

APPENDIX A

Packtest

The Packtest were used in this study following the procedure in Figure A-1 to determined ammonium, nitrate, phosphate and COD as showed more details in no. 1 – 4.

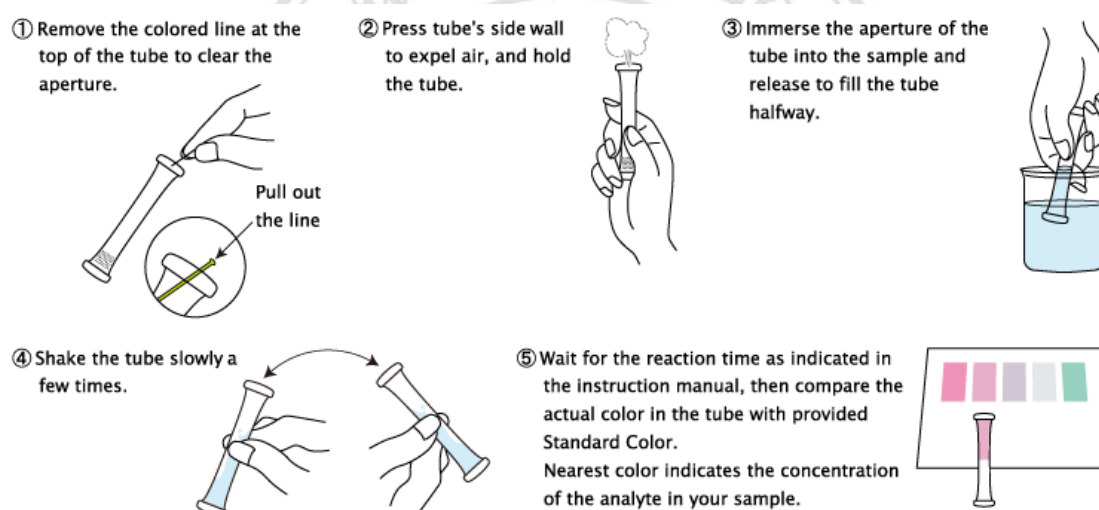


Figure A1 How to use the Packtest [74]

1. Packtest Ammonium

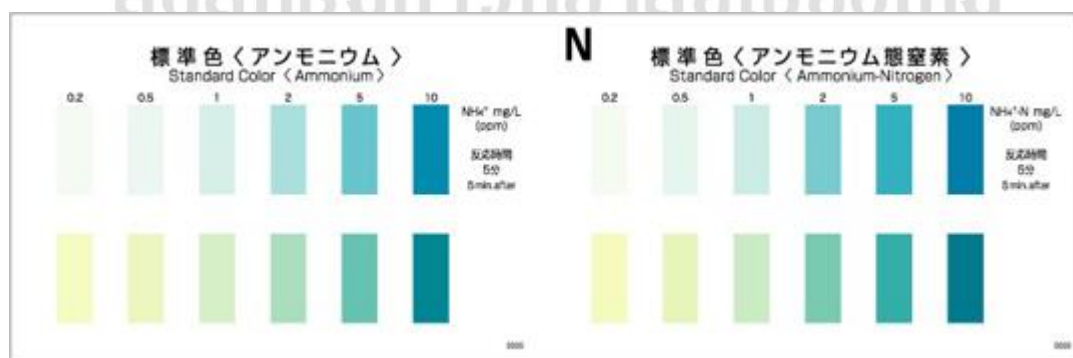


Figure A2 Standard Color of Ammonium

Table A1 Detail of Pack test Ammonium model WAK-NH4

Measuring Method	Indophenol Blue Visual Colorimetric Method
Range	<Ammonium> 0.2, 0.5, 1, 2, 5, 10 mg/L <Ammonium-Nitrogen> 0.2, 0.5, 1, 2, 5, 10 mg/L
Reaction Time	5 min.

2. Packtest Nitrate

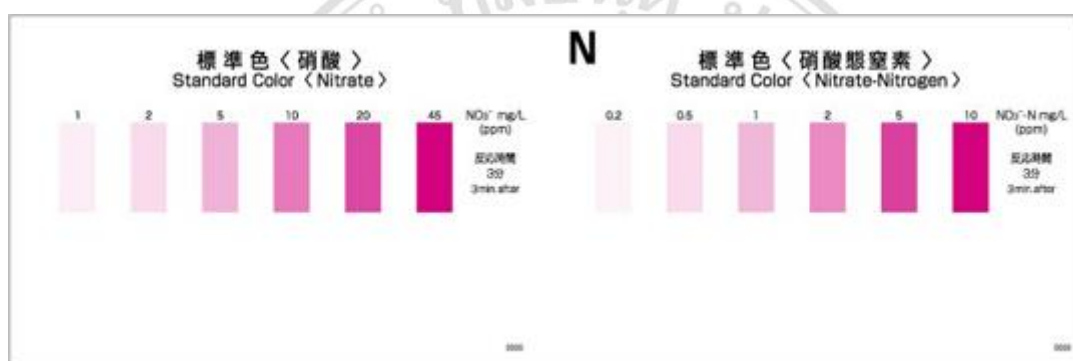


Figure A3 Standard Color of Nitrate

Table A2 Detail of Packtest Nitrate model WAK-NO3

Measuring Method	Reduction and Naphthylethylenediamine Visual Colorimetric Method
Range	<Nitrate> 1, 2, 5, 10, 20, 45 mg/L <Nitrate-Nitrogen> 0.2, 0.5, 1, 2, 5, 10 mg/L
Reaction Time	3 min.

3. Packtest Phosphate

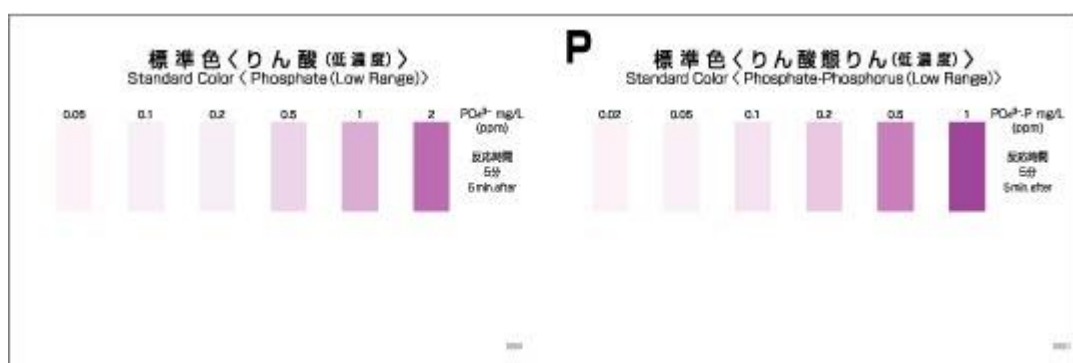


Figure A4 Standard Color of Phosphate (Low Range)

Table A3 Detail of Packtest Phosphate (Low Range) model WAK-PO4(D)

Measuring Method	4-Aminoantipyrin Visual Colorimetric Method with Enzyme
Range	<Phosphate> 0.05, 0.1, 0.2, 0.5, 1, 2 mg/L <Phosphate-Phosphorus> 0.02, 0.05, 0.1, 0.2, 0.5, 1 mg/L
Reaction Time	5 min.

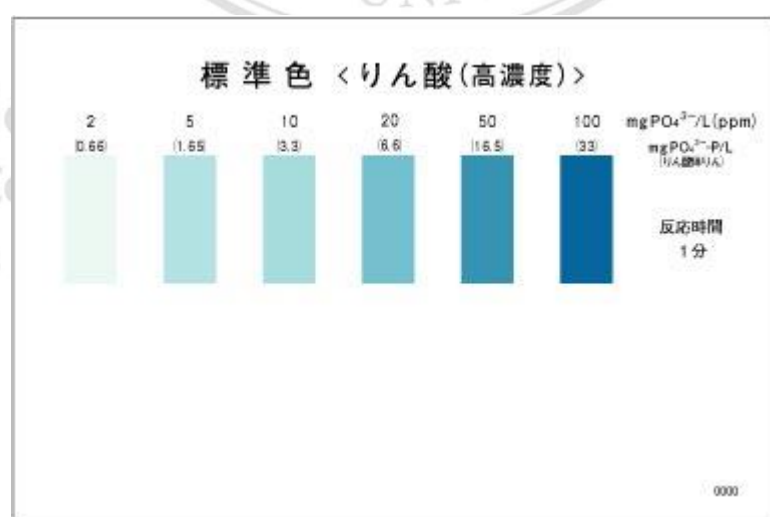


Figure A5 Standard Color of Phosphate (High Range)

Table A4 Detail of Packtest Phosphate (High Range) model WAK-PO4(C)

Measuring Method	Molybdenum Blue Visual Colorimetric Method
Range	<Phosphate> 2, 5, 10, 20, 50, 100 mg/L <Phosphate-Phosphorus> 0.66, 1.65, 3.3, 6.6, 16.5, 33 mg/L
Reaction Time	1 min.

4. Packtest COD

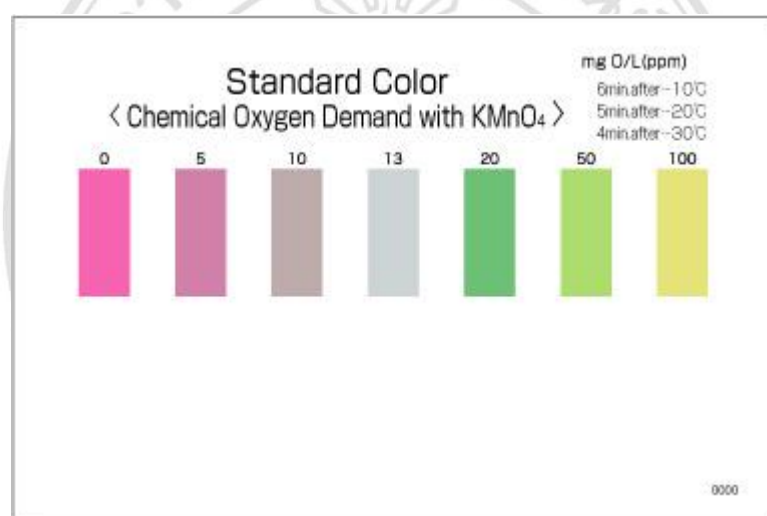


Figure A6 Standard Color of COD

Table A5 Detail of Packtest COD model WAK-COD

Measuring Method	Oxidation with Potassium Permanganate in Alkalinity and Visual Colorimetric Method
Range	0, 5, 10, 13, 20, 50, 100 mg/L
Reaction Time	Sample Temp.10°C : 6 min. Sample Temp.20°C : 5 min. Sample Temp.30°C : 4 min.

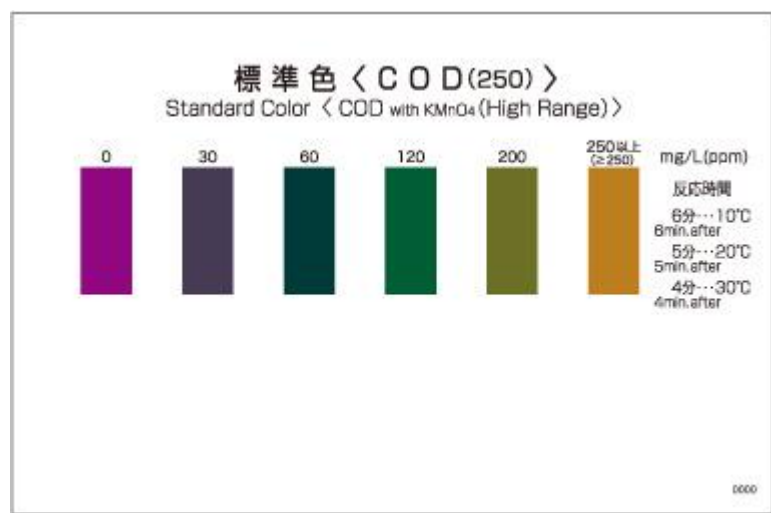


Figure A7 Standard Color of COD (High Range)

Table A6 Detail of Packtest COD (High Range) model WAK-COD(H)

Measuring Method	Oxidation with Potassium Permanganate in Alkalinity and Visual Colorimetric Method
Range	0, 30, 60, 120, 200, ≥ 250 mg/L
Reaction Time	Sample Temp.10°C : 6 min. Sample Temp.20°C : 5 min. Sample Temp.30°C : 4 min.

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APPENDIX B

Data of water quality monitoring of Chiang Mai Moat

Table B1 Water quality of some parameter of physical, chemical and biological in Chiang Mai Moat [79]

Sampling Site	Temp. (°C)	pH	Conduct. (µS.cm ⁻¹)	TDS (mg/L)	DO (mg/L)	
					Measure	% DO Sat
March 25, 2013						
Chang Phuak Gate	29	8	235	174	8.4	109
Tha Phae Gate	26	7	218	178	4.3	53
Chiang Mai Gate	25	8	197	171	8.2	99
Suan Dok Gate	25	8	216	171	5.9	71
April 5, 2013						
Chang Phuak Gate	28	8	227	180	7.4	94
Tha Phae Gate	28	7	223	181	3	39
Chiang Mai Gate	28	7	229	195	4.8	62
Suan Dok Gate	28	7	218	182	4.8	61

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Table B1 Water quality of some parameter of physical, chemical and biological in
Chiang Mai Moat [79] (continued)

Sampling Site	COD (mg/L)	Nitrate (mg/L)	Ammonium (mg/L)	Phosphate (mg/L)	BOD (mg/L)
March 25, 2013					
Chang Phuak Gate	5	0.72	0.72	0.05	6
Tha Phae Gate	10	0.22	0.22	0.24	3
Chiang Mai Gate	8	0.19	0.19	0.09	7
Suan Dok Gate	8	0.48	0.48	0.07	2
April 5, 2013					
Chang Phuak Gate	6	0.33	0.33	0.17	4
Tha Phae Gate	10	0.28	0.28	0.3	5
Chiang Mai Gate	15	0.63	0.63	0.33	4
Suan Dok Gate	12	0.36	0.36	0.34	9

Remarks: Sampling site Chang Phuak Gate nearly sampling site CM 2
 Sampling site Tha Phae Gate nearly sampling site CM 4
 Sampling site Chiang Mai Gate nearly sampling site CM 6
 Sampling site Suan Dok Gate nearly sampling site CM 8

APPENDIX C

Data of water quality monitoring of Mae Ping River passing through Chiang Mai City

Table C1 Data of water quality of Mae Ping River passing through Chiang Mai city on March 9, 2012

Sampling Zone-Trip	Temp. (°C)	pH	Conduct. ($\mu\text{s}.\text{ms}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
					Measure	% DO Sat					
P0-4	26	7	278	185	6	78	5	57	2	0.2	0.2
P1-4	28	7	247	165	4	47	5	72	2	0.2	0.3
P2-4	29	7	250	167	4	47	4	54	3	0.2	0.2
P3-4	29	7	242	160	3	39	15	48	2	0.2	0.3
P4-4	28	7	476	320	4	47	15	21	0.5	10	3
P5-4	29	7	260	173	2	27	7	43	4	1	0.5
P6-4	24	7	317	214	5	64	10	22	15	2	0.5

Table C2 Data of water quality of sub zone P4, Mae Ping River passing through Chiang Mai city

Sampling site on website	Sub zone grouping	Temp. (°C)	pH	Conduct. (µs.ms ⁻¹)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
						Measure	% DO Sat					
December 22, 2012												
P4-1 (A)	P4(A)	26	7	317	213	4	42	30	30	< 1	6	1.5
P4-1 (B)	P4(B)	24	7	510	342	2	21	30	20	< 1	> 10	2
December 23, 2012												
P4-2 (A)	P4(A)	24	7	323	213	2	24	10	38	1	7	0.7
P4-2 (B)	P4(B)	24	7	495	331	2	22	15	46	< 1	10	> 2
P4-2 (C)	P4-3	25	7	282	188	5	59	15	32	3	1.5	0.5
December 24, 2012												
P4-3 (A) [*]	P4(A)	25	7	340	229	4	44	15	40	< 1	9	2
P4-3 (A) ^{**}	P4(A)	24	7	501	327	4	42	25	39	< 1	> 10	6
P4-3 (A) ^{***}	P4(A)	26	7	383	255	4	50	20	31	1.5	8	2
P4-3 (B) [*]	P4(B)	25	7	510	348	2	23	20	57	< 1	> 10	6
P4-3 (B) ^{**}	P4(B)	24	7	489	326	1	15	25	45	< 1	> 10	6

Table C2 Data of water quality of sub zone P4, Mae Ping River passing Chiang Mai city (continued)

Sampling site on website	Sub zone grouping	Temp. (°C)	pH	Conduct. ($\mu\text{s}.\text{ms}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
						Measure	% DO Sat					
P4-3 (B)***	P4(B)	25	7	463	310	1	16	20	77	1	> 10	4
P4-3 (C)*	P4-3	25	7	254	169	5	61	20	33	< 1	0.5	0.5
P4-3 (C)**	P4-3	26	8	262	176	7	91	10	31	< 1	0.5	0.5
P4-3 (C)***	P4-3	26	7	249	168	7	88	10	22	1	0.5	0.3
March 9, 2013												
P4-4 (C)	P4-3	31	7	242	161	5	61	3	59	2	0.2	0.2
P4-4 (B)	P4(B)	28	7	476	320	4	47	15	21	0.5	10	3
P4-4 (A)	P4(A)	31	7	259	175	4	56	5	52	2	1	0.5
March 10, 2013												
P 3-5 (1)	P4-3	28	7	252	167	4	52	5	47	2	0.2	0.2
P 4-5 (1)	P4(B)	26	7	562	377	1	10	20	26	0.5	10	5
P 4-5 (2)	P4(A)	28	7	277	187	4	44	10	45	2	1	0.5
P 4-5 (3)	P4	28	7	270	180	4	56	5	47	5	1	0.4

Table C2 Data of water quality of sub zone P4, Mae Ping River passing Chiang Mai city on December, 2012 (continued)

Sampling site on website	Sub zone grouping	Temp. (°C)	pH	Conduct. ($\mu\text{s}.\text{ms}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
						Measure	% DO Sat					
P 4-5 (4)	P4	28	7	266	181	3	41	5	43	5	1	0.5
P 3-5 (1)-II	P4-3	30	7	259	173	4	56	5	41	2	0.2	0.2
P 4-5 (1)-II	P4(B)	27	7	594	398	1	18	20	20	0.5	10	10
P 4-5 (2)-II	P4(A)	30	7	270	181	4	55	5	45	3	1	0.5
P 4-5 (4)-II	P4	30	7	276	184	7	90	5	42	5	1	0.3

Remarks: * = Water quality monitoring in the Morning
 ** = Water quality monitoring in the Afternoon
 *** = Water quality monitoring in the Evening

Table C3 Correlation of all parameters at zone P4

Correlation	Temp.	pH	Conduct.	TDS	%DO Sat	COD	Turbid	NH⁴	NO³	PO₄³⁻
Temp.	1.000									
pH	0.200	1.000								
Conduct.	-0.484	-0.481	1.000							
TDS	-0.479	-0.481	0.999	1.000						
%DO Sat	0.457	0.548	-0.771	-0.773	1.000					
COD	-0.730	-0.296	0.671	0.667	-0.549	1.000				
Turbid	0.229	-0.176	-0.147	-0.145	-0.143	-0.305	1.000			
NH⁴	-0.486	-0.308	0.886	0.885	-0.733	0.610	-0.452	1.000		
NO³	0.393	-0.094	-0.622	-0.620	0.481	-0.665	0.270	-0.669	1.000	
PO₄³⁻	-0.369	-0.334	0.901	0.900	-0.666	0.576	-0.077	0.730	-0.544	1.000

Table C4 Data of water quality of sub zone P5, Mae Ping River passing through Chiang Mai city

Sampling site on website	Sub zone grouping	Temp. (⁰ C)	pH	Conduct. (μ s.ms ⁻¹)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
						Measure	% DO Sat					
December 22, 2012												
P5-1	P5	25	7	285	190	4	51	20	30	3	1.5	0.4
December 23, 2012												
P5-2 (A)	P5(A)	24	7	280	186	5	54	15	27	3	1.5	0.5
P5-2 (B)	P5(B)	25	7	280	187	2	23	15	16	3	1.0	0.5
P5-2 (C)	P5(C)	25	7	278	189	2	25	15	24	3	1.5	0.5
March 9, 2013												
P5-4	P5	29	7	260	173	2	27	7	43	4	1.0	0.5
March 10, 2013												
P 5-5 (1)	P5	29	7	266	180	3	39	7	40	5	1.0	0.5
P 6-5 (A)	P5(A)	29	7	245	164	5	64	5	38	7	1.0	0.3
P 6-5 (B)	P5(B)	27	7	364	247	6	77	10	17	15	4.0	1.0

Table C4 Data of water quality of sub zone P5, Mae Ping River passing through Chiang Mai city (continued)

Sampling site on website	Sub zone grouping	Temp. (⁰ C)	pH	Conduct. (μ s.ms ⁻¹)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
						Measure	% DO Sat					
March 11, 2013												
P 5-6 (2)	P5	27	7	264	172	1	16	8	37	3	1.0	0.2
P 5-6 (A)	P5(A)	29	7	278	187	2	21	10	31	8	1.0	0.2
P 5-6 (B)	P5(B)	28	7	286	192	2	19	8	37	6	1.0	0.6
March 12, 2013												
P 5-7 (C)	P5(C)	26	7	286	193	2	30	7	41	6	1.5	0.6
P 5-7 (B)	P5(B)	27	7	282	189	2	21	-	51	7	1.5	0.5
P 5-7 (A)	P5(A)	27	7	282	189	2	20	6	45	7	1.5	0.5
P 5-7 (C): II	P5(C)	27	7	291	194	3	42	8	33	5	1.5	0.5
P 5-7 (B): II	P5(B)	28	7	294	197	2	31	8	35	5	1.5	0.5
P 5-7 (A): II	P5(A)	29	7	295	199	2	21	10	35	5	1.5	0.5
P 5-7 (B)	P5(B)	26	7	282	189	2	24	5	51	5	1.0	0.5

Table C5 Data of water quality of sub zone P6, Mae Ping River passing through Chiang Mai city

Sampling site on website	Sub zone grouping	Temp. (°C)	pH	Conduct. (μs.ms ⁻¹)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
						Measure	% DO Sat					
December 22, 2012												
P6-1 (A)	P6(A)	26	7	285	191	6	74	15	25	4	1.0	0.4
P6-1 (B)	P6(B)	24	7	333	223	5	63	15	43	8	3.0	0.5
December 23, 2012												
P6-2 (A)	P6(A)	26	7	278	187	7	80	10	25	6	1.0	0.5
P6-2 (B)	P6(B)	24	7	338	224	6	69	25	31	10	4.0	0.8
P6-2 (C)	P6(C)	26	7	282	189	6	68	20	19	5	0.7	0.5
December 25, 2012												
P6-3 (A)*	P6(A)	25	7	318	212	3	39	15	24	7	7.0	1.0
P6-3 (A)**	P6(A)	26	7	295	197	4	52	15	22	7	5.0	1.0
P6-3 (A)***	P6(A)	27	7	294	197	6	68	10	24	6	3.0	0.5
P6-3 (B)*	P6(B)	24	7	312	206	3	42	20	35	8	1.5	0.5
P6-3 (B)**	P6(B)	24	7	313	212	4	51	20	32	9	1.0	0.5

Table C5 Data of water quality of sub zone P6, Mae Ping River passing through Chiang Mai city (continued)

Sampling site on website	Sub zone grouping	Temp. (°C)	pH	Conduct. ($\mu\text{s}.\text{ms}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
						Measure	% DO Sat					
P6-3 (B)***	P6(B)	26	7	315	208	5	58	20	32	8	1.0	0.5
P6-3 (C)*	P6(C)	25	7	315	210	4	52	20	25	7	5.0	1.0
P6-3 (C)**	P6(C)	26	7	308	207	5	66	20	24	8	3.0	0.7
P6-3 (C)***	P6(C)	26	7	302	202	6	77	20	28	8	2.0	0.5
March 9, 2013												
P6-4 (A)	P6(A)	29	7	251	168	5	59	6	48	10	0.5	0.3
P6-4 (B)	P6(B)	24	7	317	214	5	64	10	22	15	2.0	0.5
P6-4 (C)	P6(C)	24	7	263	176	4	48	5	37	10	1.0	0.2
March 11, 2013												
P 6-6 (1)	P6	27	7	263	176	5	62	14	34	8	0.5	0.2
P 6-6 (2)	P6	27	7	253	169	4	54	12	31	7	1.0	0.2
P 6-6 (3)	P6	25	7	401	271	6	70	35	17	10	5.0	1.0

Table C5 Data of water quality of sub zone P6, Mae Ping River passing through Chiang Mai city (continued)

Sampling site on website	Sub zone grouping	Temp. (⁰ C)	pH	Conduct. (μs.ms ⁻¹)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
						Measure	% DO Sat					
March 12, 2013												
P 6-7(A)	P6(A)	28	7	289	193	5	59	8	20	10	1.0	0.5
P 6-7(B)	P6(B)	26	7	445	299	6	73	14	21	20	5.0	1.5
March 13, 2013												
P 6-8 (A)	P6(A)	27	7	283	190	3	41	10	14	12	1.0	0.5
P 6-8 (B)	P6(B)	24	7	431	288	6	73	12	19	17	6.0	1.5
P 6-8 (1)	P6	27	7	419	277	4	44	8	17	12	3.0	1.0
P 6-8 (2)	P6	29	7	301	200	4	50	7	25	12	1.0	0.4
P 6-8 (3)	P6	27	8	402	269	5	64	12	22	25	6.0	1.5
P 6-8 (4)	P6	27	8	392	266	4	56	11	21	15	3.0	1.0

APPENDIX D

Data of water quality monitoring of Phayao Lake

Water quality monitoring data of Phayao Lake was investigated and showed follow as;

1. Data of water quality monitoring of Phayao Lake.

The data of water quality monitoring of Phayao Lake showed showed in Table D1. The code name of zone were refer to zone number, trip number, sub-zone name and trip number. For example;

Zone LP 1-3-A-1 that means sampling of Zone LP 1 is the trip 3 in Sub Zone A is the trip 1.

Water quality monitoring data of the trip 1 and trip 2 were investigate followed another agencies that do not zoning to water quality monitoring. The data were matched and applied to zone that showed in Table D1.

The data of phosphate of trip 1 and trip 2 were measured by model high range of Packtest that make the Data determined lower detection.

2. Data of sub-zone water quality monitoring of Phayao Lake in trip 8.

3. Data of water quality monitoring at sampling site LP 2-B (coordinates 19°9'51.0" N, 99°53'48.6" E).

4. Data of wastewater dispersion at sampling site LP 2-B and surrounding.

1. Data of water quality monitoring of Phayao Lake

Table D1 Data of water quality monitoring of Phayao Lake

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
1	LP 4-1-B-1 (LP-7(O))	4	30	7	114	76	4	53	20	129	< 1	0.2	-
1	LP 4-1-A-1 (LP-6(O))	4	29	8	133	89	6	78	15	54	< 1	0.2	-
1	LP 3-1 (LP-5(O))	3	28	9	147	99	7	89	10	54	< 1	0.2	-

Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
1	LP 2-1-B-1 (LP-4(O))	2	28	9	151	102	7	89	25	54	< 1	0.2	-
1	LP 2-1-A-1 (LP-3(O))	2	27	9	152	101	7	88	10	54	< 1	0.2	-
1	LP 1-1-B-1 (LP-2(O))	1	28	9	155	135	8	102	10	53	< 1	0.2	-
1	LP 1-1-A-1 (LP-1(O))	1	27	8	159	107	6	75	5	40	< 1	0.2	-

Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
1	LP 10-1 (LP-12(O))	10	27	7	161	107	3	38	10	34	< 1	0.2	-
1	LP 9-1 (LP-11(O))	9	27	9	144	96	5	63	10	44	< 1	0.2	-
1	LP 8-1 (LP-10(O))	8	30	8	148	101	6	79	5	13	< 1	0.2	-
1	LP 6-1 (LP-9(O))	6	30	8	155	104	7	93	5	8	< 1	0.2	-
1	LP 7-1 (LP-8(O))	7	29	9	146	95	10	130	20	42	< 1	0.2	-

Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
2	LP 4-2-B-2 (LP-7-2(O))	4	31	7	119	80	4	54	15	24	< 1	0.2	-
2	LP 4-2-A-2 (LP-6-2(O))	4	31	9	135	91	7	94	15	53	< 1	0.2	-
2	LP 3-2 (LP-5-2(O))	3	31	9	148	99	8	112	10	36	< 1	0.2	-
2	LP 2-2-B-2 (LP-4-2(O))	2	30	9	148	98	9	119	10	38	< 1	0.2	-

Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
2	LP 2-2-A-2 (LP-3-2(O))	2	30	9	149	100	9	114	10	38	< 1	0.2	-
2	LP 1-2-B-2 (LP-2-2(O))	1	29	8	155	105	5	65	5	88	< 1	0.2	-
2	LP 1-2-A-2 (LP-1 - 2(O))	1	30	8	162	108	6	79	10	66	< 1	0.2	-
2	LP 10-2 (LP-12-2(O))	10	29	7	150	102	5	65	5	123	< 1	0.2	-

Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
2	LP 9-2 (LP-11-2(O))	9	30	8	145	97	7	93	10	25	< 1	0.2	-
2	LP 8-2 (LP-10-2(O))	8	30	7	153	103	5	66	10	18	< 1	0.2	-
2	LP 6-2 (LP-9-2(O))	6	30	7	158	105	6	79	10	12	< 1	0.2	-
2	LP 7-2 (LP-8-2(O))	7	30	8	133	89	7	93	15	33	< 1	0.5	-
3	LP 4-3	4	31	7	94	63	3	41	20	11	< 1	0.5	0.4
3	LP 3-3	3	31	8	112	74	6	77	25	17	< 1	0.2	0.2

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Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S.cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
3	LP 2-3	2	31	9	117	77	8	107	20	19	< 1	0.2	0.2
3	LP 1-3	1	30	9	112	76	8	106	20	18	< 1	0.2	0.2
3	LP 10-3	10	30	8	117	79	7	89	15	17	< 1	0.5	0.2
3	LP 9-3	9	30	9	112	75	8	110	15	26	< 1	0.2	0.3
3	LP 8-3	8	29	8	127	85	7	95	15	16	< 1	0.2	0.3
3	LP 6-3	6	31	8	107	72	7	89	20	17	< 1	0.2	0.5
3	LP 5-3	5	31	8	100	69	8	101	20	10	< 1	0.2	0.2
3	LP 7-3	7	29	9	110	78	8	98	20	24	< 1	0.2	0.4
4	LP 4-4	4	31	7	92	62	4	57	20	11	< 1	0.2	0.2
4	LP 3-4	3	30	7	114	74	4	46	15	11	< 1	0.2	0.2
4	LP 2-4	2	31	8	114	76	7	89	15	13	< 1	< 0.2	0.2
4	LP 1-4	1	30	7	120	80	4	53	15	11	< 1	0.2	0.2
4	LP 10-4	10	29	7	116	77	4	51	15	10	< 1	0.2	0.2
4	LP 9-4	9	29	7	124	80	5	64	15	13	< 1	0.2	0.05
4	LP 8-4	8	29	8	129	86	7	87	15	9	< 1	0.2	0.2

Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S.cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
4	LP 6-4	6	29	8	127	84	5	66	15	8	< 1	0.2	0.1
4	LP 5-4	5	30	7	103	69	7	95	15	4	< 1	< 0.2	0.2
4	LP 7-4	7	30	8	112	75	7	97	20	13	< 1	0.2	0.2
5	LP 4-5	4	29	7	99	66	4	52	10	13	< 1	< 0.2	0.2
5	LP 3-5	3	29	7	118	79	6	78	20	16	< 1	< 0.2	0.2
5	LP 2-5	2	30	8	121	81	7	89	10	18	< 1	< 0.2	0.2
5	LP 1-5	1	31	7	123	82	5	72	10	14	< 1	< 0.2	0.1
5	LP 10-5	10	30	7	120	80	5	59	15	19	< 1	< 0.2	0.1
5	LP 9-5	9	29	8	117	78	7	97	15	19	< 1	< 0.2	0.1
5	LP 8-5	8	29	8	122	81	7	88	10	13	< 1	< 0.2	0.05
5	LP 6-5	6	29	8	113	75	7	94	10	8	< 1	< 0.2	0.1
5	LP 5-5	5	30	8	101	68	6	80	10	4	< 1	< 0.2	0.2
5	LP 7-5	7	29	9	115	77	8	102	10	20	< 1	< 0.2	0.2
6	LP 4-6	4	28	7	103	70	4	48	15	9	< 1	0.2	0.1
6	LP 3-6	3	28	8	119	80	7	88	10	17	< 1	0.2	0.1

Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S.cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
6	LP 2-6	2	29	8	126	84	6	83	15	16	< 1	0.2	0.1
6	LP 1-6	1	30	7	127	85	6	84	10	14	< 1	0.2	0.1
6	LP 10-6	10	28	7	125	83	3	43	15	13	< 1	0.2	0.1
6	LP 9-6	9	28	8	117	78	5	67	15	19	< 1	0.2	0.1
6	LP 8-6	8	28	7	120	80	5	69	15	11	< 1	0.2	0.1
6	LP 6-6	6	28	7	118	78	5	66	15	9	< 1	0.2	0.1
6	LP 5-6	5	28	7	106	71	4	55	20	7	< 1	0.2	0.1
6	LP 7-6	7	28	8	115	77	7	85	15	18	< 1	0.2	0.1
7	LP 4-7	4	27	7	132	89	7	90	15	31	< 1	0.2	0.2
7	LP 3-7	3	26	9	143	95	8	99	20	17	< 1	0.2	0.1
7	LP 2-7	2	28	8	143	96	7	94	15	24	< 1	0.2	0.3
7	LP 1-7	1	28	8	150	100	7	90	20	14	< 1	0.2	0.1
7	LP 10-7	10	26	7	140	95	4	53	15	36	< 1	0.2	0.1
7	LP 9-7	9	25	8	139	93	8	95	20	13	< 1	0.2	0.1
7	LP 8-7	8	25	8	139	94	7	81	20	8	< 1	0.2	0.1

Table D1 Data of water quality monitoring of Phayao Lake (continued)

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S.cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
7	LP 6-7	6	26	7	139	93	6	74	15	5	< 1	0.2	0.1
7	LP 5-7	5	26	8	141	94	7	87	15	10	< 1	0.2	0.2
7	LP 7-7	7	25	9	141	94	10	117	15	21	< 1	0.2	0.2
10	LP 4-10	4	25	9	133	88	6	75	12	10	< 1	0.2	0.2
10	LP 3-10	3	26	9	155	104	6	76	5	18	< 1	0.2	0.2
10	LP 2-10	2	27	9	156	104	6	69	7	19	< 1	0.2	0.2
10	LP 1-10	1	27	8	157	105	6	72	7	26	< 1	0.2	0.1
10	LP 10-10	10	25	7	143	96	5	58	5	11	< 1	0.2	0.2
10	LP 9-10	9	26	8	152	102	5	64	7	16	< 1	0.2	0.2
10	LP 8-10	8	26	8	153	102	4	53	6	16	< 1	0.2	0.2
10	LP 6-10	6	26	8	154	103	6	79	7	14	< 1	0.2	0.2
10	LP 5-10	5	28	9	154	104	8	104	7	10	< 1	0.2	0.2
10	LP 7-10	7	26	9	152	102	8	96	7	17	< 1	0.2	0.2

Table D2 Correlation of each parameter

Correlation	Temp.	pH	% DO Sat	COD	Turbid.	Conduct.	TDS	NH ⁴	PO ₄ ³⁻
Temp.	1.000								
pH	-0.111	1.000							
% DO Sat	0.128	0.716	1.000						
COD	0.232	-0.103	0.091	1.000					
Turbid.	0.091	0.176	0.002	-0.124	1.000				
Conduct.	-0.471	0.377	0.148	-0.553	0.330	1.000			
TDS	-0.443	0.398	0.171	-0.539	0.355	0.965	1.000		
NH ⁴	0.053	-0.050	-0.057	0.162	0.062	0.027	0.032	1.000	
PO ₄ ³⁻	0.288	0.232	0.166	0.144	0.162	-0.194	-0.169	0.283	1.000

2. Data of sub-zone water quality monitoring of Phayao Lake in trip 8

Table D3 Data of sub-zone water quality monitoring of Phayao Lake in trip 8

Trip	Code on website	Zone LP	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NO ₃ ⁻ (mg/L)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat					
8	LP 2-A	2	27	8	147	98	6	81	25	17	< 1	0.2	0.1
8	LP 2-B	2	27	8	150	100	5	67	25	16	< 1	0.2	0.1
8	LP 2-(C-D)	2	26	9	142	94	9	112	25	16	< 1	0.2	0.2
8	LP 4-A	4	25	7	142	95	6	69	15	51	< 1	0.2	0.2
8	LP 4-B	4	25	7	131	87	3	34	25	37	< 1	0.2	0.2
8	LP 4-C	4	25	6	134	89	2	27	25	13	< 1	0.2	0.2
8	LP 4-D	4	26	7	137	91	5	55	20	6	< 1	0.2	0.2
8	LP 5-(A-B)	5	25	8	143	95	7	90	20	13	< 1	0.2	0.2
8	LP 5-C	5	26	7	144	97	6	74	25	4	< 1	0.2	0.2
8	LP 5-D	5	26	7	150	100	5	63	20	3	< 1	0.2	0.3
8	LP 7-8	7	26	9	141	94	9	113	20	16	< 1	0.2	0.2

3. Data of water quality monitoring at sampling site LP 2-B (coordinates 19°9'51.0" N, 99°53'48.6" E)

Table D4 Data of water quality monitoring at sampling site LP 2-B (coordinates 19°9'51.0" N, 99°53'48.6" E)

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. (µS.cm ⁻¹)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat				
11-Feb-13	18:00	LP 2-B	28	7	178	119	3	39	25	28	1.0	0.1
	19:00	LP 2-B	28	7	170	112	2	25	25	26	1.0	0.1
	20:00	LP 2-B	27	7	184	124	3	42	25	17	1.0	0.1
	21:00	LP 2-B	27	7	173	114	3	40	25	16	1.0	0.1
12-Feb-13	7:30	LP 2-B	27	7	214	138	2	21	20	25	3.0	0.1
	8:30	LP 2-B	27	7	216	145	2	28	20	15	2.0	0.2
	9:30	LP 2-B	27	7	209	142	2	26	20	14	2.0	0.2
	10:30	LP 2-B	27	8	169	108	2	29	20	23	1.0	0.2
	10:30	LP 2-A (1)	-	-	-	-	-	-	-	-	0.1	0.2
	10:30	LP 2-A (2)	-	-	-	-	-	-	-	-	0.2	0.5
	10:30	LP 1-B	-	-	-	-	-	-	-	-	0.2	0.5

Table D4 Data of water quality monitoring at sampling site LP 2-B (coordinates 19°9'51.0" N, 99°53'48.6" E) (continued)

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. (µS.cm ⁻¹)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat				
16-Feb-13	8:00	LP 2-B	-	-	223	-	-	-	25	-	3.0	0.2
	12:00	LP 2-B	-	-	148	-	-	-	25	-	0.2	0.2
	17:00	LP 2-B	-	-	153	-	-	-	25	-	0.5	0.1
17-Feb-13	8:00	LP 2-B	-	-	217	-	-	-	20	-	3.0	0.2
	12:00	LP 2-B	-	-	188	-	-	-	30	-	3.0	0.2
	17:00	LP 2-B	-	-	168	-	-	-	25	-	1.0	0.1
18-Feb-13	8:00	LP 2-B	-	8	190	-	-	-	20	-	2.0	0.2
	12:00	LP 2-B	-	8	194	-	-	-	25	-	2.0	0.5
	17:00	LP 2-B	-	8	187	-	-	-	25	-	1.0	0.2
19-Feb-13	8:00	LP 2-B	-	9	254	-	-	-	25	-	3.0	0.3
	12:00	LP 2-B	-	9	161	-	-	-	20	-	1.0	0.3
	17:00	LP 2-B	-	8	158	-	-	-	30	-	0.5	0.1

Table D4 Data of water quality monitoring at sampling site LP 2-B (coordinates 19°9'51.0" N, 99°53'48.6" E) (continued)

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. ($\mu\text{S.cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat				
20-Feb-13	8:00	LP 2-B	-	8	268	-	-	-	20	-	5.0	0.5
	12:00	LP 2-B	-	8	154	-	-	-	20	-	0.2	0.2
	17:00	LP 2-B	-	8	159	-	-	-	20	-	0.5	0.1
21-Feb-13	8:00	LP 2-B	-	8	227	-	-	-	20	-	3.0	0.2
	12:00	LP 2-B	-	8	188	-	-	-	20	-	1.0	0.2
	17:00	LP 2-B	-	8	218	-	-	-	25	-	2.0	0.1
22-Feb-13	8:00	LP 2-B	-	8	305	-	-	-	25	-	5.0	0.5
	12:00	LP 2-B	-	8	412	-	-	-	25	-	7.0	2.0
	17:00	LP 2-B	-	9	-	-	-	-	25	-	0.5	0.1

4. Data of wastewater dispersion at sampling site LP 2-B and surrounding

Table D5 Data of wastewater dispersion at sampling site LP 2-B and surrounding

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. ($\mu\text{S.cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH ₄ ⁺ (mg/L)	PO ₄ ³⁻ (mg/L)
							Measure	% DO Sat				
23-Mar-13	18:00	LP 2-B	28	7	383	255	0.2	3	10	22	2.0	0.1
	21:00	LP 2-B	28	7	342	226	0.2	3	12	25	5.0	0.2
24-Mar-13	0:00	LP 2-B	28	7	861	572	0.2	3	20	58	> 10	1
	1:00	LP 2-B	28	7	851	566	0.2	3	20	58	> 10	1
	2:00	LP 2-B	27	7	849	565	0.3	4	20	61	> 10	1
	4:00	LP 2-B	27	7	839	559	0.2	3	25	38	> 10	1
	6:00	LP 2-B	27	7	845	558	0.2	2	20	27	10	1
	0:00	LP 2-A (1)	27	-	157	104	6	76	5	-	0.2	0.1
	0:00	LP 2-A (2)	26	-	157	104	5	61	5	-	0.2	0.05
	0:00	LP 1-B	28	-	156	104	4	48	5	-	0.2	0.1

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Table D5 Data of wastewater dispersion at sampling site LP 2-B and surrounding (continued)

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH_4^+ (mg/L)	PO_4^{3-} (mg/L)
							Measure	% DO Sat				
24-Mar-13	13:00	LP 2-B (2 - L)	30	8	157	104	5	72	8	87	0.2	0.1
	13:00	LP 2-B (1 - L)	31	8	159	106	4	55	7	45	0.2	0.1
	13:00	LP 2-B (0 - L)	27	7	220	147	0.1	1	7	42	0.5	0.2
	13:00	LP 2-B	27	7	864	571	0.3	4	120	19	10.0	2
	13:00	LP 2-B (0 - R)	27	7	663	444	0.1	1	30	71	7.0	0.5
	13:00	LP 2-B (1 - R)	29	7	294	196	2	23	7	21	0.2	0.2
	13:00	LP 2-B (2 - R)	31	7	156	105	3	44	7	35	0.2	0.1

Table D5 Data of wastewater dispersion at sampling site LP 2-B and surrounding (continued)

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. ($\mu\text{S.cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH_4^+ (mg/L)	PO_4^{3-} (mg/L)
							Measure	% DO Sat				
24-Mar-13	21:00	LP 2-B (2 - L)	-	-	-	-	-	-	-	-	-	-
	21:00	LP 2-B (1 - L)	28	7	174	115	4	56	5	34	0.5	0.05
	21:00	LP 2-B (0 - L)	29	7	208	130	0.4	5	7	29	0.2	0.05
	21:00	LP 2-B	28	7	220	146	0.2	3	10	17	0.5	0.05
	21:00	LP 2-B (0 - R)	29	7	171	113	0.5	6	7	17	0.2	0.05
	21:00	LP 2-B (1 - R)	27	7	162	107	0.8	10	5	44	0.2	0.05
	21:00	LP 2-B (2 - R)	-	-	-	-	-	-	-	-	-	-

Table D5 Data of wastewater dispersion at sampling site LP 2-B and surrounding (continued)

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH_4^+ (mg/L)	PO_4^{3-} (mg/L)
							Measure	% DO Sat				
25-Mar-13	6:00	LP 2-B (2 - L)	26	7	158	106	5	59	5	30	0.2	0.1
	6:00	LP 2-B (1 - L)	26	7	174	115	3	41	5	23	0.5	0.1
	6:00	LP 2-B (0 - L)	26	7	618	412	0.2	2	30	28	8.0	0.1
	6:00	LP 2-B	27	7	803	528	0.3	4	40	23	8.0	0.05
	6:00	LP 2-B (0 - R)	26	7	442	292	0.4	5	15	28	5.0	0.1
	6:00	LP 2-B (1 - R)	25	7	236	153	0.8	10	7	41	1.0	0.2
	6:00	LP 2-B (2 - R)	26	7	182	120	2	20	5	18	0.2	0.1

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Table D5 Data of wastewater dispersion at sampling site LP 2-B and surrounding (continued)

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. ($\mu\text{S}\cdot\text{cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH_4^+ (mg/L)	PO_4^{3-} (mg/L)
							Measure	% DO Sat				
25-Mar-13	13:00	LP 2-B (2 - L)	31	8	159	106	6	75	15	48	0.2	0.1
	13:00	LP 2-B (1 - L)	31	7	164	109	5	70	7	41	0.2	0.1
	13:00	LP 2-B (0 - L)	28	7	250	168	0.3	4	10	38	1.0	0.2
	13:00	LP 2-B	27	7	696	462	0.2	3	20	23	7.0	0.05
	13:00	LP 2-B (0 - R)	28	7	345	231	0.3	4	13	32	1.0	0.2
	13:00	LP 2-B (1 - R)	30	7	213	130	2.4	32	10	27	0.2	0.1
	13:00	LP 2-B (2 - R)	29	7	181	124	1.7	22	12	17	0.2	0.2

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Table D5 Data of wastewater dispersion at sampling site LP 2-B and surrounding (continued)

Date	Time	Sampling Site	Temp. (°C)	pH	Conduct. ($\mu\text{S.cm}^{-1}$)	TDS (mg/L)	DO (mg/L)		COD (mg/L)	Turbid. (NTU)	NH_4^+ (mg/L)	PO_4^{3-} (mg/L)
							Measure	% DO Sat				
25-Mar-13	21:00	LP 2-B (2 - L)	-	-	-	-	-	-	-	-	-	-
	21:00	LP 2-B (1 - L)	28	7	177	118	2.5	32	5	22	0.2	0.05
	21:00	LP 2-B (0 - L)	28	7	357	224	0.3	4	8	28	1.0	0.05
	21:00	LP 2-B	28	7	280	186	0.3	4	10	18	2.0	0.05
	21:00	LP 2-B (0 - R)	28	7	219	146	0.4	5	8	18	0.5	0.05
	21:00	LP 2-B (1 - R)	28	7	184	122	0.8	10	5	30	0.2	0.05
	21:00	LP 2-B (2 - R)	-	-	-	-	-	-	-	-	-	-

Wastewater dispersion at sampling site LP 2-B and surrounding

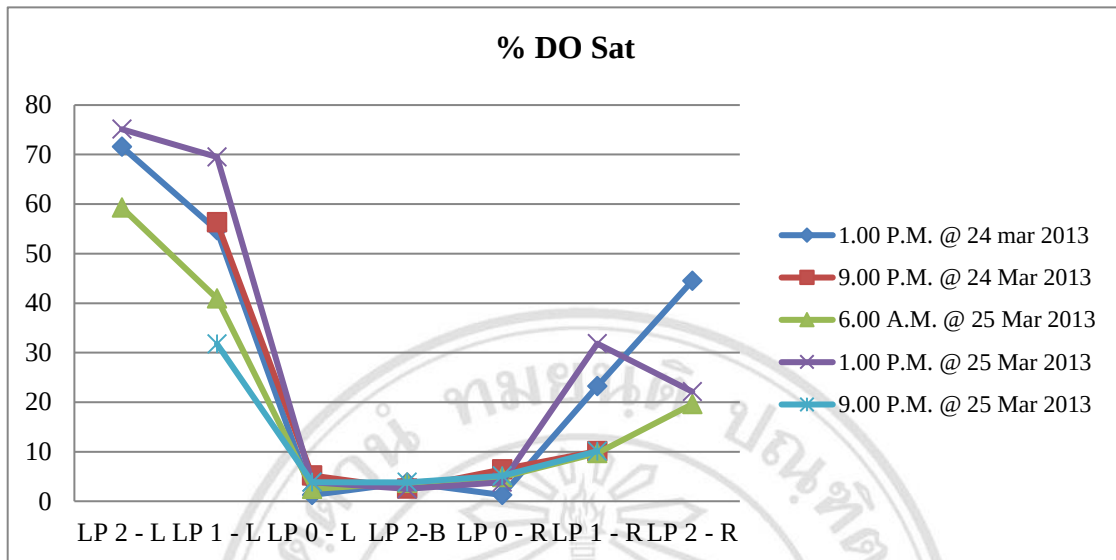


Figure D1 Concentration of % DO Sat at sampling site LP 2-B and surrounding

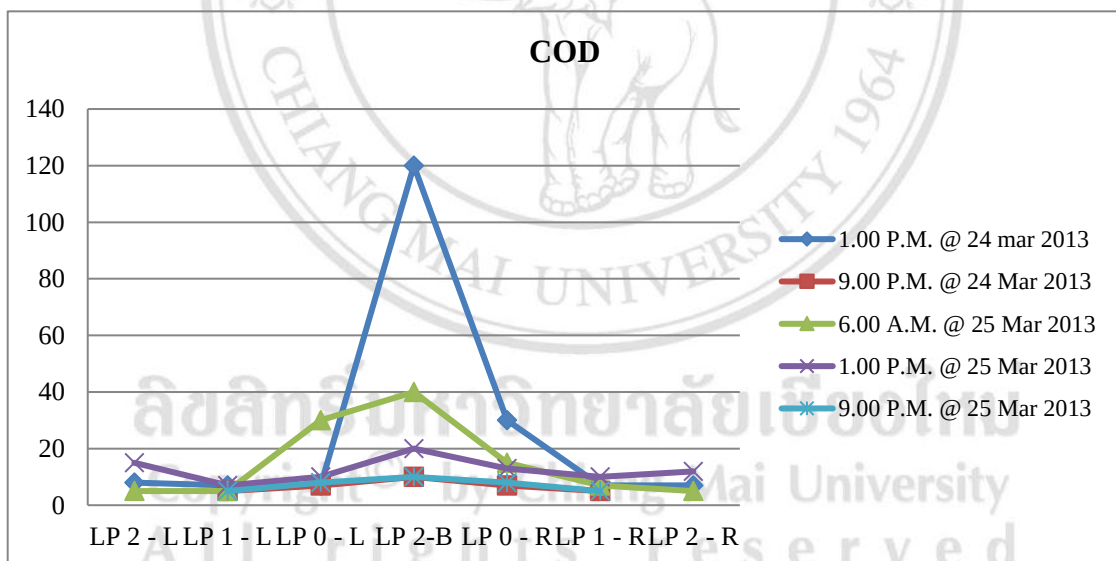


Figure D2 Concentration of COD at sampling site LP 2-B and surrounding

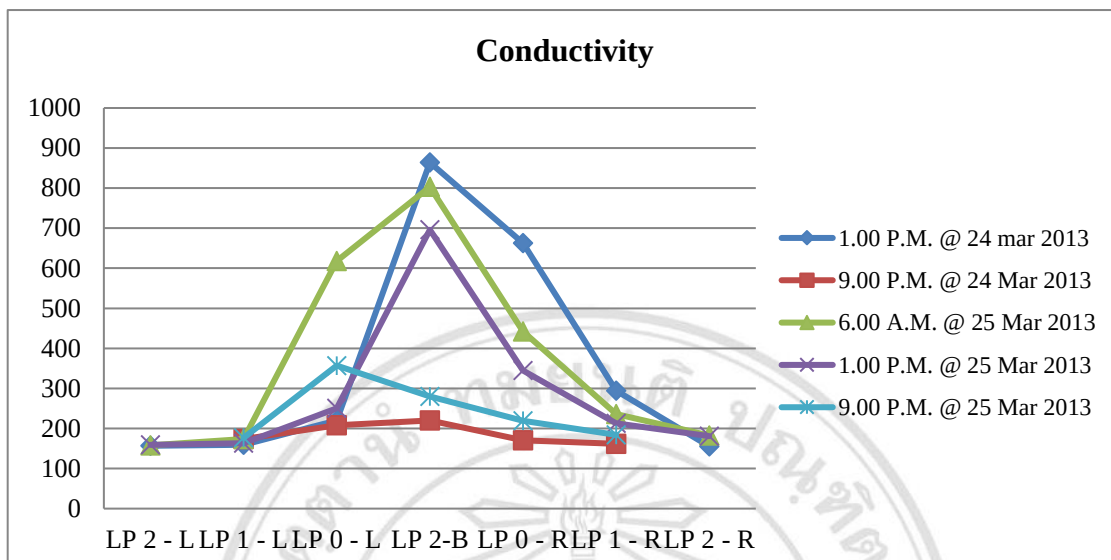


Figure D3 Conductivity at sampling site LP 2-B and surrounding

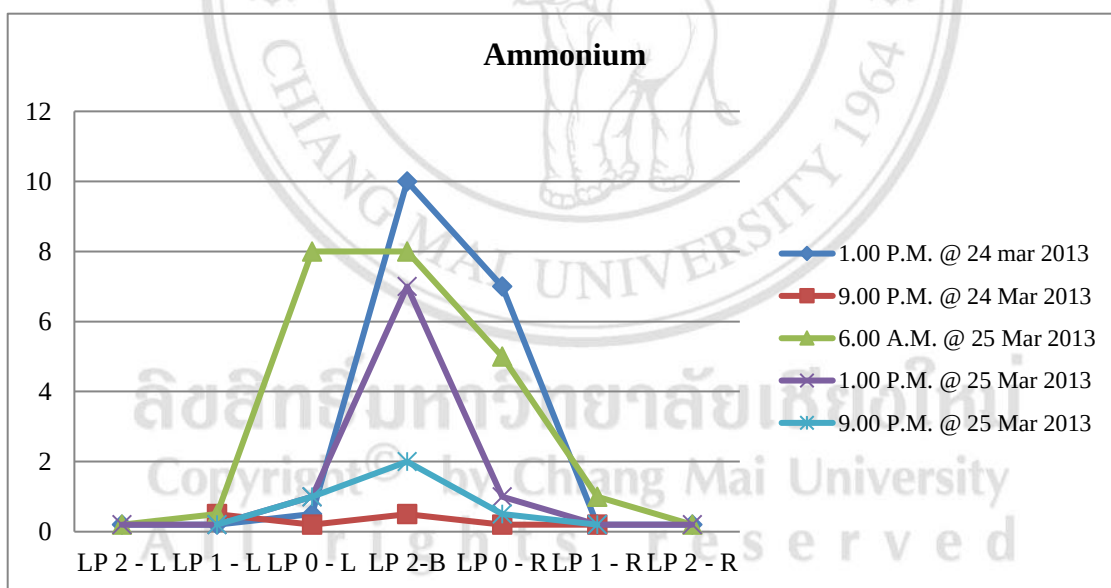


Figure D4 Concentration of ammonium at sampling site LP 2-B and surrounding

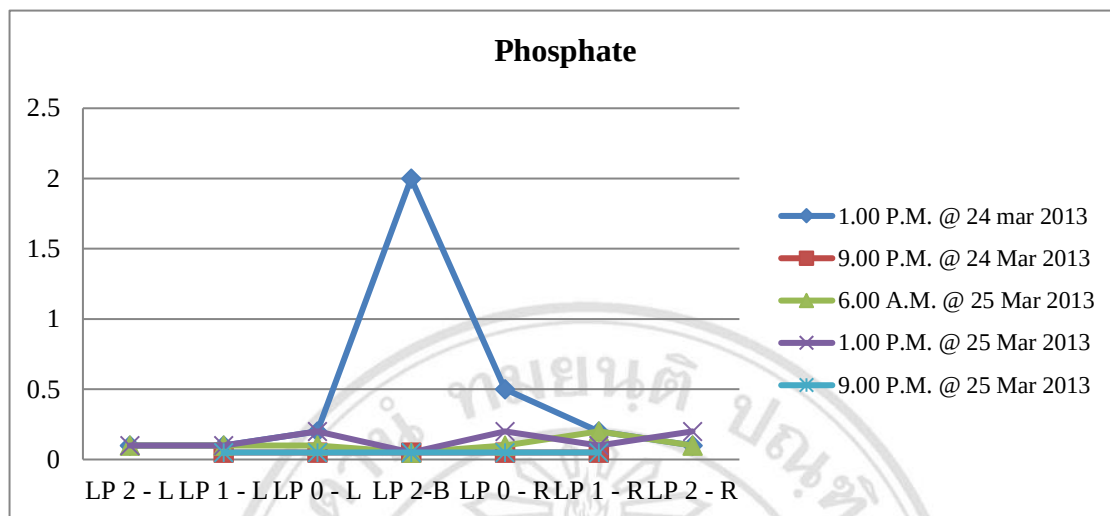


Figure D5 Concentration of phosphate at sampling site LP 2-B and surrounding

Table D6 Rainfall in Phayao province area

Trip	D/M/Y	Rainfall (mm.)	
		24 hr	Total
1	4/8/2012	0	488.5
	5/8/2012	0	488.5
	6/8/2012	0	488.5
	7/8/2012	0.2	488.7
	8/8/2012	76.1	564.8
	9/8/2012	0.1	564.9
	10/8/2012	0	564.9
2	19/8/2012	4.3	569.2
	20/8/2012	5.8	575.0
	21/8/2012	2.5	577.5
	22/8/2012	0.5	578.0
	23/8/2012	3	581.0
	24/8/2012	8	589.0
	25/8/2012	0	589.0
3	16/9/2012	0	589.0
	17/9/2012	0	589.0
	18/9/2012	0	589.0
	19/9/2012	0	589.0
	20/9/2012	0	589.0
	21/9/2012	0	589.0
	22/9/2012	0	589.0
4	11/10/2012	0	958.9
	12/10/2012	0	958.9
	13/10/2012	0	958.9
	14/10/2012	0	958.9
	15/10/2012	0	958.9
	16/10/2012	0	958.9
	17/10/2012	1.5	960.4
5	22/10/2012	0	960.4
	23/10/2012	0	960.4
	24/10/2012	0	960.4
	25/10/2012	0	960.4
	26/10/2012	0	960.4
	27/10/2012	0	960.4
	28/10/2012	0	960.4
6	9/11/2012	0	960.4
	10/11/2012	0	960.4
	11/11/2012	0	960.4
	12/11/2012	0	960.4
	13/11/2012	3.1	963.5
	14/11/2012	0	963.5
	15/11/2012	0	963.5

Remark: Information rainfall from Thai Meteorological Department access data adapted from <http://www.tmd.go.th/climate/climate.php>

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Presentations

1. Kitti Phojuang, Wasin Wongwilai, Kate Grudpan, **Internet of Things (IoT) bridging chemical analysis for agriculture: Experiences in Chiang Mai**, 21st ICFIA, 3 – 8 September 2017, Saint Petersburg, Russia.
2. Kitti Phojuang, Wasin Wongwilai, Supara Grudpan, Siraprapa Wattanakul, and Kate Grudpan, **Internet of Things (IoT) in Modern Chemical Analysis**, the 13th Asian Conference on Analytical Sciences (ASIANALYSIS XIII), 8–11 December 2016, The Empress hotel, Chiang Mai, Thailand.
3. Kitti Phojuang, Kanokwan Kiwfo, Kajornchai Thajee, Pheeraya Jaikang, Sutasinee Apichai, Yuji Oki, Kinichi Morita, Wasin Wongwilai and Kate Grudpan, **Modern chemical analysis employing “PiCOEXPLORER” and modern information technology**, International forum 2016 on I&E sensing Technology & Environment monitoring, 22 March 2016, Kyushu University, Japan.
4. Kanokwan Kiwfo, Kajornchai Thajee, Pheeraya Jaikang, Sutasinee Apichai, Kitti Phojuang, Yuji Oki, Kinichi Morita, Wasin Wongwilai and Kate Grudpan, **Down scaling chemical analysis employing “PiCOSCOPE” and modern information technology**, 52th JAFIA Annual Symposium, 19 – 23 November 2015, Kiryu, Japan.
5. Wasin Wongwilai, Kanokwan Kiwfo, Kitti Phojuang, Supara Grudpan, Siraprapa Wattanakul, Kate Grudpan, **Modern information technology (Modern IT) for Environmental Analysis: Green analytical chemistry - some experiences by a groups of Chiang Mai University**, International Symposia on Research toward Green Innovation, 12-13 Jan 2014, Chiang Mai, Thailand.
6. Wasin Wongwilai, Kitti Phojuang, Siraprapa Wattanakul, Supara Grudpan, Kate Grudpan, **Analytical Chemistry Made Easy with Every Day Modern IT for Flow Based and Down Scaling Analysis**, ICFIA

2014:19th International Conference on Flow Injection Analysis and Related Techniques, 30 November – 5 December 2014, ACROS Fukuoka, Japan.

7. W. Wongwilai, Kitti Phojuang, I. D. McKelvie and Kate Grudpan, **Novel Water Quality Monitoring Employing Modern Information Technology: Study Cases in Thailand** , Aisanalysis XII 2013, 21-25 August 2013, Fukuoka, Japan.
8. Kitti Phojuang, Wasin Wongwilai, Somchai Lapanantnoppakhun, Ian D McKelvie and Kate Grudpan, **Novel Water Quality Monitoring Approach By Employing Modern Information Technology: A Case Study For The Effects Due To Flooding In Thailand**, The 6th PACCON 2012, 11 – 13 January 2012, The Empress Convention Center, Chiang Mai, Thailand.

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K. Phojuang, P. Nilagupta, S. Baulert, B. Pitiyon, **Study of Atmospheric Stability in Bangkok Mass Transit System (BTS) Area by Meteorological Pre-Processor Model**, The Proceeding of 45th Kasetsart University Annual Conference, 30 January – 2 February 2007, ISBN 978-974-537-9992, Page 755 – 762.

Experience

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