International Journal of Research in Economics and Social Sciences(IJRESS)
Available online at: http://euroasiapub.org
Vol. 8 Issue 9, September- 2018
ISSN(o): 2249-7382 | Impact Factor: 6.939 |

Fluoride Level in Ground Water and Population Clinical Status: A Case Study

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Abstract:*The body's sources of fluoride are drinking water and food. But drinking water is considered the main source of fluoride in the body. Groundwater is one of the most important natural resources. 33 percent of domestic water and 42 percent of river water come from here. It is a reliable source of drinking water for many people around the world. Soil pollution is a reflection of soil quality, quality and water level. Therefore, the possibility of soil contamination should be understood in the initial investigation and management of these elements. This study aims to investigate the fluoride content in the soil and the symptoms commonly seen in fluorite patients. The study was carried out in 40 villages of Rohtak district of Haryana and two towns of Tehsil Meham. Using random sampling for systematic purposes, select the 420 best representative water points (10 for each data point) for source data (recorded groundwater samples) to evaluate fluoride parameters of water bodies. An additional sample of 840 male and female participants (20 for data points) aged 15 to 60 years included dental fluorosis, Skeletal fluorosis, arthritis and stomach disease, etc. It was used to examine the symptoms of fluoritis patients, such as Medical assistant. From the recorded groundwaters, it was determined that there was fluoride in 14 villages in this region, and more fluoride than allowed for Food Safety Association Desserts in 28 villages in the study area. Of the 840 responders, 491 (58.45%) had fluoride symptoms. Symptoms included dental caries in 74 patients (15.07%), mottled enamel in 82 patients (16.70%), skeletal fluorosis in 92 patients (18.73%), spotted teeth with white spots in 40 patients (8.15%), mottled teeth were present. There were black teeth (18.33%), caries and pitting, osseous rheumatism and neck vertebrae in 56 individuals (11.41%), abdominal pain in 37 (7.54%), and severe fluorosis in 20 (4.07%). Further analysis revealed that the fluoride patients' symptoms corresponded to the fluoride levels in the groundwater. Therefore, it is possible to provide safe water with a chemical fluoride content of less than 1.5 mg/L for villages affected by fluorosis by applying a treatment process to transfer the water to a safe place or to remove fluoride from the existing water.*

Keywords:*Fluoride, Clinical symptoms, Dental and skeletal fluorosis, Gastrointestinal discomfort.*

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Introduction: Water is an important natural resource that ensures the continuity of life and the environment. On the other hand, the chemical composition of surface water or groundwater is an important factor in water availability. Groundwater is an important natural resource and a reliable source of drinking water for many people around the world. Water is an essential component of all living things and makes up about two-thirds of the weight of the human body (Gore 2006). Currently, around 2 billion people worldwide do not have access to safe drinking water (Kubakaddi 2001). Drinking poor quality, contaminated water has many consequences that are not fully understood. According to the World Health Organization (WHO), drinking contaminated water is one of the causes of diarrhea; these diseases are the second cause of death in children (WHO 1981). Overall, the provision of safe drinking water helps reduce or eliminate preventable deaths and improve the quality of life of low-income families worldwide (Danish 1952). Ensuring safe and reliable water supply is an important prerequisite for population growth and further development (Mathur 1976). Groundwater is an important source of water for about a third of the world's population (ISI 1983).

Fluoride is the main naturally occurring inorganic pollutant in soil in India. Fluoride is a valuable element that is not seen in samples in nature due to its high activity. Fluoride is present in almost all waters in a range from a streak to high concentrations. (Malik P.K. 2016). Fluoride concentrations in soil depend on factors such as temperature, pH and solubility of fluorine-containing minerals, anion exchange capacity of the aquifer, the nature of geological formations and the contact time of water with some formations (Panadey, H.K. 2015.). Human activities such as the use of phosphate fertilizers, pesticides, agricultural sewage and sludges, and the depletion of groundwater are also responsible for the fluoride concentration in the soil. Therefore, soil is an important factor that directly or indirectly affects water quality. When groundwater is used for irrigation, the crops contain fluoride, among other sources (Naik, R.G, 2017). Groundwater is an important and preferred drinking water source in rural and urban areas (especially in India) and is important in terms of soil quality, water quality and water quality (Malik P.K. 2016).

Groundwater is contaminated by the use of many mineral or incompatible fertilizers, such as calcium, magnesium and fluoride masses found in the soil. Among the harmful substances, fluoride is important for normal bone formation. It forms teeth and tooth enamel and supports the growth of many plant species. Low fluoride (<0.6 mWlts) in water causes tooth decay. On the other hand, too much fluoride can harm plants, animals and humans, causing fluorosis. Fluorosis is now a global problem (ICMR 1999). Higher doses (> 1.5 mWlts) may cause dental fluorosis or mottled enamel formation, and excess fluoride (> 3.0 mg/lts) may cause bone fluorosis (WHO 1984). In general, between 2.0 and 2.5 mg/L of fluoride in water can cause teeth to become visible; initially appear as opaque white plaques on teeth, then dental fluorosis (brown black teeth on teeth) followed by pitted teeth. Skeletal fluorosis and symptoms of severe skeletal fluorosis can occur when fluoride levels in drinking water exceed 2.50 mg/L (BIS, 1992). High fluoride concentrations show up as bone density and cause calcification of long bones and ligaments. Symptoms include rheumatic/arthritic pain in the joints and muscles, severe pain in the cervical region, and both stiffness and stiffness (Teotia SP, 1994). Various harmful substances such as fluoride, nitrate, sulfate and other heavy metals have been reported in groundwater in many parts of India. Although the source of this product is mostly geological, serious health problems are known in India due to the use of groundwater containing fluoride as drinking water (ICMR 1999). This disease can occur in people with subclinical, chronic or severe consequences. Chronic fluorosis occurs when the fluoride level in the water exceeds 10 mg/l (Carlson 1960). The severity of fluorosis depends on the fluoride concentration in drinking water, daily intake, exposure time and

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duration, safety (ICMR 1999), prevailing conditions, classification, and the installation of safety-critical systems.

Health problems caused by fluoride pollution are more common in India. The problem of excess fluoride in Indian groundwater was first reported in 1937 in Andhra Pradesh. Fluorosis is currently a major public health problem in 18 of India's 28 states. It was determined that approximately 177 areas were contaminated with fluoride. Recent research has shown that approximately 62 million people, including 6 million children, are exposed to fluorosis due to drinking water containing high levels of fluoride (WHO (1970).

Study Area: The Tehsil Meham lies between 28°50'41.78"N to 29°05’09.93’’N and76°12’02.32’’E to76°31'25.42"Ecovering an area of 54,772 Hectare (Figure-1). It is located in state of Haryana (India). The study area is located in the Indo-gangetic plain which was formed by the deposition of the alluvial segments brought by the Himalayan River. The study area generally experience monsoon climate. The drainage system of the study area is influenced by south-west monsoon. The study area has population of2,45,427 (2011 census).The total numbers of villages in the study area is 40 and 02 town (Figure-2). Out of the total geographical area of the district 79.12 percent of area is used for the agriculture in 2001 but it decreases to 66.18 percent in 2010-11.

Objectives: The main objectives of the present study are:

1. To investigate the impact of fluoride content on human being by ground water.
2. To assess the clinical symptoms like dental and skeletal fluorosis, Joint pains and gastrointestinal diseases among local population.
3. To find out the severity of the disease in the study area.
4. To understand the present contamination level, distribution and developing a methodology for safe drinking.

Database and Methodology: The general fluoride content of the groundwater in the study area was investigated by gold and electrode methods. A good and objective random sampling method is used to select the 1610 most representative water points based on data (recorded groundwater samples) to measure fluoride in body water. By visiting the villages, samples are collected from boreholes/hand pumps in order to evaluate fluoride and other physicochemical parameters. Samples are collected in high quality polyethylene bottles with a one liter capacity. Testing is done directly in rinsed water bottles without any additional reagents to avoid contamination and sampling. The fluoride concentration of the sample is determined by the ion electrode method. The fluorine concentration in groundwater is closely related to soil quality, water quality and water level. The main characteristics of groundwater are defined by the horizontal outflow and the relationship. Further sample survey of 840 respondents of male and female age between 15 to 60 years at different study points (20 from each settlement) used to examine the Prevalent Clinical Symptoms of Fluorite Patients, like dental and skeletal fluorosis, joint pains and gastrointestinal diseases with the help of medical practitioner.

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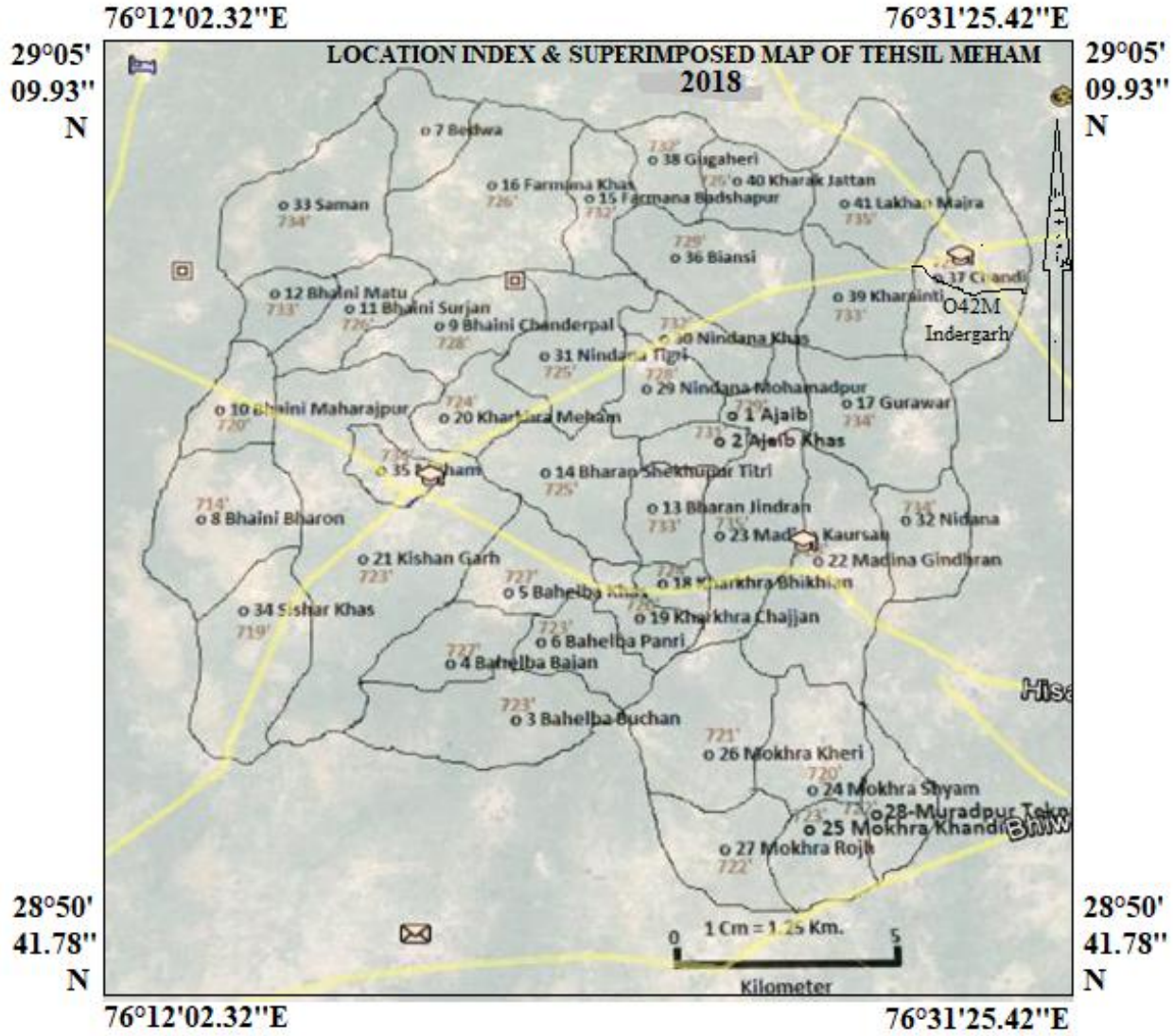
Figure 1



Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth

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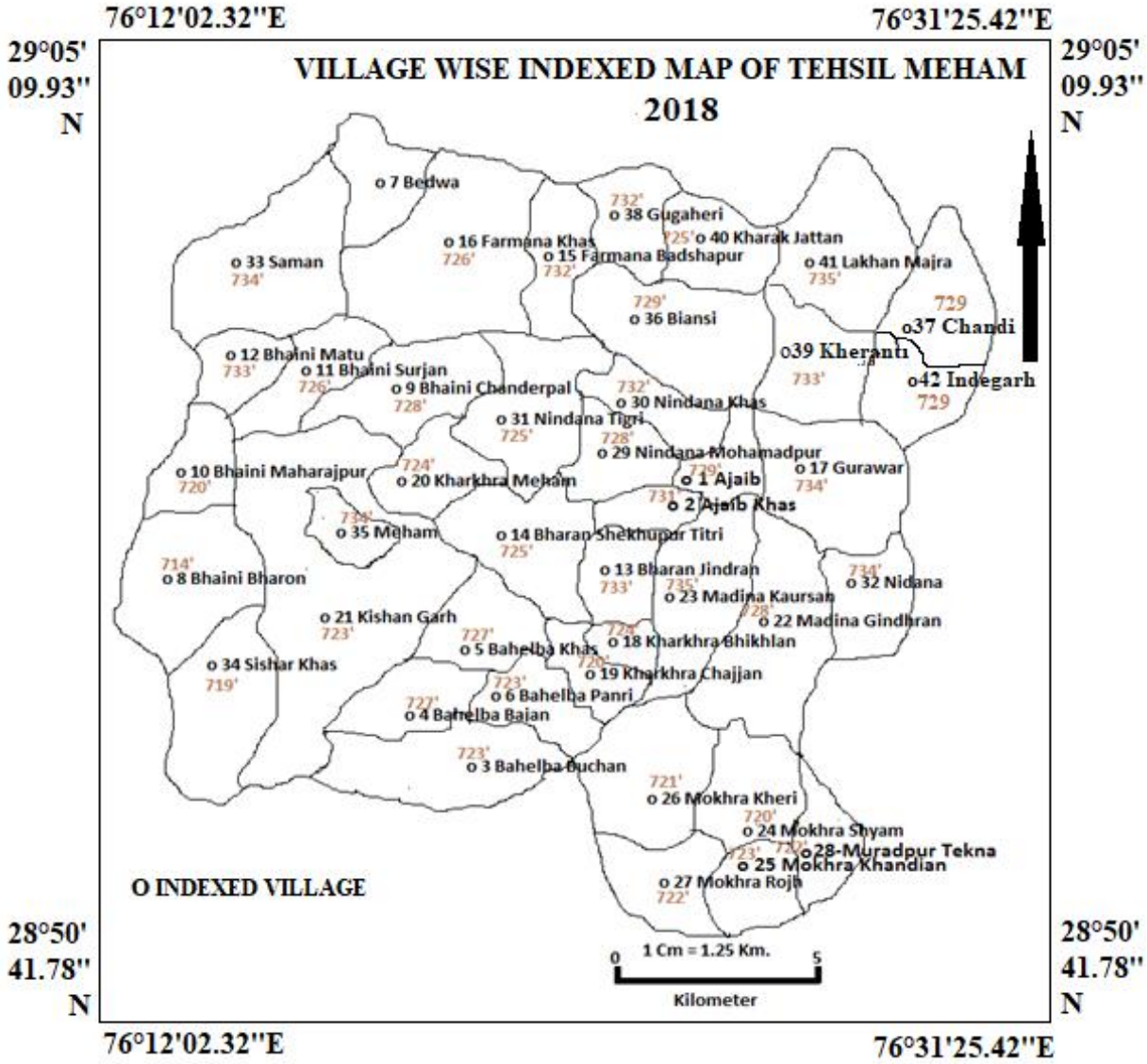
Figure-2



Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth

Note: 1M-Ajaib,2M-Ajaib Khas,3M-Bahelba Buchan,4M-Bahelba Bajan,5M-Bahelba Khas,6M Bahelba Panri,7M-Bedwa,8M-Bhaini Bharon,9M-Bhaini Chanderpal,10M-Bhaini Maharajpur,11M-Bhaini Surjan,12M-Bhaini Matu,13M-Bharan Jindran,14M-Bharan Shekhupur Titri,15M-Farmana Badshapur,16M-Farmana Khas,17M-Gurawar,18M-Kharkhra Bhiklan,19M-Kharkhra Chajjan,20M-Kharkhra Meham,21M-Kishangarh,22M-Madina Gindhran,23M-Madina Kaursan,24M-Mokhra Shyam,25M-Mokhra Khandian,26M-Mokhra Kheri,27M-Mokhra Rojh,28M-Muradpur Tekna,29M-Nindana Mohamad pur,30M-Nindana Khas ,31M-Nindana Tigri,32M-Nidana,33M-Saman,34M-Sishar Khas,35M-Meham,36M-Bainsi,37M-Chandi,38M-Gugaheri,39M-Kherainti,40M-Kharak Jatan,41M-Lakhan Majra,42M-Indergarh

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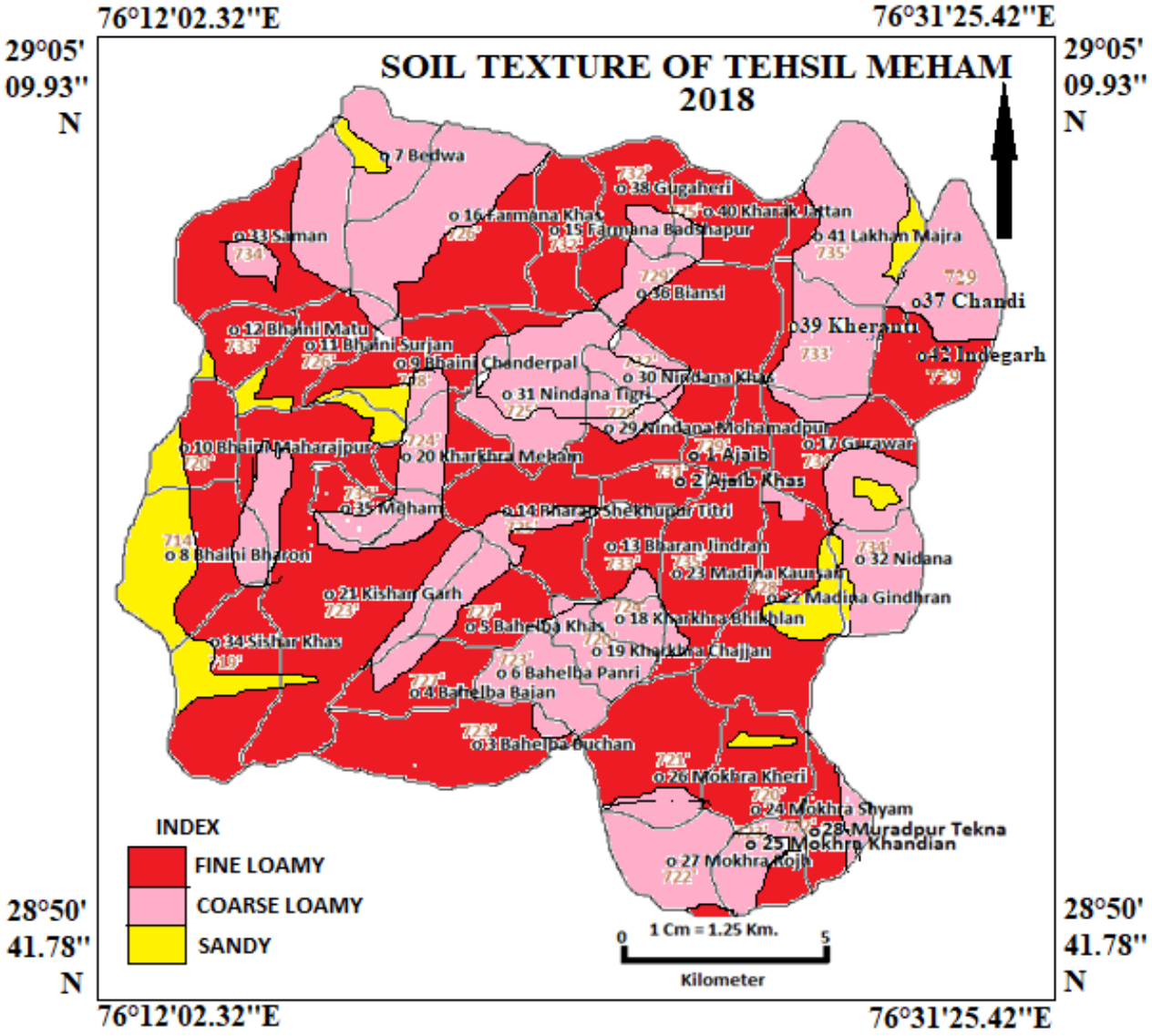
Figure-3



Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth

In the study area soil texture varies from Fine Loamy, Coarse Loamy to Sandy Soil. Soil texture is one of the major determinants for water contaminations. In the Study area (31767.7 Hectare) 58.0 percent area identified with Fine Loamy Soil,(19717.9 Hectare) 36 Percent Coarse Loamy Soil and (3286.4 Hectare) 6.0 Percent Sandy soil. (Figure-3).

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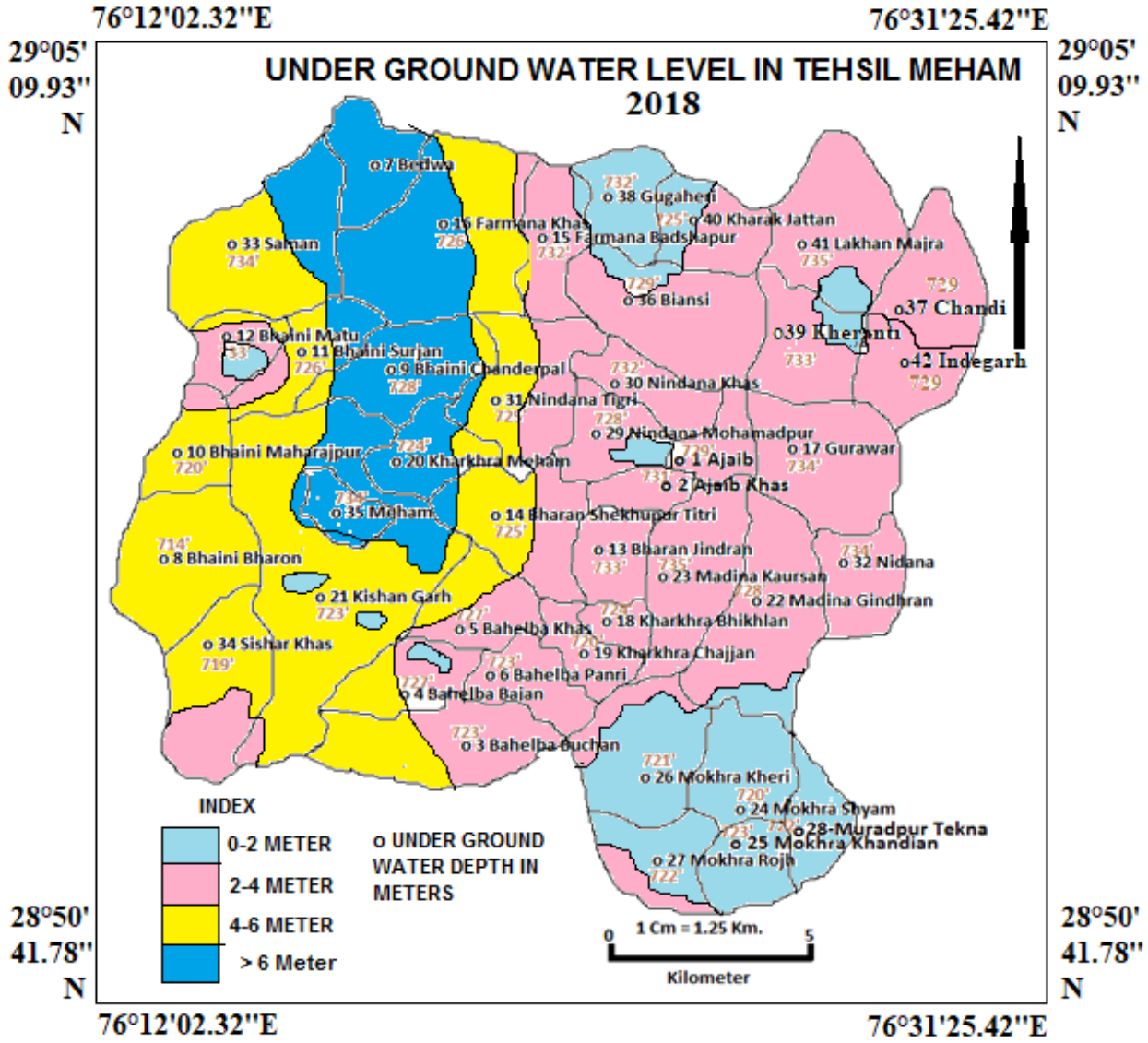
Figure-4



Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth

It has been observed that underground water level in the study area varies from 2 Meter to more than six meter. Low level of ground water is directly linked with high fluoride contamination. In the study area (4,382 Hectare) 8 Percent area identified with Less than 2 meter water level, (35,054.5 Hectare) 64 Percent with 2 to 4 meter water level (12,049.5 Hectare) 22 Percent 4 to 6 Meter water level and (3,286 Hectare) 6 Percent area more than 6 meter water level (Figure -4)

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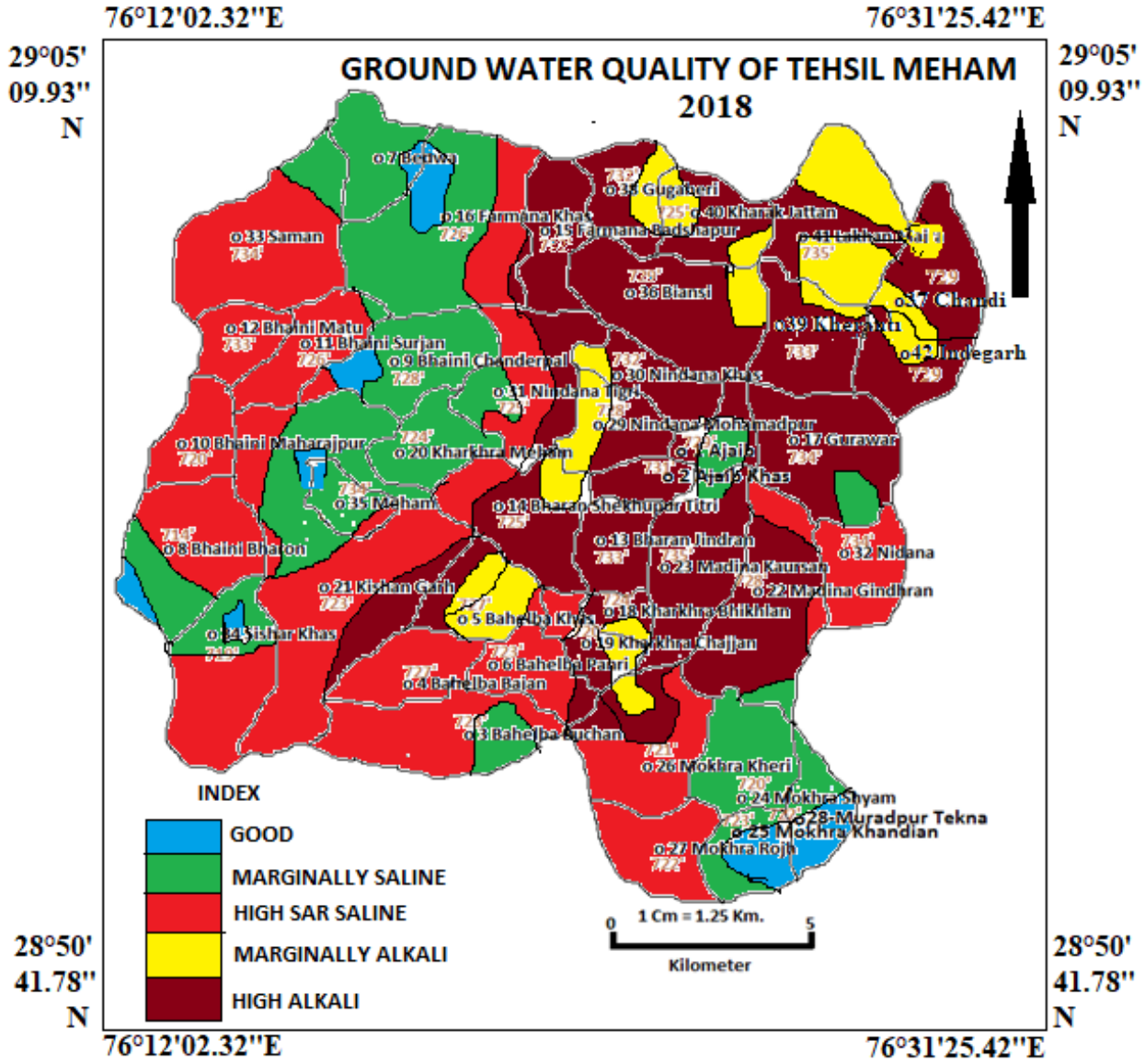
Figure-5



Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth

It has been observed that underground water quality in the study area varies from Good Quality, Marginally Saline, High SAR Saline, Marginally Alkali and High Alkali..Quality of water too is directly linked with high fluoride contamination. In the study area (1,369 Hectare) 2.5 Percent area identified with Good Quality Water , (10954.5 Hectare) 20 Percent with Marginally Saline , (15063 Hectare) 27.5 Percent with High SAR Saline ,(7120 Hectare) 13 Percent with Marginally Alkali and (20265.5 Hectare) 37 Percent area with High Alkali (Figur -5). It is remarkable that (27385.5 Hectare) 50 Percent area has alkali ,(26017.5 Hectare) 47.5 Percent salty has water characteristic and only 2.5 percent area is marked with Good Quality Water.

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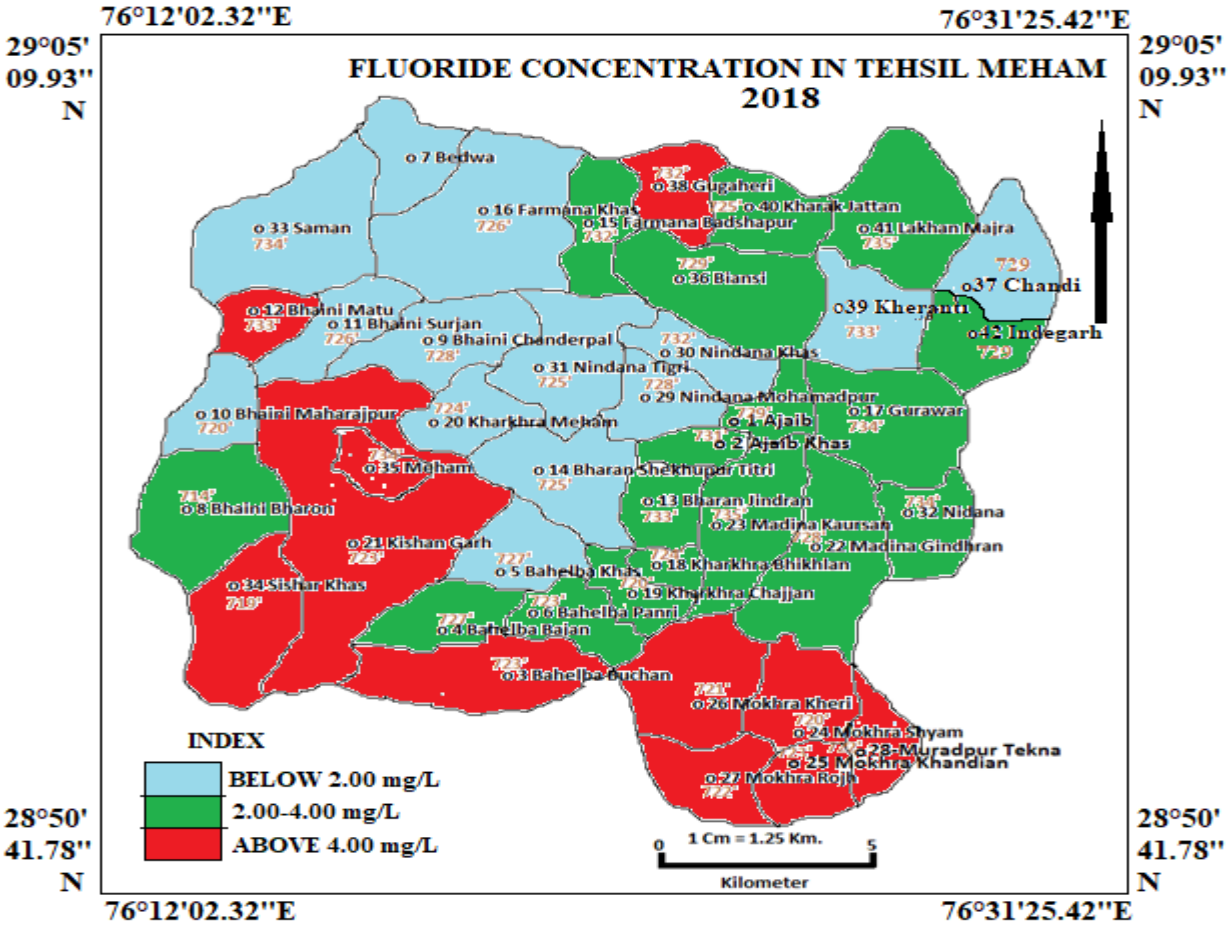
Figure-6



Source: Field Survey with GPS and Image@2018 Landsat/Copernicus CNES/Airbus, Google Earth

Table-1

Level of Fluoride Concentration in Ground Water in the Study Area-2018

Sr. No.	Contagion Level (mg/l)	Number of Villages	Name of the Village
1	High – above 4.00 mg/l	11	3M-Bahelba Buchan,12M-Bhaini Matu,21M-Kishangarh,24M-Mokhra Shyam,25M-Mokhra Khandian,26M-Mokhra Kheri,27M-Mokhra Rojh,28M-Muradpur Tekna, 34M-Sishar Khas,35M-Meham, 38M-Gugaheri,
2	Medium-2.00-4.00 Mg/l	17	,1M-Ajaib,2M-Ajaib Khas, 4M-Bahelba Bajan, 6M BahelbaPanri, ,8M-Bhaini Bharon, 13M-Bharan Jindran, 15M-Farmana Badshapur, 17M-Gurawar, 18M-Kharkhra Bhiklan,19M-Kharkhra Chajjan, 22M-Madina Gindhran,23M-Madina Kaursan, 32M-Nidana, 36M-Bainsi, 40M-Kharak Jatan,41M-Lakhan Majra,42M-Indergarh,
3	Low-Below 2.00 mg/l	14	,5M-Bahelba Khas, 7M-Bedwa, 9M-Bhaini Chanderpal,10M-Bhaini Maharajpur,11M-Bhaini Surjan, 14M-Bharan ShekhupurTitri, 16M-Farmana Khas, 20M-Kharkhra Meham, 29M-Nindana Mohamad pur,30M-Nindana Khas ,31M-Nindana Tigri, 33M-Saman, 37M-Chandi, 39M-Kherainti,

Source: Field Survey

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Analysis of the Results:Most of the fluorine pollution in the study area is a natural process, namely the leakage of foods containing fluorine, and there is no visible pollution to humans. Fluorite, apatite, mica and other minerals participate in the rock-water interaction, causing fluoride to be released into the soil. People living in this area often suffer from dental and skeletal fluorosis such as mottled teeth, deformed ligaments, curvature of the spine and aging problems. Because there is currently no published information about the presence of fluoride and health problems in the groundwater in the study area. To this end, the researchers investigated the fluoride content of groundwater in the study area and the symptoms of the population. Of the 420 samples recorded, the groundwater data of 126 samples (30%) were within the allowable range for the study area, 14 samples (3.34%) were lower than expected yes, the remaining 280 (66.67%) data were within the allowable range for the study area. was determined to be. . is shown as not met. It exceeds the maximum fluoride limit (2.00 mg/It) set by ISI and WHO. (Annexure 1).

In this study, the fluoride content of 113 samples of 11 village samples exceeded 4 00 mg/lt. However, the level of fluorine pollution in the salt water region is high, the soil structure is fine loam and the groundwater level is low. (Table 1) Among 170 samples from 174 villages, poor water quality was loam, marginal saline and low groundwater. Fluoride content (2.00 to 4.00 mg/Its) is recorded in this category. The remaining 133 samples from 14 villages in the study area were below the fluorine limit (> 2.00) determined by the World Health Organization, especially from deep waters, soil samples such as coarse soil to sand and water quality ranging from good to alkaline (Figure 3).

It has been determined that the fluorine content in drinking water exceeds the permissible limit, and drinking it for 5 to 10 years will cause dental fluorosis. 4 to 8 mg/L for 15 to 20 years can cause severe dental and cartilage fluorosis, and drinking more than 8 mg/L for 5 to 10 years or longer can cause severe dental and bone fluorosis. Therefore, drinking water for 15 to 20 years is sufficient for the development of dental and cartilage fluorosis. There are symptoms of dental fluorosis and skeletal fluorosis that threaten the health of the population in the study area. Immediate action must be taken and a way to provide safe water from other sources must be found. The health of people in different villages varies according to the severity of fluorosis, which is directly related to the fluorine content in drinking water. In this region, more severe fluorosis, joint pain, diarrhea and excessive thirst are seen.

The fluoride concentration in the soil is high. (Table-2,3,4&5) The results showed that 491 (58.45%) out of 840 participants had fluoride symptoms. Symptoms included dental caries in 74 patients (15.07%), mottled enamel in 82 patients (16.70%), skeletal fluorosis in 92 patients (18.73%), spotted teeth with white spots in 40 patients (8.15%), mottled teeth were present. There were black teeth (18.33%), caries, pitting, 56 patients (11.41 people) had joint rheumatism and cervical spondylosis, 37 (7.54%) intestinal pain, 20 (4.07%) severe bone pain . for fluorosis. Learn about safe drinking water in fluorosis villages. Keep the fluoride in your water below 1 mg/l by diverting water from a safe source or using a treatment process to remove fluoride from existing water.

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Table-2
Correlation of Fluoride Content in Ground Water, Quality of Water, Level of Water and Texture of Soil in the Study Area-2018

Variable	Fluoride Content in Water	Quality of Water r-value(p-value)	Level of Water r-value(p-value)	Texture of Soil r-value(p-value)
Fluoride Content in Water	1	0.513 (P= < .00001)	0.835 (P= < .00001)	0.642 (P= < .00001)
Quality of Water		1	0.312 (P= < .000063)	0.689 (P= < .00001)
Level of Water			1	0.454 (P= < .00001)
Texture of Soil				1

*0.01 Significance Level

Table-3
Regression Analysis of Fluoride Content in Ground Water, Quality of Water, Level of Water and Texture of Soil in the Study Area-2018

Variable	Regression Analysis
Fluoride Content in Ground Water V/S Quality of Water	0.575
Fluoride Content in Ground Water V/S Level of Water	0.774
Fluoride Content in Ground Water V/S Texture of Soil	0.688
Quality of Water V/S Level of Water	0.451
Quality of Water V/S Texture of Soil	0.518
Level of Water V/S Soil Texture of Water	0.413

Table-4
Correlation of Fluoride Content in Ground Water and Clinical Symptoms in the Study Area-2018

Variable	Fluoride Content in Water	Clinical Symptoms r-value(p-value)
Fluoride Content in Water	1	0.912 (P= < .00001)
Clinical Symptoms		1

*0.01 Significance Level

Table-5
Regression Analysis of Fluoride Content in Ground Water and Clinical Symptoms in the Study Area-2018

Variable	Regression Analysis
Fluoride Content in Ground Water V/S Clinical Symptoms	0.984

Conclusion It is concluded that, the role of drinking water in the increasing incidence of fluorosis disease is obvious. It is therefore, essential that the village's affected by flnorosis be

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supplied with safe drinking with requisite fluoride content, either by changing the water source to safer once or by adapting suitable treatment technique to remove fluoride in the existing drinking water sources. Since vegetables and milk are also significant sources to increase the fluoride content in human being, their fluoride content could be taken into account while fixing the safe level of fluoride in drinking water. Fluoride in groundwater is mainly due to dissolution from fluoride bearing minerals like Fluorspar, Fluorite, etc. In this area(280) 66.67% samples are found exceeding permissible limit(*491) 58.45%* percent of total sample observed with Clinical Symptoms. Since these people are dependent on the groundwater for domestic use. So, remedial measures such as defluoridation techniques and rain water harvesting are needed.Nutritional diet such as calcium and phosphorus rich food should be recommended to those affected with fluorosis. As decreases the rate of accumulation of fluoride in the human body, human health will be improved. Now, urgent need to conduct environmental awareness programme on how to reduce the fluoride and fluorosis content of the ground water through new innovative techniques, for better health. The concerned government and non-government authorities should plan to supply the safe and good quality drinking water to build sound body citizens in the region.

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Annexure-1

Fluoride Content Level in Ground Water and Prevalent Clinical Symptoms of Fluorite Patients in Tehsil Meham 2019-20

S. N.	Name	Location	Altitude	Soil Texture	Ground Water Level in Meetrs	Ground Water Quality	Fluoride level (1.0 - 1.5 mg/l)	Prevalent Clinical Symptoms of Fluorite Patients								
								Tooth Decay	Dental Fluorosis or Mottled Enamel	Skeletal Fluorosis	Dental Mottling-White Patches	Dental Mottling- Black Stain and pitting teeth	Rheumatic in Joints Cervical spines	Gastro-Intestinal discomfort	Crippling Skeletal Flurosis	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1 M	Ajaib	28º58'N 76 º 25'E	729'	FL	<4	HA,MS	3.90	1	3	2	3	1	1	1	1	13
2 M	AjaibKhas	28 º 58'N 76 º 25'E	731'	FL	<4	HA	3.60		2	3	2	2	1	2		12
3 M	Bahelba Buchan	28 º 53'N 76 º 20'E	723'	FL, CL	<6	HSS,MS	4.20	1	3	3		4	2	1	2	16
4 M	Bahelba Bajan	28 º 54'N 76 º 19'"E	727'	FL, CL	<6	HSS,HA	3.90	1		2	1	3	1	2	1	11
5 M	Bahelba Khas	28 º 55'N 76 º 20'E	727'	CL, FL	<4	MA,HSS	1.60	1	1		1	2	1	1		07
6 M	BahelbaPanri	28 º 54'N 76 º 21'E	723'	CL	<4	HSS,HA	3.10	3	2	2		1	1	2		11
7 M	Bedwa	29 º 03'N 76 º 17'E	723'	CL, SN	<8	MS,G	1.40	1		1	1	1	1	1		06
8 M	BhainiBharon	28 º 56'N 76 º 13'E	714'	SN,FL	<6	HSS,MS,G	3.50	1	3	1	1	3	1	1	1	12
9 M	BhainiChanderpal	29 º 00'N 76 º 18'E	728'	FL,CL,SN	<8	MS,G	1.30		1	1	1			2	1	06

International Journal of Research in Economics and Social Sciences(IJRESS)
Available online at: http://euroasiapub.org
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ISSN(o): 2249-7382 | Impact Factor: 6.939 |

10 M	BhainiMaharajpur	28° 58'N 76° 13'E	720'	FL, SN	<6	HSS	1.55	2		1	1	1	1	1		07
11 M	BhainiSurjan	29° 00'N 76° 16'E	726'	CL, SN	<8	HSS	1.50	2	1		1	1	1	1		07
12 M	BhainiMatu	29° 00'N 76° 14'E	733'	CL, SN	<4	HSS	4.35	4	3	3		2		2	1	15
13 M	BharanJindran	28° 57'N 76° 23'E	732'	FL, CL	<4	HA	3.70	1	1	2		3	1	1	1	10
14 M	BharanShekhupurTitri	28° 57'N 76° 21'E	725'	FL, CL	<6	HA	1.60	1			1	1	1	2	1	07
15 M	FarmanaBadshapur	29° 02'N 76° 21'E	732'	FL	<4	HA	2.90	1	2	3	1	3	1			11
16 M	FarmanaKhas	29° 02'N 76° 19'E	726'	CL, FL	<8	MS,G	1.10	2				1	1	1	1	06
17 M	Gurawar	28° 59'N 76° 28'E	734'	FL, CL	<4	HA	2.95	3	2	2	1	2	2		1	13
18 M	KharkhraBhiklan	28° 56'N 76° 23'E	724'	CL	<4	HA,MA	2.85	2	2	4	1	2	1			12
19 M	KharkhraChajjan	28° 55'N 76° 23'E	720'	CL, FL	<4	HA,MA,HSS	3.20		2	3	4	1		1	1	12
20 M	KharkhraMeham	28° 58'N 76° 18'E	724'	FL, CL	<8	MS,HSS	1.20		2		1	1	1			05
21 M	Kishangarh	28° 56'N 76° 17'E	723'	FL, SN	<6	HSS,MS,HA,G	6.10	1	3	4	1	5	3	1	1	19
22 M	MadinaGindhran	28° 56'N 76° 27'E	728'	FL,SN,CL	<4	HA	3.60	2	3	4	2	1	2			14
23 M	MadinaKaursan	28° 56'N 76° 25'E	735'	FL, CL	<4	HA,MS	3.10	3	2	3		3			1	12
24 M	MokhraShyam	28° 52'N 76° 27'E	720'	FL, SN	<2	MS	6.05		4	3	3	5	3	1	1	20
25 M	MokhraKhandian	28° 52'N 76° 27'E	723'	CL, FL	<2	MS,G	6.00	1	4	4	2	4	2	1	1	19
26 M	MokhraKheri	28° 53'N 76° 25'E	721'	FL,CL	<4	HSS,HA,MA	5.80	2	3	4		5	4			18
27 M	MokhraRojh	28° 51'N 76° 25'E	722'	CL, FL	<4	HSS,MS	5.70	5	3	3		4	3			18
28 M	MuradpurTekna	28° 52'N 76° 28'E	722'	FL, CL	<2	G,MS	5.65	4	4	5	1	4				18
29 M	NindanaMohamadpur	28° 59'N 76° 23'E	728'	CL ,FL	<4	HA,MA	1.50	2		1		1	1	2		07
30 M	NindanaKhas	29° 00'N 76° 23'E	732'	CL, FL	<4	HA	1.65	1	1	1		1	1	1	1	07
31 M	NindanaTigri	28° 59'N 76° 21'E	725'	CL, FL	<6	HSS,HA,MS	1.50	2	1			1		2		06
32 M	Nidana	28° 57'N 76° 29'E	734'	FL, SN	<4	HSS	3.80		3	3		3	1	2	1	13
33 M	Saman	29° 02'N 76° 14'E	734'	FL, CL	<8	HSS,MS	1.60	2	2			1	1			06
34 M	SisharKhas	28° 55'N 76° 14'E	719'	FL, SN	<6	HSS,MS,G	5.85	3	3	4		2	3	2	1	18
35 M	Meham	28° 57'N 76° 16'E	714'	CL, FL	<8	MS,HSS,G	5.90	3	3	4	2	4	2	1		19
36 M	Bainsi	29° 01'N 76° 23'E	729'	FL, CL	<4	HA,MA	3.70	4	4	3		1	1			13
37 M	Chandi	29° 01'46.06"N 76° 30'05.11"E	732'	CL, FL	<4	HA,MA	1.65	2			2	1	2			07

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38 M	Gugaheri	29° 03'N 76° 23'E	732'	FL, CL	<2	HA,MA	4.60	4	3	2	1	3	3			16
39 M	Kherainti	29° 01'N 76° 27'E	733'	CL, FL	<4	HA	1.50	2			1	1	1		1	06
40 M	KharakJatan	29° 03'N 76° 25'E	725'	FL, CL	<4	HA,MA	3.10	1	2	4	1		2	1		11
41 M	Lakhan Majra	29° 03'N 76° 27' E	735'	CL, FL	<4	MA,HA	2.70	1	2	3		4	2			12
42 M	Indergarh	29°01'16.27"N 76° 30'24.86"E	730	CL	<4	HA,MA	2.80	2	2	4	3	1		1		13
	Meham Tehsil							***74***	***82***	***92***	***40***	***90***	***56***	***37***	***20***	***491***

Source: Field Survey