

Assessment of Groundwater Resources to Support Sustainable Development of Khat Ngong Village, Champasak Province, Southern Laos

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INTRODUCTION

Groundwater Resources are absolutely vital for communities in Southern Laos as the sole source of Rural Water Supplies. There is a little knowledge regarding the extent, accessibility and Sustainability of groundwater resources in Laos. Therefore, this study was conceived and conducted to better understand the groundwater resources of Khat Ngong Village, Champasak Province, Laos.

OBJECTIVE

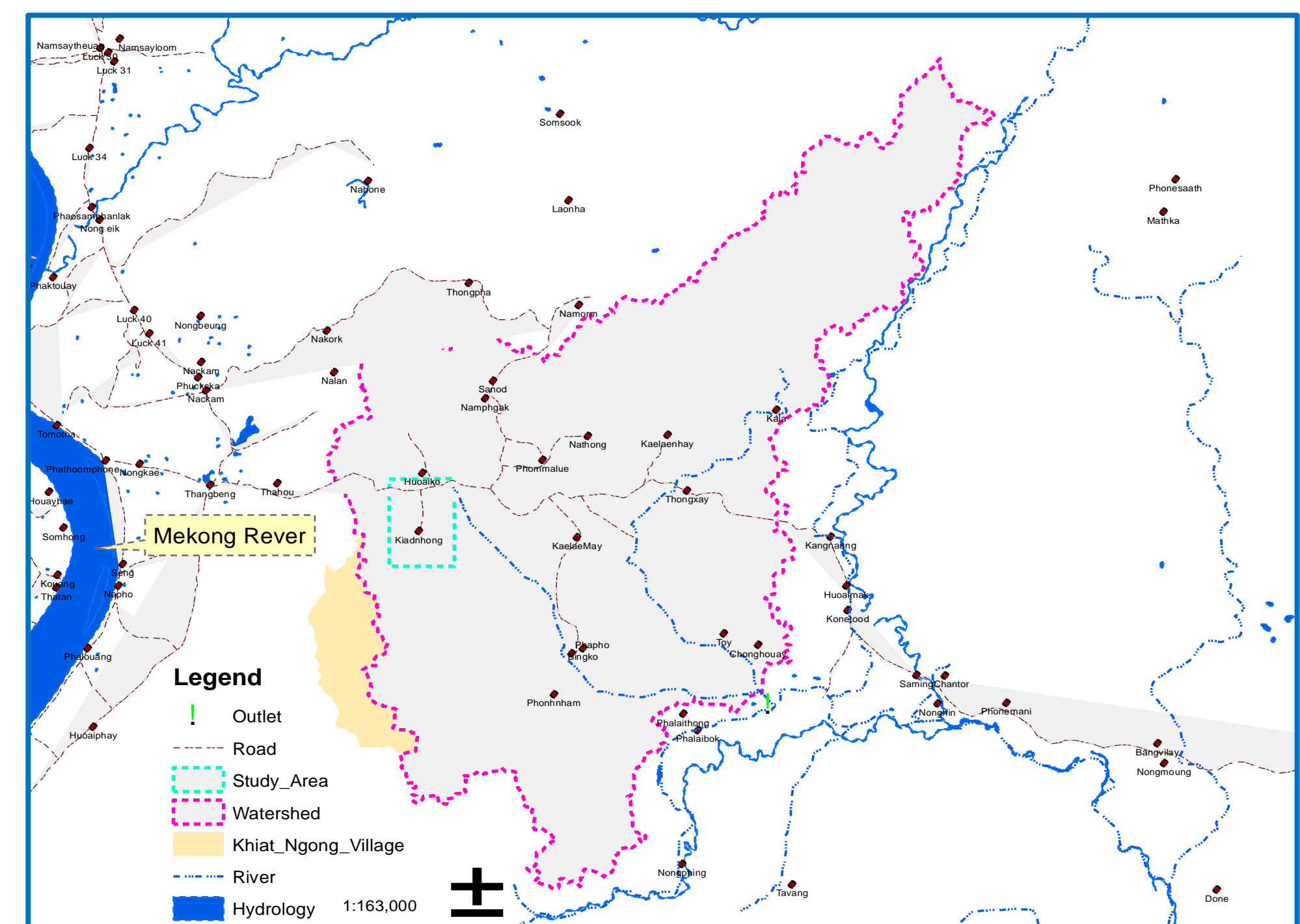
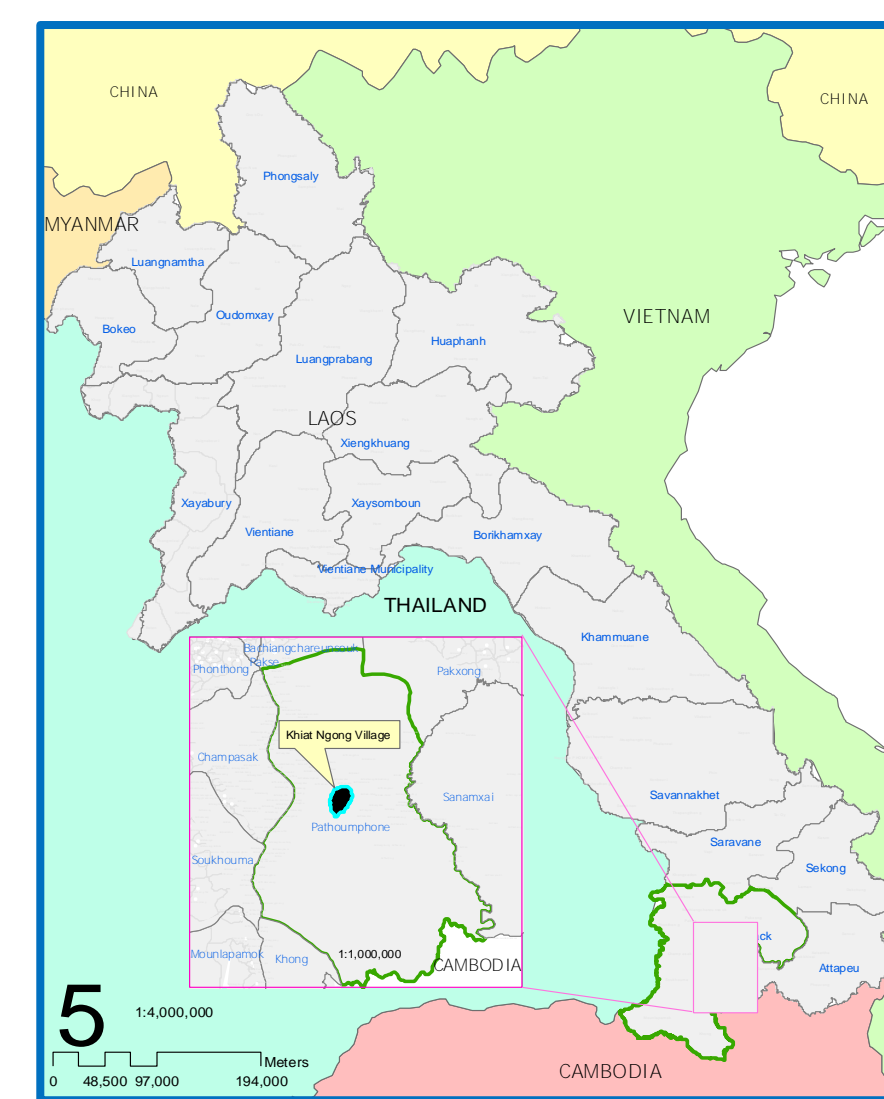
- Evaluate the groundwater resources at a Village Scale;
- Measure the Groundwater Quality and how it affects Domestic Supplies
- Estimate the Groundwater Balance for the village (i.e. Recharge, Discharge, and Lateral Flow).

METHODOLOGY

- Review of the literature and available data.
- Conduct fieldwork on 3 occasions between September 2014 and May 2015 involving: drilling of 4 new boreholes; aquifer pump testing (K, T); groundwater levels and flow direction; groundwater use; groundwater and rainwater quality analysis.

SITE DESCRIPTION

Khat Ngong village (population 1123) is situated on the lowland plains of Southern Laos. The source of livelihoods include farming and other small enterprises (tourism, trade etc). The village is remote from major rivers and so relies upon groundwater for domestic supplies. The local groundwater is fresh but unfortunately, affected by arsenic concentrations in some areas.



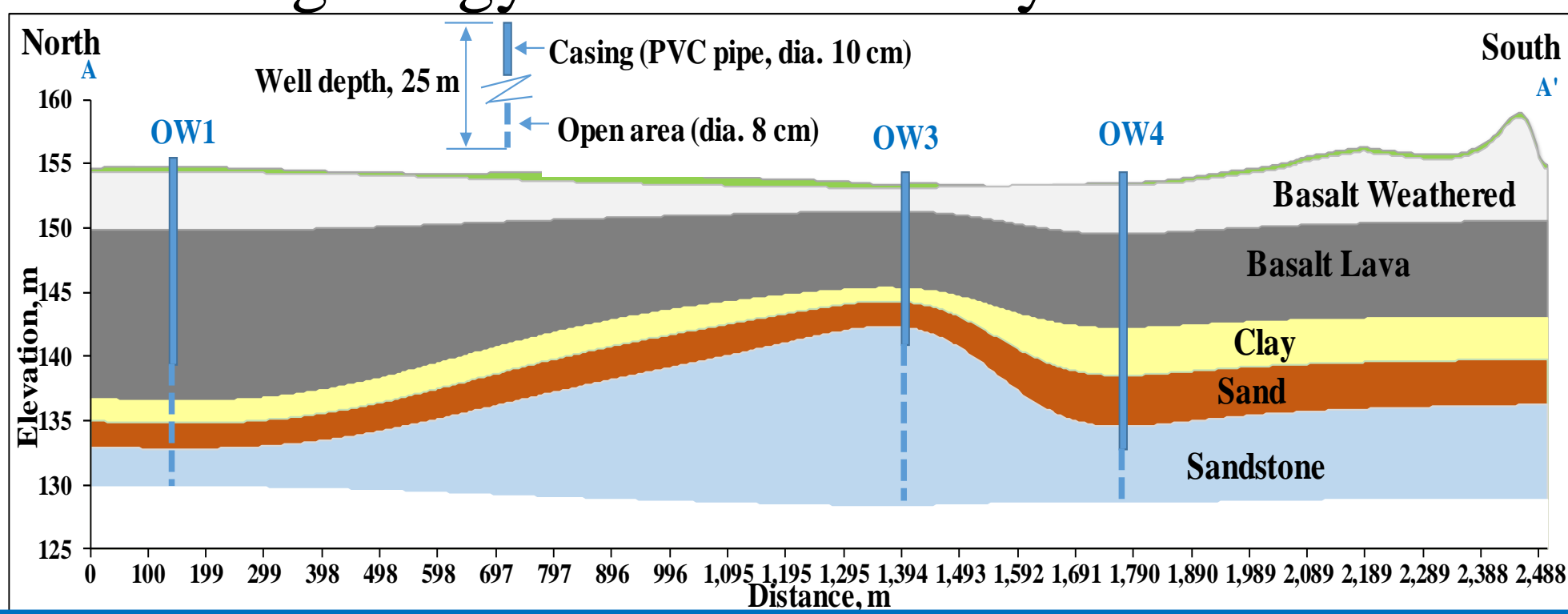
RESULTS AND DISCUSSION

GEOLOGICAL SETTING

Core samples of drilled wells show this sequence:

- Basalt weathered, 3 – 5 m thick
- Basalt lava, 8 – 19 m
- Clay, 1 – 4 m
- Sand (weather sandstone), 2 – 4 m.
- Sandstone, 3 – 14 m

Surface geology over entire study area is basaltic

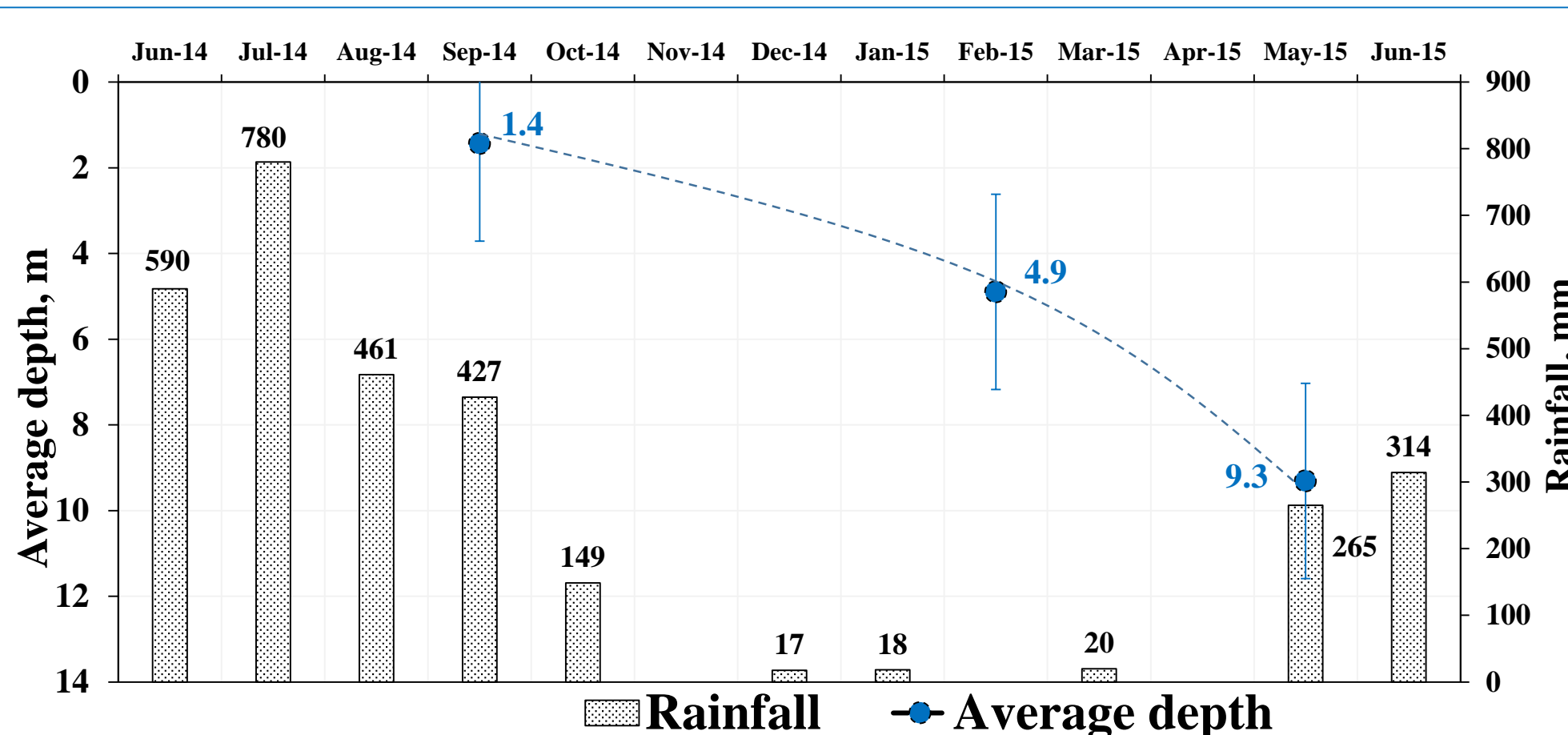


HYDRAULIC PROPERTIES OF AQUIFER

- Most wells in the village are completed to unknown depths and layers, thus making assessment difficult
- Pump testing of wells drilled for the study showed that Sandstone has $K = 0.1$ m/day and $T = 3.4$ m²/day.

GROUNDWATER LEVEL TRENDS

- Average groundwater levels varied from a low of 1.4 m (Sept. 2014) to 9.3 m (May 2015)
- The decline of groundwater level is attributed to limited rainfall due the extended dry season (November to April)

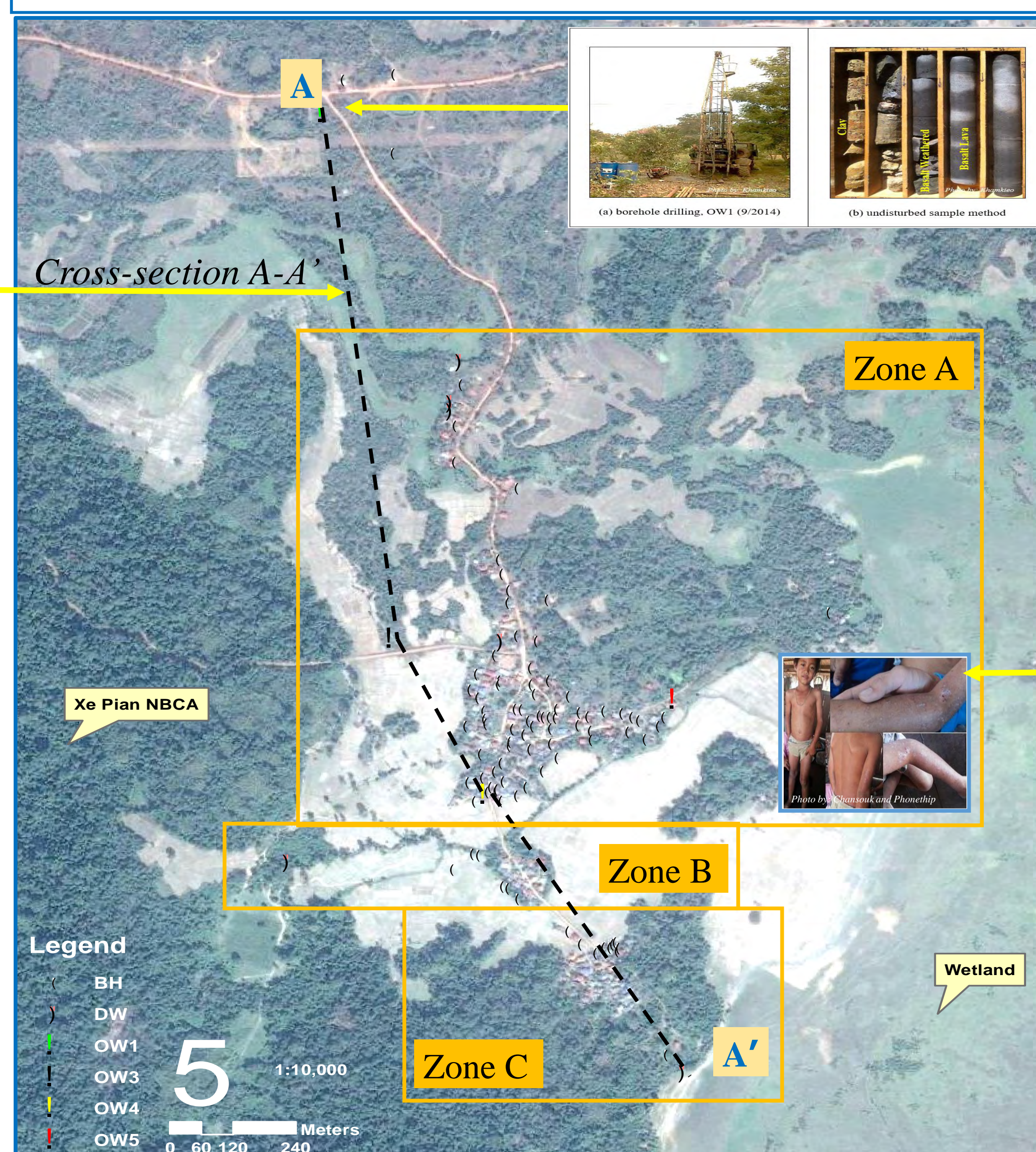


GROUNDWATER FLOWS

Groundwater flow pattern is highly seasonal in terms of both gradients and directions:

- wet season: mounding under the village up to 0.4 m below ground surface
- dry season: cone of depression under the village down to 15.6 m below ground surface

The satellite image illustrated the natural environment and location of borehole well inside Khat Ngong village



GROUNDWATER USE

A survey of 63 households reveals that:

- All surveyed households rely only on boreholes and dug wells for water supply
- Groundwater use for domestic supply is 19 L/capita/day, at village it represents 7,788 m³/yr
- Minimal use of the groundwater for irrigation crops at the garden scale
- Most households do not have sufficient quantities of water in the latter part of the dry season

PRELIMINARY WATER BALANCE

- Recharge is estimated by Chloride Mass Balance at 753 mm/yr (~30% of rainfall) or 1.8×10^6 m³/yr for the entire village area
- The total volume of discharge is 11.4×10^6 m³/yr which includes domestic water use, agriculture abstraction and lateral subsurface outflows (lateral subsurface inflows are 1.81×10^6 m³/yr)
- The ratio of groundwater outputs to groundwater inputs in the village is 55%

GROUNDWATER QUALITY

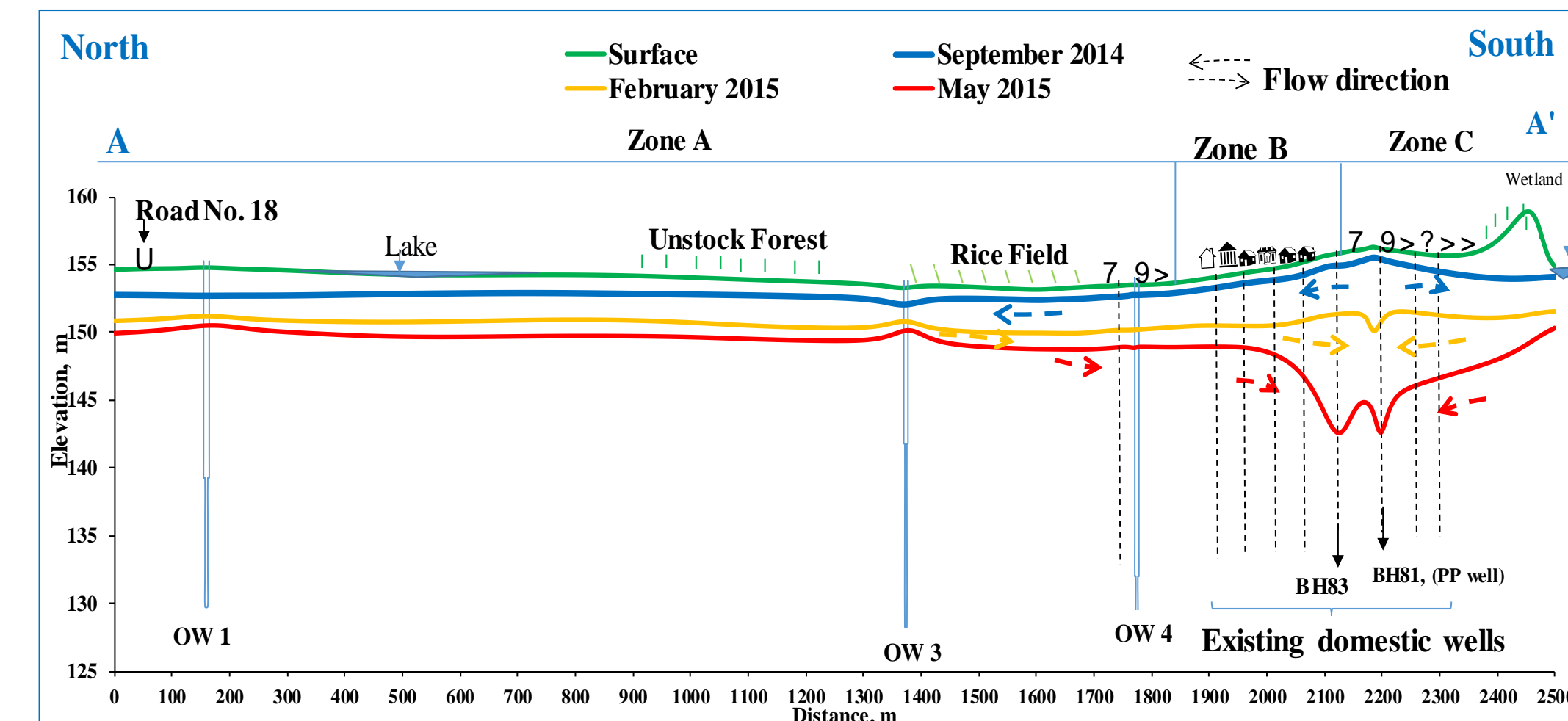
- 2 out of 6 wells sampled in the village have arsenic concentrations which exceed national standard (0.05 mg/L)
- Field observations reveal skin disease which is probably linked to domestic water use

CONCLUSIONS

- Drilling and core sampling reveal a two layer aquifer systems comprised of basalt overlaying sandstone
- Groundwater flow patterns are highly seasonal
- Recharge is estimated to be high in absolute terms and as percentage of rainfall
- Limited sampling confirms risks arsenic contamination and possible human health impacts for the community

OUTLOOK

- The study area will be expanded to include the adjacent wetland within a watershed context
- This watershed approach will more clearly identify key groundwater flow patterns and chemical trends in the area
- The study ultimately seeks to promote sustainable management of the aquifer accounting for the needs of the community and the environment



ACKNOWLEDGEMENTS

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