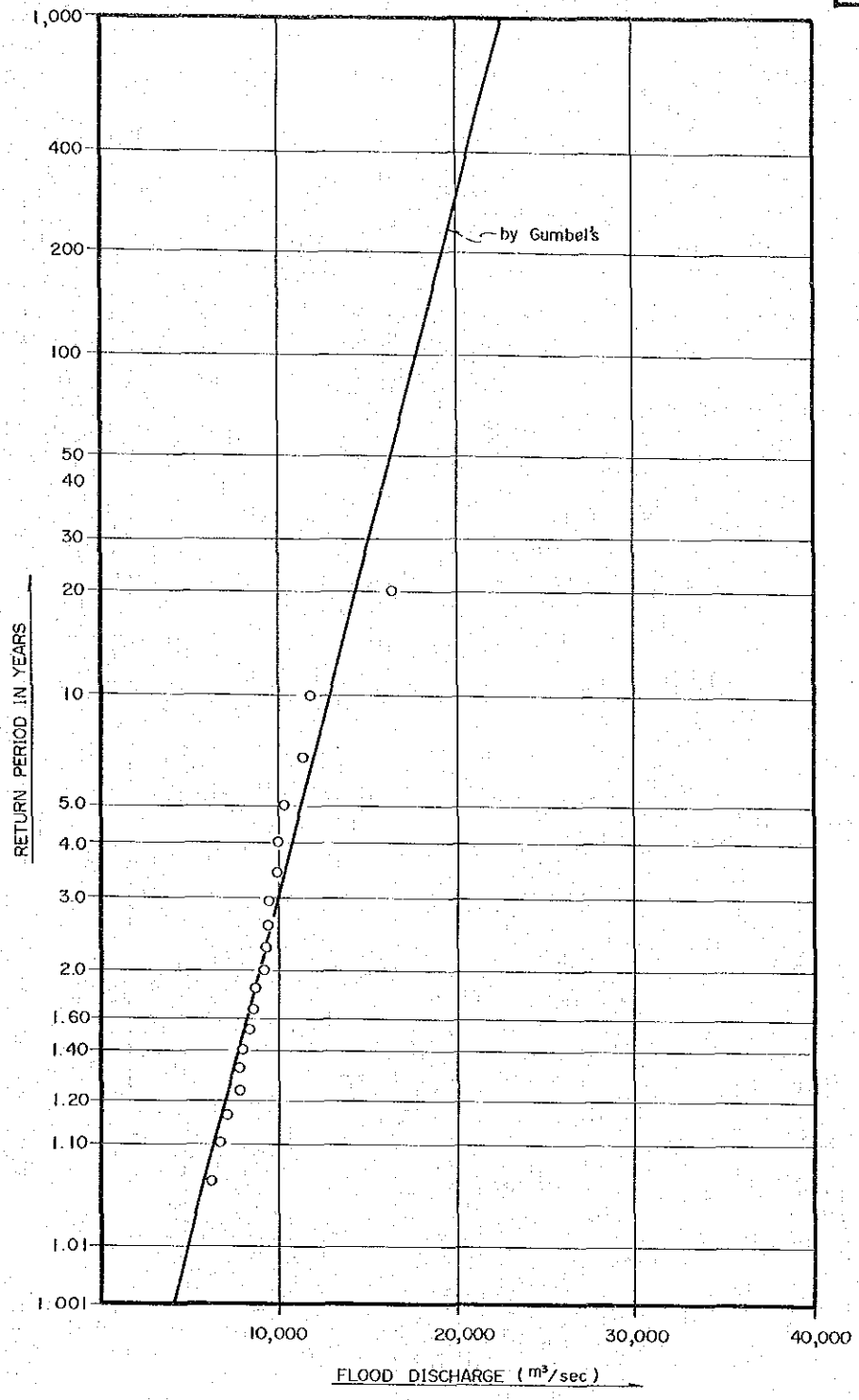


FIG- C.10 : PROBABILITY CURVE AT THE DAMSITE

HIS MAJESTY'S GOVERNMENT OF NEPAL
SAPT GANDAKI HYDROELECTRIC
POWER DEVELOPMENT PROJECT
FEASIBILITY REPORT
JAPAN INTERNATIONAL COOPERATION AGENCY

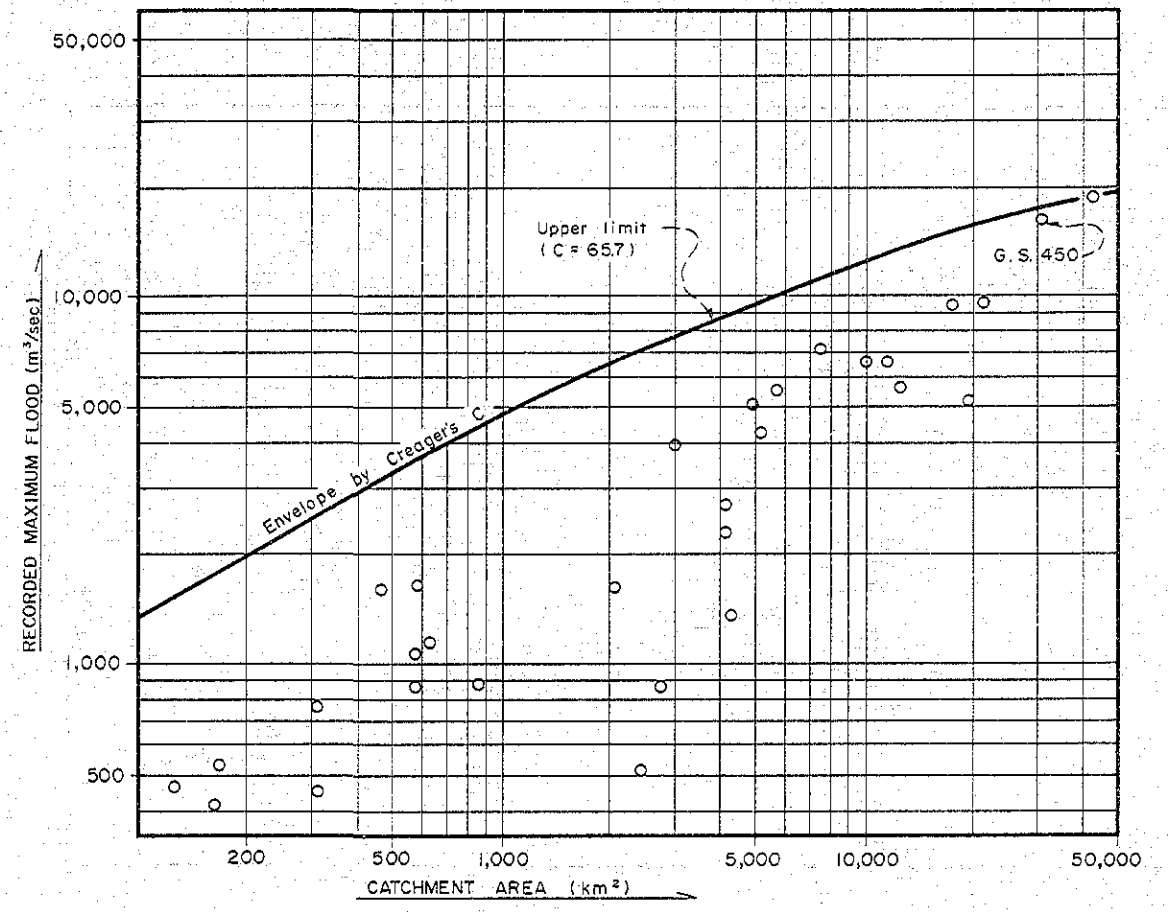


FIG- C.11 : ENVELOPE CURVE OF RECORDED MAXIMUM FLOODS IN NEPAL

HIS MAJESTY'S GOVERNMENT OF NEPAL SAPT GANDAKI HYDROELECTRIC POWER DEVELOPMENT PROJECT FEASIBILITY REPORT	FIG- C.11
JAPAN INTERNATIONAL COOPERATION AGENCY	

FIG- C.12

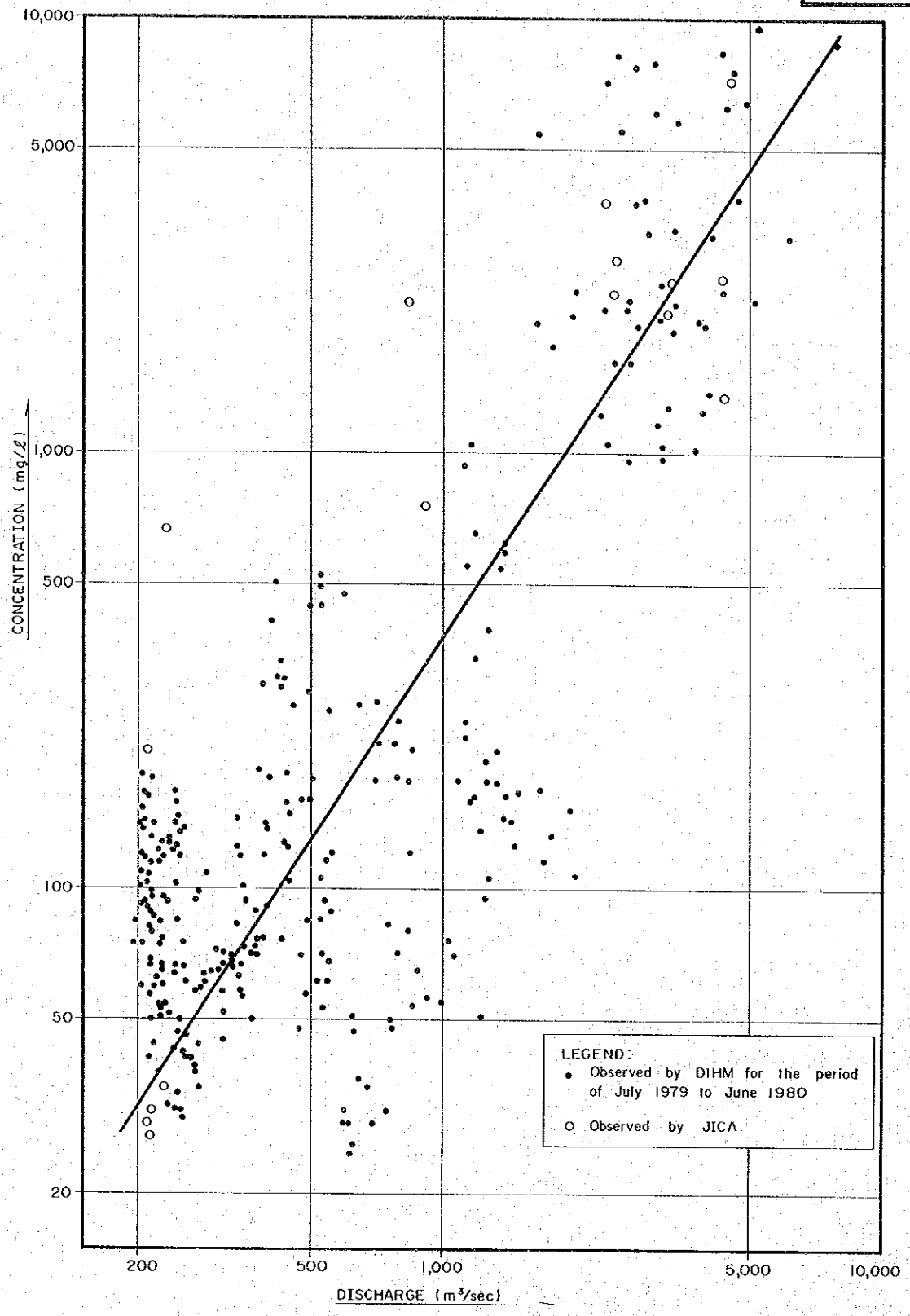


FIG- C.12 : SUSPENDED LOAD VERSUS DISCHARGE

HIS MAJESTY'S GOVERNMENT OF NEPAL
SAPT GANDAKI HYDROELECTRIC POWER DEVELOPMENT PROJECT
FEASIBILITY REPORT
JAPAN INTERNATIONAL COOPERATION AGENCY

ATTACHMENTS

DAILY MEAN DISCHARGES

AT GAGING STATION 450

(1963 TO 1980)

*** DAILY DISCHARGE ***

YEAR : 1963 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1						1160	2800	4010	4900		1240	
2						1180	2670	3870	5240	2570	1260	
3						1320	2770	5140	4890		1360	
4						1300	2860	6320	4740		1260	
5						1330	2670	5460	4390	2020	1230	
6						1320	2640	5070		2180	1170	
7						1490	2700	4410		2100	1150	
8						1430	2760	6200		2040	1120	
9						1500	3460	6180		2000	1090	
10						1670	3850	6270		1900	1060	
11						1710	3270	6420		1840	1040	
12						1540	3790	5830		1780	1040	
13						1300	4830	5500		1720	1030	
14						1300	4440	4540	3680	1650		
15						1920	3740	4880		1630		
16						2100	3540	4930	5280	1570		
17					924	1760	3340	5190	4420	1550		
18					782	1680	3650	5050		1510		
19					687	1440	3270	6420		1470		
20					715	1650	3450	5970		1460		
21					833	1410	4990	6060		1430		
22					878	1550	4740	5460				
23					782	1800	3490	4640				
24					754	1970	3470	4420				
25					760	1790	4140	4650				
26					855	1870	5050	4970				
27				332	855	2110	5370	4470				
28				330	816	2310	5220	4180		1280		
29					844	2670	4900	4710		1240		
30					918	2110	4810	4290		1210		
31					984		4520	4590		1210		
MEAN						1656	3781	5165				
MAX						2670	5370	6420				
MIN						1160	2640	3870				

*** DAILY DISCHARGE ***

YEAR : 1964 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	564	407	316	312	609	329	2250	5740	5680	2730	1290	738
2	570	402	316	323	620	385	2270	4930	4600	2520	1270	732
3	570	402	323	312	519	463	2330	4270	4440	2370	1240	715
4	553	402	329	346	547	502	2370	6750	3900	1880	1200	698
5	530	402	329	318	592	514	2280	5370	3700	1760	1180	693
6	508	402	323	306	575	497	2620	4410	3540	1830	1160	687
7	497	396	323	323	474	502	2730	4080	3620	1560	1130	676
8	480	396	312	357	446	519	2640	3900	3450	1900	1120	670
9	469	396	312	402	424	502	3010	3710	3400	1410	1110	670
10	458	396	312	385	458	530	3680	3500	3550	1280	1090	670
11	441	390	323	396	458	598	3740	3890	3410	1200	1080	665
12	435	390	329	441	396	693	4220	3850	3130	1880	1060	659
13	430	385	334	463	435	799	3670	3750	2930	1980	1040	654
14	430	379	323	491	553	889	3510	4500	3010	1870	1030	648
15	424	407	306	502	491	1310	3750	5190	3810	1800	1010	642
16	424	418	301	480	424	1710	3990	5770	4130	1810	996	637
17	424	362	306	435	418	1330	3960	5400	3470	1950	978	626
18	424	379	295	435	446	1070	3850	4920	3410	1900	954	620
19	418	379	295	402	441	1090	3720	5160	3900	1850	930	620
20	418	374	290	390	385	1110	3680	4680	3500	1760	918	620
21	418	357	312	418	486	1190	3810	4140	3470	1730	866	614
22	418	346	312	396	469	1690	5250	4060	3130	1710	833	609
23	418	346	290	446	536	2070	5310	4840	2880	1690	816	603
24	418	368	295	441	407	1730	6770	4310	2930	1670	799	598
25	418	357	306	402	362	1800	6800	3900	3640	1660	782	592
26	418	340	306	446	540	2090	5650	3700	4060	1660	766	586
27	418	323	312	463	318	2350	4770	3490	3370	1640	732	581
28	413	312	312	473	290	2350	5070	3350	3230	1550	726	575
29	407	318	295	474	278	2410	6480	3230	2930	1500	738	570
30	407		290	575	278	2390	6160	3750	2880	1340	754	564
31	407		290		290		5760	5620		1300		558
MEAN	452	377	310	412	444	1180	4061	4457	3570	1764	987	638
MAX	570	418	334	575	620	2410	6800	6750	5680	2730	1290	738
MIN	407	312	290	306	278	329	2250	3230	2880	1200	726	558

*** DAILY DISCHARGE ***

YEAR : 1965 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	553	390	301	295	698	810	2820	3440	3770	1720	1430	704
2	547	374	290	323	676	805	3060	3740	3930	1640	1210	698
3	553	374	273	368	642	833	2760	3770	4640	1620	1140	676
4	553	362	267	340	626	918	2470	3760	3310	1600	1130	670
5	542	362	267	312	564	936	2450	3890	3310	1610	1320	659
6	530	362	256	323	514	924	2570	3890	3210	1590	1210	648
7	525	351	267	312	530	883	5260	3570	3240	1510	1130	637
8	519	351	273	323	609	771	4620	3630	3490	1480	1100	631
9	514	340	273	362	575	771	4540	3900	3630	1430	1000	626
10	502	329	262	424	519	838	3770	4920	3470	1380	996	620
11	491	312	256	452	469	990	2850	6000	3400	1390	996	614
12	486	301	239	491	486	1000	2550	6910	3270	1350	960	609
13	480	312	234	698	525	1020	3450	5640	3120	1310	936	609
14	474	306	228	665	525	1100	3220	5890	2920	1260	924	598
15	463	306	228	581	514	1190	3130	6690	2690	1210	906	586
16	452	301	234	536	614	1620	2940	5700	2490	1180	906	581
17	452	290	239	553	698	2270	2790	4780	2400	1170	906	575
18	446	306	250	570	710	2220	2530	4000	2460	1160	889	570
19	446	306	250	654	715	2170	2700	4010	2500	1180	872	564
20	441	329	295	614	760	1860	2730	4180	2310	1450	861	558
21	435	334	278	486	732	1830	2880	5280	2310	1300	833	564
22	435	318	273	430	665	1860	2730	4410	2210	1200	822	553
23	430	301	256	402	598	1560	2670	4140	2230	1150	805	553
24	430	290	256	424	631	1530	3100	4000	2200	1130	799	553
25	430	278	262	491	710	1920	3090	3740	2150	1100	788	564
26	430	284	256	525	721	2390	3120	3810	2180	1090	766	553
27	424	290	306	486	732	2430	3040	3960	2120	1070	754	542
28	418	295	340	486	738	2730	3030	4950	1900	1110	743	519
29	418		318	542	782	2860	2850	6980	1850	1040	732	508
30	407		284	642	805	2670	3310	4890	1780	1060	721	502
31	402		284		816		4100	4320		1170		497
MEAN	472	323	268	470	642	1524	3133	4606	2816	1312	953	592
MAX	553	390	340	698	816	2860	5260	6980	4640	1720	1430	704
MIN	402	278	228	295	469	771	2450	3440	1780	1040	721	497

*** DAILY DISCHARGE ***

YEAR : 1966 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	491	306	284	222	430	805	2550	6160	6420	1730	996	682
2	491	301	267	228	446	855	2930	6110	6030	1710	990	670
3	497	301	262	211	497	850	3450	5440	5490	1640	990	665
4	486	295	278	206	530	936	3170	4770	5140	1570	960	659
5	530	295	290	206	542	827	2450	5610	4740	1610	960	648
6	474	301	273	239	570	822	2270	5910	4370	1640	948	648
7	441	295	256	267	654	822	2370	5220	4200	1620	942	637
8	424	290	234	239	659	850	2170	4620	3940	1510	936	631
9	413	306	228	217	603	960	2090	4860	4360	1480	930	620
10	402	312	228	206	564	978	2410	4930	3940	1440	942	614
11	396	284	234	195	637	966	2750	4750	3670	1410	918	603
12	390	273	234	190	542	1010	4800	5320	3840	1380	889	598
13	385	306	234	190	458	1020	4800	5130	3490	1350	872	592
14	374	525	245	256	407	1160	4210	5100	3270	1310	855	592
15	368	407	245	334	430	1080	3410	5200	3340	1280	844	592
16	362	351	239	362	486	984	2860	4440	3360	1250	850	586
17	362	329	222	362	530	966	3340	4250	3150	1240	844	564
18	351	312	206	323	553	1010	3370	4030	2830	1230	822	553
19	346	306	211	295	558	1350	2830	3850	2670	1210	810	553
20	340	306	228	267	558	1330	2890	3770	2550	1240	794	547
21	340	301	211	273	581	1240	3230	3760	2430	1230	782	547
22	340	295	206	351	710	1230	3720	4990	2380	1190	782	542
23	334	290	206	362	726	1720	3810	5500	2250	1170	777	542
24	329	284	222	323	738	2000	4010	7720	2120	1150	760	547
25	323	290	256	301	866	2080	4270	6700	2020	1130	754	542
26	318	295	295	323	827	2410	4620	5220	1970	1090	749	530
27	346	301	318	407	810	2470	4270	5800	1930	1070	738	514
28	362	312	301	379	749	2370	4720	5970	1860	1050	715	514
29	334		245	396	605	2340	4530	5670	1810	1030	710	519
30	323		222	413	822	2400	4740	7040	1790	1020	693	519
31	312		206		766		5160	7220		1000		508
MEAN	387	313	245	285	615	1328	3490	5325	3379	1322	852	583
MAX	530	525	316	413	866	2470	5160	7720	6420	1730	996	682
MIN	312	273	206	190	407	805	2090	3760	1790	1000	693	508

*** DAILY DISCHARGE ***

YEAR : 1967 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	497	351	278	318	676	777	1990	3400	3300	2010	972	659
2	491	357	284	357	609	805	2140	3350	3310	1960	960	642
3	491	351	284	390	525	855	2260	3640	3180	1890	948	626
4	486	351	290	396	491	726	2950	3450	2950	1830	942	620
5	491	357	278	362	463	978	3450	3960	3300	1800	918	614
6	486	357	262	323	435	1000	2930	3890	3010	1720	900	603
7	486	362	256	301	418	860	3030	3900	2870	1630	900	598
8	480	368	256	278	418	738	3700	4450	3400	1620	883	592
9	474	362	262	267	486	776	5060	3930	3340	1610	872	581
10	474	351	262	256	592	948	7040	4240	3550	1580	855	575
11	469	340	278	256	654	1230	5240	4480	3580	1530	844	564
12	474	334	245	256	626	1450	3510	3930	3500	1490	827	558
13	469	329	278	262	581	1520	3070	4210	3280	1470	827	547
14	463	323	334	284	581	1600	2990	4060	2970	1420	810	547
15	458	323	346	334	536	1700	3720	4720	3110	1370	816	542
16	447	323	318	446	558	2260	4740	4690	3030	1320	794	530
17	435	329	323	430	469	1860	4680	4770	2890	1280	799	525
18	430	334	323	508	446	1540	5700	4360	2710	1260	771	514
19	424	323	312	799	458	1820	5470	4270	2710	1230	766	508
20	408	323	295	586	469	1620	4180	3760	2760	1190	754	502
21	396	318	295	480	508	1450	3490	3670	3010	1160	738	497
22	396	306	340	458	570	1550	3490	3620	3000	1140	721	491
23	390	295	334	530	687	1580	3700	5050	2980	1100	704	486
24	374	295	385	570	766	1460	4040	4590	2970	1090	704	486
25	368	284	357	502	760	1470	4380	4210	2970	1070	704	514
26	362	278	334	452	738	1730	3710	4410	2800	1070	721	502
27	357	278	402	463	654	2150	3340	4540	2500	1060	704	486
28	357	278	385	620	631	1930	3460	3920	2290	1040	687	480
29	346		346	603	648	1830	3340	3620	2170	1010	676	469
30	340		323	575	710	1840	3450	3440	2100	990	665	458
31	346		306		749		3410	3290		984		458
MEAN	431	328	309	422	578	1402	3795	4059	2985	1385	806	541
MAX	497	368	402	799	766	2260	7040	5050	3580	2010	972	659
MIN	340	278	245	256	418	726	1990	3290	2100	984	665	458

*** DAILY DISCHARGE ***

YEAR : 1968 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	452	407	295	284	556	872	3230	4350	3300	4000	1300	794
2	435	374	284	278	687	855	3030	4440	3190	3640	1300	782
3	435	362	273	267	631	838	2980	4640	3330	3720	1260	771
4	430	351	267	262	693	782	3150	4010	3350	4650	1240	766
5	430	346	245	273	687	850	3220	3760	3250	8820	1230	754
6	424	340	206	295	614	883	3500	3680	3070	6830	1170	743
7	424	340	228	334	570	930	3370	3830	3010	4500	1180	732
8	463	334	385	424	564	936	3770	3880	2940	3640	1180	721
9	435	318	329	452	542	1120	3290	4380	2890	3230	1170	715
10	418	306	301	424	502	1260	3510	4600	2790	2980	1140	710
11	424	312	306	390	497	1380	2940	4040	2930	2740	1120	704
12	441	301	306	368	553	1430	3220	3970	2670	2560	1100	698
13	418	295	295	368	564	1560	3460	3930	2500	2400	1090	693
14	407	290	295	368	536	1710	4780	4280	2530	2310	1060	682
15	441	290	340	357	480	2000	4530	4100	3710	2430	1050	670
16	418	290	346	340	603	2730	3800	3700	3800	2320	1030	665
17	402	290	374	334	592	2650	4480	3630	4280	2250	1010	648
18	398	284	469	329	525	2700	5760	4480	4500	2170	996	642
19	385	284	430	318	620	3060	5340	4650	4070	2170	972	637
20	385	273	390	357	605	2560	5550	4470	2980	2030	954	631
21	379	267	357	390	743	2200	4650	4390	2890	1980	960	626
22	368	284	346	418	773	2030	5580	4900	2770	1910	930	620
23	368	290	334	452	805	2370	8360	4920	2690	1870	900	620
24	362	273	318	435	738	2310	7420	4540	2700	1830	889	614
25	357	273	312	390	698	2250	5190	3970	3130	1790	889	609
26	346	267	318	396	682	2790	5340	3830	2930	1730	872	603
27	340	267	318	396	693	3230	5160	4350	2870	1500	849	603
28	346	301	312	374	710	2620	5380	4360	2680	1420	833	598
29	385	334	323	413	676	3250	5260	4360	2910	1390	816	586
30	430		323	486	637	3450	4710	3720	3750	1350	805	575
31	463		306		754		4650	3300		1320		570
MEAN	407	308	320	366	637	1920	4471	4176	3147	2822	1043	670
MAX	463	407	469	486	805	3450	8360	4920	4500	8820	1300	794
MIN	340	267	206	262	480	782	2940	3300	2500	1320	805	570

*** DAILY DISCHARGE ***

YEAR : 1969 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	560	428	327	560	450	709	1590	3400	3670	2380	1050	659
2	560	428	321	360	400	787	1390	3740	3550	2300	1040	648
3	549	422	316	354	385	1020	1470	3490	3820	2120	1020	637
4	538	411	321	337	360	953	1960	3070	4180	2000	999	637
5	532	406	327	310	349	1040	1860	3920	3910	1940	999	626
6	527	394	332	299	394	1280	2150	3530	4440	1880	982	620
7	521	389	332	288	428	1600	2180	3820	4700	1800	964	604
8	521	383	327	305	496	1660	2280	5110	4610	1740	964	598
9	316	383	327	349	385	1600	2940	4220	4130	1720	947	598
10	516	383	327	360	389	1470	2750	3880	3860	1710	936	587
11	510	389	327	349	444	1360	2960	4290	3530	1640	924	576
12	505	394	327	354	593	1240	3210	4020	3490	1570	907	571
13	499	389	337	499	654	1090	3220	3480	3490	1510	884	554
14	499	394	337	472	609	1050	3170	3570	4070	1470	873	543
15	554	417	343	428	587	1070	3790	3500	3980	1420	867	538
16	565	400	354	499	604	1190	3910	3760	3420	1390	838	527
17	527	389	377	604	637	1180	4360	4030	3550	1360	815	521
18	520	377	372	582	604	1270	3950	3780	3620	1330	804	521
19	505	366	527	466	532	1490	3320	4830	4030	1320	793	521
20	494	360	444	466	538	1520	3010	5080	4030	1280	776	521
21	477	354	433	488	543	1590	2930	5570	4300	1260	765	510
22	466	349	394	483	560	1660	3150	5230	4080	1270	759	505
23	461	349	372	428	659	1500	3310	4730	3400	1330	742	494
24	461	349	417	377	742	1660	3590	4610	3700	1260	726	488
25	455	349	383	354	821	1690	3780	4400	3330	1200	714	477
26	461	337	472	343	876	1370	4860	4030	3370	1170	703	466
27	461	332	461	332	930	1230	4300	3630	3130	1160	698	461
28	455	332	400	327	896	1310	4080	3780	2920	1130	687	455
29	450		366	337	861	1280	4080	3760	2710	1110	681	450
30	439		354	439	833	1340	3590	4350	2600	1080	670	444
31	433		354		765		3490	3950		1060		433
MEAN	495	380	366	399	591	1307	3117	4083	3721	1513	851	542
MAX	565	428	527	604	930	1690	4860	5570	4700	2380	1050	659
MIN	316	332	316	288	349	709	1390	3070	2600	1060	670	433

*** DAILY DISCHARGE ***

YEAR : 1970 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	433	332	294	222	543	450	2250	6880	2380	1950	862	440
2	428	327	294	205	565	576	2560	5540	2190	1810	846	432
3	422	310	264	193	532	827	2370	5700	1930	1700	835	425
4	417	305	252	188	472	1330	2440	5540	2270	1650	818	421
5	411	299	234	188	516	941	2370	4520	2190	1580	755	417
6	406	294	226	193	598	759	2550	5720	2090	1510	729	413
7	394	288	222	234	571	681	2600	6580	2010	1530	714	409
8	389	276	216	258	494	665	2840	6670	1930	1510	694	402
9	383	270	211	240	466	659	3150	5450	1910	1400	670	398
10	372	276	211	222	477	815	3540	5520	1820	1330	650	394
11	372	264	211	216	516	873	2660	5220	1910	1270	627	390
12	366	252	240	216	549	1140	3080	5180	1940	1230	603	387
13	372	264	276	258	560	1170	5410	5170	1990	1200	594	387
14	372	258	240	310	615	1270	6820	4470	2020	1180	594	379
15	366	252	240	354	703	1330	5490	3700	1940	1160	603	376
16	360	252	234	444	804	1720	8770	3780	1930	1140	589	372
17	354	258	222	692	890	3710	6990	4070	1870	1080	576	368
18	349	252	222	505	827	6140	4330	3570	1770	1050	567	368
19	349	252	222	383	709	5040	3510	3590	1870	1040	549	358
20	337	270	228	316	659	2350	5640	3230	2060	1030	540	351
21	372	258	228	327	770	2210	5580	2600	2150	994	519	347
22	444	264	205	372	703	2130	4930	2510	2110	982	510	347
23	389	283	193	433	609	2310	4470	2740	2510	976	489	344
24	366	321	205	488	516	2240	4750	3200	2870	964	481	340
25	360	299	216	428	560	2070	3970	4520	2700	964	472	333
26	354	276	216	532	571	2110	5240	4560	2750	935	464	330
27	377	264	216	742	554	2110	5540	3260	2850	913	464	323
28	377	258	246	742	543	2360	4820	3730	2720	901	464	320
29	343		270	659	488	2400	5000	3590	2410	884	460	316
30	337		294	593	428	2450	5520	3170	2170	873	452	313
31	332		252		428		6650	2800		873		313
MEAN	378	278	236	372	588	1828	4382	4412	2175	1213	606	371
MAX	444	332	294	742	890	6140	8770	6880	2870	1950	862	440
MIN	332	252	193	188	428	450	2250	2510	1770	873	452	313

*** DAILY DISCHARGE ***

YEAR : 1971 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	316	229	229	202	387	797	3980	2870	3380	1680	1230	
2	316	227	218	213	394		4730	2940	3440	1700	1230	
3	306	229	213	213	409		5130	3010	3080	1690	1250	
4	303	224	202	213	405		4590	3780	3040	1650	514	
5	303	227	202	229	421	1290	3670	3650	3530	1540	502	
6	296	229	218	241	436	1450	3810	4560	3060	1530	502	
7	296	224	215	344	440		4330	4950	2910	1480	493	
8	293	224	215	290	481		3530	6860	2700	1480	493	
9	274	218	213	277	456		3730	5330	3080	1480	440	
10	280	215	207	358	429		3530	5070	2830	1480	402	
11	277	224	202	303	405		5040	4890	3170	1480	394	
12	274	224	202	300	523		4470	4890	2500	1480	383	
13	271	218	196	323	489		3920	4590	2390	1560	376	
14	268	210	202	320	497		3440	4100	2190	1500	365	
15	268	210	202	296	631		3030	4100	2090	1480	365	
16	268	207	196	268	608		3000	4250	1900	1500	365	
17	265	207	194	256	514		2910	4330	1800	2360		
18	265	210	191	303	527		3010	5090	1720	2180		
19	262	213	191	347	460		2910	5110	1690	2110		
20	253	202	196	558	417		3600	4950	1690	1800		
21	250	207	191	452	460		3650	4300	1650	1540		
22	247	207	191	372	468		3450	3890	1650	1520		
23	247	202	191	409	464		2910	3410	1710	1480		
24	247	202	191	402	485		3200	3260	1720	1320		
25	250	202	204	361	531		3450	3160	1900	1320		
26	247	196	199	351	523		2740	3640	1690	1320		
27	241	196	210	326	506		2600	3530	1690	1280		
28	244	202	218	323	489		2870	2600	1690	1280		
29	241		218	316	612		3080	2580	1690	1240		
30	235		207	390	631		2890	2560	1700	1240		
31	235		207		670		2870	3180		1240		
MEAN	269	214	204	319	489		3551	4046	2309	1546		
MAX	316	229	229	558	670		5130	6860	3530	2360		
MIN	235	196	191	202	387		2600	2560	1650	1240		

*** DAILY DISCHARGE ***

YEAR : 1972 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1			229	271	268	765	1330	6170	2330	1360	1570	472
2			227	247	265	786	1840	4200	2190	1290	1610	464
3			221	235	274	689	2390	4820	2550	1250	724	456
4			215	218	287	704	2670	4080	5500	1200	675	444
5			215	215	259	750	2710	3820	4300	1140	699	436
6			271	210	247	694	2590	3590	3620	1110	689	432
7			268	207	241	599	2260	3790	3840	1140	679	421
8			265	210	354	585	3560	3650	3530	1330	660	417
9			235	213	326	571	1980	4070	2780	1150	660	409
10			221	227	277	540	1910	5260	2260	1090	641	409
11			218	296	354	567	1750	5370	2680	1050	631	409
12			215	253	402	599	1710	4030	2270	1020	622	405
13		250	213	227	365	603	1540	3560	2560	1000	631	394
14		340	210	221	519	802	1520	3410	2170	982	622	
15		313	221	224	510	829	1550	3010	2860	970	603	
16		256	218	238	481	829		2620	2370	953	603	
17		250	215	238	580	1490		2620	2130	913	594	
18		253	213	290	545	1160		3170	2030	896	599	
19		250	213	265	545	2100		2330	1840	868	558	
20		250	213	256	641	4400		2230	1740	829	549	
21		244	232	227	612	1710	4590	2040	1730	818	531	
22		238	229	218	594	1630	5910	2230	1610	797	523	
23		235	229	218	797	1730	4200	2160	1470	792	514	
24		232	229	218	802	1560	3200	3210	1580	786	502	
25		229	221	235	1000	1260	4330	2560	1630	719	493	
26		229	229	232	1080	1330	4470	3480	1610	734	489	
27		229	241	271	1010	1240	5640	3040	1760	714	549	
28		229	293	253	829	1190	8670	3500	1750	709	506	
29		229	265	259	818	1760	6710	2710	1530	1400	485	
30			271	271	797	1490	8570	2490	1410	2370	472	
31			274		724		6770	2420		2300		
MEAN			235	239	542	1165		3408	2388	1086	656	
MAX			293	296	1080	4400		6170	5500	2370	1610	
MIN			210	207	241	540		2040	1410	709	472	

*** DAILY DISCHARGE ***

YEAR : 1973 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	326	274	303	316	472	612	1850	4610	3290	2010	1210	684
2	320	268	265	296	436	603	1820	4710	4080	2460	1260	670
3	316	262	262	290	425	580	1910	4730	3080	4570	1210	655
4	316	253	244	300	472	558	1820	5000	2700	7870	1150	646
5	313	256	227	293	452	622	3200	5830	2560	8130	1120	631
6	313	256	210	296	489	675	3170	5020	2830	4930	1080	627
7	313	253	238	293	531	901	3140	5170	3110	3590	1040	617
8	316	250	238	287	624	1290	1940	5070	2970	2870	1080	612
9	326	253	235	287	1010	1170	1850	5280	2670	2740	1040	603
10	330	250	241	271	829	1100	1690	4870	2800	2680	1010	594
11	316	250	250	274	740	1170	1610	5830	2970	2280	994	585
12	310	244	247	303	650	1460	1680	5430	5390	2160	976	576
13	313	241	241	330	531	1850	1780	4500	7160	6790	970	571
14	320	235	247	376	497	2050	1830	3810	4470	5320	959	567
15	310	235	253	387	497	1870	2050	3560	4610	3740	918	549
16	306	232	253	344	519	3470	2320	3080	4400	2780	947	549
17	300	229	255	326	555	4570	2250	3010	5260	2280	947	540
18	296	227	253	310	527	4120	2450	4250	4330	1910	913	531
19	293	221	256	330	506	2180	2160	4100	4100	1700	873	523
20	290	215	250	368	460	2140	2150	3360	2930	1620	846	519
21	293	238	250	387	409	1990	2190	3010	2710	1590	829	514
22	303	227	244	405	409	2070	1970	3200	2700	1580	813	506
23	296	224	232	429	510	1650	1800	2780	2350	1560	797	497
24	287	221	241	402	472	1570	2160	2510	2510	1510	797	489
25	287	224	256	413	558	1630	3940	2390	2540	1470	771	485
26	280	224	284	472	724	1820	5110	2640	3300	1440	750	481
27	271	241	303	519	890	2260	4930	2590	2750	1410	740	472
28	271	333	296	576	884	2600	3290	2530	2350	1370	729	468
29	293		313	485	918	3450	2890	2720	2210	1260	709	464
30	293		316	444	818	2460	3200	2910	2040	1260	699	464
31	284		323		792		3730	2980		1240		460
MEAN	303	244	259	360	607	1816	2512	3919	3372	2843	939	553
MAX	330	333	323	576	1010	4570	5110	5830	7160	8130	1260	684
MIN	271	215	210	271	409	558	1610	2390	2040	1240	699	460

*** DAILY DISCHARGE ***

YEAR : 1974 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	460	361	326	313	425	724	2060	6880			994	562
2	460	354	326	313	432	750	3070	7850			976	553
3	452	351	290	313	464	862	3060	6560			947	562
4	452	333	284	313	452	699	2410	6440			930	594
5	436	326	280	347	466	684	2090	14750			930	603
6	436	320	274	344	497	755	2140				918	594
7	436	323	265	316	464	953	1850				901	612
8	436	326	259	303	466	734	1650				884	608
9	436	326	256	306	562	617	1750				879	599
10	421	330	265	313	603	553	1860				868	580
11	425	333	290	303	612	510	2040				868	567
12	421	344	293	303	585	477	2270				846	553
13	421	347	284	300	562	585	2260				818	523
14	417	340	280	320	571	655	3590				797	514
15	460	337	284	330	589	1080	3100				786	510
16	429	326	277	358	531	1060	3270				765	497
17	421	330	277	361	489	1040	3260				750	519
18	413	326	277	398	472	1200	3030				740	558
19	409	323	271	472	540	1400	2710				719	536
20	409	313	268	456	448	1070	2540			1330	694	523
21	405	316	265	452	549	1540	2800			1310	679	481
22	402	313	271	472	510	2530	3780			1290	665	468
23	398	313	287	519	493	1460	4660			1310	655	460
24	398	313	306	481	429	1290	2970			1290	655	460
25	394	303	313	452	417	1130	6360			1300	641	502
26	383	306	313	436	413	1020	5170			1200	631	497
27	376	287	313	429	417	1010	4570			1100	608	493
28	379	333	313	436	409	1080	3670			1050	599	489
29	379		310	436	497	1380	6860			1040	594	485
30	376		310	477	580	1750	6940			994	699	477
31	368		313		622		7030			994		755
MEAN	416	327	286	379	502	1020	3388				781	540
MAX	460	361	326	519	622	2530	7030				994	755
MIN	368	287	256	300	409	477	1750				594	460

*** DAILY DISCHARGE ***

YEAR : 1975 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	472	440	383	330	603	567		3950	2960	2320	1010	670
2	468	452	372	337	580	536		4320	3470	2170	994	665
3	660	432	358	365	531	540		10690	3870	2010	988	655
4	531	425	354	354	510	755		7310	4250	2180	988	650
5	497	421	347	409	489	734		5070	3900	2130	982	641
6	477	417	347	405	448	724		4950	4170	2000	982	636
7	472	425	354	485	481	755		3860	6090	2290	982	627
8	468	421	396	460	493	760		3360	8860	1920	976	617
9	464	417	402	440	549	786		3040	7070	2050	970	612
10	464	425	368	402	549	862		2830	5470	1830	970	599
11	472	402	354	354	636	567		2890	4230	1810	970	589
12	448	417	330	333	622	765		3200	3790	1740	970	585
13	440	383	333	326	660	959		2710	3590	1720	952	576
14	448	405	323	372	760	1160		2760	5930	1630	935	571
15	448	409	320	337	699	1480		2630	4840	1580	924	567
16	440	398	316	316	765	2560		2620	4450	1560	901	562
17	432	390	306	330	502	2230		2670	4250	1530	878	558
18	432	383	303	323	622	1880		2720	3900	1510	851	553
19	429	365	306	337	750	2800		2680	4450	1480	835	553
20	432	376	313	330	646	2970		2780	3180	1470	818	549
21	421	354	330	347	631	4730		2590	4370	1410	792	545
22	429	402	326	448	594	3936		2500	3940	1360	771	545
23	440	372	333	460	627	3199		2760	3060	1330	750	536
24	421	365	313	531	689	2551		3100	2510	1300	734	527
25	429	372	340	567	840	2040	4320	7470	2440	1280	719	523
26	425	358	333	523	873	2030	5850	4520	2270	1260	714	523
27	421	351	316	622	684	7450	6710	3350	2530	1230	714	519
28	417	368	313	545	571	9860	6940	2750	2780	1180	709	519
29	413		303	627	536	6860	6030	2560	3000	1100	689	514
30	417		330	617	599	8500	4640	2330	2550	1070	675	514
31	440		351		650		4400	2550		1040		510
MEAN	454	398	336	421	619	2518		3662	4072	1629	871	575
MAX	660	452	402	627	873	9860		10690	8860	2320	1010	670
MIN	413	351	303	316	448	536		2330	2270	1040	675	510

*** DAILY DISCHARGE ***

YEAR : 1976 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	549		365	405	247	622	2460	3000	3970	1580		
2	506		351	405	296	924	1950	3070	3440	1510		
3	502		351	405	296	813	2660	2980	3540	1480		
4	502	372	351	405	330	924	2460	2460	3680	2360		
5	497	358	358	405	296	813	2460	2440	4230	2340		
6	493	358	351	405	540	1260	1950	2450	4400	2240		
7	493	368	351	405	330	1340	1950	2450	3980	2220		
8	489	372	351	405	296	1200	1650	3140	4540	2290		
9	489	365	347	405	296	1530	890	3140	2930	2230		
10	489	365	347	405	296	2510	879	3140	2890	2250		
11	485	365	351	405	296	4150	1320	3140	2260	2050		
12		365	347	405	241	4030	890	3140	2460	2180		
13		365	347	405	241	4030	890	3140	2710	1970		
14		365	347	405	247	4030	1510	3140	2750	1900		
15		365	347	405	247	4030	3590	3140	2760	1900		157
16		361	347	409	247	1210	1950	3140	2350	1900		159
17		361	358	409	247	1230	5450	4230	2290			293
18		358	358	409	247	1240	4710	3390	2240			290
19		358	413	409	247	1240	2930	4100	2180			280
20		358	409	409	247	2150	2760	3170	2160			296
21		358	409	361	293	1270	2700	3210	1950			293
22		354	405	368	262	1240	2550	3180	1840			287
23		351	405	368	247	1270	2680	3180	1790			280
24		354	405	368	262	1950	2670	6030	1720			213
25		354	405	372	585	1400	2670	4450	1650			194
26		358	405	372	585	1400	2850	3710	1630			268
27		351	405	372	585	2120	3000	3700	1720			150
28		351	405	368	398	2306	3000	3900	1650			210
29		351	405	280	585	2560	3000	3820	1560			213
30	379		405	540	617	1950	3000	2660	1490			183
31	379		405		617		3000	2400				186
MEAN			374	396	347	1891	2465	3298	2625			
MAX			413	540	617	4150	5450	6030	4540			
MIN			347	280	241	622	879	2400	1490			

*** DAILY DISCHARGE ***

YEAR : 1977 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	210	166	316	316	684	1240	2260	5040			813	506
2	183	161	280	323	372	679	2070	4330			802	497
3	169	150	268	326	402	1280	2240	6540			857	502
4	213	161	271	323	734	1410	2300	8270			1100	497
5	250	161	280	358	576	1200	3060	4980			982	502
6	268	159	280	323	760	1090	3060	4680			797	502
7	287	159	277	316	760	1170	3000	4170		1290	781	523
8	271	157	284	313	734	1110	3100	5130		1180	558	481
9	238	159	287	347	576	994	3650	4350		1170	603	493
10	215	159	290	358	402	1040	4370	4420		1070	734	464
11	262	169	290	358	745	1030	4180	5320		1220	760	456
12	232	221	290	358	684	947	3140	4170		1200	740	448
13	232	280	290	684	734	846	3920	6970		1110	684	460
14	271	358	347	660	709	519	4030	9660		964	689	460
15	274	358	347	694	760	1050	3744	9230		982	675	452
16	241	358	344	684	750	970	3470			1140	631	444
17	238	354	310	709	694	935	3470			1010	627	440
18	232	354	326	603	699	964	3670			970	631	425
19	232	354	326	679	340	941	4180			982	612	440
20	232	354	323	689	699	1300	4860			947	585	409
21	227	351	344	472	670	1180	5130			935	576	394
22	229	351	358	699	709	1790	4180			924	576	376
23	224	351	347	468	750	1950	4270			884	567	394
24	224	313	344	218	771	1860	4540			857	567	394
25	229	310	351	271	750	1860	4450			824	567	394
26	207	293	354	709	402	2010	4640			813	567	394
27	221	290	354	760	402	2090	5090			813	567	405
28	196	287	358	734	402	1930	4420			824	562	402
29	194		358	734	421	1840	3950			824	540	440
30	183		323	650	1200	2120	4770			797	502	421
31	178		323		1280		3160			464		417
MEAN	228	261	317	505	664	1312	3754				675	446
MAX	287	358	358	760	1280	2120	5130				1100	523
MIN	169	150	268	218	340	519	2070				502	376

*** DAILY DISCHARGE ***

YEAR : 1978 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	405	306	290	340	622	1400	3680	6920	2270	2010	935	506
2	390	290	287	306	636	1270	3260	6920	2170	1820	918	531
3	409	296	293	300	689	1230	3300	5990	2080	1730	947	585
4	402	293	287	310	835	1160	3010	5870	2390	1650	924	549
5	402	280	296	303	665	1170	3300	6480	2490	1770	924	456
6	398	284	290	310	771	1330	5000	5640	2390	2460	901	510
7	398	287	277	310	781	1440	4570	4790	2590	2100	868	489
8	387	323	271	310	750	1740	6400	5760	2720	1820	857	481
9	383	330	266	326	813	1990	5300	7650	2750	1720	835	485
10	372	306	274	347	896	1960	4950	5600	2800	1630	835	497
11	368	296	290	361	635	1840	4250	7510	3110	1540	846	440
12	361	296	340	356	771	1510	4890	7830	2410	1490	689	421
13	361	296	413	365	792	1510	4856	6360	2700	1450	675	405
14	379	303	337	514	884	1550	4856	4770	4070	1400	670	429
15	368	296	310	589	1150	1530	4800	3980	3350	1370	670	440
16	802	296	310	549	1390	1750	8430	3510	2900	1310	627	429
17	351	303	303	558	1300	1720	5450	3860	2620	1300	622	417
18	344	330	365	622	1200	2010	4930	4300	2390	1260	612	417
19	337	368	413	589	1120	2540	4130	4170	3380	1240	594	405
20	330	351	358	540	1090	2310	4500	3590	2680	1200	489	402
21	323	323	310	456	1140	1980	4680	3260	2270	1170	540	402
22	320	296	303	432	1260	2530	4230	3440	2140	1230	603	402
23	365	296	316	425	1180	2530	4980	3920	1840	1150	585	398
24	354	296	323	432	1090	2670	4820	3650	2000	1090	594	383
25	337	296	303	464	930	3030	5300	3450	2050	1070	558	394
26	333	290	306	466	1010	3230	4020	3390	2050	1110	558	387
27	330	293	300	448	1140	2760	3650	3000	2440	1020	585	379
28	323	287	296	481	1150	3230	5600	2630	2490	1040	540	365
29	310		296	589	1140	3780	6110	2450	2170	1030	527	365
30	323		313	523	1040	4590	5060	2290	2090	1050	527	365
31	340		344		1190		4890	2400		970		361
MEAN	374	304	313	431	976	2110	4742	4690	2527	1426	702	435
MAX	802	368	413	622	1390	4590	8430	7830	4070	2460	947	585
MIN	310	280	266	303	622	1160	3010	2290	1840	970	489	361

*** DAILY DISCHARGE ***

YEAR : 1979 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	354	271	235	274	425	326	2740	4220	3450	1090	750	704
2	351	271	229	229	432	351	2870	4200	2660	1190	745	549
3	330	265	229	229	493	330	2750	5740	3780	1190	699	527
4	337	259	227	259	500	235	1790	4450	4220	1390	670	523
5	337	253	229	265	468	405	1650	4610	4130	1370	646	523
6	323	256	224	247	405	390	2300	3390	3140	1190	627	440
7	333	265	235	235	379	398	1360	3040	2640	1260	617	440
8	323	277	229	229	323	417	1550	7200	2500	1390	622	432
9	320	323	274	238	372	540	824	3870	2380	1150	617	425
10	310	287	227	265	413	489	1630	3940	2560	1250	608	421
11	316	277	221	284	432	493	2320	3710	2740	1260	594	409
12	316	271	224	293	432	571	2410	4660	2380	1480	594	402
13	316	284	218	316	514	797	2510	3650	2000	1320	567	394
14	310	277	213	284	489	709	2660	4770	1910	1200	562	383
15	310	265	229	287	489	959	3100	4730	1750	1220	558	390
16	313	253	213	351	1010	755	3260	3440	1670	1050	549	387
17	316	253	213	316	675	622	2420	3140	1700	1020	549	379
18	316	247	224	303	549	627	2910	3110	1990	988	549	372
19	310	250	218	284	460	729	2350	2980	1460	994	540	372
20	310	253	207	287	429	1040	1970	4380	1380	913	540	365
21	310	290	207	320	477	1220	2600	8500	1410	873	531	351
22	310	306	213	296	562	1100	3060	6170	1310	824	523	351
23	296	274	207	306	421	1120	3390	4350	1280	846	514	347
24	303	265	213	303	361	1430	7920	3820	1230	824	497	344
25	284	244	196	250	330	1440	5280	3130	1200	835	493	340
26	280	235	196	296	310	1530	4030	3140	1170	846	481	337
27	296	235	202	313	306	1810	3840	3980	1140	835	481	323
28	271	247	196	347	316	1980	3920	3380	1120	781	472	323
29	274		199	365	300	2160	5110	3260	1120	776	477	316
30	277		207	432	287	2080	4910	3080	1130	760	641	323
31	265		235		300		4120	3170		755		365
MEAN	310	266	217	289	441	902	3011	4168	2085	1060	577	405
MAX	354	323	235	432	1010	2160	7920	8500	4220	1480	750	704
MIN	265	235	196	224	287	235	824	2980	1120	755	472	316

*** DAILY DISCHARGE ***

YEAR : 1980 UNIT : CMS

	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
1	344	232	247	207	277	510	2490		5760	1730	781	481
2	344	232	271	204	224	689	3350		4400	1690	760	477
3	320	227	236	202	429	594	2530		3900	1710	755	472
4	316	253	235	204	440	792	2200		3080	1490	771	464
5	316	250	241	204	523	714	2030		3840	1410	745	452
6	310	241	247	207	523	704	2700		8010	1430	729	440
7	316	227	284	215	523	781	2000		5890	1410	719	432
8	313	227	244	210	481	868	3210		6320	1440	709	432
9	303	224	227	236	432	4820	3110		4570	1390	699	425
10	296	221	229	247	456	2000	4120		5410	1260	684	417
11	287	227	229	236	497	1320	4130		3350	1240	679	409
12	280	224	213	229	440	1690	2860		3000	1250	660	402
13	277	215	199	256	372	1480	2550		3590	1210	650	394
14	277	218	210	253	358	1260	3570		3060	1160	641	387
15	271	213	204	250	379	1170	3530		2890	1140	631	387
16	271	215	202	250	417	1150	4640		2670	1100	585	379
17	271	227	213	244	405	1040	4380	3110	2530	1070	571	387
18	265	227	207	224	417	1100	4070	3140	2590	1070	599	376
19	259	213	196	244	444	1100		2830	2490	1050	603	372
20	265	218	204	290	489	1070		2780	2350	1030	585	379
21	259	213	202	351	531	1440		3260	2800	1010	576	372
22	259	213	215	477	636	1530		4170	2440	982	576	361
23	253	213	253	558	502	1570		3840	2190	970	562	358
24	247	241	241	390	448	1720		4200	2090	970	531	351
25	253	241	213	394	489	1950		3710	1930	982	523	344
26	247	221	218	394	527	1810		3560	1880	924	523	337
27	241	213	210	372	493	2290		3640	1810	884	519	326
28	244	218	204	337	425	2180		4540	1840	862	506	323
29	247	221	204	344	387	2070		2970	1790	840	497	316
30	232		202	337	402	2150		2910	1740	829	493	316
31	235		207		452			2390		813		323
MEAN	278	225	223	286	446	1452			3340	1172	629	390
MAX	344	253	284	558	636	4820			8010	1730	781	481
MIN	232	213	196	202	224	510			1740	813	493	316

ANNEX (D)

POWER DEMAND FORECAST

BY

CONSUMER SECTOR

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

I. OBJECTIVE AND METHODOLOGY APPLIED

1.1 Objective

The objective of this ANNEX (D) is to present the methodology, assumptions and procedures used in making the power demand forecast by consumer sectors which were carried out by HMG and referred in the Clause 3.3 of the Main Report. The JICA Team's view on this study is provided at the end of this ANNEX (D).

1.2 Methodology Applied

For the purpose of the power demand forecast, the consumers were divided into following five sectors.

(i) Industrial
(ii) Commercial
(iii) Irrigation
(iv) Domestic
(v) Street lighting, water supply and others

The sectoral power demand forecast was based on past data on the power demand, economic growths and potential projects projected in the 6th and 7th Five Year Plans which cover the periods from 1980/71 to 1984/85 and from 1985/86 to 1989/90, respectively. Among the projected economic growth, those having a significant influence on the power demand forecast are given below.

Economic Growth Projected in 6th and 7th Plans

	Item	6th Plan	7th Plan	Sector to be applied
(i)	Growth in non-agricultural GDP (%/year)	5.6	7.0	Industrial
(ii)	Growth in tourist arrivals (%/year)	15	15	Commercial
(iii)	Newly irrigated area (ha) (Groundwater & lift)	23,750	86,000	Irrigation
(iv)	Growth in domestic consumers (%/year)	8.2	8.2	Domestic, street lighting & others

In order to forecast the future energy requirement by the said consumer category, the following projection methods were used and the results were compared in the sectors where two different methods were applied.

	Method	Sector applied
(i)	Macro economic	Industrial, commercial & domestic
(ii)	Identification of potential projects or investments	Industrial & irrigation
(iii)	Forecast of domestic consumers and consumption rate	Domestic

The detail procedures used in forecasting energy requirement by the sector are described in the succeeding sections.

II. SECTORAL POWER DEMAND FORECAST

2.1 Industrial Demand

Energy sales to the industrial sector inclusive of those in the Kulekhani project increased at an annual rate of 25% for the period from 1970/71 to 1974/75 and 24% for the period from 1975/76 to 1979/80 as shown in Table-D.1. The industrial demand was firstly estimated by means of the macro-economic method in which the recorded relationship between the electricity sales to the sector and the non-agricultural GDP was used. Besides the macro-economic method, an alternative approach was made by relating the amount of investment to the total energy requirement for the industrial projects which are planned in the 6th and 7th Plans, and the results by these methods were compared.

(1) Macro-economic method

As stated, the industrial power demand was firstly examined based on the records of electricity sales to the industrial sector and of non-agricultural GDP, considering a relationship between these two indicators.

Based on the recorded data of the non-agricultural GDP and the energy consumption in the industrial sector, which are shown in Table-D.1 and Table-D.2 respectively, a logarithmic model representing the relation between these indicators was established as follows.

$$Sn = So \cdot \left(\frac{Gn}{Go}\right)^{a} = So \cdot \left(\frac{Gn}{Go}\right)^{3}$$

where, So : electricity sales in the base year
Gn, Go : non-agricultural GDP in year n and base year, and
a : elasticity value which is estimated to be 3.0 based on the historical data

The annual growth rate of the non-agricultural GDP was projected at 5.6% in the Sixth Plan (from 1980/81 to 1984/85) and 7.0% in the Seventh Plan (from 1985/86 to 1989/90) respectively.

Applying the annual growth rates of non-agricultural GDP projected in the Sixth and Seventh Plans on the established logarithmic model, the annual growth rates of energy consumption in the industrial sector were estimated as shown below:

Period	Projected growth rate of non-agricultural GDP (%)	Estimated consumption growth rate in industrial sector (%)
1980/81 - 1984/85	5.6	17.8
1985/86 - 1989/90	7.0	22.5

From the above figures, the energy requirement in the industrial sector for the period were calculated as shown in Table-D.3, assuming that the energy loss ratio to the energy consumption will gradually decrease from 40% in 1980/81 to 30% in 1989/90. The results of the analysis indicated a rapid growth of industrial energy requirement from around 60 GWh in 1979/80 to 488.9 GWh in 1989/90.

(2) Method by relating energy requirement to total investment

In the 6th and 7th Plans, a number of industrial projects were planned to be implemented as shown in Table-D.4. The start-up date, required energy and investment cost of the respective project are mentioned in the Table. An alternative approach of relating the energy requirement to the total investment was tried to make the demand forecast based on the identified potential project. This approach was made for confirmation of the forecast made by the macro-economic method.

In the analysis, the sector was sub-divided into industrial, construction and transportation sectors.

(i) New industries in the 6th Plan

The average power requirement per Rs Billion of the investment for the industrial projects likely to be developed in the 6th Plan was estimated to be 12.5 MW/Rs billion as shown in Table-D.5. According to HMG's plan, the total investment cost in the industrial sector in the 6th Plan is expected to amount to around Rs 1.2 billion. Accordingly, the power and energy requirements for the new industrial projects were

estimated to reach 15 MW and 66 GWh in 1984/85 assuming an energy loss ratio of 20%, load factor of 60% and capacity utilization ratio of 70%.

(ii) New industries in the 7th Plan

In the 7th Five Year Plan, certain industrial projects such as steel industry and nitrogen fertilizer projects will be more energy intensive, with higher ratio of energy requirement to investment. Hence, a ratio of 20 MW/Rs billion was assumed for the prediction of the power requirement. The anticipated total investment in the industrial sector for the Plan is around Rs 2.0 billion, around 75% higher than that in the 6th Plan. Then, the power and energy requirement in 1989/90 for the 7th Plan were estimated to be 40 MW and 218 GWh assuming a energy loss ratio of 20%, load factor of 65% and capacity utilization ratio of 80%.

(iii) Energy requirements for construction and transportation sectors

The Kulekhani hydroelectric project consumed 10 GWh in 1989/90 during its construction stage. In near future, some hydroelectric projects such as Kulekhani No.2, Marsyangdi are planned for implementation. Thus, the electricity consumption in the construction sector was assumed to reach 20 GWh in 1984/1985 and 40 GWh in 1989/90, by taking into account that these projects will be realized.

1.2 GWh was sold to the transportation sector which comprises the Kathmandu-Hetauda ropeway and the trolly-bus system. In the 6th Plan, these facilities are to be extended and upgraded to meet the increasing demand. In addition, the new ropeway lines in other regions than the Central Nepal, such as Bhojpur-Dankhuta (Eastern region), Jomsom-Baglung (Western) and Surkhet-Jumla (Far western) are now in the feasibility study stage and are expected to be constructed in the course of the 7th Plan. Taking into consideration these plans, the electricity consumption in the transportation sector was estimated to be 2.4 GWh in 1984/85 and 4.8 GWh in 1989/90.

(3) Comparison of two methods for industrial demand forecast

The energy requirement estimated by relating the energy requirement to the investment are summarized in Table-D.6. The total energy requirement in the industrial sector is derived to be 198 GWh in 1984/85 and 463 GWh in 1989/90. These figures concurred approximately with those

derived by the Macro-economic method shown in Table-D.3.

2.2 Commercial Demand

The large consumers in the commercial sector consist mostly of hotels. And it was recognized from the historical data on the growth of energy consumption in the commercial sector that there is a high correlation between the number of toursit arrivals and the energy consumption in the sector as seen on Fig.-D.1. As such, the demand forecast in the commercial sector was made based on the growth of tourist arrivals projected in the 6th and 7th Plans.

In the 6th and 7th Plans, it was projected that the recorded mean growth rate of 15% during the past 10 years will be maintained over the next 10 years. Based on the relation of a direct proportion between the tourist arrivals and energy consumption in the commercial sector, the demand forecast in the commercial sector was made as shown in Table-D.7. In the forecast, the energy loss rate was assumed to reduce from 39% in 1980/81 to 30% in 1989/90.

As seen in the Table, the energy requirement in the commercial sector was forecast to reach 42.7 GWh in 1984/85 and 82 GWh in 1989/90.

2.3 Irrigation Demand

In 1979/80, the irrigation sector consumed only 2 GWh. The small consumption was due to the poor progress of irrigation projects planned to be implemented in the previous Plan. Consequently, it is stressed in the 6th Plan to strongly promote the implementation of agricultural development. The irrigation projects both on-going and likely to be implemented in the 6th and 7th Plan which have a significance in electricity consumption, namely groundwater or lift scheme, are listed in Table-D.8.

The energy requirement for the operation of these irrigation projects were also estimated as shown in the Table based on the power requirement and implementation schedule presented in each feasibility study report, a load factor of 50%, energy loss ratio of 20% and coin-

cidence factor of 35%. As seen in the Table, the energy requirement in the irrigation sector is anticipated to reach 183.4 GWh in 1989/90.

2.4 Domestic Demand

Electricity sales to the domestic sector increased at an annual average rate of 13% for the period between 1970/71 and 1979/80 and 15% for the period between 1970/71 and 1978/79 as shown in Table-D.9. The number of domestic consumers has grown steadily at a rate of 10.2% for the period between 1970/71 and 1979/80. The average consumption per consumer for the period from 1975/76 to 1978/79 was estimated to be around 800 kWh/consumer, while it lowered in 1979/80 to 713 kWh/consumer due to the severe influence of load shedding. The demand forecast in the domestic sector were made by means of the macro-economic method and the method of projecting the number of consumers and the consumer's average consumption based on the historical data.

(1) Macro-economic method

Since the major part of the domestic consumers are in urban areas or in their neighbourhood, electricity sales to the sector are considered to have a correlation with non-agricultural GDP to a considerable extent.

The comparison of the respective evolution of domestic sales and non-agricultural GDP over the period 1970/71 to 1978/79 resulted in the following logarithmic relationship.

$$\underset{(GWh)}{\text{Sales}} = 2.48\ (\text{N.A.GDP})^{1.75}$$

where, N.A. GDP : Non-agricultural GDP in Rs. billion at 1974/75 price.

Applying the growth of non-agricultural GDP projected in the 6th and 7th Plans, the energy sales to the domestic sector was projected as shown in Table-D.11. As seen in the Table, the projected energy requirement in the domestic sector through the macro-economic method was 186.3 GWh in 1984/85 and 325.0 GWh in 1989/90.

(2) Consumer's average consumption method

The domestic demand was forecast by assuming that the number of domestic consumers will increase at an average growth rate of 8.2% and that the average consumption of 800 kWh/consumer/year which has been stagnant due to the load shedding will increase at a yearly increment of 20 kWh/consumer/year.

Assuming the gradual decrease of energy loss ratio from the current 40% to 30% in 1989/90, the energy requirement in the domestic sector is estimated to be 189 GWh in 1984/85 and 300 GWh in 1989/90 as shown in Table-D.10. These figures well coincide with those estimated by the macro-economic method.

2.5 Street Lighting, Water Supply and Other Requirements

A high correlation was observed between the sales of electricity for street lighting and the number of consumers in the domestic sector as shown in Table-D.9. Consumption for street lighting amounts to 20 kWh/consumer in average. This relationship was applied to the projected number of consumers to forecast the future requirements for street lighting.

It is reasonable to assume that water supply requirements will expand with the number of domestic consumers. Presently, the consumption for water supply is about 10 kWh/consumer, which was applied to the projected number of consumers to forecast the future requirements for water supply.

Self consumption of the utilities has been 1.5% of the energy requirements in average over the last five years. A similar figure was used for the future requirements.

Exports of electricity to India from the CNPS have been 6 GWh in average over the last five years. The forecast of the future requirement for exports was made assuming these will remain constant in the future.

Detailed calculation of the energy requirements for all the above sectors appears in Table-D.12. As seen in the Table, the energy requirement for the above was estimated to reach 32.2 GWh in 1989/90.

III. THE JICA TEAM'S VIEW FOR SECTORAL DEMAND FORECAST

The summary of the sectoral demand forecast made by HMG is given in Table-D.13. It is seen in the Table that the total energy requirement in Nepal will reach around 500 GWh in 1984/85 and 1,000 GWh in 1989/90.

The JICA Team's view on this forecast is as follows.

(1) The sectoral demand forecast is considered as a logical approach to estimate the future energy requirement, but it also relies on the assumption of the economic indicators concerning the future growths in non-agricultural GDP, tourist arrival, domestic consumers, etc. In view of the recent international economic situation, it is difficult to judge the reliability of the indicators assumed in this forecast, but, as a whole, the assumptions are not so optimistic and the estimated requirement of about 1,000 GWh in 1989/90 is not considered overestimated. However, as for the share of the requirement for each sector, it is judged that the requirement for the industrial sector is overestimated, while that for the domestic sector is underestimated, eventually offsetting the overestimation.

(2) The energy requirement in the industrial sector was forecasted by two methods, i.e. the macro-economic method based on the growth of non-agricultural GDP and the method by relating the requirement to the investment for the potential industrial projects planned in the 6th and 7th Plans. The requirement estimated by these two methods indicated an approximate concurrence, being 450 to 500 GWh. However, this amount takes more than 45% in the share of the total energy requirement and this seems to be excessive. Among the potential industrial projects and the required investments in the 6th and 7th Plans which are shown in Table-D.4, the promising projects to be implemented with realistic background would be the Hetauda Cement Plan and the Magnesite Industry in the 6th Plan, and the Nitrogen Fertilizers Plant and Udaypur Cement Plant in the 7th Plan. Then, even if all of these projects are implemented, the total investment would be around 90% of that projected in the period of the 6th and 7th Plan or until 1989/90. Further, there is still a risk of deferment in implementation due to the

prevailing economic recession, resulting in less investment during the period of the Plan.

Therefore, in general, it seems that so far as the approach by relating the energy requirement to the investment is concerned, it would indicate less future energy demand and that this would happen more likely than that estimated by the macro-economic method.

(3) The energy requirement in the domestic sector was also forecasted by two methods, i.e. the macro-economic method and the method by assuming that the number of domestic consumers will increase at the average growth rate of 8.2% and that the average consumption rate of 800 kWh/consumer/year will gradually increase at a yearly increment of 20 kWh/consumer/year based on the past records of energy consumption. This projection is judged to be rather conservative.

In the domestic sector, it is generally recognized that the demand has been suppressed due to the load shedding and suspension of new consumers' applications and that it will rapidly grow once the power generating capacity and distribution system are improved. This tendency is endorsed by the fact that the power demand in CNPS jumped up from 35 MW to 56 MW immediately after the completion of the Kulekhani No.1 Project and reinforcement of the Kathmandu distribution system. HMG plans to reinforce the power supply capacity by a series of hydropower development such as the Devighat Project, Kulekhani No.2 Project and Marsyangdi Project, etc. and also to expand the power transmission system to the eastern and western regions. Besides, further improvement of the Kathmandu distribution system is planned. The electrification plan in the rural area is also to be materialized in the near future.

Such being the situation and also because of the fact that the growth rate of the number of domestic consumers for the past 10 years until 1979/80 was 10.2% on an average, the number of consumers is anticipated to increase at a growth rate higher than 8.2%. The consumption rate of 800 kWh/consumer/year is also anticipated to increase at a yearly increment of more than 20 kWh/consumer/year.

With the above in view, it is considered that the requirement in the domestic sector estimated by HMG is rather moderate and that the share of the requirement for this sector would be more or less the same as that for the industrial sector.

TABLES

Table-D.1: HISTORICAL ENERGY CONSUMPTION IN INDUSTRIAL SECTOR

a) Nation-Wide Sales - 1970/71 to 1979/80

Fiscal Year	Recorded Sales (MWh)	Less Irrigation, Water Supply (MWh)	Plus Kulekhani (MWh)	Adjusted Sales (MWh)
1970/71	8,732	200/1	-	8,732
1971/72	10,714	300/1	-	10,414
1972/73	13,908	400/1	-	13,508
1973/74	15,757	500/1	-	15,257
1974/75	21,397	638	-	20,759
1975/76	32,128	939	-	31,189
1976/77	39,036	1,313	-	37,723
1977/78	42,751	2,548	-	40,203
1978/79	47,827	1,884	3,900	49,843
1979/80	52,089	2,741	10,820	60,168

Note: /1; Estimated

b) Region Distribution of Sales - 1979/80

	Nepal	Region			
		Eastern/1	CNPS	West-ern	Far-Western & Fifth
Reocrded Sales (MWh)	52,089	14,569	31,087	4,376	2,057
Less Irrigation, Water Supply (MWh)	2,741	-	2,474	267	-
Plus Kulekhani (MWh)	10,820	-	10,820	-	-
Adjusted Sales (MWh)	60,168	14,569	39,433	4,109	2,057
Percentage (%)	100	24	66	7	3

Note: /1; Including Janakpur, Gaur and Malangwa

Table-D.2: HISTORICAL DATA OF G.D.P.

Fiscal Year	Non-Agricultural GDP (Rs. Million)		Agricultural GDP (Rs. Million)		Total GDP (Rs. Million)	
	Current Price	74/75 Price	Current Price	74/75 Price	Current Price	74/75 Price
1970/71	2,904	4,309	-	-	-	-
1971/72	3,263	4,507	-	-	-	-
1972/73	3,391	4,677	-	-	-	-
1973/74	3,957	4,928	-	-	-	-
1974/75	5,021	5,021	11,550	11,550	16,571	16,571
1975/76	5,783	5,686	11,611	11,615	17,394	17,300
1976/77	6,774	6,680	10,506	11,141	17,280	17,822
1977/78	7,846	6,943	11,752	11,141	19,598	18,087
1978/79	8,862	7,288	12,290	11,480	21,152	18,765
1979/80	10,898	7,578	12,969	10,933	23,867	18,510

Table-D.3: ENERGY REQUIREMENT IN INDUSTRIAL SECTOR BY MACRO-ECONOMIC METHOD

Fiscal Year	Sectoral Growth Rate of Electricity Sales (%)	Sales (GWh)	Losses (%)	Energy Required (GWh)
1980/81	17.8	70.9	39	98.6
1981/82	17.8	83.4	38	115.1
1982/83	17.8	98.3	37	134.7
1983/84	17.8	115.7	36	157.4
1984/85	17.8	136.3	35	184.0
1985/86	22.5	167.0	34	223.8
1986/87	22.5	204.6	33	272.1
1987/88	22.5	250.6	32	330.8
1988/89	22.5	307.0	31	402.2
1989/90	22.5	376.1	30	488.9

Table-D.4: INDUSTRIAL PROJECTS IN THE 6TH AND 7TH PLANS

Projects	Location (System)	Anticipated Start-up Year (Fiscal Year)	Required Investment (Rs. Million)	Maximum Demand (kW)	Energy Required at Capacity (MWh)	Load Factor at Capacity (%)	Requirement in 1984/85 /2		Remarks
							Use of Capacity (%)	Energy (MWH)	
Sixth Plan									
(1) Hetauda Cement	Hetauda (CNPS)	1983/84	720	5,400	30,000*	63*	70	21,000	
(2) Magnesite Industry			230	3,500	13,800	45	80	11,000	
- Extraction	Kharidunga (CNPS)	1981/82							
- Dead Burnt Magnesia Plant	Lamosangu (CNPS)	1982/83							
- Magnesite Refractory Plant	Birganj (CNPS)	1983/84							
- Talc Plant	Lamosangu (CNPS)	1981/82							
(3) Lead and Zinc	Ganesh Himal (CNPS)	1983/84	96	2,000*	7,825*	45*	70	5,500	
(4) Pilot Foundry	Patan (CNPS)	1983/84	28	660*	3,800	65	70	2,700	
(5) Printing Paper Plant	Bharatpur (Western)	-	120	1,500	7,900	60	60	4,800	
(6) Starch and Glucose	Hetauda (CNPS)	-	16	700*	3,700	60	70	2,600	

- to be continued -

Projects	Location (System)	Anticipated Start-up Year (Fiscal Year)	Required Investment (Rs. Million)	Maximum Demand (kW)	Energy Required at Capacity (MWh)	Load Factor at Capacity (%)	Requirement in 1984/85 /2 Use of Capacity (%)	Requirement in 1984/85 /2 Energy (MWH)	Remarks
(7) Minor Projects /1	Hetauda	-		410*	2,200*	61*	60	1,300	
Total			1,210	14,170	69,225	56		48,900	
Seventh Plan									
(1) Steel Industry	Hetauda (CNPS)	-	885	30,000	206,000	-	-	-	
(2) Nitrogen Fertilizers	- (CNPS)	-	900-1,200	43,000	-	-	-	-	
(3) Cement Plant	Udayapur (Eastern)	-	1,290	16,500	-	-	-	-	
Total			3,075-3,375	89,500					

Note: /1; Resin and Turpentine plant, lime plant and silica brick industry.

/2; The Department of Mining and Geology reckons that a project operation at 60% during the first year and gradually reaching capacity within 5 years.

*; Extracted from feasibility reports. Others figures are estimated.

Table-D.5: RELATION BETWEEN POWER REQUIREMENT FOR POTENTIAL INDUSTRIAL PROJECTS IN THE 6TH FIVE YEAR PLAN

Industrial Sectors	Number of Projects (Nos.)	Power Required (MW)	Investment Cost (Rs. Billion)	Power/Investment Ratio (MW/Rs. Billion)
Non-metallic Minerals	93	26.8	2.18	12.3
Wood, Paper	36	8.7	0.65	13.4
Textile	27	5.7	0.48	12.0
Metal Processing	6	3.6	0.09	38.8
Others	95	3.8	0.50	7.6
Total	157	48.6	3.90	12.5

Table-D.6: ENERGY REQUIREMENT IN INDUSTRIAL SECTOR BY RELATING ENERGY REQUIREMENT TO TOTAL INVESTMENT

Industrial Sub-sector	Energy Requirement		
	1979/80	1984/85	1989/90
1) Industry			
- Existing Consumers /1	68	102	102
- New Industries in 6th Plan /2	-	66	85
- New Industries in 7th Plan	-	-	218
(Sub-total)	(68)	(168)	(405)
2) Construction	14 /3	27 /4	52 /5
3) Transportation	2 /3	3 /4	6 /5
Total	84	198	463

Note: /1; A capacity factor is assumed to be 60% in 1979/80 and 90% in 1984/85 and onward.

/2; A capacity factor is assumed to be 90% in 1989/90.

/3; Loss of 40% is added.

/4; " 35% " .

/5; " 30% " .

Table-D.7: ENERGY REQUIREMENT IN COMMERCIAL SECTOR

Fiscal Year	Electricity Sales (GWh)	Energy Losses (%)	Energy Requirement (GWh)
1980/81	18.2	39	25.3
1981/82	20.8	38	28.7
1982/83	23.9	37	32.7
1983/84	27.4	36	37.3
1984/85	31.6	35	42.7
1985/86	36.2	34	48.5
1986/87	41.6	33	55.3
1987/88	47.8	32	63.1
1988/89	55.0	31	72.1
1989/90	63.1	30	82.0

Table-D.8: ENERGY REQUIREMENT IN IRRIGATION SECTOR

Irrigation Project	Region	Project (MW)	Yearly Peak Demand (MW)									
			1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90
Battar lift	Central	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
Birganj	Central	1.02	.95	1.00	1.05	1.0	1.15	1.20	1.20	1.20	1.20	1.20
Lumbini I	Western	2.55	-	.85	1.70	2.55	2.55	2.55	2.55	2.55	2.55	2.55
Kailali	Fifth	2.72	-	-	-	-	-	.20	.80	1.67	2.38	2.67
Narayani lift	Central	6.51	-	-	-	4.70	6.51	6.51	6.51	6.51	6.51	6.51
Rajbiraj	Eastern	4.17	-	-	-	-	-	1.04	3.13	4.17	4.17	4.17
Marchuwar	Western	.79	-	-	-	-	-	.20	.41	.41	.41	.41
Lumbini II	Western	2.55	-	-	-	-	.19	.75	1.57	2.23	2.50	2.55
Sagaramatha	Eastern	5.61	-	-	-	.17	.62	1.18	2.02	2.97	3.98	4.77
Prospective groundwater	..	10.88	-	-	-	-	-	.32	1.20	2.28	3.92	5.77
Prospective lift	..	6.53	-	-	-	-	-	.65	1.31	1.96	2.61	3.27
Total		44.35	2.0	2.9	3.8	9.5	12.0	15.7	21.7	27.5	31.2	34.9
After diversity M.D. (MW)/1			.8	1.2	1.5	4.0	5.0	6.6	9.1	11.3	13.1	14.7
Energy requirements (GWh)/2			10.5	15.2	20.0	49.9	63.1	82.5	114.1	141.4	164.0	183.4

Note: /1; Assuming a coincidence factor of 35% and technical losses of 20%.

/2; Assuming a load factor of 50% and technical losses of 20% of requirements.

Table-D.9: HISTORICAL ENERGY CONSUMPTION IN DOMESTIC SECTOR

a) Sales and Consumers

Fiscal Year	Sales (MWh)	Consumers (Nos)	Average Consumption (kWh/consumer)
1970/71	24,866	43,867	567
1971/72	32,918	52,422	628
1972/73	38,775	63,379	612
1973/74	47,710	66,331	719
1974/75	54,090	71,351	758
1975/76	61,787	76,717	805
1976/77	65,679	81,948	802
1977/78	71,348	89,348	799
1978/79	77,221	96,489	800
1979/80	74,823	104,905	713

b) Regional Distribution

	Region			
	Eastern	Central/1	Western	Far-Western
i) Sales (MWh)				
1970/71	1,630	22,826	410	-
1979/80	8,086	57,971	5,636	3,130
ii) Consumers (Nos)				
1970/71	2,120	40,550	1,197	-
1979/80	13,937	76,959	9,531	4,478
iii) Average Consumption (kWh/cons)				
1970/71	769	563	343	-
1978/79	724	830	645	841
1979/80	580	753	591	699

Note: /1; CNPS only; Janakpur, Gaur, Malangawa are included in Eastern Region.

Table-D.10: ENERGY REQUIREMENTS IN DOMESTIC SECTOR

Fiscal Year	Consumers /1 (10^3)	Average Consumption /2 (kWh/consumer)	Sales (GWh)	Losses (% of Sales)	Generation Requirements (GWh)	After Diversity /3 Maximum Demand (MW)
1979/80 (Base)	105.0	800		40		
1980/81	113.6	820	93.2	39	129.5	36.9
1981/82	122.9	840	103.2	38	142.5	40.7
1982/83	133.0	860	114.4	37	156.7	44.7
1983/84	143.9	880	126.6	36	172.2	49.2
1984/85	155.7	900	140.1	35	189.2	54.0
1985/86	168.5	920	155.0	34	207.7	59.3
1986/87	182.3	940	171.4	33	227.9	65.0
1987/88	197.3	960	189.4	32	250.0	71.4
1988/89	213.4	980	209.1	31	274.0	78.2
1989/90	230.9	1,000	230.9	30	300.2	85.7

Note: /1; 8.2% annual growth

/2; 20/kWh yearly increment

/3; 40% group load factor, 100% coincidence factor

Table-D.11: FORECAST SALES TO DOMESTIC SECTOR BY MACRO-ECONOMIC METHOD

Fiscal Year	Non-Agricultural GDP (Rs. Billion, 1974/75 Price)	Sales (GWh)	Assumed Loss (%)	Generation Requirement (GWh)
1980/81	8.00	94	39	130.7
1981/82	8.45	104	38	143.5
1982/83	8.93	114	37	156.2
1983/84	9.43	125	36	170.0
1984/85	9.45	138	35	186.3
1985/86	10.65	155	34	207.7
1986/87	11.40	175	33	232.8
1987/88	12.19	197	32	260.0
1988/89	13.05	223	31	292.1
1989/90	13.96	250	30	325.0

Table-D.12: ENERGY REQUIREMENT IN STREET LIGHTING, WATER SUPPLY AND OTHERS

Fiscal Year	Consumers (10^3)	Sales (MWH)			Generation Requirement for Street Light & Water Supply (GWh)	Self-Consumption (GWh)	Export /1 to India (GWh)	Total Required Energy (GWh)	After Diversity Maximum Demand (MW) /2
		Street Lighting	Water Supply	Assumed Loss (%)					
1980/81	113.6	2,270	1,140	39	4.8	4.0	7.2	16.0	4.6
1981/82	122.9	2,460	1,230	38	5.1	4.7	7.2	17.0	4.9
1982/83	133.0	2,660	1,330	37	5.5	5.5	7.2	18.3	5.2
1983/84	143.9	2,870	1,440	36	5.9	6.4	7.2	19.5	5.6
1984/85	155.7	3,120	1,560	35	6.3	7.3	7.2	20.8	5.9
1985/86	168.5	3,370	1,680	34	6.8	8.5	7.2	22.5	6.4
1986/87	182.3	3,650	1,830	33	7.3	10.0	7.2	24.5	7.0
1987/88	197.3	3,950	1,980	32	7.8	11.7	7.2	26.7	7.6
1988/89	213.4	4,270	2,130	31	8.4	13.7	7.2	29.3	8.4
1989/90	230.9	4,620	2,300	30	9.0	16.0	7.2	32.2	9.2

Note: /1; Including technical loss of 20%.
/2; Assumed load factor of 40%.

Table-D.13: SUMMARY OF ENERGY REQUIREMENT IN THE WHOLE NEPAL (SECTORAL DEMAND FORECAST)

Fiscal Year	Energy Requirement by Sector					
	(1) Industrial	(2) Commercial	(3) Irrigation	(4) Domestic	(5) Street Lighting & Others	Total
1980/81	98.6	25.3	10.5	129.5	16.0	279.9
1981/82	115.1	28.7	15.2	142.5	17.0	318.5
1982/83	134.7	32.7	20.0	156.7	18.3	362.4
1983/84	157.4	37.3	49.9	172.7	19.5	436.3
1984/85	184.0	42.7	63.1	189.7	20.8	499.8
1985/86	223.8	48.5	82.5	207.7	22.5	585.0
1986/87	272.1	55.3	114.1	227.9	24.5	639.9
1987/88	330.8	63.1	141.4	250.0	26.7	812.0
1988/89	402.2	72.1	164.0	274.0	29.3	941.6
1989/90	488.9	82.0	193.4	300.2	32.2	1,086.7

Table-D.14: TOURIST ARRIVALS AND HOTEL BEDS

Fiscal Year	Tourist		Hotel Beds	
	Number of Tourists (Nos.)	Growth Rate (%)	Number of Hotel Beds	Growth Rate (%)
1975/76	92,440	-	1,663	-
1976/77	105,108	13.7	2,099	26.2
1977/78	129,329	23.0	4,600	19.2
1978/79	156,123	20.7	4,888	6.3
1979/80	162,276	3.9	5,018	2.7

Source: Department of Tourism thru "Economic Survey" 1979/80, Ministry of Finance, 1980.

FIGURES

FIG- D.1

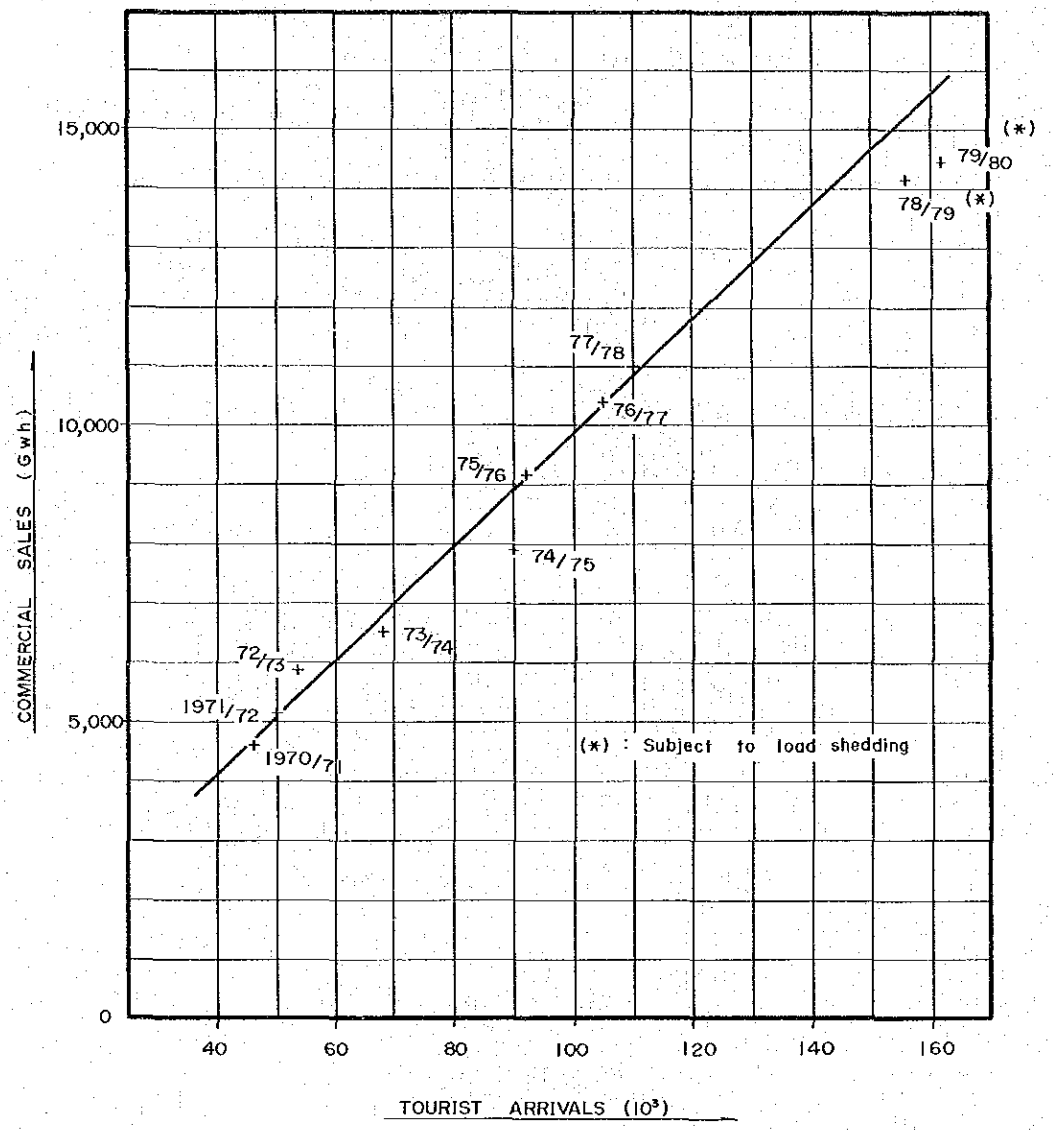


FIG- D.1 : COMMERCIAL CONSUMPTION VS TOURIST ARRIVALS (1970/71 TO 1979/80)

HIS MAJESTY'S GOVERNMENT OF NEPAL
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