

# Historical Background of Hydrology in Ancient Text

Dr. Sala Besra

Assistant Professor of Sanskrit, Gangadhar Meher University, Sambalpur.  
Email - salabesra@gmail.com

**Abstract:** Water the building block of life, a clean source of energy, a philosophical powerhouse, teaches us to be flexible and a potential mode of transport, the role of hydraulic structures including waterways management becomes more important. In the 21<sup>st</sup> century this management seems to be a cakewalk. But it has deep roots in our ancient knowledge system and literature. Ancient people were proficient in inland navigation thus proving that reverse played an important part in the sustenance development and growth of mankind. To facilitate trade and transportation many ancient cities and industrial towns were established along rivers and their tributaries. Although most of the forgone hydrologic knowledge is unexplored to the world. So, this paper will try to bring very interesting classic facts on hydraulic structures including waterways management system in ancient India.

**Key Words:** Rig Veda, Yajur Veda, Atharva Veda, Mahabharata. Ramayana, Noria, Asmacakra, Udghatna, Varshamana, Varahamihira.

## 1. INTRODUCTION:

We have a rich history of managing water. The various ancient civilizations which were developed at places where water was required for agricultural and where whatever is readily available at that time mainly in the vicinity of springs, lakes, rivers, seas, etc. This extends from civilization to the Vedas and the references can be related to the current system. Our ancient history is full of advanced development in the field of water resources, or we can say water science Indus valley civilizations was contemporary to the Egyptian civilization to the Mesopotamian civilization to the Chinese civilization. But if we look at the developments in terms of the water science then this our Indus valley civilization was at the apex. Agriculture was the main source of this socio-economic activity at that time. And we know that the Mohenjo-Daro and dholavira were the two major cities at that time. The people of Indus valley civilizations were familiar with the advanced water management and drainage systems in that time. Everybody knows this great bath of Mohenjo-Daro. So that great bath is an excellent example that the Harappans peoples were knowing about the water management system. At the same time the Harapan peoples were aware about the seasonal rainfall and flooding of the Indus valley. Ancient agriculture was practiced at large in that and the irrigation was being done by the canals they were able to develop these water storage systems and low-cost water harvesting its structures such as small check dams burn and using the locally available material. We can take one example of dholavira city which is located between the femoral historians mansar and Manohar. There we can have a series of check dams and storage reservoirs. The purpose was to basically see runoff is coming taking lot of sediments with it so by constructing small check dams they were able to reduce the velocity of the flow so that the segments will get deposited and finally clean water will be stored in the reservoir. So now we can imagine what the knowledge about the hydraulics they were having at that time. It is more than you can say 4000 to 5000 years just type of knowledge was available there.

## 2. Knowledge of hydrology in Indus Vally Civilization :

This Indus valley civilization was having uniqueness particularly in terms of the water. The citizens of the Harappan civilization were known for their obsession with water. They pray to the reverse every day and accorded the rivers a divine status and carrying that is spirit. Even today, if we compare the development in the water sciences to all the contemporary civilizations. Then I think we will keep our Indus valley civilization at the top. We know that in Indus valley civilizations most of the houses were equipped with the private wells. Almost all the houses had private wells with bath and toilet area, line with the Indian standardise size burnt bricks and draining into the soak water into the street

drains. Indus valley civilization is credited with the development of the flushing laboratories for the first time in the world. Where we are using even today. In the Egyptian civilization it was lacking flushing laboratories and sophisticated seaware waste water disposal system at that time. If we take the example of Mesopotamian civilization of course they were having well-constructed storm drainage and sanitary seaware systems. However, we know that in Indus valley civilization water supply was through walls also means vertical water supply. Where is in the Mesopotamian, we do not have any means of this system that there exists the vertical water my system means supply of water through wells. 700 wells mean vertical water supply system were there in the Mohenjo-Daro state of the art toilet areas land with the burnt bricks were there. We do not find these exemplary settlements in other civilization. This Indus valley civilization was unique as far as developments in the water sciences is concerned Lothal is a place in Gujarat in Sabarmati basin. There we have dockyard. That dockyard particularly is the world's oldest ducat. other than this Indus valley civilization.

### 3. Knowledge of hydrology in Vedic Era and later Vedic Era :

In Vedic era also mini hydraulic machines were there. That hydraulic machine was being used for irrigating the agricultural fields. That that machine was first being used during the Indus valley civilization and Vedic. And thereafter that the technology went to the Chinese civilization and then Western countries of course now a days it is being called as *Noria* in the Western countries. The *Noria* is commonly used for devices which use the power to turn the wheel. For device powered by animals. But for the first time it was invented in Indus valley civilization so these are the some of the salient inventions we can create it to the Indus civilization as compared to the other civilizations. So, the water quality hydraulic machines and other structures and nature-based solutions for water resource management was also there.

Mantras references that we have in the Vedas to understand this better. If we go for the Rigveda which is the ancient religious scripture contains lot of references on the hydrologic cycle and associated processes.

जाम्यतीतपे धनुर्वयोधा अरुहद्वनम् । दृषदं जिह्वावधीत् ॥

This is verse number 8.72.4 of the Rigveda says that atmospheric air gets heated due to sun, then this heat reaches the earth and converts the humidity into vapour and collect it as clouds. Which is the cause of the rain and food grain products. So ultimately it is referring to agriculture of course. Rigveda further says in verse number 1.32.10.

अतिष्ठन्तीनामनिवेशनानां काष्ठानां मध्ये निहितं शरीरम् ।

वृत्रस्य निष्यं वि चरत्यापो दीर्घं तम आशयदिन्द्रशत्रुः ॥

It mentions that water is never stationary but it continuously gets evaporated off course now a days in our textbooks were reading the hydrologic cycle. We are thinking that these concepts have been given by our western scientist. But long ago we were having complete knowledge of this hydrologic cycle. further references mention the Atharva Veda also. According to the Atharva Veda verse number 1.5.2 यो वः शिवतमो रसस्तस्य भाजयतेह नः। उशतीरिव मातरः ॥

It says that the same ways are the main causes of rain and evaporation as was mentioned in the Rigveda 1.23.17 with some more details. So, the verse is like this अमूर्या उप सूर्ये याभिर्वा सूर्यः सह । ता नो हिन्वन्त्वध्वरम् ॥

The Yajurveda explains the process of water movement from clouds to the earth and its flow true channels and storages into oceans and further of course evaporation water cycle or hydrological cycle was completely defined with their components 4000 years ago right from now. So, this is really thought provoking that to Vedic people knew about this water cycle hydrological cycle and we also know that rain was the only source to replenish water in rivers to provide clean and safe drinking water for may be agriculture and everything. In Rigveda we even find references to *Kullya* canals. The canal system that we are referring to which is duck to divert water from the river for irrigation to the fields as we have mentioned. Because in Mahabharata also we get the mention of *Kullya*. And in Mahabhashya of Patanjali the same word is found. There are many references of collecting water in the rate with particularly collecting water from hilly areas and carrying it to our agricultural fields, to our settlements through the canals. In Rigveda verse 8.3.10 there is a mention of the construction of the canal now a days we call "**Engineer.**" But there it is '**Rebus**'. This world is particularly used for the persons who are engaged in the construction of the Canal. In Rigveda verse 10.93.12 and 10.101.7 has a mention of *Asmacakra*. That is a wheel made of stones. The water was being raised with the help of that wheel which was tightened trailer row barrister. At the same time there is one more word used for this water lifting device and that is *Ghatayantra*, a drum saved field. That was also tightened through a rope and pulley and that was being used for lifting water from our wells from the ponds for irrigation purposes. The western scholars are agreeing that this *Noria* are *Asmacakra* are *Udghatna* this hydraulic machine was invented in Indus valley civilization or during the Vedic era.

And later, the technology was propagated to the Chinese civilization 350 BCE. There is a reference in Mahabharata also the verse 12,184.15-16 explains the water uptake process by the plants and rainfall occurs in just four months. Kishkinda Kanda of Ramayana chapter number 28 many verses are there those are dealing with this hydrologic cycle particularly verse number 3 mentioned the formation of clouds and verse number 46 in this case kind of convention overflowing of the river due to heavy rains in the rainy season and many other verses are there in this Kishkindha Kand those explains the process of cloud transportation laden with the water and elevation effects of the mountains on the whole process of this transportation. In *Brihat Samhita* on hydrology in ancient times there are 33 chapters and 10 chapters devoted to the metrology but there is one chapter 55 Dakar gala this whole chapter is dedicated to the groundwater. And the chapter number 55 completely discusses about this groundwater and discusses about the geographical pointers such as plants reptiles and insects and many other soil markers two explorer better to say occurrence and distribution of the groundwater at a particular variety of plants is there. so, there will be more groundwater less groundwater so actually pointers reading on the need of the water by the plant we can add on that basis they are able to know the groundwater occurrence and distribution. They were also using bio indicators plant species for estimating the occurrence and distribution of the groundwater and many other such as morphologic and physiographic features they were also using to as an indicator two explorer the distribution and occurrence of the groundwater. This is a great compilation of the metrology as well as water sciences *Barahamihir* can be credited as the earliest hydrologist of the world. Mauryan empire is also credited for the first hydraulic civilization characterised by construction of dams with spillovers reservoirs and the canals and channels. The development of instrumentation and the first observation station was set up during this modern period only in the 4<sup>th</sup> century BC. Their contribution to the ancient knowledge system on hydraulic structures including waterways management a lot of developments during the Mauryan empire it was the Mauryan. Only we started the measurement of the rainfall. In Arthasastra written by Chanakya this modern period is also credited with the development of the first observatory now a days we call it rain gauge but at that time we were calling it *Varshamana* it was 24 angels the equivalent to 18 inch this *Varshaman* are reengage is kept in front of a store warehouse and there was a special officer for this to collect the data and that officer was supposed to be from the agriculture department. An example, from the Arthasastra the quantity of rain that falls in the country of jungle. Jungle means desert is 16 drona's. Drona's in weight unit at that time half as much in *Anupam* moist reasons the reasons which are fit for agriculture. In Maharashtra 23 donors in *Avanti* and immense quantity in *Aparantanam* the borders of Himalayas the countries where water channels are made for using agriculture so during the modern period, we were having the complete information about the rainfall and rainfall distribution also. So, the rain is of course now we are having the advanced rain gauges but, in those periods, we were having the instrument to measure the rainfall this more an empire is also called as first hydraulic civilization why the hydraulic civilization because it is and water technology is better to say this waste water treatment and sanitation. We might be knowing the recent campaign of our government national mission on clean Ganga I think this is also an example that we are not forgetting to respect our rivers cleaning our reverse secondly I think for water management I think you might be knowing about this JAL shakti Abhiyan this campaign was the conservation of the water management in rural parts of the country many points were constructed check dams and for the purpose was to conserve the water for agricultural purposes so I think this is also an example that we learnt from our ancient history and moving ahead this interlinking of rivers is also one such an example to transport water to the regions through that water deficit reasons there are various inland national waterways in India and you know identified for the purpose of water transport and all and there are 30 national waterways are operational for shipping and navigation.

#### 4. Conclusion :

Thus, from the above discussion we can conclude that our ancient text are full of knowledge as far as water science is concerned moreover not only the hydrologic cycle in those days, we have many references of the irrigation through canals irrigation through many hydraulic machines. These have taken inspiration from these historical references. Whatever we are progressing today actually we have our footprints in long back so we have discussed that we were having their navigation system in place whether it is dholavira or Lothal the oldest dockyard. Whether it is the canal found in excavation by ASI in the modern period. So, we are getting inspiration from our rich in Indian technologies for however there is a further need to go for more and more research in this field also so that we will be able to explores some new things in this water resources management and hydrological aspects in our ancient times.

#### REFERENCES :

1. Kenoyer, J. M.: Ancient cities of the Indus valley civilization, American Institute of Pakistan Studies., 1998.
2. Sarasvati, S. P.: Rig Veda, DAV Publication Division., 2009.

3. Griffith, Ralph T.H., The Yajur Veda Samhita, Text with Translation & commentary Mantra & Names Index ETC. Nag Publishers, Delhi-1990.
4. Joshi, K. L., Atharveda Samhita (AV) with Sanskrit text, English translation according to D. Flimey and Sayanacana Bhashya, Parimal Publications, New Delhi. 2004.
5. Kangle, R.P., Kautilya Arthashastra, (3 vols.). Laurier Books, Motilal, New Delhi, 1997.
6. Tarkaratna, Pt. Paneenan, Mahabharata, Calcutta, 1826.
7. Chand Dev, the Atharvaveda, New Delhi, India: Mushiram Manoharlal Publishers, 1982.
8. Choudhary, Radhakrishna, Kautilya's political ideas and Institutions, Chowkamba Sanskrit Studies Varanasi, India, 1971.
9. Cowen, H. H, A History of Indian Literature from Vedic Times to the Present Day, Appleton, New York. 1931.
10. History of Indian Culture and Civilization (Vedic Period) Bharatiya Vidya Bhawan, Bombay.
11. Karuppan, G., and Kumudamani, K., History of Science and Technology in India, Vol I-III, Sundeep Prakashan, Delhi-1990.
12. Shamasastri, R.: Kautilya's Arthashastra, Mysore Printing and Publishing House., 1961.
13. Jha, P. A.: Vrhat Samhita (550 AD) by Varahmihira, Chow Khamba Vidyabhawan., 1988.
14. Vālmīki and Goswami, C.: Śrīmad Valmiki-Rāmāyaṇa: with Sanskrit text and English translation, Gita Press.,1973.
15. Bhat, M.R., (report. 1992). Varahamihira's Brhat Samhita. Part -1. Motilal Banarsidass, Delhi, 1981.
16. Murty, K. S.: Varahamihira, the Earliest Hydrologist, Water Future Hydrol. Perspect. IAHS Publ., (164), 1987.
17. Prasad, E. A. V.: Ground water in Varahamihira's Vrhat Samhita. MASSLIT series No. 1, Sri Venkateswara University Press, Tirupathi, India., 1980.
18. Prasad, E. a. V.: Bioindicators of Ground Water in Varahamihira's Brihat Samhita, Groundwater, 24(6), 824–828, 1986.
19. Jigyasu, B.: Ashtadhyayi (bhashya) prathamavrtti, three volumes., Ramlal Kapoor Trust Bahalgadh., 1979.
20. Goel, M.M., Kautilya's Arthashastra and its Relevance -2000.
21. NIH: Hydrologic Knowledge in Ancient India, National Institute of Hydrology, Jal Vigyan Bhavan, Roorkee,India., 2018.
22. Chow, V. T.: Handbook of Applied Hydrology: A Compendium of Water-resources Technology, 1st edition.,
23. Gopal, L., Aspects of History of Agriculture in Ancient India, Varanasi, 1980.
24. Bagchi, K. S. and Bagchi, S. S.: History of Irrigation in India I. Irrigation in Ancient India (From 2295 Bc upto the 11th Century), Irri. Power J., 48(3), 69–76, 1991.
25. Baker, M. N. and Horton, R. E.: Historical development of ideas regarding the origin of springs and ground-water, Eos Trans. Am. Geophys. Union, 17(2), 395–400, 1936.
26. Bhattacharya, P. K.: Irrigation and Agriculture in Ancient India. Sectional President's Address, Proc. Indian Hist. Congr., 73, 18–34 [online] Available from: <https://www.jstor.org/stable/44156186> (Accessed 27 April 2020),
27. Jain, S. K., Agarwal, P. K. and Singh, V. P.: Hydrology and Water Resources of India, Springer Science & Business Media., 2007.
28. Khan, S.: Sanitation and wastewater technologies in Harappa/Indus valley civilization (ca. 2600–1900 BC), in Evolution of Sanitation and Wastewater Technologies through the Centuries, vol. 25, IWA Publishing., 2014.
29. Mujumdar, P. P. and Jain, S.K.: Hydrology in Ancient India: Some Fascinating Facets, in EGU General Assembly Conference Abstracts, vol. 20, p. 8690., 2018.
30. Srinivasan, T. M.: Measurement of Rainfall in Ancient India, Indian J. Hist. Sci. Calcutta, 11(2), 148–157, 1976. 641 Sutcliffe, J., Shaw, J. and Brown, E.: Historical water resources in South Asia: the hydrological background, 642 Hydro. Sci. J., 56(5), 775–788, doi:10.1080/02626667.2011.587425, 2011.