CHAPTER: I

GEOGRAPHICAL FRAME-WORK AND HYDROLOGICAL SYSTEM OF FOUR RIVERS: JORDAN, LITANI, EUPHRATES AND TIGRIS
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INTRODUCTION

West Asia is a rapidly developing region and water scarcity is not a new phenomenon in the arid region. Annual water supply in the West Asian region is neither reliable nor plentiful. While demand for water is rapidly increasing in West Asia, the supply of fresh water is limited. As a result, the situation is getting worse progressively and the shortage of water is approaching crisis levels. The major rivers of the region are the Jordan, the Litani, the Orontes, the Euphrates, the Tigris, the Shatt-al-Arab, and the Nile. (See Fig-1). The physiography of this region is very complicated and its topography directly influences the life style and occupation of the inhabitants of the region.

The region may be divided into separate units. The northern mountain zone, overlying the states of Turkey, northern Iraq, Syria and Iran which consists of lofty mountain ranges. The southern zone consists of plains and plateau. A characteristic feature of the region is that plateaus are situated in between most of the mountains. The Anatolia stands between the two major mountain belts (Pontus and Taurus). The Pontus mountains lie in the north along Black Sea with the highest peak, Kalar Dagi, 3870 metres above sea level. The Taurus range is a great formidable mountain chain.

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2. Ibid.
Figure 1: Regional Map of West Asia
Source: Middle East Research Institute (Naff and Maston) 1984
The highest peak is Mor Dagi, 3147 meters located in the eastern Taurus. The moun­
tain ranges are the Elburz and Zagros mountains.

The plateaus have an important place in the physical features of the region. The Central Plateau Iran is occupied by a series of closed basin with no outward drainage of any sort. Plains also play a significant role in the physical features of the region. The climatic conditions of West Asia also varies from region to region. In most of the West Asian States climate is harsh and arid with scanty rainfall and very high potential evaporation except in the coastal and mountainous regions. West Asia is also a cyclone dominated area. Cyclones come from the west, cross over the Mediterranean Sea and enter West Asia. Some areas of the region which are nearer the Mediterranean Sea experience a special type of climate called the Mediterranean climate. The winters are mild, summers are warm and there rainfall is during the winter season. Throughout the region there is a shortage of water. Only in parts of north-eastern Turkey and north-western Iran there is surplus water supply. Smaller areas of surplus water supply occur along the highland regions of Turkey, the higher parts of the Elburz mountain in Iran, along the coastal strip of Syria and the Lebanon and the Black Sea coast of Turkey. Water surplus areas permit river system to exist in the region. They are also responsible for replenishing the ground water resources.

The surplus water of northern region is transported through very great distances into areas experiencing water scarcity by river systems and ground water reservoirs. For example, the Tigris and Euphrates rivers transport the surplus water to the intensively arid regions of Southern Iraq. The type of water resources development which has been most common in the West Asia since the Second World War has been the construction of large dams with the objective of serving a number of purposes. These have usually included the provision of irrigation water, domestic and industrial water supply, hydro-electric power generation and flood control. The West Asian re-

gion can be divided into three main river basin: the Jordan Basin, the Litani and the Euphrates-Tigris Basin.

### 1. THE JORDAN RIVER

The Jordan River is the major source of water in Jordan Basin. It is the third largest perennial river in West Asia. The Jordan is a multinational river. It has four riparian states: Israel, Jordan, Syria and Lebanon (See Fig-2). The length of Jordan is 156 miles of which 73 miles is under Israeli occupied territory and the remainder in Syria, Lebanon and Jordan. The Jordan river flows southward rising in the slopes of Mount Hermon and draining into the Dead Sea. The total flow of water of Jordan river is 1880 million cubic metre (MM) annually. Of this 1488 MCM or 77 per cent originates in three Arab States and 432 MCM or 23 per cent in Israel.

The Jordan river has two-sections the al-Sharea and the Jordan. The al-Sharea, is the name of the Jordan river, before it rises from Lake Tiberias and descends from a height of 230 feet above sea level to Lake Tiberias, 650 feet below sea level. The northern headwaters of the Jordan are formed by the confluence of three rivers. These are, from west to east, the Hasbani in Lebanon, the Dan in Israel and Baniyas in Syria.

The Hasbani originates in southern Lebanon near Hasbia in the south west of Gabal-El-Sheikh. Its annual flow varies widely depending on rainfall and its annual discharge is 138 MCM. The Dan river rises entirely within Israel. It flows from Tel Khadi in Israel and is the largest among the three tributaries. Its annual discharge is 245 MCM. The Baniyas river has its source in south-western Syria. It has an annual discharge of 121 MCM. These three sources of the Jordan river meet at a point six kilometres inside Israel where they give rise to the Upper Jordan river. The total

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8. Ibid.
FIG. 8
Source: Samir N Saliba, The Jordan River Dispute, 1968
average annual flow of the three rivers based on the above cited statistics is 491 MCM. The Jordan river and its tributaries are the principal water source for Israel and Jordan. The Jordan river is joined ten kilometres south of the lake by the Yarmuk river. Before reaching the Jordan, the Yarmuk river forms the Syrian-Jordanian border for 40 kilometer and then becomes the Israeli-Jordanian border. The Yarmuk is a major tributary of the Jordan river. The headwaters of the Yarmuk (450-475MCM) are in Syria. Its basin covers an area of 7,252 square kilometres of which 1,424 sq. km, lie within Jordan and 5,828 sq.km. within Syria. The Yarmuk's flow is derived from winter precipitation that average 364 MM in a year. The mean annual discharge is 400 MCM, which is 65 per cent of the total discharge of 607 MCMY from the Jordan’s East Bank. The flow is largely influenced by rainfall pattern in the Mediterranean climate. The salinity of the Yarmuk is quite low.

Surface water resources are dominated by the Yarmuk and Zarqa rivers which provide the majority of the irrigation water for the Jordan Valley. The Yarmuk’s mean annual discharge of 400 MCM provides almost half of the surface water resources of the Jordan river. South of its confluence with the Yarmuk, the Jordan flows on the surface of the late tertiary rocks that partially fill the Rift Valley. For the first 40 km the river forms the international boundary between Israel and Jordan; south of that reach, it abuts the Israeli occupied West Bank of the Jordan where it forms the present cease-fire line. The Jordan here flows via the deepest subaerial portion of the Rift Valley to pass the Dead Sea at 398 metre below sea level, which is the lowest point on the surface of the Earth. Jordan is shaped into a shallow Valley along the Lake Tiberias and the Dead Sea, which it meanders for about 320 km in broad loops.

The ground water inflow have important place in the discharge of Jordan river.

11. Thomas Naff and Maston, op.cit.
14. Thomas Naft and Maston, op.cit., p.21 and See also World Bank Jordan Water Resources (Sector Study World Bank Report, No.7099).
Upper Jordan and the headwaters of the Yarmuk play a key role in ground water resources. This is supplemented by spring flow to the lower parts of the system. Rather much of that contributed is saline and its effect is to contaminate water quality. The catchment of the Jordan river, excluding its upper basin, is an integral part of the arid to semi-arid region. The total area covered by the Jordan basin is 18,300 sq km. Of this three per cent is located in pre-1967 Israel.\textsuperscript{15} The Jordan basin also includes Israeli occupied territories i.e. West Bank, Gaza Strip and the Golan Heights.

The Jordan system discharge an average annual flow of 1,850 MCM into the Dead Sea.\textsuperscript{16} Generally high quality of water is received by the headwater of Jordan. Its three branches have a salinity of about 15-20 parts per million (ppm). The quality of water of Jordan is good for agricultural, domestic and industrial purposes. As the Jordan proceeds down into the Rift Valley toward the Dead Sea it becomes saltier. Ultimately, the salinity of the Jordan River system reaches 25 per cent or 250,000 ppm in the Dead Sea. The quality of the lower Jordan is reflected by rainfall patterns and the quantity of base flow extracted up stream. Water salinity is about 350 mg of total dissolved solids per litre in the rainy season. It increases to 2,000-4,000 mg per litre in the dry season at Allenby Bridge near Jericho. Finally, the salinity reaches 250,000 mg of total dissolved solids per litre in the Dead Sea.\textsuperscript{17} The riparian states which share the Jordan basin are dependent on the waters of the Jordan river in varying degrees. The degree of dependency rests on a numbers of factors such as climatic conditions, rainfall and availability of other sources of fresh water etc.

In Syria the climate and economic activities are very closely related and dependent on each other. The rainfall in the west is up to 700 MM in a year. Though most of Syria has an annual rainfall of 250 MMY, rainfall is fairly abundant in the west, where the height of the land tends to determine the amount received. The eastern and southern zone of Syria are almost rainless. The north has sufficient rainfall to support

\textsuperscript{15} Murakami Masahiro, \textit{op.cit.}, p.74.
\textsuperscript{17} Murakami Masahiro, \textit{op.cit.}, p.79.
light vegetation. Syria controls the headwaters of the Yarmuk river. In 1967 Syria received 50-60 MCM of water from the Yarmuk and 20 MCM of the water from the Lower Yarmuk. Since 1975, Syria has been increasing the use of Yarmuk for irrigation. It is planning to construct a number of projects. Syria’s farmers are fully dependent on the Yarmuk river water for irrigation purpose. In 1990 Syria was using 153 MCM from Yarmuk river.

Lebanese water supplies are seasonal and storage facilities are practically non-existent. The total water supply of water in Lebanon is approximately 4,800 MCM. There are 15 permanent rivers, of which three are shared by other countries: the Kabir and the Asi draining into Syria and the Hasbani which flows into Israel. The climatic conditions of Lebanon varies according to elevation and distance from the sea. The coastal lowlands are moderately hot in summer and warm in winter and completely free from frost. Lebanon is the only state in West Asia which is relatively rich in surface and ground water resources. At present Lebanon is working on a project to harness the water of the Hasbani river.

Israel and Jordan both have semi-arid climate and are located between the relatively high rainfall area of Lebanon in the north and the low rainfall land of Egypt in the south. In the northern and central portion of the country the annual rainfall ranges from 400 to 700 MM. In the southern desertic section the annual rainfall varies from 25 MM in the south to 250 MM in the north. Annual rainfall estimated to be around 500-700 MM, is received by the western slope of West Bank. The eastern slopes receives about 100-500 MM of rain, while the Gaza Strip receives 200-400 MM of rain throughout the year.

The north of Israel provides 80 per cent of Israeli water resources of which 65 percent is used in agriculture. The total renewable fresh water resources of Israel is

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20. Ibid.
21. Ibid., pp.78-87.
estimated to be 1,600 MCM, of which 35 per cent originate from the Jordan river valley and Lake Tiberias. Israel's water consumption was estimated at 1,750 MCM in 1990. Of this 1,162 MCM was consumed for irrigation purposes, 484 MCM for domestic and 106 MCM for industrial uses. In addition Israel utilizes approximately 70-100 MCM of water from the Yarmuk river per year.

Ground-water supplies account for 60 per cent of Israel's annual water supply. The main reservoirs are the coastal aquifer, with an annual safe yield estimated at 240-300 MCMY. The mountain or Yarkon-Taninim aquifer is located in the western highlands of the West Bank and supplies 340 MCMY of water, 80 per cent of which is used by Israeli consumers. This aquifer is considered an important and integral part of the Israeli network. Few ground water systems are available in Galilee, in the northern part of the West Bank and Gaza Strip. The Israeli water sector is facing major problems. Over use of existing water stocks and mismanagement by the water authorities of the countries of the region have collectively contributed to a situation of extreme water scarcity.

Water is a scarce natural resource in Jordan. Only 8.6 per cent of the country receives more than 200MM annual rainfall. This scarcity has led to considerable concern among Jordanian technocrats about the country's dwindling water supplies. The annual water supply of Jordan is approximately 800 MCMY, of which surface water is 320 MCM, renewable ground water 270 MCM and non-renewable water 210 MCM, the latter being Jordanian strategic resources abstracted at a rate of 50 MCMY.

In 1990 the total water consumption in Jordan was 360 MCM of surface water and 383 MCM of ground water. The domestic sector consumed 75 MCM water, the industrial sector 35 MCM and the agricultural sector 520 MCM. Jordan has one of the lowest per capita annual water consumption in the world. But despite this, water de-

mand began to outpace supply in 1987 and municipal rationing was introduced. Consumption is expected to reach 1,120 MCM, of which 300 will be in the domestic sector in the year 2005. Jordanian ground water is being abstracted at a rate of 170 MCM, beyond its safe yield. It has precipitated the decline of water tables, notably at the al-Azraq oasis, the main source of supply of drinking water to Amman. The Disi aquifer shared with Saudi Arabia, could produce 100-120 MCMY of high-quality drinking water, to be pumped to the cities of Aqaba, Amman and Zarqa.

Jordan is also facing water management problem, which may be broadly summarized as follows: institutional competition; heavy municipal network losses; irrigation network losses, lack of storage facilities, industrial pollution and a weak water pricing policy. The Jordanian water planners are acutely aware of the need to educate the population in water conservation.

2. THE LITANI RIVER

Lebanon is a small mountainous country, and is rich in water resources. However, the country has very little mineral resources or raw materials. The southern part of the country stretches from the Awali river to the Israeli border and from the Mediterranean Sea to the west to Mount Hermon and the Syrian-Israeli border in the east. It is called Jabal Amil. Topographically, the main regions of south are following: (i) A coastal Plain 1.5 km in width, (ii) A group of plateaus, gentle valley and rolling hills which becomes more rugged as it connects with Mount Hermon of the Lebanese Syrian-Israeli border. The Mountains on the two sides of the border face each other, with Jabal Sheikh forming the highest peak overlooking the area around it. In the south, the Jabal Amil is connected with the lower Jabeel mountain of Palestine (iii) Mount Hermon and Jabal Amil join in the Rashayya where the Litani river from the north is blocked and diverted westward by Jabal Al-Gharb. Al Gharb is strategically important for the defense of Damascus. (iv) The inner Marjuy'un Valley runs south of Jabal Al-Gharb, all

26. Ibid.
28. Ibid.
the way to the Hula Valley in Palestine. The Hasbani river is the branch of the Jordan river which passes through Marjuy\'un Valley\textsuperscript{29}. The Litani, which flows in the south of Lebanon is the most important river in the Republic of Lebanon. A wholly national river, the Litani is 170 km in length and has narrow ridge and width approximately 6 km (See Fig-3) The Litani basin is divided into three parts: The Upper Basin lies in Biqa Valley of eastern Lebanon. The Middle Basin starts near Qir\'un, an area of rugged terrain, where the southern ends of the Lebanon Mountains and Mount Hermon meet. The river itself flows in a deep gorge. From Nabatiyah, the river turns westward and enters the lower basin. Then it flows to the sea through the Galilean uplands, which is an area of low hills with steep slopes.\textsuperscript{30}

Litani river flows within Lebanon and drains not far from Israel. It rises in Bekaa Valley, a short distance west of Baalbeek and it flows south between the Lebanon in the west and the anti-Lebanon in the east.\textsuperscript{31}

The basin covers an area of 2,290 square kilometre that separates the Litani from the Hasbani river, a branch of Jordan. Approximately 700 MCM of water flows in Litani per year, of which the Upper Basin contributes 325 MCM annually, the Middle Basin adds a net flow of 315 MCM and the Lower Basin 60 MCM. The source of water in the Litani Basin is precipitation. The Middle Basin has 1,000 MM to 1,600 MMY of annual rainfall. The rainfall quantity decreases to the northeast in the Upper Basin. In between Nabatiyah and the Lower Basin the annual rainfall is about 800 MMY.\textsuperscript{32} Percipitation is highly seasonal and varies substantially from year to year. The flow of Litani is somewhat less seasonal because of snow storage and ground water storage. Most of the annual flow of about 60-65 per cent occurs during a four month period from January to April. About 15 per cent occurs during May and June, 12 per cent during July to October and 10 per cent during November and December. Hence, reservoirs are very sig-

\textsuperscript{29} Khalil, A.Khalil, \textit{The War of Lebanon and Crisis of the Arab Revolution} (Beirut: Centre of Socialist Study of Socialist progressive Party, No-2, 1977), pp.11-106.


\textsuperscript{32} Thomas Naff and Maston, \textit{op.cit.}, p.63.
Figure 3: Litani River With Major Water Projects

Source: Middle East Research Institute (Naff and Maston) 1984
significant for the development of the Litani’s water resources. They provide the storage necessary to dam the cyclical fluctuations in water availability. Litani Basin is only region which is relatively well endowed with surface and ground water resources. The five major uses of the Litani water are: household and business, industrial, hydroelectric power, cooling water for steam electric power plants and irrigation. The first four are primarily important to urban users and largely non-consumptive in nature. Hence, they have greater opportunity for reutilization. Redistribution of Litani water is very significant for the development and it was undertaken to provide hydropower. At Markaba water of the Litani is diverted to the Awali through a tunnel. The total annual flow at Markaba is 520 MCM. From Markaba, 25 MCMY water comes into the Litani to weather demands of the Qasimiyah Project. The remaining water goes through a tunnel to the Awali, making it the second largest river (645 MCMY) in Lebanon. Thus on the Litani below Markaba, there is 25 MCMY from Qasimiyah plus 120 MCMY of inflow between Markaba and Khardali, for a total of 145 MCMY at Khardali. Inflow from the arid region below Khardali of 60 MCMY provides 205 MCMY to the Lower Litani.

The Litani Project is multipurpose in nature and hence beneficial for both agricultural and industrial utilization. Lebanon consumes approximately 900 MCM of water every year. Of this 185 MCM is for domestic use, 35 MCM for industrial use and 670 MCM for irrigation purposes. The projected increase by the turn of the century is 1,700 MCM including 450 for domestic use, 120 for industrial use and 1,120 for the agricultural sector. Litani is intensively exploited for Hydro Electric Power (HEP) generation but its relatively low salinity level, less than 20 mg/1 makes it an attractive source of drinking water too. Since 1950’s studies were prepared for a comprehensive Litani development project to develop HEP and irrigate large areas of the south to improve the standard of living of Shia population. The Litani Valley authority claimed that 80 per cent water of Litani were still not being utilized. Currently, plans are being considered to divert the Litani at its source, in the Beqa Valley and to build a dam at Basri (120 MCM) and at Khardali which at present is located within South Lebanon.

33. Ibid., pp. 68-69.
34. Ibid., p.67.
35. Natasha Beschomer, op.cit, p.18.
3. THE EUPHRATES RIVER

The main source of water in Euphrates-Tigris Basin is Euphrates river. It is an international river, which flows through Iraq, Syria, Turkey and some part of Iran. These riparian states are sharing the water of Euphrates and its tributaries. The Euphrates is 1480 miles/2333 kilometres long from the confluence of the Karasu and the Murad Suyu to Basra. It rises in the mountains of southern Turkey and flows in a south easterly direction through Syria and subsequently into Iraq. The Euphrates joins the Tigris in its lower course at Qurna, to form the waterway known as the Shatt-al-Arab (See Fig.-4). The Euphrates passes though Nassiriya and Suqash Shuyukh before it enters Hammara Lake. The total flow of Euphrates river is not as great as that of the Tigris.

The Euphrates is Syria's largest river. Within Syria, three main tributaries feed into it; each year the Sajur contributes 125 MCM, the Balikh 100 MCM and the Khabur some 1900 MCM. Syria was the first of the riparian states to try extensively to control the flow of the Euphrates. The main stream of Euphrates is formed by the junction of two principal arms, the Karasu which has a length of 280 miles/450 kilometres and the Murad - Suyu which is 400 miles/650 kilometres long.

The Firta is the major stream of the Euphrates in Turkey. It has four chief tributaries the Karasu, the Murad, the Munzur and the Peri. After leaving Turkey, the Euphrates has one large tributary the Khabur, which joins the main stream in Syria. The waters of the Euphrates and its major tributary the Khabur, are used primarily for agricultural purposes in Syria. The water resources of the Euphrates river have been almost fully developed since 1970's by the construction of large dams at Keban, Karakaya, Ataturk

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and the Tabqa on the Upper and Middle reaches of the main stream.\textsuperscript{41}

The Euphrates has a mean discharge of 31,820 MCMY. The annual discharge varies from 16,871 MCM to 43,457 MCM. Maximum discharge is 164,000 MCM per annum. The melting of winter snow in the uplands of Turkey releases large quantities of water into the river to produce a discharge peak during April and May. The Euphrates carries as much as 6,100 ppm silt by weight and it is deposited in the inland delta. The salinity of the river increases from 160 to 525 ppm over the seasonal cycle as measured at Samama and Qurna. The lower portion of Euphrates and Shatt-al-Arab are facing severe problem of salination.\textsuperscript{42}

The Euphrates and its tributaries drain an enormous basin, 444,000 sq km in area of which 28 per cent lies in Turkey, 17 per cent in Syria, 40 percent in Iraq and 15 per cent in Saudi Arabia. Approximately 88 per cent of the average annual flow is generated within Turkey and the remaining 12 per cent within Syria.\textsuperscript{43} After flowing for 440 kms through Turkey the river enters Syria where it is joined by the Balikh and Khabur. The area from which the Euphrates is fed is virtually confined to the mountain of north Turkey.

4. THE TIGRIS RIVER

The total length of Tigris is 1,718km. The Tigris rises in the mountains of south eastern Turkey and is joined by various large branches in Turkey and Iraq. It flows directly into Iraq from Turkey. The river first passes through the border village of Fiesh Khabur and then it flows through Fatha which separates Hamrin and Makhood uplands. There are narrow flood plain and well defined snowy banks in the area of Tigris. It has four main tributaries, all of which unite with the main stream in Iraq. The Great Zab originates in the Turkish high lands and joins the Tigris just outside the city of Mamood.\textsuperscript{44} This is the major tributary of the Tigris and 33 per cent of water flowing in the trunk

\textsuperscript{41} Murakami Masahiro, \textit{op cit.}, p. 36.
\textsuperscript{42} Naft and Maston, \textit{op cit.}, p. 86.
\textsuperscript{43} Ibid. p.83
\textsuperscript{44} Encyclopedia of Islam, \textit{op cit.}, p. 947.
river is brought by the Zab Kabîr. The Lesser Zab and Diyala originate in Iran. All of
the catchment of the Adhaim, which is the smallest stream in Iraq. It is a seasonal
tributary. On the eastern bank of Tigris between Baghdad and Mosul there are many
small streams which descend from the Zagros ranges.\footnote{Marakami Masahiro, \textit{op. cit.}.}

The Tigris carries an average of 42,230 MCM of water per annum. The mini-
mum discharge is estimated to be 5,140 MCMY and maximum 440,000 MCMY. The
Tigris effluent is due to direct surface runs from mountain torrents. The lower Tigris
carries more silt because it is closer to the sediment source.\footnote{Naff and Maston, \textit{op. cit.}, pp. 86-87.} During times of flood, the
Tigris has received as much as 20,000 ppm silt by weight. The Tigris moves annually
40,000,000 MCM of sediment past Baghdad, of which only a tenth reaches the Persian
Gulf.\footnote{Ibid.} The basin formed by the Euphrates and Tigris includes Turkey, Syria, Iraq and
Iran. Between the Upper Tigris and Euphrates lies the region known as the Jezirch. It
is bounded on two sides by the rivers and on the north by the fold ranges of Asia Minor.
The total length of the Tigris-Euphrates is approximately 4,051 km. The rivers origi-
nate from widely separate sources in the Guneydogu Toroslar and Zagros mountains,
each deriving the bulk of water from winter rains and snow.\footnote{Encyclopedia of Islam, \textit{op. cit.}, p. 947.} The Shatt-al-Arab is
formed by convergence of Euphrates and Tigris rivers near the head of the Persian
Gulf. It is a broad navigable waterway, fringed by a belt of palms for a depth of 1-4km
behind which occur masses of tall reeds sometime more than 6 metre in height. The
Euphrates and Tigris lowland consists of valleys and forms associated with fluvialite
deposition; such as Lagoons and marsh bordered lakes, channels, embarked rivers and
course with oxbow. The whole area is extremely flat, with a fall of only 4cm per km
over the last 300km of the Euphrates and under 8cm per km along the Tigris.

The two rivers drain 808,000sq km. The basin is located in the mountains of the
Turkey and Iran and some of it lies in the desert of Syria and Iraq.\footnote{Marakami Masahiro, \textit{op. cit.}.} Geographically;
both rivers have carried heavy content of silt from the highlands during the flood sea-

\footnote{\textit{Marakami Masahiro, \textit{op. cit.}.}}
sons. However, little of this sediments reaches the sea, but rather it is deposited across the plain. It is useful for agricultural development. A large area of the plain is irrigated with water of Tigris and Euphrates to support crops of wheat, barley, millet, rice and dates.

CONCLUSION

West Asia is an underdeveloped region and is facing the problem of water scarcity. The climate is largely arid or semi-arid with average annual rainfall levels of less than 250 MM Y. West Asia is also a cyclone prone area. Cyclones come from the west, cross over the Mediterranean Sea and enter West Asia. Some areas of the region which are nearer the Mediterranean Sea, experience a special type of climate called the Mediterranean Climate. The winters are mild, summers are warm and there is rainfall during the winter season. Throughout the region there is an acute scarcity of water. Only in parts of north-eastern Turkey and north-western Iran there is surplus water supply. Smaller areas of high water surplus occur along the high land regions of Turkey, the higher parts of the Elburz mountain in Iran, along the coastal strip of Syria and the Lebanon and the Black Sea coast of Turkey. The surplus water of northern region is transported through very great distance into areas of severe shortage of water by river systems and ground water reservoirs. For instance, the Tigris and Euphrates Rivers transport the surplus water into the intensively arid regions of southern Iraq.

The West Asian region can be divided into three major river basins; the Jordan Basin, the Litani Basin, the Euphrates-Tigris Basin. The Jordan River is the major source of water in Jordan Basin. It is fed by headwaters and tributaries rising in Israel, Jordan, Syria and Lebanon. The Jordan is 156 miles long of which 73 miles is under Israeli occupied territory and the remainder in Syria, Lebanon and Jordan. The total flow of water of Jordan river is 1880 million cubic meter annually. Of this 77 per cent rises in three Arab states and 23 per cent in Israel. The northern headwaters of the Jordan have three important tributaries; Hasbani in Lebanon; the Dan in Israel and Baniyas in Syria. The Yarmuk river is a major tributary of the Jordan river. Its basin covers an area of

7,252 sq kms. of which 1,424 sq km is located within Jordan and 5,828 sq km within Syria.

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Ground water inflow has an important role in the discharge of Jordan river. Upper Jordan and headwaters of Yarmuk are major sources of groundwater. The Jordan Basin includes Israeli captured territories-West Bank, Gaza Strip, and the Golan Heights. The Jordan system discharges an average annual flow of 1,850 MCM into the Dead Sea. Generally high quality of water is received by the Jordan’s headwaters. As the Jordan proceeds down into the Rift Valley toward the Dead Sea it becomes saltier.

The Litani, which flows in the south of Lebanon is the most important river in the Republic of Lebanon. The Litani is 170 km in length and has narrow ridge and width about 6 km. The Litani Basin is divided into three parts: the Upper Basin the Middle Basin and the Lower Basin. The Basin covers an area of 2,290 sq. km that separates the Litani from the Hasbani river, a branch of Jordan. Approximately 700 MCM of water flows in Litani annually, of which the Upper Basin contributes 325 MCM, the Middle Basin adds a net flow 313 MCM, and Lower Basin 60 MCM. In the Litani, precipitation is main source of water. The Middle Basin has 1,000 MM to 1,600 MMY of annual rainfall. The rain quantity decreases to the north-east in the Upper Basin. The Lower Basin has an annual rainfall of 800 MMY. The Awali river is also an important source of Lebanon’s water.

The major source of water in Euphrates-Tigris basin is Euphrates River. The Euphrates-Tigris Basin is located primarily in three countries-Turkey, Syria and Iraq. The length of Euphrates is 1,480 miles from the confluence of Karasu and Murad-Suyu to Basra. It rises in the mountains of southern Turkey and flows in a south-easterly direction through Syria and subsequently into Iraq.
The Euphrates joins the Tigris in its lower course at Qurna, to form the waterway known as the Shatt-al-Arab. The total flow of Euphrates river is not as great as that of the Tigris. The Firat is the major stream of the Euphrates in Turkey. It has four major tributaries, the Karasu, the Murad, the Munzur and the Peri. After leaving Turkey, the Euphrates has one large tributary, the Khabur, which joins the main stream in Syria. The Euphrates has a mean discharge of 31,820 MCM. The annual discharge varies from 16,871 MCM to 43,457 MCM. The maximum discharge is 164,000 MCM per annum. The Euphrates carries as much as 6,100 ppm silt by weight and it is deposited in the inland delta.

The Tigris rises in southern Turkey and flows directly into Iraq from Turkey and the total length of Tigris is 1,718 km. It has four main tributaries- The Great Zab, the Lesser Zab, Diyala and Adhaim. The Tigris carries an average of 42,230 MCM of water. The minimum discharge is estimated to be 5,140 MCM, and the maximum 440,000 MCM. The lower Tigris carries more silt because it is closer to the sediment source. During times of flood, the Tigris receives about 20,000 ppm silt by weight. Tigris and Euphrates drain 808,000 sq km. The basin is located in the mountains of the Turkey and Iran and some of it in the desert of Syria and Iraq.

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