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# Water Budget and Environment Flow

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**SUMMARY**

This article reviews that it is the measure of amount of water entering and leaving the system. It provides a means for evaluating availability and sustainability of a water supply and insight into groundwater, surface water and their interactions. An overview and qualitative description of water budgets are given in this study, which serves as the cornerstone for efficient management of freshwater hydrologic systems' environmental factors and water resources. We used to talk about pond water intake, outflow, and budget in this study. The report's first section discusses the flow and storage of water in the subsurface, on land, and in the atmosphere, as well as the exchange of water between these compartments. We also explore the inherent uncertainties in measuring techniques and our ability to measure these occurrences. The report's last section includes several case studies that show how water budget studies are carried out, details how human activity affects water budgets, and explains how water budgets are applied to environmental and water-related issues.

## INTRODUCTION

A water budget essentially says that the rate at which water enters and exits a region, like a watershed, balances the rate of change in the amount of water stored there. Planning and managing water resources and the environment efficiently depends on having an extensive knowledge of water budgets and the underlying hydrologic processes. An area's observed variations in water budgets over time can be used to evaluate how human activity and climatic variability affect water supplies. It is possible to quantify the impacts of geology, soils, vegetation, and land use on the hydrologic cycle by comparing the water budgets of various locations (Healy, R.W.; Winter, et al.,). Several human actions have an impact on the hydrologic cycle. The soil is altered to support Agri-culture by the installation of irrigation and drainage systems, which changes the rates of plant transpiration, evaporation, runoff, and infiltration. In urban settings, structures like parking lots, roadways, and buildings often increase runoff and reduce infiltration. Water budgets serve as a foundation for evaluating the potential effects of changes made to one component of the hydrologic cycle by humans or nature on other components of the cycle.

**The general equation to be satisfied for a water budget are:**

Inputs = Outputs + Change in Storage

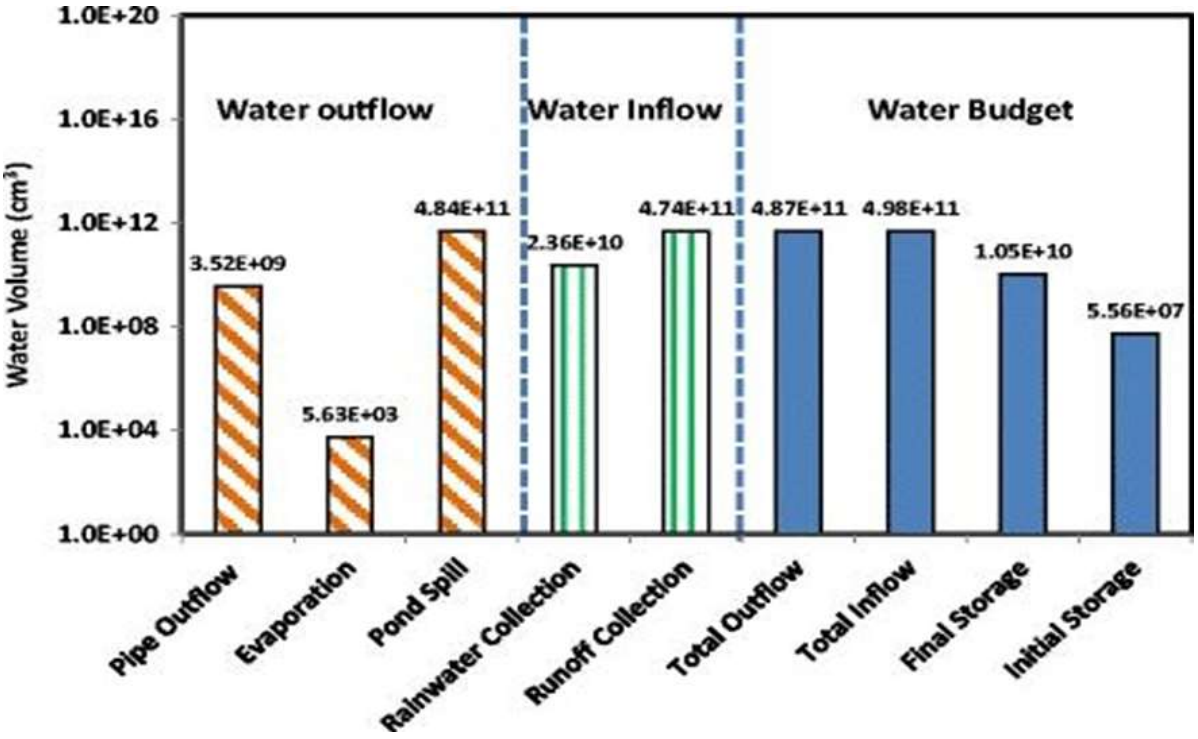
$$\mathbf{P + SWin + GWin + ANTHin + Din = ET + SWout + GWout + ANTHout + Dout + \Delta S}$$

Where:

P = precipitation
SWin = surface water flow in
GWin = groundwater flow in
ANTHin = anthropogenic or human inputs
Din = diversion into the watershed
ET = evaporation and transpiration

***Pond water inflow, outflow and budge***

SWout = surface water flow out
GWout = groundwater flow out
ANTHout = anthropogenic or human abstractions
Dout = diversion out of the watershed
ΔS = change in storage.




**Distribution of earths water resources**

The diagram below shows that groundwater which includes ice caps, glaciers, permanent snow, ground ice, and permafrost is the largest source of fresh water after ice. Nevertheless, precise groundwater review is particularly challenging. It is kept below the earth's surface in rocks and sediments.

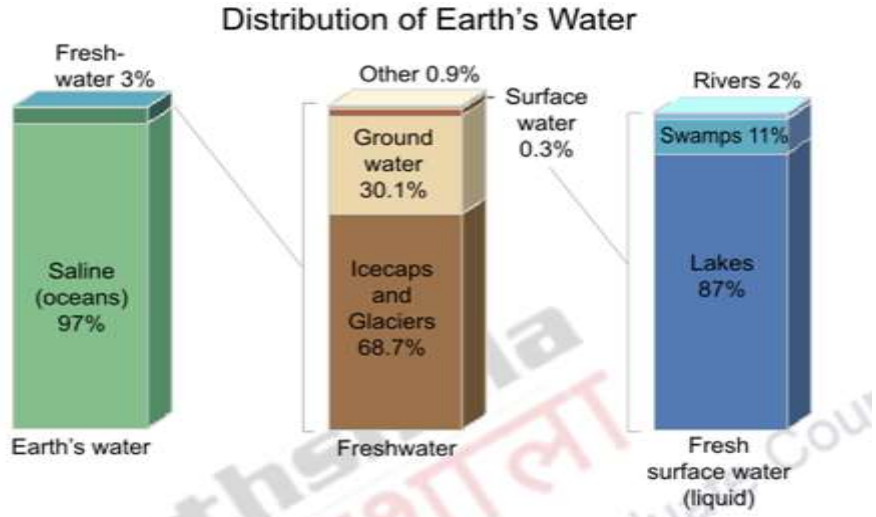



**Figure: 1 Distribution of Earth Water Resources**

(Source: wwwga.usgs.gov/edu/waterdistribution.html).

**Annual water budget**

One of the main tasks for effective management of water resources is water budgeting. In actuality, a "water budget" is a list of all the water that is used, produced, and stored in various locations such as the lithosphere, atmosphere, and seas. Thus, the term "water budget" refers to the equilibrium between the nation's total water supply and its current water use. Water underutilization and availability are therefore in balance. Water from land and oceans evaporates due to solar radiation, and moisture from plant transpiration enters the atmosphere and falls back on Earth as precipitation. The various mechanisms involved in the water cycle, such as surface and subsurface flow, evapotranspiration, evaporation, and precipitation, are all included in the water budget computation. (Asthana and Asthana,2010). It is estimated that about 525100 cubic kms water introduce into the atmosphere and from this about 21.6% water vapours come to earth as precipitation over land surface. The various mechanisms involved in the water cycle, such as surface and subsurface flow, evapotranspiration, evaporation, and precipitation, are all included in the water budget computation. (Asthana and Asthana,2010)

**Annual water budget of planet earth**

| S. No | Particulars | Water in cubic kms |
|---|---|---|
| 1 | Total evaporation from sea surface | 4,52,600 |
| 2 | Total evaporation from land surface | 72,500 |
| 3 | Total precipitation on ocean surface | 4,11,600 |
| 4 | Total precipitation on land surface | 1,13,500 |
| 5 | Total surface and ground water flow | 41,000 |
| 6 | Total evaporation from land and sea surface | 5,25,100 |
| 7 | Total precipitation on land and sea surface | 5,25,100 |

(*Source: Asthana and Asthana, 2010*)**.**

As the above table makes clear, the world's oceans contribute roughly 4,52,600 cubic kilometres of water each year to the atmosphere, yet they only receive 4,11,600 cubic kilometres in precipitation. Still, the 41,000 cubic kilometres of surface and subsurface runoff they receive more than make up for this shortfall. Gravity eventually causes this extra water to return to the oceans (Roggers,1991). Furthermore, there is a dynamic balance between the amount of water in the oceans, on land, in groundwater, in the sky as vapor, etc.

**Sector-wise Demand Scenarios of Water in India (billion cubic metres)**

| S. No | Sector | 2010 | 2025 | 2050 |
|---|---|---|---|---|
| 1 | Irrigation | 688 | 910 | 1072 |
| 2 | Drinking (including livestock) | 56 | 73 | 102 |
| 3 | Industrial | 12 | 23 | 63 |
| 4 | Energy | 05 | 15 | 130 |
| 5 | Others (Forestry, pisciculture tourism, navigation etc) | 52 | 72 | 80 |
| Total | | 813 | 1093 | 1447 |

Source: Central water Commission Report, 1993.

Reassessment of water resources potential of India, CWC, New Delhi. Moreover, fresh water resources of country are already under pressure e.g. in year 1951, the per capita availability of fresh water was nearly 3000 m3, has been declined to 1100 m3 in 1998 and is projected to be 687 m3 by the year 2050 as given in below table.

**Per capita Availability of Water**

| Year | 1951 | 1991 | 2010 | 2025 | 2050 |
|---|---|---|---|---|---|
| Population ($10^6$) | 361 | 846.3 | 1,157 | 1,333 | 1,581 |
| Average Water Resources ($m^3$/person/year) | 3,008 | 1283 | 938 | 814 | 687 |

Source: Bhattacharyya et al., 2015.

**CONCLUSION**

As the human population on Earth continues to grow, so will its demands for water. The accessibility as well as the viability of a water supply can be assessed through water budgets. A link among all components of a water budget serves as a basis for predicting how a natural or human-induced change to one component, such as ground-water extraction, may be reflected in other components, such as streamflow or evapo-transpiration. When viewed with an understanding of the underlying hydrologic processes and the uncertainties associated with quantifying those processes, water budgets form a foundation for evaluating water-resources and environmental planning and management options (Healy, R.W.; Winter. Et.al.,). Science and technology can also assist in the development and improvement of decision support systems that allow managers to evaluate various operational options. Water budgets form a foundation upon which those policies and laws can be developed. (Healy, Et.al.,).

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