DEPENDABLE DISCHARGES OF THE UPPER AND MIDDLE DIYALA BASINS

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ABSTRACT

The Diyala river is a major tributary of the Tigris river that runs through Iran and Iraq which drains an area of 32600 km^2. The catchment area consist of four parts which are the area of the basin above Derbendi-Khan, Upper Diyala, Middle Diyala and lower Diyala. Through the last two decade the water coming to the upstream Derbendi-Khan reduced and this reduction reach to about 35%. This research focusing on the water dependable discharges reached to upper and middle Diyala river basin as compared with Russian study(water balance). The water balance mention that the discharge can be supplied the above basins with probability of 95%for the year (1947-1948). In this research consider the mean discharge down stream Derbendi-Khan dam for the period (1989-2007) in order to find the dependable probability for discharge which can be satisfied and equivalent to the water balance study .

In this research considered different probabilities (95%,80% and 50%) of each months (Oct-Sep) water year for the period (1989-2007) by using the empirical Wei Bull probability equation, and it was conclude that the probability of 50% can be considered the suitable probability for the water requirement to upper and middle basins.

الخلاصة

يعتبر نهر ديالى احد الروافد الرئيسية لنهر دجلة والذي ينبع من الأراضي الإيرانية والعراقية حيث تبلغ مساحة حوضه الكلي حوالي 32000 كلم^2 . ويمكن تقسيم الحوض إلى أربعة أجزاء , الحوض الواقع اعلى سد دربندخان والأخرى تباعا هي الحوض العالي والوسطي والسفلي. خلال فترة العقدين السابقين تظهر بان التصاريف القادمة قد قلت بحدود 35%. إن هذا البحث سوف يركز على التصاريف الواصلة إلى أعالي والوسطي لحوض نهر ديالى مقارنة مع دراسة الموازنة المائية (1982) المعدة من قبل الروس. إن دراسة الموازنة المائية اشارت بان التصاريف اللازمة للحوض أعلاه يمكن أن تكون باحتمالية 95% لسنة (1947-1948). في هذا البحث سوف يأخذ معدل التصاريف المطلقة بين سنة (1989-2007) وإمكانية إيجاد الاحتمالية المناسبة باستعمال معادلة وضعية من قبل Wei bull.

تم إيجاد احتمالية 95%,80% و 50% لمعدل التصاريف من سنة 1998-2007 ولكل شهر (تشرين الأول ولغاية شهر أيلول) حيث اتضح بان معدل التصاريف لاحتمالية 50% (1989-2007) هو الذي يمكن أن يعطي نتائج مقاربة لاحتمالية 95% (1947-1948) بموجب دراسة الموازنة المائية.

KEY WORD:- Diyala River Basin

INTRODUCTION

The Diyala river basin is a major tributary of the Tigris river and runs through Iran and Iraq drains an area of 32600 km^2. The river basin are shown in figure (1). The character of the river basin verses widely from the semi-arid plans to the north of Baghdad at about 33 meter G.T.S where the average annual rainfall is only 140mm to the high mountainous of the west rain Iran where there are many peaks over 2500 meter rising the height 3370 meter G.T.S. in this region there are large area where the average annual precipitation exceed 1000 mm and the high peak are covered perennial snow . The area of these basin can be shown in table (1).

Table 1. Area of Diyala Basin (4)

	Basin	**Area km^2**
1	Above Derbendi-Khan dam	17900
2	Upper Diyala	3910
3	Middle Diyala	8850
4	Lower Diyala	1440
Total		32600

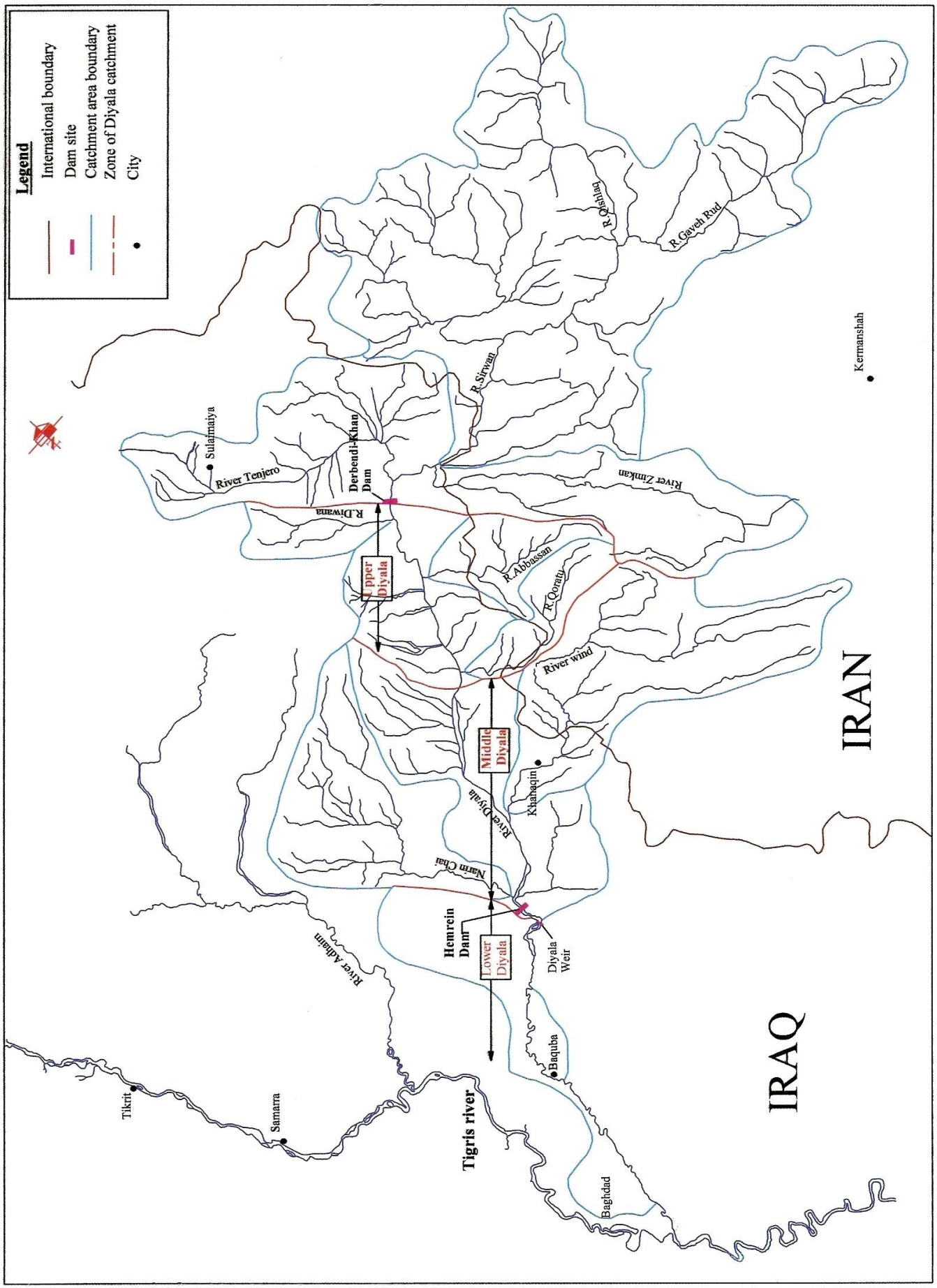

Fig. 1 Diyala River Basin (6)

The difference between two periods will be ((6.4 – 4.14)/6.4)×100 = 35%. Figure(2) and figure(3)shows the hydrograph of the two period. The water requirement for the year 2000 equal to 3.87 km^3as mentioned in the water balance (8) and this amount is less 6.8% than the average of the year(1989-2007) i.e. the water requirement for this region will need to increase 10% for each decade.

Discharge Down Stream Derbendi-Khan dam with 95% Probability

This Research was worked by (8) experts for water resources and land development in Iraq (1982) which may called water balance and as referring to Diyala river basin they suggest three probabilities can be covered the requirement for upper and middle Diyala basin. Those probability are: 50% for the year (1935-1936), 80% for the year (1954-1955) and 95% for the year (1947-1948) and the mean discharge are 103.67 m^3/sec,98.8 m^3/sec and 94.48 m^3/sec respectively.
The study worked by (2) consider 95% probability for the upper and middle basin for the period (1947-1948) can be satisfied the requirement. Figure(4) shows the 95% for period (1947-1948).

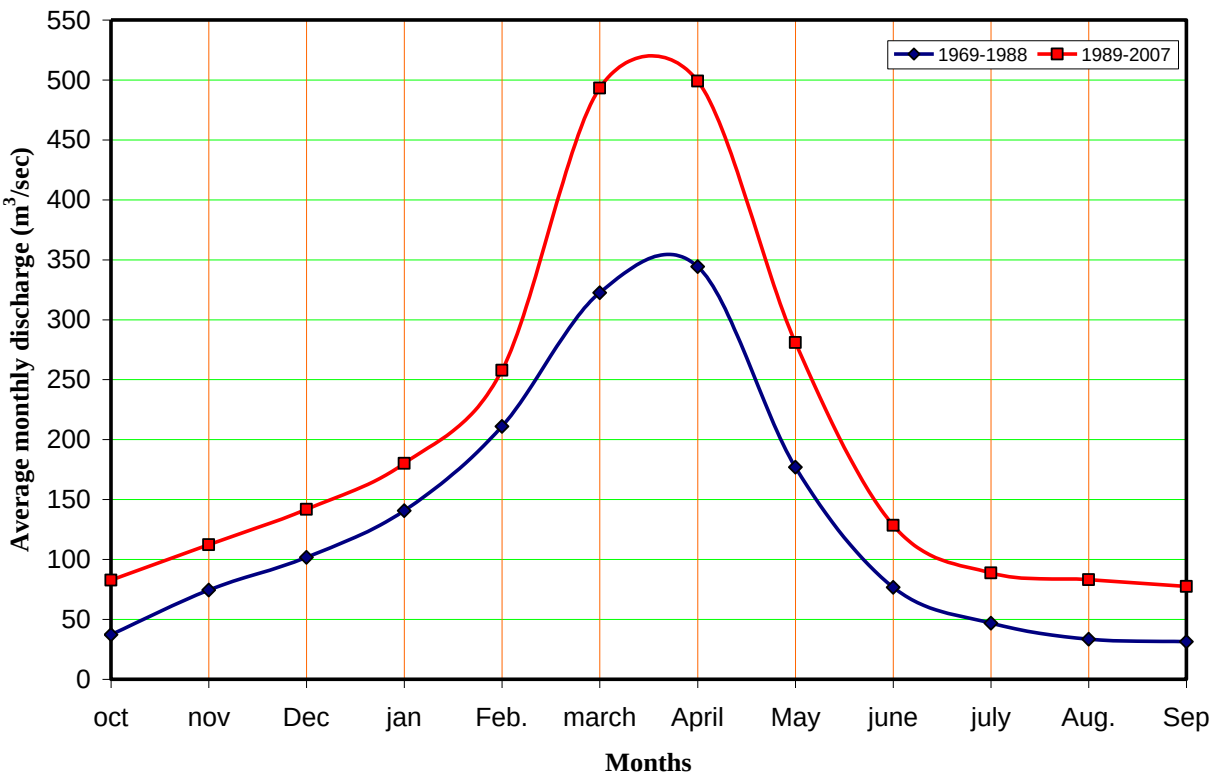

Fig. 2 Monthly Average Discharge (m^3/sec) for Upstream Derbendi-Khan Dam

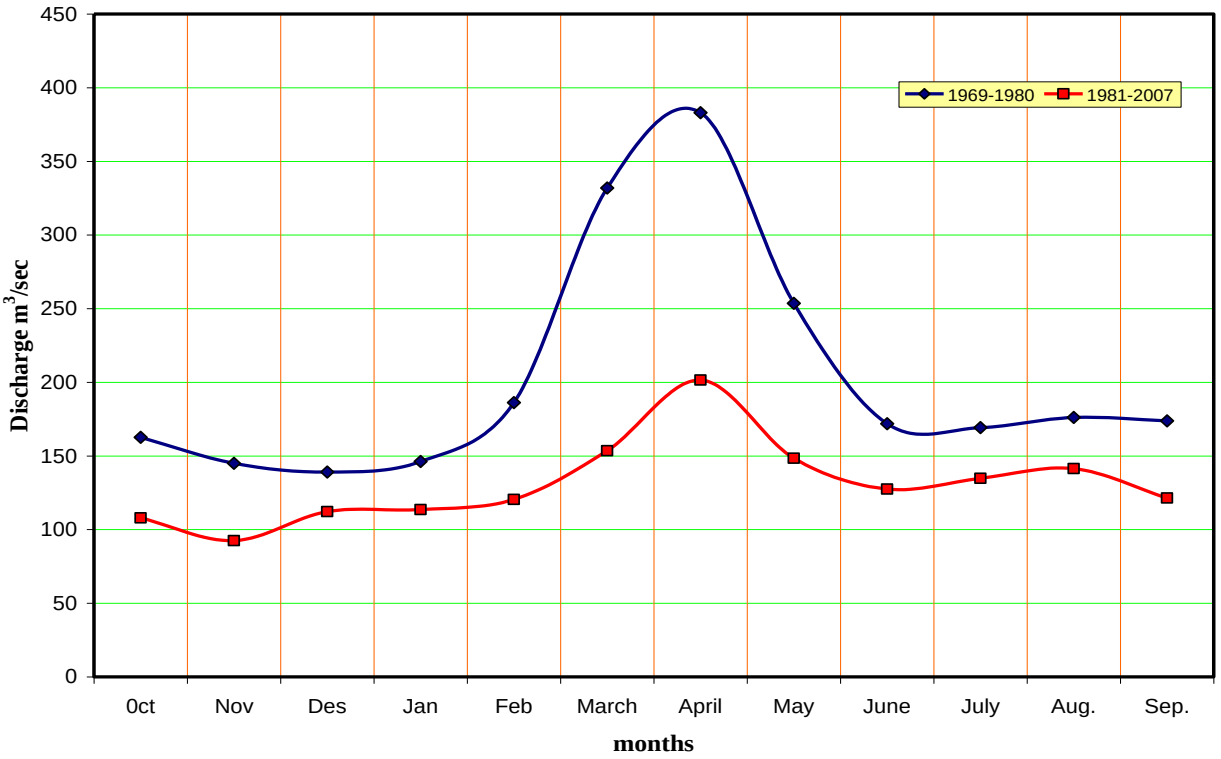

Fig. 3 Monthly Average Discharge (m^3/sec) Down Stream Derbendi- Khan Dam flow.

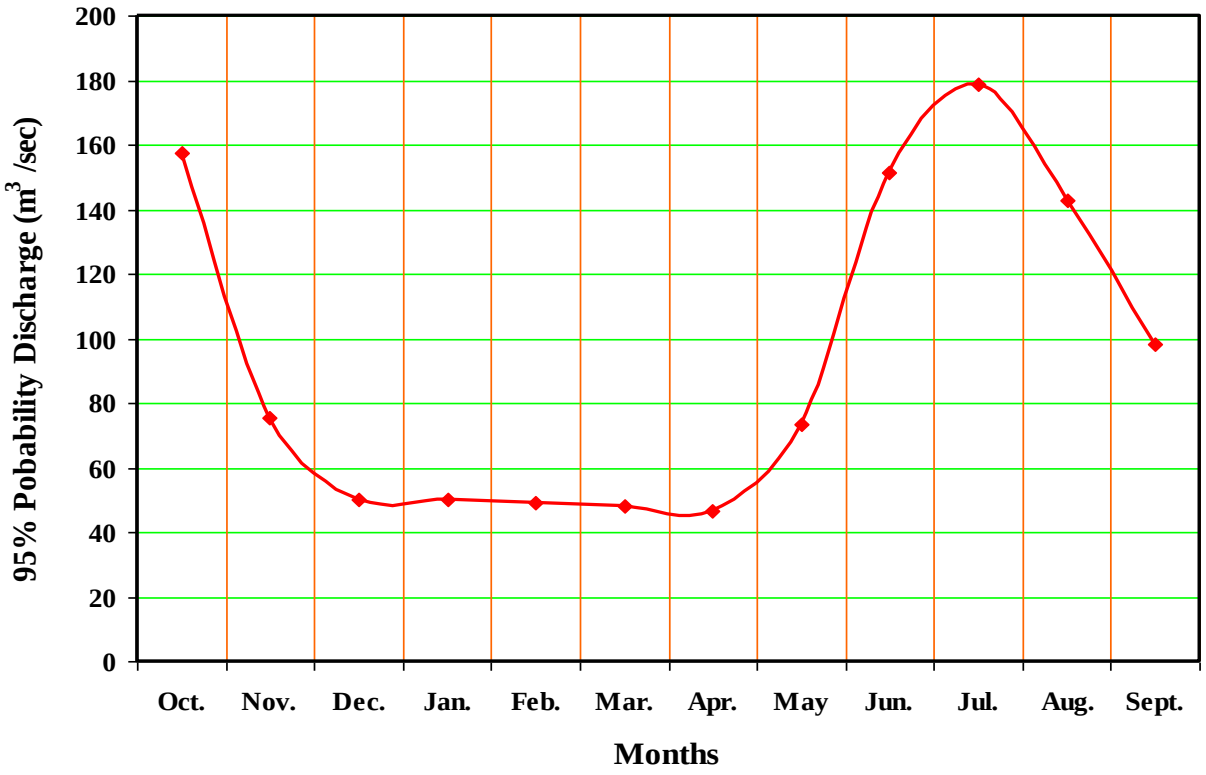

Fig. 4 95% Probability Discharge Downstream Derbendi-Khan for year 1947- 948(Water Balance).

Probability for Discharge Downstream Derbendi-Khan dam for the period (1989-2007)

The analysis was consider the frequency percent for each month (water year) by using empirical Wei Bull probability equation (1) from October to September and find the probability of 95%,80% and 50% which can be shown in figure(5),(6) and (7). The average yearly flow for these probability are 38, 59.52 and 101 m^3/sec respectively. Naturally the mean discharge of 101 m^3/sec of probability 50% can be satisfied the requirement of upper and lower basin.
The 50% dependable discharge downstream Derbendi-Khan dam are shown in the following table (2) which the coefficient of variation C_v which can indicate large time variation and distribution.

$$P_m = \frac{m}{1+n} \quad (1)$$

Where:
P_m : Frequency of recurrence of a certain term of the series
m : Number carried by the term of the descending series.
n : Number of the term in the series.
$p = \frac{1}{T}$, T=Recurrence interval of return period.

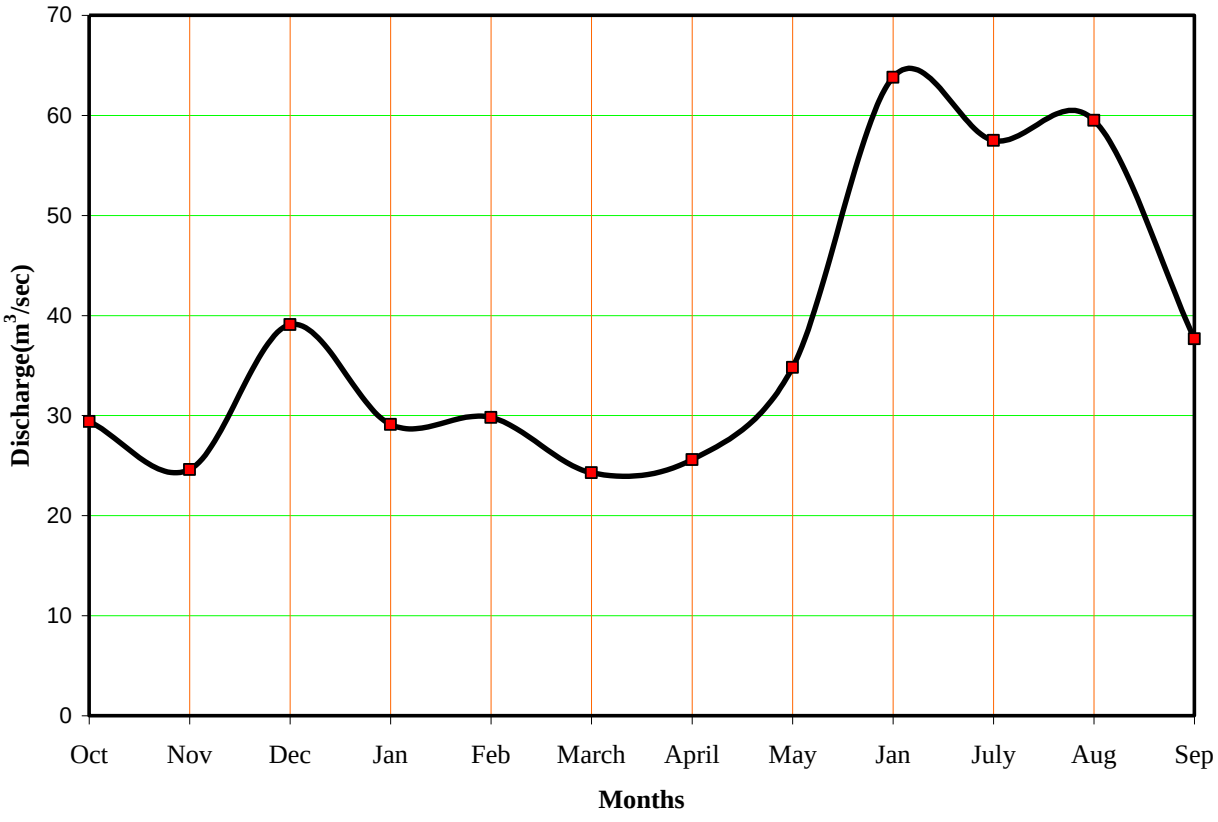

Fig. 5 95%Probability Average Discharge Derbendi-Khan (1989-2007).

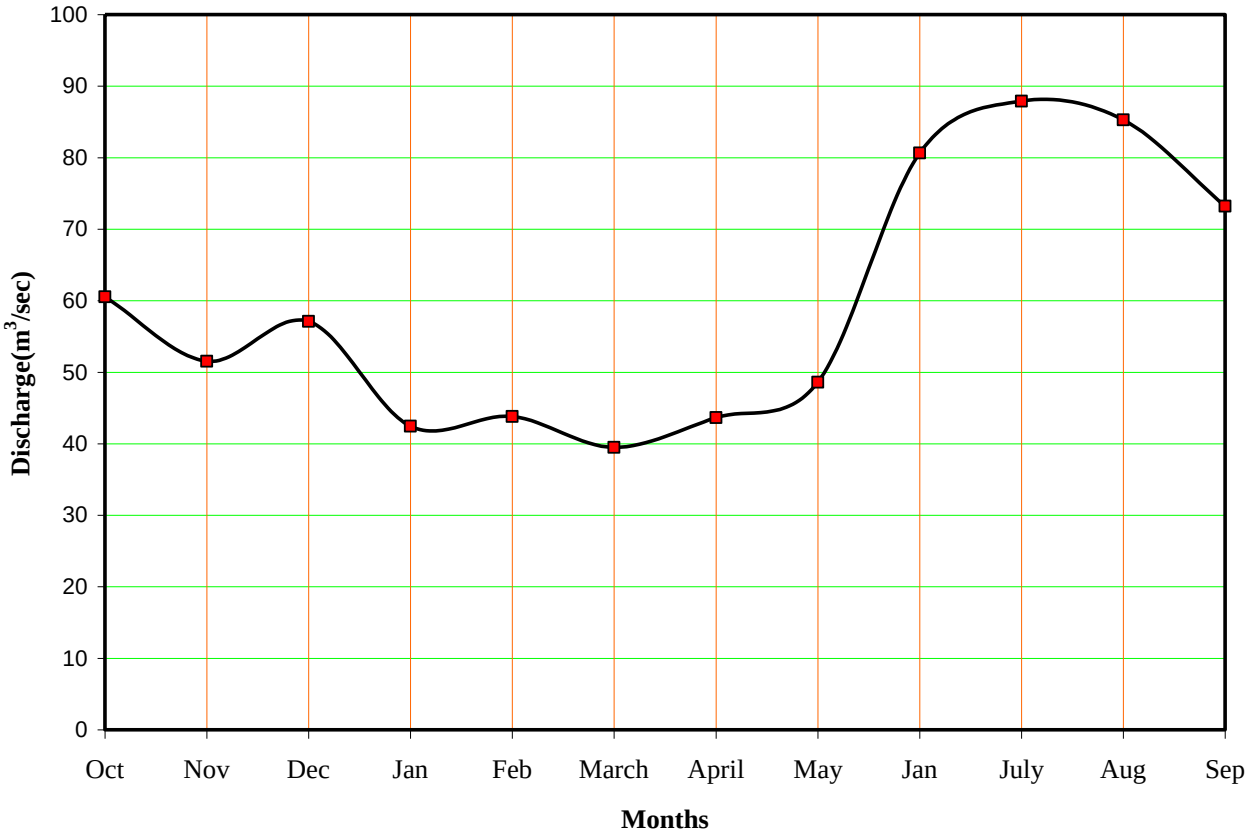

Fig. 6 80%Probability Average Discharge Derbendi-Khan (1989-2007).

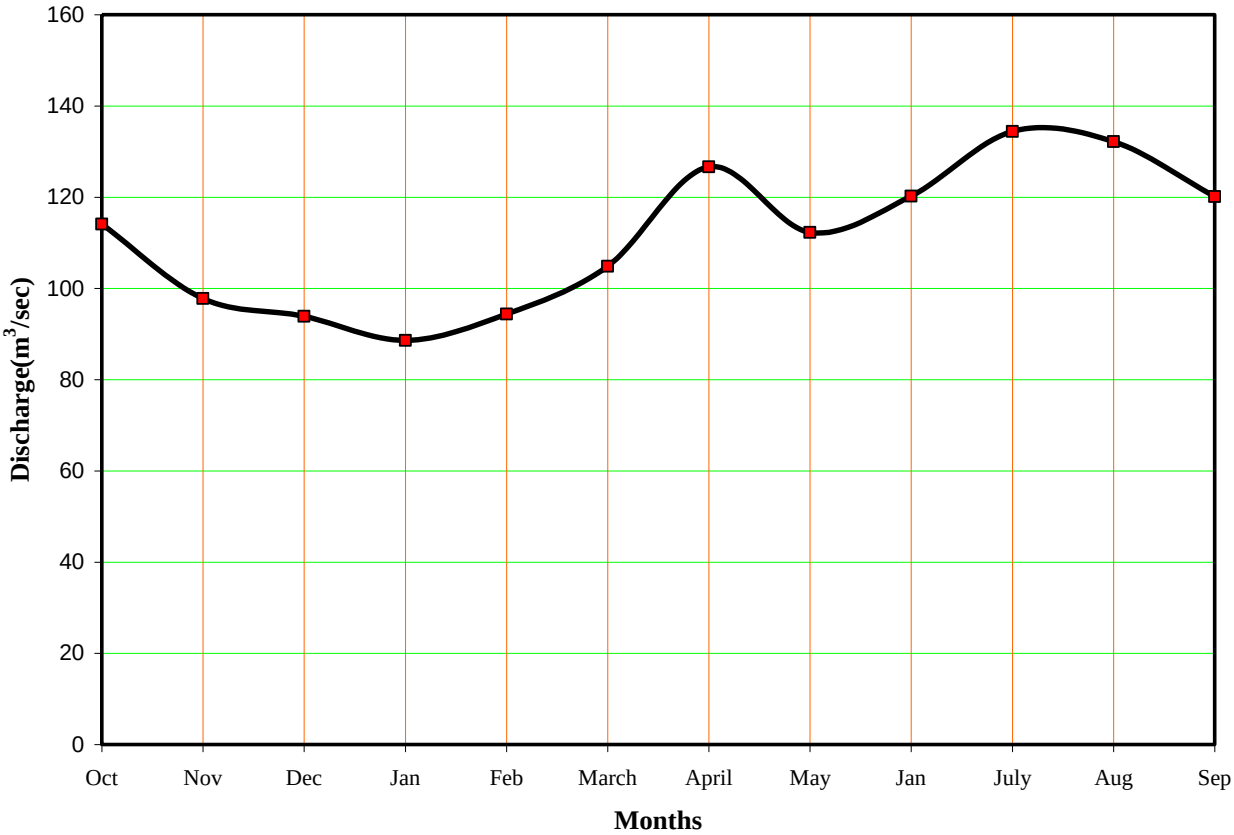

Fig. 7 50%Probability Average Discharge Derbendi-Khan (1989-2007).

Table 2. 50% Dependable Discharge Down Stream Derbedi-Khan dam

Month	Mean discharge m^3/sec	Standard deviation (σ)	Coefficient of variation (C_v)	Skew coefficient (C_s)	Dependable discharge m^3/sec 50% probability
Oct	107.95	43.63	0.404	-0.387	114.1
Nov	92.53	38.37	0.415	-0.418	97.8
Dec	111.84	55.89	0.499	0.756	93.9
Jan	111.79	79.58	0.711	1.447	88.6
Feb.	120.36	87.53	0.727	1.335	94.4
March	153.53	138.23	0.900	1.566	104.89
April	201.52	210.48	1.044	1.83	126.66
May	148.47	114.09	0.77	1.628	112.26
June	127.42	48.69	0.382	0.066	120.24
July	135.36	44.84	0.331	-0.116	134.38
Aug.	141.42	57.06	0.403	0.648	132.2
Sep.	120.73	47.02	0.389	0.213	120.10

Water Requirement Down Stream Derbendi-Khan Dam

The water released downstream Derbendi-Khan dam will be shred different project located between down stream Derbendi-Khan dam and Hemrein dam. The main project are Shaik-Langer,Balajo Khanaqin, Qara Tappe, Jalawla and Al-Saadia.
The total water requirement for those project at maximum and minimum water requirement as mentioned in the water balance can be shown in the table (3) below. The maximum discharge in July and the minimum discharge are in January.

Table 3. Minimum Discharge required is in January and Maximum Discharge is in July

Name of project	Water requirement for January		Water requirement for July	
	Vol. Million m^3	Discharge m^3/sec	Vol. Million m^3	Discharge m^3/sec
Shaik-Langer	0	0	6.2	2.31
Balajo Khanaqin	0.26	0.1	16.16	6.03
Qara Tappah	0.59	0.22	24.7	9.22
Jalawla	0.09	0.034	3.90	1.46
Al-Saadia	0.11	0.041	10.78	4.03
Total	1.05	0.395	61.74	23.05

The maximum and minimum discharge for 50% probability of the period (1989-2007) can cover the water requirement of the project between Derbendi-Khan dam and upstream Hemrein dam.Figure (8),(9) show the water requirement for the above project during the year.

CONCLUSIONS

The result of this research indicate the following conclusions

- There is reduction in discharge downstream Derbendi-Khan dam with 35% during about two decade.
- The existing discharge for the period (1981-2007) can be satisfy the discharge of Diyala river which 50%probability in order to be equivalent to the probability of 95%(1947-1948) worked by water balance.

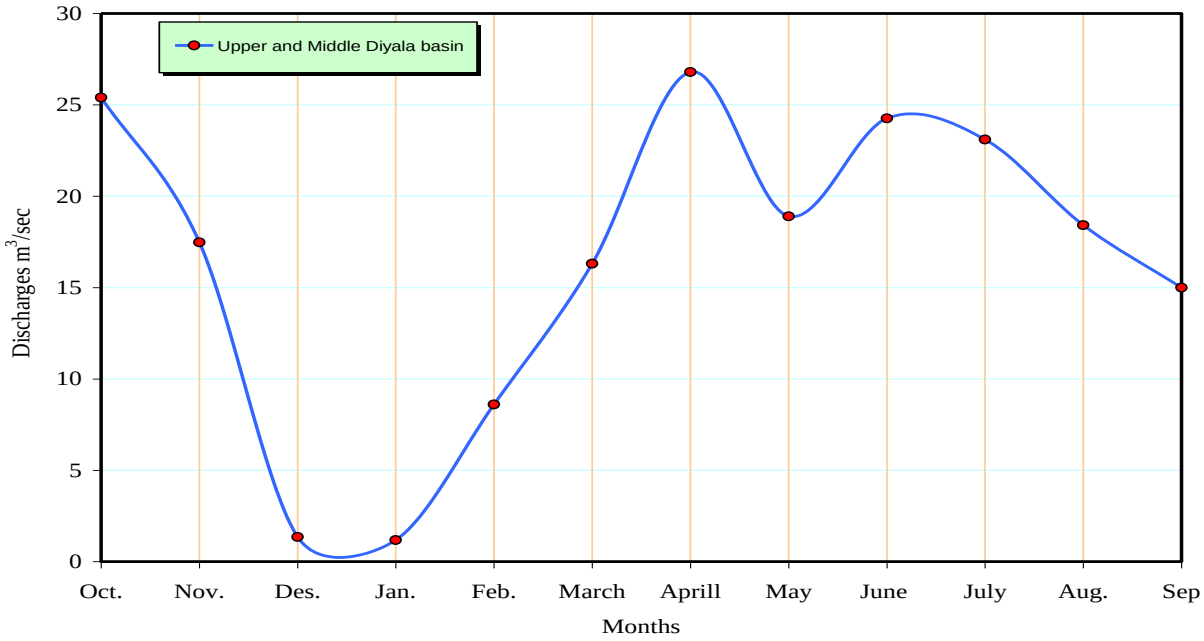

Fig. 8 Mean Flow Discharge for D/S Derbindi-Khan and Hemreen Dam for the Period (1989-2007)

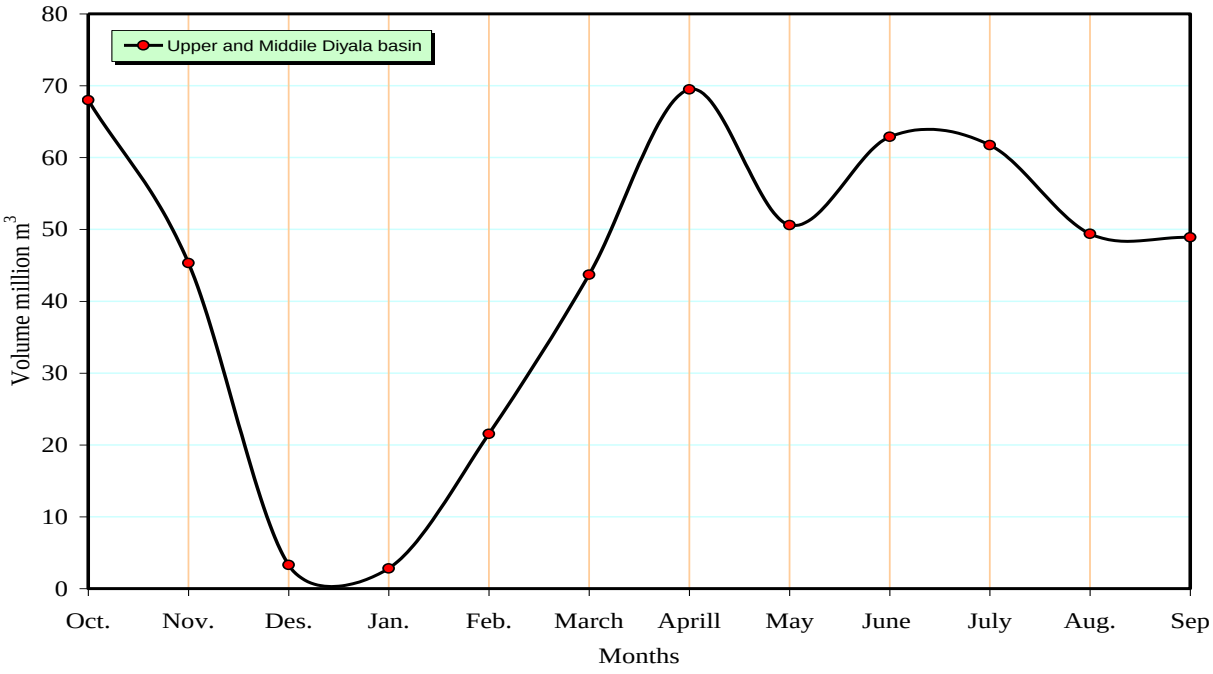

Fig. 9 Water Requirement for Diyala Basin (Million m^3)

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SYMBOLS

G.T.S: Greater Trigonometric Survey base for leveling in Iraq