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Hydrology	المادة باللغة الانجليزية
هايدرولوجي	المادة باللغة العربية
الرابع	المرحلة الدراسية
محمد مجيد حميد	اسم التدريسي
Mass Curve Method for Reservoir Capacity Estimation : part1	عنوان المحاضرة باللغة الانجليزية
طريقة المنحنى التراكمي لتقدير سعة الخزان: الجزء 1	عنوان المحاضرة باللغة العربية
6	رقم المحاضرة
Subramanya, K. 2017. Engineering Hydrology. 4th ed. New Delhi: McGraw Hill Education.	المصادر والمراجع
Chow, Ven Te, David R. Maidment, and Larry W. Mays. 2013. Applied Hydrology. 2nd ed. New York: McGraw Hill Education.	
Dingman, S. Lawrence. 2015. Physical Hydrology. 3rd ed. Long Grove, IL: Waveland Press	



# Hydrology

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Hameed

# Reservoir Planning: Estimating Reservoir Capacity of a Dam By “Mass Curve” method

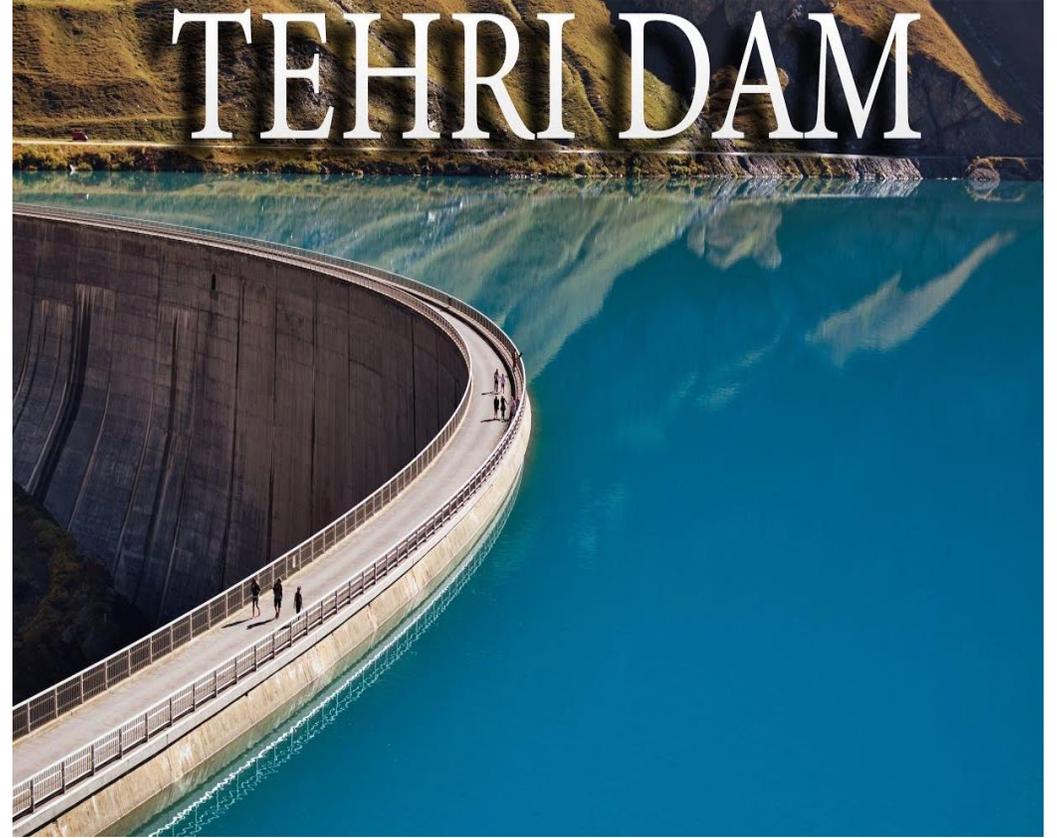
Learning Outcome

At the end of this session

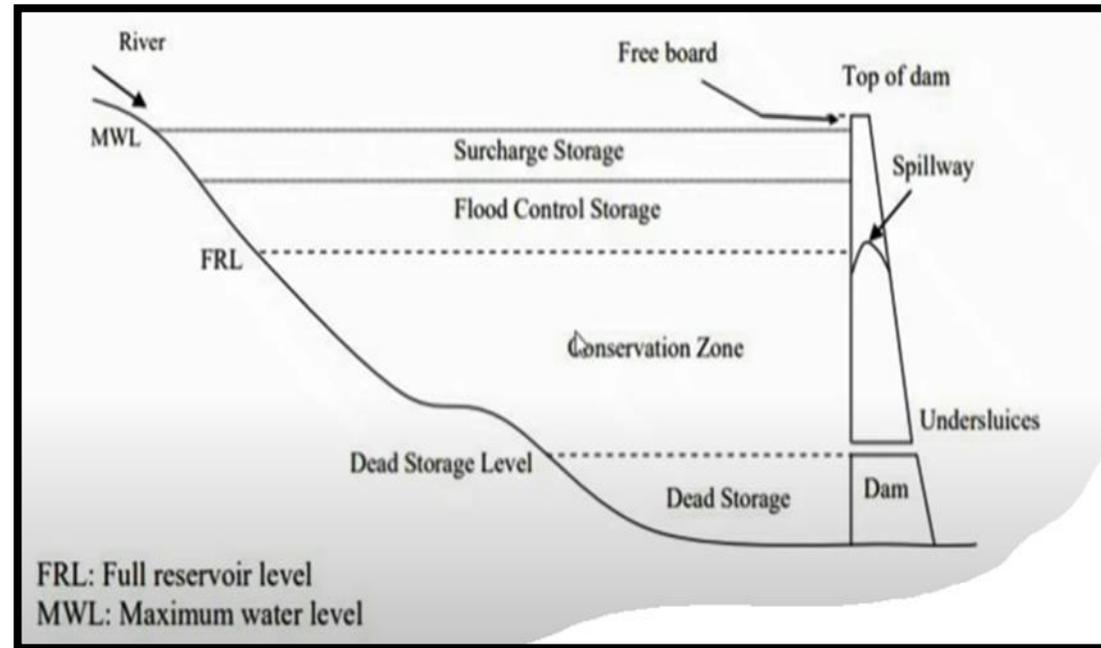
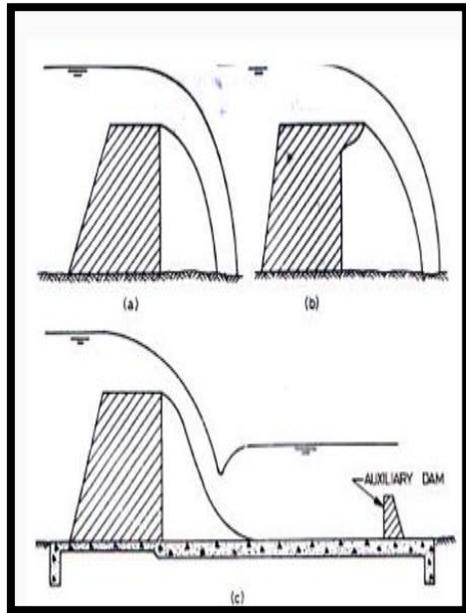
1. The student will be able to explain the ‘Mass Curve Technique’ adopted for estimating the required storage capacity of a dam reservoir for a particular inflow Outflow Pattern.
2. The student will be able to estimate the required storage capacity of a dam reservoir for a particular Inflow Outflow Pattern

# Overview

- View of a typical dam reservoir with changing water levels.
- Mass Curve Method for estimating reservoir capacity.
- Numerical example of the Mass Curve Method for estimating reservoir capacity.



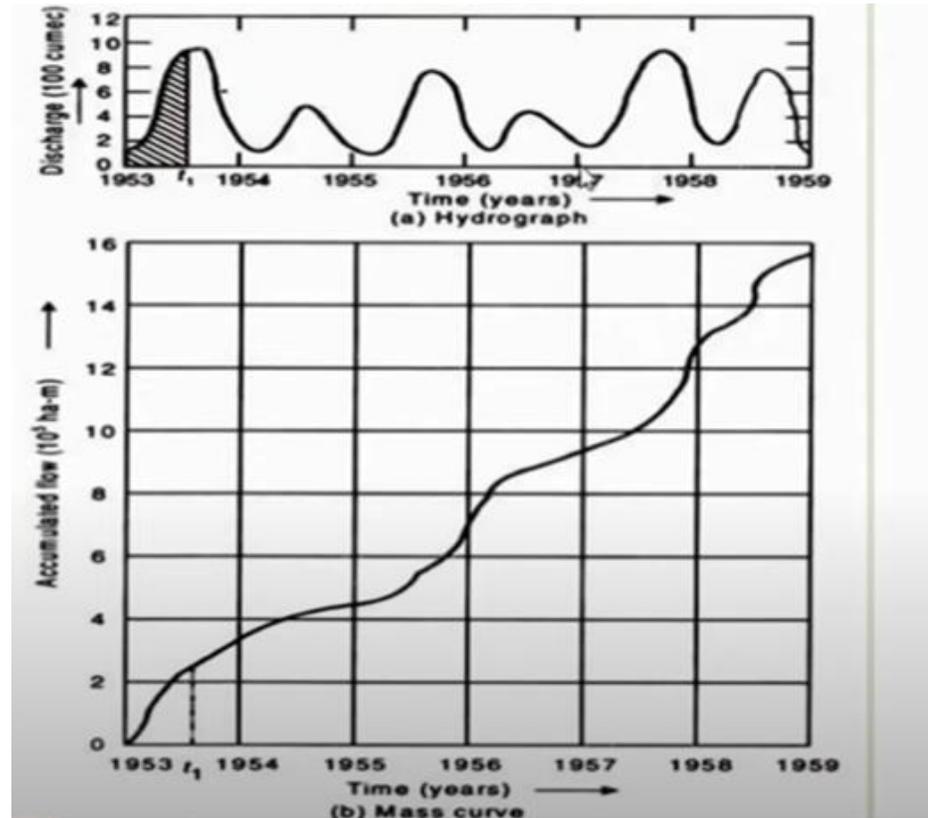
# Storage Zones of a Reservoir with ungagged spillway



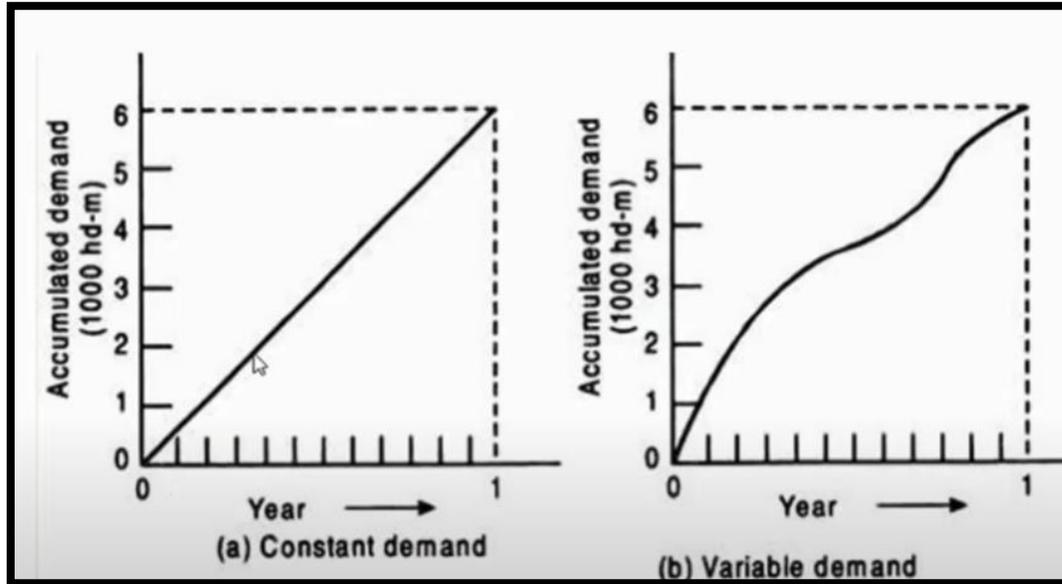
# Hydrograph and Mass Curve

- Hydrograph is a plot of discharge v/s Time
- Mass curve is accumulated discharge v/s
- Mass curve will continuously rise as it is the plot of the accumulated inflow
- If constant rate withdrawal is required from the reservoir, the mass curve of demand will be a straight line having a slope equal to demand rate

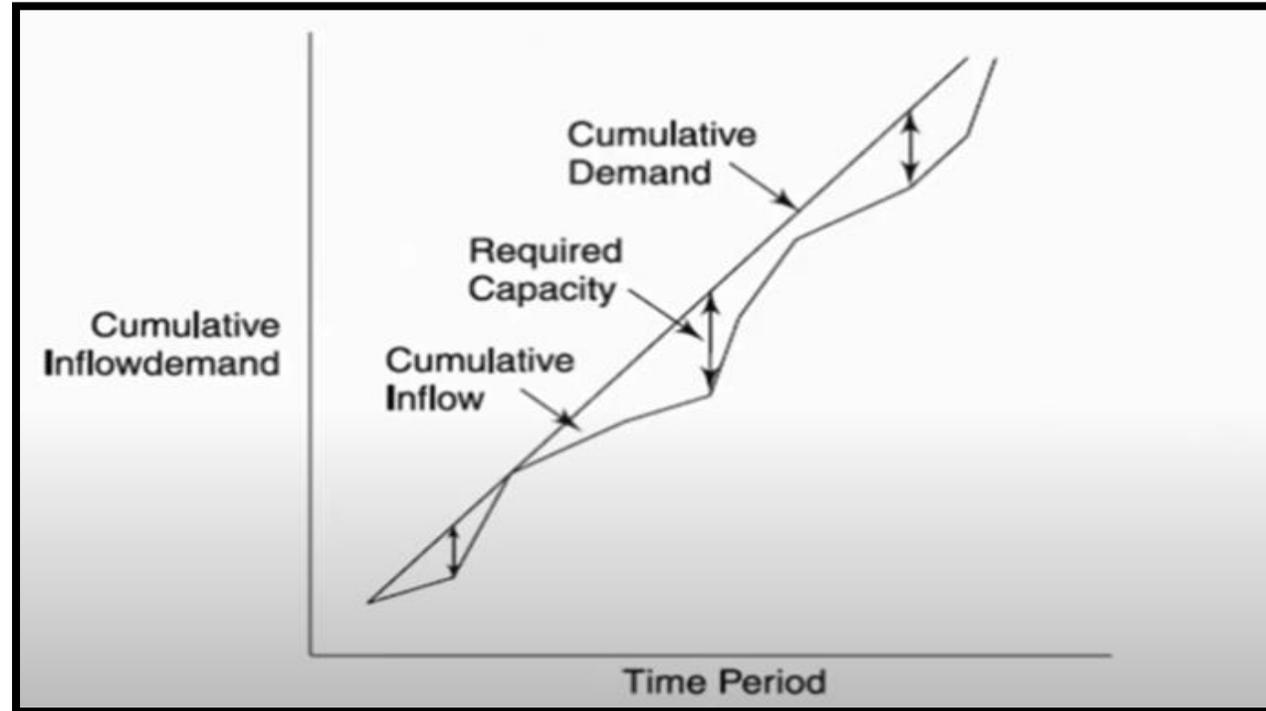
# Stream flow hydrograph and mass curve of inflow



# Mass curve of constant demand and variable demand



# Mass curve approach to determine required reservoir capacity



# Questions!

The crest of a ungated dam spillway is provided at R.L. equal to that of its :

- (a) maximum reservoir level
- (b) dead storage level
- (c) maximum conservation level
- (d) none of the above.

The capacity of a storage reservoir can be decided by using :

- (a) the mass curve of inflow
- (b) the mass curve of outflow
- (c) by both (a) and (b)
- (d) none of the above.

## Answers to Questions !

The crest of a ungated dam spillway is provided at R.L. equal to that of its :

- (a) maximum reservoir level
- (b) dead storage level
- (c) maximum conservation level
- (d) none of the above.



The capacity of a storage reservoir can be decided by using :

- (a) the mass curve of inflow
- (b) the mass curve of outflow
- (c) by both (a) and (b)
- (d) none of the above.

# Example:

- Tables shows inflow of water at hydropower generation site over a period of two year Calculate the maximum uniform monthly demand can be satisfied by given inflow patten, assuming policy of using total available water. Also calculate the required reservoir capacity to use the inflow fully, without allowing any spill of water

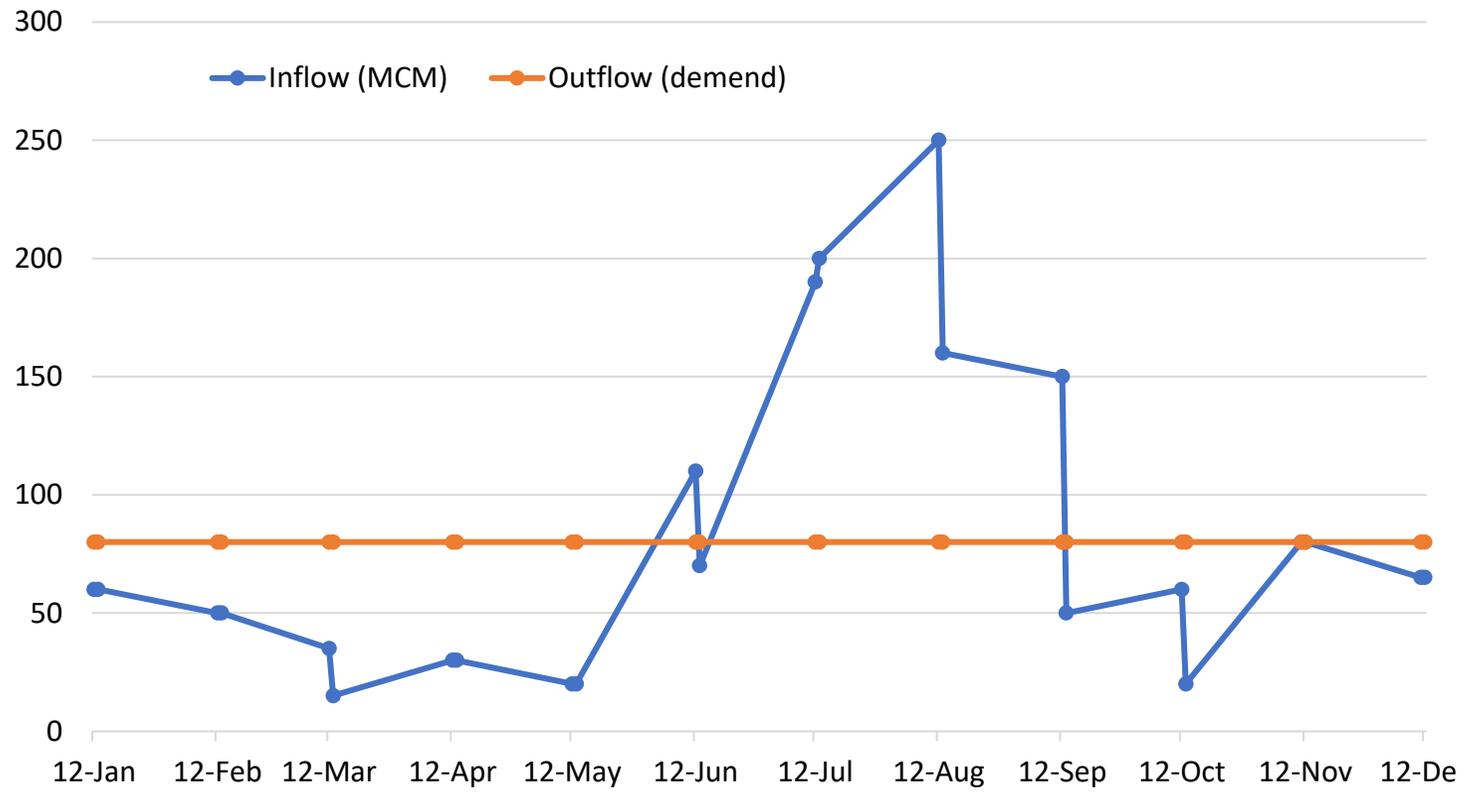
Month	Nov11	Dec11	Jan12	Feb12	Mar12	Apr12	May12	Jun12	Jul12	Aug12	Sep12	Oct12
Inflow (MCM)	80	65	60	50	35	30	20	110	190	250	150	60
Month	Nov12	Dec12	Jan13	Feb13	Mar13	Apr13	May13	Jun13	Jul13	Aug13	Sep13	Oct13
Inflow (MCM)	80	65	60	50	15	30	20	70	200	160	50	20

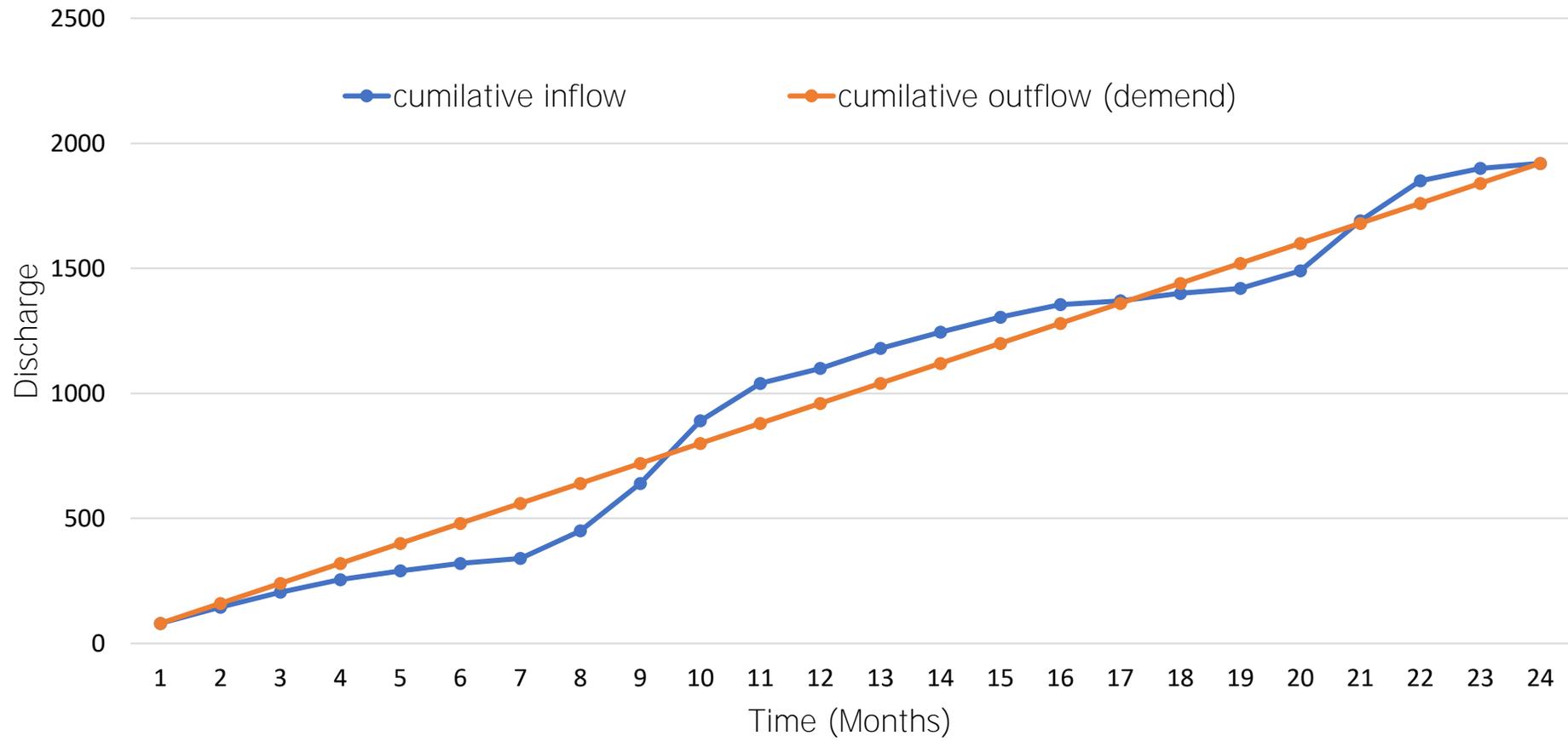
# Solution

Month	Inflow (MCM)	Outflow (demand)	cumulative inflow	cumulative outflow (demand)	Difference
11-Nov	80	80	80	80	0
11-Dec	65	80	145	160	-15
12-Jan	60	80	205	240	-35
12-Feb	50	80	255	320	-65
12-Mar	35	80	290	400	-110
12-Apr	30	80	320	480	-160
12-May	20	80	340	560	-220
12-Jun	110	80	450	640	-190
12-Jul	190	80	640	720	-80
12-Aug	250	80	890	800	90
12-Sep	150	80	1040	880	160
12-Oct	60	80	1100	960	140
12-Nov	80	80	1180	1040	140
12-Dec	65	80	1245	1120	125
13-Jan	60	80	1305	1200	105
13-Feb	50	80	1355	1280	75
13-Mar	15	80	1370	1360	10
13-Apr	30	80	1400	1440	-40
13-May	20	80	1420	1520	-100
13-Jun	70	80	1490	1600	-110
13-Jul	200	80	1690	1680	10
13-Aug	160	80	1850	1760	90
13-Sep	50	80	1900	1840	60
13-Oct	20	80	1920	1920	0

Outflow (demand) = mean (Inflow )

Monthly inflow and outflow





**Required reservoir capacity = 220+160 = 380  
MCM**



**Thanks for your  
attention!**

**Any questions?**