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Testing Of Drilling Well and Experimental Drowing of Ground Water on the Example of Drilling Well Bk-1, Locality Kiseljak, Tuzla

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ABSTRACT

Within the aim of provision of needed quantities of mineral water for water(Tuzlanski kiseljak Mg ++) municipality, by scientific – expert aproach it was approached with performance of geological – research and exploatin works at the locality Kiseljak. Analysing the lithologic composition of the terrain with the interpretation of experimental water drawing confirmed are hydrogeological parameters:K,T. On the drilling well BK-1 was done standard experimental drawing with three different capacities in period of five days with electric soaked well pump of enough capacity and enough lifting. Measuring of drawing quantity were done on classic way by water meter, and conrol measuring were done by container with stopwatch. Registration of lowering the water level was measured on standard way by use of levelmeasurer equiped with sound and light signal. Recording of datas has been done manualy as a standard written report.

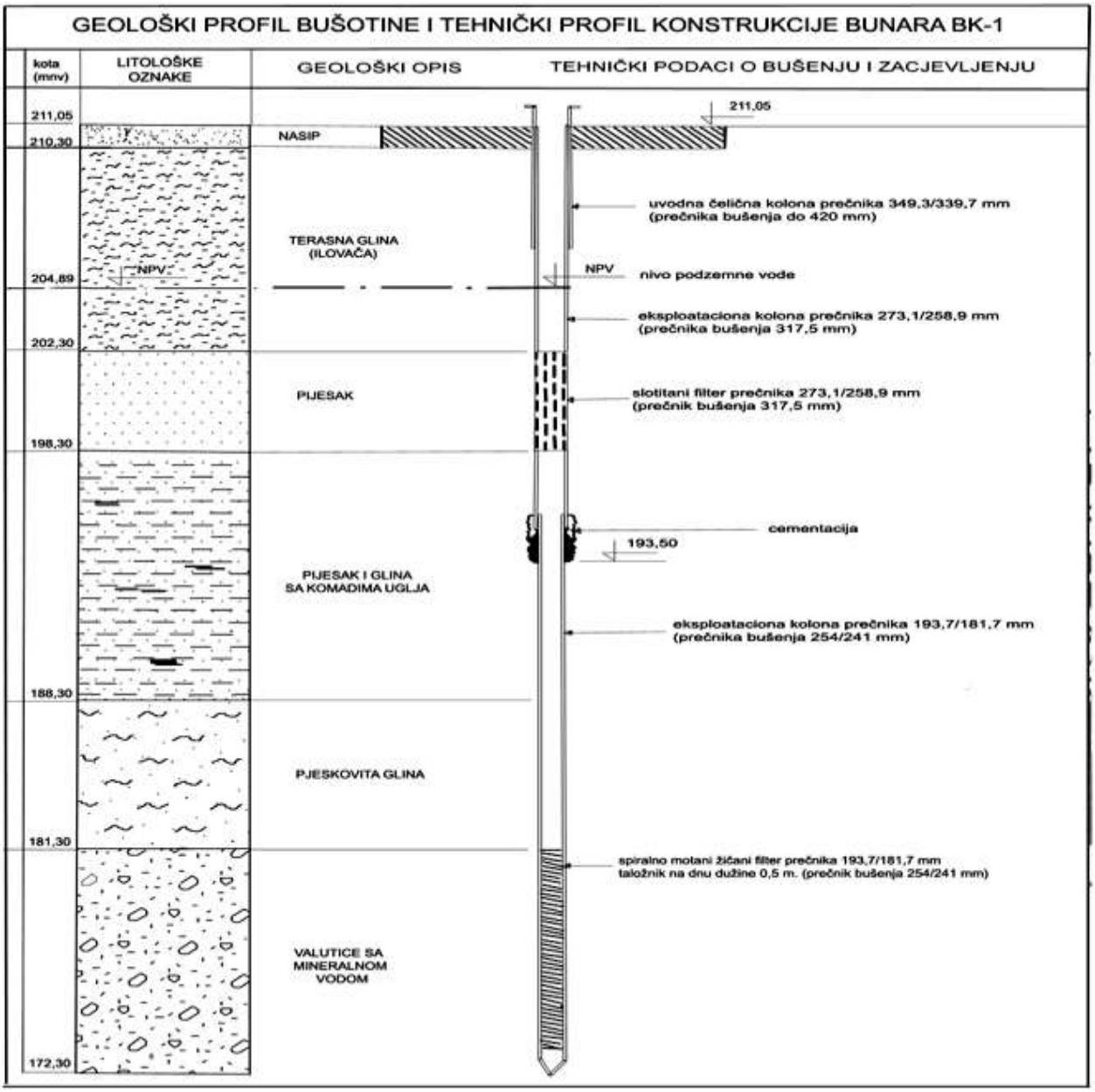
Keywords: Geological, hydrogeological, ground water.

1. INTRODUCTION

Tested area Kiseljak- Ljubache is characterised by manifestation of ground drinking and mineral water very rich with magnesium. In that aspect in this work are explained aspects of testing and experimental drawing of natural mineral water on the drilling well BK-1 locality Kiseljak, and in function of finding natural mineral water.Many ects of natural mineral water occurrance should be taken into consideration and the most important are hydrogeological and hydrological. Many datas for wider area arek known, about genesis and occurrance of mineral water with regard to understanding factors related to occurrance of mineral water. Wider area is placed 10-17 km southwest from Tuzla , along railroad nad magistral road Tuzla-jivinice- Sarajevo, and closer name is Kiseljak- Ljubache. In smaller parts it also occupied place Maline , left and right around river Sprecha downriver from Jivinice. Drilling well BK-1 has been in use since 1995 by Pivara d.d Tuzla and from it ther is uncontinued exploatation of natural mineral water because of limited production and bottling with commercial name(Tuzlanski kiseljak Mg++).[1]

2. VERTICAL DRILLING WELL BK-1, PLACE KISELJAK NEAR TUZLA

On the drilling well BK-1 was done standard experimental drawing with three different capacities in period of five days with electric soaked well pump of enough capacity and enough lifting. Measuring of drawing quantity were done on classic way by water meter, and conrol measuring were done by container with stopwatch. Registration of lowering the water level was measured on standard way by use of levelmeasurer equiped with sound and light signal. Recording of datas has been done manualy as a standard written report. Drilling well BK-1 has been in use since 1995 by Pivara d.d Tuzla and from it ther is uncontinued exploatation of natural mineral water because of limited production and bottling with commercial name (Tuzlanski kiseljak Mg++). There has not been noticed any abnormality from earlier characteristics of productivity or water quality from well BK-1.[2,3]



Picture 1. - Geotechnical profile of drilling well BK -1

3. CALCULATION OF BASIC HYDROGEOLOGICAL PARAMETERS Well BK-1[4]

In this (single case), that is calculation of hydrogeological parameters on the sole well, for calculation of maximum well capacity are adopted following hydrogeological prerequisite:

- aquipher is under pressure (subartesian).
- well is hydrogeologicaly (complete), it completely cap aquipher by the width.
- calculation forms from important authors are used.
- drawing datas processing is done by licenced computer software.
- well diameter is shorter than 200 meter and it does not include old well Kiseljak.
- maximum lowering of water level is not more than 1/3 of complete possible lowering.

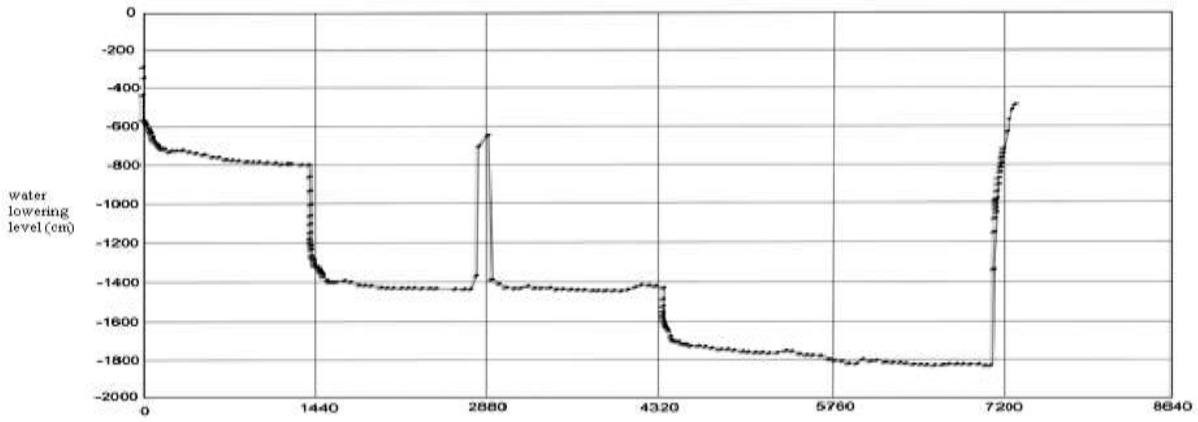
Hydrogeological sheme is following:

- well depth is 37,80 m.
- well filter is on the depth from 28,80 m to 37,80 m.
- static water level is on the 5,41 m depth.
- width of well is 32,39 m.

- width of capped area under pressure is 9,0 m.
- effective well diameter is cca 200 mm.

Experimental water drawing datas which were used are listed in following atachments:

Table of lowering and recovery level (from 15.01 to 20.01 . 1996)



From listed atachment and constructed Logger WL-14 File, Kiseljak BK -1, it can be concluded:

- constant discharge was 7120 min or 4,94 days.
- recovery data was 150 min or 0,10 days.

During the discharge(drawing), which was done by depth pump with 3 different capacities, results are 3 relatively unchangeable levels:

Q_1 = 1,5 I/sec iii 129m^3/day

S_1 = 805cm,

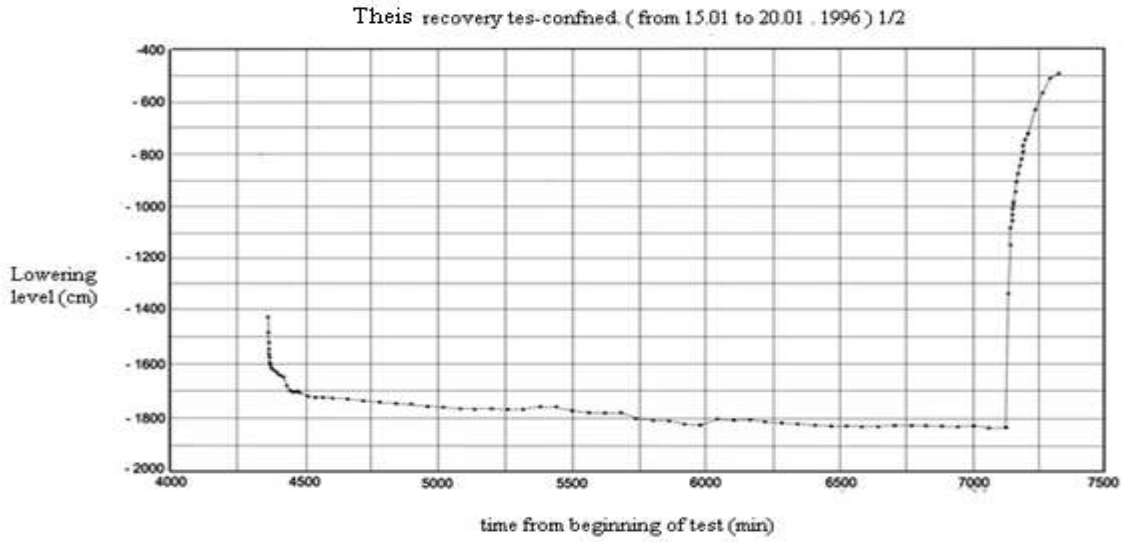
Q_2 = 2,5 I/sec iii 216 m^3/day

S_2 = 1 427cm,

Q_3 = 3,0 I/sec iii 259m^3/day

S_3 = 1 828cm

Recovery level is shown on the following atachment:

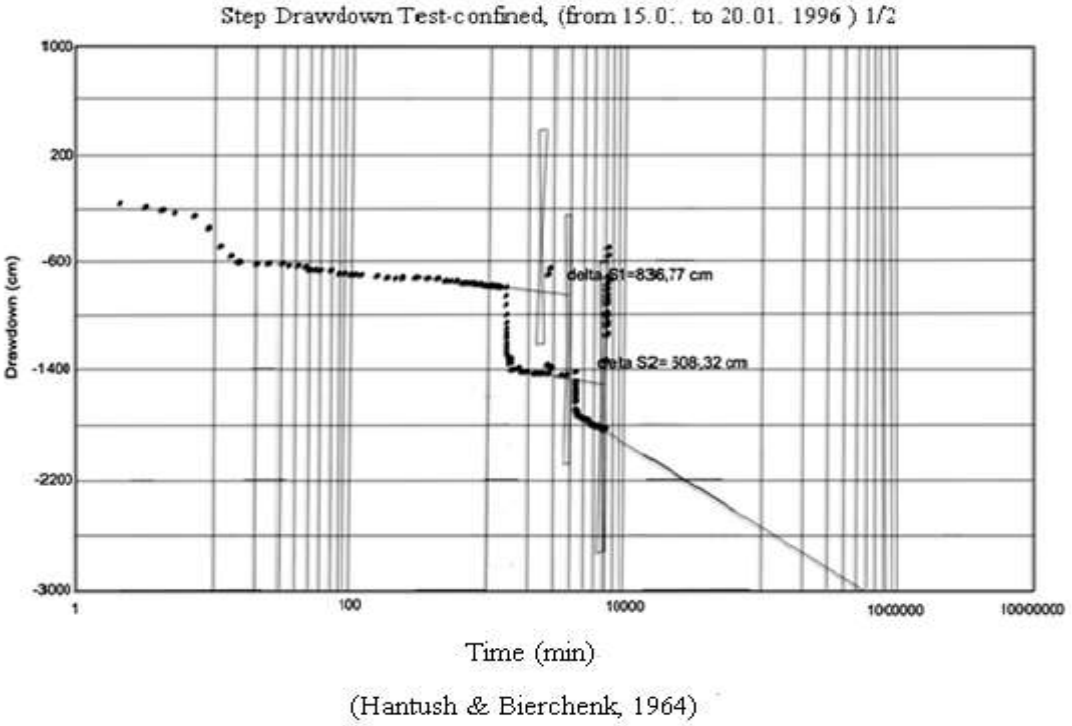


Atachment 2. - Experimental drawing on well BK-1- Theis Recovery Test (confined) 1/2.

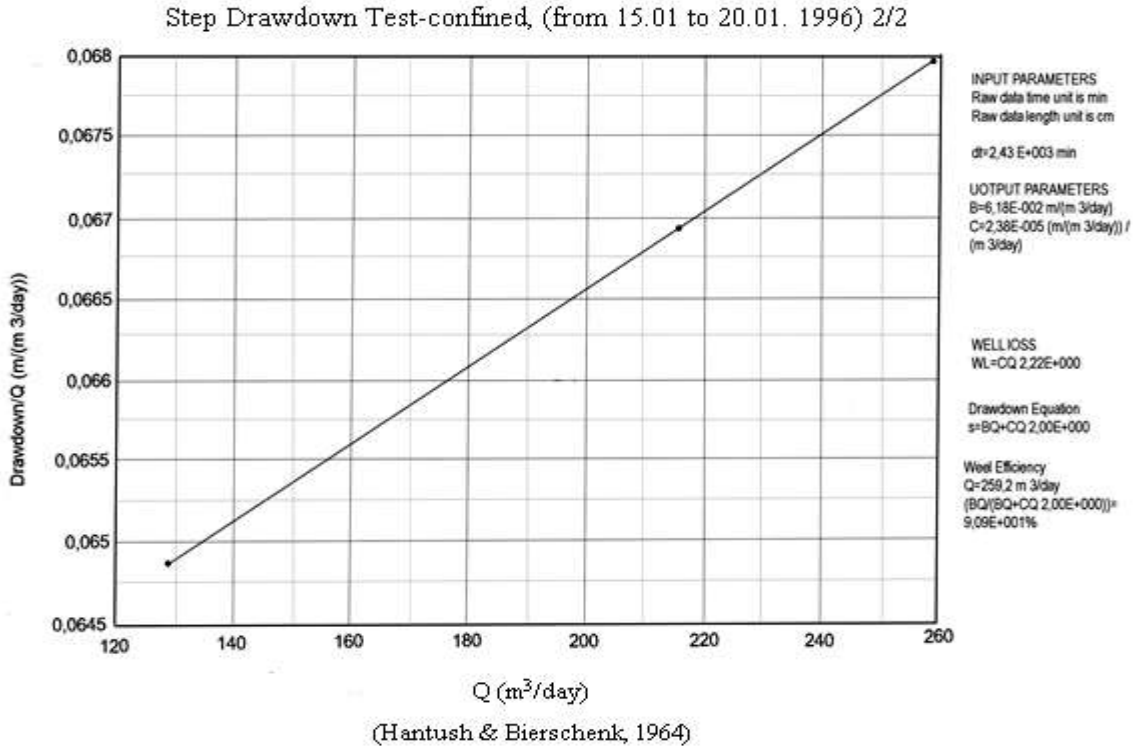
4. HYDROGEOLOGICAL CALCULATION[5,6,7,8]

4.1.Step Drawdown Test

Drawing datas are processed in(Single Well)program by method of Step Drawdown Test, of two famous authors(Hantush & Bierschenk,1964.). The results of grapho-analyzing calculation are shown in following attachments:



Atachment 3. - Experimental drawing on well BK-1- Step Drawdown Test (confined) 1/2.



Atachment 4. - Experimental drawing on well BK-1- Step Drawdown Test (confined) 2/2.

By these calculations following coefficients B and C for famous Jacob's equation of relation between drawing of well and lowering of water level are calculated:

$BxQ+Cx(Q)^2 = S$

$B = 6.18\ E - 0,02\ m/(m^3/day)$

$C = 2,38\ E - 0,05\quad (m/(m^3day))/(m^3/day)$

Well lost(hydraulic resistance of filtering the well) are:

$WL = CQ^2 = 1.60\ m$

Maximum permitted water lowering in this well is 1/3 of watered profile or S_{max} = 10,68 m what contains also local lost(additional lowering) from 1,60 m. With taking into consideration that this lost represents local deformation piesoarea, but not real depression of piesolevel in aquipher, for maximum permitted lowering and for that height, can be realy increased so that maximum permitted lowering of piesolevel inside the well:

$S_{max} = BxQ_{max} + Cx(Q_{max})^2$

$S_{max} = 1/3x\ 32,39\ m = 10,68\ m + 1,60\ m = 12,28\ m$

Maximum capacity of the well for maximum permitted lowering is in that case:

$S_{max} = BxQ_{max} + Cx(Q_{max})^2$

$6,18E\text{-}0,02m/(m^3/day)xQ_{max}+2,38E\text{-}0,045(m/(m^3/day))/(m^3/day)x\ (Q_{max})^2=12,28\ m$

$S_{max} = BxQ_{max}+1,60\ m$

$Q_{max} = (S_{max} - 1,60\ m)/B$

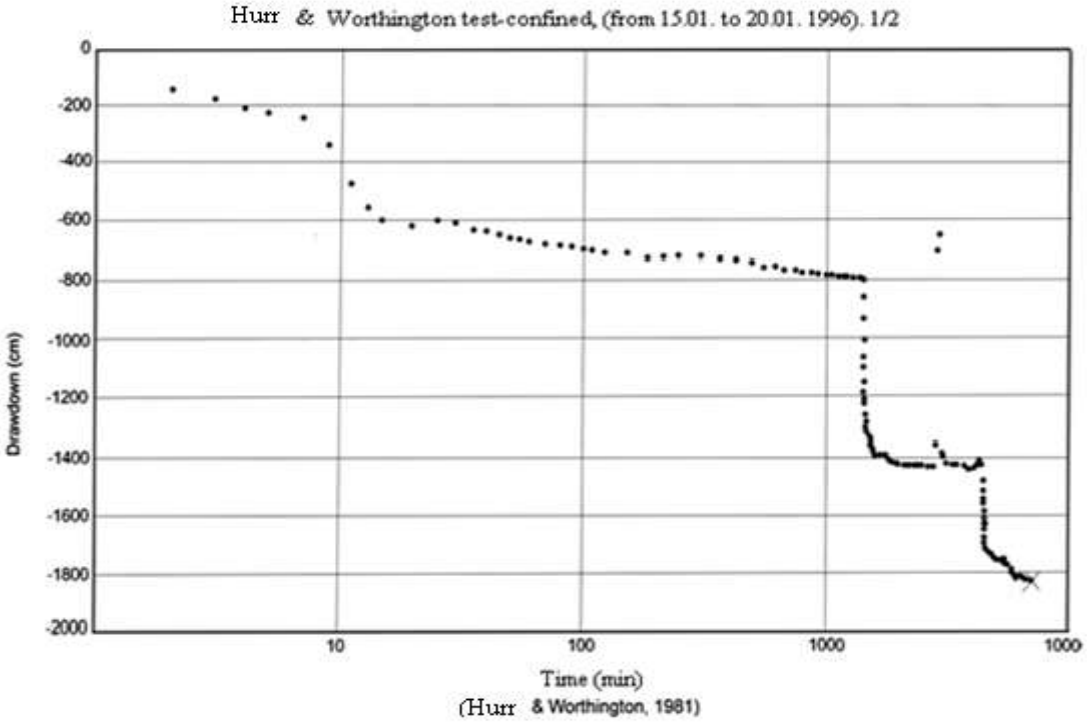
$Q = 172,8\ m^3/day = 2,0\ l/sec$

Well efficiency under those hydrogeological conditions is calculated:

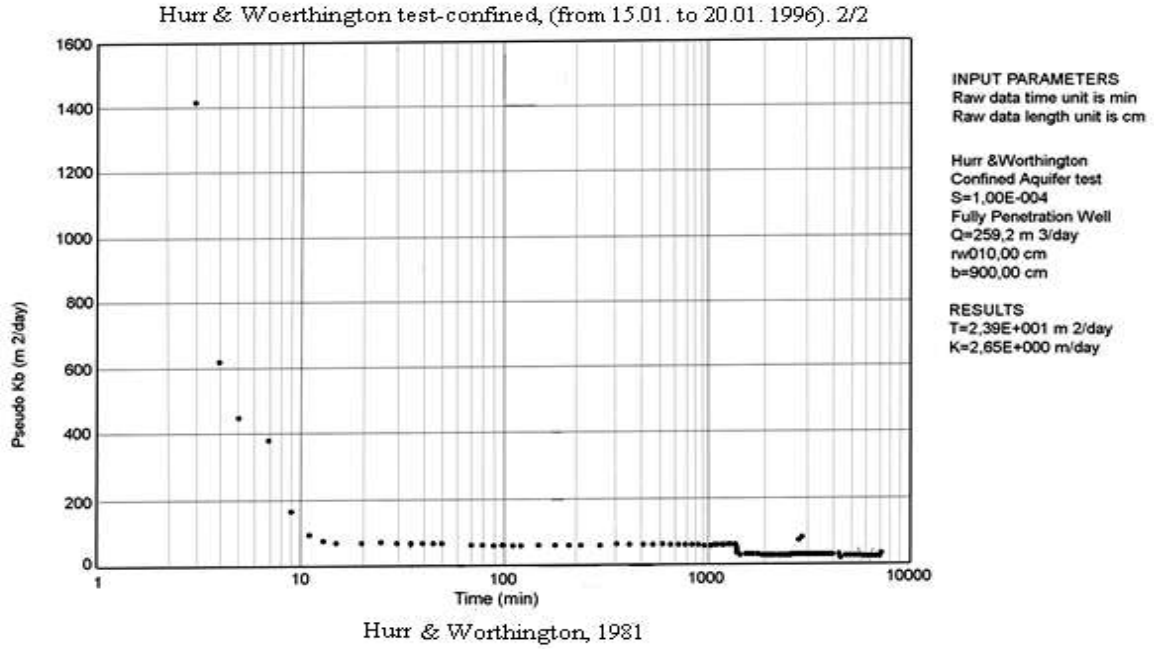
$BQ / (BQ + CQ^2) = 90,9\%$

4.2.Hurr & Worhington Test

Declining line on the diagram of drawing is additionaly analysed by Constant Discharge Test method of two famous authors(Hurr & Worthington), and results of grafoanalitic calculation are shown below:



Attachment 5. - Experimental Drawing Test of Well BK-1, Kiseljak- Hurr & Worthington Test (confined) ½



Attachment 6.- Experimental Drawing Test of Well BK-1, Kiseljak- Hurr & Worthington Test (confined)2/2

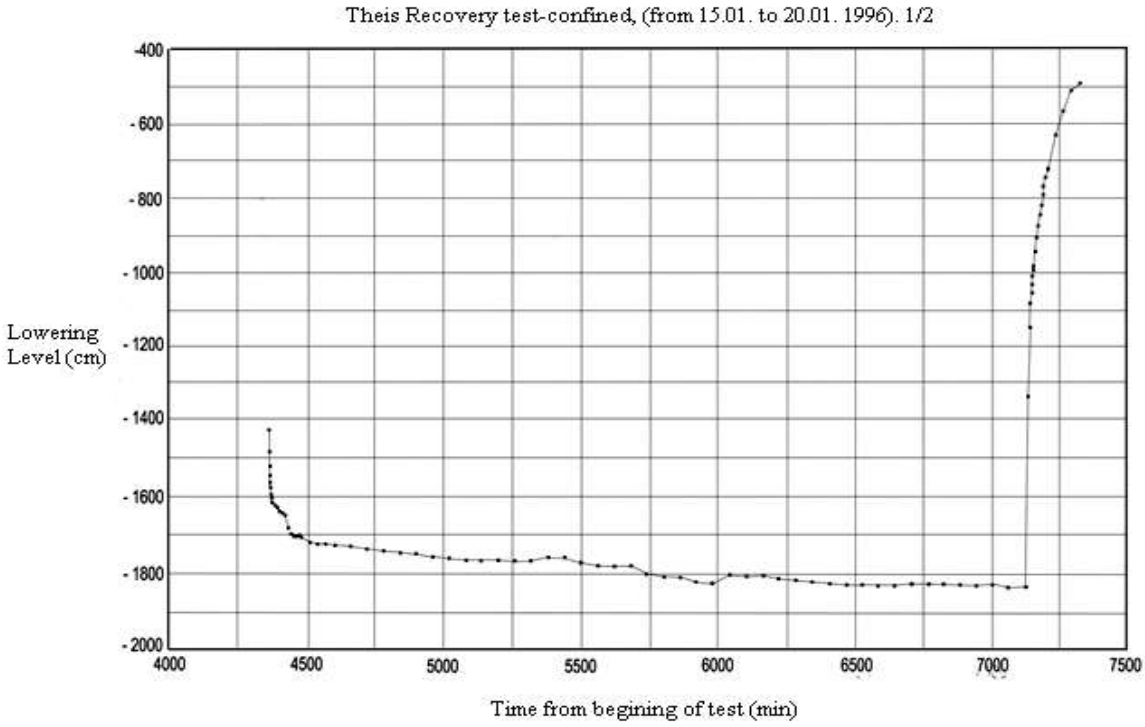
and calculated values for hydro-geological parameters T and K are:

T = 23,90 m^2/day

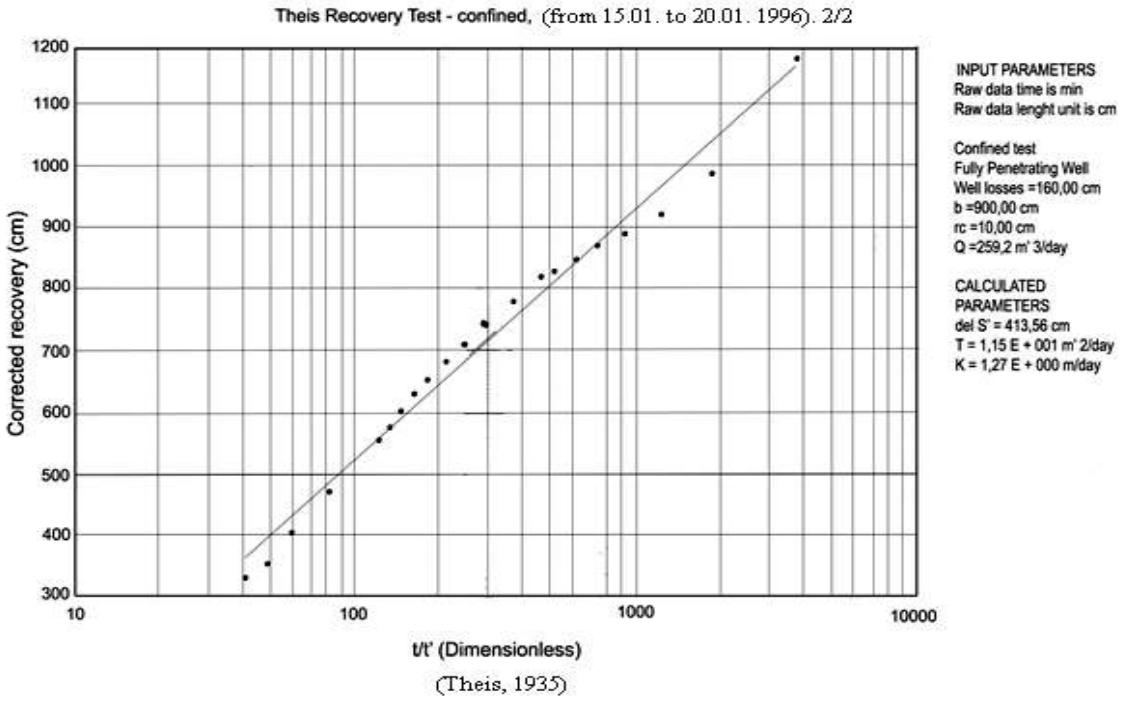
K = 2,65 m /day.

4.3.Theis Recovery Test

Rising line on the diagram of drawing is additionaly analysed by famous grapho-analysing method(Theis Constant Discharge and Recovery Test-a) famous author Theis. Results of grafo-analytic calculation are shown below:



Attachment 7. - Experimental Drawing Test of Well BK-1, Kiseljak- Theis Recovery Test (confined) ½



Attachment 8. - Experimental Drawing Test of Well BK-1, Kiseljak- Theis Recovery Test (confined) 2/2

and calculated values for hydro-geological parameters T and K are:

$T = 11{,}50\ m^2/day$

K = 1,27 m /day.

CONCLUSION

In this work are presented results of drawing , which was done by depth pump with 3 different capacities and results are 3 relatively unchangeable levels. Drawing datas are processed in (Single Well) program by method of Step Drawdown Test, of two famous authors (Hantush & Bierschenk,1964.). Declining line on the diagram of drawing is additionaly analysed by Constant Discharge Test method of two famous authors (Hurr & Worthington). Rising line on the diagram of drawing is additionaly analysed by famous grapho-analysing method(This Constant Discharge and Recovery Test-a) famous author Theis. In this work is also shown calculation of basic hydro-geological parameters during 3 experimental drawings and also methods of calculation. Hydro-geological parameters values on all 3 calculations show relatively weak filtering characteristics of aquipher in which is accumulated natural mineral water and small influence diameter of drawing on well BK-1. That is reason why five-day drawing did not influenced on decreasing of natural capacity of old well (Kiseljak) remote only cca 200 m from BK-1. Well maximum capacity value can serve for calculation of exploitation reserves of natural mineral water which can be produced from this well in condition of continuing production and in average hydrological conditions.

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