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RESEARCH ARTICLE

Comparative study of aquifer characteristics and ground water potential of Dun Valley and Terai Area: Case study from Dang Valley and Kapilvastu area

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ABSTRACT

This study compares aquifer characteristics in the Dang Valley and Kapilvastu area using litholog and pumping test data. It analyzed 20 lithologs and pumping tests from Dang and 27 from Kapilvastu. Subsurface formations were interpreted from lithologs, and key aquifer parameters were calculated using the Jacob method. The study found that Dang Valley and Kapilvastu share different subsurface formations, with groundwater typically occurring below the third or fourth layer. Pumping test analysis provided key aquifer parameters, including transmissivity, hydraulic conductivity, and specific capacity. The results show that the average transmissivity in Dang Valley is 2689.84 m^2/day, while in the Kapilvastu area it is 2296.58 m^2/day, indicating that the most of the aquifer in Dang Valley has a consistent capacity to transmit groundwater as compare to Kapilvastu areas, but highest transmissibility obtained in Valwad Kapilvastu (7120 m^2/day). Similarly, the average hydraulic conductivity is higher in Kapilvastu (246.87 m/day) compared to Dang Valley (123.32 m/day), suggesting that the aquifer materials in Kapilvastu allow water to move more freely. The specific capacity, is greater in Kapilvastu (229.71 m^3/day) than in Dang valley (194.72 m^3/day). The Dun Valley experienced a greater decrease in water levels compared to the Terai, with an average drawdown of 18.43 meters and a maximum drawdown of 37 meters.

Overall, these comparisons show that the central part of the Dang Valley including Dharna, Guruwagaun, Goltakuri, and Gairtilawari as well as in the northeastern part of Kapilvastu such as Bhaluwad, Mormi, Banganga, Nibuwa, and Gorusinge, the aquifer characteristics were found to be similar, indicating areas with good groundwater potential. In contrast, the peripheral areas of the Dang Valley and the southeastern part of Kapilvastu including Fattepur, Purnihawa, and Semari as well as the western areas such as Jawabhari, Birpur, and Turuntapur, have aquifers that showed relatively poor groundwater potential, which is likely due to differences in the depositional environment and the nature of the sediments.

Keywords: ***Hydraulic conductivity, Transmissibility, Specific capacity, Drawdown***

INTRODUCTION

Aquifer characterization specifies the determination of its hydraulic properties and its distribution pattern (Todd, 2001; Pandey at al., 2021). The aquifers develops in different geological phenomena and the environment of the aquifer formation time and later on stages plays significant role in aquifer development (Todd, 2001). The sedimentation and stratification of aquifer systems in inner mountain valley and Terai reason are different (Sharma, 1974; Shrestha et al., 2018). The mode of aquifer formation significantly controls the groundwater potential of the area. Inter-fingering modes are generally develops in Dun valley area. Pathak (2018) and Pathak and Rao (1998) study shown that linear stratification are seen in Bhabar and Terai area with different size of sediment depositions. In this study groundwater potential and aquifer characteristics of two similar ground but having different geological setting is comparing and attempt to show differentiating groundwater potential with respect to aquifer characteristics (Pandey at al., 2021). The understanding of aquifer system with their characteristics will not only help to know the groundwater potential but also planning for groundwater management and aquifer preventing from contamination. Urbanization in the Terai is rapid and has risk of aquifer pollution because of increasing landfill sites and other influents (Panthee, 2008).

The climate of both study area is tropical to subtropical. The mean annual rainfall of Dang valley ranges from 5 mm to 140 mm in month of April and June respectively and The rainfall of the Kapilvastu district is maximum about 500 mm-600 mm in June to August and minimum 0-5 mm in March and the temperature reached maximum about 40-45°C in May and fall down 10-15° C in the months of March.

The Babai River is one of the major rivers in the Dang valley, flowing east to west and passing through the southern end of the valley. Other perennial streams, such as the Sisne Gwar, Baulaha and the Katwa, originate in the lesser Himalaya and join the Babai River on the south, creating alluvial fan plains, sand and gravel bars, depositional basins and other depositional landforms. The subsurface is underlain by fluvio-lacustrine sediments that form aquifer systems ranging from unconfined near the recharge areas to semi-confined or confined (Rao and Piya, 1996) at depth, a pattern observed in Dun Valley (Dang) and in the Terai plains (Kapilvastu), where tubewell investigations and regional hydrogeological surveys document layered sand–silt–clay sequences controlling confinement and yield. The erosional activity of the rivers has indented the river terrace of the valley by 8 to 15 m and has created badland topography in the northern part. The Banganga is the main river of Kapilvastu flowing from north to south and middle part of Kapilvastu area and beside the Banganga River there are other small rivers in the Kapilvastu area.

Study area

The study area lies in Dang valley and Kapilvastu district of Lumbini Providence of Nepal. Dang valley lies between longitudes 82° to 82° 45' E and latitude 28° to 28° 10' N and Kapilvastu area is bounded between longitude 27° to 27° 65' 41" E and latitude 82° to 82° 99' 31" N (Fig. 1). The total study area at Kapilvastu and Dang valley are about 1738 km^2 and 2400 Km^2. The Valley elevations range from 600 meters along the Babai with alluvial slopes gradually rising northward to 700 meters along the base of the Mahabharat Range. The Kapilvastu area is situated at a height of 93 to 1,491 meters. Both of the study area are easily accessible from motor road i.e. Mahendra (East –West) Highway. The Dang valley is about 25 km north from Lamahi and the study area of the Kapilvastu district is near Chandrauta surrounding which is easily accessible by motor road from east-west Highway.

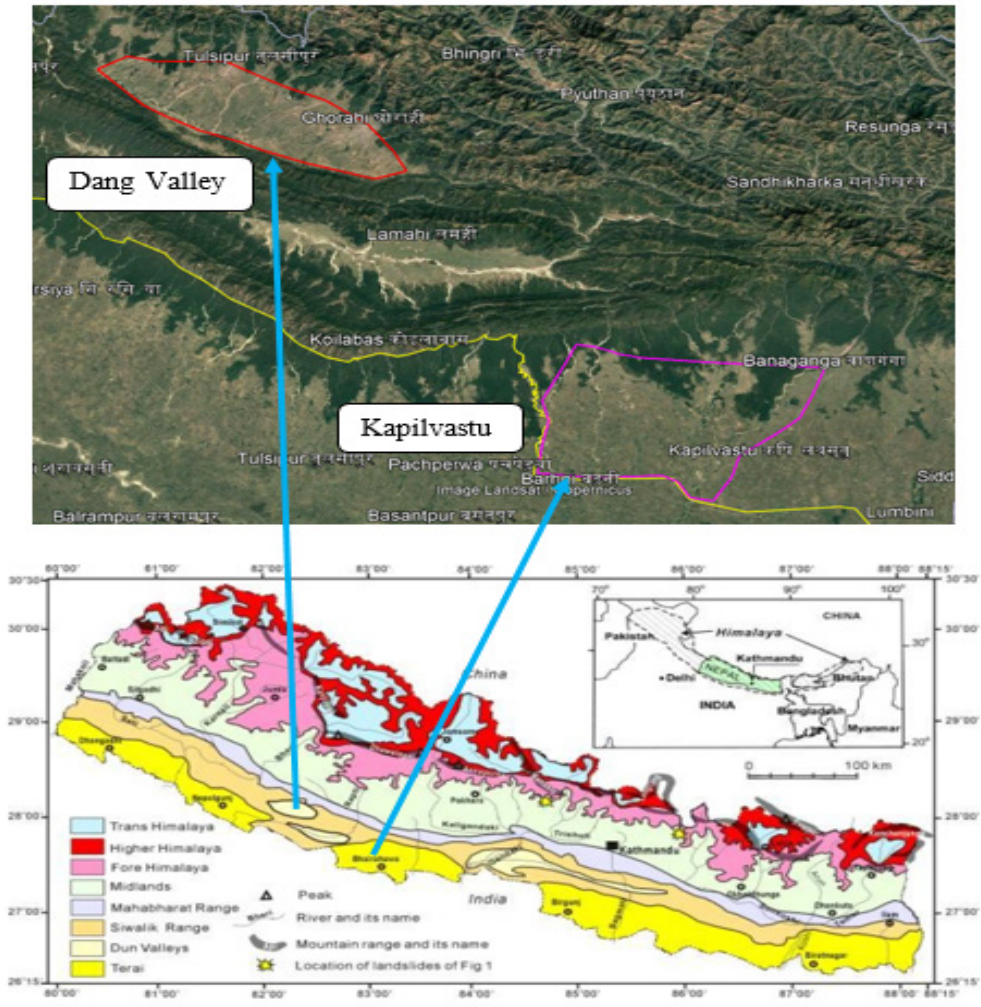


Fig. 1: Study area location map

Hydro-geological setting of the study area

Hagen (1969) classified Nepal into ten geomorphic regions, including the Dun Valley, with Dang Dun Valley being a tectonic Dun Valley within the Siwalik range. Dang Valley stretches 55 km WNW-ESE and is up to 18 km wide, surrounded by Siwalik formations on three sides and Lesser Himalaya to the north. The Siwalik rocks mainly consist of Neogene conglomerates, sandstones, and clays. The valley is a tectonic depression filled with fluvio-lacustrine deposits, alluvial fans, and river terraces formed by tributaries of the Babai River (Rao and Piya, 1996). These sediments include angular to sub-angular pebbles and cobbles derived from the Main Boundary Thrust area, with terraces located along local rivers and their tributaries. Groundwater occurs predominantly below the third and fourth sedimentary formations in the valley, stored within the porous and permeable alluvial deposits. The aquifer system is thus controlled by the depositional environment, sediment type, and tectonic activity, making Dang Valley an important groundwater reservoir in the region.

Similarly, Kapilvastu district, located in Nepal's Terai region south of the Siwalik range and bordered by the Main Frontal Thrust (MFT), consists of thick sediment deposits formed by mountainous outwash from the softer geological ranges. Morphologically, it has two alluvial plains: the northern Bhabar Zone and the southern Gangetic plain. The Bhabar Zone contains alluvial materials beneath it, while the Gangetic plain lies directly to the south. These sediments form the main aquifer for groundwater in the area. The northern part has coarse and uniform alluvial sediments, while the Gangetic alluvium consists of mixed layers of silt, clay, sand, pebbles, and gravel, with higher silt and clay content near the Churia foothills.

Methodology

A field survey was undertaken to determine the hydrogeological conditions in the study area, and the preliminary data was collected at the Groundwater Irrigation Development Division (GWIDD) Lamai, Dang. Deep tubewells selected for present study were located in a location map (Fig.1). The study was conducted during the monsoon. Geological information regarding the deep tubewell section of the fluvial terrace was correlated with the nearest Fence diagram band these data was obtained from boreholelogs. Transmissivity is very useful and important parameter for the estimation of aquifer potential and calculated using Jacob's curve method of pump test data for analysis of aquifer characteristics is expressed as:

$T=2.303Q/4\pi\Delta S$ ……..…… (I)

Where,

Q is discharge measured in m^3/day;

ΔS is the change in drawdown in meters.

and hydraulic conductivity from geophysical methods is determined using the following formula:

$T = Kb$…….. (II)

$K=T/b$……...……. (III)

Where T is transmissivity measured in m^2 /day,

b is the aquifer thickness measured in meters and

K is hydraulic conductivity measured in m/day.

Specific capacity is a quantity that which a water well can produce per unit of drawdown. It is normally obtained from a step drawdown test. Specific capacity is expressed as:

$Sc = Q/h_0-h$…… (IV)

Where;

Sc is the specific capacity; m^2/day or USgal/day/ft)

Q is the pumping rate; m^3/day or USgal/day),

and h_0-h is the drawdown; m or ft)

The above parameter showed the potential of groundwater in the both areas and the possibility of future extraction for irrigation and other human needed purpose.

Result

The observation well data from both study area were analyzed. The detailed bore log study and pumping test data analysis on the both study area were summarized in the following subsections.

SUBSURFACE GEOLOGY

Dang Valley is an intermountain basin filled with fluvio-lacustrine deposits, including alluvial fans and river terraces mainly formed by tributaries of the Babai River. These sediments, observed around areas like Jaspur village and northwest of Ghorahi, consist largely of angular to sub-angular pebbles, cobbles, sand, gravel, and boulders transported from surrounding mountains. The sediment distribution is relatively uniform and dominated by coarse materials such as sand, gravel, and boulders, especially on the valley's periphery. The northern part of the valley has more boulders and hard rock formations, while clay and silt are more common in the southern parts along the Babai River. Overall, the subsurface lithology is composed of mixed layers of sand, gravel, silt, clay, and Quaternary detritus, showing little variation across the valley shown in (Fig. 2).

The Kapilvastu area, located in the Terai region, is characterized by thick alluvial deposits, primarily formed from sediments from mountainous regions south of the Siwalik range. The geology is divided into two main units: the Bhabar Zone and the southern Gangetic plain, with silt and clay being the primary aquifer system shown in (Fig. 3).

The comparative study of these wells shows that the peripheral part of the Dang valley and north eastern part of the Kapilvastu area has coarse sand and gravel. Towards the south and especially along the Babai River and southern part of Kapilvastu area are dominant by clay and silt. Intermixing of gravel and fines is dominant in the middle part of the both studied area. The subsurface lithology is composed of boulder, cobble, pebble, gravel, and sand with intercalation of clays as well as detritus of quaternary age.

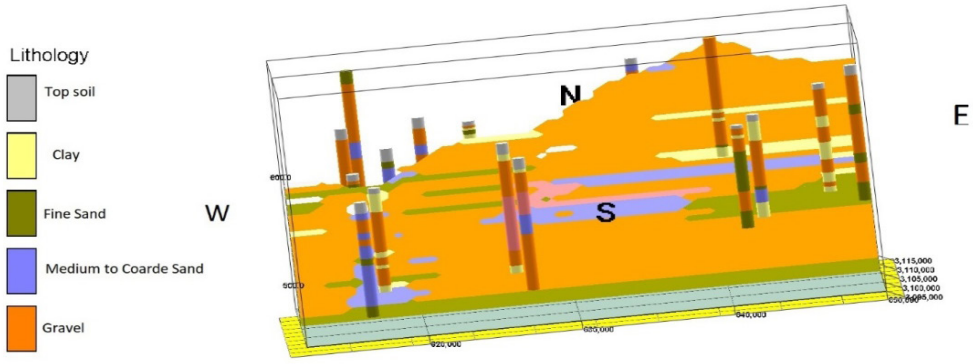


Fig. 2: Fence diagram showing the different layers of aquifer at Dang Valley

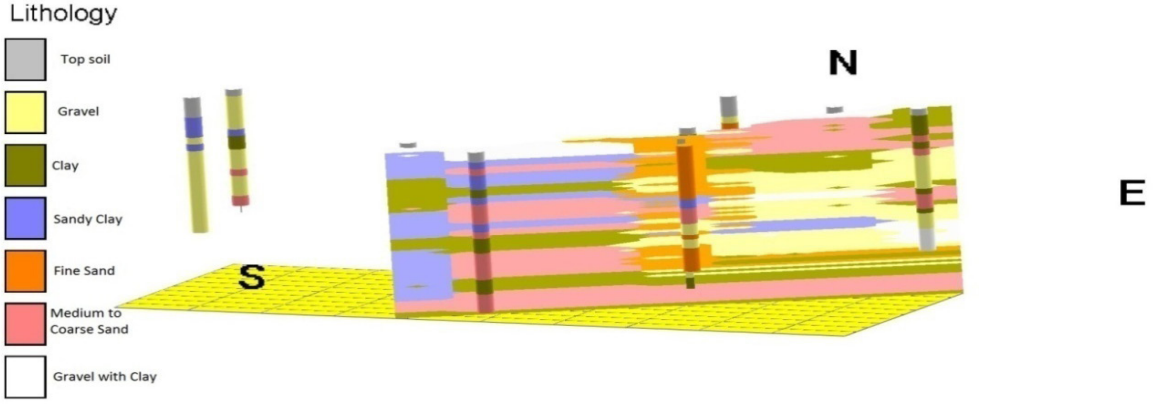


Fig. 3: Fence diagram showing the different layers of aquifer at Kapilvastu area

AQUIFER CHARACTERISTICS

The characteristics of an aquifer depend on the amount of groundwater it can discharge. The different types of aquifers in both areas were studied, and their characteristics are explained in the following sections. Specific Capacity (Sc), Hydraulic conductivity (K) and transmissivity (T) were calculated using available pumping test data. These data were analyzed using Jacob's type curve method for confined aquifers, and three empirical formulas were also used. The results are presented in Tables 1 and 2.

TRANSMISSIVITY

Transmissivity values in Kapilvastu range from 302 to 7120 m^2/day, with higher values in the north eastern regions, indicating productive aquifers. In Dang Valley, transmissivity varies more widely, from 95.4 to 4605.12 m^2/day, with the highest values in the central and western parts. Although both areas show spatial variation, Dang valley generally has higher and more consistent transmissivity, suggesting more extensive and conductive aquifer zones compared to Kapilvastu. But north eastern part of kapilvastu (7120 m^2/day) shows more transmissible than Dang valley shown in (Fig. 4 and 5).

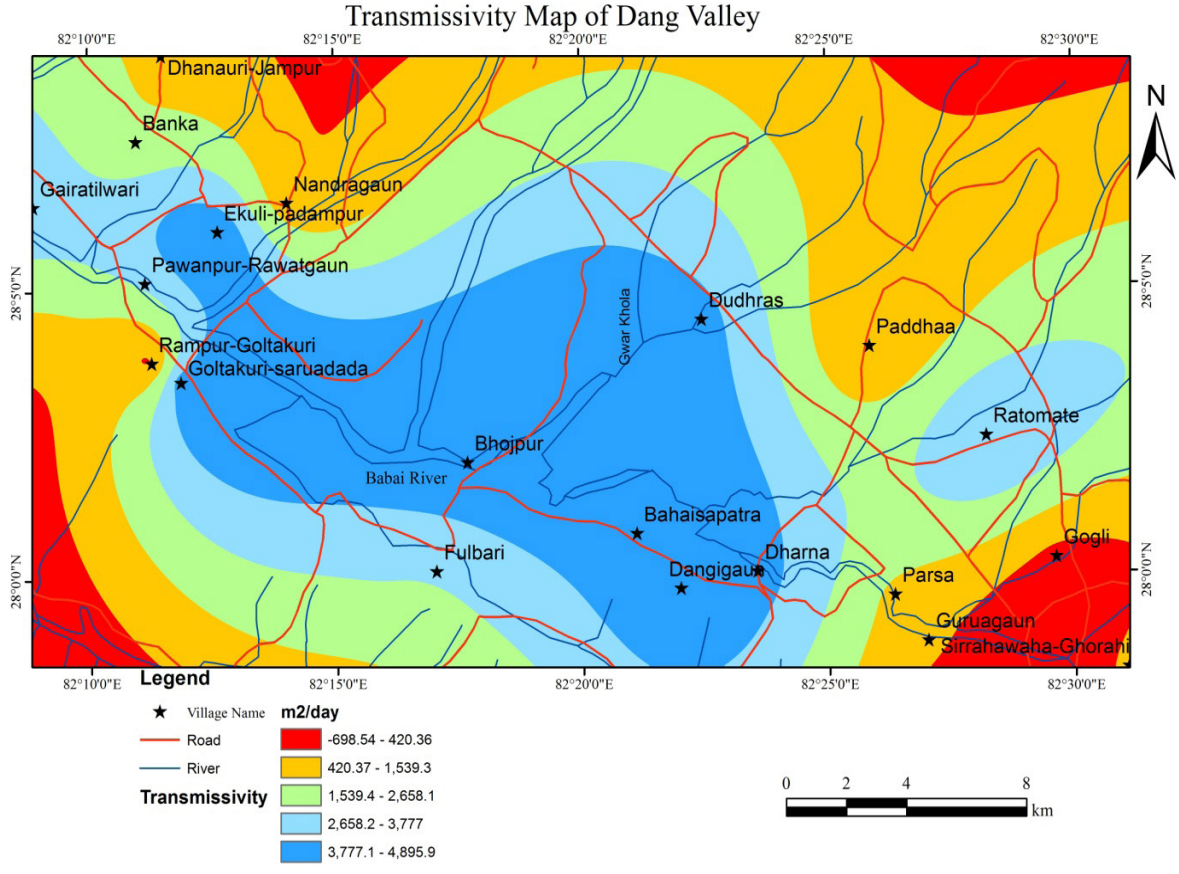


Fig. 4: Transmissivity map of Dang valley

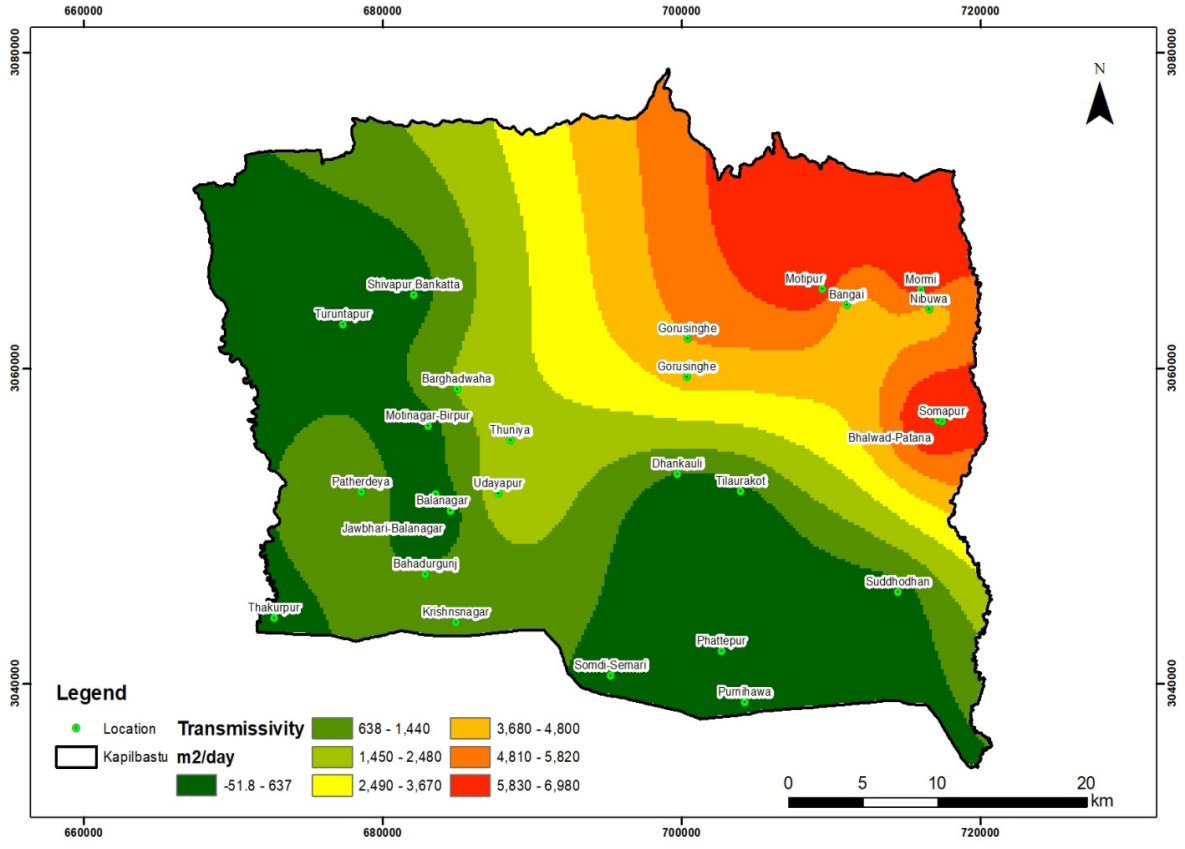


Fig.5: Transmissivity map of Kapulvastu.

HYDRAULIC CONDUCTIVITY

The average hydraulic conductivity of Dang Valley is 124.70 m/day, while that of Kapilvastu is 216.01 m/day. However, the highest value in Kapilvastu is 326.56 m/day, and in Dang Valley, it is 219.29 m/day. From this, it can be concluded that the aquifer in the Terai areas discharges water better than that in the valley. Furthermore, the north eastern part of Kapilvastu and the central part of Dang valley have the beter hydraulic conductivity than other parts of the both studied areas as shown in (Fig. 6 and 7).

SPECIFIC CAPACITY

Specific capacity in Kapilvastu ranges from 37.73 to 388.80 m^3/day, with higher values in the northern and north eastern regions and lower ones in the southern and western. In contrast, Dang Valley shows a much wider range, from 7.0 to 240 m^3/day, with the highest capacities in the central and western areas. Lower values are found in the periphery of the valley, while the south-central region also shows higher well efficiency. These spatial differences reflect variations in aquifer properties and groundwater potential between the two areas shown in (Fig. 8 and 9).

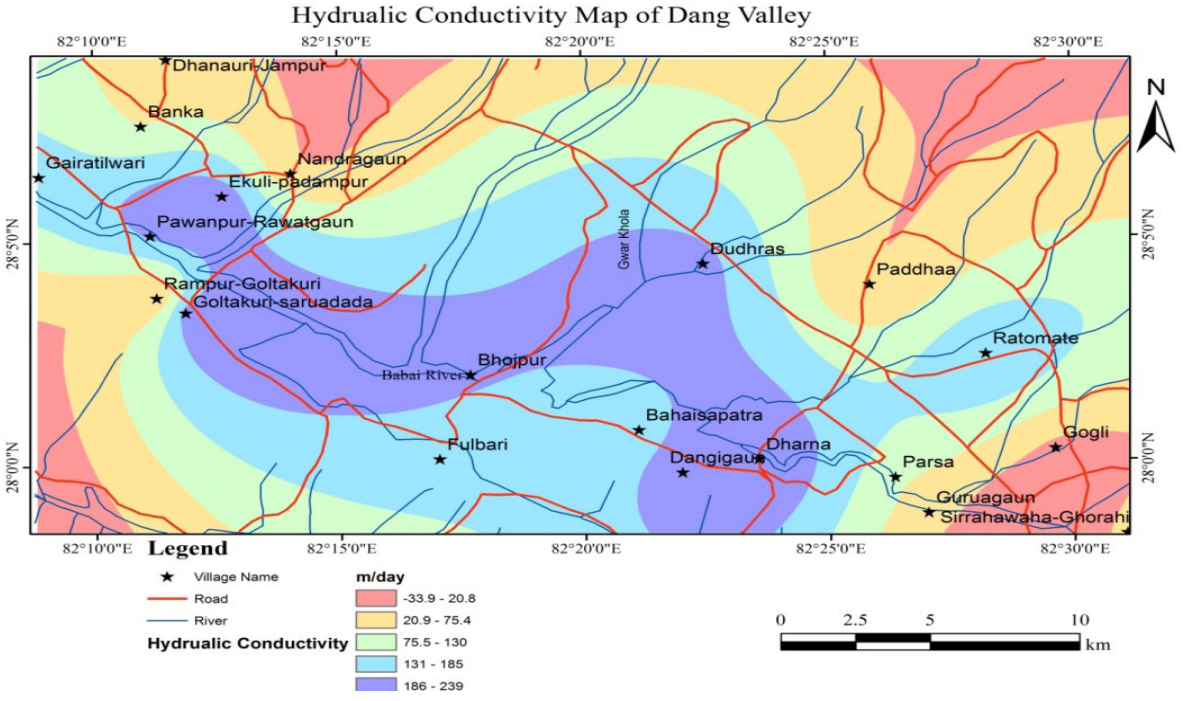


Fig. 6: Hydraulic conductivity map of Dang valley

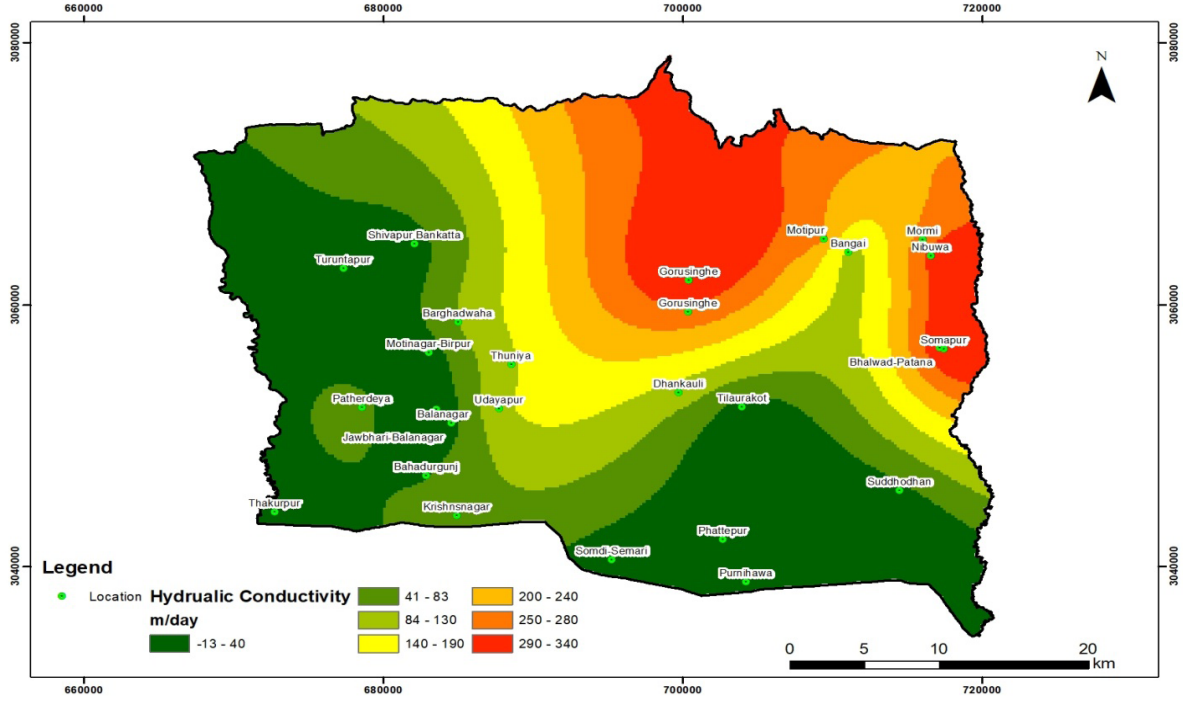


Fig. 7: Hydraulic conductivity map of Kapilvastu

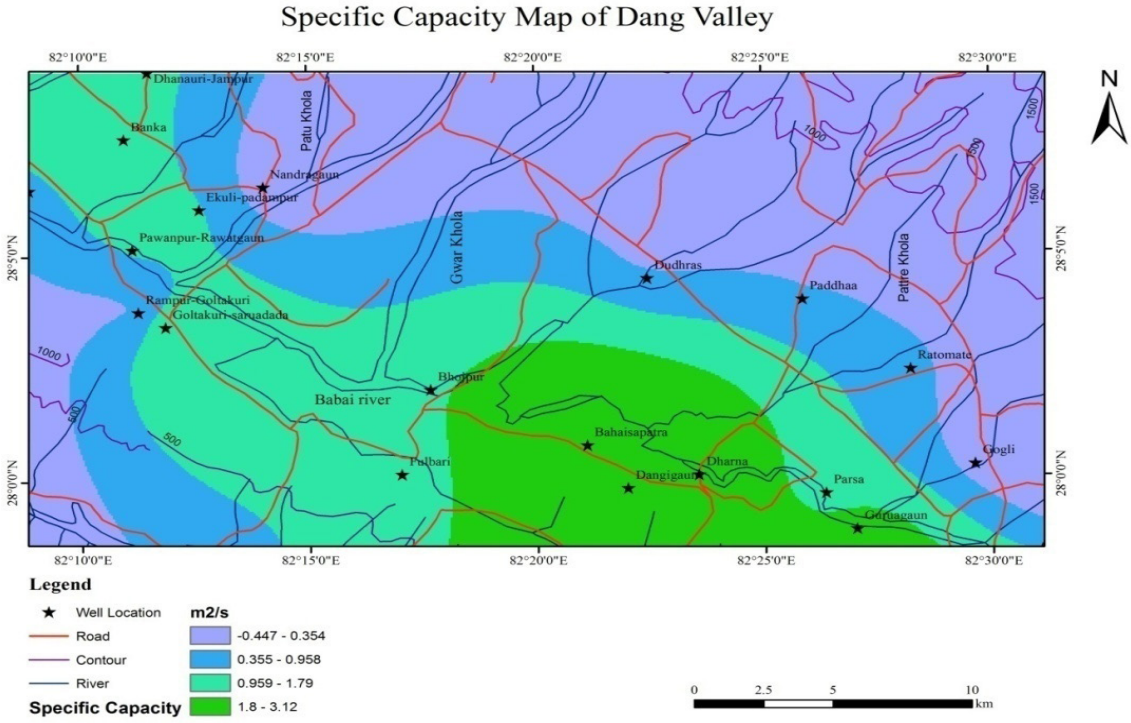


Fig. 8: Specific Capacity map of Dang valley

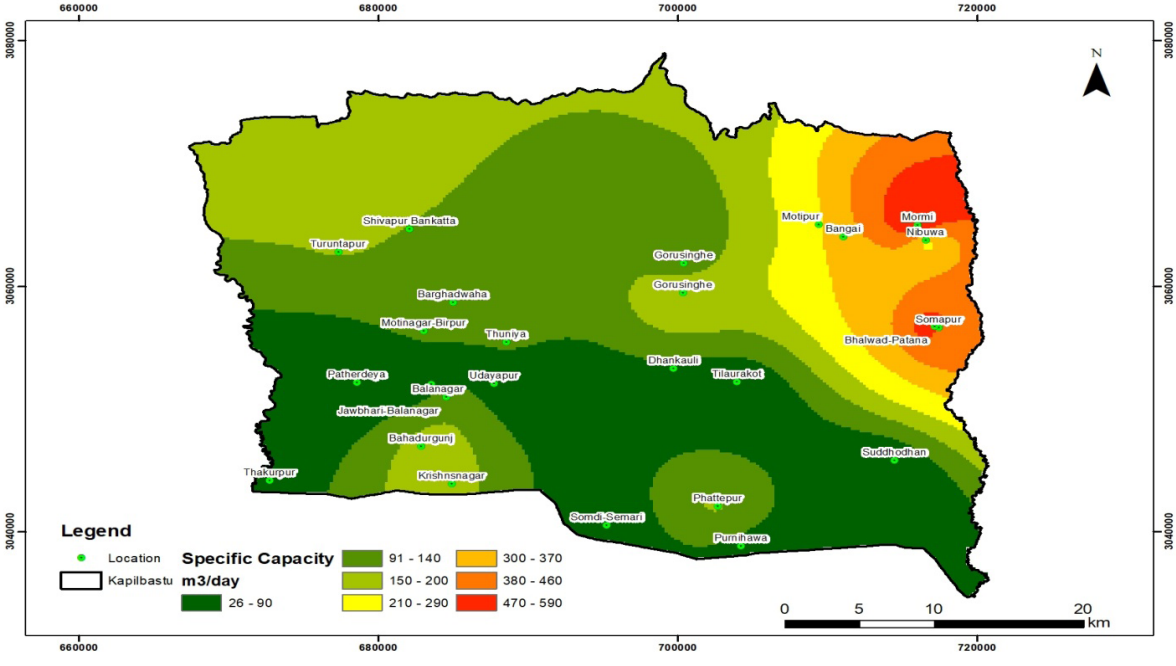


Fig. 9: Specific Capacity map of Kapilvastu

Table 1: Aquifer characteristics of Kapilvastu study area

Well no.	Location	Elevation (m) asl	Northing	Easting	Total depth (m)	Aquifer thickness (m)	Yield lps	Specific capacity (m3/day)	Draw down (m)	Hydraulic conductivity (m/day)	Transmissivity (m2/day)
KV1	Bahadurgunj	100	3046957.4	682837.5	135	18	24.5	162.83	13.0	38.14	686.5
KV2	Barghadwaha	127	3058641.6	685008.1	125	18	25.5	122.40	18.0	84.42	1519.5
KV3	Gorusinghe	115	3061867.25	700402.37	112	15	15	108.00	12.0	317.55	4763.2
KV4	Dhankauli	114	3053293.22	699744.32	122	18	22	77.58	24.5	115.92	2086.5
KV5	Krishnsnagar	97	3043860.7	684914.7	113	18	25	163.86	11.2	61.91	1114.3
KV6	Patherdeya	106	3052125.63	678571.59	155	21	11	43.20	22.0	47.08	988.6
KV7	Phattepur	99	3042049.79	702693.51	145	21	27	145.80	16.0	18.94	397.8
KV8	Gorusinghe	119	3059432.69	700359.65	125	15	23	198.72	10.0	273.71	4105.6
KV9	Nibuwa	108	3063715.25	716617.53	120	15	26.5	286.20	8.0	292.38	4385.7
KV10	Somapur	125	3056589.8	717483.43	128	18	18	388.80	4.0	326.57	5878.2
KV11	Udayapur	124	3052028.54	687745.28	124	14	13	59.51	18.0	132.14	1850
KV12	Thuniya	138	3055396.95	688543.63	153	16	16	172.80	31.0	125.26	2380
KV13	Jawabhari	133	3051984.73	683520.08	171	22	10	41.14	21.0	13.73	302
KV14	Balanagar	124	3050963.94	684524.38	155	9	14	67.20	18.0	37.89	341
KV15	Tilaurakot	126	3052165.8	703956.47	122	18	13	59.12	19.0	23.39	421
KV16	Motipur	144	3065006.31	709465.84	123	25	24	172.80	12.0	250.64	6266
KV17	Bangai	148	3063979.6	711077.17	88	18	23	198.72	10.0	116.00	2088
KV18	Shivapur Bankatta	163	3064626.6	682070.52	79.5	13	14	57.60	21.0	27.23	354
KV19	Bhalwad-Patana	143	3056701.9	717216.31	124	23	27	333.26	7.0	309.57	7120
KV20	Mormi	165	3064958.4	716067.2	88	25	25	270.00	8.0	253.12	6328
KV21	Turuntapur	166	3062771	677329.55	61	11	10	48.00	18.0	29.91	329
KV22	Motinagar-Birpur	140	3056329.1	683044.75	127	19	9	37.03	21.0	20.84	396
KV23	Jawbhari-Balanagar	130	3050963.9	684524.38	142	20	11	41.32	23.0	18.85	377
KV24	Suddhodhan	119	3045805.6	714488.67	126	12	14	46.52	26.0	29.58	355
KV25	Purnihawa	116	3038815.9	704225.68	99	18	18	74.06	21.0	18.94	341
KV26	Somdi-Semari	112	3040522.9	695267.38	110	18	14	50.40	24.0	20.94	377
KV27	Thakurpur	124	3044175.7	672741.73	127	21	16	47.67	29.0	19.48	409

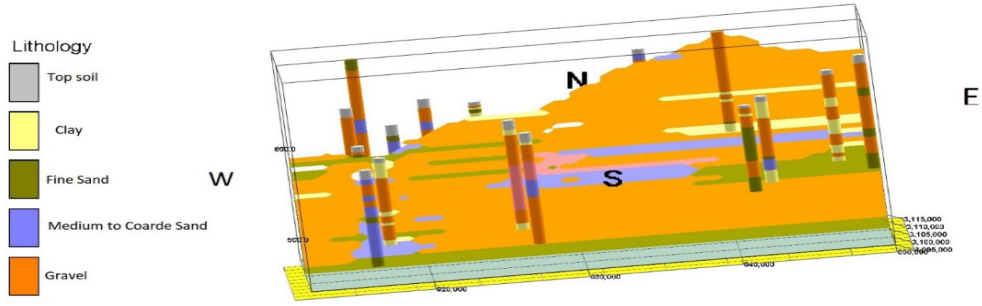
Table 2: Aquifer characteristics of Dang valley study area

Well No.	Well Location	Elevatin (m)	Easting	Northing	Well Depth (m)	Aquifer thickness (m)	Discharge (lps)	Specific capacity (m3/ day)	Drawdown (m)	Hydrulic conductivity (m/day)	Transmissivity (m2/day)
DH1	Guruagaun	611	642665	3096805	95	15	22	211.2	9	46.65	699.84
DH2	Nandragaun	615	621242	3110789	110	24	3	7	37	3.975	95.4
DH3	Gogli	661	646911	3099502	100	15	4.5	12.15	32	8.78	131.76
DH4	Parsa	602	641542	3098271	95	15	16	115.2	12	88.70	1330.56
DH5	Pawanpur-Rawatgaun	571	616532	3010819	102	15	18	88.86	17.5	189.79	2846.88
DH6	Rampur-Goltakuri	551	616757	3010563	106	21	10	29.79	29	19.97	419.4
DH7	Paddhaa	673	640667	3106235	116	24	12	38.4	27	23.4	561.6
DH8	Fulbari	603	626264	3098988	120	18	10	108	8	157.68	2838.24
DH9	Sirrahawaha-Ghorahi	646	649341	3095992	125	18	18	77.76	20	38.39	691.1
DH10	Goltakuri-saruadada	565	617737	3105019	96	21	15	129.6	10	217.33	4564.08
DH11	Ratomate	661	644568	3103389	110	21	14	46.52	26	175.68	3689.28
DH12	Gairatilwari	558	612797	3110622	110	21	21	181.44	0	156.75	3291.84
DH13	Dudhras	624	635076	3107075	121	21	10	39.27	22	199.54	4190.4
DH14	Dhanauri-Jampur	655	617051	3111548	125	21	20	101.64	17	63.36	1330.56
DH15	Bhojpur	582	627289	3102583	122	24	13	140.4	8	190.26	4566.24
DH16	Banka	607	616217	3112735	117	24	13	70.2	16	77.76	1866.24
DH17	Ekuli-padampur	590	618937	3109850	100	21	18	129.6	18	219.29	4605.12
DH18	Dharna	556	636963	3099008	80	18	25	240	9	237.6	4276.8
DH19	Dangigaun	561	634414	3098453	92	21	24	172.8	12	216	4536
DH20	Bahaisapatra	570	632938	3100208	100	27	22	271.54	7	163.2	4406.4

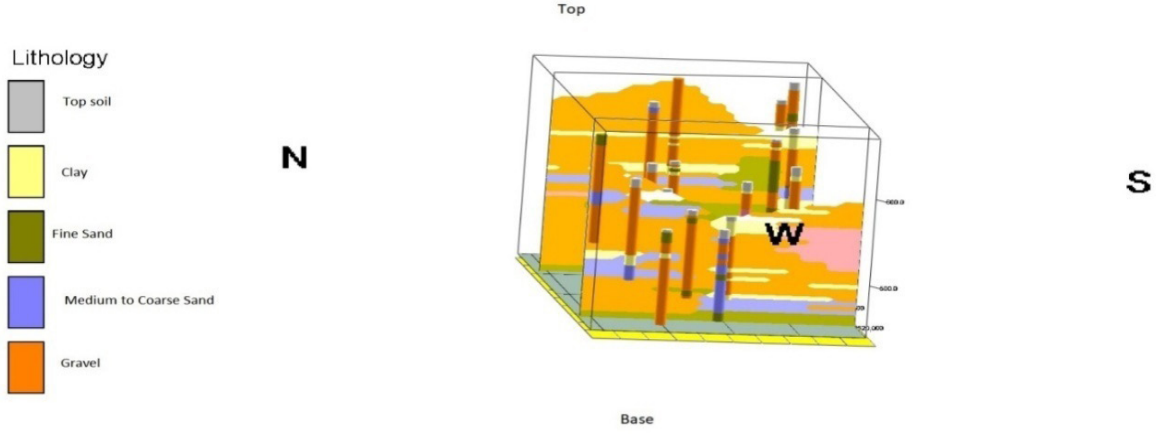
GROUNDWATER CONDITION

The Dang Dun valley aquifers are primarily filled with highly porous and permeable unconsolidated to poorly consolidated pediment alluvium or fan deposits, known as Dun Fan Gravels. These deposits from the main aquifer system appear homogeneous in tubewell logs and hydraulic properties. There are two types of aquifer systems: confined and unconfined. Confined aquifers are common in the valley, with thicknesses ranging from 15m to 27m. Unconfined aquifers are found in granular zones like gravel and sand in western part of the valley.

In contrast, the Kapilvastu area, in the Terai plain, has porous and permeable pediment deposits and a multilayer aquifer system. The porous and permeable pediment deposits from the main large aquifer system in this area. The aquifer system is multilayer in nature, as commonly found in alluvial deposits. Groundwater is under unconfined or water table types in shallow aquifers and under semi-confined or leaky confined conditions in deeper aquifers. Perched water table conditions also present in some places. The deeper aquifers are productive and have been tapped through hundreds of tube wells. Well inventory of deep wells are presented in Table 1 and 2 of Kapilvastu area and Dang valley respectively.



(A)



(B)

Fig.10: Fence diagram (A) E-W view of different aquifer layers and (B) N-S view of different aquifers layers

Dang Valley shows significant variation in groundwater levels, ranging from 0 to 25 m below ground level (bgl), with deeper levels in the north and shallower ones near southern rivers, due to the lack of impermeable layers. In contrast, Kapilvastu has more stable water levels, mostly between 0 and 7 m bgl during April–May. The greater fluctuation in Dang is likely due to low porosity or high transmissivity, leading to rapid recharge in the north and fast discharge to the south. Groundwater flow is fastest in central Dang, with the highest discharge at Gairatilwari (25 l/s) and the lowest at Nandragaun (3 l/s). In Kapilvastu, the highest discharges are at Valwad (27 l/s) Nibuwa (26.5 l/s), Bargadawaha (25.5 l/s), and Krishnanagar (24.5 l/s), with the lowest at Birpur (9 l/s).

GROUNDWATER RECHARGE

In the study area, the aquifers are mainly recharged through rainwater infiltration. Additionally, parallel streams flowing across the valley contribute to the recharge of the Dang Valley. Since the northern fringes of both the Dang Valley and Kapilvastu district consist of coarse materials such as gravels and boulders, major recharge occurs in these zones. In the Kapilvastu area, rivers flowing from the foothills of the mountain front, along with the Banganga River, serve as important sources of groundwater recharge.

SAFE YIELD

The storage co-efficient is much lower in confined aquifers because they are not drained during pumping. Any water released from storage is obtained primarily by compression of the aquifer and expansion of the water when pumped. Thus, assuming the higher value for the aquifer in the study area, which is 10^{-4} (Driscoll 1987) and on the basis of the data average safe yield of the area were estimated as given in the table 3.

Safe yield = area of aquifer × storage coefficient × mean piezometric surface fluctuation.

Table 3: Average safe yield of the study area

SN	Study area	Mean piezometric surface fluctuation(m)	Average safe yield (m^3/ year)
1	Dang area	13.2	$3.16*10^7$
2	Kapilvastu	6	$1.05*10^6$

Discussion

The aquifer properties in Dang Valley and Kapilvastu differ due to their unique depositional environments, though both are shaped by fluvial processes. Dang Valley has a complex basin-fill with interlayered textures, while Kapilvastu's aquifers develop from north-to-south flowing rivers. In the Terai, aquifers mainly form from alluvial fan and meandering river deposits. Overall, the depositional environment controls aquifer distribution, characteristics, and groundwater recharge in both areas. The aquifer properties of the two different physiographic areas were analyzed. The depositional characteristics of the both area are different. The Dang area has basing fill depositional environment and the different textural layers are positioned in almost inter-fingering condition (Yamanaka and Yagi 1984, Sapkota, 2003 and Shrestha and Neupane, 2009). Similarly, the Kapilvastu area is also deposited fluvial process rivers running from north to south. The aquifer developed in the Terai area are dominantly by fluvial processes, at mountain front alluvial fan type of deposits are dominant and at southern part it is dominated by meandering type of river deposits (Sharma, 1974; Hagen, 1969; Rao and Pathak,1996; Pathak, 2016; Shrestha at el., 2014). The aquifer distributions in the deposits are fully controlled by the depositional environment of the area. The depositional positions in the both area are highly influencing the aquifer characteristics and ground water recharge.

In Kapilvastu, high recharge occurs in the Bhabar zone, while in Dang, it is concentrated in the peripheral parts of the valley. The texture of aquifer

materials significantly affects hydraulic conductivity and transmissibility. In Kapilvastu, coarser aquifers are found in the north eastern part and Bhabar zones, with texture and aquifer quality gradually decreasing southward, leading to a decline in specific capacity. In contrast, the Dang Valley shows a different pattern, generally exhibits higher and more consistent transmissivity, indicating larger and more conductive aquifer zones than those found in the Kapilvastu area. Where, the aquifer quality diminishes toward the valley center as well as south and western part of Kapilvastu.

The central part of the Dang Valley and north eastern part of Kapilvastu has higher transmissivity, hydraulic conductivity and specific capacity, meaning water can move more easily through the ground there. But peripheral part of Dang valley and in the southeastern part of Kapilvastu — such as Fattepur, Purnihawa, Semari — as well as in the western areas like Jawabhari, Birpur, and Turuntapur, the aquifers have not shown very good potential for groundwater. These differences are mainly due to the varying nature of the underground layers, or aquifer properties, in each area.

Conclusions

The comparison of the aquifer properties in both area were carried out in different aspects and following conclusions were given based on the observations.

a. The grain size of the alluvium gradually decreased from north to south. The aquifers are multi layered interconnected lenses of sand, gravel and pebble alternating with silt and clay. Aquifer materials for unconfined and semi-confined aquifers are generally sand, gravel, pebble and even cobble and boulder.

b. Deep aquifers are recharged by inflow of the Babai River and shallow aquifers may be recharged in the lower reaches of the Dang valley. It may not be possible to recharge the terraces of study area because present bed level of the Babai River is 570 m a.m.s.l., whereas these terraces are in higher elevation, i.e., 700 m a.m.s.l.. At Kapilvastu district's aquifer may recharge by rain water infiltration and by Banganga River.

c. The Dun Valley's aquifers are made up of coarser materials like sand, gravel, and boulders, allowing water to flow more easily. This results in thicker layers with higher and nearly similar transmissivity, while the Terai region has finer sediments like silt, sand and clay mixed gravel slowing groundwater flow. But the northeastern portion of Kaplvastu shows the better potential aquifer than Dang valley.

d. The aquifer characteristics of Dang Valley are almost similar across all areas except peripheral parts, whereas the aquifer characteristics of Kapilvastu were found to be quite different compared to Dang. For example, the aquifers in the northeastern part of Kapilvastu like Bhalwad, Mormi, Banganga, Nibuwa, Gorusinge area showed behavior similar to those in Dang, while the aquifers in the southeastern part of Kapilvastu — including Fattepur, Purnihawa, Semari and the western localities such as Jawabhari, Birpur, and Turuntapur exhibit limited groundwater potential.

e. Groundwater potential at both areas are satisfactory and groundwater draft is in safe level. Present water demand of both area are fulfilled by the groundwater resources. In case of Dang valley, it is at saturation level in dry season but in Kapilvastu area it is not so serious.

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