

AN ANALYSIS OF GROUNDWATER CONDITION IN A SALINE AREA: A CASE STUDY GROUNDWATER LEVEL, NAKHON PANOM PROVINCE, 2009-2011

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ABSTRACT

The lower Namkam river basin area in Nakhon Phanom province with area of 1100 km² have problems for agriculture, because of lack of water in dry season and salinity problem in groundwater. The author observes shallow groundwater levels in 6 points in this area from 2006 by using automatically groundwater level observation systems. This research is analysis of groundwater level (GWL) change and groundwater flow using the data by automatically observation systems in the lower NamKam river basin. From data analysis, groundwater level in shallow aquifer is increased and then farmer can use shallow groundwater for irrigation. This rising up of shallow groundwater level is caused by the NamKam Dam operation.

INTRODUCTION

The study area is the Lower NamKam River Basin. The NamKam Dam is constructed from 2005 and built up July, 2009 [1-6]. And then, there is a big pond by keeping water in the NamKam Dam. In this research project, the author observe groundwater level (GWL) change in the Lower Nam Kam area to know influence to GWL by infiltration through pond by the NamKam Dam.

The observation sight of GWL is 10 points, 4 points are for deep groundwater and 6-points are for shallow groundwater. Interval of these groundwater observations are 1 hour's. Using these data, we can make GWL distribution map and can estimate tendency of groundwater flow direction. We can use these map to groundwater modeling and a reference in developing the groundwater basin in the lower Namkam basin. If groundwater behavior becomes clear, the result of this study is support to water management in future.

STUDY AREA

The NamKam River Basin is a subset of the Middle Mekong Basin with the province of Sakon Nakhon and Nakhon Phanom which areas are located in the Northeast of Thailand. The basin is shown in Fig. 1 and the study area is a square range in Fig 1

This basin belongs to the tropical monsoon. The average annual rainfall is between 1500 to 2000 mm. And rainy season is during April to September. Due to the lack of rain in the dry season, this area has water shortages. The average annual temperature is 31.1 °C, and highest monthly average temperature is about 33.4 °C in April, and the lowest temperature is 14.4 °C in June. Amount of annual pan

evaporation is about 1740 mm, which is quantity to be past annual precipitation in 16%.

Peak runoff occurs in September with about 393.7MCM and the lowest occurs in February with 9.93MCM. Then groundwater use in this area is limited in dry season. Only shallow groundwater can be consumed. Because the concentration of chemical substance is high, deep groundwater is not usable [7].

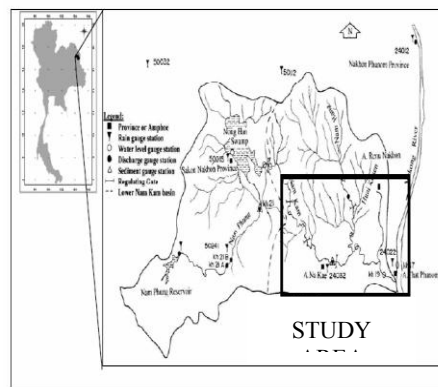


Fig. 1 study area Lower Nam Kam River Basin

DATA COLLECTION

The groundwater levels (GWL) in boundary now have 5 observations well. The station DM6, NK2, NK3, NK8 and NKOW14 are location in shallow aquifer (less than 50 or 60m from ground surface). The electric conductivities (EC) station is 3 sight; i.e. DM6, NK3 and NKOW14 as shown in fig. 2. Deep GWL observation sights (DM1, DM2, DM4 and DM8) are stopped in July, 2009. Because Deep ground water levels are not so changed.

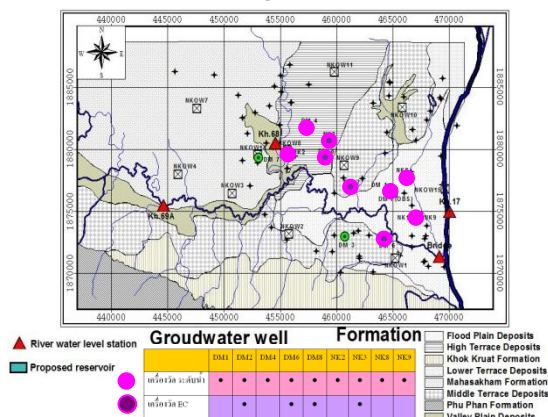


Fig. 2 The locations of groundwater electric conductivities

DATA ANALYSIS OF GROUNDWATER,

Groundwater Level Observation Results

Fig.-3 shows the daily GWL change during 2005-2011. In the first period (2005-2006), GWL observation sight is only 3 (DM1, DM2 and DM8). In 2006, we set 5 sights of GWL observation points (DM4, DM6, NK2, NK8 and NK9). And NKOW14 is set on 2010. From Fig.-3, we can understand that deep GWLs are almost same level, but shallow GWLs change have yearly interval. Peak of GWL in shallow groundwater is September to October and bottom of groundwater level is May. This means that shallow GWL is recharged by rainfall, because the period of GWL rise is rainy season (May to Sep.).

In the next, we see shallow GWL change in each observation sights.

1) DM6

Fig. 4 shows the GWL change at station DM6. Fig. 5 show the monthly change of GWL at station DM6 in April, May, Jun and July of 2010, 2011, respectively. We will think GWL change

during 2010-2011. From Fig. 4, GWL at DM6 is rise up from 2009. It is seems that GWL rise is caused by the NamKam Dam.

In April 2010 and 2011 (Fig. 5), GWL is down continuously as shown in Fig. 5, because of dry season. And we can understand that GWL have daily change. This is means that farmer pump up groundwater from shallow aquifer.

In May 2010 and 2011 (Fig. 5), GWL decrease in first decade, but GWL rise up after 5 to 7, May. This means that rainy season start in these days. Daily change of GWL is stop during rainy season. This means that farmer needs not so much groundwater without drinking water in rainy season. In Jun and July, tendency of GWL change is almost same to May as shown in Fig. 5.

2) NK2

Fig. 6 shows the GWL change at station NK2. Fig. 7 show the monthly change of GWL at station NK2 in April, May, Jun and July of 2010, 2011, respectively. We will think GWL change during 2010-2011. From Fig. 6, GWL change in NK2 is almost same level. This is depending on the location of GWL observation sight.

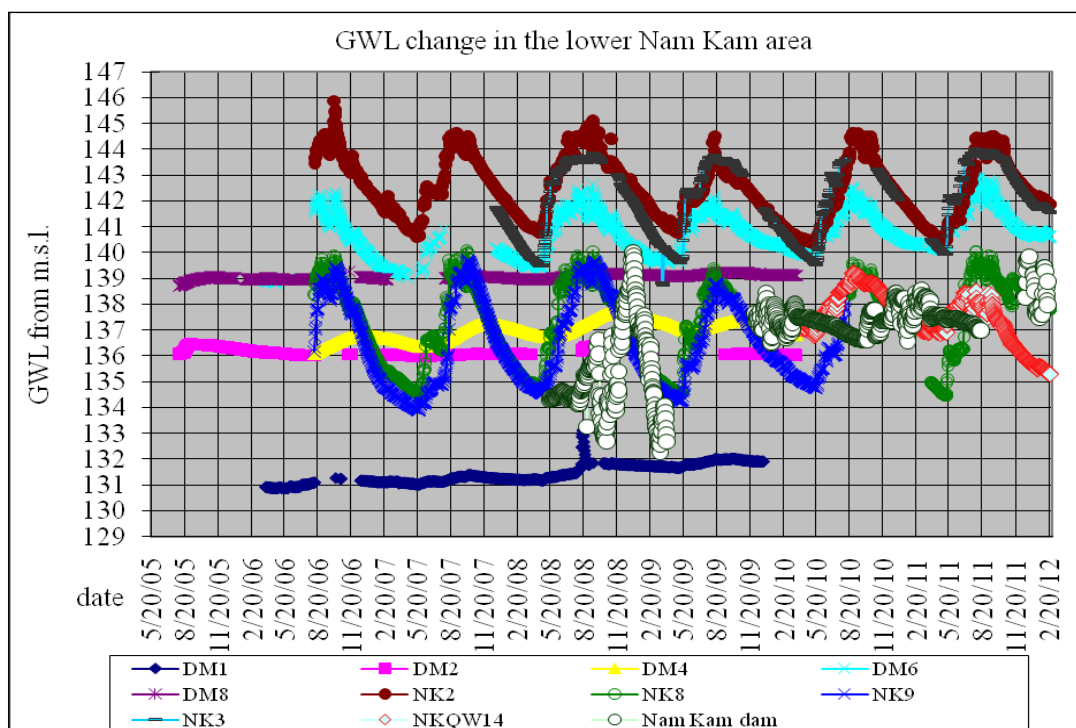


Fig. 3 Groundwater level change from 2005 to 2012

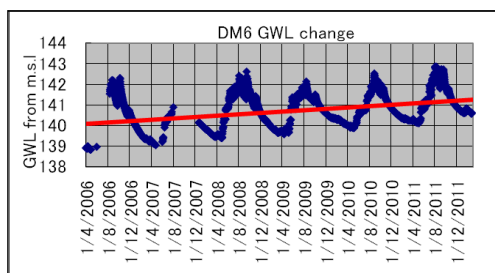


Fig. 4 Groundwater level change at station DM6

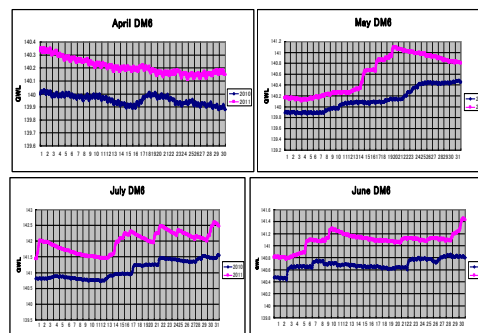


Fig.5 Groundwater level monthly data at station DM6

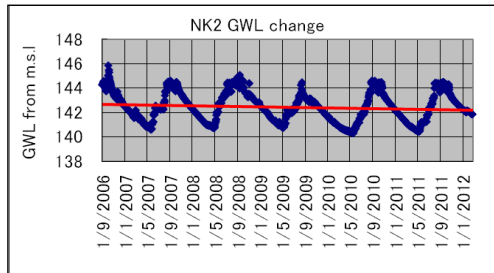


Fig. 6 Groundwater level change station NK2

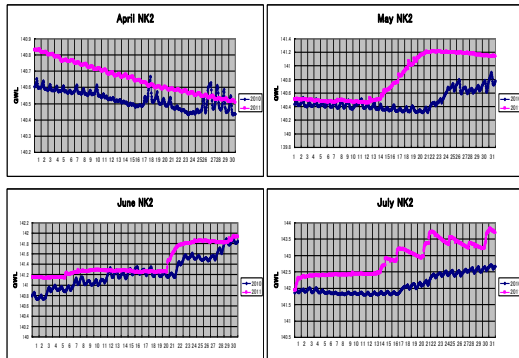


Fig. 7 groundwater level monthly data at station NK

In April 2010 and 2011 (Fig. 7), GWL is down continuously as shown in Fig. 7, because of dry season. And we can understand that GWL have daily change. Particularly, GWL change is hardly up and down. This is means that farmer pump up groundwater from shallow aquifer for irrigation use.

In May 2010 and 2011 (Fig. 7), GWL decrease until second decade, but GWL rise up after 12 to 20, May. This means that rainy season start in these days. Daily change of GWL is not so high during rainy season. This means that farmer needs not so much groundwater without drinking water in rainy season. In Jun and July, tendency of GWL change is almost same to May as shown in Fig. 7.

3) NK3

Fig. 8 shows the GWL change at station DM6. Fig. 9 show the monthly change of GWL at station NK3 in April, May, Jun and July of 2010, 2011, respectively. We will think GWL change during 2010-2011. From Fig. 8, GWL at NK3 is little rise up from 2009. It is seems that GWL rise is caused by the NamKam Dam. In Fig. 8, the shape of GWL change in top is flat. The ground height of this point is 143.6m from mean sea level, so groundwater spring out from well. And then GWL is flat in top level.

In April 2010 and 2011 (Fig. 9), GWL change shows up and down as shown in Fig. 9, because of rainfall. And we can understand that GWL have not so much daily change. This is depending on the location of GWL observation sight.

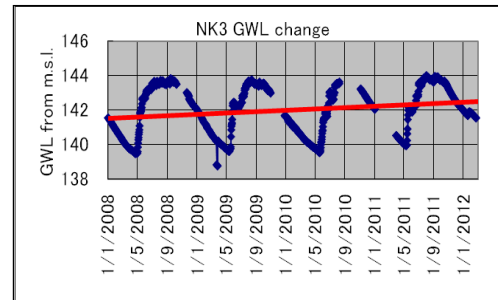


Fig. 8 Groundwater level change at station NK3

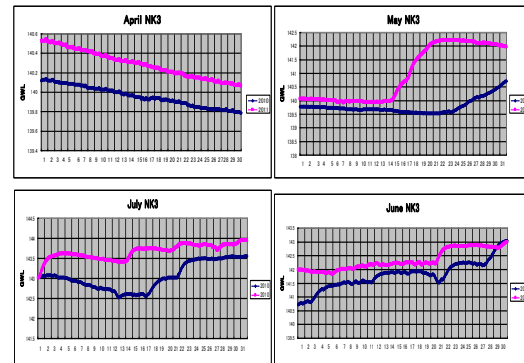


Fig. 9 groundwater level monthly data at station NK3

4) NK8

Fig. 10 shows the GWL change at station NK8. Fig. 11 shows the monthly change of GWL at station NK8 in April, May, Jun and July of 2011, respectively. We will think GWL change during 2010-2011. From Fig. 10, GWL change in NK8 is almost same level. This is depending on the location of GWL observation sight.

The GWL is up with rainfall as shown in Fig. 11. And we can understand that GWL have no daily change. Farmer mainly gets irrigation water from the Mekong river with out of lack of river water. Then GWL change is depend on the Mekong river water level.

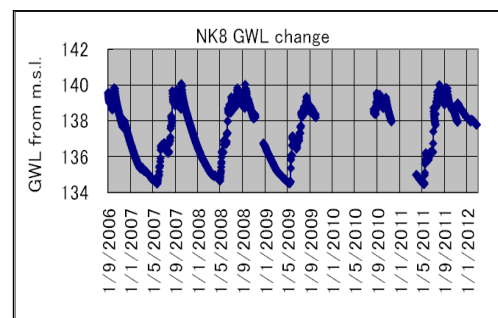
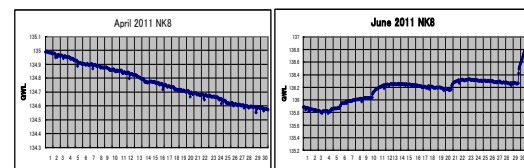


Fig. 10 Groundwater level change at station NK8



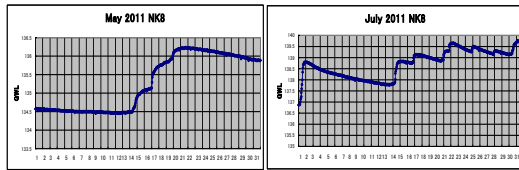


Fig. 11 groundwater level monthly data at station NK8

5) NKOW14

Fig. 12 shows the GWL change at station NKOW14. Fig. 12 shows the monthly change of GWL at station NKOW14 in April, May, Jun and July of 2010 and 2011, respectively. We will think GWL change during 2010-2011. From Fig. 12, GWL change in NKOW14 is decreasing. The reason of this GWL decreasing is not clearly. We must check observation systems.

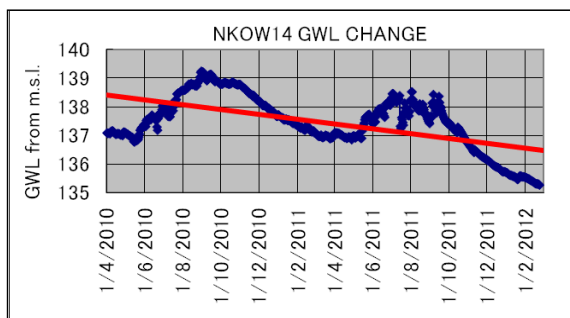


Fig. 11 Groundwater level change station NKOW14

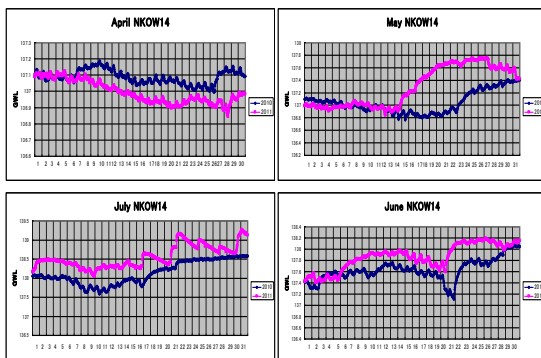


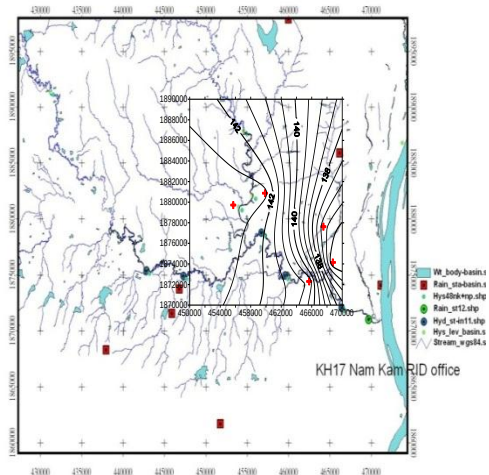
Fig. 13 groundwater level monthly data at station NKOW14

Groundwater level distribution and moving

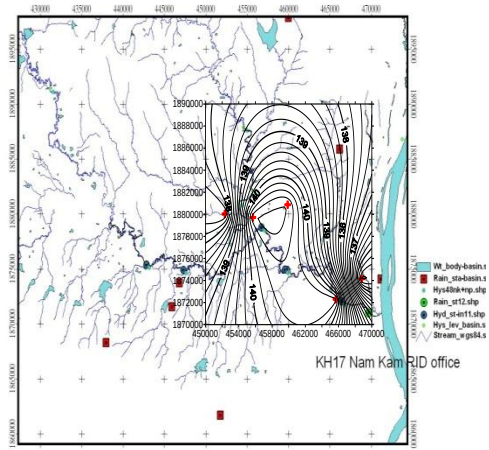
From GWL data in 2008, 2010 and 2011, the author made GWL level distribution map as shown in Fig. 14. We can understand the following things.

1. In 2008, groundwater flow direction is west to east. Groundwater flow toward the Mekong river.

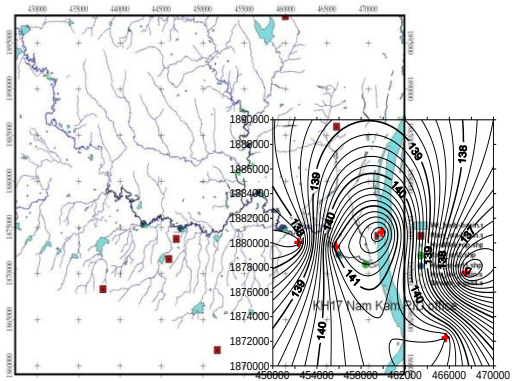
After built up the NamKam Dam, a pond occurred after dam construction, and the place where groundwater swelled by infiltration from the pond appeared.



1 JUNE 2008



1 JUNE 2010



1 JUNE 2011

Fig. 14 GWL distribution map in 2008, 2010 and 2011

CONCLUSION

From observation data analysis in the NamKam field, following conclusions are got.

1. The GWL of shallow aquifer located in close to the NamKam Dam is increased during this 2 years. This



means that there is much infiltration through the bottom of pond by the NamKam Dam.

The daily GWL change located in the remote place from the Mekong river is very big. But those GWL changes are mainly caused in dray season.

From GWL data in 2008, 2010 and 2011, the author made GWL level distribution map. After built up the Nam Kam Dam, a pond occurred after dam construction, and the place where groundwater swelled by infiltration from the pond appeared.

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