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## TANK IRRIGATION BY MUSLIM CASE STUDY (HAUZ KHAS) A HISTORICO – GEOGRAPHICAL STUDY

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**Abstract :**

The study end to highlight and dedicate sites of spatial and seasonal pollution of khurasan stream from the sites that we take samples from five sites from the study area . The study best on spatial analysis for difference sites from the canal . The study depend on field study which dedicate the sites of pollution places and sources . We did laboratory test for each source of polletance in the course of the stream.

We choose twelve elements from the chemical elements and by two samples for the period (1-8 – 2009 ) up to (1- 5 -2010 ) . The study nature need research work also , the research content three sections , in the first section we took the theoretical base introduction , problem , hypothesis , the research aim and the study area limit as well as the source of the data and the way we took the samples for analysis . The second section come to spatial analysis for the pollution of the water of stream in the same time we derived the PH of the stream water, also the biological oxygen demand and chemical oxygen demand . In the last section which come to evaluate the usability of Khurasan canal water for different uses .

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## **INTRODUCTION**

The name Hauz Khas has been derived from Arabic which means " **Special Tank** ". As the name indicates this tank built specially to supply water to the inhabitants of siri once a capital town .(1)

Throughout Indian history there have been many references to the using of the tanks .

Many parts of the country still bear evidence of old storage reservoirs and canal system . Some of which have been improved for modern use while others have been neglected .(2)

The Hauz Khas occupies a catchment area of ( **11031250** ) sq. meters in the south of Delhi metropolitan region . As geographical unit it provides very interesting example of man and nature relationships .(3)

The Hauz Khas is very important from the historical view point .

## **OBJECTIVE OF THE STUDY**

The main objectives of the study are :

1. To evaluate the Geographical aspects of Hauz Khas .
2. To work out the catchment area and estimate water storage .

## **METHODOLOGY**

Basically field work techniques are used for the study . However for the study of different parameters such as geomorphology of the area and the calculating the catchment area the contour map of Delhi has been used . The historical account has been gathered from various sources found in Archeological Survey of India library .

The catchment map has been prepared with the help of the watershed .

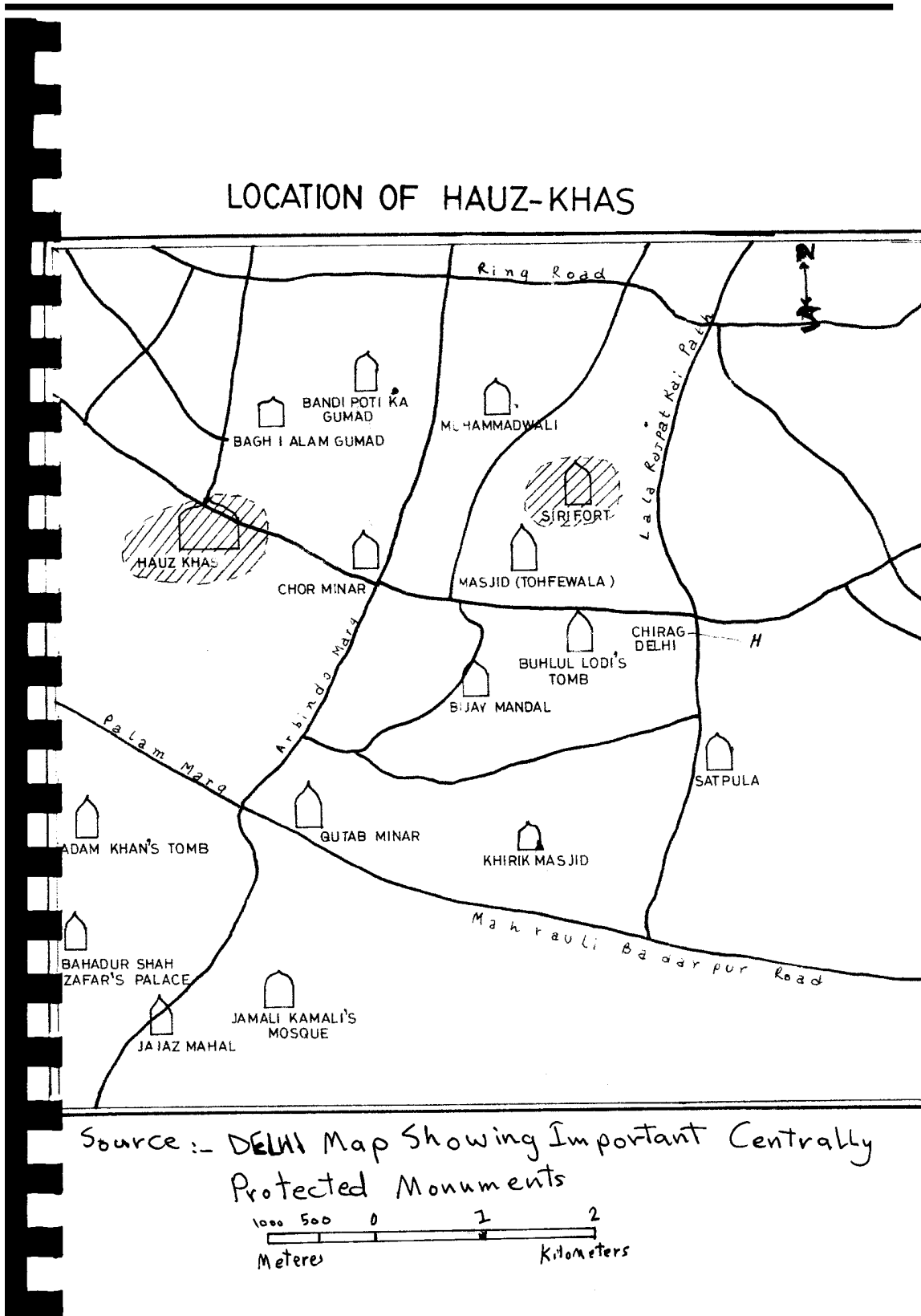
## **HAUZ KHAS AN HISTORICAL PERSPECTIVE :**

This tank was built during the Sultanate of Delhi by khilji . The kiliji's were one of the numerous tribes of the Turkish race . In ( 1276 ) the year of the murder of Alauddin Sultan Alauddin Khilji took over . In the year of ( 1303 ) Alauddin laid the foundation of siri which was the second city of Delhi to be his capital . Siri is the first city was built by Muslims . It was surrounded by a wall and according to the Zafarname " **contained 7 gate ways** " . The wall is mostly ruined and it is only on the south and west that some portions still stand . The main features in the south wall are ( **i** ) a bastion and ( **ii** ) the ruins of gateway near the south east corner . Alauddins reign marked the peak of the Sultanate and is in epoch in the history of Delhi . Alauddin Khilji himself assumed the title of khalife . (4)Delhi this time become Dar-ul khilalah ( **seat of khilafat** ) . He brought almost the whole of Indian sub-continent under his way . Alauddin khilji was confront with the problem of water

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supply to his new city . In ( **1303** ) got dug the magnificent tank covering over ( **70** ) acres of land which was originally known as Hauz-I-Ala and was intended to meet the need of water supply of the citizens of siri . The tank was enclosed by stone and masonry wall . It was filled with water in the rainy season . After the death of Alauddin his six years old son Shihab-ud-din Umar successor him . But he could not manage the affairs of the state . So the tank and the city both were neglect .(5)

After Shihab-ud-din Umar Firoz Tughlaq come to power in ( **1351 – 1388** ) . When Tughlaq came to power the Hauz Alai was already filled up and dried . People carried on cultivation on the dried bed and some wells for irrigation were also dug . Firoz Shah was essentially a man of peace and devoted his energies towards improving the lot of people . He was interested in developing irrigation channel hence the large reservoir which was built earlier by Alauddin Khilji and which was ruined was reconstructed by him . One historian wrote that the tank was so large that " an arrow cannot be shot from one side to the other it



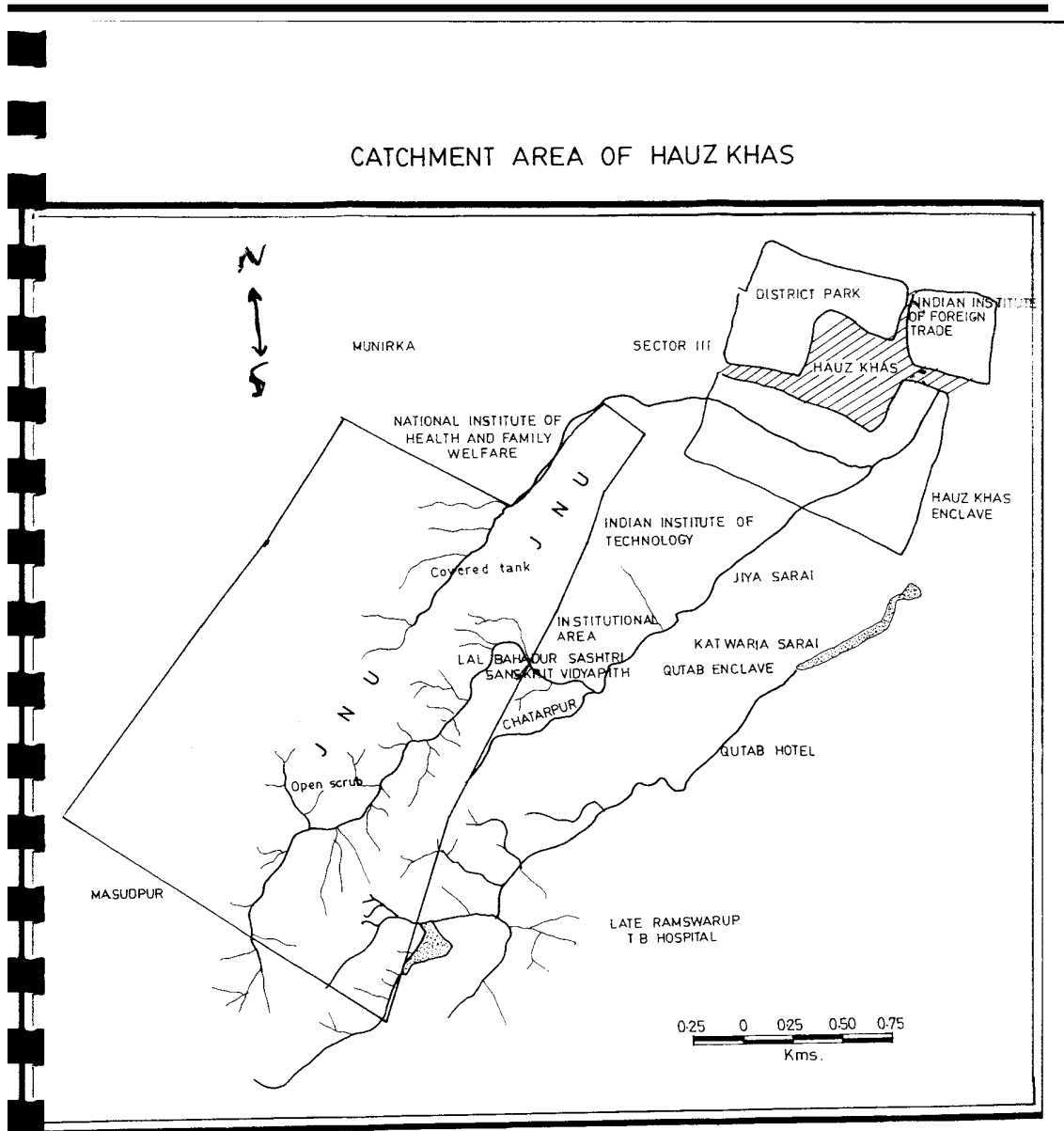
is again filled by rain water in the rainy season and all people of Delhi obtain water from it all year round " .(6)

## THE CATCHMENT AREA ANALYSIS OF HAUZ KHAS :

The Hauz Khas is situated in southwest Delhi . The catchment area of the tank lies on the northern outliers of the Ravalli . It shows basically denundattional processes . As a physiographic unit the Aravallis of Delhi represent the Indo-Gaga water divide at its maximum expression , with the sloping towards both east and west . The area is occ upped by system of ridges and valleys in south of north east .direction and this represent the general characteristic of the Aravalli ridges . The general catchment area of this tank consist of mainly two big nullahs which are aligned in the south to north direction . The character of these nullahs is similar to other storm water nullah system of the Aravalli outlier , in and around Delhi . These nullahs are seasonal in character . These nullahs it join together to form important units of the natural drainage system . After demarcating the catchment area of Hauz Khas from Delhi contour map we fined that the tank occupies an area of ( **11031250** ) sq. meters . (7)

If we want to calculate the amount of rainfall in this area in the absence of the evaporation , infiltration and seepage we find the amount of water is ( **5151593-8** ) cubic meters because the normal rainfall in Delhi ( **46.7** ) cm .

The catchment area of the tank is situated in the semi arid climatic region . So the percentage of evaporation in this case is high . Through my visit and observation to the field in general and the tank in particular I have seen many evidences indicate that the high of the water in the tank about ( **9 – 10** ) meters . In this case the amount of water which use to reach the tank it is ( **280.000** ) cubic meters because the tank occupied and area of ( **70** ) acres . The amount of the water which it goes by different process are ( **2351593** ) cubic meters and it is about ( **46 %** ) of



Source :- DELHI Guide Map  
Surveyed 1982

the total rainfall of the area . Almost the whole of the water dries by evaporation because high temperature is the main reason or factor in this case . The other factors infiltration and seepage consist less per cent because the geological formation and the nature of the slop of the area don't allow more water to go .



The over all view of the catchment area and the amount of water in this tank it is good amount and it is fresh water . So I start believe in those people they write description of this tank " **that hug so huge that an a arrow can't cross it from one side to the other** " .

So the problem of the water shortage in siri city solved in the excavated of this tank . (8)

### **HAUZ KHAS DRAINAGE :**

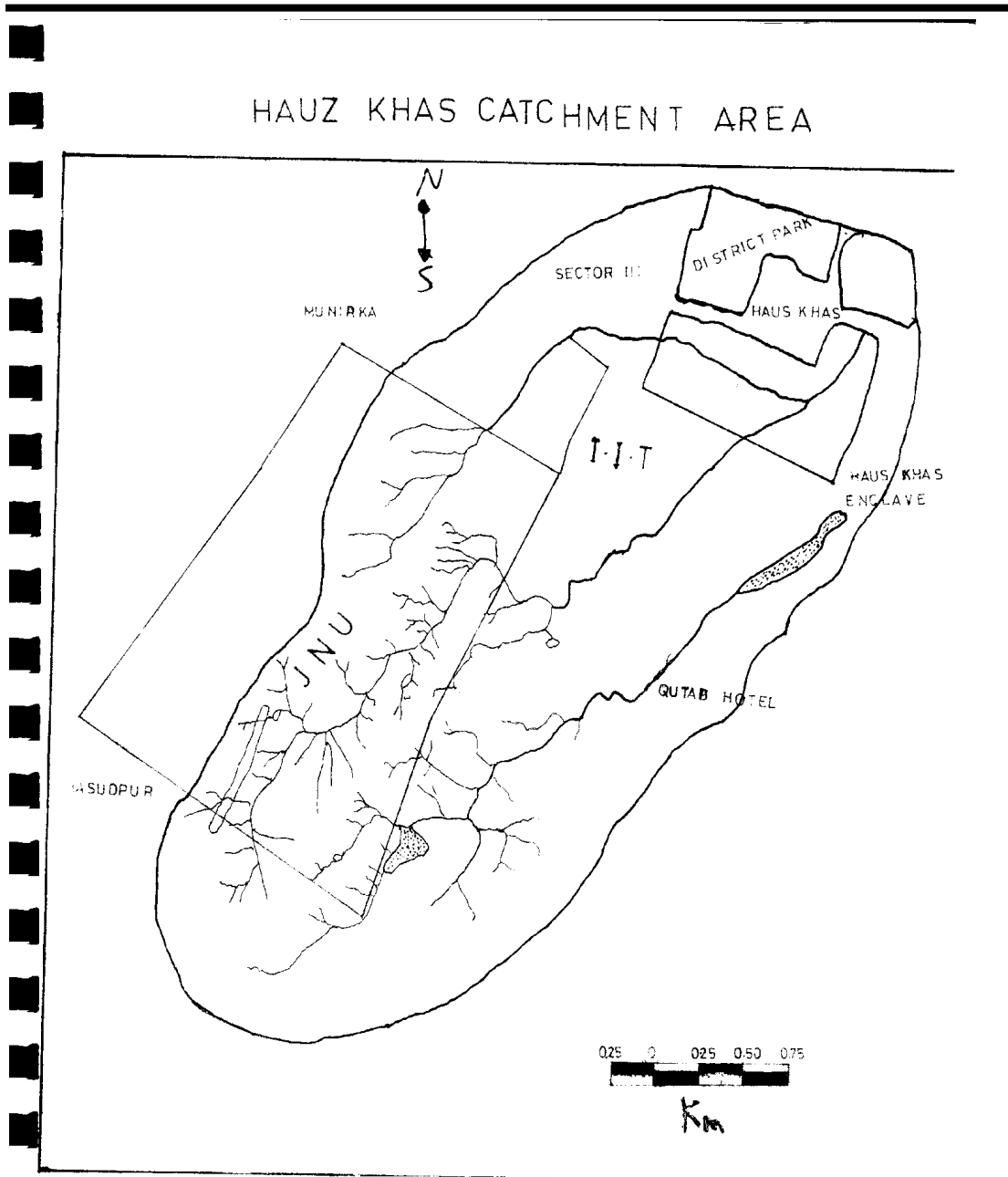
The general slope of the area is from south to the north-direction . It is inland drainage pattern . The drainage network is from of seasonal nullahs . The main source of water in Hauz Khas is rainfall during monsoon . The water flows through nullahs . It is usually dry and contains water only after heavy rainfall . Hauz Khas catchment area is drained by two nullahs . They are the main source of water . The first nullah flow through **J.N.U.** campus . The other flows from the margin of Mehrauli and pass between Katwaria Sarai and Qutab Hotel . Both of these nullahs join Hauz Khas . (9)

### **STREAM ANALYSIS :**

In the present section and attempt has been made to identify the linear properties of the stream network . This plan metric analysis is based on strahler's method . The study deals with stream ordering and drainage density .

### **STREAM ORDERING :**

First of all the hierarchy of stream orders has been identified in all the two drainage basin of the Hauz Khas . It is



Source :- DELHI Guide Map  
Surveyed 1982

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ident from the catchment area map that the stream attain only the fourth in both basins . According to Strahler " **the first order stream indicates the uppermost channel** " . The higher tip , the confluence of the two develops a second order stream . The two second order streams give birth to third order stream so on . But when a lower order stream meets the higher one the

order of the latter remains the same . Strahler physical geography p. 483 .(10)

**J.N.U.Nullah  
Table No. I**

Stream order	No. of segment	% of total segment	Bifurcation ratio
<b>I</b>	<b>60</b>	<b>76 / 95</b>	<b>4.28</b>
<b>II</b>	<b>14</b>	<b>19</b>	<b>7</b>
<b>III</b>	<b>2</b>	<b>3</b>	<b>5</b>
<b>IV</b>	<b>1</b>	<b>2</b>	
<b>Total</b>	<b>79</b>	<b>100 %</b>	<b>4.42</b>

**Qutab Nullah  
Table No. II**

Stream order	No. of segment	% of total segment	Bifurcation ratio
<b>I</b>	<b>30</b>	<b>78</b>	<b>5</b>
<b>II</b>	<b>6</b>	<b>17</b>	
<b>III</b>	<b>2</b>	<b>3</b>	<b>5</b>
<b>IV</b>	<b>1</b>	<b>2</b>	
<b>Total</b>	<b>39</b>	<b>100 %</b>	<b>3.33</b>

The tables reveal the following facts :

1. Nearly three-fourth of the total segments are of the first order in both the basins .
2. By adding the share of segments of the second order in the basins to the previous order , we find overwhelming dominance ( **nearly 95 percent** ) of the first two orders which reflect the rudimentary nature of drainage network in the area .
3. The segments of the third and fourth orders contribute not more than ( **5 percent** ) in any case and reflects in significant role played by them in the area stream network .

After identifying the stream order and their respective number of segments the bifurcation ratio was computed .

Generally it is believed that in a river basin of uniform rock formations and climatic conditions the ratio will remain constant from one order to the other . The table shows no regulation in the bifurcation ratio in all orders in both **J.N.U.** and **Qutab Nullahs** .

### **STREAM LENGTHS :**

In this section the total length of all segments of each order , and their respective share in the total length of all the segments in the area were found out . The results , thus , obtained can be tabulated as below :

### **Result of stream length Analysis**

**J.N.U.Nullah**  
**Table No. 2**

Stream order	Length in mts.	% to the total stream length
<b>I</b>	<b>8950</b>	<b>40.00</b>
<b>II</b>	<b>4375</b>	<b>19.52</b>
<b>III</b>	<b>8450</b>	<b>37.71</b>
<b>IV</b>	<b>625</b>	<b>2.77</b>
<b>Total</b>	<b>22400 mts.</b>	<b>100.00</b>

## Qutab Nullahs

Stream order	Length in mts.	% to the total stream length
<b>I</b>	<b>5022</b>	<b>49.14</b>
<b>II</b>	<b>2525</b>	<b>24.69</b>
<b>III</b>	<b>550</b>	<b>5.38</b>
<b>IV</b>	<b>2125</b>	<b>20.78</b>
Total	<b>10.225 mts.</b>	<b>100.00</b>

Stream length taken together reveal the following pattern :

Stream order	Length in mts.	% to the total stream length
<b>I</b>	<b>13975</b>	<b>42.83</b>
<b>II</b>	<b>6900</b>	<b>21.15</b>
<b>III</b>	<b>9000</b>	<b>27.59</b>
<b>IV</b>	<b>2750</b>	<b>8.43</b>
Total	<b>39.625 mts.</b>	<b>100.00</b>

The table shows the dominance of the first order in both the streams separately as well as together . The first order contribute nearly ( **43 percent** ) to the total length of streams . The fourth order shows very low percentage share . ( **about 8 percent to the total streams length** ) . These results represent the seasonal character of the streams which flow just after the rain and remain dry in most of the months .(11)

### DRAINAGE DENSITY :

In this simple exercise the drainage density for the two nullahs was calculated with the help of the following formula :

$$D = ELK / AK$$

Where : **D** = is drainage density in km / per square km of the area .

**AK** =means total catchment area of the Hauz Khas .

**ELK** = mean total length of segments of all orders .

The results has been given below :

**Table no. 3**

	Total catchment area in sq. kms.	Total length of stream in km.	Density per km.
Hauz Khas	<b>11.03125</b>	<b>32.625</b>	<b>2.95</b>

The result reveals the fact that high drainage density is observed in the area .(12)

### **GEOLOGY :**

The structure of the area consists of various formation . The region forms apart of the Delhi system and Alwar quartzites representing the oldest pre-Cambrian rocks . This region consists of oldest formations which belong to pre-Cambrian period . The geologists have identified several cycles of upliftment and peneplanation .The Alwar quartzites are the dominant rocks of the region and are grey to pinkish – purple in colour . Mica and impure limestone are also found . Geologically speaking if we want to cross the area from Maksudpur in the south of the Hauz Khas in the north , we come across the formation of pre-Cambrian in the north and the recent alluvium in the south . The thickness of alluvium increases from the south towards the north .(13)

### **GEOMORPHOLOGIC FEATEURS :**

The nullahs which are under consideration forming ( **11.03 sq. mts.** ) of south Delhi . Geomorphologic ally . The whole nullah system can be divided into two parts :

**a.** The upper catchment area south of new Mehrauli Road . The catchment area of this part is characterized by several small channels which have made their path through the slopes of the adjoining ridges and tors . these channels are vary small measuring about ( 2 – 3 ) meters wide and ( 1.5 – 2 ) meters deep with the base formed by bare tocks and boulders .

**b.** The nullah north of new Mehrauli Road . This portion of the nullah is characterized by deep and wide channel and from here it has higher capacity carry water . Climatologically speaking this area represent semi arid conditions which has clear bearing on the land forms . Along and near the nullahs , tore are easily identified . The nullahs shows both the depositional and erosional features , however the depositional features do dominate .

### **DEPOSITIONAL FEATURES :**

All along the nullahs one can find , alluvium deposits which are composed of soils , ranging in nature from very fine to course grained . The nature of deposition varies with the slope gradient and also the nature of bed-rock of the catchment .

At the head waters of nullahs the deposits which have been transferred by sheet wash from the slopes of its catchment are more gradually and consist of mica in parts . The colour is reddish , suggesting oxidation and the presence of sediments of weathered granitic rocks . The lower part of the catchment the deposits are mainly of liner alluvium , which is of salty loam character , however in parts , where the gradient is high the deposition range from small rocks or kankar to small boulders .

### **DENUATION FEATURES :**

The erosion in the catchment is prominent in terms of sheet wash of the slopes . This , at many place , has exposed the bed rock . Exfoliation of rocks can very easily be identified . The semi arid nature of the climate , the high diurnal ranges of temperatures , presence of quartzitic and granitic rocks with

visible joints in them have molded the erosional topography of the region . The presence of joints and cracks result in block disintegration along them . Granular disintegration is also very prominent . The presence of the xerophytes vegetation which takes root in the joints also give rise to block disintegration . As referred earlier exfoliation of exposed rocks on the slope is very common due to high temperature variations . The channel deepening is not evident but the differences in the dimension and type of channel in the south and north of new Mehrauli can be seen . In the south of this road when volume of water is not much the formation of deep channel has not taken place but in the north of the above mention road water relatively more and soil is alluvium have great channel deepening capacity .(14)

### CLIMATE :

Climatically , the area lies in the transitional zone of the semi-arid in the west and sub-humid in the east . The climate of the area is hot and dry in summer and cold and dry in winter , with high variability of rainfall in space and time . These characteristics make the region semi-arid type according to the koppen's classification of climates .

The area records extremes of climatic condition specially in temperature . With extreme value in the months of January and June . The semi arid of the climate is reflected by the rainfall . The area normally received ( 46 – 7 ) cm. of rainfall . Nearly ( 90 ) m percent of the total rainfall is received during June – September period .

The direction and speed of the wind also change with the seasons . During winter they are north westerly with an average velocity of ( 3 ) km. per hour . But the winds become worth westerly during summer reason and are of great importance as they bring rains with them . The average wind velocity goes up to ( 12 – 13 ) km. per hour . Occasionally the area witness high velocity storms .

By the end of June the weather changes dramatically . The area comes under the impact of south west monsoon regime .



The weather starts cooling , the relative humidity rises up to ( 70 – 75 ) percent and the burst of monsoon a meteorological event of great importance takes place .

Rain usually begins by the end of June the normal date of onset is 29<sup>th</sup> June , although they may be delayed as late as middle of July . July and August are the rainiest month of the year . The area received normally ( 46 – 7 ) cm. of rain fall , and it is main source of water for Hauz Khas . (15)

## **NATURAL VEGETATION :**

The vegetation of an area can be taken as the mirror of its overall geographical conditions – in the plant life , one can notice effects of all the parameters of a landscape . In general , the term plant is applied to all those living organisms which by the presence of Chlorophyll are able to perform the functions of photosynthesis . The term plant may also be applied to vast range of organism , ranging from Unicellular types to the complex growth of trees . Generally the vegetation life is classified as trees and shrubs which are wood plants . Trees are distinguished by a single main trunk . Shrubs are also woody plants having several stems close to the ground . The " **Linanas** " in the third category are also woody which climb upon trees . The fourth category are the herbs which lack in woody stems and the last are Epiphytes which use other plants as supporting structure and do not have any contact with soil .

The development of vegetative growth is based on climatic, geomorphic , biotic and other factors .

In terms of water need the plants are classified as Xerophytes or dry plants , hydrophytic or wet plants and mesophytic or the middle plants .

The vegetating of Hauz Khas ranges from xerophytic to mesophytic and it is only during the monsoons that hydrophytic vegetation seasonally in the pits and other depressions where water collects temporarily .

The permanent vegetation of Hauz Khas area is xerophytic characterized by thick , woody stem , small leaves , thorny

character , these are the characteristics which reflect the negative water balance of the area . The thorny shrubs occur in widely spaced clumps supporting a number of lianas like scabra . However the vegetation at the base along the nullahs of Hauz Khas is different and is mesophytic in nature . The xerophytic vegetation is dominated by " **Acacia** " . It is a tree with thick bark and thin stem with small leaves and thorny nature . It is best suited for dry areas and is a natural tree in the region . Both varieties of keeker namely the Vilayati and Desi are available . The other xerophytic plants are Karir ( **Capparis deciduas** ) Karir is a leafless , much branched shrub with thorns replacing leaves and during the flowering season topped by red flowers . This is a characteristic of dry areas dry of Delhi .Jungles Karonda is small thorny bush with leaves and is found well distributed all along the courses of Hauz Khas Nullahs . In the wild form the fruit of which is not edible . Ber ( **Ziziphus nummularia** ) is a shrub with small leaves and thorny branches , is found widely distributed in the area . Even in the wild form it's fruit red in colour , small in size , are edible . It is picked by the local villagers for sale .

The mesophytic plants are characterized by medium need of moisture . These includes a few variety of deciduous trees like Neem , Dhak . These are basically planted vegetation of the area phyllanodiflora is the creeper herb having roots at the nodes of leaves . This can be identified at the bed of the channel . The distribution of xerophytic and mesophytic vegetation shows very significant characteristics . The dry channel deg which still retain some moistures have mesophytic vegetation while hardly few set away the xerophytic plant takes over . Thus the channel of the bed can be identified even at places where it is not very clear by vegetation of greener leaves .(16)

To sum up , vegetation cover the area is mainly xerophytic in it's character and the species are common to those of the semi-arid part of country . This situation can be attributed to the insufficient rainfall poor soils and rampant ravages of the inhabitants living in the area . The wood cutting and cattle

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grazing by the neighboring villagers have a gravated the problem and needs special attention .

## **CONCLUSION :**

Hauz Khas provides a very interesting example of man's attempt to interact with nature for his own advantage . Hauz Khas was made to provide drinking water to the inhabitants of Siri town . The other cities or towns prior to Siri to had to be suffer due to lack of water . The best example were Mehrauli and Tughlakabed . The town of Delhi ; an important capital town from earlier period , had suffered due to lack of water . Hauz Khas represents the awareness of the problem of water scarily and man's capacity to solve this problem in the past .

## المستخلص :

الهدف الرئيس للدراسة هو لتقييم الخصائص الجغرافية للحوض الخاص الذي كان في يوم ما المورد الرئيس لمياه الشرب والسقي لعاصمة شبه القارة الهندية في العهد الإسلامي . حيث تتم دراسة الخواص الجيومورفولوجية والجيولوجية والمناخية للمنطقة ومعرفة مقدار التساقط والتبخر والتسرب إلى باطن الأرض وكذلك معرفة كمية المياه القادمة الى الحوض من خلال حساب مساحة منطقة التغذية للحوض والمساحة التي تقطعها الوديان المختلفة واهم الاشكال التضاريسية الناتجة مع معرفة الانحدار الارضي وتشكيل الانهار في المنطقة وطوالها ومقدار التحت الحاصل والإرساب في الحوض وكذلك في النهاية تم التعرف على النبات الطبيعي السائد في منطقة التغذية والتعرف اخيرا على مال اليه الحوض في الوقت الحاضر حيث تم تسليمه الى الهيئة العامة للحفاظ على التراث العالمي التابع للأمم المتحدة .

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