TRAINING ASSESSMENT REPORT AND TRAINING MATERIALS

Introduction to Groundwater Management

July 22 – 26, 2019, Savannakhet Province, Lao PDR

SUSTAINABLE INFRASTRUCTURE PARTNERSHIP

LOWER MEKONG INITIATIVE (LMI)

SUSTAINABLE INFRASTRUCTURE PARTNERSHIP (SIP)

pact building local promise.

ACKNOWLEDGEMENTS

This training assessment report is a key output delivered from the training of-trainers (TOT) workshop, "Introduction to Groundwater Management" held in Savannakhet Province, Lao PDR, from July 22 – 26, 2019. The training is part of the Lao National Groundwater Capacity Building Program under the Lower Mekong Initiative (LMI) - Sustainable Infrastructure Partnership (SIP), funded by the US Department of State (DOS) and conducted in partnership with the Friends of the Lower Mekong (FLM), including Australia, European Union (EU), Japan, South Korea, New Zealand, World Bank (WB), and Asian Development Bank (ADB).

Pact, as the lead implementer of SIP, is grateful for consistent support of LMI, DOS, and partners. A special thank you to the partner organizations who had helped shape the program into reality and designed and oversaw the workshop: the World Bank's Mekong Integrated Water Resource Management Program, the Thai Department of Groundwater Resources (DGR), the Lao Department of Water Resources (DWR), and the National University of Laos (NUOL). The training would not have been successful without our resourceful trainers and active participants.

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ACRONYMS

ADB	Asian Development Bank
DDG	Deputy Director-General
DGR	Department of Groundwater Resources
DONRE	District Office of Natural Resources and Environment
DOS	Department of State
DWR	Department of Water Resources
EU	European Union
FLM	Friends of the Lower Mekong
IAH	International Association of Hydrogeologists
IASH	International Association of Scientific Hydrology
LMI	Lower Mekong Initiative
MONRE	Ministry of Natural Resources and Environment
NUOL	National University of Laos
PONRE	Provincial Office of Natural Resources and Environment
SIP	Sustainable Infrastructure Partnership
TOT	Training of Trainers
UNESCO	United Nations Educational, Scientific and Cultural Organization
WB	World Bank

TRAINING SUMMARY

Introduction to Groundwater Management for Professional management level

July 22 – 26, 2019 at Daosavanh Resort, Savannakhet, Lao PDR

Target groups:	Government officers in charge of groundwater resources management and well inventory
Number of training days:	Five days
Training program agenda:	See Annex I
Number of invited trainees:	19 (9 Female/10 Male) **with full attendance**
List of trainees:	See Annex II
Trainers:	Experts from Department of Groundwater Resources, Ministry of Natural Resources and Environment, Thailand Dr. Tussanee Nettasana Dr. Surin Worakijthamrong Ms. Anchalee Pongsatitpat Mr. Prasert Mhumak Mr. Patsakron Assiri Mr. Somkiat Kongsuwan Ms. Pattra Khaiman
Training methodologies:	Class lecture, group exercise, panel discussion, quiz game, and field practice
Training materials:	See attached all presentation files, short films, and photos stored in the given CD
Recommended field equipment:	Resistivity Meter, Cable Reel, Electrode Walkie Talkie, Battery and Field Notebook
Training assessment results and findings:	The training workshop met each key objective. Trainees have evaluated the improvement in their level of knowledge from moderate to high, with an the average score range of 3.1 – 3.7 out of 4.0.
Recommendations for next steps:	Next training on data interpretation. Additional focused training on each topic

TRAINING ASSESSMENT RESULTS

The training workshop conducted a post-training assessment with trainees and trainers to evaluate the level of capacity building that was achieved, gauge overall participant satisfaction, and invite additional feedback. For the full 5-day training, all **19 participants had 100% attendance.** Nine women and 10 men participated in the training. Most participants were from central government agencies.

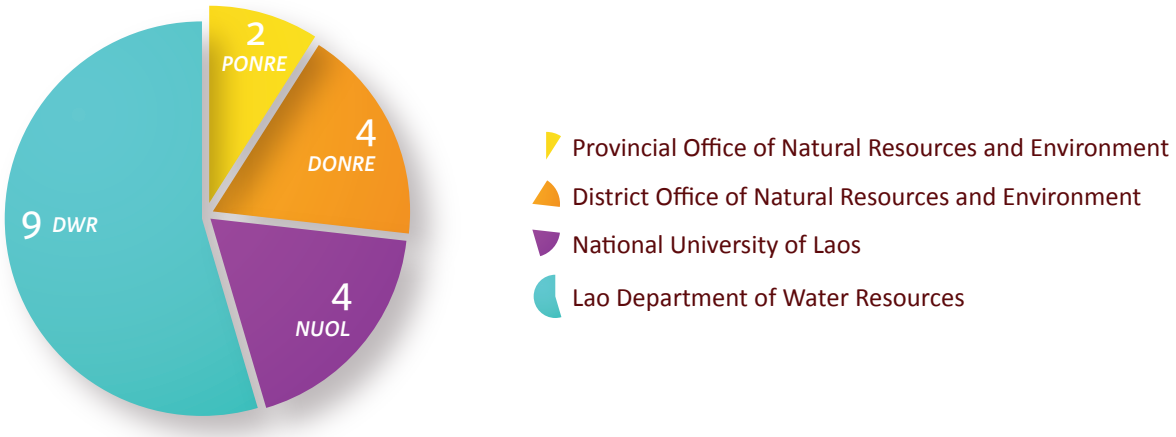

Figure 1: Composition of trainee group

Ex post evaluation showed that trainees improved their level of understanding of topics covered. **The evaluation found that most had improved by a moderate to high level, with an average score range of 3.1 – 3.7 out of 4.0 (76 – 92%).**
A few participants felt their improvement was slight, possibly due to limited training time as reflected in survey comments. **The training approach that trainees felt had most improved their knowledge was field work, with an average score of 3.7 (92%).**

Improved Level of Understanding of Trainees by Topics / Approaches

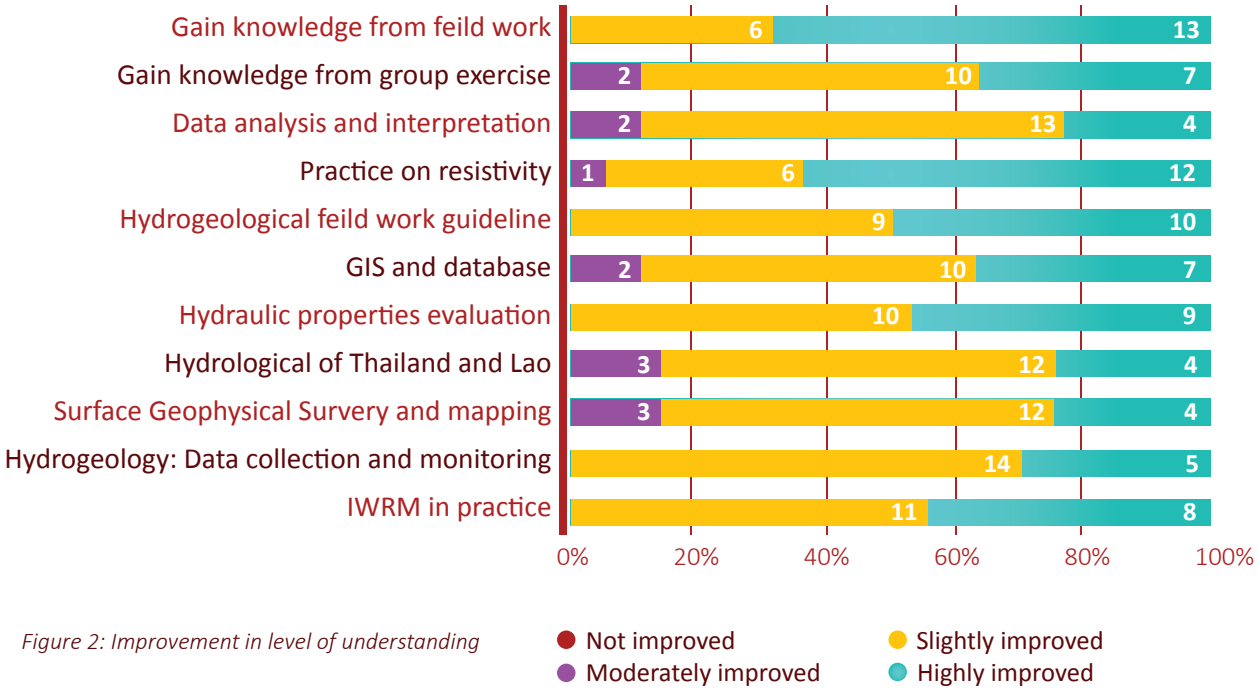

Figure 2: Improvement in level of understanding

Overall, knowledge and skills of the trainees have increased from 3.3 (83%) BEFORE to 3.7 (92%) AFTER the training. (Figure 3) The participants were highly satisfied with the training in terms of meeting the objectives and overall logistical organization.
The trainees rated high extent of score 3.8/4.0 using skills and knowledge gained during this workshop to advance in their career.

Overall knowledge and skills before and after participanting in the training

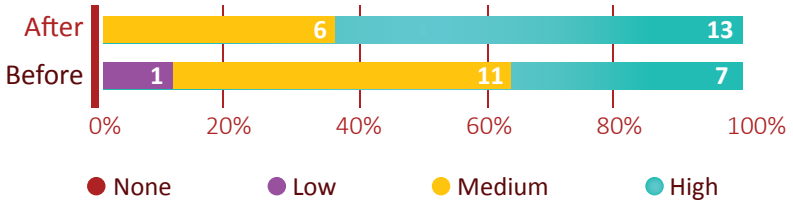

Figure 3: 'Before and after' comparison of trainee knowledge and skills

1. INTRODUCTION

1.1 Justification

Groundwater is of vital importance for the livelihood and health of people since it is often the main source for domestic water. It is also widely used for irrigated agriculture and for industry. This is particularly true in dry regions where surface water is scarce or seasonal, and in rural areas with dispersed populations. Climate change is likely to lead to a greater dependence on groundwater as a cushion against drought and increasing uncertainty in surface water availability. Up to now, the extent of groundwater exploitation in the Lower Mekong region varies from limited to very extensive, and this is likely to increase in the short- to medium-term future.

Through our research and experiences, except in Thailand, groundwater management capacity in Lower Mekong countries is considered inadequate in almost every aspect. Despite growing competition in groundwater extraction among industry, agriculture, urban development and rural development sectors, Cambodia, Lao PDR and Myanmar still do not have institutional capacity at national and subnational levels to perform key management roles of groundwater assessment, monitoring, regulating, and borehole drilling. Individual technical capacity of staff working in this field is yet to be developed.

Lower Mekong Initiative (LMI) - Sustainable Infrastructure Partnership (SIP) implemented by Pact, in partnership with Lao National - World Bank Mekong Integrated Water Resources Management (IWRM) Program organized the first consultation between Lao PDR and Thailand in July 2018 to discuss needs and develop the Lao National Groundwater Capacity Building Program, through technical assistance support from Thailand's Department of Groundwater Resources.

Figure 4: Group photo of participants

The meeting agreed to start up the program with on-the-job training on existing well monitoring and inventory, groundwater mapping, and lectures in groundwater management principles. The program is buildiing long-term human resource capacity with NUOL. A field survey was organized in early April 2019 at the proposed pilot study area in Savannakhet Province in order to design an on-the-job training program, with the first training being delivered in July 2019.

1.2 Objectives of the Training

1. To provide an understanding of basic principles of groundwater management to Lao government officers through lectures, workshops, and hands-on experience in hydrogeo logical field work.
2. To build long-term human resource capacity with NUOL.
3. To promote bilateral technical collaboration on groundwater resources management between the Thai and Lao governments, facilitated by LMI – SIP

1.3 Target Groups of this Training

This training was primarily designed for Lao government officers who are responsible for groundwater resource conservation, management, monitoring, and inventories in both central government and local authorities. A secondary target group is Lao academia who are responsible for formulating a practical academic curriculum in groundwater management.

1.4 Training Modules and Approaches

This training covered five full days of lectures, group work, field exercise, and panel discussion on the following groundwater management topics:

Topic 1: Integrated Water Resources Management in Practice: Water Use and Allocation in Practice
Topic 2: Introduction to Hydrogeology: Data Collection and Monitoring
Topic 3: Hydrogeological Exploration and Investigation
Topic 4: Surface Geophysical Survey and Mapping with Resistivity Measurement
Topic 5: Hydrological Map of Thailand and Laos
Topic 6: Hydraulic Properties Evaluation
Topic 7: GIS and Database
Topic 8: Hydrogeological Field Work Guideline
Topic 9: Water Quality Assessment

One full day of field exercise was intended for participants to have a hands-on practice in investigating surface geophysical properties and hydrogeological properties of the salt pit area to that of the household area; practicing resistivity, water level, and water quality measurement, as well as basic well inventory; and gaining in-depth understanding of groundwater management principles.

2. TRAINING WORKSHOP PROCEEDINGS

2.1 Day 1: Monday, July 22, 2019
Morning Session

Before the training workshop officially began, Dr Pinida Leelapanang Kamphaengthong, LMI-SIP Senior Program Officer from Pact Thailand, gave a warm welcome to all participants. She briefed participants on the Lao National Capacity Building Program that LMI-SIP had formulated with the World Bank's IWRM Program, in partnership with Thailand's Department of Groundwater Resources and Lao's Department of Water Resources. The Lao National Capacity Building Program is conducted under an MOU between the countries' respective Natural Resource and Environment ministries. Then, Mr Ounakone Xayviliya, Deputy Director of the Groundwater Resources Division, introduced the training objectives, which, he said, will be the first step for Lao government officials to implement the pilot Savannakhet Groundwater Management Program.

The workshop was officially opened by Mr Noukhane Inthapanya, Deputy Director-General of the Savannakhet Provincial Office of Natural Resources and Environment. His remarks addressed the essentials of a proper groundwater management plan, noting that Savannakhet, as a dry province depends solely on groundwater for both domestic and industrial uses. He welcomed the contribution of experts from Thailand's Department of Groundwater Resources as a great opportunity for Lao government officials to learn from a neighbor with similar geographic conditions and language. Mr Kingkham Manivong, Deputy Director-General of the Department of Water Resources, expressed hope that trainees would gain basic knowledge and join forces in a working group to support the formulation of a Savannakhet Groundwater Resources Management Plan.

Figure 5: Mr Noukhane Inthapanya (right) and Mr Kingkham Manivong (left) gave welcome remarks and messages to the training.

Topic 1: Integrated Water Resources Management in Practice: Water Use and Allocation in Practice

Dr Surin Worakijthamrong invited participants to introduce themselves and describe their expectations for this training. The workshop began with problem identification, with an activity called "Town Detective." Participants were divided into three groups by the targeted towns - Outhumpon, Jumpon, and Kayson - and brainstormed on their knowledge about problems of water uses. They found that Outhumpon uses groundwater mainly for domestic purposes, and has an issue of shallow wells. For Jumpon, the problem is one of competing domestic and agricultural uses in the dry season. Roughly 70 percent of Jumpon's agricultural land is rice paddies. For Kaysone, it is suspected that industry is the main sector impacting water resources.

Then, he gave a lecture on Integrated Water Resources Management in Practice, which highlighted the need to know all the water sources to estimate supply available, then manage the demand accordingly. He explained how to estimate water demand and supply by sectors; domestic, industrial, and agriculture, and assigned homework to estimate water demand and supply.

NEW WATER BALANCE MODEL

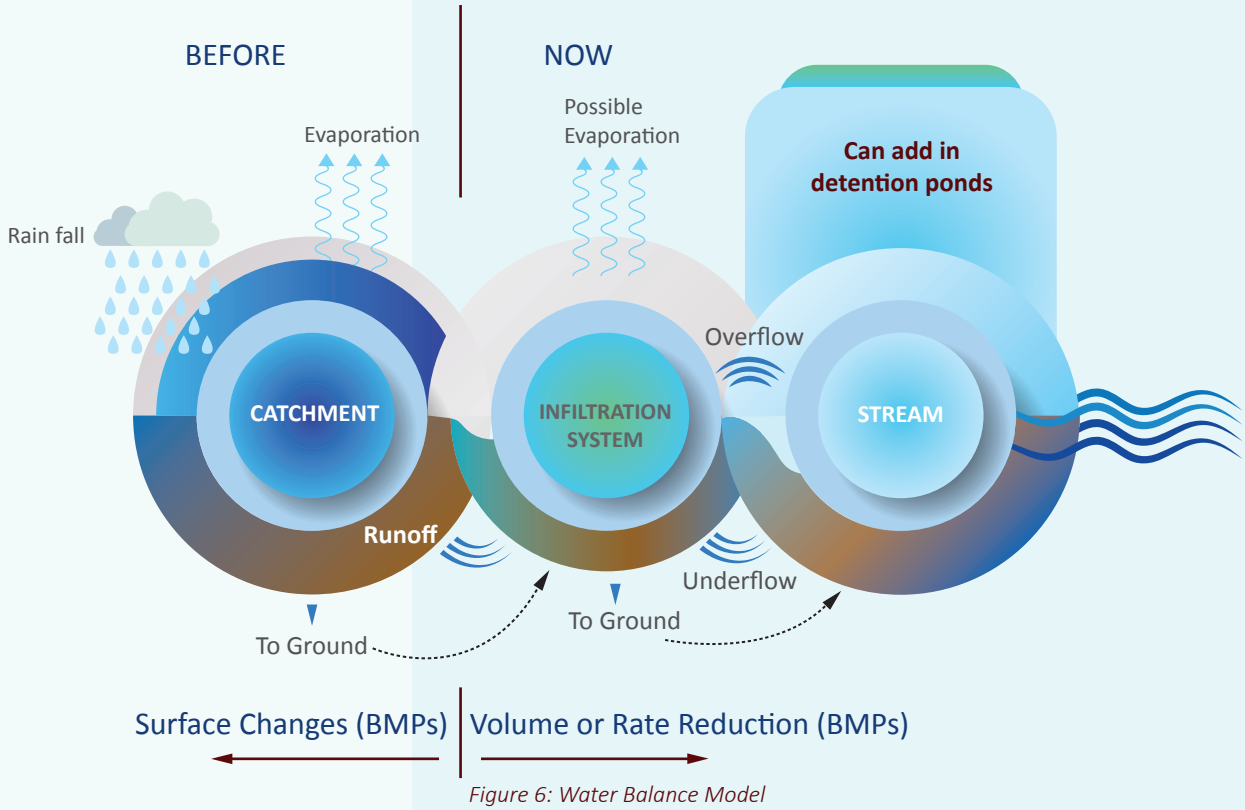

Figure 6: Water Balance Model

Afternoon Session

Topic 2: Introduction to Hydrogeology: Data Collection and Monitoring

Dr Tussanee Nettasana laid a foundation on Introduction to Hydrogeology. By definition, hydrogeology is the study of water (hydro) and earth (geo) interaction.
She explained that Earth materials are composed of rock, sediment (soil), and fluids (water), while geological processes include formation, transformation, and distribution. In order to be able to estimate water resources available, ones needs to understand aquifer types, factors controlling groundwater capacity, safe drawing levels, water flow, water quality, and prevention of contamination.

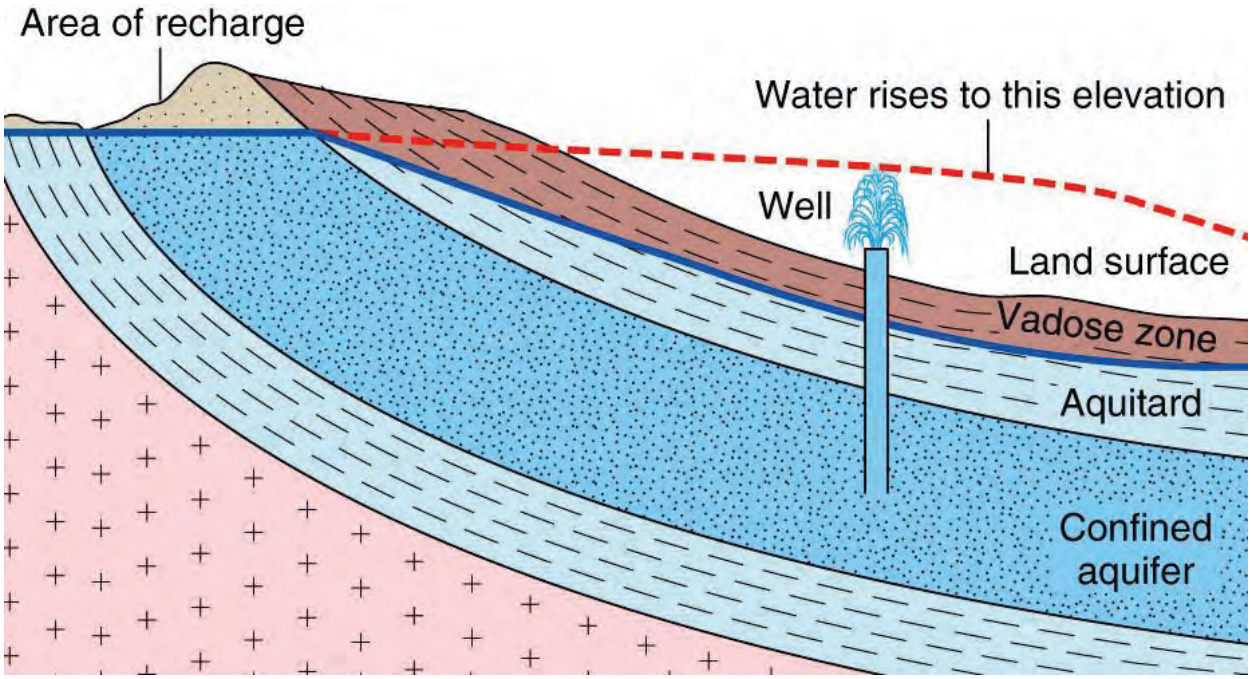

Figure 7: Illustration of recharge area in relation to aquifer and wel

Then, she presented key concepts in Data Collection and Groundwater Monitoring. While groundwater is concealed and relatively inaccessible, it can become visible by means of monitoring. By monitoring water levels, water managers will become aware when there is a decline in the water table and can properly manage the resources. In order to identify aquifers and monitor wells, one needs to compile stratigraphic, geologic, and geomorphic information.

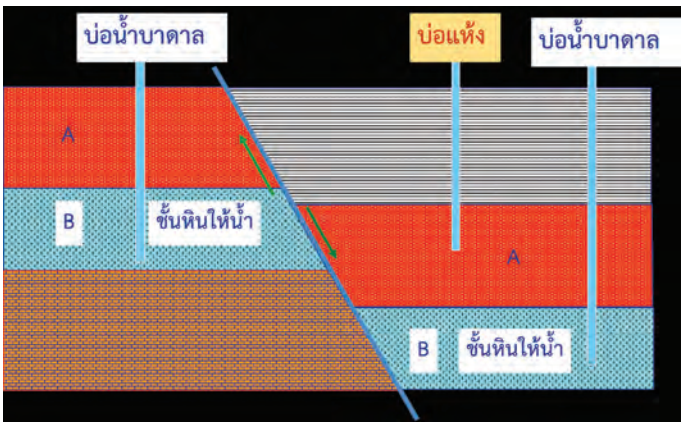

Figure 8: Example of monitoring well

Topic 3: Hydrogeological Exploration and Investigation

Ms Anchalee Pongsatitpat gave a lecture on data requirements to produce hydrogeological maps and their relationship to Hydrogeological Exploration and Investigation. The map making follows UNESCO/IAH/IAHS standards. Elements of a hydrogeological map include topography maps, boreholes of well logs, cross-sections, fence diagrams, block diagrams, and isometric surface diagrams

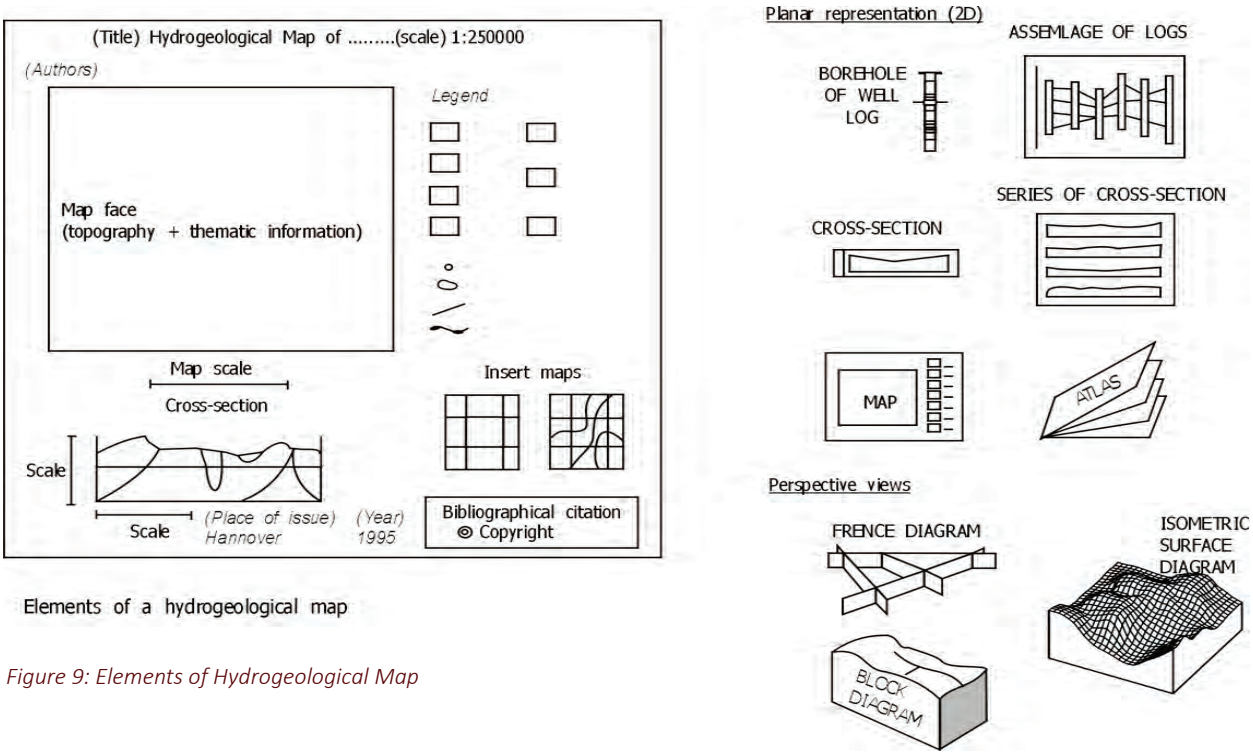

Figure 9: Elements of Hydrogeological Map

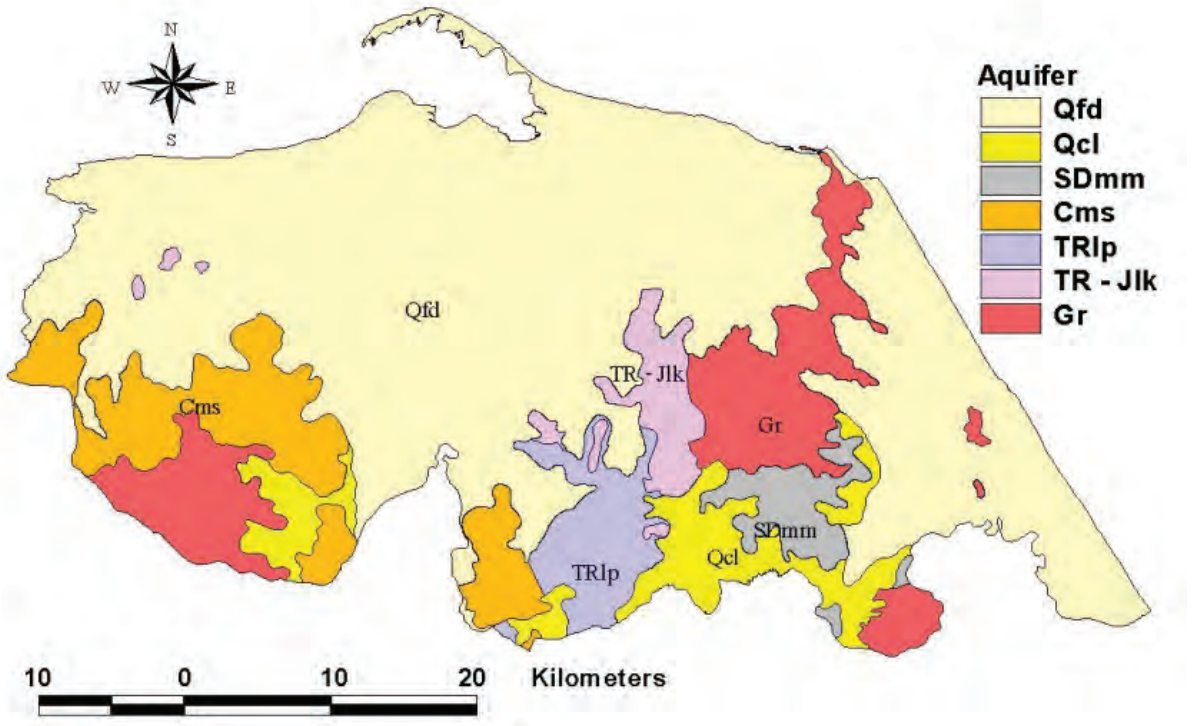

Figure 10: Aquifer Map

2.2 Day 2: Tuesday, July 23, 2019
Morning Session

Topic 4: Hydrological map of Thailand and Lao

Dr Tussanee Nettasana presented a Hydrological Map of North-Eastern Thailand, which shows similar conditions to those of Lao PDR It serves as a case study for Lao to understand groundwater management in the complete context.

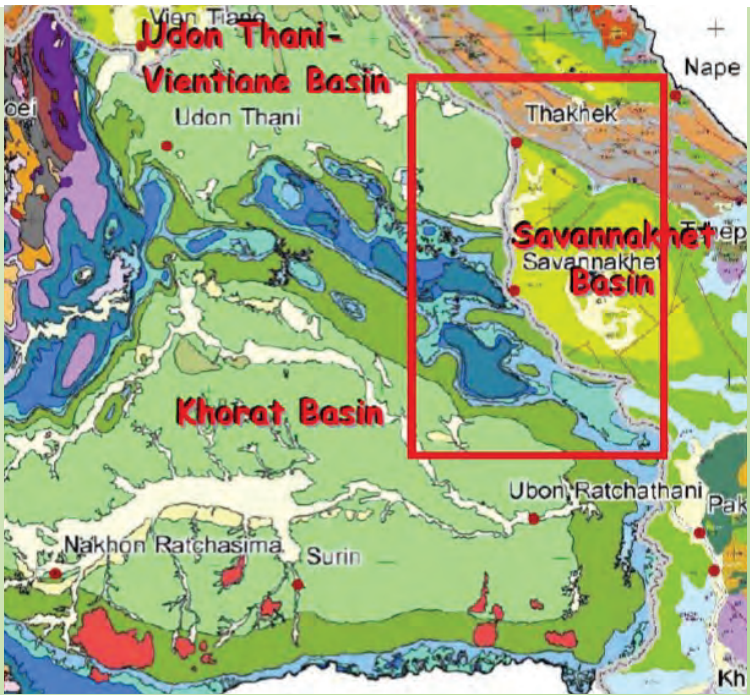

Figure 11: Hydrological Map of North-Eastern Thailand which includes Savannakhet area as well.

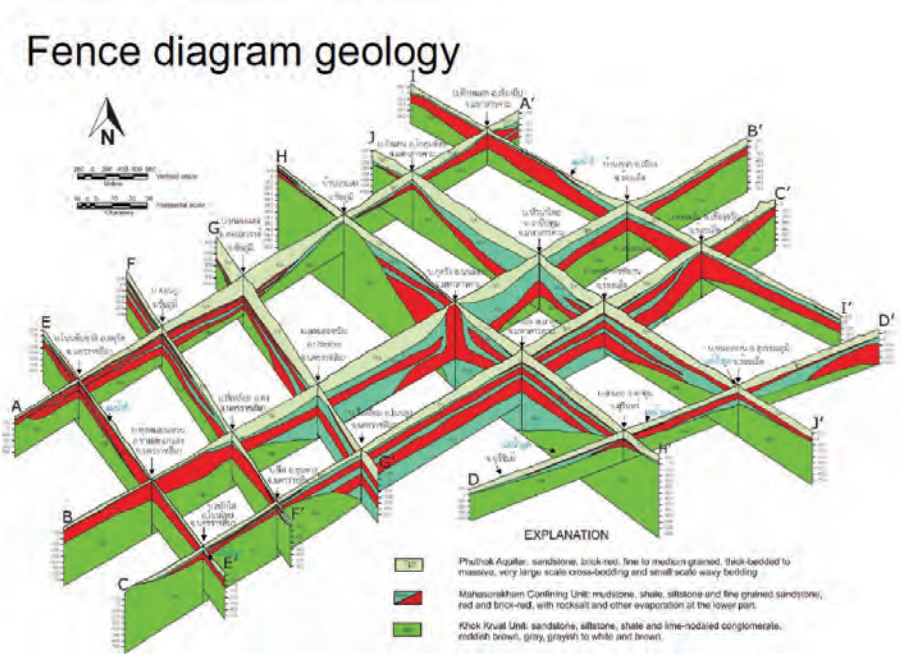

Figure 12: Example of Fence diagram of one of the areas in North-Eastern Thailand.

Topic 5: Surface Geophysical Survey and Mapping with Resistivity Measurement

Mr Patsakorn Assiri explained the connection of topography map with hydrogeological properties. He briefly showed a video of an internal view of a well, where rock layers and well infrastructure were visible. Next, he explained how to interpret data from a graph measured by E-Log equipment to determine the type of soil, type of rock, groundwater level and groundwater quality Then, he showed pictures of a pumping test in the field with related equipment.

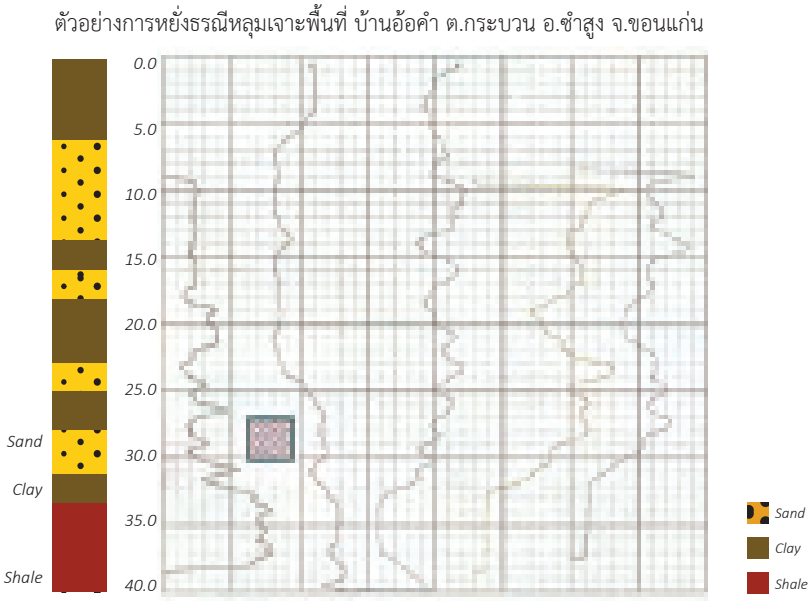

Figure 13: Example of E-log measurement and results interpretation.

Topic 6: Hydraulic Properties Evaluation

Dr Tussanee Nettasana lectured on the theory of Hydraulic Properties Evaluation. A pumping test is used to retrieve hydraulic conductivity (K), transmittivity (T), and storage (S) coefficients, which define the Yield – Drawdown characteristics of each well. Participants were given a calculation exercise on yield, drawdown, and hydraulic conductivity.

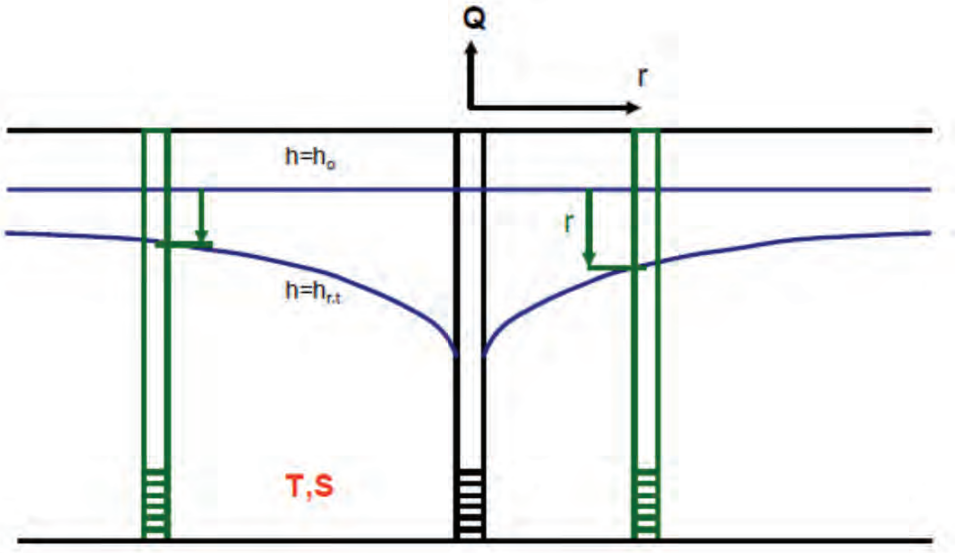

Figure 14: Illustration of radial flow to the well.

Afternoon Session

Dr Surin reviewed lessons from the previous day with quizzes on water balance, hydrogeology, data collection and monitoring, and hydrogeological mapping.

Topic 7: GIS and Database

Ms Anchalee Pongsatitpat presented basic knowledge on GIS and Databases in six main components: (1) software; (2) hardware; (3) procedure; (4) data; (5) user; and (6) network. GIS data are stored in layers, which can be analyzed and presented as a map with geographicalreferences. Thailand DGR has developed HYGIS (Hydrogeological Information System) to gather all data that is necessary for groundwater mapping.

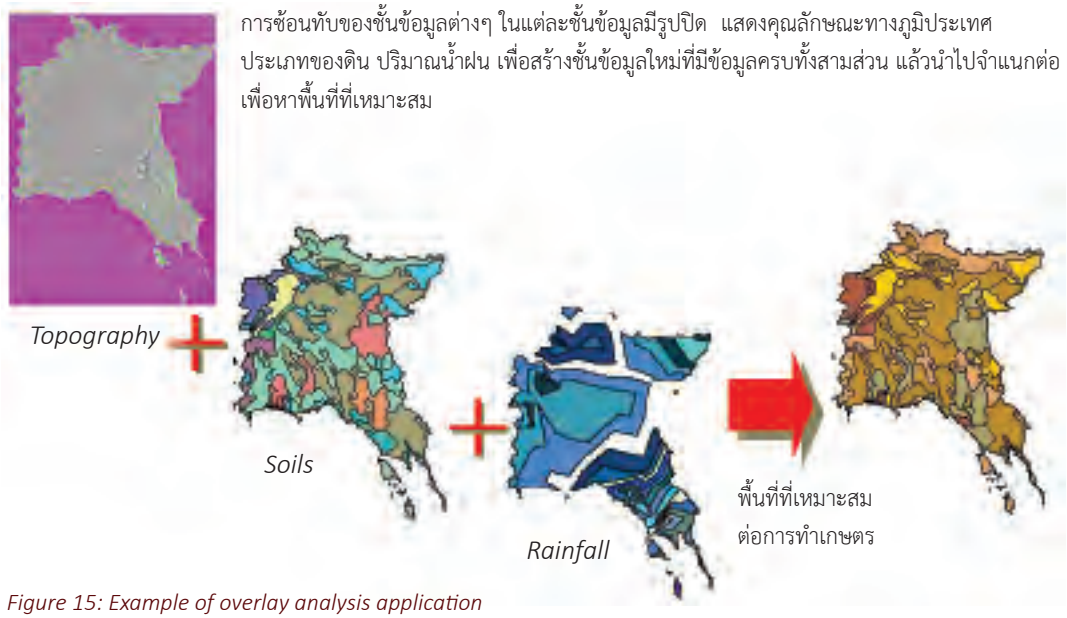

Figure 15: Example of overlay analysis application

Mr Prasert Mhumak reiterated basic knowledge on Geophysical Survey, which participants would use the following day. With Mr Somkiat Kongsuwan, he demonstrated the use of resistivity field equipment to familiarize participants with the equipment.

Figure 16 Participants were familiarized with the resistivity equipment.

At the end of the day, key persons of DWR, NUOL, and trainers had a small group meeting to ensure mutual understanding on the basic data to be collected for the next workshop.

Figure 17: Small group meeting at the end of the second day

2.3 Day 3: Wednesday, July 24, 2019

Topic 8: Hydrogeological Field Work Guideline

Morning Session

Participants visited Natuay Salt Factory in Kayson District, which uses groundwater for salt precipitation either by sun-drying or boiling methods. Participants explored a salt marsh and the operation of a groundwater well. Trainers led the survey with explanations of surface geology, hydrogeology, and well construction. Participants had a chance to practice on-site resistivity and water quality measurement along with basic information collection, including recording of GPS coordinates and elevation.

Figure 18: Sundry pond for salt precipitation.

Figure 19: Boiling stove for salt precipitation.

Figure 20:
Mr Patsakorn Assiri explained the surface geology of the salt factory area to participants.

Figure 21:
Investigating groundwater well at the salt factory, instructed by Ms Anchalee Pongsatitpat &DrTussanee Nettasana

Figure 22:
Practicing resistivity measurement in the salt factory ground, instructed by Mr Somkiat Kongsuwan

Afternoon Session

Participants visited two household groundwater wells in Outhumpon District, where they practiced well depth, water level, and water quality measurement; pumping test and drawdown measurement; and resistivity in the nearby field.

Figure 23: Practicing well depth and water level measurement, instructed by Mr Somkiat Kongsuwan

Figure 25: Practicing resistivity measurement in the household area, instructed by Mr Somkiat Kongsuwan

Figure 24: Practicing water quality measurement.

2.4 Day 4: Thursday July 25, 2019

Morning Session

Dr Surin Worakijthamrong reviewed data and information from field visit in the previous day. Having collected the salt factory's coordinates, the collected data can be integrated by pin-pointing, using online freeware tools such as Google Maps and Google Earth. Through quizzes, he also reviewed participants' retention of basic knowledge on acquiring and interpreting data from the second and the third day lectures.

Figure 26: Dr Surin Worakijthamrong showed how to utilize online tools with the field data

Afternoon Session

Mr Prasert Mhumak and the trainer team led participants in resistivity graph hand-plotting practice. This meant to test trainees' level of understanding before utilizing the usual practice of computer-plotting.

Figure 27: Paticipants practiced resistivity graph plotting by hand with assistance from trainers.

Dr Tussanee Nettasana led an exercise in drawing a hydrogeological cross-section of a given well using features of topography, elevation, well depth, position, and water level. All trainers were involved in facilitating this session.

Figure 28: Participants practiced hydrogeological cross-section drawing by hand with assistance from trainers

2.5 Day 5: July 26, 2019

Morning Session

Dr Surin Worakijthamrong continued instruction in using online tools to convert coordinates from North/East to Lat/Long, then converting Lat/Long to UTM to complement data preparation for GIS. Then, he demonstrated how to integrate all data into water demand - supply calculations from the actual average annual rainfall of Kaysone district using a template that he created, which divided water uses into sectors. Participants practiced calculation using the provided template to learn and understand how to assimilate data into information for planning. Then, each group presented their calculation and summary of demand – supply in each district. The result was discussed and evaluated in terms of water use and management scenarios.

Figure 29: Each group presented results of water demand - supply calculation and dicussed water uses and management scenarios.

Topic 9. Water Quality

Dr Tussanee presented an introduction to groundwater Hydro Chemistry. Chemical constituents in groundwater are from the natural weathering of rocks caused by water, temperature, oxygen, and mild acids that form minerals. Key processes are hydrolysis, oxidation, and dissolution.

A common unit of meq/L is used to present water chemistry. Participants then practiced unit conversion calculation for anion and cation parameters into meq/L from the measurement results.

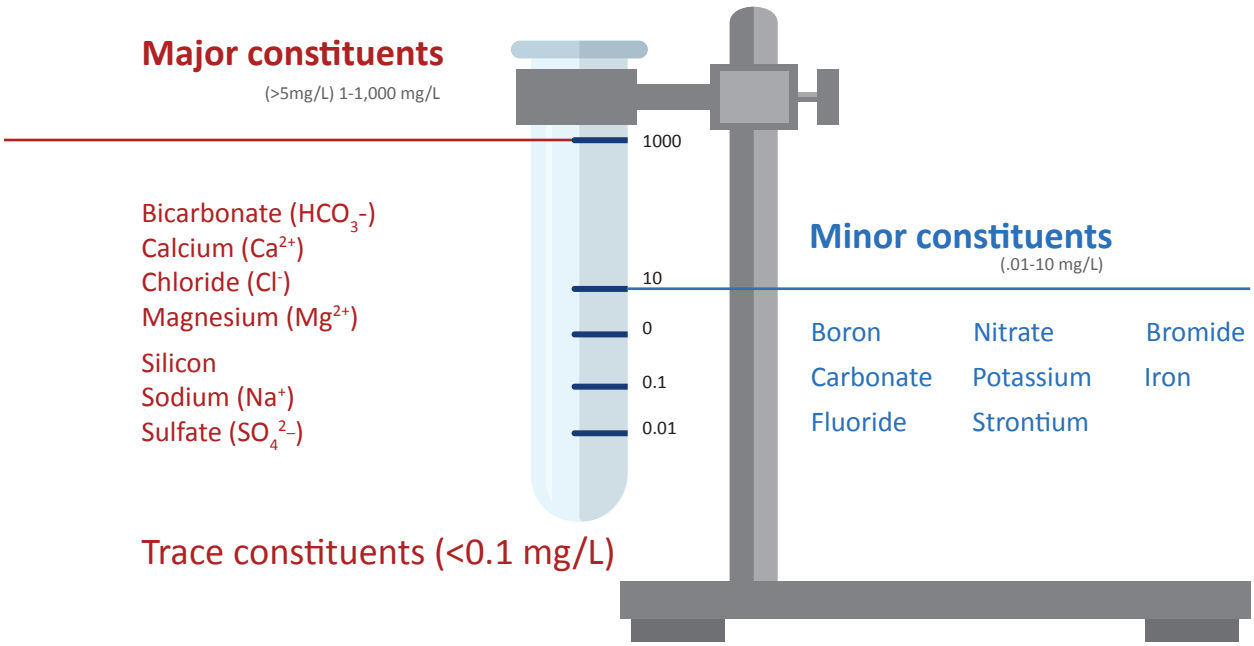

Figure 30: Constituents of groundwater in general.

Figure 31: Participants brainstormed problems and possible solutions for water resource management in each district.

Figure 31: Participants brainstormed problems and possible solutions for water resource management in each district.

Afternoon Session

Participants brainstormed problems and possible solutions for water resource management in each district. Necessary data and information are suggested depending on problems. See Table 1 for details.

Table I: Summary of water demand – supply problems and possible management solutions of three focused districts. (Note that trainers' comments are marked in red.)

Quantity	Quality	Management/Other Issue
Outhumpone Distric		
Domestic Sector: Uses water at 45 – 60 meters. Not enough water in some area. Industrial Sector: Uses water at 60 – 100 meters. Mostly for ice-making factory. Not enough water and supply dries out within 2 – 3 hours, resulting in dry wells. Agricultural Sector: Not much information. Should search for land-use data.	Domestic Sector: Calcium residual and saline in some area. Cannot identify where. Industrial Sector: Saline and wastewater from Reverse Osmosis process (70:30). Needs additional data on initial water quality. May not need to do 70:30.	1. No specific agency in charge of groundwater resource preservation 2. No agency to control ground-water drilling. Only there is the recent law on groundwater.
Jumpone Distric		
Domestic Sector: Uses water at 35 – 40 meters. Some use surface water. Needs more information on where the boundary is. Industrial Sector: Not much. Mostly agriculture area. Agricultural Sector: Rice grow-ing in 2 seasons a year. Uses water from reservoir in dry season. Needs additional information on water release from reservoir.	1. Concerns on agricultural water uses that may have issues in the future. Some questions on salt mining whether there are lining installed. 2. Shallow well issue and high turbidity. Some questions on either shallow well no sealing around the well that caused the issue. 3. Calcium precipitate around the well in some household. Needs additional information on Hydrogeology, rock and soil layers, cross section, and groundwater map.	1. Lack of expert in this area. Need to identify what position and how many. 2. No clear policy on groundwa-ter resources preservation. Needs to research on the current groundwater law. 3. Lack of drilling equipment. Needs to identify what for, development of survey. 4. Lack of budget. Needs to identify area of concerns which should be in line with national strategies.
Keystone Distric		
Domestic Sector: Increasing population, increasing water demand. Needs to evaluate water demand – supply of the current population, then project for the future. April and May have water shortage but not sure of the causes, dry aquifer or effects from big industry. Industrial Sector: The big industry uses 100 – 200 meters. Needs information on water uses by industry types and in the industrial estates.	Domestic Sector: May have contamination from industry. There are researches on BOD, COD, Fe contamination from industry. Should retrieved the research paper. Have acidic water issue. Need to research for causes.	1. DONRE which is the local agency disseminates rules and policy to the public both hardcopy and via online. 2. Basic data collection has not been completed. Needs format. 3. Lack of expert. Mostly graduated in accounting, public administration, and agriculture. What position and how many is needed. 4. Lack of budget. Needs to identify area of concerns which should be in line with national strategies.

ANNEX I: TRAINING PROGRAM AGENDA

Day 1	Subject	Trainer/Facilitator
08:00 – 08:15	Registration	Pact Thailand
08:15 – 08:30	Objectives and Introduce Participants	Lao DWR
08:30 – 08:45	Opening Remark	Mr Noukhane Inthapanya, DDG of PONRE
08:45 – 09:00	Comment and Message for the Training	Mr Kingkham Manivong, DDG of DWR
09.00 – 10:30	Integrated Water Resources and Management(IWRM) in Practice - Concept of IWRM - One Water - Water Use and Water Allocation in Practice	Dr Surin Worakijthamrong
10:30 – 10:45	Tea/Coffee Break	
10:45 – 12:00	Integrated Water Resources and Management (IWRM) in Practice (continue)	Dr Surin Worakijthamrong
12:00 – 13:00	- Water Use and Water Allocation in Practice	Dr Tussanee Nettasana
13.00 – 14.30	Lunch	
14:30 – 14:45	Introduction to Hydrogeology: Data collection and Monitoring	Ms Anchalee Pongsatitpat
14.45 – 16.00	Tea/Coffee Break	
16.45 – 17.30	Hydrogeological Exploration and Investigation Surface Geophysical Survey and Mapping (Resistivity)	Mr Prasert Mhumak
Day 2		
08:30 – 10:30	Hydrogeology of Thailand and Laos	Dr Tussanee Nettasana
10:30 – 10:45	Tea/Coffee Break	
10:45 – 12.00	Hydraulic properties Evaluation	Mr Pasakorn/ DrTussanee
12:00 – 13:00	Lunch	
13:30 – 14:30	GIS and database	Ms Anchalee
14:30 – 14:45	Tea/Coffee Break	
14:45 – 15:45	Hydrogeological field work guideline	Mr Pasakorn
15:45 – 17:00	Practice on Resistivity Survey	Mr Prasert
Day 3		
08:30 – 12:00	Hydrogeological Field work - Water Level Measurement - Water Quality Sampling - Well Inventories	Thai DGR Team
12:00 – 13:00	Lunch	
13:00 – 16:00	Hydrogeological Field work (continue) - interview on water uses - resistivity survey	Thai DGR Team

ANNEX I: TRAINING PROGRAM AGENDA

Day 4	Subject	Trainer/Facilitator
08:30 – 10:30	Data Analysis and Interpretation - Mapping and Cross Section	Dr Tussanee Nettasana
10:30 – 10:45	Tea/Coffee Break	
10:45 – 12:00	Data Analysis and Interpretation (continue) - Mapping and Cross Section	Dr Tussanee Nettasana
12:00 – 13:00	Lunch	
13.00 – 14:30	Data Analysis and Interpretation (continue) - Water Use Estimation - Monitoring Design	Dr Surin Worakijthamrong
14:30 – 14:45	Tea/Coffee Break	
14:45 - 17:00	Data Analysis and Interpretation (continue) - Water Quality Interpretation Reporting	Dr Tussanee Nettasana
Day 5		
08:30 – 10:30	Preliminary Result Presentation	Dr Tussanee Nettasana
10:30 – 10:45	Tea/Coffee Break	Dr Tussanee Nettasana
10:45 – 12:00	Preliminary Result Presentation (continue)	Thai DGR Team
12:00 – 13:00	Lunch	
13:30 – 14:30	Action Plan for Next Step	Pact Thailand
14:30 – 14:45	Tea/Coffee Break	
14:45 – 16:30	Certificates Ceremony	
16:30 – 17:00	Closing Remark	Mr Noukhane Inthapanya, DDG of PONRE
18:00 – 20:00	Farewell Dinner	

ANNEX II: LIST OF PARTICIPANTS, RESOURCE PERSONS, AND STAFF MEMBERS

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ANNEX II: LIST OF PARTICIPANTS, RESOURCE PERSONS, AND STAFF MEMBERS

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ANNEX III: POST-TRAINING ASSESSMENT AND FEEDBACK FORM

FEEDBACK FORM

INTRODUCTION TO GROUNDWATER MANAGEMENT TRAINING

UNDER DEVELOPMENT OF LAO NATIONAL GROUNDWATER CAPACITY BUILDING PROGRAM

JULY 22 - 26, 2019, IN SAVANNAKHET, LAO PDR

Please complete this form to help us plan and improve our future activities.

Name (optional)..... **Country**..... **Gender:** □ Female □ Male

I work for □ Government Agencies □ Academic Institutions □ NGOs/INGOs □ Private sector □ Other_____

	Not at All	Slightly	Moderately	Highly
1) **How well was the training objective stated below met in overall?** • To build basic understanding on Introduction to Groundwater Management for Lao trainees, focusing on Hydrological and Mapping particularly Hydrological Field Work.	□	□	□	□

	Not Improved	Slightly Improved	Moderately Improved	Highly Improved
Rate your knowledge and skills in the following topics AFTER participating in the training				
2) Understanding Integrated Water Resources and Management (IWRM) in practice	□	□	□	□
3) Understanding Introduction to Hydrogeology: Data Collection and Monitoring	□	□	□	□
4) Understanding Surface Geophysical Survey and mapping (Resistivity)	□	□	□	□
5) Understanding Hydrological of Thailand and Laos	□	□	□	□
6) Understanding Hydraulic properties Evaluation	□	□	□	□
7) Understanding GIS and database	□	□	□	□
8) Understanding Hydrogeological filed work guideline	□	□	□	□
9) Practice on resistivity	□	□	□	□
10) Data analysis and interpretation	□	□	□	□
11) Gained knowledge from group exercise	□	□	□	□
12) Gained knowledge from field work	□	□	□	□

	None	Low	Medium	High
13) Rate your <u>OVERALL</u> knowledge and skills in the topics **<u>BEFORE</u>** participating in the training	□	□	□	□
14) Rate your <u>OVERALL</u> knowledge and skills in the topics **<u>AFTER</u>** participating in the training	□	□	□	□
	Not at All	**Slightly**	**Moderately**	**Highly**
15) To what extent will your participation in this training help advance your work?	□	□	□	□
	Poor	**Fair**	**Good**	**Excellent**
16) Logistical arrangement quality of the training	□	□	□	□

ANNEX III: POST-TRAINING ASSESSMENT AND FEEDBACK FORM

Written comments to organizers:

17) What are you impressed ***the most*** in this training?
18) What are you impressed ***the least*** in this training?
19) After participating the training, can you apply knowledge and skill for your actual work? ☐ Yes (please explain) ☐ No, why not
20) What ***recommendations*** **or suggestions** would you like to make for future events?
21) Do you have any questions to any trainers and/or organizer team? **(optional)**

Thank you very much for your time in completing this feedback form.

ANNEX IV: LIST OF TRAINING MATERIAL DOCUMENTS

Dr Surin Worakijthamrong

Document no.		Type
1	Integrated Water Resources Management in Practice Presentation	Spreadsheet
	Water Demand – Supply Calculation Template	Spreadsheet
	Average Annual Rainfall of Lao PDR	Map

Dr Tussanee Nettasana

Document no.		Type
2.1	Introduction to Hydrogeology	Presentation
2.2	Data Collection and Groundwater Monitoring	Presentation
	Cooper-Jacob Form	Spreadsheet
	Transmittivity Calculation Exercise	Practice Sheet
4	Hydrogeological Map of Northeastern Thailand	Presentation
6	Hydraulic Properties Evaluation	Presentation
10	Groundwater Assessment	Presentation
11	Hydro Chemistry	Presentation
	DMR Analysis	Spreadsheet

Ms Anchalee Pongsatitpat

Document no.		Type
3	Hydrogeology Investigation	Presentation
7	GIS and Database	Presentation
	Data Check List	Spreadsheet

Mr Prasert Mhumak

Document no.		Type
5	Geophysical Survey	Presentation
	Surface Geophysical Survey Form	Practice Sheet

Mr Patsakorn Assiri

Document no.		Type
	Lao Topography Map	GIS files
	Topography and Rock Layers	Presentation
8	E-log	Presentation
9	Pumping in Field	Presentation

SUSTAINABLE INFRASTRUCTURE PARTNERSHIP

LOWER MEKONG INITIATIVE (LMI)

SUSTAINABLE INFRASTRUCTURE PARTNERSHIP (SIP)

SUSTAINABLE INFRASTRUCTURE PARTNERSHIP

pact building local promise.

For more information and contactdetails, please visit:

SIP Program facebook page: www.facebook.com/LowerMekongInitativeSIP

Mekong Water Data Olatform: www.MekongWater.org