

## **ENVIRONMENTAL MONITORING OF HOUSING SCHEME WITH SPECIAL REFERENCE TO DRINKING WATER QUALITY**

MUZAFFAR AHMAD KHAN<sup>1</sup>, MOHAMMAD NAFEES<sup>2</sup>, SHAH NAWAZ KHAN<sup>3</sup>

<sup>1</sup>*Department of Environmental Sciences, University of Haripur, Khyber Pakhtunkhwa, Pakistan*

<sup>2</sup>*Department of Environmental Sciences, University of Peshawar, 25120, Peshawar, Khyber Pakhtunkhwa, Pakistan*

<sup>3</sup>*Centre for Disaster Preparedness & Management, University of Peshawar, 25120, Peshawar, Khyber Pakhtunkhwa, Pakistan*

**Abstract:** This study was conducted on *Taru-Jabba* housing scheme which was designed without Environmental Impact Assessment (EIA). In Pakistan, for housing schemes Initial Environmental Examination (IEE) study is compulsory but exempted from detail EIA and periodic monitoring. It is a general perception that EIA focus on impacts of human on environment. Impacts of environment on human is usually not considered in EIA. In this paper, an attempt has been made to know about the present status of ongoing construction and environment. The main focus is on availability and quality of water and its effects on residents. For this purpose, drinking water from different sources were characterized for physical and chemical parameters and compared with water quality guidelines standards. It was found that water quality of dug-well is not complying drinking water quality standards. Water quality of tube-well was comparatively good. It was concluded that the ground water will affect the health of local residents. It was, therefore, recommended to make periodic monitoring mandatory for housing schemes and make necessary arrangement for providing tube-well water to all the residents.

**Key Words:** EIA, IEE, monitoring, water quality, dug-well, tub-well.

### **Introduction**

Housing scheme is one of the basic needs for survival. A large increase in population will asked for large scale houses. Housing development schemes is now regular business throughout the world. Worldwide 600 million people need houses in cities. It is estimated that the figure will become triple at the end of this century (Berner, 2001). In developing world, due to lack of proper financial and technical resources, housing schemes are growing in haphazard manners that has got negative impacts on environment as well as on the inhabitants (Wright, and Kloos, 2007). Proper housing is a worldwide problem in both developed and developing

countries. United Nation started its efforts in 1996 and makes it integral part of basic human rights. A detail documents was prepared to address the basics of housing with the title “Adequate Shelter for all”. According to this, all Governments have responsibilities to take appropriate action in order to promote protect and ensure proper realization of provision of adequate housing for its citizens (UN-Habitat, 1996). Pakistan started housing scheme in the form of *Kachi Abadi* which latter on become slums and created health problems. Since that the housing situation in Pakistan has continuously deteriorated over past many years and most of the policies announced were not implemented (Hasan and Raza, 2012).

In Pakistan, initially house construction was informal. It was an individual to decide, where to construct his/her house. Now it is state or housing developers deciding where to start a housing scheme and accommodate people migrating from rural and over populated urban centers (Berner, 2001).

To maximize financial benefits, developers are always seeking less productive land. This selection is irrespective of environmental considerations. The various criteria adopted for such selection include availability of infra-structure, education and health facilities, distance with main business centers and security. From environment point of view two aspects needed to be addressed i.e. impact of environment on human being and vis-à-vis. The various environmental impacts on human include natural disasters (flood, earth quack) and pollution hazard (Goebel, 2007, and Rashid, 2007). To cope with the impacts of environment on human such sites are evaluated and are usually avoided. Human impacts on environment include solid waste, municipal effluents, noise, impacts on flora and fauna (Isik, and Tulbentci, 2008).

To address these impacts, EIA was introduced worldwide with the idea to identify, evaluate and mitigate negative environmental impacts of human on environment. In Pakistan, EIA was introduced in 1983 after promulgation of Environmental Protection Ordinance (Nadeem and Hameed, 2008). EIA become mandatory for all sort of developmental activities, including housing scheme after the approval of environmental Protection Act-1997. The period between 1983-1997 can be considered as preparatory period. During this period 11 EIA and 41 IEE have been submitted to Environmental Protection

Agency, Peshawar. These reports can be termed as pilot studies. In this way from the very beginning IEE and EIA were kept separately. This was further highlighted in the 2000 IEE/EIA regulation with the idea to keep EIA process simple easy and efficient (Government of Pakistan, 2000). In 2001 the rules were further relaxed in the form of monitoring rules 2001. All projects need IEE was exempted from periodic monitoring. Monitoring is required only for those projects for which EIA is mandatory (Nafees, et al 2012).

Similar categories have been defined for housing scheme also. If the number of houses is less than 100, there is no need of IEE. Housing scheme planned for more than 100 house need IEE, while housing scheme planned for 1000 houses or above, need detail EIA and periodic annual monitoring (GoP, 2000).

It is quite easy for a housing schemes developer to split a particular big housing scheme into small packages register it with different names, avoid EIA and periodic monitoring. There are some housing schemes which are started before 1983 for which no EIA/IEE was conducted. But if we look into EIA regulation, the number of houses matter. For example Hayatabad Township was started in early 1970s. At that time the concept of EIA was not introduced in Pakistan. To cope with the municipal wastewater a treatment plant was designed. The treatment plant was operational in 1990. In 1992 the housing scheme was doubled. Due to which there was increase in municipal effluent as well as put pressure in ground water resources. Due to which the treatment plant was closed in 1993. It is perceived that if the concept of monitoring was there, it

could be easy to evaluate and make necessary arrangement for the municipal waste water.

Similarly a town ship was initiated in the east of Peshawar city called Wapda Employees Cooperative Housing Society (WECHS) also called Tarru-Jabba<sup>1</sup> housing scheme. *Jabba* mean water logged area while *taro* is name of a local bird. This was a special habitat for local and migratory birds and was not used for agriculture. Housing scheme was initiated with the idea that the land was not used for agriculture and was termed as less productive, and cheap. Besides, the township is situated near main GT-road and having accessibly to two main cities of Khyber Pakhtunkhwa, Peshawar in west and Nowshera in the east (Fig. 1). In this way it was quite attractive site for housing in term of accessibility and low cost of land. This was a good habitat for local birds and a resting place for migratory birds and was converted into a housing scheme therefore, the impacts on environment was obvious, but were not considered at that time. The project was started in late 1990. Till 2012 only 2% plots have been constructed. Now question arise, why the construction is so slow and what mitigation measure could be adopted if the housing scheme has got effects on human being.

Therefore, a detail monitoring study was carried out of the said housing scheme with the objective to know about water quality and its effect on residents. This will also answer a question “why the development is so slow?” This study may also be helpful, to incorporate impacts of environment on human and to re-consider the EIA and monitoring rules, for housing schemes.



Fig. 1. Map of study area [Source: Google Maps]

## **Materials and Methods**

This study was based on both, primary and secondary data. Primary data were collected with the help of field survey, while secondary data was collected through internet and library search.

Data like site selection and related environmental related hazard were collected by using library and internet.

### ***Questionnaire Survey Among the Residents***

At present only 2.15% houses have been constructed (Table 1). A total of 63.75% residents were interviewed. They were asked about present problems due to which people are hesitant to construct houses. A similar survey was conducted among plot owners and were asked why they are not constructing their houses. Four problems were identified. These include i) availability of drinking water, ii) solid waste disposal, iii) drainage cum municipal waste disposal, and vi) noise pollution. Each respondent was asked to prepare a priority list. In this way the problem need immediate solution was placed at the top with a score of 5, and problem need less importance was placed at the bottom with a score 1. The acquired score was averaged and converted into percentage (percent

<sup>1</sup> *Taru-Jabba* is a Pushto word, *Taro* is name of a local bird while *Jabba* mean water logged

preference). Among these various problems, drinking water was investigated in depth.

### Water Analysis

Water samples were collected from tub-well, bore-well and dug well and were analyzed for drinking water quality parameters and were compared with drinking water quality standards. These include pH, conductivity, Alkalinity, hardness, Nitrate, Sulfate and BOD<sub>5</sub>. All these parameters were analyzed by following standard methods for examination of water and wastewater.

## Results and Discussion

### Present Construction Status and Various Facilities

Table 1 summarizes present construction status. In total there are 3260 plots ranging from 5 marla to 20 marla (1 kanal). Construction status ranged from 1.25 to 3.33% with average of 2.15%. The

results revealed that construction is very slow in *Taru-Jabba*.

The questionnaire survey revealed that due to non-availability of basic facilities, plot owners are reluctant to construct house. The various problems include drinking water availability, poor drainage especially observed during rainy season, solid waste disposal and noise pollution. Among these various problems, drinking water was listed on the top by scoring 55% preference. Drinking water was followed by solid waste disposal with 25% preference, poor drainage by 15 % and noise pollution by 5% preference (Fig. 2). It was also observed that there is not solid waste dump site. At present, with 2% construction, the problem of solid waste disposal is ranked as second to drinking water. When population increased, it may be become a top ranked problem. Irregular dumping of solid waste could also add to ground water contamination, especially to dug-well.

**Table 1: Construction status of the *Taru-Jabba* Housing Scheme**

Demographic Trends	Total Plots	Total Constructed	Percent Constructed	Interviewed	Percentage
Kanal	200	4	2	3	75.00
13 Marla	2000	25	1.25	15	60.00
7 Marla	1000	20	2	4	20.00
5 Marla	60	2	3.33	2	100.00
Total	3260	51	2.15	24	

[Source for total plots: Office of WAPDA Housing scheme *Taru-Tabba*].

## Drinking Water Quality

For water supply there are four tube-wells out of which only one was operational. This tube-well was providing water to 52% (26) houses only while remaining houses were with their own arrangements. The tube-well could provide water to all but due to blockage/ damaged pipe line and lack of maintenance, only 26 houses were benefited. Therefore, remaining 48% houses were with their own arrangement, out of which, 44% were with bore-wells and 4% have arranged dug wells (Fig. 3). It is worth mentioning that the depth of tub-well was 300 feet. While that of bore-well was 150 feet and dug-well below 50 feet.

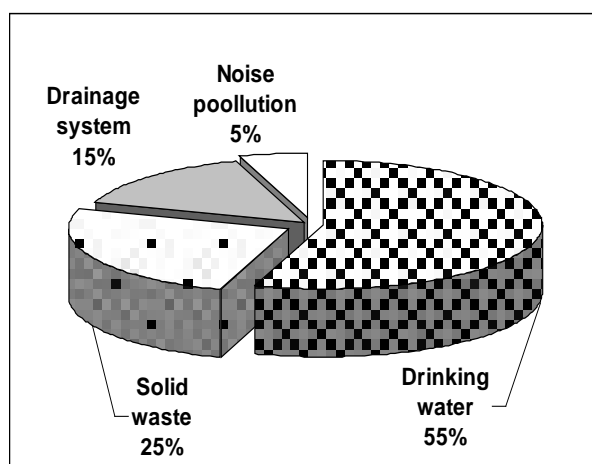


Fig 2: List of problems faced by residents of the studied housing scheme along with percent preference

The water testing results showed that the water of tube well was within the permissible limits set by Pakistan Council of Research in Water Resources (PCRWR). Laboratory analysis revealed that results of electric-conductivity and Alkalinity of dug-well were comparatively high from that of Tube well and bore well. Although, there is

no guideline standards available for these two parameters to compare with. This high value of conductivity shows presence of dissolved substances. While presence of high alkalinity revealed presence of carbonates and bi-carbonate.

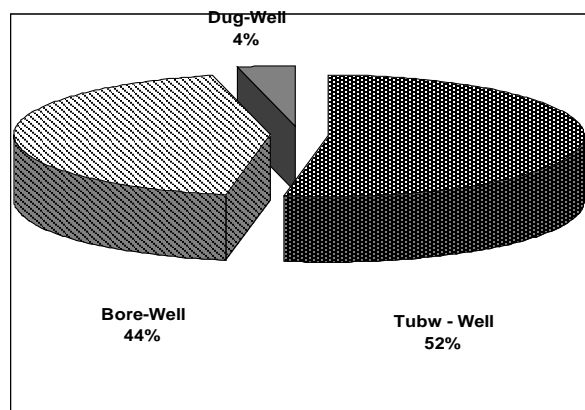


Fig 3. Availability of different types of water

Guidelines standard adopted for hardness (500 mg/L as  $\text{CaCO}_3$ ) is quite relaxed when compared with drinking water quality of other countries. In India standard for hardness is 300 mg/L as  $\text{CaCO}_3$  (Ramakrishnaiah, et al, 2009). By comparing the hardness results with 300, all sources are crossing the permissible limit. By comparing it with 500, only dug-well water crossing permissible limit.

Level of chloride and sulfate was comparatively less, when compared with Pakistan drinking water quality standards of 600 and 400 mg/L respectively. Nitrate was within permissible limits in all types of well. In dug-well the concentration of nitrate was comparatively high. For Biological Oxygen Demand (BoD), guideline-standard for drinking is also not provided in Pakistan. On comparison with standard set by WHO (6 mg/L), the water of tube-well and bore-well were within permissible limits, but that of dug-well was

crossing the permissible limit. BOD is indicator of bio-degradable organic substances and therefore, the increase level of BOD can pose negative health effect

(Kazi, et al, 2009). Similarly the results for sodium (Na) were also compared with guideline standard of WHO and were within the permissible limits of 200 mg/L.

**Table 3: Drinking Water Quality of *Taru-Jabba* Housing Scheme**

Source	Pak Drinking Water Quality Maximum Acceptable Concentration	Main Tube well Near Colony Office			Bore Well inside a house			Hand Pump (Dug-Well)		
		Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
pH	7.0 – 8.5	7.5	8.2	7.9	7.2	8.3	7.9	7.9	8.2	8.1
Conductivity (µs/cm)	NO Guideline Value Set	750.3	770.4	760.4	823.6	835.4	829.1	1234.5	1256	1245.1
Alkalinity (mg/L as CaCO <sub>3</sub> )		180.5	195.4	187.6	205.3	215.9	210.1	256.9	285.4	270.6
Hardness (mg/L as CaCO <sub>3</sub> )	500	350.7	370.4	360.1	456.4	470.6	463.1	505.4	525.8	515.6
Chloride (mg/L)	600	78.4	85.2	81.6	95.8	105.7	100.6	164.7	174.3	169.1
Sulfate (mg/L)	400	170.6	180.6	175.1	82.8	95.3	89.1	834.2	845.5	839.6
Nitrate (mg/L)	50	0	0.1	0.05	0.79	2.5	1.6	2.2	5.5	3.9
BOD <sub>5</sub> (mg/L)	6	0.5	2.2	1.3	0.62	2.3	1.5	5.4	6.9	6.1
Sodium (mg/L)	200	74.9	85.4	79.6	95.4	114.7	105.1	138.2	145.3	141.9

### Depletion and Pollution of Local Ground Water

In order to provide drinking water facilities to the inhabitants of the newly

planned *Taru-Jaba* Housing Scheme, a complete water supply system has been installed. The system is mainly consists of four tube well, high level over head reservoirs

one lac gallons of each with a loop-network of distribution pipeline. In the system the over head reservoir shall be filled through installed tube wells. The rising main is also connected directly to the system so that supply is not interrupted during cleaning or repair of the reservoirs and also to ensure full supply at peak demands. During low and average demands, reservoirs will be filled and during peak demands, water, both from the tube wells and reservoirs will be flowing into the system.

- excessive pressures in parts of the system are avoided, which may cause leakage and breakage of the supply system.
- Uniform pressures in the system could be maintained, as far as possible.
- Keeping in view the climatic conditions and social habits of the same class of the society that is expected to be inhabiting in the town, the following figures have adopted for the design of the system, considering that the population will be served through house connection;
  - a) Domestic demand: 30 gallons per capita per day
  - b) Non domestic demand: 3000 gallons per acre per day

As the housing scheme is situated in waterlogged area surrounded by Kabul River system, therefore, ground water depletion may not be a problem. But on continuous ground water extraction, there is possibility that the water from the top surface may percolate down and can affect tub-well water quality also.

### **Solid Waste Management**

The solid waste management is a basic health requirement. If the solid waste is not properly collected and disposed off, it may create indiscriminate and much serious health hazard to the inhabitants of the society/colony.

At present, there are no available National Solid Waste Management guide lines standards for commercial or domestic solid waste in PEPA 1997. However, research has shown Pakistan estimates as per national standard i.e. “0.283 to 0.613 kg/capita/day or 1.896 to 4.29 kg/house/day” (Capital Development Authority, 2008). Whereas for *Taru-Jabba* Housing Scheme there is a big question mark “where the people will dump their solid waste”. According to our survey, at present only 2% construction has been completed. At this stage the people used the empty plot for waste disposal, but when it become fully operational, it will create serious environmental problem. Besides, it will directly contribute to ground water and can further deteriorate the dug-well water. Therefore, proper solid waste management may have to be implemented for the betterment of the inhabitants and over all environmental protection.

### **Conclusions**

On the basis of the present study it was concluded that:

- i. The area was water logged and was not used for primary agriculture therefore, the price was quite low. At the same time it was situated on main G.T road and railway track with accessibly to main cities (Peshawar and Nowshera). In this regards was quite attractive.

- ii. Field survey revealed that only 2% plots have been constructed. Results of percent preferences showed that it is mainly due to non availability of drinking water and drainage system.
- iii. At present there is no solid waste management plan and will affect the area negatively in future.
- iv. During monsoon season stagnant water was observed which can provide a good habitat for mosquito breeding.

### Recommendations

- i. The number of deep well especially bore-well with a depth of 80 feet and above is required for drinking water.
- ii. Solid waste management plan is an urgent need and a corner may be selected after proper study.
- iii. All possible efforts should be made for the provision of tube-well water along with mandatory periodic monitoring for its quality to all the residents of the housing scheme.

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