## D-7 MONTHLY LIST OF MASS CURVE

## (1) Monthly List of Mass Curve (Nam Ngao Project)

(Unit : $m^3/s$-d)

| | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < OCT > | < NOV > | < DEC > |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | -1128.0 | -2186.5 | -3391.4 | -4606.9 | -5873.8 | -6483.2 | -6695.5 | -4513.0 | -2100.9 | -2067.3 | -2744.1 | -3680.0 |
| 1960 | -4817.0 | -5911.2 | -7124.3 | -8350.3 | -8907.1 | -9295.5 | -9069.9 | -5486.1 | -3184.3 | -703.1 | -403.5 | -693.6 |
| 1961 | -1362.5 | -2188.5 | -3260.6 | -4343.8 | -5463.3 | -5670.7 | -4774.4 | -2474.7 | 1756.3 | 2572.5 | 2250.4 | 1811.5 |
| 1962 | 1047.9 | 152.2 | -915.8 | -1999.6 | -2283.2 | -2514.7 | -1343.7 | 495.3 | 2328.7 | 5671.6 | 5538.2 | 5006.1 |
| 1963 | 4180.6 | 3263.3 | 2187.2 | 1077.9 | -136.3 | -60.7 | 982.0 | 2350.1 | 3993.4 | 6230.6 | 6766.8 | 6264.2 |
| 1964 | 5516.5 | 4582.9 | 3494.9 | 2396.7 | 1404.7 | 457.7 | 3074.3 | 4459.0 | 7207.3 | 9227.8 | 8905.0 | 8319.1 |
| 1965 | 7457.1 | 6521.9 | 5435.5 | 4331.7 | 3133.3 | 2667.3 | 2573.0 | 4551.3 | 5763.7 | 6747.9 | 7255.5 | 6644.1 |
| 1966 | 5821.6 | 4890.9 | 3786.7 | 2661.7 | 1633.9 | 1545.5 | 2560.8 | 6537.4 | 8407.8 | 8107.9 | 7531.7 | 6688.3 |
| 1967 | 5692.0 | 4727.5 | 3607.2 | 2463.3 | 1357.5 | 311.1 | 472.8 | 3636.3 | 6481.3 | 7688.1 | 7378.8 | 6792.8 |
| 1968 | 5938.5 | 4981.7 | 3885.5 | 2750.4 | 1748.7 | 1981.3 | 2257.8 | 4528.7 | 5641.6 | 5934.9 | 5358.8 | 4583.4 |
| 1969 | 3646.0 | 2684.6 | 1515.4 | 372.7 | -567.3 | -402.4 | 624.7 | 9855.4 | 14547.9 | 16112.5 | 16446.3 | 16197.3 |
| 1970 | 15583.2 | 14832.4 | 13841.7 | 12868.2 | 12118.9 | 11757.8 | 12806.6 | 15059.6 | 17480.9 | 18122.2 | 17856.7 | 17241.7 |
| 1971 | 16375.5 | 15453.8 | 14347.9 | 13200.3 | 12187.8 | 12110.7 | 16043.4 | 20510.9 | 23185.8 | 23902.5 | 23688.1 | 23008.2 |
| 1972 | 22112.8 | 21146.3 | 20042.9 | 18969.9 | 17832.0 | 17029.2 | 19158.9 | 22730.5 | 24545.3 | 25234.1 | 25271.3 | 24880.4 |
| 1973 | 24128.6 | 23252.4 | 22217.7 | 21120.2 | 20199.6 | 19898.7 | 20469.2 | 22456.2 | 24771.0 | 26057.9 | 26077.2 | 25593.7 |
| 1974 | 24716.6 | 23785.5 | 22639.2 | 21527.5 | 20591.9 | 20440.3 | 21282.1 | 23659.2 | 24813.8 | 25227.7 | 24967.8 | 24181.2 |
| 1975 | 23335.7 | 22425.1 | 21373.7 | 20262.4 | 19251.1 | 19054.6 | 20047.3 | 21366.2 | 23132.7 | 24102.7 | 23879.6 | 23144.8 |
| 1976 | 22267.7 | 21321.8 | 20202.8 | 19052.3 | 18082.9 | 17599.7 | 18251.9 | 20631.6 | 22022.7 | 22903.2 | 22774.5 | 22061.9 |
| 1977 | 21541.6 | 20646.9 | 19556.8 | 18462.4 | 17366.7 | 16456.2 | 16205.5 | 17526.1 | 20189.7 | 20237.3 | 19847.5 | 19032.9 |
| 1978 | 18051.7 | 17100.8 | 15958.4 | 14798.8 | 13754.8 | 12744.7 | 13219.9 | 15355.1 | 16374.5 | 16684.2 | 16014.0 | 15059.9 |
| 1979 | 13940.2 | 12897.2 | 11688.6 | 10494.4 | 9289.7 | 8189.9 | 7716.2 | 10552.0 | 11011.5 | 11304.0 | 10703.0 | 9766.4 |
| 1980 | 8686.6 | 7609.8 | 6433.9 | 5268.3 | 4372.0 | 3680.5 | 3741.6 | 4506.2 | 7836.0 | 9416.4 | 9386.7 | 8821.3 |
| 1981 | 7958.9 | 6974.8 | 5807.9 | 4653.0 | 3499.9 | 3119.7 | 4117.9 | 6981.5 | 7862.6 | 8234.8 | 8046.4 | 7403.5 |
| 1982 | 6494.9 | 5534.3 | 4381.5 | 3238.1 | 2279.1 | 2781.1 | 4566.0 | 10319.8 | 13074.3 | 14200.2 | 13956.5 | 13212.1 |
| 1983 | 12247.2 | 11240.2 | 10048.7 | 8851.2 | 7617.9 | 6665.4 | 5698.8 | 5842.1 | 6352.6 | 6885.5 | 6658.7 | 5875.7 |
| 1984 | 4881.6 | 3837.6 | 2665.0 | 1505.9 | 332.4 | 966.2 | 1783.4 | 4651.4 | 6037.3 | 6309.5 | 5795.5 | 4943.0 |
| 1985 | 3944.8 | 2964.2 | 1813.9 | 671.2 | -414.6 | 160.3 | 1842.5 | 4418.0 | 6298.4 | 6692.8 | 6506.2 | 5895.5 |
| 1986 | 5054.4 | 4170.2 | 3093.2 | 1993.5 | 906.9 | 439.5 | 1209.5 | 2155.8 | 2356.9 | 1803.2 | 1001.2 | 0.0 |

## (2) Monthly List of Mass Curve (Mae Lama Luang Project : Individual Development)

(Unit : $m^3/s$-d)

| | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < OCT > | < NOV > | < DEC > |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | -2421.2 | -4703.6 | -7316.5 | -9933.2 | -12628.1 | -14166.2 | -14977.2 | -10883.2 | -5843.3 | -5661.7 | -7093.8 | -9075.8 |
| 1960 | -11475.5 | -13826.9 | -16455.1 | -19096.0 | -20481.1 | -21661.9 | -21539.7 | -13748.8 | -8919.5 | -3823.0 | -3224.7 | -3823.4 |
| 1961 | -5289.9 | -7042.2 | -9324.8 | -11679.3 | -14092.9 | -14839.2 | -13182.2 | -8592.3 | 735.2 | 2554.4 | 1997.8 | 1055.2 |
| 1962 | -560.7 | -2421.6 | -4690.7 | -7028.2 | -7753.1 | -8512.6 | -6381.9 | -2554.6 | 1305.2 | 7942.7 | 7706.1 | 6573.0 |
| 1963 | 4834.5 | 2915.5 | 617.0 | -1757.3 | -4305.2 | -4475.0 | -2391.0 | 626.1 | 4477.5 | 9301.7 | 10505.4 | 9568.5 |
| 1964 | 8023.7 | 6123.4 | 3853.7 | 1516.4 | -563.1 | -2643.0 | 2823.0 | 5887.6 | 13020.6 | 17343.9 | 16946.1 | 15823.0 |
| 1965 | 14107.4 | 12231.6 | 9984.9 | 7666.9 | 5187.4 | 3980.4 | 3577.7 | 7754.8 | 10363.7 | 13040.9 | 14345.7 | 13204.8 |
| 1966 | 11524.3 | 9632.5 | 7334.0 | 4967.2 | 2915.8 | 2644.3 | 4976.0 | 14041.4 | 18484.4 | 18198.4 | 17116.0 | 15469.3 |
| 1967 | 13387.0 | 11341.5 | 8943.2 | 6512.7 | 4271.4 | 2241.8 | 2296.8 | 8138.9 | 14661.0 | 16996.1 | 16322.7 | 14987.9 |
| 1968 | 13112.8 | 11042.1 | 8682.5 | 6299.4 | 4261.5 | 4370.1 | 4860.4 | 9351.0 | 11683.9 | 12763.9 | 11681.4 | 10057.1 |
| 1969 | 8040.8 | 5992.3 | 3526.1 | 1109.2 | -901.8 | -948.5 | 611.5 | 17896.2 | 27024.0 | 29828.0 | 30419.3 | 29805.2 |
| 1970 | 28422.4 | 26775.0 | 24637.6 | 22554.2 | 21234.7 | 20562.7 | 22294.9 | 27330.5 | 32699.2 | 34452.9 | 34025.5 | 32917.3 |
| 1971 | 31131.6 | 29216.9 | 26911.3 | 24516.4 | 22567.2 | 22357.6 | 29870.1 | 38551.9 | 44093.1 | 45726.2 | 45262.5 | 43902.6 |
| 1972 | 42035.0 | 40007.7 | 37674.2 | 35419.9 | 33062.4 | 31359.2 | 34778.2 | 41868.3 | 45120.8 | 46318.2 | 46461.2 | 45499.7 |
| 1973 | 43856.0 | 41971.3 | 39727.7 | 37374.8 | 35484.3 | 34651.2 | 35999.6 | 41598.5 | 47799.1 | 50666.9 | 50587.4 | 49466.5 |
| 1974 | 47668.2 | 45741.8 | 43343.6 | 40994.9 | 39087.8 | 38508.9 | 39675.4 | 44076.0 | 46693.1 | 47482.5 | 47241.0 | 45669.1 |
| 1975 | 43986.8 | 42075.3 | 39811.4 | 37432.3 | 35326.4 | 34721.2 | 36310.0 | 39983.8 | 45735.0 | 48690.6 | 48537.7 | 47252.2 |
| 1976 | 45478.0 | 43517.3 | 41167.5 | 38748.6 | 36698.6 | 35451.7 | 36222.0 | 40414.2 | 43463.9 | 45513.5 | 45281.4 | 43956.3 |
| 1977 | 42743.0 | 40834.9 | 38500.1 | 36211.5 | 33958.7 | 32058.5 | 31461.9 | 34076.0 | 40359.4 | 41194.0 | 40667.4 | 39207.5 |
| 1978 | 37348.2 | 35414.9 | 33036.6 | 30612.1 | 28435.1 | 26347.2 | 27771.5 | 32784.4 | 36601.7 | 38261.3 | 37327.1 | 35538.7 |
| 1979 | 33411.8 | 31310.4 | 28787.3 | 26310.9 | 24009.2 | 21928.4 | 20957.5 | 25888.2 | 26816.7 | 27454.5 | 26128.6 | 24145.7 |
| 1980 | 21847.7 | 19552.6 | 17028.3 | 14540.4 | 12725.3 | 11500.8 | 11655.9 | 13421.4 | 20867.7 | 23975.6 | 23774.7 | 22578.5 |
| 1981 | 20708.7 | 18627.6 | 16147.7 | 13692.5 | 11276.6 | 10256.4 | 11783.2 | 17332.9 | 19227.0 | 19833.8 | 19375.2 | 17978.3 |
| 1982 | 16015.8 | 13955.7 | 11489.8 | 9090.3 | 7048.6 | 7749.5 | 10472.7 | 20497.2 | 26226.0 | 28929.3 | 28469.2 | 26973.3 |
| 1983 | 24978.7 | 22889.6 | 20384.4 | 17863.0 | 15287.4 | 13258.2 | 11234.5 | 11296.9 | 12172.5 | 13104.1 | 12570.3 | 10944.9 |
| 1984 | 8835.2 | 6625.4 | 4103.5 | 1660.1 | -830.1 | -61.0 | 987.2 | 5947.8 | 9545.6 | 11055.3 | 10224.6 | 8529.4 |
| 1985 | 6394.7 | 4263.5 | 1749.0 | -749.1 | -2926.5 | -2889.5 | -936.6 | 2857.8 | 7814.8 | 11350.1 | 12228.3 | 11638.5 |
| 1986 | 10000.7 | 8182.4 | 5915.8 | 3681.6 | 1519.7 | 143.5 | 1104.2 | 3127.7 | 3879.4 | 3084.4 | 1818.7 | 0.0 |

## (3) Monthly List of Mass Curve (Mae Lama Luang Project : Integrated Development)

(Unit : $m^3/s$-d)

| | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < OCT > | < NOV > | < DEC > |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | -588.0 | -1119.0 | -1707.0 | -2276.0 | -2863.9 | -3432.9 | -3645.2 | -3246.6 | -2860.9 | -2827.2 | -3253.9 | -3694.9 |
| 1960 | -4135.8 | -4548.2 | -4989.2 | -5415.9 | -5856.8 | -6245.3 | -6019.6 | -4484.2 | -2998.4 | -1463.1 | -1163.4 | -1376.4 |
| 1961 | -1589.5 | -1781.9 | -1995.0 | -2201.2 | -2414.2 | -2620.4 | -1724.1 | -341.6 | 996.3 | 1812.5 | 1654.2 | 1490.6 |
| 1962 | 1327.1 | 1179.3 | 1015.7 | 857.4 | 693.8 | 535.5 | 1638.5 | 2741.4 | 3808.7 | 4911.7 | 4778.2 | 4460.7 |
| 1963 | 4143.1 | 3856.3 | 3538.8 | 3231.5 | 2913.9 | 2989.6 | 3614.9 | 4240.2 | 4845.4 | 5470.7 | 6006.9 | 5643.2 |
| 1964 | 5279.5 | 4939.3 | 4575.6 | 4223.6 | 3859.9 | 3507.9 | 4758.0 | 6008.1 | 7217.8 | 8467.9 | 8145.1 | 7790.1 |
| 1965 | 7435.2 | 7114.5 | 6759.6 | 6416.0 | 6061.1 | 5717.6 | 5623.2 | 5844.9 | 6059.4 | 6281.1 | 6495.6 | 6187.1 |
| 1966 | 5878.5 | 5599.8 | 5291.3 | 4992.7 | 4684.2 | 4595.8 | 5611.1 | 6646.1 | 7647.8 | 7348.0 | 6853.8 | 6343.1 |
| 1967 | 5832.4 | 5371.1 | 4860.4 | 4366.2 | 3855.6 | 3361.3 | 3523.0 | 4670.4 | 5780.8 | 6928.2 | 6628.3 | 6318.4 |
| 1968 | 6008.5 | 5718.6 | 5408.8 | 5108.9 | 4799.0 | 4872.7 | 4948.9 | 5025.1 | 5098.8 | 5175.0 | 4794.0 | 4400.4 |
| 1969 | 4006.8 | 3651.2 | 3257.6 | 2876.6 | 2483.0 | 2647.9 | 3675.0 | 9095.5 | 13788.0 | 15352.6 | 15686.4 | 15557.9 |
| 1970 | 15429.5 | 15313.5 | 15185.1 | 15060.8 | 14932.3 | 14808.0 | 15452.6 | 16097.2 | 16721.0 | 17362.3 | 17096.7 | 16780.2 |
| 1971 | 16463.6 | 16177.6 | 15861.0 | 15554.7 | 15238.1 | 15160.9 | 17608.9 | 20056.9 | 22425.8 | 23142.5 | 22928.2 | 22513.6 |
| 1972 | 22099.0 | 21711.1 | 21296.5 | 20895.3 | 20480.7 | 20079.5 | 21328.2 | 22576.9 | 23785.4 | 24474.2 | 24511.4 | 24283.0 |
| 1973 | 24054.5 | 23848.1 | 23619.7 | 23398.6 | 23170.1 | 22949.0 | 23519.5 | 24118.8 | 24698.7 | 25298.0 | 25317.2 | 25031.9 |
| 1974 | 24746.6 | 24488.9 | 24203.6 | 23927.5 | 23642.2 | 23490.6 | 23736.9 | 23983.2 | 24221.5 | 24467.8 | 24207.9 | 23883.2 |
| 1975 | 23558.4 | 23265.1 | 22940.4 | 22626.1 | 22301.4 | 22104.9 | 22416.9 | 22728.9 | 23030.8 | 23342.8 | 23119.7 | 22760.3 |
| 1976 | 22400.8 | 22064.6 | 21705.1 | 21357.3 | 20997.9 | 20650.0 | 21026.4 | 21402.7 | 21766.9 | 22143.2 | 22014.6 | 21647.8 |
| 1977 | 21281.1 | 20949.8 | 20583.1 | 20228.2 | 19861.4 | 19506.5 | 19255.8 | 19344.2 | 19429.7 | 19477.3 | 19087.6 | 18606.1 |
| 1978 | 18124.7 | 17689.8 | 17208.3 | 16742.4 | 16260.9 | 15795.0 | 15827.6 | 15860.2 | 15891.7 | 15924.3 | 15343.6 | 14743.6 |
| 1979 | 14143.6 | 13601.6 | 13001.6 | 12420.9 | 11820.9 | 11240.2 | 10766.5 | 10691.5 | 10619.0 | 10544.0 | 10073.3 | 9586.8 |
| 1980 | 9100.3 | 8645.3 | 8158.8 | 7688.0 | 7201.6 | 6730.8 | 6791.9 | 7420.2 | 8028.2 | 8656.5 | 8626.8 | 8267.5 |
| 1981 | 7908.3 | 7583.8 | 7224.5 | 6876.9 | 6517.6 | 6169.9 | 6498.8 | 6827.7 | 7146.0 | 7474.9 | 7286.5 | 6953.1 |
| 1982 | 6619.8 | 6318.7 | 5985.3 | 5662.7 | 5329.4 | 5831.4 | 7616.3 | 10003.9 | 12314.4 | 13440.3 | 13196.5 | 12629.2 |
| 1983 | 12061.8 | 11549.3 | 10982.0 | 10432.9 | 9865.5 | 9316.5 | 8749.1 | 8203.7 | 7675.8 | 7130.4 | 6602.5 | 6057.1 |
| 1984 | 5511.6 | 5001.4 | 4455.9 | 3928.1 | 3382.6 | 3848.6 | 4330.0 | 4811.4 | 5277.3 | 5549.6 | 5137.2 | 4711.1 |
| 1985 | 4285.0 | 3900.2 | 3474.1 | 3061.8 | 2635.7 | 3210.5 | 3995.0 | 4779.4 | 5538.5 | 5932.9 | 5746.2 | 5416.3 |
| 1986 | 5086.3 | 4788.3 | 4458.4 | 4139.1 | 3809.1 | 3489.8 | 2901.8 | 2313.9 | 1744.9 | 1156.9 | 588.0 | 0.0 |

D-8 MONTHLY LIST OF POWER AND ENERGY AT GENERATING END

## (1) Monthly List of Power at Generating End

### (Nam Ngao Project: Integrated Development)

(Unit: MW)

| | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < OCT > | < NOV > | < DEC > | <TOTAL> |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 140.0 | 140.0 | 140.0 | 140.0 | 122.9 | 122.7 | 124.8 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1630.4 |
| 1960 | 140.0 | 140.0 | 140.0 | 140.0 | 130.2 | 125.9 | 128.2 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1644.3 |
| 1961 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 126.9 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1653.9 |
| 1962 | 140.0 | 140.0 | 140.0 | 136.2 | 132.1 | 129.6 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1658.0 |
| 1963 | 140.0 | 140.0 | 140.0 | 136.2 | 136.9 | 127.5 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1660.6 |
| 1964 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 125.4 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1652.4 |
| 1965 | 140.0 | 140.0 | 140.0 | 136.2 | 137.0 | 125.1 | 125.5 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1643.7 |
| 1966 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 127.5 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1654.5 |
| 1967 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 131.9 | 126.8 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1645.6 |
| 1968 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 129.2 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1656.1 |
| 1969 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 128.8 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1655.8 |
| 1970 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 126.1 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1653.0 |
| 1971 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 127.6 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1654.5 |
| 1972 | 140.0 | 140.0 | 140.0 | 136.2 | 137.2 | 125.4 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1658.8 |
| 1973 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 126.4 | 137.3 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1650.6 |
| 1974 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 127.2 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1654.1 |
| 1975 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 126.9 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1653.9 |
| 1976 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 125.5 | 136.2 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1648.7 |
| 1977 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 125.4 | 124.6 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1637.0 |
| 1978 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 125.4 | 128.4 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1640.8 |
| 1979 | 140.0 | 140.0 | 140.0 | 140.0 | 136.6 | 99.8 | 123.5 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1619.9 |
| 1980 | 140.0 | 140.0 | 140.0 | 136.5 | 130.8 | 125.4 | 126.2 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1638.9 |
| 1981 | 140.0 | 140.0 | 140.0 | 136.2 | 137.1 | 125.7 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1659.1 |
| 1982 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 130.6 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1657.6 |
| 1983 | 140.0 | 140.0 | 140.0 | 136.2 | 136.8 | 129.2 | 64.3 | 126.7 | 140.0 | 140.0 | 140.0 | 140.0 | 1573.2 |
| 1984 | 140.0 | 140.0 | 140.0 | 140.0 | 136.1 | 129.4 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1665.5 |
| 1985 | 140.0 | 140.0 | 140.0 | 136.3 | 130.8 | 131.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1658.0 |
| 1986 | 140.0 | 140.0 | 140.0 | 136.2 | 130.7 | 125.5 | 136.8 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1649.2 |
| TOTAL | 3920.0 | 3920.0 | 3920.0 | 3829.7 | 3695.9 | 3533.1 | 3722.5 | 3906.7 | 3920.0 | 3920.0 | 3920.0 | 3920.0 | 46127.8 |
| AVE | 140.0 | 140.0 | 140.0 | 136.8 | 132.0 | 126.2 | 132.9 | 139.5 | 140.0 | 140.0 | 140.0 | 140.0 | 1647.4 |
| MAX | 140.0 | 140.0 | 140.0 | 140.0 | 137.2 | 131.9 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 140.0 | 1665.5 |
| MIN | 140.0 | 140.0 | 140.0 | 136.2 | 122.9 | 99.8 | 64.3 | 126.7 | 140.0 | 140.0 | 140.0 | 140.0 | 1573.2 |

## (2) Monthly List of Energy at Generating End

(Nam Ngao Project: Integrated Development)

(Unit: MWh)

| | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < OCT > | < NOV > | < DEC > | <TOTAL> |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 15624. | 14112. | 15624. | 15120. | 13711. | 13249. | 14065. | 15624. | 63573. | 29361. | 15650. | 16022. | 241835. |
| 1960 | 15814. | 14616. | 15624. | 15120. | 22976. | 23838. | 14319. | 40921. | 76851. | 81603. | 33833. | 27803. | 383319. |
| 1961 | 26970. | 18920. | 18067. | 17260. | 14641. | 23965. | 15624. | 32721. | 100800. | 46065. | 20674. | 26702. | 362409. |
| 1962 | 22952. | 17511. | 18148. | 17250. | 25454. | 24308. | 15624. | 34428. | 66854. | 99996. | 24665. | 24765. | 391955. |
| 1963 | 21681. | 17076. | 17986. | 16751. | 15277. | 24033. | 15624. | 20689. | 62794. | 76397. | 38840. | 25377. | 352525. |
| 1964 | 23279. | 17619. | 17750. | 16969. | 17057. | 15325. | 15624. | 44490. | 86382. | 71772. | 20657. | 23644. | 370566. |
| 1965 | 20931. | 16714. | 17782. | 16860. | 15286. | 22814. | 14112. | 15624. | 36535. | 49652. | 38235. | 23113. | 287658. |
| 1966 | 21742. | 16803. | 17430. | 16445. | 16379. | 24040. | 15624. | 72573. | 67643. | 22243. | 15679. | 17971. | 324573. |
| 1967 | 18178. | 16120. | 17109. | 16077. | 14902. | 14245. | 14216. | 28970. | 88446. | 54403. | 20941. | 23642. | 327247. |
| 1968 | 21091. | 17152. | 17588. | 16247. | 16875. | 24252. | 15624. | 28313. | 51475. | 34903. | 15682. | 19398. | 278600. |
| 1969 | 19384. | 16184. | 16138. | 16101. | 18043. | 24207. | 15624. | 104160. | 100800. | 62040. | 34555. | 27827. | 455063. |
| 1970 | 27479. | 21987. | 19682. | 19400. | 21659. | 23859. | 15624. | 31732. | 79402. | 42332. | 21869. | 23038. | 348061. |
| 1971 | 20847. | 16986. | 17395. | 16005. | 16670. | 24048. | 37094. | 104160. | 84813. | 43941. | 22952. | 21687. | 426598. |
| 1972 | 20248. | 16955. | 17445. | 17458. | 15310. | 17765. | 15624. | 80124. | 66456. | 43346. | 28278. | 27701. | 366711. |
| 1973 | 23195. | 17905. | 18808. | 16983. | 18410. | 23902. | 15320. | 17467. | 77129. | 56113. | 27897. | 25775. | 338904. |
| 1974 | 20625. | 16794. | 16594. | 16705. | 18126. | 23998. | 15624. | 34346. | 52363. | 37479. | 21989. | 19466. | 294107. |
| 1975 | 21272. | 17209. | 18476. | 16714. | 16692. | 23967. | 15624. | 15821. | 64219. | 49348. | 22767. | 20544. | 302653. |
| 1976 | 20624. | 17370. | 17135. | 15949. | 17485. | 23776. | 15205. | 23395. | 57412. | 47437. | 24766. | 21005. | 301560. |
| 1977 | 27373. | 18125. | 17709. | 17042. | 15094. | 15997. | 14047. | 15624. | 49295. | 29660. | 19240. | 18883. | 258088. |
| 1978 | 18488. | 16394. | 16670. | 15773. | 16071. | 14162. | 14336. | 15624. | 48435. | 35254. | 15650. | 15870. | 242726. |
| 1979 | 15647. | 14112. | 15624. | 15120. | 15245. | 10774. | 13960. | 15624. | 31049. | 34886. | 15674. | 16059. | 213774. |
| 1980 | 16132. | 14864. | 15969. | 15675. | 18881. | 20034. | 14171. | 15624. | 57898. | 62378. | 26861. | 24069. | 302556. |
| 1981 | 20924. | 15725. | 16184. | 15865. | 15301. | 23810. | 15624. | 42259. | 46527. | 36587. | 23503. | 22456. | 294766. |
| 1982 | 19976. | 16200. | 16463. | 16088. | 17682. | 24439. | 15624. | 104149. | 86514. | 52675. | 22330. | 20344. | 412486. |
| 1983 | 18822. | 15262. | 15695. | 15035. | 15268. | 13950. | 7172. | 14207. | 15120. | 15624. | 15230. | 15625. | 177008. |
| 1984 | 15624. | 14616. | 15624. | 15120. | 15188. | 24285. | 15624. | 57199. | 57300. | 34454. | 16609. | 18095. | 299737. |
| 1985 | 18139. | 15794. | 16513. | 16104. | 15284. | 24487. | 15624. | 72997. | 67856. | 37062. | 23539. | 23128. | 346528. |
| 1986 | 21361. | 17744. | 17968. | 16940. | 15263. | 23786. | 15263. | 15624. | 15565. | 16247. | 15527. | 15741. | 207029. |
| T O T A L | 574422. | 466868. | 479202. | 458175. | 474229. | 591316. | 437638. | 1114484. | 1759597. | 1303255. | 644090. | 605749. | 8909028. |
| A V E | 20515. | 16674. | 17114. | 16363. | 16937. | 21118. | 15630. | 39803. | 62843. | 46545. | 23003. | 21634. | 318180. |
| M A X | 27479. | 21987. | 19682. | 19400. | 25454. | 24487. | 37094. | 104160. | 100800. | 99996. | 38840. | 27827. | 455063. |
| M I N | 15624. | 14112. | 15624. | 15035. | 13711. | 10774. | 7172. | 14207. | 15120. | 15624. | 15230. | 15625. | 177008. |

## (3) Monthly List of Power at Generating End

### (Mae Lama Luang Project: Integrated Development)

(Unit: MW)

| | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < OCT > | < NOV > | < DEC > | <TOTAL> |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 240.0 | 240.0 | 240.0 | 227.4 | 189.5 | 192.8 | 201.1 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2730.8 |
| 1960 | 240.0 | 240.0 | 231.1 | 220.3 | 208.2 | 215.5 | 209.2 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2764.3 |
| 1961 | 240.0 | 240.0 | 240.0 | 240.0 | 227.9 | 217.3 | 218.3 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2823.6 |
| 1962 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 221.8 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2831.1 |
| 1963 | 240.0 | 240.0 | 240.0 | 240.0 | 227.2 | 216.5 | 223.1 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2826.9 |
| 1964 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.3 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2849.0 |
| 1965 | 240.0 | 240.0 | 240.0 | 240.0 | 227.9 | 217.5 | 209.2 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2814.6 |
| 1966 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 221.2 | 229.9 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2840.7 |
| 1967 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 209.2 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2818.5 |
| 1968 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 222.3 | 213.7 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2825.6 |
| 1969 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 220.7 | 216.5 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2826.8 |
| 1970 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 216.9 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2826.2 |
| 1971 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 222.1 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2851.7 |
| 1972 | 240.0 | 240.0 | 240.0 | 240.0 | 228.8 | 218.6 | 227.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2834.4 |
| 1973 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 218.6 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2828.0 |
| 1974 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 209.9 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2819.2 |
| 1975 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 215.3 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2824.7 |
| 1976 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 209.2 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2818.5 |
| 1977 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 209.2 | 236.7 | 240.0 | 240.0 | 240.0 | 240.0 | 2815.2 |
| 1978 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.2 | 220.7 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2829.6 |
| 1979 | 240.0 | 240.0 | 240.0 | 238.6 | 228.2 | 216.4 | 205.6 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2808.9 |
| 1980 | 240.0 | 240.0 | 235.3 | 221.6 | 214.1 | 215.3 | 209.2 | 233.4 | 240.0 | 240.0 | 240.0 | 240.0 | 2768.9 |
| 1981 | 240.0 | 240.0 | 240.0 | 240.0 | 228.2 | 217.8 | 214.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2820.1 |
| 1982 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 227.2 | 234.3 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2851.2 |
| 1983 | 240.0 | 240.0 | 240.0 | 239.2 | 225.0 | 208.3 | 134.0 | 214.3 | 240.0 | 240.0 | 240.0 | 240.0 | 2700.9 |
| 1984 | 240.0 | 240.0 | 240.0 | 236.8 | 223.0 | 216.1 | 212.2 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2808.2 |
| 1985 | 240.0 | 240.0 | 240.0 | 239.3 | 228.9 | 219.7 | 209.2 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2817.1 |
| 1986 | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 219.7 | 209.2 | 234.3 | 240.0 | 240.0 | 240.0 | 240.0 | 2812.8 |
| TOTAL | 6720.0 | 6720.0 | 6706.4 | 6663.2 | 6331.1 | 6101.1 | 5986.8 | 6678.7 | 6720.0 | 6720.0 | 6720.0 | 6720.0 | 78787.1 |
| AVE | 240.0 | 240.0 | 239.5 | 238.0 | 226.1 | 217.9 | 213.8 | 238.5 | 240.0 | 240.0 | 240.0 | 240.0 | 2813.8 |
| MAX | 240.0 | 240.0 | 240.0 | 240.0 | 229.6 | 227.2 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 240.0 | 2851.7 |
| MIN | 240.0 | 240.0 | 231.1 | 220.3 | 189.5 | 192.8 | 134.0 | 214.3 | 240.0 | 240.0 | 240.0 | 240.0 | 2700.9 |

## (4) Monthly List of Energy at Generating End

### (Mae Lama Luang Project: Integrated Development)

(Unit: MWh)

| | < JAN > | < FEB > | < MAR > | < APR > | < MAY > | < JUN > | < JUL > | < AUG > | < SEP > | < OCT > | < NOV > | < DEC > | <TOTAL> |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1959 | 29590. | 26008. | 27405. | 25223. | 21147. | 20820. | 25352. | 32340. | 137435. | 59116. | 28643. | 29427. | 462505. |
| 1960 | 28821. | 25831. | 26346. | 23792. | 24536. | 33298. | 39729. | 94485. | 146588. | 153517. | 57456. | 54027. | 708425. |
| 1961 | 46501. | 34571. | 31905. | 28369. | 26102. | 39314. | 47428. | 63297. | 172800. | 90568. | 35005. | 49224. | 665085. |
| 1962 | 41713. | 32511. | 32154. | 28667. | 48113. | 41903. | 47947. | 63177. | 127967. | 178560. | 41224. | 45496. | 729433. |
| 1963 | 39344. | 31409. | 31614. | 28021. | 26048. | 43256. | 48142. | 46754. | 127808. | 148286. | 69224. | 49337. | 689243. |
| 1964 | 43084. | 33536. | 32144. | 28670. | 29742. | 24606. | 54134. | 102638. | 172800. | 138665. | 38090. | 45691. | 743800. |
| 1965 | 39788. | 32229. | 32566. | 29008. | 26103. | 35304. | 36453. | 37372. | 89086. | 107048. | 71189. | 45343. | 581489. |
| 1966 | 40464. | 31926. | 31614. | 28153. | 30219. | 46317. | 49130. | 164551. | 139170. | 50133. | 28837. | 31043. | 671557. |
| 1967 | 32706. | 29013. | 29775. | 27037. | 26987. | 25162. | 39678. | 57473. | 172800. | 100477. | 32732. | 41547. | 615387. |
| 1968 | 36707. | 30306. | 30488. | 27867. | 30451. | 46465. | 46741. | 49612. | 98640. | 76371. | 28837. | 31476. | 533961. |
| 1969 | 33980. | 28957. | 28526. | 27274. | 30909. | 46247. | 47158. | 178560. | 172800. | 109484. | 57319. | 52917. | 814131. |
| 1970 | 47472. | 37975. | 34579. | 33121. | 42678. | 45489. | 47225. | 69654. | 156950. | 89311. | 37515. | 45982. | 687951. |
| 1971 | 38434. | 31493. | 31482. | 27660. | 31961. | 46438. | 90513. | 178560. | 160262. | 86995. | 36810. | 41055. | 801661. |
| 1972 | 36852. | 31127. | 30970. | 30124. | 26171. | 29268. | 48702. | 138329. | 116303. | 78625. | 48603. | 48857. | 663932. |
| 1973 | 41174. | 32061. | 32623. | 28396. | 32961. | 41830. | 47477. | 74272. | 172800. | 110709. | 44278. | 45734. | 704315. |
| 1974 | 38190. | 31271. | 29778. | 28470. | 32678. | 43564. | 46165. | 50565. | 104099. | 70788. | 41129. | 36905. | 553601. |
| 1975 | 40429. | 31552. | 32249. | 27938. | 29292. | 43872. | 46985. | 46356. | 163266. | 112395. | 42852. | 42511. | 659698. |
| 1976 | 38656. | 32391. | 30668. | 27240. | 30244. | 38005. | 43268. | 37263. | 112409. | 94994. | 41311. | 41738. | 568187. |
| 1977 | 48929. | 32162. | 30944. | 29525. | 26789. | 27301. | 35852. | 26782. | 137091. | 71658. | 35587. | 39097. | 541717. |
| 1978 | 37012. | 31139. | 30143. | 27141. | 28082. | 24597. | 47786. | 62484. | 126248. | 87502. | 29853. | 32625. | 564612. |
| 1979 | 31911. | 27431. | 28285. | 26059. | 26126. | 24380. | 30449. | 35552. | 65994. | 67875. | 28662. | 29466. | 422190. |
| 1980 | 28924. | 26107. | 26674. | 24777. | 25008. | 34012. | 42885. | 26529. | 147922. | 115321. | 41919. | 44259. | 584337. |
| 1981 | 36810. | 28337. | 28361. | 26526. | 26126. | 38120. | 46791. | 73821. | 90211. | 67282. | 36910. | 40330. | 539625. |
| 1982 | 35019. | 28735. | 28532. | 27580. | 30385. | 47170. | 49768. | 178560. | 163867. | 107550. | 36879. | 38393. | 772437. |
| 1983 | 34399. | 28186. | 28324. | 26103. | 25875. | 23752. | 14953. | 25029. | 26139. | 38975. | 29014. | 32466. | 333215. |
| 1984 | 29818. | 27310. | 28180. | 25922. | 25719. | 45582. | 46524. | 70762. | 122934. | 84624. | 29676. | 34490. | 571540. |
| 1985 | 31694. | 27387. | 28310. | 26109. | 27067. | 41739. | 45707. | 66870. | 149042. | 123530. | 62896. | 56133. | 686484. |
| 1986 | 41289. | 33319. | 32201. | 30476. | 28338. | 35609. | 44431. | 26592. | 43015. | 39924. | 28864. | 30034. | 414092. |
| T O T A L | 1049710. | 854282. | 846839. | 775248. | 815858. | 1033420. | 1257366. | 2078231. | 3616441. | 2660276. | 1141312. | 1155597. | 17284576. |
| A V E | 37490. | 30510. | 30244. | 27687. | 29138. | 36908. | 44906. | 74223. | 129159. | 95010. | 40761. | 41271. | 617306. |
| M A X | 48929. | 37975. | 34579. | 33121. | 48113. | 47170. | 90513. | 178560. | 172800. | 178560. | 71189. | 56133. | 814131. |
| M I N | 28821. | 25831. | 26346. | 23792. | 21147. | 20820. | 14953. | 25029. | 26139. | 38975. | 28643. | 29427. | 333215. |

# APPENDIX—E

# PRELIMINARY DESIGN

# APPENDIX-E PRELIMINARY DESIGN

## CONTENTS

# E-1 TRIFURCATION DESIGN OF PENSTOCK FOR MAE LAMA LUANG HYDROELECTRIC POWER PLANT

APPENDIX E-1 TRIFURCATION DESIGN OF PENSTOCK FOR MAE LAMA LUANG HYDROELECTRIC POWER PLANT

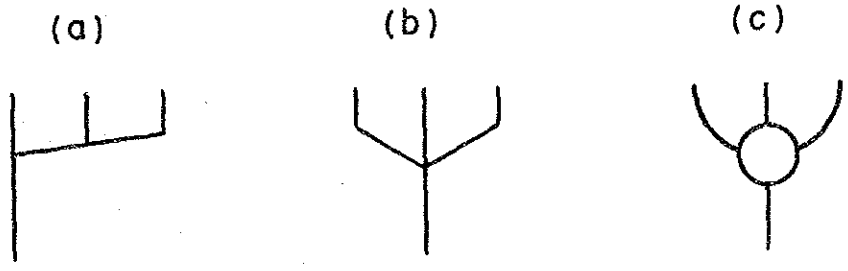
Ramification design of penstock (D = 7.4 m) into three manifolds (D = 4.5 m respectively) to connect three hydraulic turbines has three types as shown in the following figures, that is, (a) F Branch, (b) Three Pipe Branch and (c) Spherical Branch.

1) Head Loss

Results of hydraulic model tests gave us the head loss ($h_B = f_B \frac{v^2}{2g}$) of 0.25 m for Type (a) and 0.75 m - 1.00 m for Type (b) and (c), and the actual head loss of 0.75 m for Type (a) and 2.25 m - 3.00 m for Types (b) and (c) respectively. The results showed that the Type (a) was the most favorable.

2) Installation

While Type (b) and (c) require a large scale exterior stiffeners resulting in a heavy construction, Type (a) has only an interior stiffener and it is easy to transport and install.



# E-2 STUDY ON ALTERNATIVE OF NAM NGAO SPILLWAY

## APPENDIX E-2 STUDY ON ALTERNATIVE OF NAM NGAO SPILLWAY

For the original spillway plan, an alternative plan was studied which discharges flood flow through gully on the left bank of the dam. But comparing with the original spillway length of 300 m, the alternative needs about 800 m which results in the increase of construction cost. There is another alternative that the flood flow is to be discharged directly from the spillway which entrance is reinforced with concrete. But in this case there is a possibility of damaging natural ground due to the flood flow of 2,100 $m^3$/sec. And also there is a possibility flooding the hydroelectric power plant located 250 m downstream from the spillway end, and the enormous volume of earth and rock scoured from ground may be deposited at the junction of the Ngao river and dam up the rivers. For the above-mentioned reasons, the original plan was adopted.

# APPENDIX—F

# CONSTRUCTION PLANNING AND COST ESTIMATE

# APPENDIX-F CONSTRUCTION PLANNING AND COST ESTIATE

## CONTENTS

F-1 BILL OF QUANTITY

F-1-(1) NAM NGAO PROJECT : INDIVIDUAL AND INTEGRATED PROJECTS

F-1-(2) MAE LAMA LUANG PROJECT: INTEGRATED DEVELOPMENT

F-1-(3) MAE LAMA LUANG PROJECT: INDIVIDUAL DEVELOPMENT

F-1-(1) BILL OF QUANTITY : NAM NGAO PROJECT

INDIVIDUAL AND INTEGRATED DEVELOPMENTS

Nam Ngao Individual and Integrated Development

Construction Cost

Unit : $10^6$Baht

| Item | Total | Currency | |
|---|---|---|---|
| | | Foreign | Local |
| Civil Works | | | |
| Diversion & Care of River | 177.5 | 87.8 | 89.4 |
| Dam | 1,036.0 | 643.0 | 393.0 |
| Spillway | 269.8 | 114.6 | 155.2 |
| Outlet Works | 6.8 | 2.9 | 3.9 |
| Intake | 27.9 | 12.2 | 15.7 |
| Headrace and Penstock | 71.5 | 33.9 | 37.6 |
| Powerhouse | 102.8 | 49.2 | 53.6 |
| Tail-race | 67.1 | 30.0 | 37.1 |
| Switchyard | 1.7 | 0.7 | 1.0 |
| Sub-total | 1,761.1 | 974.3 | 786.8 |
| Hydraulic Equipment | | | |
| Diversion Gate | 6.4 | 5.1 | 1.3 |
| Spillway Gate | 21.4 | 17.1 | 4.3 |
| Intake Gate | 10.3 | 8.2 | 2.1 |
| Screen | 3.4 | 2.4 | 1.0 |
| Tail-race | 5.6 | 4.5 | 1.1 |
| Outlet Valve | 14.8 | 11.6 | 3.2 |
| Penstock | 97.6 | 68.3 | 29.3 |
| Sub-totall | 159.5 | 117.2 | 42.3 |

# (1) Main Dam

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 391,000 | 60 | 42 | 18 | 23,460,000 | 16,422,000 | 7,038,000 |
| Rock Excavation | $m^3$ | 44,000 | 130 | 65 | 65 | 5,720,000 | 2,860,000 | 2,860,000 |
| Embankment Rockfill | $m^3$ | 5,026,000 | 110 | 72 | 38 | 552,860,000 | 361,872,000 | 190,988,000 |
| Embankment Filter Material | $m^3$ | 348,000 | 150 | 98 | 52 | 52,200,000 | 34,104,000 | 18,096,000 |
| Embankment Impervious Material | $m^3$ | 324,000 | 150 | 98 | 52 | 48,600,000 | 31,752,000 | 16,848,000 |
| Concrete Facing | $m^3$ | 43,000 | 2,500 | 704 | 1,796 | 107,500,000 | 30,272,000 | 77,228,000 |
| Reinforcement | t | 3,300 | 15,600 | 13,185 | 2,415 | 51,480,000 | 43,510,500 | 7,969,500 |
| Ancher Bar ($\phi$ 25m/m, $\ell$ =3.0m) | PC | 730 | 1,000 | 800 | 200 | 730,000 | 584,000 | 146,000 |
| Curtain Grouting | m | 36,000 | 2,500 | 1,615 | 885 | 90,000,000 | 58,140,000 | 31,860,000 |
| Consolidation Grouting | m | 2,500 | 2,500 | 1,615 | 885 | 6,250,000 | 4,037,500 | 2,212,500 |
| Water stop | m | 5,000 | 600 | 400 | 200 | 3,000,000 | 2,000,000 | 1,000,000 |
| Miscellaneous Works | L.S. | 1 | | | | 94,180,000 | 57,463,000 | 36,716,800 |
| Sub Total | | | | | | 1,035,980,000 | 643,017,200 | 392,962,800 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Ngao Project

## (2) Coffer Dam

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 70,300 | 60 | 42 | 18 | 4,218,000 | 2,952,600 | 1,265,400 |
| Rock Excavation | $m^3$ | 4,300 | 130 | 65 | 65 | 559,000 | 279,500 | 279,500 |
| Embankment Impervious Material | $m^3$ | 41,500 | 150 | 98 | 52 | 6,225,000 | 4,067,000 | 2,158,000 |
| Embankment Rockfill | $m^3$ | 200,500 | 110 | 72 | 38 | 22,055,000 | 14,436,000 | 7,619,000 |
| Miscellaneous Works | L.S. | 1 | | | | 3,305,700 | 2,173,510 | 1,132,190 |
| Sub Total | | | | | | 36,362,700 | 23,908,610 | 12,454,090 |
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Ngao Project

## (3) Spillway

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 350,000 | 60 | 42 | 18 | 21,000,000 | 14,700,000 | 6,300,000 |
| Rock Excavation | $m^3$ | 73,000 | 130 | 65 | 65 | 9,490,000 | 4,745,000 | 4,745,000 |
| Backfill | $m^3$ | 30,000 | 90 | 60 | 30 | 2,700,000 | 1,800,000 | 900,000 |
| Structual Concrete | $m^3$ | 13,000 | 2,400 | 704 | 1,696 | 31,200,000 | 9,152,000 | 22,048,000 |
| Mass Concrete | $m^3$ | 47,000 | 1,800 | 588 | 1,212 | 84,600,000 | 27,636,000 | 56,964,000 |
| Backfilling Concrete | $m^3$ | 65,000 | 1,200 | 472 | 728 | 78,000,000 | 30,680,000 | 47,320,000 |
| Reinforcenent | t | 1,170 | 15,600 | 13,185 | 2,415 | 18,252,000 | 15,426,000 | 2,825,550 |
| Miscellaneous Works | L.S. | 1 | | | | 24,524,200 | 10,413,945 | 14,110,255 |
| Sub Total | | | | | | 269,766,200 | 14,553,395 | 155,212,805 |
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Ngao Project

## (4) Diversion Work

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 18,000 | 60 | 42 | 18 | 1,080,000 | 756,000 | 324,000 |
| Rock Excavation | $m^3$ | 25,000 | 130 | 65 | 65 | 3,250,000 | 1,625,000 | 1,625,000 |
| Tunnel Excavation | $m^3$ | 76,000 | 580 | 286 | 294 | 44,080,000 | 21,736,000 | 22,344,000 |
| Structual Concrete | $m^3$ | 6,600 | 2,400 | 704 | 1,696 | 15,840,000 | 4,646,400 | 11,193,600 |
| Concrete Lining | $m^3$ | 12,000 | 2,500 | 733 | 1,767 | 30,000,000 | 8,796,000 | 21,204,000 |
| Plug Concrete | $m^3$ | 3,800 | 2,200 | 645 | 1,555 | 8,360,000 | 2,451,000 | 5,909,000 |
| Shotcrete | $m^2$ | 28,000 | 260 | 172 | 88 | 7,280,000 | 4,816,000 | 2,464,000 |
| Rockbolt | PC | 6,200 | 860 | 570 | 290 | 5,332,000 | 3,534,000 | 1,798,000 |
| Reinforcement | t | 470 | 15,600 | 13,185 | 2,415 | 7,332,000 | 6,196,950 | 1,135,050 |
| Mortor Injection | $m^3$ | 500 | 3,000 | 1,580 | 1,420 | 1,500,000 | 790,000 | 710,000 |
| Curtain Grouting | m | 1,700 | 2,500 | 1,615 | 885 | 4,250,000 | 2,745,500 | 1,504,500 |
| Miscellaneous Works | L.S. | 1 | | | | 12,830,400 | 2,745,500 | 1,504,500 |
| Sub Total | | | | | | 141,134,400 | 63,902,135 | 77,232,265 |
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# (5) Bottom Outlet

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 2,700 | 60 | 42 | 18 | 162,000 | 113,400 | 48,600 |
| Rock Excavation | $m^3$ | 4,100 | 130 | 65 | 65 | 533,000 | 266,500 | 266,500 |
| Tunnel Excavation | $m^3$ | 1,700 | 580 | 286 | 294 | 986,000 | 486,200 | 499,800 |
| Structual Concrete | $m^3$ | 600 | 2,400 | 704 | 1,696 | 1,440,000 | 422,400 | 1,017,600 |
| Concrete Lining | $m^3$ | 750 | 2,500 | 733 | 1,767 | 1,875,000 | 549,750 | 1,325,250 |
| Plug Concrete | $m^3$ | 200 | 2,200 | 645 | 1,555 | 440,000 | 129,000 | 311,000 |
| Reinforcement | t | 50 | 15,600 | 13,185 | 2,415 | 780,000 | 659,250 | 120,750 |
| Miscellaneous Works | L.S. | 1 | | | | 621,600 | 262,650 | 358,950 |
| Sub Total | | | | | | 6,837,600 | 2,889,150 | 3,948,450 |
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Ngao Project

## (6) Power Intake

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 22,000 | 60 | 42 | 18 | 1,320,000 | 924,000 | 396,000 |
| Rock Excavation | $m^3$ | 7,100 | 130 | 65 | 65 | 923,000 | 461,500 | 461,500 |
| Structual Concrete | $m^3$ | 3,700 | 2,400 | 704 | 1,696 | 8,880,000 | 2,604,800 | 6,275,200 |
| Mass Concrete | $m^3$ | 4,700 | 1,800 | 588 | 1,212 | 8,460,000 | 2,763,600 | 5,696,400 |
| Reinforcement | t | 230 | 15,600 | 13,185 | 2,415 | 3,588,000 | 3,032,550 | 555,450 |
| Connecting Bridge | L.S. | 1 | | | | 2,200,000 | 1,320,000 | 880,000 |
| Miscellaneous Works | L.S. | 1 | | | | 2,537,100 | 1,110,645 | 1,426,455 |
| Sub Total | | | | | | 27,908,100 | 12,217,095 | 15,691,005 |
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Ngao Project

## (7) Penstock

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 24,000 | 60 | 42 | 18 | 1,440,000 | 1,008,000 | 432,000 |
| Rock Excavation | $m^3$ | 8,900 | 130 | 65 | 65 | 1,157,000 | 578,500 | 578,500 |
| Tunnel Excavation | $m^3$ | 30,000 | 580 | 286 | 294 | 17,400,000 | 8,580,000 | 8,820,000 |
| Structual Concrete | $m^3$ | 5,700 | 2,400 | 704 | 1,696 | 13,680,000 | 4,012,800 | 9,667,200 |
| Concrete Lining | $m^3$ | 3,100 | 2,500 | 733 | 1,767 | 7,750,000 | 2,272,300 | 5,477,700 |
| Concrete Filling | $m^3$ | 4,800 | 1,200 | 472 | 728 | 5,760,000 | 2,265,600 | 3,494,400 |
| Mortar Injection | $m^3$ | 600 | 3,000 | 1,580 | 1,420 | 1,800,000 | 948,000 | 852,000 |
| Curtain Grouting | m | 750 | 2,500 | 1,615 | 885 | 1,875,000 | 1,211,250 | 663,750 |
| Consolidation Grouting | m | 2,000 | 2,500 | 1,615 | 885 | 5,000,000 | 3,230,000 | 1,770,000 |
| Shotcrete ( t = $10^{cm}$ ) | $m^2$ | 12,200 | 260 | 172 | 88 | 3,172,000 | 2,098,400 | 1,073,600 |
| Rockbolt ($\phi$25m/m, $\ell$ = $2.0^{m}$ ) | PC | 2,800 | 860 | 570 | 290 | 2,408,000 | 1,596,000 | 812,000 |
| Reinforcement | t | 230 | 15,600 | 13,185 | 2,415 | 3,588,000 | 3,032,550 | 555,450 |
| Miscellaneous Works | L.S. | 1 | | | | 6,503,000 | 3,083,340 | 3,419,660 |
| Sub Total | | | | | | 71,523,000 | 33,916,740 | 37,616,260 |
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Ngao Project

## (8) Powerhouse

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 37,000 | 60 | 42 | 18 | 2,220,000 | 1,554,000 | 666,000 |
| Rock Excavation | $m^3$ | 43,000 | 130 | 65 | 65 | 5,590,000 | 2,795,000 | 2,795,000 |
| Backfill | $m^3$ | 16,000 | 90 | 60 | 30 | 1,440,000 | 960,000 | 480,000 |
| Structual Concrete | $m^3$ | 6,800 | 2,400 | 704 | 1,696 | 16,320,000 | 4,787,200 | 11,532,800 |
| Mass Concrete | $m^3$ | 14,500 | 1,800 | 588 | 1,212 | 26,100,000 | 8,526,000 | 17,574,000 |
| Reinforcement | t | 730 | 15,600 | 13,185 | 2,415 | 11,388,000 | 9,625,050 | 1,762,950 |
| Pavement Works | $m^2$ | 9,600 | 600 | 180 | 420 | 5,760,000 | 1,728,000 | 4,032,000 |
| Architectural Works | L.S. | 1 | | | | 24,600,000 | 14,760,000 | 9,840,000 |
| Miscellaneous Works | L.S. | 1 | | | | 9,341,800 | 4,473,525 | 4,868,275 |
| Sub Total | | | | | | 102,759,800 | 49,208,775 | 53,551,025 |
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# (9) Tailrace

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 102,000 | 60 | 42 | 18 | 6,120,000 | 4,284,000 | 1,836,000 |
| Rock Excavation | $m^3$ | 15,000 | 130 | 65 | 65 | 1,950,000 | 975,000 | 975,000 |
| Embankment | $m^3$ | 55,000 | 150 | 98 | 52 | 8,250,000 | 5,390,000 | 2,860,000 |
| Structual Concrete | $m^3$ | 3,700 | 2,400 | 704 | 1,696 | 8,880,000 | 2,604,800 | 6,275,200 |
| Mass Concrete | $m^3$ | 17,400 | 1,800 | 588 | 1,212 | 31,320,000 | 10,231,200 | 21,088,800 |
| Reinforcement | t | 290 | 15,600 | 13,185 | 2,415 | 4,524,000 | 3,823,650 | 700,350 |
| Miscellaneous Works | L.S. | | | | | 6,104,400 | 2,730,865 | 3,373,535 |
| Sub Total | | | | | | 67,148,400 | 30,039,515 | 37,108,885 |
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Ngao Project

# (10) Switchyard

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 350 | 60 | 42 | 18 | 21,000 | 14,700 | 6,300 |
| Structual Concrete | $m^3$ | 500 | 2,400 | 704 | 1,696 | 1,200,000 | 352,000 | 848,000 |
| Reinforcement | t | 20 | 15,600 | 13,185 | 2,415 | 312,000 | 263,700 | 48,300 |
| Miscellaneous Works | L.S. | | | | | 153,300 | 63,040 | 90,260 |
| Sub Total | | | | | | 1,686,300 | 693,440 | 992,860 |
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F-1-(2) BILL OF QUANTITY : MAE LAMA LUANG PROJECT
INTEGRATED DEVELOPMENT

Mae Lama Luang Integrated Development

Construction Cost

Unit : $10^6$Baht

| Item | Total | Currency | |
|---|---|---|---|
| | | Foreign | Local |
| Civil Works | | | |
| Diversion & Care of River | 227.1 | 114.0 | 113.1 |
| Dam | 533.3 | 348.3 | 185.0 |
| Spillway | 422.4 | 180.5 | 241.9 |
| Outlet Works | 7.4 | 3.1 | 4.3 |
| Intake | 35.6 | 15.2 | 20.4 |
| Headrace and Penstock | 55.6 | 28.0 | 27.6 |
| Powerhouse | 186.6 | 89.4 | 97.2 |
| Tail-race | 130.1 | 47.4 | 82.7 |
| Switchyard | 1.7 | 0.7 | 1.0 |
| Sub-total | 1,599.8 | 826.6 | 773.2 |
| Hydraulic Equipment | | | |
| Diversion Gate | 9.8 | 7.8 | 2.0 |
| Spillway Gate | 37.4 | 29.9 | 7.5 |
| Intake Gate | 15.9 | 12.7 | 3.2 |
| Screen | 5.2 | 3.6 | 1.6 |
| Tail-race | 6.5 | 5.2 | 1.3 |
| Outlet Valve | 15.0 | 11.7 | 3.3 |
| Penstock | 115.6 | 80.9 | 34.7 |
| Sub-totall | 205.4 | 151.8 | 53.6 |

Mae Lama Luang Project

## (1) Main Dam

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 494,000 | 60 | 42 | 18 | 29,640,000 | 20,748,000 | 8,892,000 |
| Rock Excavation | $m^3$ | 72,000 | 130 | 65 | 65 | 9,360,000 | 4,680,000 | 4,680,000 |
| Tunnel Excavation | $m^3$ | 800 | 580 | 286 | 464 | 464,000 | 228,800 | 235,200 |
| Embankment Rockfill | $m^3$ | 2,704,000 | 110 | 72 | 38 | 297,440,000 | 194,688,000 | 102,752,000 |
| Embankment Filter Material | $m^3$ | 377,000 | 150 | 98 | 52 | 56,550,000 | 36,946,000 | 19,604,000 |
| Embankment Impervious Material | $m^3$ | 446,000 | 150 | 98 | 52 | 66,900,000 | 43,708,000 | 23,192,000 |
| Concrete Lining | $m^3$ | 200 | 2,500 | 733 | 1,767 | 500,000 | 146,600 | 353,400 |
| Curtain Grouting | m | 4,500 | 2,500 | 1,615 | 885 | 11,250,000 | 7,267,500 | 3,982,500 |
| Blanket Grouting | m | 5,100 | 2,500 | 1,615 | 885 | 12,750,000 | 8,236,500 | 4,513,500 |
| Miscellaneous Works | L.S. | 1 | | | | 48,485,400 | 31,664,940 | 16,820,460 |
| Sub Total | | | | | | 533,339,400 | 348,314,340 | 185,025,060 |
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Mae Lama Luang Project

## (2) Coffer Dam

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 78,000 | 60 | 42 | 18 | 4,680,000 | 3,276,000 | 1,404,000 |
| Rock Excavation | $m^3$ | 5,800 | 130 | 65 | 65 | 754,000 | 377,000 | 377,000 |
| Embankment Rockfill | $m^3$ | 243,000 | 110 | 72 | 38 | 26,730,000 | 17,496,000 | 9,234,000 |
| Embankment Impervious Material | $m^3$ | 47,000 | 150 | 98 | 52 | 7,050,000 | 4,606,000 | 2,444,000 |
| Miscellaneous Works | L.S. | 1 | | | | 3,921,400 | 2,575,500 | 1,345,900 |
| Sub Total | | | | | | 43,135,400 | 28,330,500 | 14,804,900 |
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# (3) Spillway

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 580,000 | 60 | 42 | 18 | 34,800,000 | 24,360,000 | 10,440,000 |
| Rock Excavation | $m^3$ | 63,000 | 130 | 65 | 65 | 8,190,000 | 4,095,000 | 4,095,000 |
| Backfill | $m^3$ | 38,000 | 90 | 60 | 30 | 3,420,000 | 2,280,000 | 1,140,000 |
| Structual Concrete | $m^3$ | 8,900 | 2,400 | 704 | 1,696 | 21,360,000 | 6,265,600 | 15,094,400 |
| Mass Concrete | $m^3$ | 78,200 | 1,800 | 588 | 1,212 | 140,760,000 | 45,981,600 | 94,778,400 |
| Backfilling Concrete | $m^3$ | 124,000 | 1,200 | 472 | 728 | 148,800,000 | 58,528,000 | 90,272,000 |
| Reinforcenent | t | 1,710 | 15,600 | 13,185 | 2,415 | 26,676,000 | 22,546,350 | 4,129,650 |
| Miscellaneous Works | L.S. | 1 | | | | 38,400,600 | 16,405,655 | 21,994,945 |
| Sub Total | | | | | | 422,406,600 | 180,462,205 | 241,944,395 |
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Mae Lama Luang Project

## (4) Diversion Work

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 31,000 | 60 | 42 | 18 | 1,860,000 | 1,302,000 | 558,000 |
| Rock Excavation | $m^3$ | 15,000 | 130 | 65 | 65 | 1,950,000 | 975,000 | 975,000 |
| Tunnel Excavation | $m^3$ | 130,000 | 580 | 286 | 294 | 75,400,000 | 37,180,000 | 38,220,000 |
| Structual Concrete | $m^3$ | 3,400 | 2,400 | 704 | 1,696 | 8,160,000 | 2,393,600 | 5,766,400 |
| Concrete Lining | $m^3$ | 14,100 | 2,500 | 733 | 1,767 | 35,250,000 | 10,335,300 | 24,914,700 |
| Plug Concrete | $m^3$ | 6,200 | 2,200 | 645 | 1,555 | 13,640,000 | 3,999,000 | 9,641,000 |
| Shotcrete ( t = 10 cm ) | $m^3$ | 38,000 | 260 | 172 | 88 | 9,880,000 | 6,536,000 | 3,344,000 |
| Rockbolt ( $\phi$25m/m, $\ell$ = 3.0m ) | PC | 8,500 | 860 | 570 | 290 | 731,000 | 4,845,000 | 2,465,000 |
| Reinforcement | t | 520 | 15,600 | 13,185 | 2,415 | 8,112,000 | 6,856,200 | 1,255,800 |
| Mortor Injection | $m^3$ | 510 | 3,000 | 1,580 | 1,420 | 1,530,000 | 805,800 | 724,200 |
| Curtain Grouting | m | 1,650 | 2,500 | 1,615 | 885 | 4,125,000 | 2,664,750 | 1,460,250 |
| Miscellaneous Works | L.S. | 1 | | | | 16,721,700 | 7,789,265 | 8,932,435 |
| Sub Total | | | | | | 183,938,700 | 85,681,915 | 98,256,785 |
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Mae Lama Luang Project

## (5) Bottom Outlet

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 3,000 | 60 | 42 | 18 | 180,000 | 126,000 | 54,000 |
| Rock Excavation | $m^3$ | 2,700 | 130 | 65 | 65 | 351,000 | 175,500 | 175,500 |
| Tunnel Excavation | $m^3$ | 1,200 | 580 | 286 | 294 | 696,000 | 343,200 | 352,800 |
| Structual Concrete | $m^3$ | 800 | 2,400 | 704 | 1,696 | 1,920,000 | 563,200 | 1,356,800 |
| Concrete Lining | $m^3$ | 750 | 2,500 | 733 | 1,767 | 1,875,000 | 549,750 | 1,325,250 |
| Plug Concrete | $m^3$ | 350 | 2,200 | 645 | 1,555 | 770,000 | 225,750 | 544,250 |
| Reinforcement | t | 60 | 15,600 | 13,185 | 2,415 | 936,000 | 791,100 | 144,900 |
| Miscellaneous Works | L.S. | 1 | | | | 672,800 | 277,450 | 395,350 |
| Sub Total | | | | | | 7,400,800 | 3,051,950 | 4,348,850 |
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Mae Lama Luang Project

## (6) Power Intake

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 16,000 | 60 | 42 | 18 | 960,000 | 672,000 | 288,000 |
| Rock Excavation | $m^3$ | 15,000 | 130 | 65 | 65 | 1,950,000 | 975,000 | 975,000 |
| Structual Concrete | $m^3$ | 4,900 | 2,400 | 704 | 1,696 | 11,760,000 | 3,449,600 | 8,310,400 |
| Mass Concrete | $m^3$ | 6100 | 1800 | 588 | 1,212 | 10,980,000 | 3,586,800 | 7,393,200 |
| Reinforcement | t | 300 | 15,600 | 13,185 | 2,415 | 4,680,000 | 3,955,500 | 724,500 |
| Connecting Bridge | | | | | | 2,000,000 | 1,200,000 | 800,000 |
| Miscellaneous Works | L.S. | 1 | | | | 3,233,000 | 1,383,890 | 1,849,110 |
| Sub Total | | | | | | 35,563,000 | 15,222,790 | 20,340,210 |
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# (7) Penstock

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Tunnel Excavation | $m^3$ | 35,000 | 580 | 286 | 294 | 20,300,000 | 10,010,000 | 10,290,000 |
| Concrete Lining | $m^3$ | 3,000 | 2,500 | 733 | 1,767 | 7,500,000 | 2,199,000 | 5,301,000 |
| Concrete Filling | $m^3$ | 6,000 | 1,200 | 472 | 728 | 7,200,000 | 2,832,000 | 4,368,000 |
| Mortor Injection | $m^3$ | 570 | 3,000 | 1,580 | 1,420 | 1,710,000 | 900,600 | 809,400 |
| Curtain Grouting | m | 750 | 2,500 | 1,615 | 885 | 1,875,000 | 1,211,250 | 663,750 |
| Consolidation Grouting | m | 1,400 | 2,500 | 1,615 | 885 | 3,500,000 | 2,261,000 | 1,239,000 |
| Shotcrete | $m^2$ | 13,000 | 260 | 172 | 88 | 3,380,000 | 2,236,000 | 1,144,000 |
| Rockbolt | PC | 2,900 | 860 | 570 | 290 | 2,494,000 | 1,653,000 | 841,000 |
| Reinforcement | t | 165 | 15,600 | 13,185 | 2,415 | 2,574,000 | 2,175,525 | 398,475 |
| Miscellaneous Works | L.S. | 1 | | | | 5,053,300 | 2,547,800 | 2,505,500 |
| Sub Total | | | | | | 55,586,300 | 28,026,175 | 27,560,125 |
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Mae Lama Luang Project

## (8) Powerhouse

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 44,000 | 60 | 42 | 18 | 2,640,000 | 1,848,000 | 792,000 |
| Rock Excavation | $m^3$ | 116,000 | 130 | 65 | 65 | 15,080,000 | 7,540,000 | 7,540,000 |
| Backfill | $m^3$ | 18,000 | 90 | 60 | 30 | 1,620,000 | 1,080,000 | 540,000 |
| Structual Concrete | $m^3$ | 12,700 | 2,400 | 704 | 1,696 | 30,480,000 | 8,940,800 | 21,539,200 |
| Mass Concrete | $m^3$ | 28,700 | 1,800 | 588 | 1,212 | 51,660,000 | 16,875,600 | 34,784,400 |
| Reinforcement | t | 1,350 | 15,600 | 13,185 | 2,415 | 21,060,000 | 17,799,750 | 3,260,250 |
| Pavement Works | $m^2$ | 5,700 | 600 | 180 | 420 | 3,420,000 | 1,026,000 | 2,394,000 |
| Architectural Works | L.S. | 1 | | | | 43,665,000 | 26,199,000 | 17,466,000 |
| Miscellaneous Works | L.S. | 1 | | | | 16,962,500 | 8,130,915 | 8,831,585 |
| Sub Total | | | | | | 186,587,500 | 89,440,065 | 97,147,435 |
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# (9) Tailrace

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 83,000 | 60 | 42 | 18 | 4,980,000 | 3,486,000 | 1,494,000 |
| Rock Excavation | $m^3$ | 23,000 | 130 | 65 | 65 | 2,990,000 | 1,495,000 | 1,495,000 |
| Embankment | $m^3$ | 59,000 | 150 | 98 | 52 | 8,850,000 | 5,782,000 | 3,068,000 |
| Structual Concrete | $m^3$ | 8,500 | 2,400 | 704 | 1,696 | 20,400,000 | 5,984,000 | 14,416,000 |
| Mass Concrete | $m^3$ | 39,400 | 1,800 | 450 | 1,350 | 70,920,000 | 17,730,000 | 53,190,000 |
| Reinforcement | t | 650 | 15,600 | 13,185 | 2,415 | 10,140,000 | 8,570,250 | 1,569,750 |
| Miscellaneous Works | L.S. | 1 | | | | 11,828,000 | 4,304,725 | 7,523,275 |
| Sub Total | | | | | | 130,108,000 | 47,351,975 | 82,756,025 |
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Mae Lama Luang Project

# (10) Switchyard

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 350 | 60 | 42 | 18 | 21,000 | 14,700 | 6,300 |
| Structual Concrete | $m^3$ | 500 | 2,400 | 704 | 1,696 | 1,200,000 | 352,000 | 848,000 |
| Reinforcement | t | 20 | 15,600 | 13,185 | 2,415 | 312,000 | 263,700 | 48,300 |
| Miscellaneous Works | L.S. | 1 | | | | 153,300 | 63,040 | 90,260 |
| Sub Total | | | | | | 1,686,300 | 693,440 | 992,860 |
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F-1-(3) BILL OF QUANTITY : MAE LAMA LUANG PROJECT
INDIVIDUAL DEVELOPMENT

Mae Lama Luang Individual Development

Construction Cost

Unit : $10^6$ Baht

| Item | Total | Currency | |
|---|---|---|---|
| | | Foreign | Local |
| Civil Works | | | |
| Diversion & Care of River | 227.1 | 114.0 | 113.1 |
| Dam | 533.3 | 348.3 | 185.0 |
| Spillway | 422.4 | 180.5 | 241.9 |
| Outlet Works | 7.4 | 3.1 | 4.3 |
| Intake | 29.7 | 12.7 | 17.0 |
| Headrace and Penstock | 46.0 | 23.3 | 22.7 |
| Powerhouse | 147.0 | 70.0 | 77.0 |
| Tail-race | 121.7 | 43.5 | 78.2 |
| Switchyard | 1.7 | 0.7 | 1.0 |
| Sub-total | 1,536.3 | 796.1 | 740.2 |
| Hydraulic Equipment | | | |
| Diversion Gate | 9.8 | 7.8 | 2.0 |
| Spillway Gate | 37.4 | 29.9 | 7.5 |
| Intake Gate | 13.1 | 10.5 | 2.6 |
| Screen | 4.3 | 3.0 | 1.3 |
| Tail-race | 6.5 | 5.2 | 1.3 |
| Outlet Valve | 15.0 | 11.7 | 3.3 |
| Penstock | 82.4 | 57.7 | 24.7 |
| Sub-totall | 168.5 | 125.8 | 42.7 |

Mae Lama Luang Project

## (1) Main Dam

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 494,000 | 60 | 42 | 18 | 29,640,000 | 20,748,000 | 8,892,000 |
| Rock Excavation | $m^3$ | 72,000 | 130 | 65 | 65 | 9,360,000 | 4,680,000 | 4,680,000 |
| Tunnel Excavation | $m^3$ | 800 | 580 | 286 | 464 | 464,000 | 228,800 | 235,200 |
| Embankment Rockfill | $m^3$ | 2,704,000 | 110 | 72 | 38 | 297,440,000 | 194,688,000 | 102,752,000 |
| Embankment Filter Material | $m^3$ | 377,000 | 150 | 98 | 52 | 56,550,000 | 36,946,000 | 19,604,000 |
| Embankment Impervious Material | $m^3$ | 446,000 | 150 | 98 | 52 | 66,900,000 | 43,708,000 | 23,192,000 |
| Concrete Lining | $m^3$ | 200 | 2,500 | 733 | 1,767 | 500,000 | 146,600 | 353,400 |
| Curtain Grouting | m | 4,500 | 2,500 | 1,615 | 885 | 11,250,000 | 7,267,500 | 3,982,500 |
| Blanket Grouting | m | 5,100 | 2,500 | 1,615 | 885 | 12,750,000 | 8,236,500 | 4,513,500 |
| Miscellaneous Works | L.S. | 1 | | | | 48,485,400 | 31,664,940 | 16,820,460 |
| Sub Total | | | | | | 533,339,400 | 348,314,340 | 185,025,060 |
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Mae Lama Luang Project

## (2) Coffer Dam

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 78,000 | 60 | 42 | 18 | 4,680,000 | 3,276,000 | 1,404,000 |
| Rock Excavation | $m^3$ | 5,800 | 130 | 65 | 65 | 754,000 | 377,000 | 377,000 |
| Embankment Rockfill | $m^3$ | 243,000 | 110 | 72 | 38 | 26,730,000 | 17,496,000 | 9,234,000 |
| Embankment Impervious Material | $m^3$ | 47,000 | 150 | 98 | 52 | 7,050,000 | 4,606,000 | 2,444,000 |
| Miscellaneous Works | L.S. | 1 | | | | 3,921,400 | 2,575,500 | 1,345,900 |
| Sub Total | | | | | | 43,135,400 | 28,330,500 | 14,804,900 |
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## (3) Spillway

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 580,000 | 60 | 42 | 18 | 34,800,000 | 24,360,000 | 10,440,000 |
| Rock Excavation | $m^3$ | 63,000 | 130 | 65 | 65 | 8,190,000 | 4,095,000 | 4,095,000 |
| Backfill | $m^3$ | 38,000 | 90 | 60 | 30 | 3,420,000 | 2,280,000 | 1,140,000 |
| Structual Concrete | $m^3$ | 8,900 | 2,400 | 704 | 1,696 | 21,360,000 | 6,265,600 | 15,094,400 |
| Mass Concrete | $m^3$ | 78,200 | 1,800 | 588 | 1,212 | 140,760,000 | 45,981,600 | 94,778,400 |
| Backfilling Concrete | $m^3$ | 124,000 | 1,200 | 472 | 728 | 148,800,000 | 58,528,000 | 90,272,000 |
| Reinforcenent | t | 1,710 | 15,600 | 13,185 | 2,415 | 26,676,000 | 22,546,350 | 4,129,650 |
| Miscellaneous Works | L.S. | 1 | | | | 38,500,600 | 16,405,655 | 21,994,945 |
| Sub Total | | | | | | 422,406,600 | 189,462,205 | 241,944,395 |
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Mae Lama Luang Project

## (4) Diversion Work

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 31,000 | 60 | 42 | 18 | 1,860,000 | 1,302,000 | 558,000 |
| Rock Excavation | $m^3$ | 15,000 | 130 | 65 | 65 | 1,950,000 | 975,000 | 975,000 |
| Tunnel Excavation | $m^3$ | 130,000 | 580 | 286 | 294 | 75,400,000 | 37,180,000 | 38,220,000 |
| Structual Concrete | $m^3$ | 3,400 | 2,400 | 704 | 1,696 | 8,160,000 | 2,393,600 | 5,766,400 |
| Concrete Lining | $m^3$ | 14,100 | 2,500 | 733 | 1,767 | 35,250,000 | 10,335,300 | 24,914,700 |
| Plug Concrete | $m^3$ | 6,200 | 2,200 | 645 | 1,555 | 13,640,000 | 3,999,000 | 9,641,000 |
| Shotcrete ( t = 10 cm ) | $m^3$ | 38,000 | 260 | 172 | 88 | 9,880,000 | 6,536,000 | 3,344,000 |
| Rockbolt ( $\phi$ 25m/m, $\ell$ = 3.0m ) | PC | 8,500 | 860 | 570 | 290 | 731,000 | 4,845,000 | 2,465,000 |
| Reinforcement | t | 520 | 15,600 | 13,185 | 2,415 | 8,112,000 | 6,856,200 | 1,255,800 |
| Mortor Injection | $m^3$ | 510 | 3,000 | 1,580 | 1,420 | 1,530,000 | 805,800 | 724,200 |
| Curtain Grouting | m | 1,650 | 2,500 | 1,615 | 885 | 4,125,000 | 2,664,750 | 1,460,255 |
| Miscellaneous Works | L.S. | 1 | | | | 16,721,700 | 7,789,265 | 8,932,435 |
| Sub Total | | | | | | 183,938,700 | 85,681,915 | 98,256,785 |
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# (5) Bottom Outlet

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 3,000 | 60 | 42 | 18 | 180,000 | 126,000 | 54,000 |
| Rock Excavation | $m^3$ | 2,700 | 130 | 65 | 65 | 351,000 | 175,500 | 175,500 |
| Tunnel Excavation | $m^3$ | 1,200 | 580 | 286 | 294 | 696 | 343,200 | 352,800 |
| Structual Concrete | $m^3$ | 800 | 2,400 | 704 | 1,696 | 1,920 | 563,200 | 1,356,800 |
| Concrete Lining | $m^3$ | 750 | 2,500 | 733 | 1,767 | 1,875 | 549,750 | 1,325,250 |
| Plug Concrete | $m^3$ | 350 | 2,200 | 645 | 1,555 | 770,000 | 225,750 | 544,250 |
| Reinforcement | t | 60 | 15,600 | 13,185 | 2,415 | 936,000 | 791,100 | 144,900 |
| Miscellaneous Works | L.S. | 1 | | | | 672,800 | 277,450 | 395,350 |
| Sub Total | | | | | | 7,400,800 | 3,051,950 | 4,348,850 |
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Mae Lama Luang Project
(Turbine & Generator : 2 units)

# (6) Power Intake

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 14,000 | 60 | 42 | 18 | 840,000 | 588,000 | 252,000 |
| Rock Excavation | $m^3$ | 13,000 | 130 | 65 | 65 | 1,690,000 | 845,000 | 845,000 |
| Structual Concrete | $m^3$ | 4,100 | 2,400 | 704 | 1,696 | 9,840,000 | 2,886,400 | 6,953,600 |
| Mass Concrete | $m^3$ | 5,000 | 1800 | 588 | 1,212 | 9,000,000 | 2,940,000 | 6,060,000 |
| Reinforcement | t | 230 | 15,600 | 13,185 | 2,415 | 3,588,000 | 3,032,550 | 555,450 |
| Connecting Bridge | L.S. | 1 | | | | 2,000,000 | 1,200,000 | 800,000 |
| Miscellaneous Works | L.S. | 1 | | | | 2,695,000 | 1,149,195 | 1,546,605 |
| Sub Total | | | | | | 29,653,800 | 12,641,145 | 17,012,655 |
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Mae Lama Luang Project
(Turbine & Generator : 2 units)

# (7) Penstock

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Tunnel Excavation | $m^3$ | 27,000 | 580 | 286 | 294 | 15,660,000 | 7,722,000 | 7,938,000 |
| Concrete Lining | $m^3$ | 2,700 | 2,500 | 733 | 1,767 | 6,750,000 | 1,979,100 | 4,770,900 |
| Concrete Filling | $m^3$ | 4,500 | 1,200 | 472 | 728 | 5,400,000 | 2,124,000 | 3,276,000 |
| Mortor Injection | $m^3$ | 530 | 3,000 | 1,580 | 1,420 | 1,590,000 | 837,400 | 752,600 |
| Curtain Grouting | m | 750 | 2,500 | 1,615 | 885 | 1,875,000 | 1,211,250 | 663,750 |
| Consolidation Grouting | m | 1,400 | 2,500 | 1,615 | 885 | 3,500,000 | 2,261,000 | 1,239,000 |
| Shotcrete | $m^2$ | 11,000 | 260 | 172 | 88 | 2,860,000 | 1,892,000 | 968,000 |
| Rockbolt | PC | 2,400 | 860 | 570 | 290 | 2,064,000 | 1,368,000 | 696,000 |
| Reinforcement | t | 135 | 15,600 | 13,185 | 2,415 | 2,106,000 | 1,779,975 | 326,025 |
| Miscellaneous Works | L.S. | 1 | | | | 4,180,500 | 2,117,500 | 2,063,000 |
| Sub Total | | | | | | 45,985,500 | 23,292,225 | 22,693,275 |
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Mae Lama Luang Project
(Turbine & Generator : 2 units)

## (8) Powerhouse

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 34,000 | 60 | 42 | 18 | 2,040,000 | 1,428,000 | 612,000 |
| Rock Excavation | $m^3$ | 83,000 | 130 | 65 | 65 | 10,790,000 | 5,395,000 | 5,395,000 |
| Backfill | $m^3$ | 17,000 | 90 | 60 | 30 | 1,530,000 | 1,020,000 | 510,000 |
| Structual Concrete | $m^3$ | 10,200 | 2,400 | 704 | 1,696 | 24,480,000 | 7,180,800 | 17,299,200 |
| Mass Concrete | $m^3$ | 22,900 | 1,800 | 588 | 1,212 | 41,220,000 | 13,465,200 | 27,754,800 |
| Reinforcement | t | 1,060 | 15,600 | 13,185 | 2,415 | 16,536,000 | 13,976,100 | 2,559,900 |
| Pavement Works | $m^2$ | 5,300 | 600 | 180 | 420 | 3,180,000 | 954,000 | 2,226,000 |
| Architectural Works | L.S. | 1 | | | | 33,825,000 | 20,295,000 | 13,530,000 |
| Miscellaneous Works | L.S. | 1 | | | | 13,360,100 | 6,371,410 | 6,988,690 |
| Sub Total | | | | | | 146,961,100 | 70,085,510 | 76,875,590 |
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# (9) Tailrace

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 63,000 | 60 | 42 | 18 | 3,780,000 | 2,646,000 | 1,134,000 |
| Rock Excavation | $m^3$ | 15,000 | 130 | 65 | 65 | 1,950,000 | 975,000 | 975,000 |
| Embankment | $m^3$ | 59,000 | 150 | 98 | 52 | 8,850,000 | 5,782,000 | 3,068,000 |
| Structual Concrete | $m^3$ | 7,000 | 2,400 | 704 | 1,696 | 16,800,000 | 4,928,000 | 11,872,000 |
| Mass Concrete | $m^3$ | 39,000 | 1,800 | 450 | 1,350 | 70,200,000 | 17,550,000 | 52,650,000 |
| Reinforcement | t | 580 | 15,600 | 13,185 | 2,415 | 9,048,000 | 7,647,300 | 1,400,700 |
| Miscellaneous Works | L.S. | 1 | | | | 11,062,800 | 3,952,800 | 7,110,000 |
| Sub Total | | | | | | 121,690,800 | 43,481,100 | 78,209,700 |
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Mae Lama Luang Project

## (10) Switchyard

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Common Excavation | $m^3$ | 350 | 60 | 42 | 18 | 21,000 | 14,700 | 6,300 |
| Structual Concrete | $m^3$ | 500 | 2,400 | 704 | 1,696 | 1,200,000 | 352,000 | 848,000 |
| Reinforcement | t | 20 | 15,600 | 13,185 | 12,415 | 312,000 | 263,700 | 48,300 |
| Miscellaneous Works | L.S. | 1 | | | | 153,300 | 63,040 | 90,260 |
| Sub Total | | | | | | 1,686,300 | 693,440 | 992,860 |
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# (11) Hydraulic Equipment

| Descripcion | Unit | Quantity | Unit Price | | | Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Total | Foreign | Local | Total | Foreign | Local |
| Diversion Gate (10m × 10m) | t | 184 | 53,000 | | | 9,752 | 7,802 | 1,950 |
| Spillway Gate (12m × 14.5m) | t | 440 | 85,000 | | | 37,400 | 29,920 | 7,480 |
| Intake Gate (Roller Gate) | t | 155 | 85,000 | | | 13,175 | 10,540 | 2,635 |
| Screen | t | 86 | 50,000 | | | 4,300 | 3,010 | 1,290 |
| Tailrace Gate | t | 76 | 85,000 | | | 6,460 | 5,170 | 1,290 |
| Outlet | | | | | | | | |
| Conduit Pipe ( D = 1.5m ) | t | 14 | 53,000 | | | 742 | 520 | 222 |
| Screen | t | 46 | 50,000 | | | 2,300 | 1,610 | 690 |
| Jet flow Gate | L.S. | | | | | 6,300 | 5,040 | 1,260 |
| High Presure Gate | L.S. | | | | | 5,600 | 4,480 | 1,120 |
| Penstock | t | 2,180 | 53,000 | | | 82,680 | 57,960 | 24,720 |
| Sub Total | | | | | | 168,709 | 126,052 | 42,657 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# F-2 UNIT COST OF CIVIL WORKS

Appendix F-2 Unit Cost of Civil Works

| Description | Total (฿) | FC (฿) | LC (฿) |
|---|---|---|---|
| Common Excavation | | | |
| Excavating | 15.3 | 13.2 | 2.1 |
| Loading | 9.2 | 8.2 | 1.0 |
| Hauling | 18.0 | 11.9 | 6.1 |
| Disposal | 9.8 | 8.8 | 1.0 |
| Sub-total | 52.3 | 42.1 | 10.2 |
| Indirection Cost (Overhead, Profit, Tax) | 7.7 | 0 | 7.7 |
| Total Cost | 60.0 | 42.1 | 17.9 |

| Description | Total (฿) | FC (฿) | LC (฿) |
|---|---|---|---|
| Rock Excavation | | | |
| Blasting | 53.9 | 37.4 | 16.5 |
| Loading | 22.0 | 11.3 | 10.7 |
| Hauling | 28.3 | 12.3 | 16.0 |
| Disposal | 8.8 | 4.0 | 4.8 |
| Sub-total | 113.0 | 65.0 | 48.0 |
| Indirection Cost (Overhead, Profit, Tax) | 17.0 | 0 | 17.0 |
| Total Cost | 130.0 | 65.0 | 65.0 |

| Description | Total (¥) | FC (¥) | LC (¥) |
|---|---|---|---|
| Embankment Rockfill | | | |
| Blasting | 24.6 | 20.7 | 3.9 |
| Stockpile | 7.2 | 5.9 | 1.3 |
| Loading | 10.3 | 8.0 | 2.3 |
| Hauling | 41.8 | 28.4 | 13.4 |
| Spreading | 10.1 | 8.1 | 2.0 |
| Compacting | 1.6 | 0.9 | 0.7 |
| Sub-total | 95.6 | 72.0 | 23.6 |
| Indirection Cost (Overhead, Profit, Tax) | 14.4 | 0 | 14.4 |
| Total Cost | 110.0 | 72.0 | 38.0 |

| Description | Total (฿) | FC (฿) | LC (฿) |
|---|---|---|---|
| Embankment Filter Material | | | |
| Excavation | 12.6 | 8.5 | 4.1 |
| Loading | 12.6 | 8.5 | 4.1 |
| Hauling | 87.5 | 66.5 | 21.0 |
| Spreading | 12.6 | 10.3 | 2.3 |
| Compacting | 5.1 | 4.2 | 0.9 |
| Sub-total | 130.4 | 98.0 | 32.4 |
| Indirection Cost (Overhead, Profit, Tax) | 19.6 | 0 | 19.6 |
| Total Cost | 150.0 | 98.0 | 52.0 |

| Description | Total (฿) | FC (฿) | LC (฿) |
|---|---|---|---|
| Embankment Impervious Material | | | |
| Excavation | 63.3 | 48.0 | 15.3 |
| Loading | 10.4 | 9.3 | 1.1 |
| Hauling | 34.0 | 25.1 | 8.9 |
| Spreading | 15.1 | 11.4 | 3.7 |
| Compacting | 7.6 | 4.2 | 3.4 |
| Sub-total | 130.4 | 98.0 | 32.4 |
| Indirection Cost (Overhead, Profit, Tax) | 19.6 | 0 | 19.6 |
| Total Cost | 150.0 | 98.0 | 52.0 |

| Description | Total (฿) | FC (฿) | LC (฿) |
|---|---|---|---|
| Structural Concrete | | | |
| Mixing | 206.9 | 159.1 | 47.8 |
| Transporting | 212.1 | 180.6 | 31.5 |
| Placing | 358.7 | 174.2 | 184.5 |
| Formwork | 411.4 | 0 | 411.4 |
| Aggregate | 236.4 | 190.1 | 46.3 |
| Cement | 661.5 | 0 | 661.5 |
| Sub-total | 2,087.0 | 704.0 | 1,383.0 |
| Indirection Cost (Overhead, Profit, Tax) | 313.0 | 0 | 313.0 |
| Total Cost | 2,400.0 | 704.0 | 1,696.0 |

| Description | Total (฿) | FC (฿) | LC (฿) |
|---|---|---|---|
| Mass Concrete | | | |
| Mixing | 206.9 | 159.1 | 47.8 |
| Transporting | 212.1 | 180.6 | 31.5 |
| Placing | 152.4 | 58.2 | 94.2 |
| Formwork | 205.9 | 0 | 205.9 |
| Aggregate | 236.4 | 190.1 | 46.3 |
| Cement | 551.3 | 0 | 551.3 |
| Sub-total | 1,565.0 | 588.0 | 977.0 |
| Indirection Cost (Overhead, Profit, Tax) | 235.0 | 0 | 235.0 |
| Total Cost | 1,800.0 | 588.0 | 1,212.0 |

| Description | Total (฿) | FC (฿) | LC (฿) |
|---|---|---|---|
| Concrete Facing | | | |
| Mixing | 206.9 | 159.1 | 47.8 |
| Transporting | 212.1 | 180.6 | 31.5 |
| Placing | 358.7 | 174.2 | 184.5 |
| Formwork | 498.4 | 0 | 498.4 |
| Aggregate | 236.4 | 190.1 | 46.3 |
| Cement | 661.5 | 0 | 661.5 |
| Sub-total | 2,174.0 | 704.0 | 1,470.0 |
| Indirection Cost (Overhead, Profit, Tax) | 326.0 | 0 | 326.0 |
| Total Cost | 2,500.0 | 704.0 | 1,796.0 |

# APPENDIX—G

# ENVIRONMENTAL IMPACT

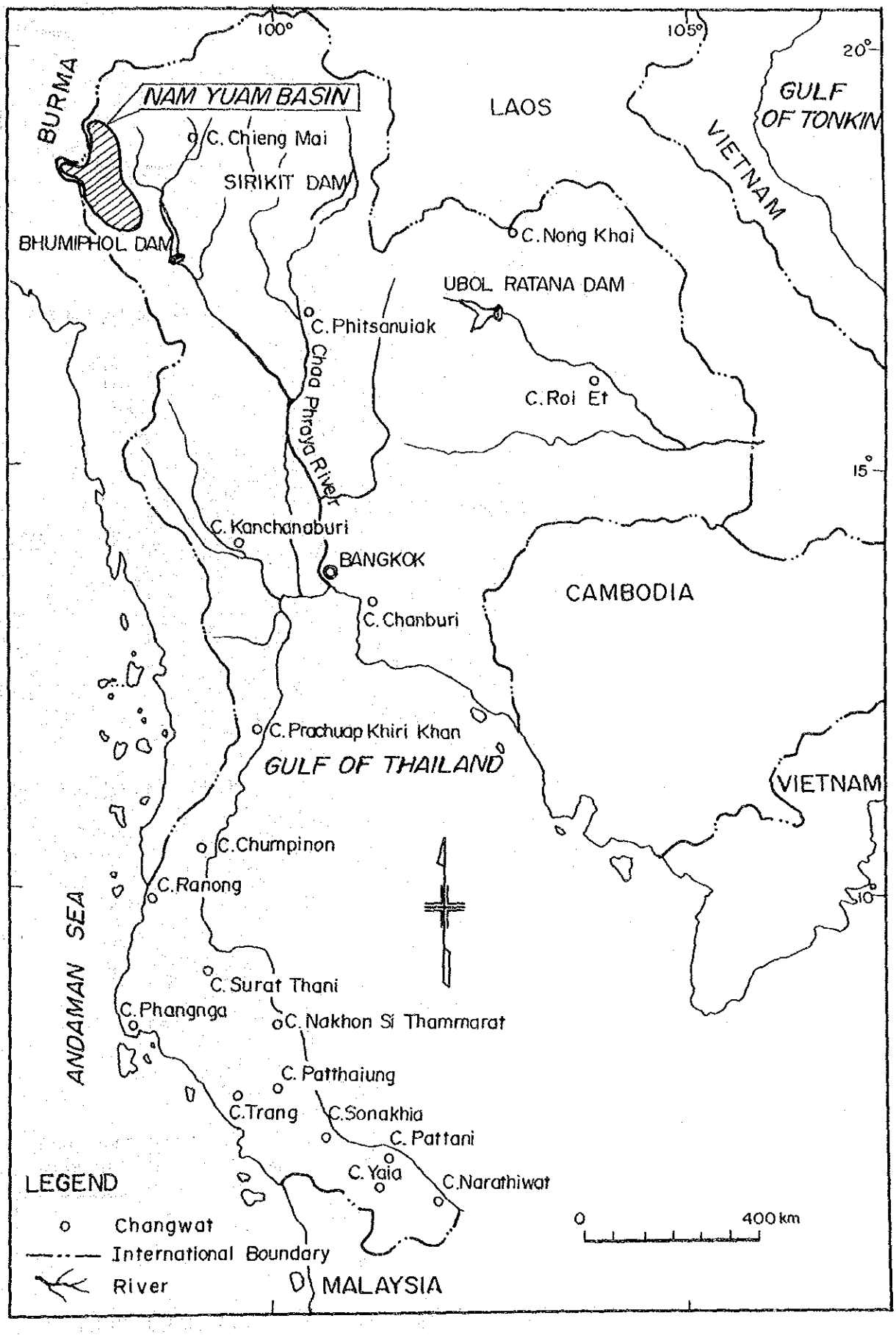


Fig. 1 LOCATION MAP

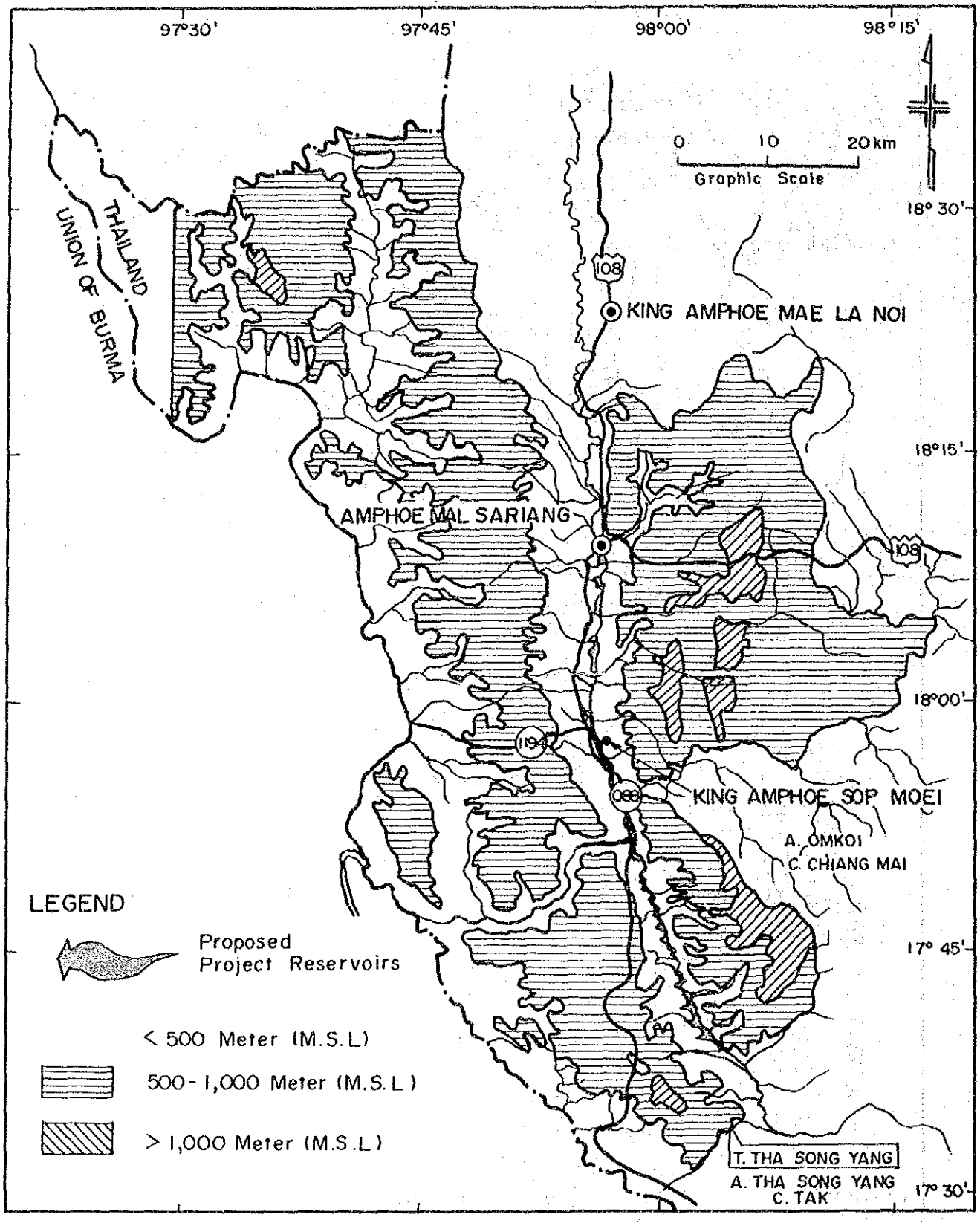


Fig. 2 GENERALIZE TOPOGRAPHY IN THE PROJECT VICINITY

Table 1 Climatological Statistics at Mae Sariang Meteorological Station (1951-1980)

| | | | |
|---|---|---|---|
| Station | MAE SARIANG | Elevation of station above MSL. | 212 meters |
| Index Station | 48 325 | Height of barometer above MSL. | 215 meters |
| Latitude | 18° 10' N | Height of thermometer above ground | 1.20 meters |
| Longitude | 97° 56' E | Height of wind vane above ground | 11.66 meters |
| | | Height of raingauge | 0.52 meters |

| | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pressure ( 1,000 or 900) | | | | | | | | | | | | | |
| Mean | 13.81 | 12.18 | 9.50 | 7.60 | 6.08 | 5.20 | 5.34 | 5.58 | 7.02 | 10.19 | 12.51 | 13.75 | 0.09 |
| Ext. Max | 22.61 | 23.92 | 19.88 | 18.20 | 15.16 | 14.24 | 14.19 | 14.19 | 16.54 | 19.48 | 23.98 | 24.99 | 24.93 |
| Ext. Min. | 4.58 | 2.75 | 0.06 | 98.03 | 94.95 | 93.20 | 93.90 | 96.38 | 0.46 | 4.30 | 4.48 | 93.20 | |
| Mean daily range | 7.17 | 7.49 | 7.46 | 7.05 | 5.49 | 4.22 | 3.93 | 4.30 | 5.28 | 5.95 | 6.24 | 6.74 | 5.95 |
| Temperature (°C) | | | | | | | | | | | | | |
| Mean | 21.7 | 23.6 | 27.6 | 30.7 | 29.3 | 27.2 | 26.6 | 26.3 | 26.0 | 26.8 | 25.2 | 22.4 | 26.2 |
| Mean Max. | 30.8 | 33.6 | 36.6 | 37.9 | 34.8 | 37.4 | 30.4 | 30.2 | 31.5 | 32.5 | 31.9 | 30.6 | 2.7 |
| Mean Min. | 13.1 | 12.9 | 16.9 | 22.1 | 24.0 | 23.5 | 23.1 | 23.0 | 23.1 | 22.1 | 19.2 | 15.3 | 19.9 |
| Ext. Max. | 36.4 | 38.8 | 41.5 | 44.1 | 42.7 | 38.6 | 35.7 | 36.4 | 37.4 | 36.3 | 36.4 | 36.0 | 44.1 |
| Ext. Min. | 3.3 | 6.2 | 8.7 | 13.8 | 19.2 | 20.5 | 20.8 | 20.6 | 19.7 | 13.4 | 6.5 | 5.0 | 3.3 |
| Relative Humidity (%) | | | | | | | | | | | | | |
| Mean | 73.0 | 65.0 | 55.0 | 55.0 | 71.0 | 81.0 | 83.0 | 85.0 | 83.0 | 80.0 | 77.0 | 76.0 | 74.0 |
| Mean Max. | 96.2 | 94.0 | 89.0 | 84.4 | 90.0 | 94.0 | 94.5 | 94.9 | 95.0 | 95.0 | 94.9 | 95.5 | 93.0 |
| Mean Min. | 43.7 | 34.2 | 29.3 | 33.7 | 53.2 | 68.4 | 71.5 | 73.3 | 68.7 | 62.6 | 55.5 | 49.8 | 53.7 |
| Ext. Min. | 17.0 | 15.0 | 13.0 | 16.0 | 21.0 | 44.0 | 49.0 | 40.0 | 44.0 | 32.0 | 24.0 | 23.0 | 13.0 |
| Dew Point (°C) | | | | | | | | | | | | | |
| Mean | 15.6 | 15.1 | 16.4 | 19.5 | 22.8 | 23.5 | 23.3 | 23.4 | 23.6 | 22.9 | 20.5 | 17.3 | 20.3 |
| Evaporation (mm.) | | | | | | | | | | | | | |
| Mean - Pan | | | | | | No Observation | | | | | | | |
| Cloudiness (0 - 8) | | | | | | | | | | | | | |
| Mean | 2.9 | 1.7 | 1.5 | 2.7 | 5.7 | 6.9 | 7.2 | 7.2 | 6.4 | 5.3 | 4.1 | 3.6 | 4.6 |
| Sunshine Duration (hr.) | | | | | | | | | | | | | |
| Mean | | | | | | No Observation | | | | | | | |
| Visibility (km.) | | | | | | | | | | | | | |
| 0700 L.S.T. | 1.4 | 1.7 | 1.5 | 3.6 | 7.9 | 6.8 | 6.3 | 6.1 | 5.6 | 4.3 | 2.4 | 1.6 | 4.1 |
| Mean | 8.4 | 6.1 | 3.3 | 5.2 | 10.4 | 9.2 | 8.4 | 8.4 | 9.5 | 10.3 | 10.7 | 10.0 | 2.3 |
| Wind (Knots) | | | | | | | | | | | | | |
| Prevailing wind | | S | S | S | S | S | S | S | S | X | X | X | -- |
| Mean wind speed | 1.8 | 2.1 | 2.9 | 3.5 | 3.2 | 2.5 | 2.6 | 2.5 | 2.2 | 2.3 | 2.2 | 2.0 | -- |
| Max. wind speed | 33 | 39 E,Sx | 52 | 50 SSr | 60 | 45 | 35 S | 35 S | 30 X | 40 x | 30 | 34 | 60 V |
| Rainfall (mm.) | | | | | | | | | | | | | |
| Mean | 12.7 | 5.1 | 8.1 | 37.6 | 170.7 | 189.5 | 202.5 | 253.4 | 210.9 | 119.6 | 23.0 | 12.2 | 1,245.3 |
| Mean rainy days | 1.3 | 0.7 | 1.2 | 3.4 | -16.3 | 24.1 | 25.9 | 26.0 | 20.9 | 12.5 | 3.5 | 2.0 | 137.5 |
| Greatest in 24 hr. | 49.4 | 38.9 | 61.3 | 62.8 | 131.0 | 95.1 | 57.2 | 92.8 | 113.8 | 96.3 | 76.7 | 58.9 | 131.0 |
| Day/Year | 10/75 | 2/53 | 13/71 | 19/77 | 23/80 | 6/55 | 4/64 | 29/71 | 3/69 | 14/60 | 1/56 | 23/61 | 26/80 |
| Number of days with | | | | | | | | | | | | | |
| xxxx | 20.6 | 24.6 | 29.5 | 22.4 | 2.7 | 0.2 | 0.0 | 0.2 | 0.4 | 3.7 | 7.3 | 12.4 | 124.4 |
| Fog | 22.0 | 12.6 | 5.6 | 1.4 | 0.2 | 0.0 | 0.4 | 0.3 | 0.9 | 6.3 | 16.5 | 22.6 | 89.3 |
| Hail | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 |
| Thunderstorm | 0.4 | 0.3 | 1.9 | 6.3 | 11.9 | 3.5 | 2.9 | 3.5 | 8.6 | 9.6 | 2.4 | 0.5 | 52.1 |
| Snowfall | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |

Source: The Meteorological Department; 1986

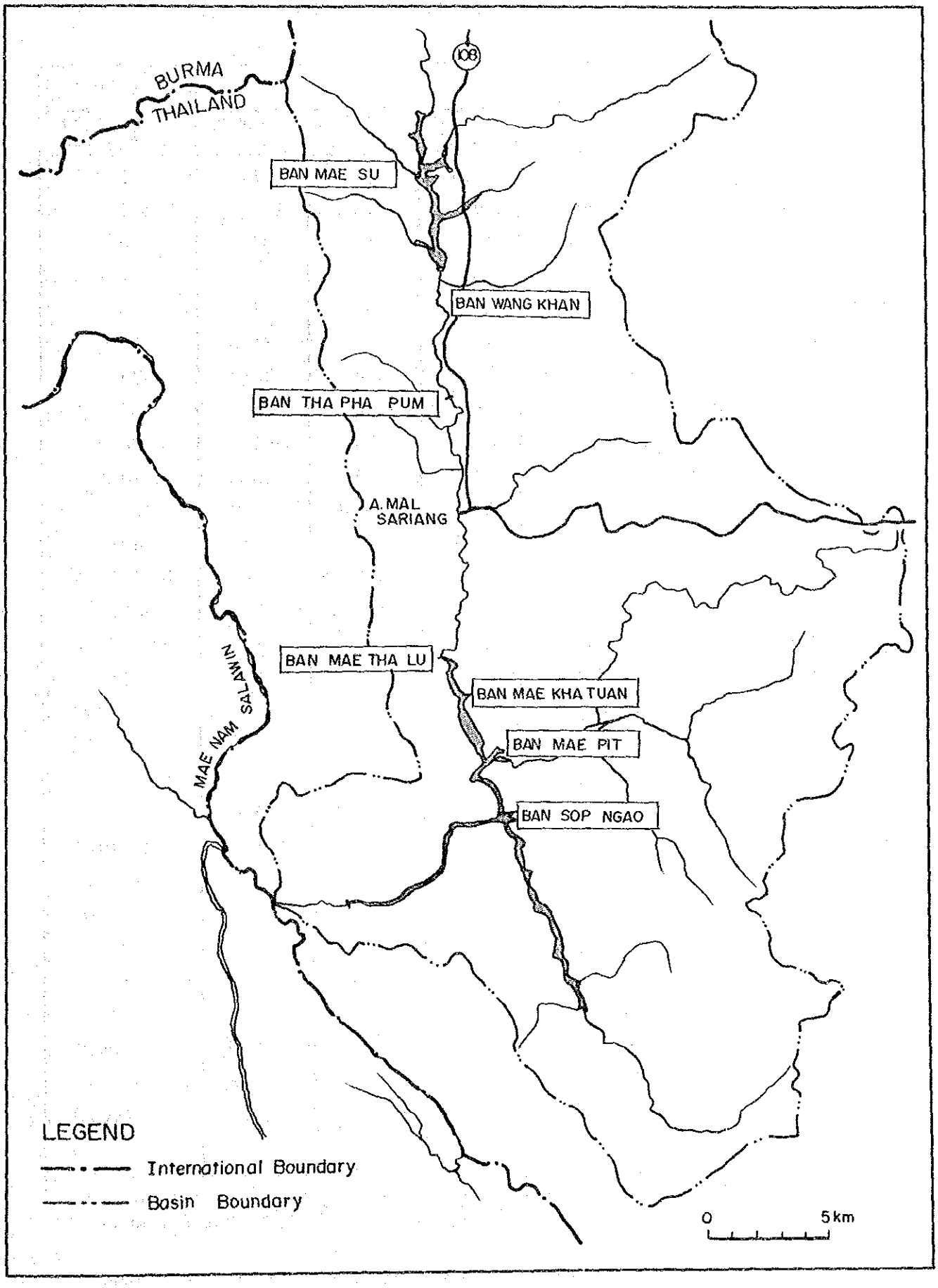


Fig. 3 WATER SAMPLING STATIONS

Table 2 Physico - Chemical Properties of Water Samplers at 7 Water Sampling Stations

| Kind of Sample / Source | Ban Mae Tha Lu | Ban Mae Rit | Ban Wang Khan | North of Ban Tha Pha Pum |
|---|---|---|---|---|
| pH | 7.5 | 7.6 | 7.7 | 7.0 |
| Conductivity (micromhos/cm) | 230 | 320 | 220 | 800* |
| Depth (cm) | 30 | 50 | 80 | 50 |
| Transparency (cm) | | | | |
| Turbidity (NTU) | 15 | 90 | 9.0 | 80 |
| Temperature (°C) Water | 33 | 31 | 31 | 32 |
| Total Alkalinity (as $CaCO_3$) | 98 | 142* | 88 | 74 |
| Total Hardness (as $CaCO_3$) | 84 | 122 | 76 | 108 |
| Calcium Hardness (as $CaCO_3$) | 64 | 94 | 64 | 78 |
| Magnesium Hardness (as $CaCO_3$) | 20 | 28 | 12 | 30 |
| Total Solids | 128.0 | 1,701.0* | 115.0 | 1,802* |
| Dissolved Solids | 121.0 | 163.0 | -- | 440 |
| Suspended Solids | 7.0 | 1,535.0* | -- | 1,362* |
| Bicarbonate (as $HCO_3$) | 119.6 | 173.2 | 107.4 | 90.3 |
| Carbonate (as $CO_3$) | -- | -- | -- | -- |
| Chloride (as CL) | 5.0 | 3.0 | 4.0 | 152* |
| Nitrate (as N) | | | | |
| Nitrite (as N) | | | | |
| Phosphate (as $PO_4$) | | | | |
| Silica (as $SiO_2$) | 15.9 | 16.8 | 20.2 | 16.0 |
| Sulfate (as $SO_4$) | 2.95 | 3.14 | 2.75 | 27.54* |
| Sulfide (as S) | | | | |
| Ammonia (as N) | | | | |
| Carbon Dioxide (as $CO_2$) | | | | |
| Chromium (VI) (as Cr) | | | | |
| Copper (as Cu) | | | | |
| Iron (as Fe) | 0.43 | 2.3 | 0.51 | 3.32* |
| Manganese (as Mr) | | | | |
| Oxygen Dissolved (as O) | 7.0 | 6.0 - 6.9 | 5.5 | 7.1 |
| Solinity (PPT) | | | | |

Remark: Water samplers at Ban Mae Rit, North of Ban Tha Pha Pum show brawn and high turbidity.

Depth, Water temperature and dissolved oxygen were collected during the field survey.

Source: Chemical and Analysis Department

Table 2 (cont')

| Kind of Sample | | | |
|---|---|---|---|
| Source | Ban Mae Ngao | Ban Mae Kha Tuan | Ban Mae Su |
| pH | 8.2 | 7.5 | 7.3 |
| Conductivity (micromhos/cm) | 215 | 210 | 210 |
| Depth (cm) | 30 | 50 | 50 |
| Transparency (cm) | | | |
| Turbidity (NTU) | 8.0 | 38.0 | 120* |
| Temperature (°C) Water | 31.9 | 28.5 | 28 |
| Total Alkalinity (as $CaCO_3$) | 100 | 92 | 88 |
| Total Hardness (as $CaCO_3$) | 94 | 84 | 80 |
| Calcium Hardness (as $CaCO_3$) | 64 | 64 | 64 |
| Magnesium Hardness (as $CaCO_3$) | 30 | 20 | 16 |
| Total Solids | 122 | 221.0 | 292.5 |
| Dissolved Solids | -- | 110.0 | 126.0 |
| Suspended Solids | -- | 111 | 166.5 |
| Bicarbonate (as $HCO_3$) | 107.4 | 112.2 | 107.4 |
| Carbonate (as $CO_3$) | 7.2 | -- | -- |
| Chloride (as CL) | 5.0 | 5.0 | 4.0 |
| Nitrate (as N) | | | |
| Nitrite (as N) | | | |
| Phosphate (as $PO_4$) | | | |
| Silica (as $SiO_2$) | 10.2 | 23.4 | 18.3 |
| Sulfate (as $SO_4$) | 1.77 | 1.37 | 4.72 |
| Sulfide (as S) | | | |
| Ammonia (as N) | | | |
| Carbon Dioxide (as $CO_2$) | | | |
| Chromium (VI) (as Cr) | | | |
| Copper (as Cu) | | | |
| Iron (as Fe) | 0.38 | 1.02 | 2.91 |
| Manganese (as Mr) | | | |
| Oxygen Dissolved (as O) | 8.2 - 8.9 | 5.8 | 5.6 |
| Solinity (PPT) | | | |

Source: Chemical and Analysis Department

Table 3 Forest Area in Mae Hong Son Province
(Classified by Type of Forest, 1975)

| Types of Forest | Plant Names | Area (rai) |
|---|---|---|
| 1. Diciduous Dipterocarp Forest | Lagerstroemia siamica Gagnep<br>Shorea obtusa Wall<br>Shorea siamensia Miq.<br>Shidora<br>Siamensia Teijsm ex Miq.<br>Family Fagaceae | 3,711,636 |
| 2. Mixed Deciduous Forest with Teak | Tectona grandis Linn. f.<br>Afzelia xylocarpa Roxb.<br>Chukrasia venlutina W. & A.<br>Diospyros mollis Griff<br>Pterocarpus macrocarpus Kurz.<br>Family Lythraceae<br>Family Myristicaceae<br>Family Gramineae | 3,541,942 |
| 3. Hill Evergreen Forest | Castanopsis acuminatisima Rehd.<br>Castanopsis argentea A. Dc.<br>Quercus poilanei Hick. & A. Camus<br>Eugenia cumini (L.) Druce<br>Family Pinaceae<br>Family Fagaceae<br>Grounding Plant: Fern, Moss,<br>Bromheadia finlaysoniana Reichb. f. | 69,126 |
| 4. Pine Forest | Family Pinaceae | 78,607 |

Table 3 (con't) Forest Area in Mae Hong Son Province
(Classified by Type of Forest 1975)

| Types of Forest | Plant Names | Area (rai) |
|---|---|---|
| 5. Dry Evergreen Forest | Dipterocarpus alatus Roxb.<br>Afella xylocarpa Roxb.<br>Family Lythraccae | 1,692 |
| 6. Disturbed Deciduous Dipterocarp Forest | -- | 361,677 |
| 7. Mixed Deciduous Forest with Disturbed Teak | -- | 138,099 |
| 8. Mixed Deciduous Forest with Undisturbed Teak | -- | 24,831 |
| 9. Disturbed Hill Evergreen Forest | -- | 1,538 |
| Total rai | -- | 7,929,130 |
| Total sq. km. | -- | 12,686.60 |

Source: Social Research Institute, Chiang Mai University 1983

Table 4 Freshwater Fauna Quality and Utilization at Amphoe Mae Sariang, Mae Hong Song Province (1980 - 1983)

| Freshwater Fauna's Name | 1980 | | 1981 | | 1982 | | 1983 | |
|---|---|---|---|---|---|---|---|---|
| | Total Catch (kg) | Sale or Consume (kg) | Total Catch (kg) | Sale or Consume (kg) | Total Catch (kg) | Sale or Consume (kg) | Total Catch (kg) | Sale or Consume (kg) |
| 1. Striped Snake-Head | 24,500 | 22,650 | 500 | 500 | 600 | 600 | 350 | 350 |
| 2. Clarias spp. | 15,200 | 14,680 | 750 | 750 | 500 | 500 | 250 | 250 |
| 3. Climbing Perch | 8,315 | 8,315 | 200 | 200 | -- | -- | -- | -- |
| 4. Puntius spp. | 1,460 | 1,460 | 1,000 | 1,000 | 500 | 500 | 600 | 600 |
| 5. Tilapia spp. | 1,250 | 1,250 | -- | -- | 2,000 | 2,000 | 800 | 800 |
| 6. Cyprinus spp. | 1,830 | 1,830 | 2,000 | 2,000 | -- | -- | 700 | 700 |
| 7. Swamp eel | -- | -- | 450 | 450 | 700 | 700 | 200 | 200 |
| 8. Other Fish | 25,400 | 19,900 | 3,000 | 3,000 | 3,500 | 3,500 | 2,500 | 2,500 |
| 9. Shrimp | 1,780 | 1,480 | 400 | 400 | 200 | 200 | 150 | 150 |
| 10. Other Freshwater Fauna | 2,370 | 2,220 | 1,200 | 1,200 | 500 | 500 | 300 | 300 |
| Total | 82,105 | 73,535 | 9,500 | 9,500 | 8,500 | 8,500 | 5,850 | 5,850 |

Source: Mae Sriang, Amphoe Fisheries Office

Remark: Not classified by freshwater fauna's source

Table 5 List of Fish Names in the Salawin River

| Scientific Name | Common Name | Year 1945 | Year 1981 |
|---|---|---|---|
| Family Notopteridae | | | |
| 1) Notopterus notoptrus (Pallas) | Hang-Pan | - | + |
| Family Mastacembelidae | | | |
| 2) Mastacembelus armatus Gunther | Lard | - | + |
| 3) Mastacembelus unicolor Cuvier and Valencennes | Lard | - | + |
| Family Anguillidae | | | |
| 4) Anguilla australis Richardson | Sa-Ngik | - | + |
| Family Flutidae | | | |
| 5) Fluta albe (Zuiew) | Yian | - | + |
| Family Cyprinidae | | | |
| 6) Danio regina Fowler | Siew | - | + |
| 7) Danio aeguipinnatus (Mc Clelland) | Siew | - | + |
| 8) Rasbora myersi Brittan | Siew | - | + |
| 9) Aspidoparia morar (Hamilton) | - | - | + |
| 10) Mystacoleucus argenteus (Day) | Hang-Luane | - | + |
| 11) Hampala macrolepidota van Hasselt | Kasoop | - | + |
| 12) Tor (Folifer) brevifilis brevifillis (Peters) | Kor-Moer-Nang | - | + |
| 13) Tor tambroides (Bleeker) | - | - | + |
| 14) Tor stracheyi (Day) | Yard | + | - |
| 15) Tor soro (Cuvier and Valenciennes) | Mung | + | + |
| 16) Rohtee alfrediana (Cuvier and Valenciennes) | Kai-Ong | - | + |
| 17) Barilius pulchellus Smith | Kaem | - | + |

Table 5 (Cont') List of Fish Names in the Salawin River

| Scientific Name | Common Name | Year 1945 | Year 1981 |
|---|---|---|---|
| 18) Barilius guttatus (Day) | Ma-Hung | + | + |
| 19) Puntius stoliczkae (Day) | Mung-Maie | + | + |
| 20) Puntius daruphani Smith | Sa-Pag | - | + |
| 21) Puntius orphoides (Cuvier and Valenciennes) | - | - | + |
| 22) Chagunius chagunio (Hamilton) | Hang-Daeng | + | + |
| 23) Acrossocheilus vittatus Smith | Jad | + | - |
| 24) Acrossocheilus malcomi Smith | Jad | - | + |
| 25) Acrossocheilus deauratus (Cuvier and Valenciennes) | - | - | + |
| 26) Acrossocheilus bantamensis (Rendahl) | - | + | - |
| 27) Scaphiodonichthys burmanicus Vinciguerra | Mum, Kam | + | + |
| 28) Labeo dyocheilus (Mcclelland) | Va | + | + |
| 29) Labao calbasu (Hamilton) | - | + | - |
| 30) Labeo behri Fowler | - | - | + |
| 31) Garra fuliginosa Fowler | Mud | - | + |
| 32) Garra sp. | - | - | + |
| 33) Epalzeorhynchos siamensis Smith | Mon | + | - |
| 34) Crossocheilus sp. | Mon | - | + |
| 35) Balitory brucei Gray | - | + | + |
| 36) Homaloptera sexmaculata Fowler | - | - | + |
| 37) Lepidocephalus octocirrhus (Van Hasselt) | Sai | - | + |
| 38) Noemacheilus multifasciatus Day | Bou | + | + |
| 39) Noemacheilus waltoni Fowler | Bou | + | + |
| 40) Noemacheilus sexcauda Fowler | Bou | - | + |

Table 5 (Cont') List of Fish Names in the Salawin River

| Scientific Name | Common Name | Year 1945 | Year 1981 |
|---|---|---|---|
| 41) Noemacheilus reidi Smith | Bou | + | + |
| 42) Silurichthys leucopodus Fowler | Varn | - | + |
| 43) Ompok bimculatus (Bloch) | - | - | + |
| Family Claridae | | | |
| 44) Clarias batrachus (Linnaeus) | Duk | - | + |
| Family Schilbeidae | | | |
| 45) Eutropiichthys vacha (Hamilton) | - | + | - |
| Family amblycipitidae | | | |
| 46) Amblyceps mangois (Hamilton) | Dack | - | + |
| Family Bagridae | | | |
| 47) Mystus seenghala Day | Kod Hour Seab | - | + |
| 48) Mystus bleekeri Day | - | - | + |
| 49) Mystus microphthalmus Day | - | - | + |
| Family Sisoridae | | | |
| 50) Bagarius yarrellie (Sykes) | Kae | - | + |
| 51) Gagata cenia (Hamilton) | - | + | - |
| 52) Hara hara (Hamilton) | - | - | + |
| 53) Exostoma vincigurrae Ragan | - | - | + |
| 54) Pseudecheneis sulcatus (Mac Clelland) | - | - | + |
| 55) Glyptothorax platypogonoides (Bleeker) | Kong-Kang, Tek-Hin | + | + |
| 56) Glytothorax trilineatus Blyth | Tek-Hin | - | + |
| 57) Glyptothorax dorsalis Vinciguerra | - | - | + |
| 58) Glyptothorax sp. | - | - | + |

Table 5 (Cont') List of Fish Names in the Salawin River

| Scientific Name | Common Name | Year 1945 | Year 1981 |
|---|---|---|---|
| Family Belonidae | | | |
| 59) Xenentodon cancila (Hamilton) | Som-Mok | + | + |
| Family Anabantidae | | | |
| 60) Trichogaster trichopterus (Pallas) | Slak | + | - |
| Family Ophicephalidae | | | |
| 61) Ophicephalus marulius Hamilton | Lim-Hang-Qua | - | + |
| 62) Ophicephalus striatus Bloch | Lim, Kor | - | + |
| 63) Ophicephalus gachua Hamilton | Kang | + | + |
| Family Centroponidae | | | |
| 64) Chanda siamensis Fowler | - | - | + |
| 65) Chanda ranga Hamilton | Peir, Wee | + | - |
| 66) Unknown species | Hour-Luam | - | + |

Source: Somposh Akatavewat, 1982

Remark: + Fish was found
- Fish wasn't found

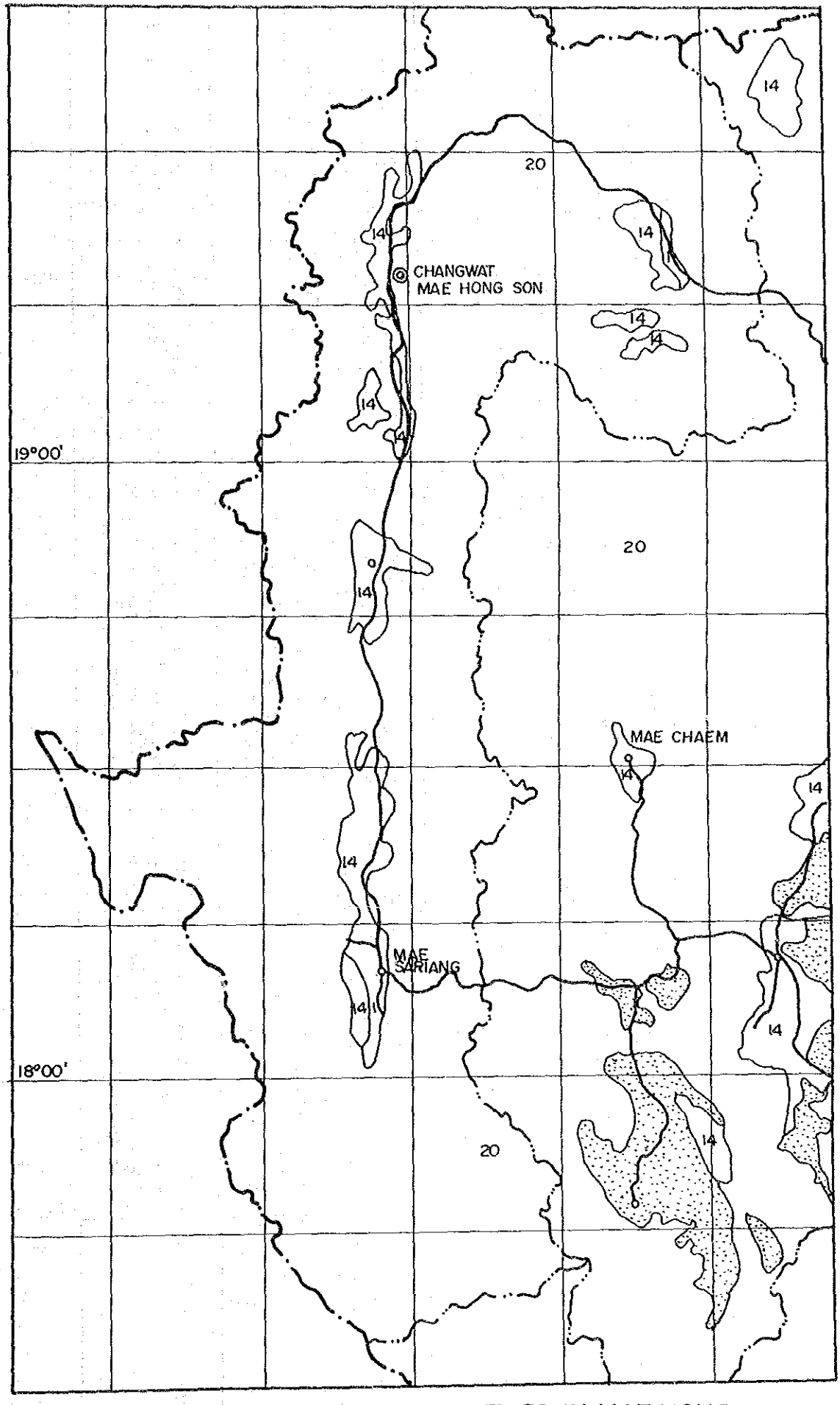


Fig.4 LAND CAPABILITY FOR AGRICULTURE IN MAE HONG SON PROVINCE

Table 6 Soil Characteristics and Land Use in the Area of Mae Hong Son Province

| Number Used as Symbols in Figure 4-2 | General Soil Characteristics | Recommendations for Land use | Land Management |
|---|---|---|---|
| 1. | Deep and well drained, Soil texture varying from silt to sandy loam, Moderate fertility. Normally found in the area of relatively flat or rolling close to the river. | Generally suitable for cultivation of cash crops such as corn, cotton, tobacco, peanut, sugar cane, sorghum and castor bean | Require moderate land management to maintain the land fertility and soil structure. Irrigation may be required for cultivation in the dry season. |
| 14. | Shallow and moderate to well drained. At the depth of 50 cm. from the surface, often found rocky lateritic soil. This type of soil are mainly in the area of moderate to steep slope. | Not suitable for cultivation. This type of land may be better for livestock raising and forest plantation. Specific land management is necessary if the land to be utilized for cultivation. | Advanced and technologies of agricultural practices are very much needed where fertilizer and soil improvement are necessary for cultivate this type of land. |
| 20. | Shallow to deep soil with very well drained and can be found mainly on slope of high hills and mountain. | Not suitable for agricultural practice of any kind. The land should be reserved as forest of watershed area. | There should not be any investment on this type of land. |

Table 7 Small Irrigation Project in Amphoe Mae Sariang, Mae La Noi and King Amphoe Sop Moei

| Project Name | Tambon | Irrigation Area (Rai) | Year Completed |
|---|---|---|---|
| Amphoe Mae Sariang | | | |
| 1. Huai Kud Weir | Ban Gart | 600 | 1983 |
| 2. Maer Ko Weir | Mae Kha Tuan | 600 | 1983 |
| 3. Mae Tob Tai Weir | Ban Gart | 1,250 | 1978 |
| 4. Mae Pan Weir | Mae Kha Tuan | 1,500 | 1978 |
| 5. Mae Tob Klang Weir | Ban Gart | 360 | 1984 |
| 6. Mae La Weir | Mae Sariang | 800 | 1989 |
| 7. Huai Luang Reservoir | Ban Gart | -- | 1988 |
| 8. Huai Luang Weir | Ban Gart | -- | 1988 |
| King Amphoe Sop Moei | | | |
| 1. Mae Suad Weir | | 1,117 | 1984 |
| 2. Mae Thalu Weir | | 200 | 1984 |
| 3. Pha Pa Rservoir | | 1,200 | 1984 |
| Amphoe Mae La Noi | | | |
| 1. Chang Moh Weir | Mae La Noi | 300 | 1982 |
| 2. Om Pai Weir | Mae La Noi | 200 | 1982 |
| 3. Mae Taie Weir | Tha Pa Pum | 650 | 1982 |
| 4. Mae La Ngoe Weir | Mae La Noi | 600 | 1982 |
| 5. Mae Koh Weir | Tha Pa Pum | 500 | 1983 |
| 6. Mae Tho Weir | Mae Tho | 185 | 1983 |
| 7. Mae Prang Weir | Mae La Luang | 100 | 1984 |

Table 8 Mae Sariang Waterwork Requirement and Its Consumers

| | Year 1986 (Cu.M.) | Year 1987 (Cu.M.) | Year 1988 (Cu.M.) |
|---|---|---|---|
| Raw Water Demand | 366,301 | 389,507 | 383,811 |
| Water Production | 363,761 | 386,633 | 380,361 |
| Number of Household Served | 947 | 1,008 | 1,104 |

Source: Data Received from Mae Sariang Waterwork Office during Field Investigation August 1989.

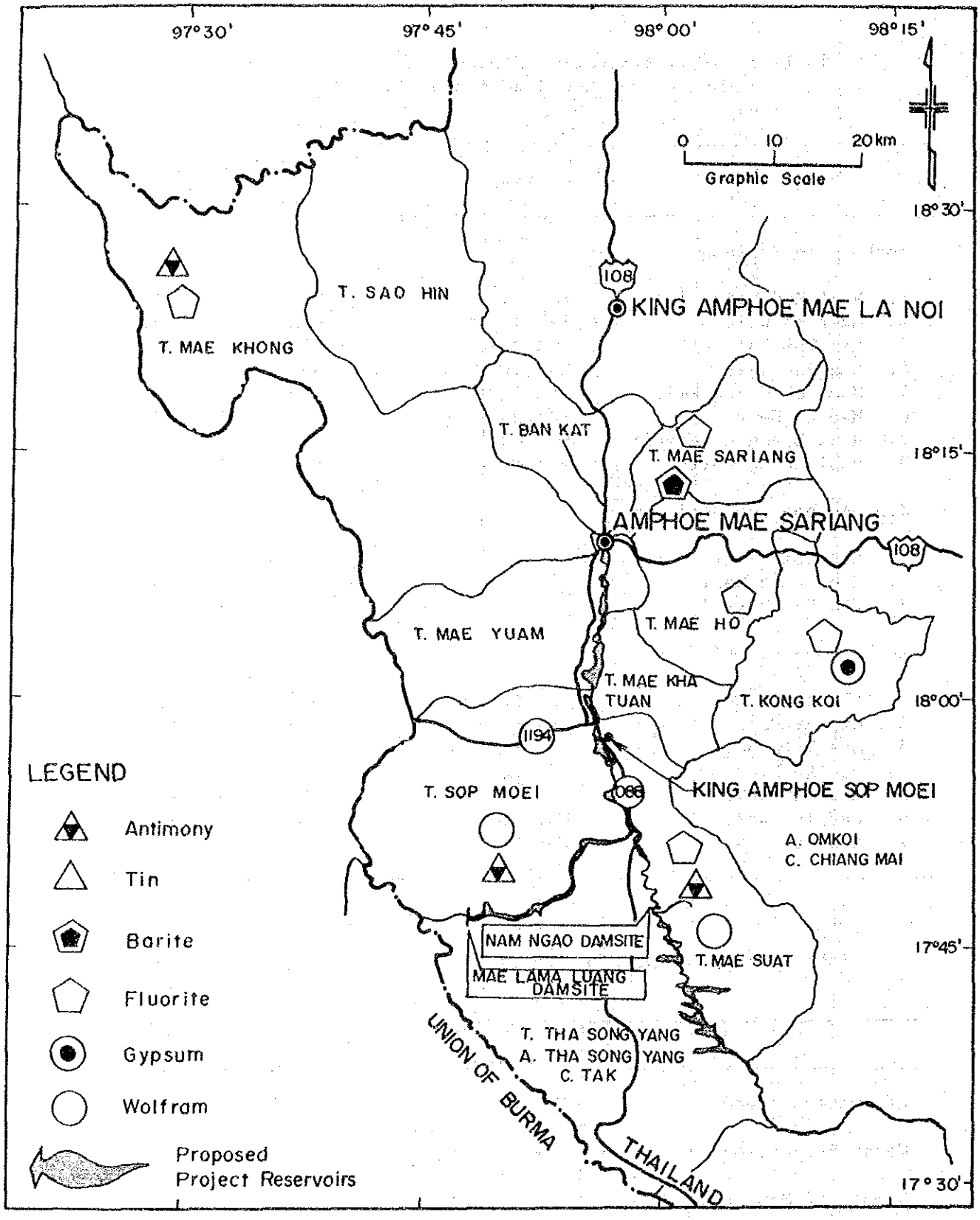


Fig. 5 MINERAL RESOURCES IN PROJECT VINICITY

Table 9 Population Distribution of Amphoe Mae Sariang

| Tambon | Moo Ban | Population | Male | Female | House-holds |
|---|---|---|---|---|---|
| Mae Sariang | 5 | 9,383 | 4,789 | 4,594 | 1,781 |
| Ban Gart | 11 | 10,868 | 5,854 | 5,014 | 2,011 |
| Mae Kong | 10 | 3,272 | 1,648 | 1,624 | 649 |
| Mae Yuam | 11 | 8,333 | 3,879 | 4,454 | 1,689 |
| Mae Huaa | 12 | 6,316 | 3,185 | 3,131 | 1,063 |
| Soa Hin | 6 | 1,434 | 723 | 711 | 266 |
| Pa Pae | 9 | 5,434 | 2,751 | 2,683 | 882 |
| Total | 55 | 39,606 | 20,078 | 19,528 | 7,459 |

Source: Brief Report of Mae Sariang 1989

Table 10 Population Distribution of King Amphoe Sop Moei

| Tambon | Moo Ban | Population | Male | Female | House-holds |
|---|---|---|---|---|---|
| Sop Moei | 9 | 4,098 | 2,074 | 2,024 | 1,247 |
| Mae Kha Tuan | 7 | 4,327 | 2,134 | 2,193 | 1,608 |
| Mae Suad | 7 | 3,898 | 1,921 | 1,977 | 690 |
| Kong Koi | 6 | 3,757 | 1,911 | 1,846 | 1,289 |
| Pa Pong | 7 | 2,885 | 1,409 | 1,476 | |
| Mae Sam Lap | 9 | 4,367 | 2,197 | 2,170 | |
| Total | 45 | 23,332 | 11,646 | 11,686 | 4,834 |

Source: Brief Report of King Amphoe Sop Moei 1989

Table 11 Public Services in Mae Sariang and Sop Moei District

| Mae Sariang | Sop Moei |
|---|---|
| Mae Sariang Administrative Office | Sop Moei Administrative Office |
| Mae Sariang Provincial Court | Rural Development Office |
| Mae Sariang Regional Forestry | Forestry Office |
| Mae Sariang District Penitentiary | Animal Husbandary Office |
| Mae Sariang District Treasury | Lands Office |
| District Attorney | Education Office |
| Police Station | Taxation Office |
| District Custom | Excise Office |
| Border Patrol Police Unit 337 | Military Recruitment Office |
| Control Unit 35 | Post Office |
| Military Unit 4, 7 | Primary School Administration Office |
| Mobile Unit for Development No. 27 | Agricultural Office |
| Unit 36 | Police Station |
| Immigation Check Point | Public Health Office |
| Nam Yuam Irrigation Project | Co-operation Office |
| EGAT Field Office | Community Hospital |
| Community Hospital | Sop Moei Secondary School |
| Malaria Control Unit No. 11 | Malaria Control Unit |
| Public Health Office | Forest Protection Unit |
| Co-operation Office | Special Task Force Unit No. 32 |
| Mae Sariang Electric Work | |
| Post Office | |
| Meteorological Station | |
| Animal Husbandary Office | |
| Rural Development Office | |
| Agricultural Office | |
| Excise Office | |
| Revenue Office | |
| Forestry Office | |
| Lands Office | |
| Military Recruitment Office | |
| Education Office | |
| Primary School Administration Office | |
| Provincial Lands Office | |
| Mae Sariang Water Work | |
| Center for Hill Tribe Development and Welfare | |
| Krung Thai Bank Ltd. | |
| The Government Saving Bank | |

Table 12 Number of Hospital and Public Health Offices (1988)

| Health Relate Facilities | Amphoe Mae Sariang | King Amphoe Sop Moei |
|---|---|---|
| District Hospital | 1 | 1 |
| District Health Office | 1 | 1 |
| Health Service Center | 6 | 4 |
| Midwifery | 2 | 1 |
| Maralia Control Unit | 1 | 1 |

Source: Brief Report on Public Health of Sop Moei Sub-District 1988
Brief Report on Public Health of Amphoe Mae Sariang 1989

Table 13 Number of Health Personal

| Health Personal | Amphoe Mae Sariang | King Amphoe Sop Moei |
|---|---|---|
| Physician | 3 | 1 |
| Nurse | 13 | 4 |
| Nurse Aid | 21 | 8 |
| Health Officer | 9 | 3 |
| Midwife | 4 | 4 |
| Health Volunteer | 8 | 5 |
| Health Communicator | 13 | 13 |

Source: Brief Report on Public Health of King Amphoe Sop Moei 1988
Brief Report on Public Health of Amphoe Mae Sariang 1989

Table 14 Health Records of Local and Endemic Diseases of Amphoe Mae Sariang

| Diseases | Number of Patient | | |
|---|---|---|---|
| | Year 1987 | Year 1988 | Oct. 88 - Jun. 89 |
| 1. Infectiuas and Parasitic Diseases | 6,935 | 6,316 | 2,863 |
| 2. Neoplasm | 194 | 290 | 468 |
| 3. Endrocrine, Nutritional and Metabolic Diseases | 1,348 | 1,155 | 1,412 |
| 4. Diseases of the Blood and Blood-forming Organs | 429 | 550 | 291 |
| 5. Mental Disorders | 1,051 | 1,329 | 1,465 |
| 6. Diseases of the Nervous System and Sense Organs | 2,121 | 2,681 | 1,172 |
| 7. Diseases of Circulatory System | 1,552 | 2,249 | 1,185 |
| 8. Diseases of the Raspiratory System | 13,819 | 11,906 | 9,684 |
| 9. Diseases of the Digestive System | 6,704 | 12,975 | 4,503 |
| 10. Diseases of the Genitourinary System | 1,826 | 1,744 | 1,281 |
| 11. Complications of Pregnancy Childbirth and the Puerpertum | 461 | 733 | 58 |
| 12. Diseases of the Skin and Subcutaneous Tissue | 3,774 | 4,843 | 2,853 |
| 13. Diseases of the Musculosketal System and Connective Tissue | 2,292 | 2,766 | 1,382 |
| 14. Congenital Anomalies | 33 | 23 | --- |
| 15. Certain Causes of Perinatal Morbidity and Mortaliry | 37 | 49 | 23 |
| 16. Symtoms and Illdefined Conditions | 12,351 | 11,292 | 8,210 |
| 17. Accidents, Poisonings and Violence | 2,634 | 2,919 | 1,736 |
| 18. Others | 11,371 | 8,024 | 7,863 |

Source: Brief Report on Public Health of Amphoe Mae Sariang 1989

Table 15 Health Records of Local and Endemic Diseases of King Amphoe Sop Moei

| Diseases | Number of Patient | | |
|---|---|---|---|
| | Year 1986 | Year 1987 | Year 1988 |
| 1. Diarrhosa | 10 | 101 | 95 |
| 2. Symthoms and Ill-defined Condition | 63 | 114 | 28 |
| 3. Measles | -- | 1 | 37 |
| 4. Conjunctivitis | 7 | 5 | 17 |
| 5. Tneumonia | 11 | 16 | 8 |
| 6. Influenza | 3 | 1 | 5 |
| 7. Malaria | 19 | 219 | 389 |
| 8. Tuberculosis | 1 | 1 | 1 |
| 9. Hepatitis | 1 | 1 | 1 |
| 10. Shigellosis | 6 | 2 | 6 |
| 11. Chicken Pox | -- | -- | 1 |
| 12. Nephritis | 1 | -- | -- |
| 13. Encephalitis | 1 | -- | -- |
| 14. Haemorrhagic Fever | 1 | -- | -- |

Source: Brief Report on Public Health of King Amphoe Sop Moei 1989

Table 16 Classification of Existing Local Tourism Resource in Mae Hong Son Province

| Amphoe | Tourism Resource | | |
|---|---|---|---|
| | National Attraction | Architectural Attraction | Cultural Attraction |
| Amphoe Muang | Pha Sour Waterfall<br>Pra Cave Park<br>Pha Pong Hot Spring<br>Pe Man cave<br>Huai Kan Waterfall | Wat Phra Non<br>Wat Hua Wiang<br>Wat Jong Kum<br>Wat Jong Krang<br>Wihara Wat Pong Toa U | Miew Village<br>Na Pa Pag<br>Ruk Kiew Ordination |
| Amphoe Pai | Moa Peng Waterfall<br>Mae Nam Pai, Floating<br>Lum Nam Pai Sanctuary | Wat Krang<br>Wat Nam Hu | |
| Amphoe Kun Yuam | Mae Surin Waterfall<br>National Park | Wat toa prai<br>Ban Muang Pon Ancient | |
| Amphoe Mae La Noi | Mae Hu Cave<br>Dao Dung Waterfall | Wat Mae La Noi | Thai Yai Local Performance Art |
| Amphoe Mae Sariang | Huai Som Pu Plant Garden<br>Salawin Sanctuary<br>Mae Nam Salawin, Floating | Wat Kittiwong<br>Wat Uttayalom | Mae Hong Son Hilltribe Development and Wellfare Center |

Source: The Tourism Authority of Thailand, 1983

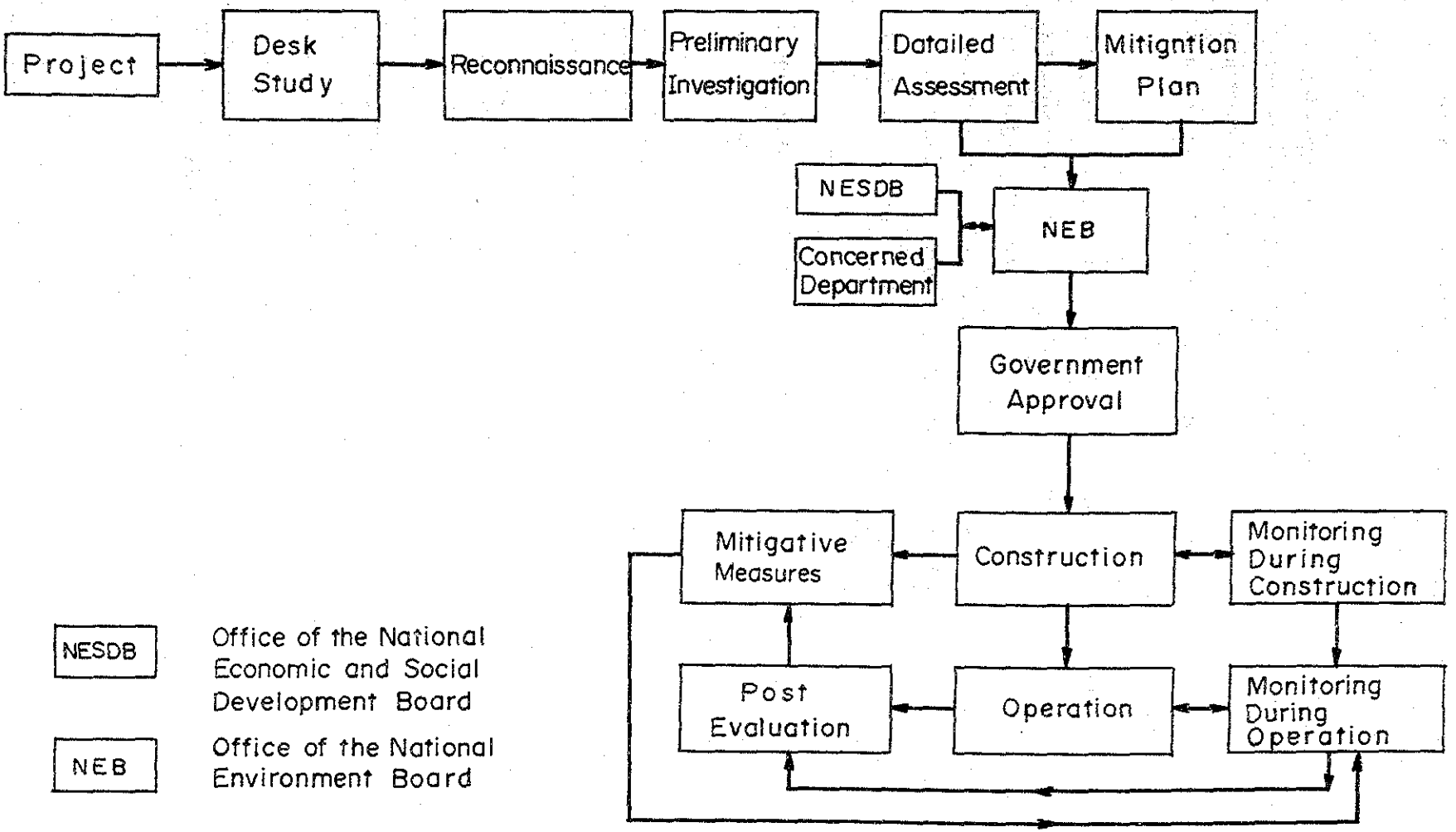


Fig. 6 ENVIRONMENTAL PROCEDURE

## G-23 Proclamation for Types and Sizes of Project Required Environmental Impact Assessment

The National Environment Board (NEB) of Thailand is now implementing "selective projects" approach in identifying environmental impact along with mitigation measures and monitoring programs for certain projects or activities to ensure efficient utilization of natural and human resources in the economic development.

Section 17 of the National Environmental Quality Act (NEQA) of 1975, as amended in 1978, provides a power to the Ministry of Science, Technology and Energy to issue proclamation for the types and sizes of projects or activities requiring Environmental Impact Assessment (EIA) reports and measures for the prevention of and remedy for the adverse effects on environmental quality. The first proclamation has been issued on 14 July 1981 which stipulates in essence an in table below:

Table: Notification of Types and Sizes of Projects or Activities Requiring EIA Reports and Measures for the Prevention of and Remedy for the Adverse Effects on the Environmental Quality.

| Items | Types of Projects or Activities | Sizes |
|---|---|---|
| 1 | Dam or Reservoir | storage volume greater than 100,000,000 cubic meters or storage surface area greater than 15 square kilometers |
| 2 | Irrigation | irrigated area greater than 80,000 rais (12,800. hectares). |
| 3 | Commercial Airport | all sizes |
| 4 | Hotel or Resort Facilities environmentally sensitive areas such as areas adjacent to rivers, coastal areas, lakes or beaches or in the vicinity of national parks | greater than 80 rooms |

| Items | Types of Projects or Activities | Sizes |
|---|---|---|
| 5 | Mass Transit System and Expressway as defined by the Announcement of the Revolutionary Party No. 290, 24 November B. E. 2515 | all sizes |
| 6 | Mining as defined by the Mineral Act No. 1 B.E. 2510, No. 2 B.E. 2516 and No. 3 B.E. 2522 | all sizes |
| 7 | Industrial Estate as defined by the Industrial Estate Authority of Thailand Act, B.E. 2522 | all sizes |
| 8 | Commercial Port and Harbour | with capacity for vessels of greater than 500 ton-gross. |
| 9 | Thermal Power Plant | capacity greater than 10 MW. |
| 10 | Industries<br>(1) Petrochemical Industry | greater than 100 tons/day of raw materials required in production processes of oil refinery and/or natural gas separation. |
| | (2) Oil Refinery | all sizes |
| | (3) Natural Gas Separation of processing | all sizes |
| | (4) Chlor-alkaline Industry requiring NaCl as raw material for production of NaOH, $Na_2CO_3$, HCl, $CL_2$, NaOCl and Bleaching Powder | production capacity of each or combined product greater than 100 tons/day |

| Items | Types of Projects or Activities | Sizes |
|---|---|---|
| 10 | (5) Iron and/or Steel Industry | requiring from are and/or scrap iron as raw materials for production greater than 100 tons/day or using furnaces with combined capacity greater 5 tons/batch. |
| | (6) Cement Industry | all sizes |
| | (7) Smelting Industry other than Iron and Steel | production capacity greater than 50 tons/day. |
| | (8) Pulp Industry | production capacity greater than 50 tons/day. |