

## **SOIL AND WATER QUALITY ANALYSIS IN KYONPYAW AREA, PATHEIN DISTRICT, AYEYARWADY REGION**

Wint Wint Htun<sup>1</sup> and Saw Zar Chi<sup>2</sup>

### **Abstract**

The study area is bordered to the north by the Laymyethnar Township, to the south by the Kyaungkong Township, to the west by the Yae kyi Township and to the east by the Danupyu Township, Pathein District, Ayeyarwady Region. The study area consists of Myawaddy, Tayza, Aung San and Panlong Wards. The area is covered by alluvial deposit and underlain by Tertiary deposits of Irrawaddy Formation. This research has been accomplished to analysis on the soil and water quality. Seven soil samples were collected from four wards and analyzed for Arsenic, Copper, Lead, Zinc, Potassium, Manganese, Sodium, Calcium, Magnesium and Cadmium. Those were examined by Atomic Absorption Spectrometry (AAS) in the Geochemistry Laboratory of the Applied Geology Department, Yangon. Some parts of the study area, Copper, Lead and Zinc in the soil results are higher than the permissible limits of WHO standard. Eleven water samples were collected from surface and groundwater. Surface water samples are collected by water sampler, depth value was tested by HONDEX PS-7-LCD SOUNDER. Multiparameters (Multi probe), Single Probe, Hand-Held Refractometer instruments were also used in the surface and groundwater quality. Physio-chemical of pH, E.C, TDS, ORP, TH, TA, DO, Salinity, Temp, Turbidity,  $Mg^{++}$ ,  $Ca^{++}$ ,  $Fe^{++}$ ,  $Ca(HCO_3)_2$ ,  $Cl^-$ ,  $SO_4^{--}$  were also analyzed at the Soil Examination Laboratory of Department of Fisheries, Ministry of Livestock and Laboratory, Thaketa Township, Yangon. According to the water quality analysis; temperature, calcium and iron are higher than WHO standard. Analyzed by the digital arsenator, arsenic in Panglong is higher than the WHO standard.

**Keywords:** *soil quality, surface and groundwater*

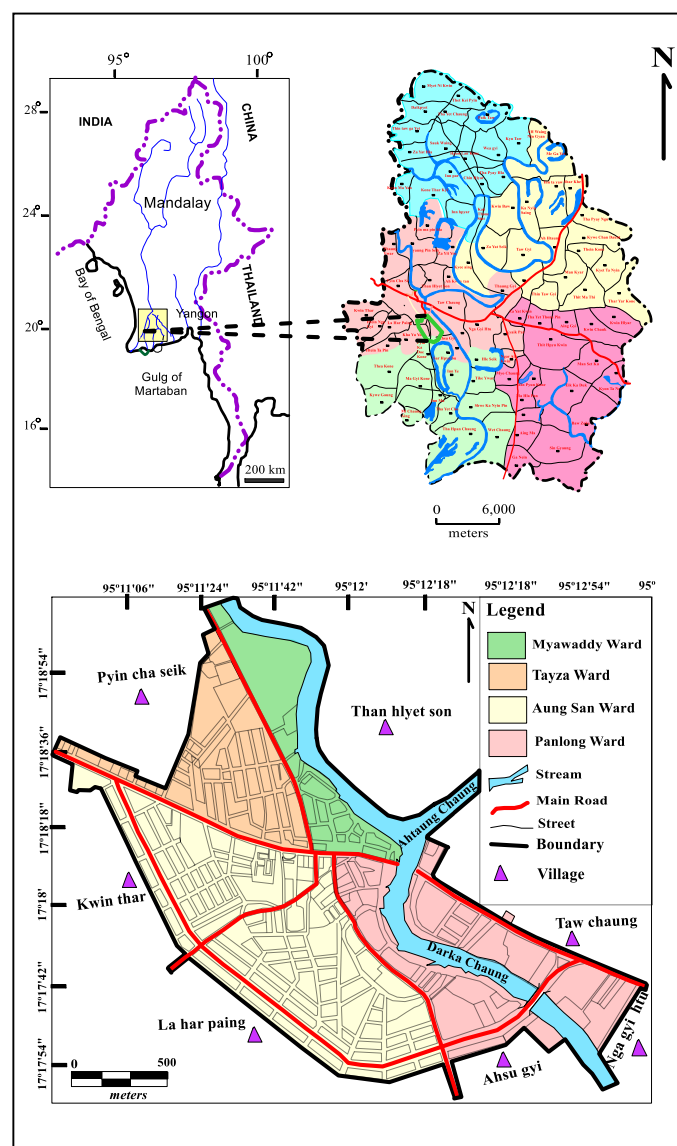
### **Introduction**

The study area lies in the western part of the Ayeyarwady Delta. The topography of the study area generally slopes gently downward from northwest to southeast, and is particularly low lying and flat especially around Darka Chaung and Ahtaung Chaung. The map index of the study area is 85 O/3 of one inch topographic map. It is the most highly populated town in Kyonpyaw Township, Pathein District, Ayeyarwady Region. Darka Chaung is flowing through Myawaddy Ward from the north and Panglong Ward to the south. It is essential for transported services to other places (Figure. 1).

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**Figure 1** Location map of the study area

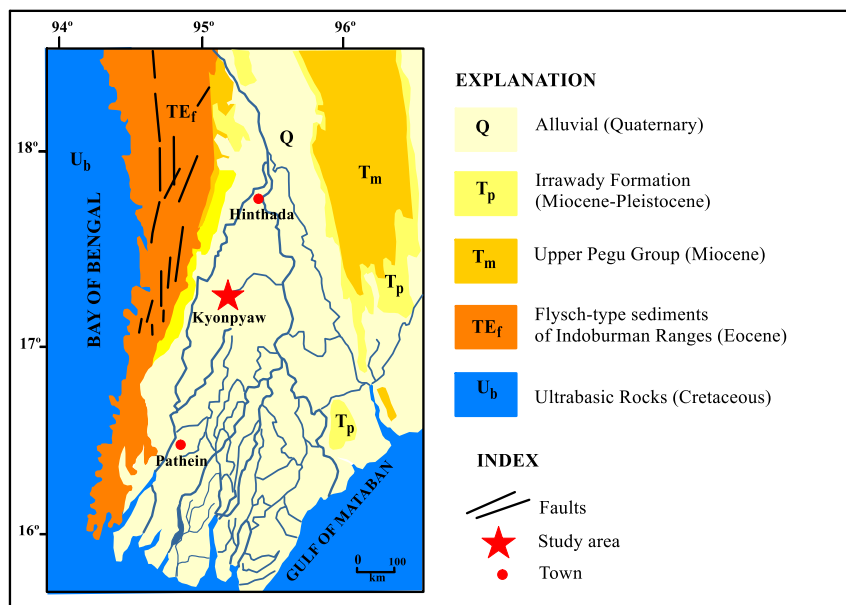
## Materials and Methods

Soil samples were collected by random collection method in December 2013 and in January 2014 in the Kyonpyaw. These samples were collected with an improvised with hand auger to a depth of 0.3 - 0.6 meter. Seven samples were randomly taken from different spots and homogenized. The all samples were analyzed for total concentrations of Arsenic, Copper, Lead, Zinc, Potassium, Manganese, Sodium, Calcium, Magnesium and Cadmium by Absorption Spectrometry (AAS) in the Geochemistry Laboratory, Applied Geology Department, Yangon.

Four surface water samples were collected from the Darka Chaung and depth value was tested by HONDEX PS-7-LCD SOUNDER. Water samples of well information were obtained from Water Resources Utilization Department (WRUD, 2013), Patheingyi. Seven groundwater samples were collected from Tayza, Aung San and Than Hlyet Sun village. Physio-chemical analyses of groundwater samples were made at the Soil Examination Laboratory of Department of Fisheries, Ministry of Livestock and Fisheries, Thaketa Township, Yangon. Multiparameters (Multi probe), Single Probe, Hand-Held Refractometer, HONDEX Ps-7- LCD DIGITAL SOUNDER and water sampler devices were well examined for surface and groundwater quality with help of Resource and Environment Myanmar Ltd. Yangon.

## Regional Geology

Kyonyaw Town is situated at the southern part of Central Lowland and southwestern part of Myanmar. It is situated at the southernmost part of the Bago Yoma. That is mainly covered by the Tertiary and Quaternary Rock sequences. Precambrian meta-sediments and crystalline rocks from the western part of Sino-Burma Ranges are bounded to the East. At that part, Mesozoic to Cenozoic intrusive and extrusive rocks is associated with the Shan Boundary Fault. To the west, Eocene Flysch sediments of Indoburman Ranges are also exposed, respectively. In the northwestern part of the area, west of Hinthada, the Indoburman Flysch type sediments are covered associated with the small serpentinite bodies. This Flysch belt runs southward to the CoCo and Andaman Islands. Their regional geology and evidence of Eocene fauna indicate that the Flysch of this part is regarded as Eocene age (Dr Win Swe, 2012). Eastern foothills of the Western Ranges, are exposed with the North South trending features. Next Miocene Molasses facies, correlative with the Upper Pegu Group of Minbu Basin, are also exposed from the northern part of this region to the south. At the eastern side of these Miocene belts, fluvial sands, gravels and shales of late-Miocene-Pliocene age are exposed in a narrow belt that is a distinctive unit with the mammalian fauna and referred to as the Irrawaddy Formation. The whole part of the study area and its environs are mainly covered by the Quaternary Alluvial, (Figure 2) which is bordered on the south by the Gulf of Mataban. The geological successions of the Ayeyarwady Division are as shown in Table (1).



**Figure 2** Regional geological map of the study area and southern part of the Western Ranges (After Bender, 1983)

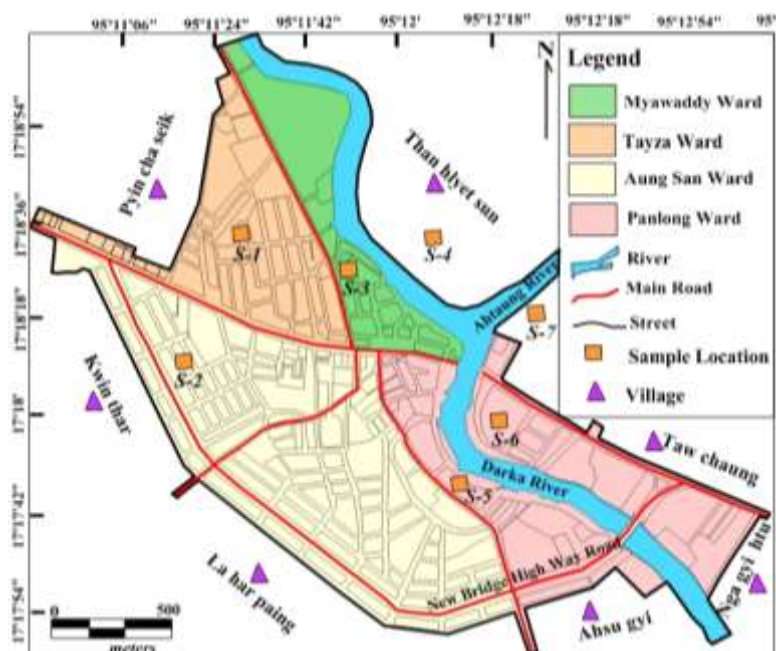
**Table (1) Geological succession of the Ayeyarwady Division**

AGE	UNIT
QUATERNARY	Alluvial terrace and landslide deposits ~~~~~
UPPER MIOCENE-PLIOCENE	Irrawaddy Formation ~~~~~
MIOCENE	Miocene strata (Upper Pegu Group) ~~~~~
EOCENE	Eocene strata of molasses facies several formation of Western Ranges
EOCENE-CRETACEOUS	Indoburman flysch of Western Ranges
Igneous rock	
CRETACEOUS	Dislocated Ultramafic rocks

## Results

### Soil quality in Kyonpyaw Town

All of the soil samples were collected by random collection from different locations of the study area, (Figure 3).

**Figure 3** Location of sampling sites for soil

Sample no.1 (S-1) soil was accounted in the east of Tayza Ward. This soil is occurred yellowish brown colored, medium-high plasticity, transportation soil. S-2 soil was accounted in the Nyaung Pin Thar Street (1), Aung San Ward. This soil is occurred yellowish-brown to bluish gray; clay portion is very high plasticity, silty clay and transportation soil. S-3 soil was accounted in the Ohwe taw street, Myawaddy Ward. This soil is occurred bluish gray colored, medium-high plasticity, transportation soil. S-4 soil was accounted in the Than Hlyet sun area. This soil is occurred yellowish brown, medium-high plasticity and transportation soil. S-5 was accounted in

the Pagoda Street, Panglong (1) Ward. This soil is occurred grayish colored, medium plasticity and transportation soil. S-6 was randomly accounted in the Kwittit Street, Panglong (4) Ward. This soil is occurred grayish colored, medium to high plasticity and transportation soil. Arsenic amount is not detected in this soil. S-7 was accounted in the Thirimingalar Street, Panlong (4) Ward near the Ahtaung Chaung. This soil is occurred reddish brown colored, medium plasticity and transportation soil.

### Comparison with WHO standard and soil quality of Kyonpyaw

The seven soil results of the study area and comparison of the sample parameters with the World Health Origination (WHO) described in Table (2).

**Table 2 Comparative study for soil quality analysis of Kyonpyaw and WHO standard**

Sample no	As	Cu *	Pb *	Zn *	Mn *	Na *	K *	Ca *	Mg *	Cd *	Cr *	Fe *
WHO		20	10	50	50	-	-	200	-	0.5	100	1000
S-1	ND	ND	0.004	0.015	0.009	-	-	-	-	0.08	0.018	5850
S-2	ND	ND	0.004	0.017	0.008	-	-	-	-	0.09	0.017	6100
S-3	ND	95	115	75	17	20	25	15	18	0.007	-	-
S-4	ND	105	130	80	18	18	30	20	15	0.006	-	-
S-5	ND	100	120	85	20	30	25	18	19	0.005	-	-
S-6	ND	95	115	80	21	25	22	20	20	0.006	-	-
S-7	ND	105	120	75	19	20	18	23	18	0.07	-	-

(\*) = ppm, ND-not detected

According to the soil quality analysis, the levels of Copper, Lead and Zinc are higher than WHO standard in Myawaddy Ward, Panlong (1) Ward, Panglong (2) Ward, Than Hlyet Sun Area and Taw Chaung village. S-1 in Tayza Ward and S-2 in Aung San Ward are higher level of Iron than WHO standard.

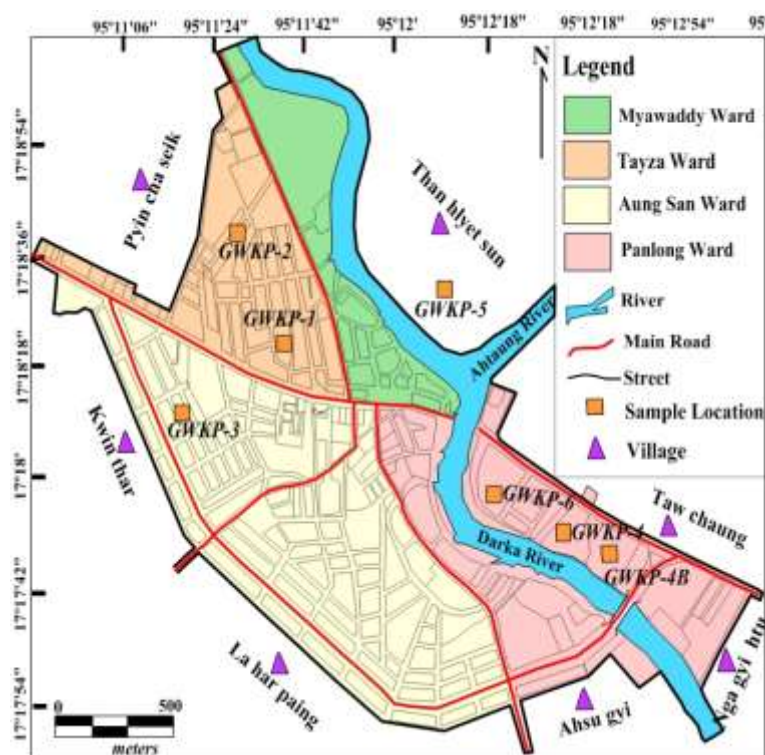
### Water quality in Kyonpyaw Town

In the Darka Chaung, four surface water samples are collected by water sampler and depth value was tested by HONDEX PS-7-LCD SOUNDER. Depend on the measurement of the depth, the maximum depth value is 5.5 m in the Darka Chaung and minimum depth value is 2.3 m in the Ahtaung Chaung. Table 3 described the surface water sample location and its characteristics.

**Table 3 Surface water sample locations and its characteristics SW-surface water**

No.	Sample no.	Location	Time/Date	Sources	Uses
1.	SW-1	N17° 18' 25.4": E 95° 11' 50.8"	1:00PM/ 6.12.13	River	Drinking, Irrigation, Industrial, Agricultural, Domestics and other purposes.
2.	SW-2	N17° 18' 10.6": E 95° 12' 13.0"	1:35PM/ 16.12.13	River	
3.	SW-3	N17° 17' 49.5": E 95° 12' 2.2"	2:05PM/ 16.12.13	River	
4.	SW-4	N17° 17' 41.4": E 95° 12' 23.2"	1:55PM/ 16.12.13	River	

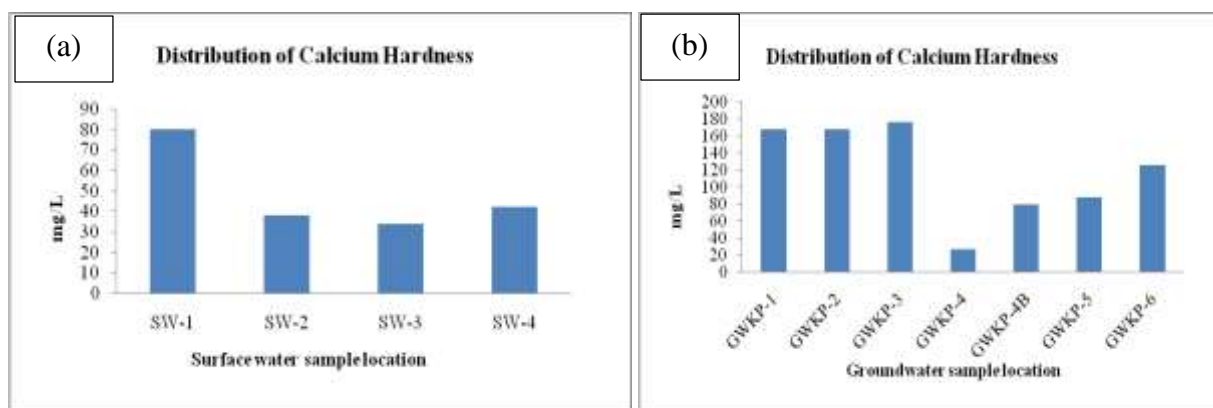
Groundwater samples of GWKP-1 was collected at the Tayza Ward of Bogyok Street, GWKP-2 was collected at the Pauktauk Shweywar Street. GWKP-3 was collected at the Nyaungpinthar Street, Aung San Ward. In the Panglong (4) Ward, GWKP-4 was collected from Kaya Street, GWKP-4B was from the Saik Kyaik Thit Street, GWKP-6 was from the Kaya street, GWKP-5 was collected from the Than Hlyet Son village. Physio-chemical analyses of all surface water and groundwater samples were made at the Soil Examination Laboratory of Department of Fisheries, Ministry of Livestock and Laboratory, Thaketa Township, Yangon. Location of groundwater collected areas is shown in (Figure 4).



**Figure 4** Location of groundwater collected areas in Kyonpyaw Town

In the study area, high temperature rate was occurred in the SW-1 and GWKP-5, low temperature rate in SW-2 and GWKP-3. Some results of the water samples were considerably appearance as turbidities. pH value is higher than permissible limit in SW-4 and GWKP-1, 2, 3, and less than in SW-1. Electrical Conductivity (EC) was tested by the Multiparameters. SW-2 showed maximum EC value and SW-3 showed minimum value. TDS value of all surface water showed not more than 99 ppm. TDS and TH of the groundwater are not more than 300 ppm. High quality of ORP value found in SW-3 and low quality in SW-1. Surface and groundwater of DO both are not more than 7 ppm. High level of Calcium hardness found in SW-1. Distribution of Calcium hardness is shown in Figure 5a and 5b. Sulphate and Chloride value of both water sources within permissible limit.

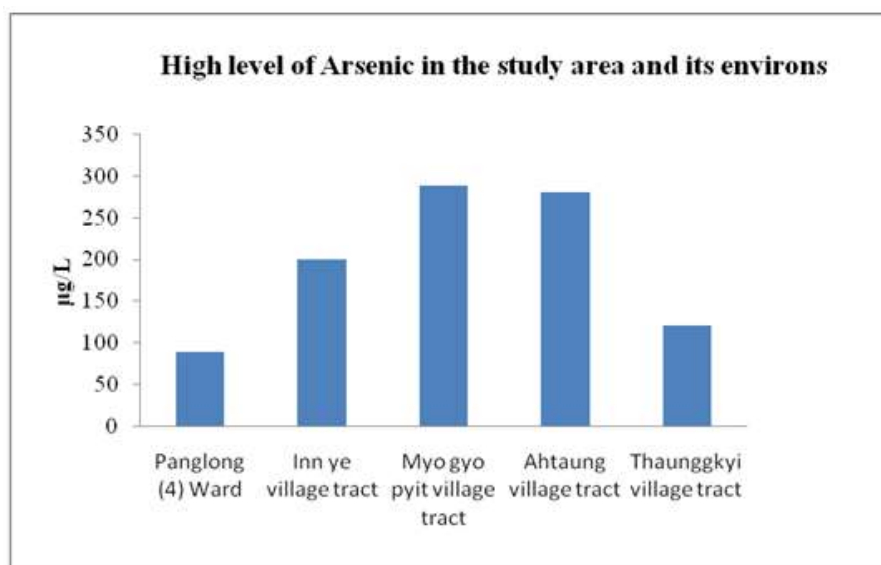




**Figure 5** (a) and (b) Distribution of Calcium hardness in surface and groundwater

### Arsenic concentration in Kyonpyaw and its Environs

Depend on the arsenic concentration measurement, Panlong 4 ward area in arsenic level is higher than WHO standard.



**Figure 6** Arsenic concentration in Kyonpyaw and its environs

### Discussion and Conclusion

In the study area, Darka Chaung is flowing through Myawaddy Ward from the north and Panglong Ward to the south. The study area extends about 7.2 km from north to south and 2.72 km from east to west. The whole part of the study area and its environs are mainly covered by the Quaternary Alluvial. Depend upon the soil quality analysis showed levels of Copper, Lead and Zinc are higher than WHO standard in Myawaddy Ward, Panlong (1) Ward, Panlong (2) Ward, Than Hlyet Sun Area and Taw Chaung village. The higher level of Iron, found more than WHO standard, in S-1 and S-2. The result of water quality, GWKP-1 to GWKP-6 and SW-1 to SW-4 of temperature are more higher limit than WHO standard. Calcium contents of GWKP-1 to GWKP-3, GWKP-4B, GWKP-5 and GWKP-6 are higher than WHO standard. Iron contents of GWKP-4 and GWKP-4B are higher limit than WHO standard. By analyzed with Digital Arsenator, Panglong (4) Quarter is more arsenic level than WHO standards.

Depend on the literature surveyed, Copper can also enter in the environment through waste dumps, domestic waste water, combustion of fossil fuels and wastes, wood production, phosphate fertilizer production. Copper is often found near mines, industrial settings, landfills and waste disposal. Zinc comes from human activities and Leads comes from industrial wastewater. Copper, Lead and Zinc compounds form the largest treat to human health.

According to field surveyed, waste disposal sites of Kyonpyaw, are located in Aung San Ward and Myawaddy Ward. It is suggested to consider selected proper disposal sites in the town and using proper waste disposal system. Also need and control of soil pollution.

The following steps have been suggested to control soil pollution.

- (a) Reducing chemical fertilizer and pesticide use.
- (b) Reusing of materials
- (c) Recycling and recovery of materials
- (d) Reforesting
- (e) Solid waste treatment
- (f) Storage of hazardous waste

The present research to reveals the relationship between geology, soil quality and water quality as well.

Municipal water supply system of Kyonpyaw Town is located only in Myawaddy Ward. All wards depend largely on dug wells, tube wells, hand-dug wells and some depends on lakes. The underlying water bearing layer is limited in amount in Aung San Ward and some parts of Tayza Ward. So, this town needs to supply of water from government and careful using our private wells.

Kyonpyaw Town is located in alluvial plain of Ayeyarwady Delta and as Laymyethnar Township, the Kyaungkong Township, the Hinthada Township has a record of high Arsenic level. Arsenic usually contaminates especially at the old Ayeyarwady River channel deposit. Most studies indicated that Arsenic is free at the well depth of 250 feet. If there is the case, one should consider to extraction the groundwater from deep tube well, rather than from the shallow ones.

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