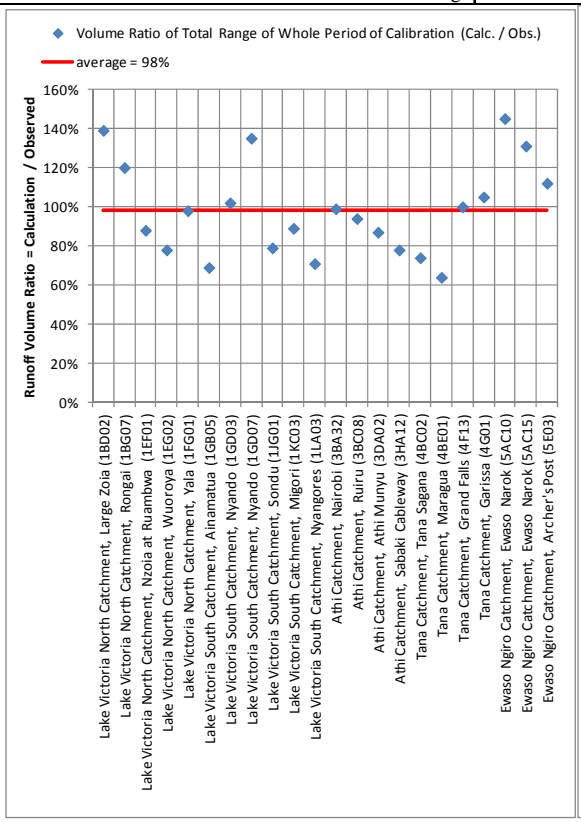
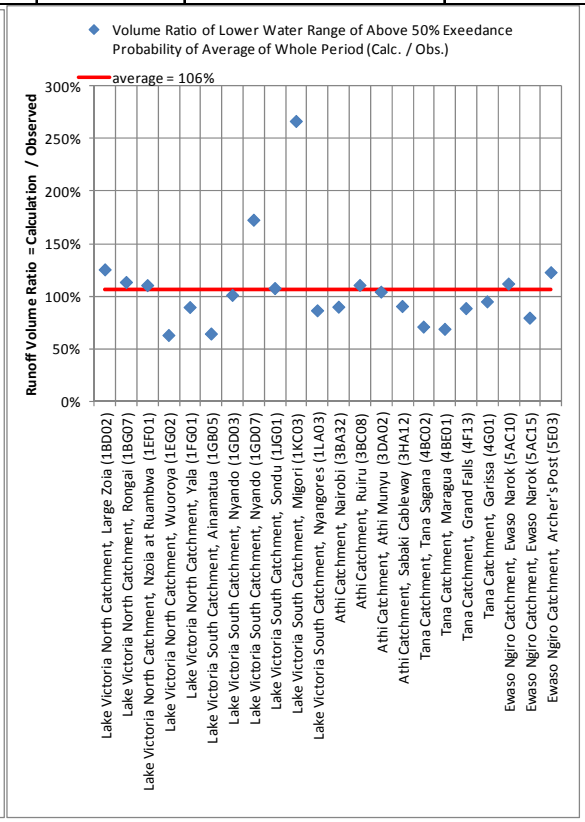
Nash Coefficient and Total Runoff Volume Ratio (Calculation / Observation)

Gauging Station	Nash Coef.	Volume Ratio of Total Range of Whole Period of Calibration (Calc. / Obs.)	Volume Ratio of Lower Water Range of Above 50% Exeedance Probability of Average of Whole Period (Calc. / Obs.)	Volume Ratio of Lower Water Range of Above 5 Exceedance Probability o Dry Year (Calc. / Obs.) [%
Lake Victoria North Catchment, Large Zoia (1BD02)	0.13	139%	125%	23
Lake Victoria North Catchment, Rongai (1BG07)	0.11	120%	113%	10
Lake Victoria North Catchment, Nzoia at Ruambwa (1EF01)	0.61	88%	110%	10
Lake Victoria North Catchment, Wuoroya (1EG02)	0.03	78%	63%	7
Lake Victoria North Catchment, Yala (1FG01)	0.57	98%	89%	8
Lake Victoria South Catchment, Ainamatua (1GB05)	0.27	69%	64%	10
Lake Victoria South Catchment, Nyando (1GD03)	0.57	102%	101%	18
Lake Victoria South Catchment, Nyando (1GD07)	0.45	135%	172%	24
Lake Victoria South Catchment, Sondu (1JG01)	0.53	79%	107%	10
Lake Victoria South Catchment, Migori (1KC03)	0.52	89%	266%	50
Lake Victoria South Catchment, Nyangores (1LA03)	0.38	71%	86%	7
Athi Catchment, Nairobi (3BA32)	0.44	99%	89%	12
Athi Catchment, Ruiru (3BC08)	0.19	94%	110%	17
Athi Catchment, Athi Munyu (3DA02)	0.59	87%	104%	18
Athi Catchment, Sabaki Cableway (3HA12)	0.23	78%	90%	12
Tana Catchment, Tana Sagana (4BC02)	0.48	74%	71%	17
Tana Catchment, Maragua (4BE01)	0.48	64%	68%	11
Tana Catchment, Grand Falls (4F13)	0.29	100%	88%	10
Tana Catchment, Garissa (4G01)	0.42	105%	95%	10
Ewaso Ngiro Catchment, Ewaso Narok (5AC10)	0.12	145%	112%	8
Ewaso Ngiro Catchment, Ewaso Narok (5AC15)	0.38	131%	79%	7
Ewaso Ngiro Catchment, Archer's Post (5E03)	0.19	112%	122%	11
Average	0.36	98%	106%	14

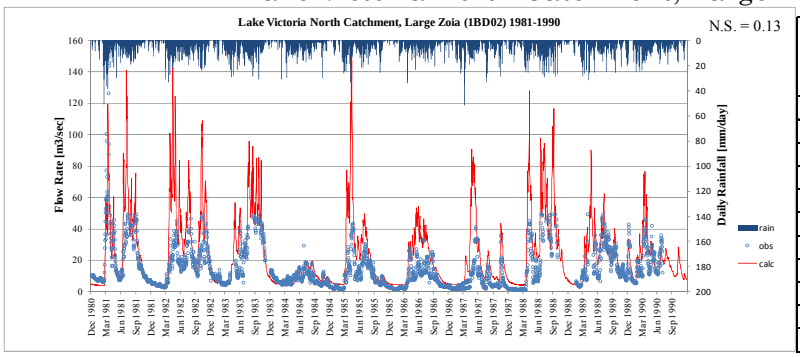




Source: JICA Study Team with original data from WRMA and MWI

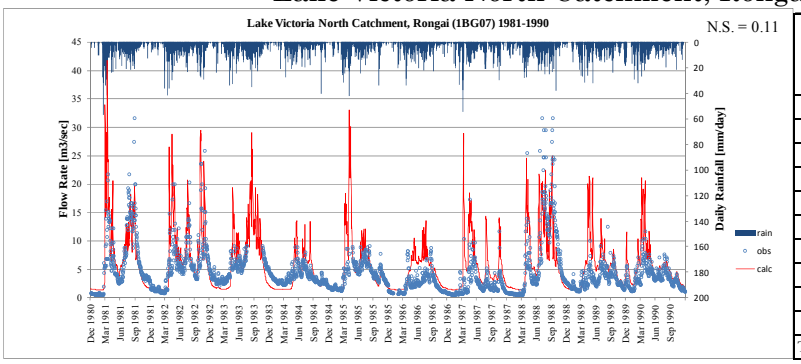
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.3.1 Summary of Calibration Result**
JAPAN INTERNATIONAL COOPERATION AGENCY	

Lake Victoria North Catchment, Large Zoia (1BD02)



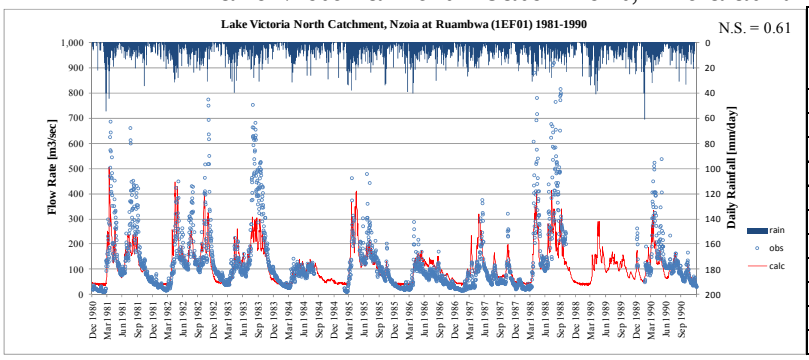
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	359.1	355.5	99%
1982	333.1	475.5	143%
1983	313.1	378.5	121%
1984	268.3	290.1	108%
1985	261.6	474.2	181%
1986	270.8	521.8	193%
1987	168.8	378.6	224%
1988	188.0	286.9	153%
1989	419.2	490.1	117%
1990	309.2	365.9	118%
Total	2891.1	4017.3	139%

Lake Victoria North Catchment, Rongai (1BG07)



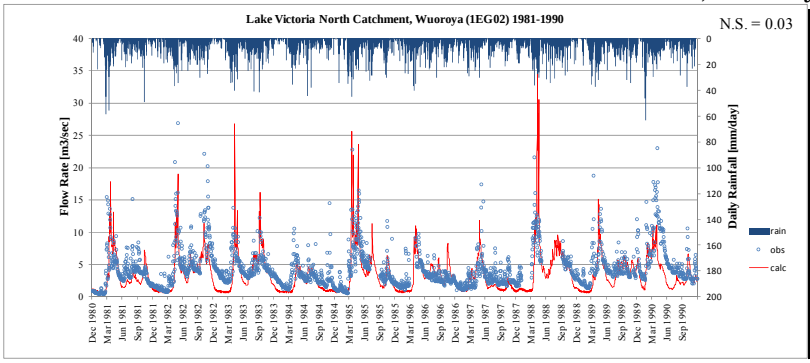
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	117.4	121.3	103%
1982	121.6	135.8	112%
1983	105.0	88.0	84%
1984	109.8	111.2	101%
1985	116.3	121.4	104%
1986	62.4	107.8	173%
1987	58.6	120.0	205%
1988	95.1	96.3	101%
1989	83.9	124.8	149%
1990	90.3	129.4	143%
Total	960.4	1156.0	120%

Lake Victoria North Catchment, Nzoia at Ruambwa (1EF01)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	4892.2	3768.9	77%
1982	4659.3	4388.3	94%
1983	5632.2	3975.3	71%
1984	1546.0	1610.1	104%
1985	3006.2	2726.2	91%
1986	2056.7	2745.6	133%
1987	2314.7	3089.9	133%
1988	5024.5	3583.4	71%
1989	0.0	0.0	-
1990	3731.2	3178.2	85%
Total	32863.0	29065.9	88%

Lake Victoria North Catchment, Wuoroya (1EG02)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	85.6	70.9	83%
1982	86.4	64.9	75%
1983	95.0	70.6	74%
1984	67.3	43.1	64%
1985	81.2	65.0	80%
1986	74.6	77.2	104%
1987	72.5	54.0	75%
1988	46.3	34.6	75%
1989	74.9	57.6	77%
1990	80.8	56.0	69%
Total	764.5	594.1	78%

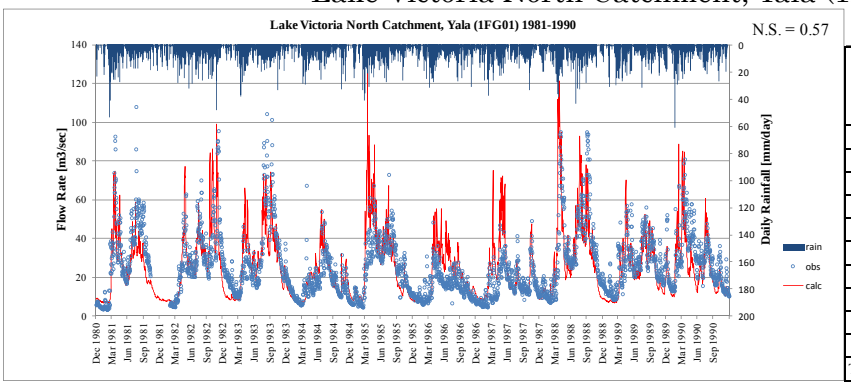
Note : N.S. (Nash coefficient)
Source: JICA Study Team with original data from WRMA and MWI

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

JAPAN INTERNATIONAL COOPERATION AGENCY

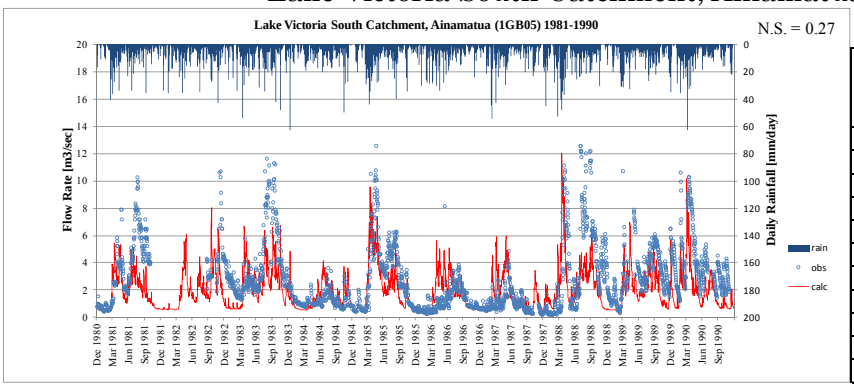
Figure 5.3.2 Comparison of Simulated Discharge and Observed Discharge (1/6)

Lake Victoria North Catchment, Yala (1FG01)



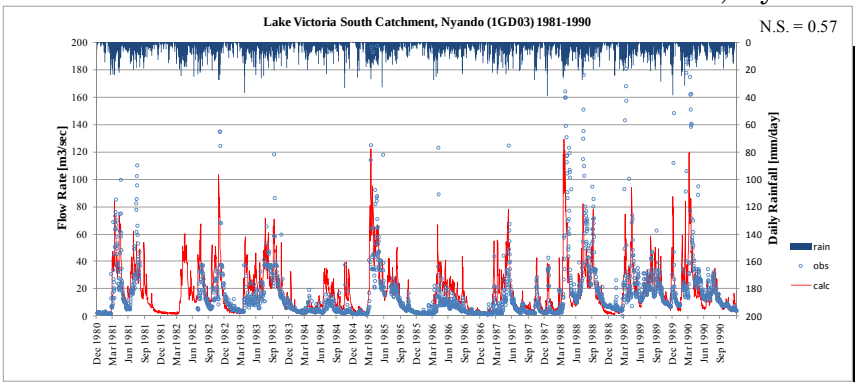
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	811.3	664.6	82%
1982	812.1	810.7	100%
1983	784.7	701.9	89%
1984	528.5	556.8	105%
1985	805.8	879.6	109%
1986	482.4	636.4	132%
1987	530.8	680.4	128%
1988	1000.3	911.1	91%
1989	829.4	713.2	86%
1990	931.6	792.3	85%
Total	7516.9	7347.1	98%

Lake Victoria South Catchment, Ainamatua (1GB05)



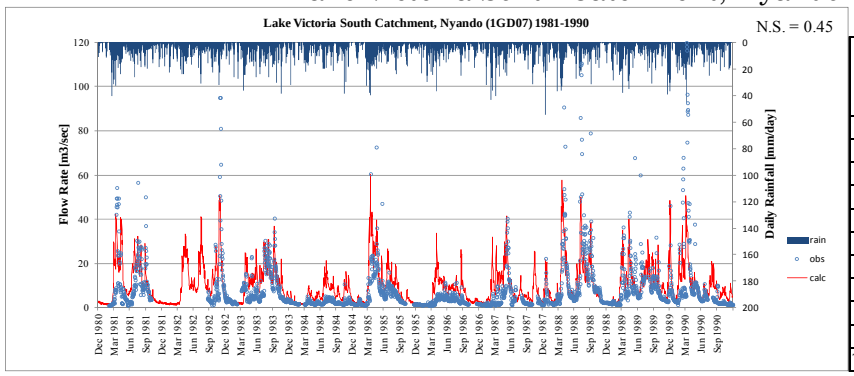
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	76.4	44.3	58%
1982	21.9	10.8	49%
1983	95.0	55.6	59%
1984	28.3	31.9	113%
1985	95.0	66.3	70%
1986	36.6	48.1	131%
1987	30.4	42.7	141%
1988	112.3	73.1	65%
1989	83.8	45.9	55%
1990	102.6	51.3	50%
Total	682.3	470.0	69%

Lake Victoria South Catchment, Nyando (1GD03)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	432.0	453.6	105%
1982	281.0	327.1	116%
1983	383.8	445.5	116%
1984	118.3	217.9	184%
1985	468.8	510.6	109%
1986	210.9	369.4	175%
1987	252.6	435.5	172%
1988	945.0	675.2	71%
1989	628.8	582.2	93%
1990	793.8	601.8	76%
Total	4514.9	4618.9	102%

Lake Victoria South Catchment, Nyando (1GD07)

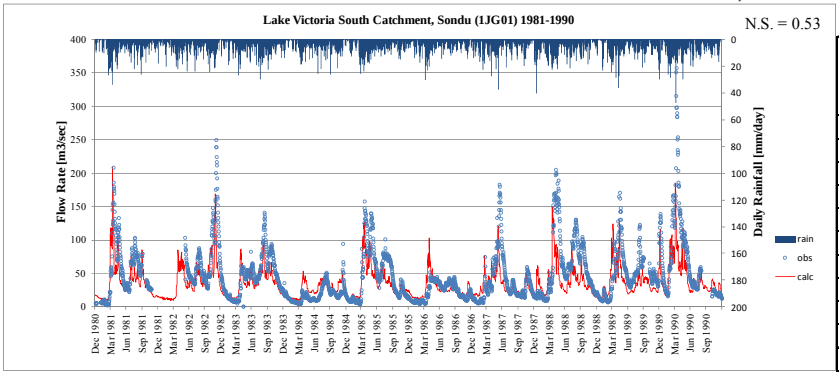


Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	226.6	314.6	139%
1982	121.4	132.8	109%
1983	243.9	333.5	137%
1984	71.5	184.8	259%
1985	198.3	331.5	167%
1986	83.6	198.6	238%
1987	115.0	227.8	198%
1988	418.7	386.2	92%
1989	254.3	306.5	121%
1990	297.0	324.4	109%
Total	2030.3	2740.8	135%

Note : N.S. (Nash coefficient)
Source: JICA Study Team with original data from WRMA and MWI

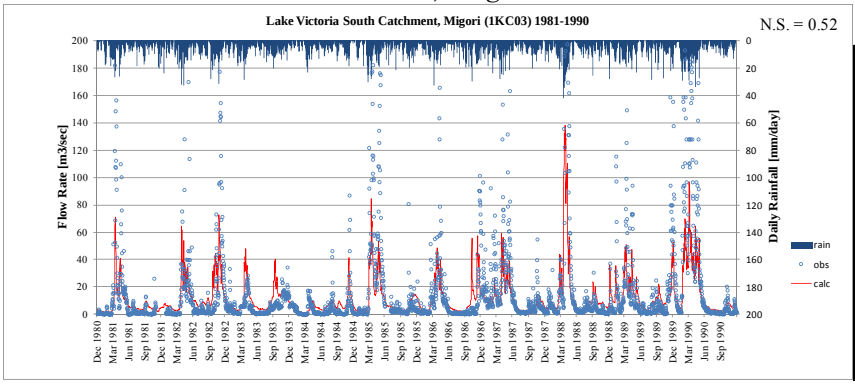
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.3.2 Comparison of Simulated Discharge and Observed Discharge (2/6)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

Lake Victoria South Catchment, Sondu (1JG01)



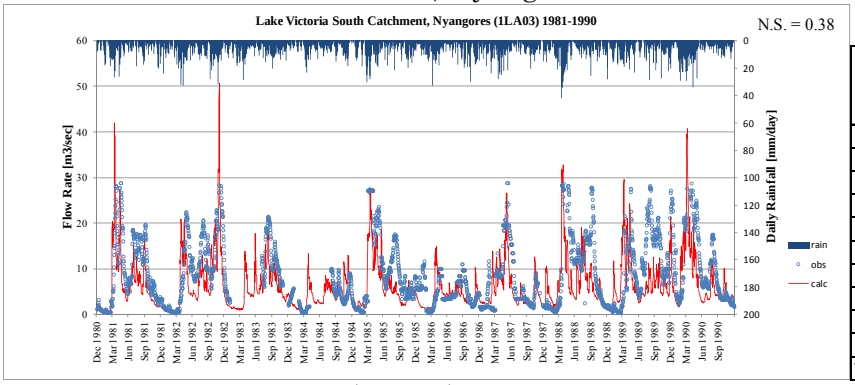
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	1243.9	971.0	78%
1982	1186.2	805.9	68%
1983	1418.2	1089.8	77%
1984	585.8	827.4	141%
1985	1498.7	1167.3	78%
1986	724.3	835.0	115%
1987	1183.7	981.7	83%
1988	1917.0	1232.9	64%
1989	1428.0	1038.3	73%
1990	1545.2	1112.4	72%
Total	12730.9	10061.6	79%

Lake Victoria South Catchment, Migori (1KC03)



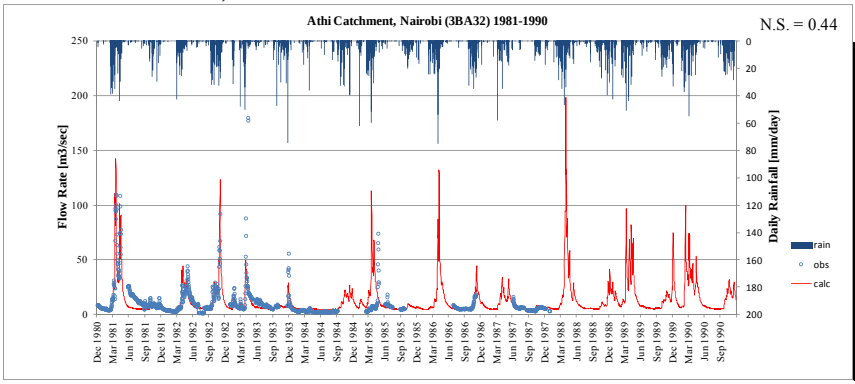
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	264.8	214.7	81%
1982	430.3	426.9	99%
1983	193.0	329.3	171%
1984	141.7	193.9	137%
1985	429.4	290.6	68%
1986	338.7	347.6	103%
1987	519.6	344.1	66%
1988	313.4	332.5	106%
1989	458.5	421.0	92%
1990	637.7	421.2	66%
Total	3727.1	3322.0	89%

Lake Victoria South Catchment, Nyangores (1LA03)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	267.3	181.5	68%
1982	293.9	205.8	70%
1983	143.4	98.1	68%
1984	75.5	79.4	105%
1985	307.4	204.9	67%
1986	154.2	134.8	87%
1987	187.8	149.2	79%
1988	279.4	182.9	65%
1989	325.9	220.8	68%
1990	299.4	198.9	66%
Total	2334.4	1656.3	71%

Athi Catchment, Nairobi (3BA32)

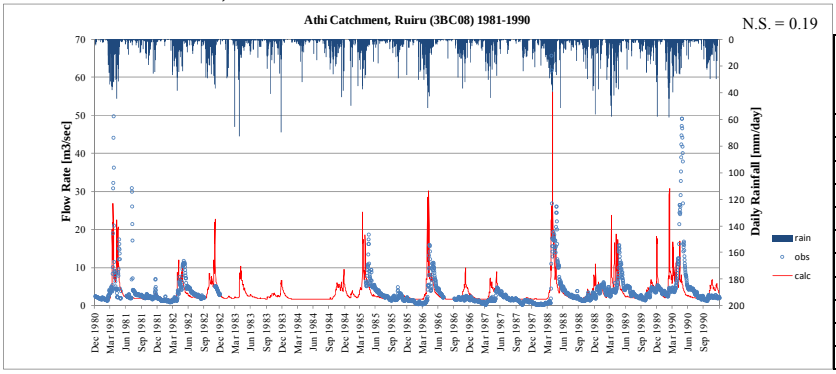


Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	460.8	351.2	76%
1982	328.7	324.6	99%
1983	273.2	218.2	80%
1984	74.4	122.8	165%
1985	111.0	225.0	203%
1986	80.4	74.2	92%
1987	87.4	91.1	104%
1988	2.6	3.6	140%
1989	-	-	-
1990	-	-	-
Total	1418.6	1410.7	99%

Note : N.S. (Nash coefficient)
Source: JICA Study Team with original data from WRMA and MWI

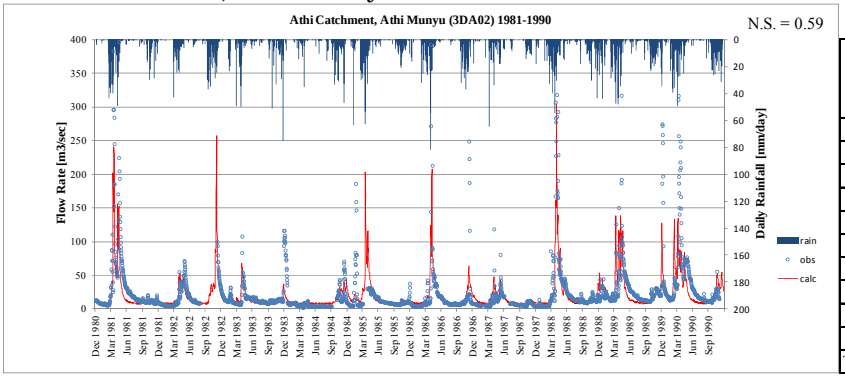
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.3.2 Comparison of Simulated Discharge and Observed Discharge (3/6)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

Athi Catchment, Ruiru (3BC08)



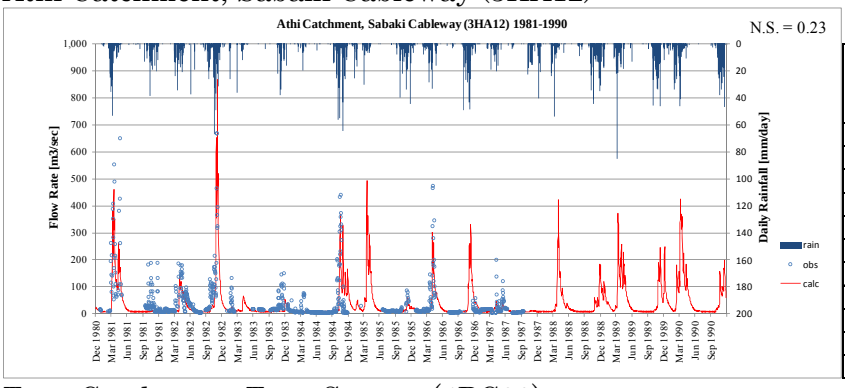
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	121.3	99.8	82%
1982	88.4	89.8	102%
1983	-	-	-
1984	-	-	-
1985	77.7	59.8	77%
1986	76.5	94.8	124%
1987	53.9	78.6	146%
1988	131.4	122.7	93%
1989	135.1	134.5	100%
1990	190.7	139.6	73%
Total	875.0	819.7	94%

Athi Catchment, Athi Munyu (3DA02)



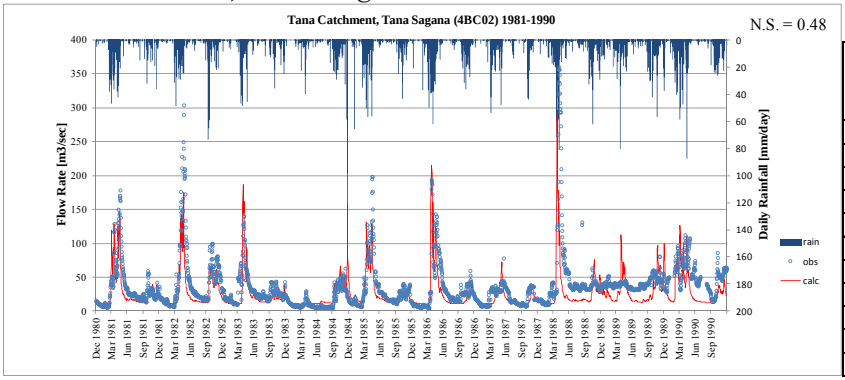
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	991.4	675.0	68%
1982	416.5	428.6	103%
1983	470.4	431.4	92%
1984	354.3	351.6	99%
1985	423.7	452.1	107%
1986	554.6	575.8	104%
1987	270.4	357.3	132%
1988	844.7	665.5	79%
1989	884.3	800.3	90%
1990	1174.8	823.7	70%
Total	6385.2	5561.4	87%

Athi Catchment, Sabaki Cableway (3HA12)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	723.2	552.9	76%
1982	1036.8	605.2	58%
1983	385.7	141.4	37%
1984	685.9	761.9	111%
1985	157.0	100.8	64%
1986	451.8	480.5	106%
1987	348.7	321.4	92%
1988	-	-	-
1989	-	-	-
1990	-	-	-
Total	3789.0	2964.0	78%

Tana Catchment, Tana Sagana (4BC02)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	1066.5	867.2	81%
1982	1464.8	923.0	63%
1983	970.8	741.0	76%
1984	456.1	616.2	135%
1985	997.3	830.9	83%
1986	1022.5	832.1	81%
1987	626.6	513.1	82%
1988	1640.5	915.5	56%
1989	1221.1	868.9	71%
1990	1335.4	880.4	66%
Total	10801.5	7988.2	74%

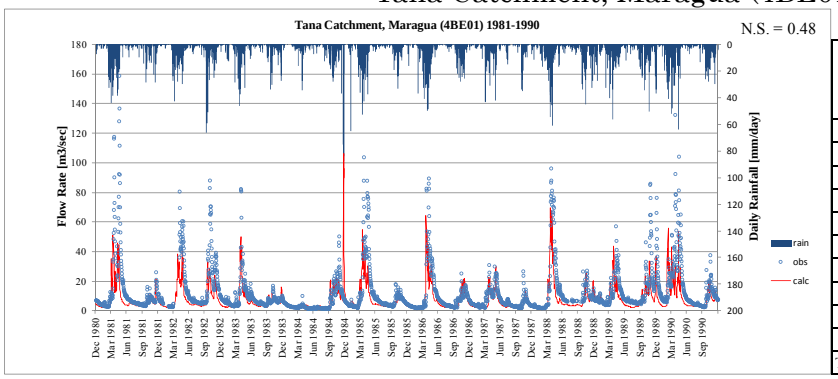
Note : N.S. (Nash coefficient)
Source: JICA Study Team with original data from WRMA and MWI

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

JAPAN INTERNATIONAL COOPERATION AGENCY

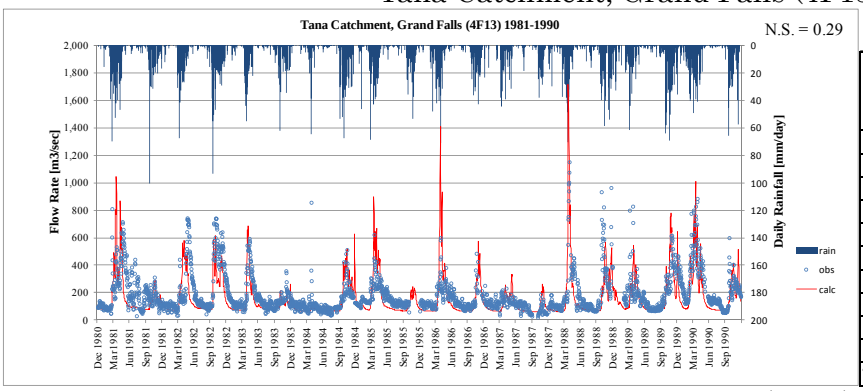
Figure 5.3.2
Comparison of Simulated Discharge and Observed Discharge (4/6)

Tana Catchment, Maragua (4BE01)



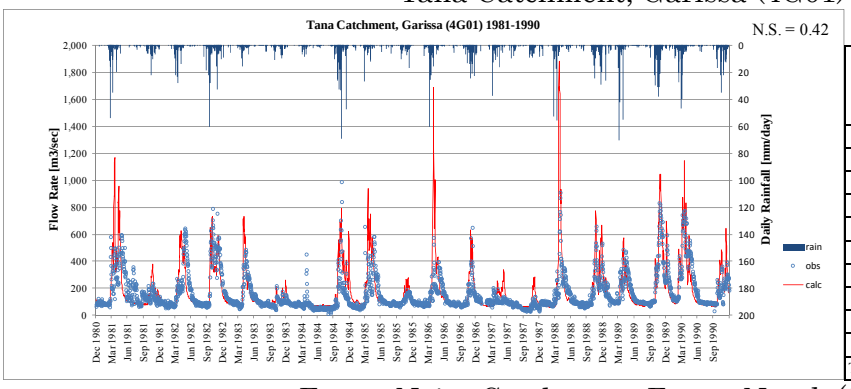
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	417.8	232.0	56%
1982	449.2	233.7	52%
1983	277.7	184.8	67%
1984	179.7	202.4	113%
1985	383.8	240.5	63%
1986	315.1	229.1	73%
1987	210.9	148.1	70%
1988	339.3	222.6	66%
1989	392.3	253.1	65%
1990	541.8	304.0	56%
Total	3507.7	2250.3	64%

Tana Catchment, Grand Falls (4F13)



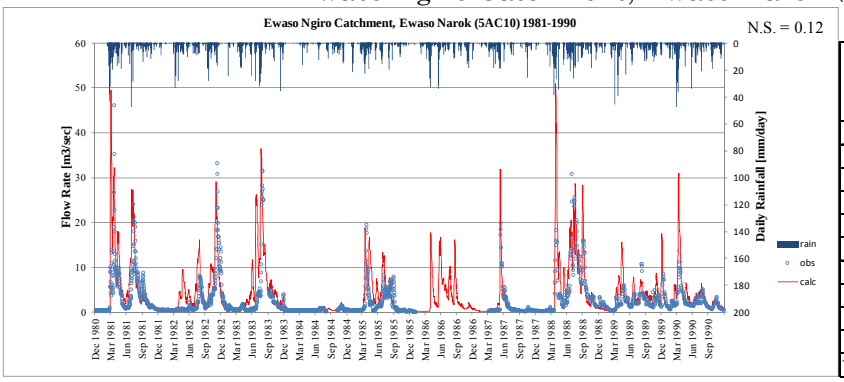
Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	6237.7	5944.3	95%
1982	7554.5	6628.0	88%
1983	5078.7	4713.1	93%
1984	3623.3	4419.7	122%
1985	4218.9	4603.5	109%
1986	3681.0	3802.6	103%
1987	2342.4	2671.3	114%
1988	4707.7	4200.1	89%
1989	4659.2	5222.6	112%
1990	7057.1	6857.7	97%
Total	49160.7	49063.0	100%

Tana Catchment, Garissa (4G01)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	5501.1	5287.0	96%
1982	6798.9	6362.5	94%
1983	4061.5	4170.2	103%
1984	3433.7	4535.2	132%
1985	4173.7	5154.9	124%
1986	4226.7	4828.7	114%
1987	2533.1	3164.1	125%
1988	4867.6	5103.9	105%
1989	6315.4	6076.4	96%
1990	7213.9	6954.7	96%
Total	49125.6	51637.8	105%

Ewaso Ngiro Catchment, Ewaso Narok (5AC10)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	135.9	195.4	144%
1982	92.2	141.0	153%
1983	75.6	136.3	180%
1984	15.3	15.5	102%
1985	67.3	105.7	157%
1986	0.7	0.8	109%
1987	25.4	25.9	102%
1988	90.8	117.8	130%
1989	42.2	53.6	127%
1990	45.0	64.4	143%
Total	590.3	856.5	145%

Note : N.S. (Nash coefficient)
Source: JICA Study Team with original data from WRMA and MWI

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030

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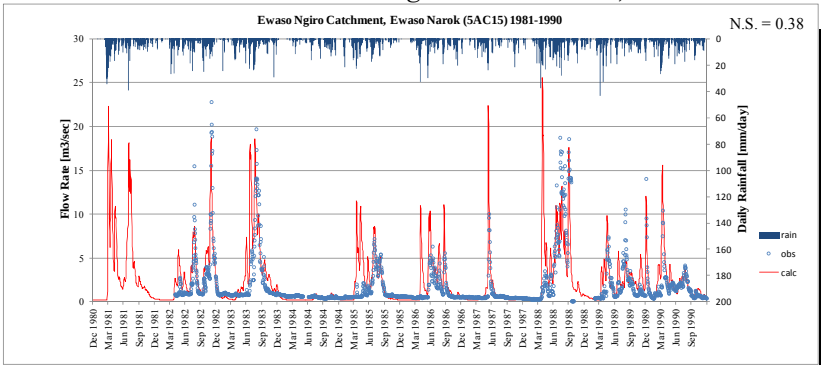
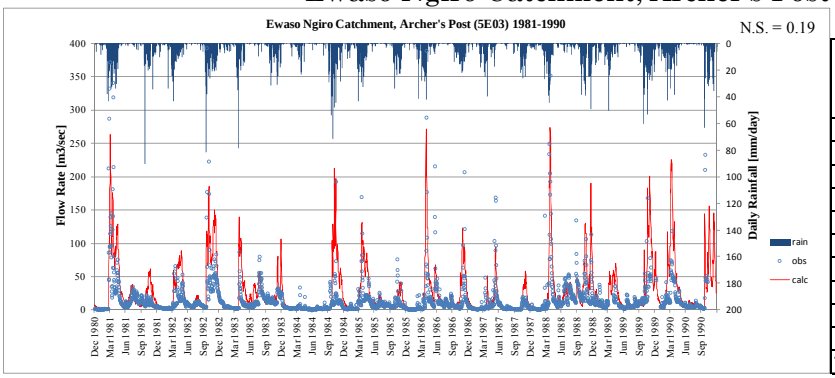
Figure 5.3.2
Comparison of Simulated Discharge and Observed Discharge (5/6)

Ewaso Ngiro Catchment, Ewaso Narok (5AC15)



Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	0.0	0.0	-
1982	61.8	82.2	133%
1983	57.7	76.0	132%
1984	12.0	8.5	71%
1985	31.4	50.2	160%
1986	28.1	48.6	173%
1987	17.7	22.2	125%
1988	75.8	80.3	106%
1989	35.2	45.7	130%
1990	36.9	52.0	141%
Total	356.8	465.7	131%

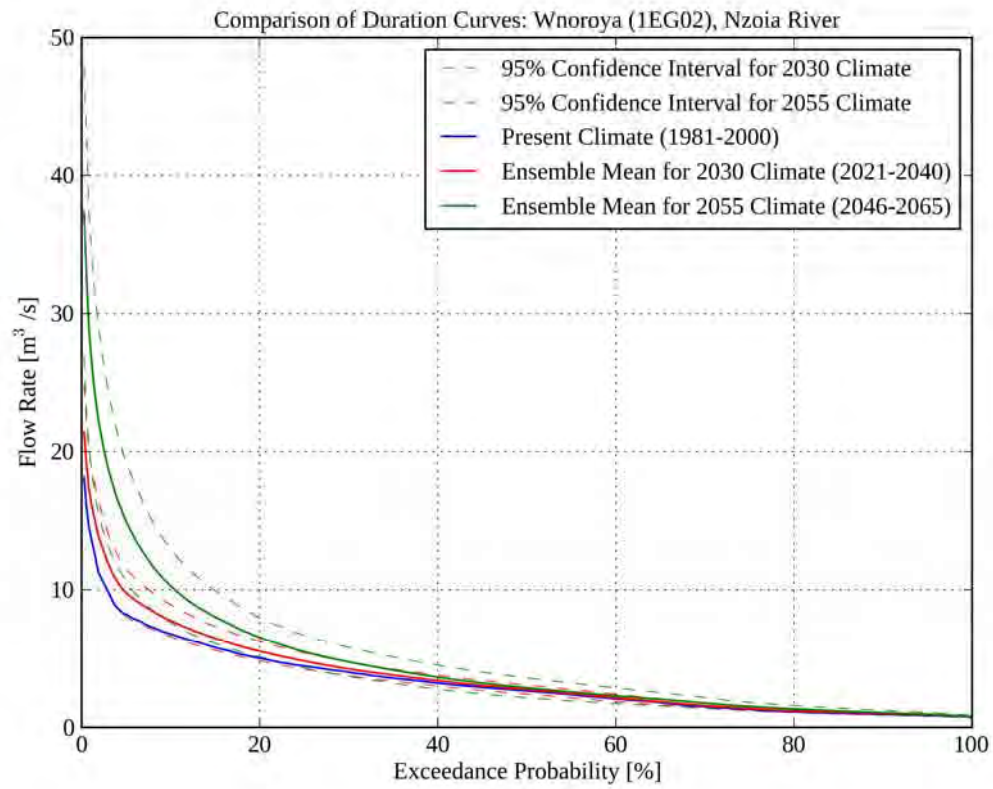
Ewaso Ngiro Catchment, Archer's Post (5E03)

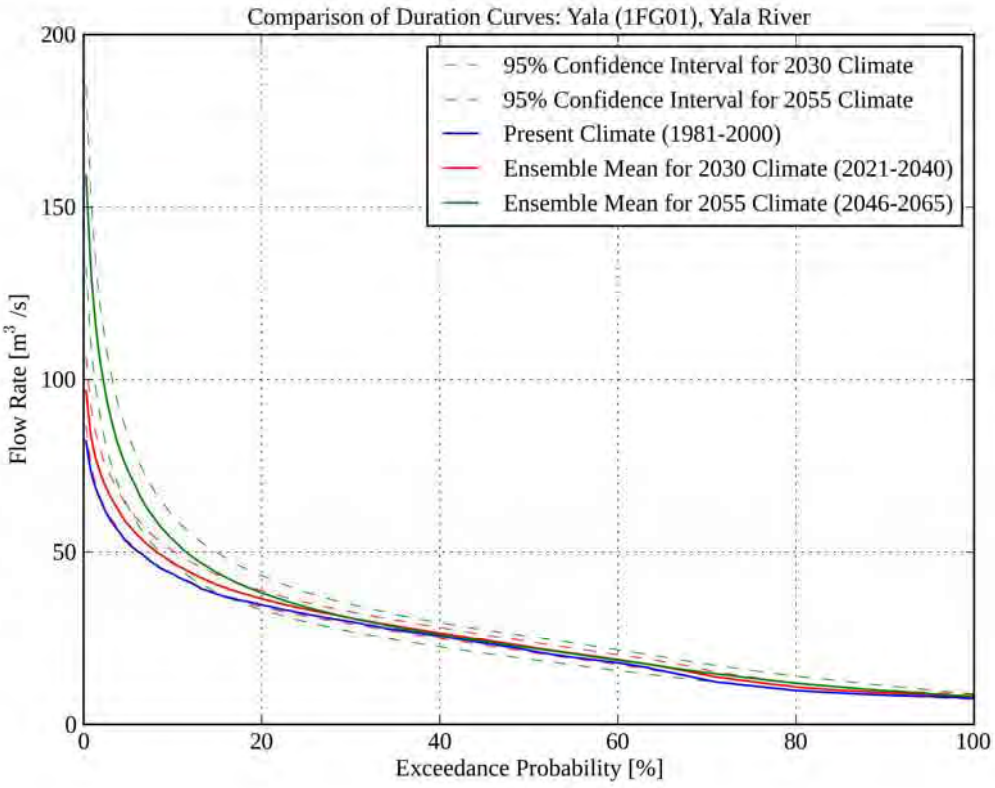


Year	Discharged Volume of Observed Data [MCM]	Discharged Volume of Calculated Date [MCM]	Calc / Obs [%]
1981	725.8	721.2	99%
1982	641.8	751.6	117%
1983	429.0	487.8	114%
1984	215.3	404.2	188%
1985	347.3	423.2	122%
1986	509.1	582.4	114%
1987	241.2	235.1	97%
1988	804.1	727.8	91%
1989	393.2	407.5	104%
1990	424.4	546.6	129%
Total	4731.0	5287.4	112%

Note : N.S. (Nash coefficient)
Source: JICA Study Team with original data from WRMA and MWI

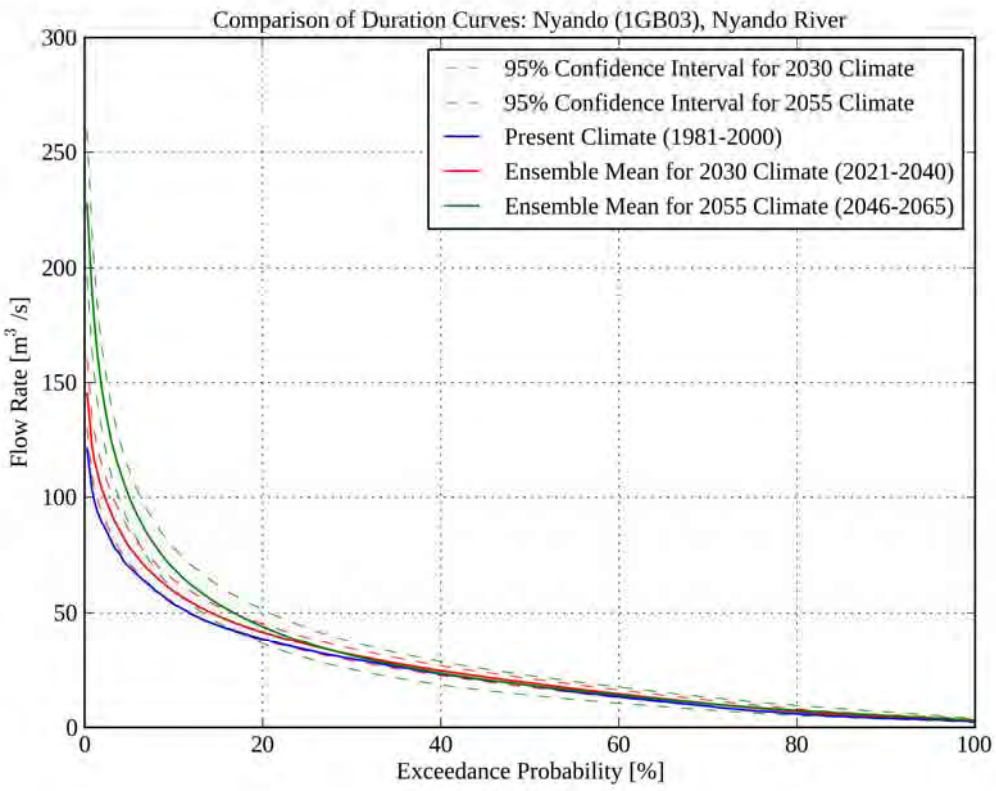
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.3.2 Comparison of Simulated Discharge and Observed Discharge (6/6)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

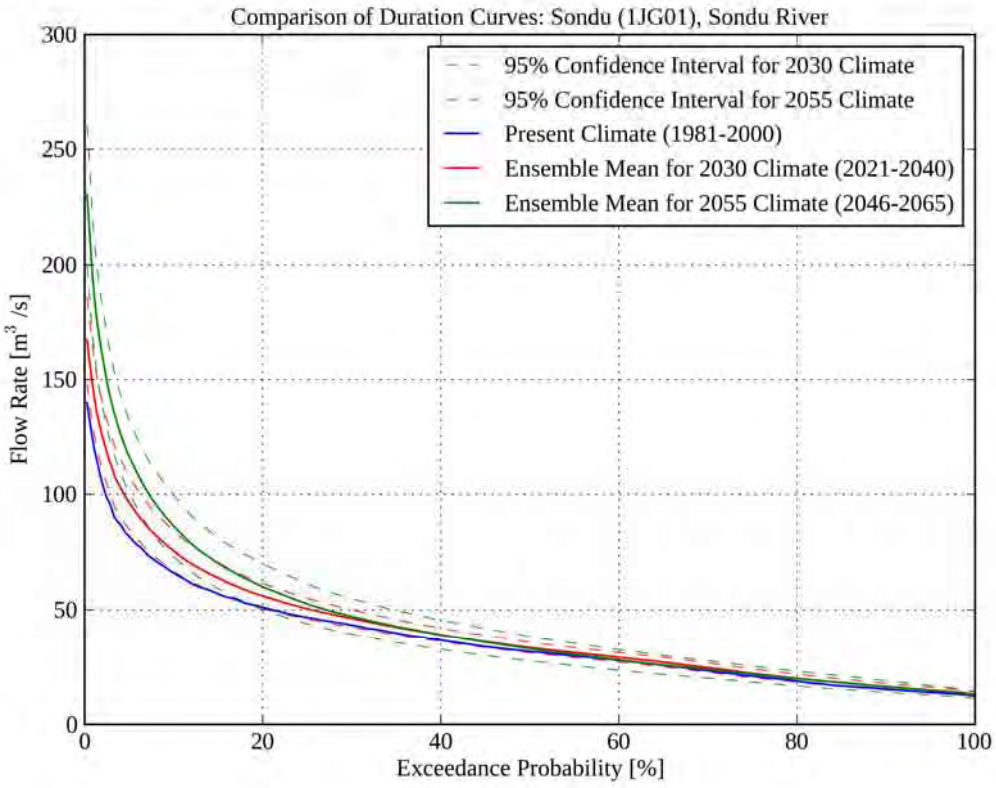




Source: JICA Study Team

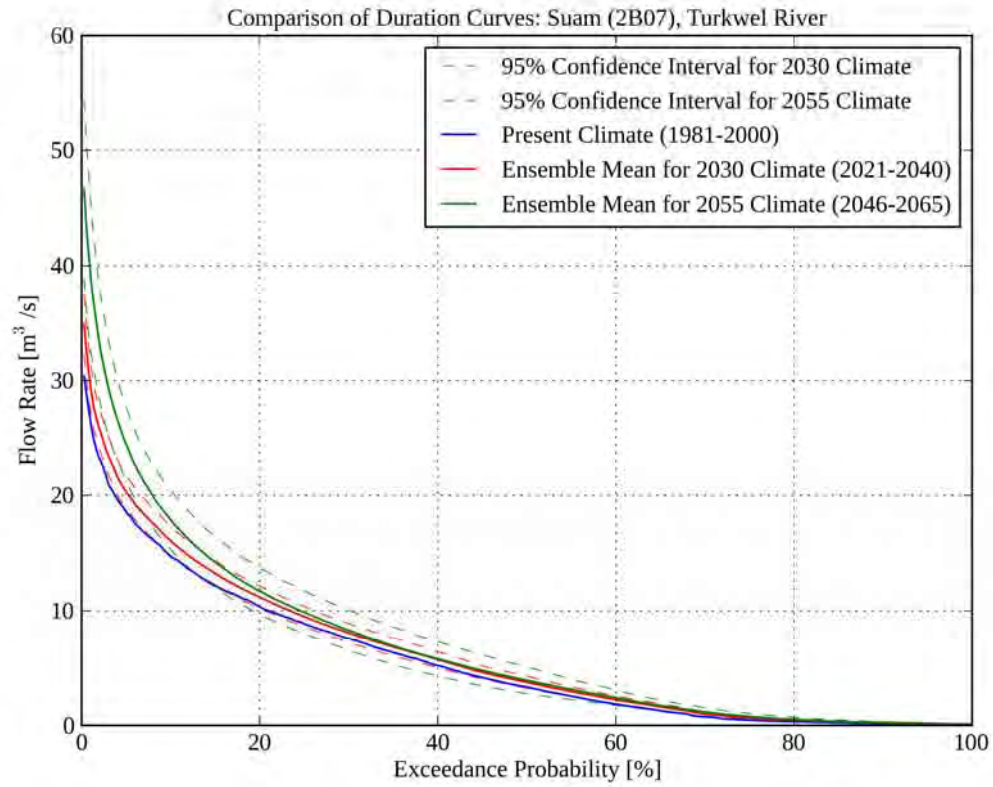
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.4.1 Comparison of Flow Duration Curves for Present and Futures Climate (1/5)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

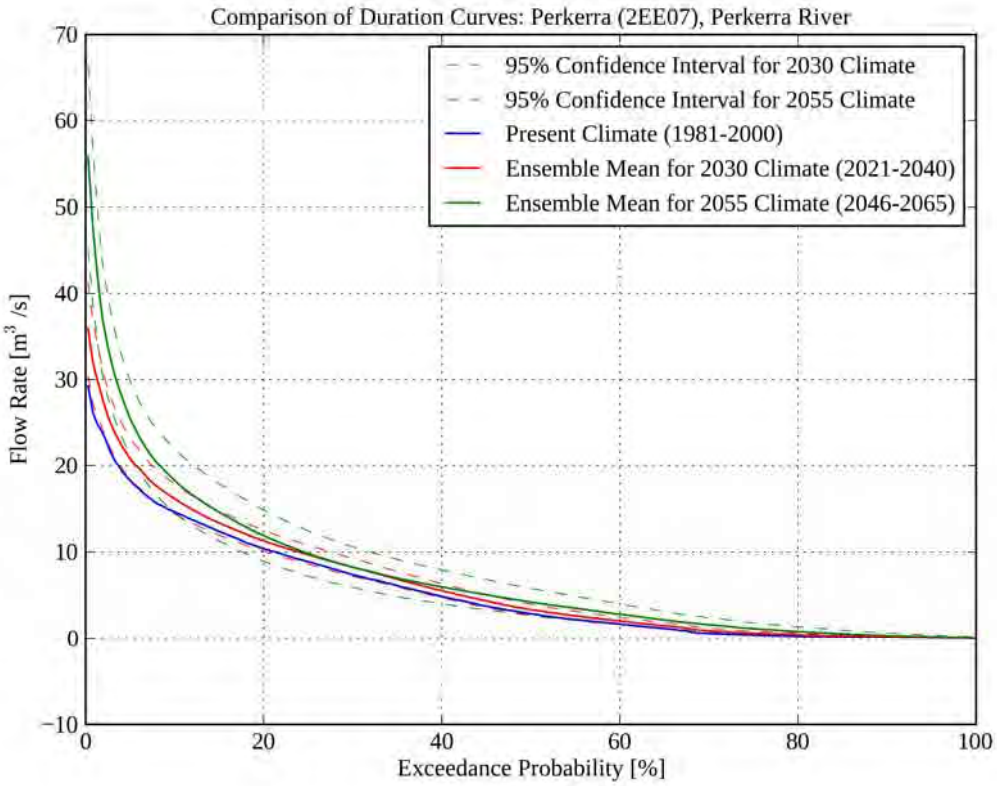




Source: JICA Study Team

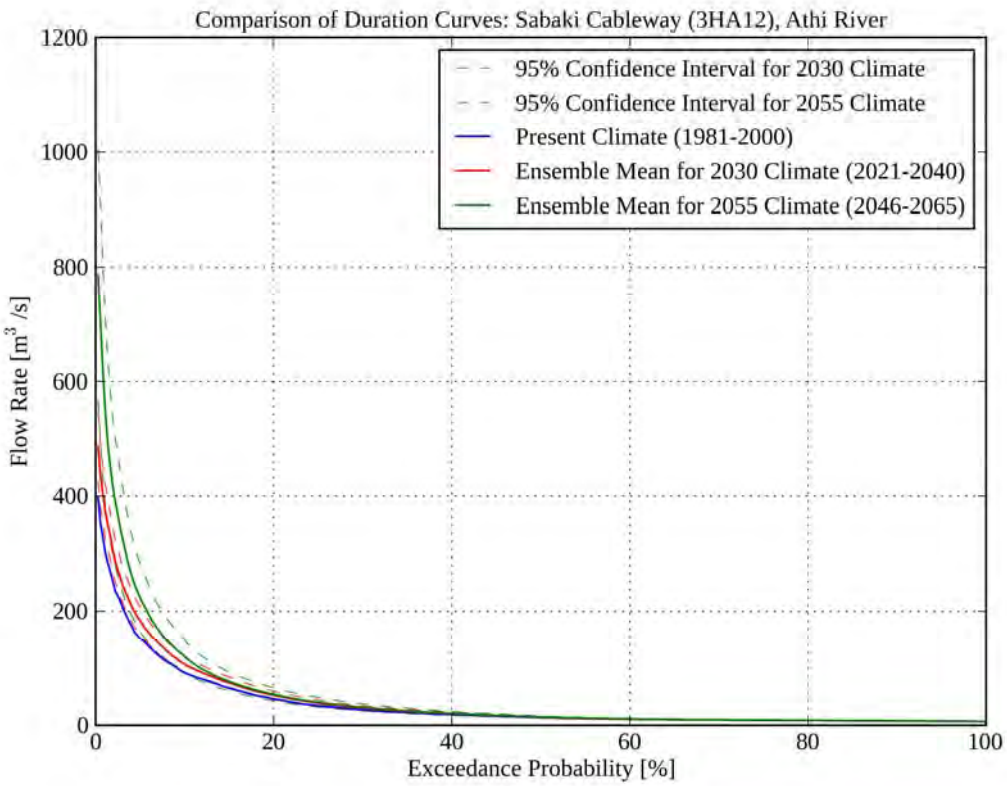
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.4.1 Comparison of Flow Duration Curves for Present and Futures Climate (2/5)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

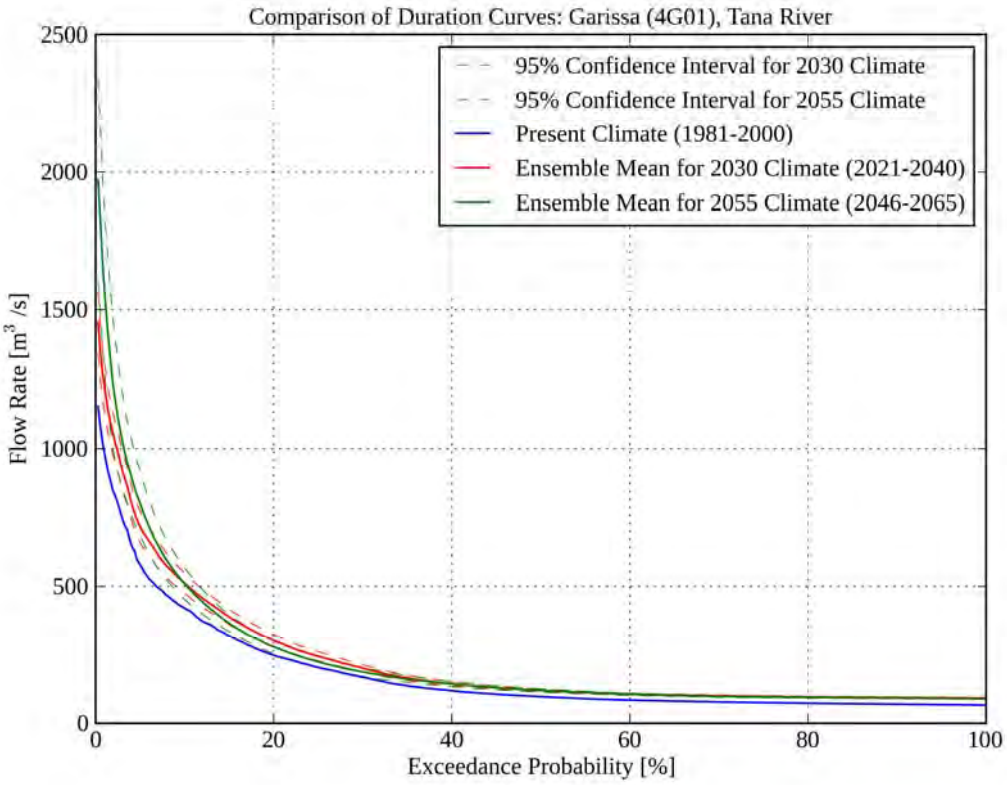




Source: JICA Study Team

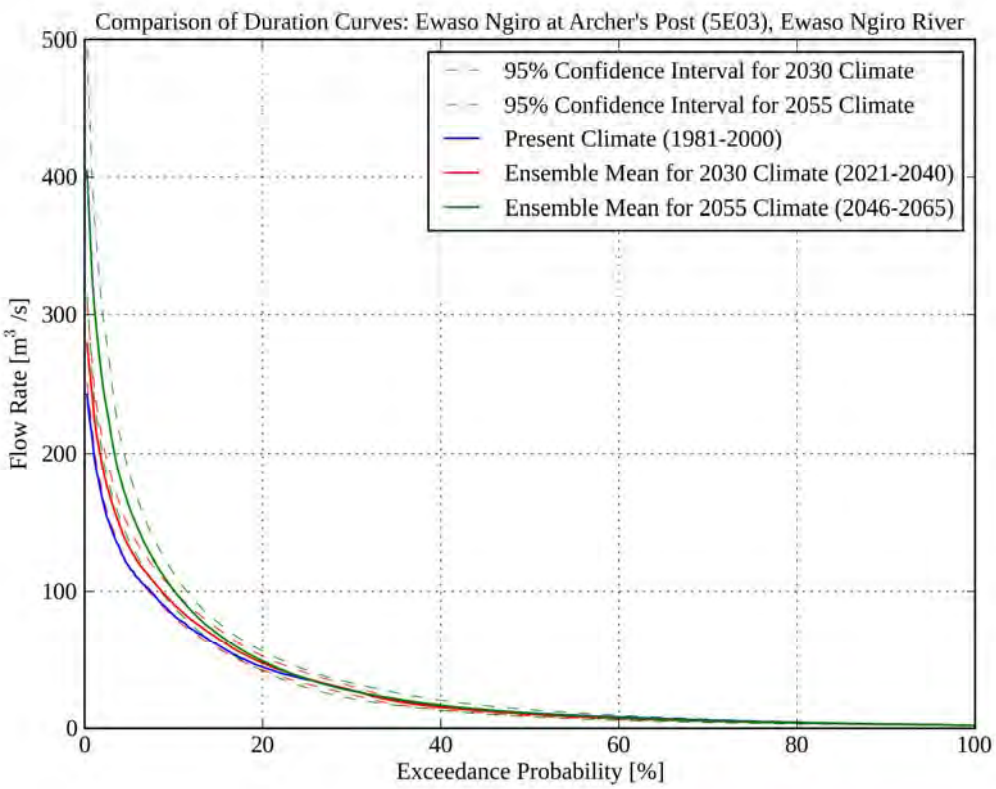
THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.4.1 Comparison of Flow Duration Curves for Present and Futures Climate (3/5)**
JAPAN INTERNATIONAL COOPERATION AGENCY	





Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.4.1 Comparison of Flow Duration Curves for Present and Futures Climate (4/5)**
JAPAN INTERNATIONAL COOPERATION AGENCY	



Source: JICA Study Team

THE DEVELOPMENT OF THE NATIONAL WATER MASTER PLAN 2030	**Figure 5.4.1 Comparison of Flow Duration Curves for Present and Futures Climate (5/5)**
JAPAN INTERNATIONAL COOPERATION AGENCY	