

# Water Resources Engineering Department MONTHLY SCIENTIFIC MAGAZINE

Editor in Chief: Shawnm Mudhafar Saleh

College of Engineering

Salahaddin University

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## Explore various engineering topics:

- Importance of Standardized Precipitation Index (SPI) for Water Resources in KRI
- Preventing Seepage through Dams Using GCL Material
- Importance of Flood-Routing in Spillway Design
- Preparation of Curve Number Grid Map of Rawanduz River Basin



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**Jehan Mohammed**  
**Assistant professor**

### Importance of Standardized Precipitation Index (SPI) for Water Resources in KRI

There is an extensive and rising water crisis in the Kurdistan Region of Iraq. The Standardized Precipitation Index (SPI), which quantifies dry or wet periods using rainfall, is a significant drought tool. Monthly irrigation and agricultural decisions are affected by the short-term SPI. Medium-term SPI improves the seasonal water supply efficiency and farming scheduling. Two of the greatest water supplies in the region, including the Dukan and Darbandikhan Dams, have been negatively impacted by long-term SPI changes. These reservoirs are being lost much earlier than they are being recharged. The SPI may be used as a crucial early-warning and diagnostic tool to comprehend and predict hydrological conditions in the Tigris (Diyala) and Greater Zab rivers in KRI by examining precipitation patterns in their various catchment areas.

Classification of SPI value scale

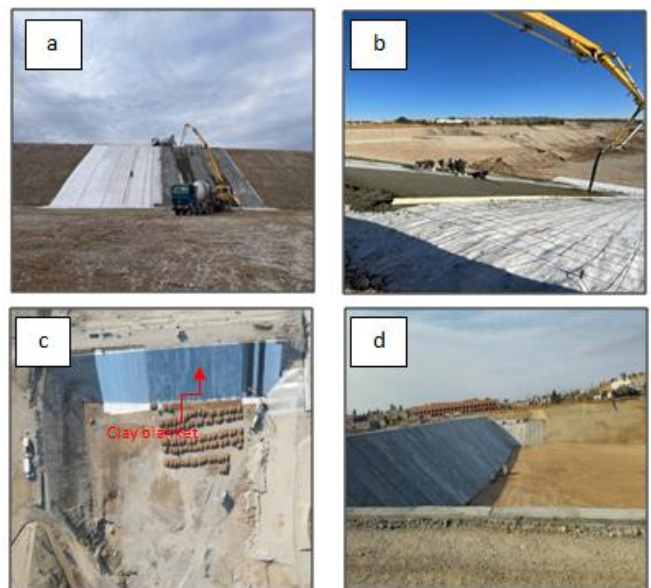
SPI value	Categories
$SPI \geq 2.00$	Wet extreme
$1.50 \leq SPI \leq 1.99$	Extremely wet
$1.00 \leq SPI \leq 1.49$	Wet
$-0.99 \leq SPI \leq 0.99$	Normal
$-1.00 \leq SPI \leq -1.49$	Dry
$-1.5 \leq SPI \leq -1.99$	Extremely dry
$SPI \leq -2.00$	Dry extreme



**Yaseen Wsu**  
**Lecturer**

### Preventing Seepage through Dams Using GCL Material

Earth dams, the most common types of dams due to the availability of materials, often experience seepage problems, primarily through their body and foundation. This significantly affects the water level in the reservoir, especially during the dry season when there is no inflow. Geosynthetic clay liner (GCL) is provided for earth dam to control seepage through the dam. It composed of clay layers bonded to one or two Geosynthetic layers. The hydraulic of permeability of GCL material was  $1 \times 10^{-11}$  m/s which was mainly depended on the hydraulic conductivity of the bentonite material. The installation of the GCL involved unrolling a GCL sheet from the top of the upstream face to cover the entire surface of the dam, extending 5 m into the reservoir. To prevent seepage between adjacent GCL layers, a 0.5 m overlap was used. Bentonite powder was then poured into the joints and, after hydration, swelled to seal any gaps. Following the successful installation of the GCL layers, a 15 cm-thick layer of reinforced (by BRC) concrete was placed over the GCL on the upstream face and abutments to protect it from weathering and damage. This material is provided at Kasnazan pond for controlling seepage through the pond body.





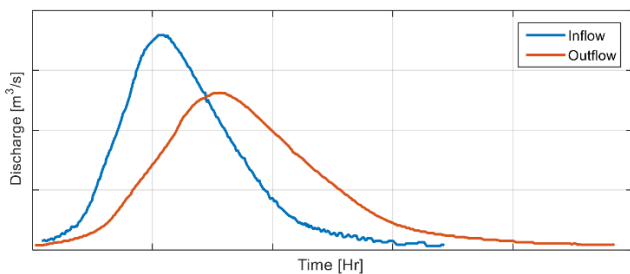
**Sarkawt Muhammad**  
**Lecturer**



**Israa Diyar**  
**Assistant Lecturer**

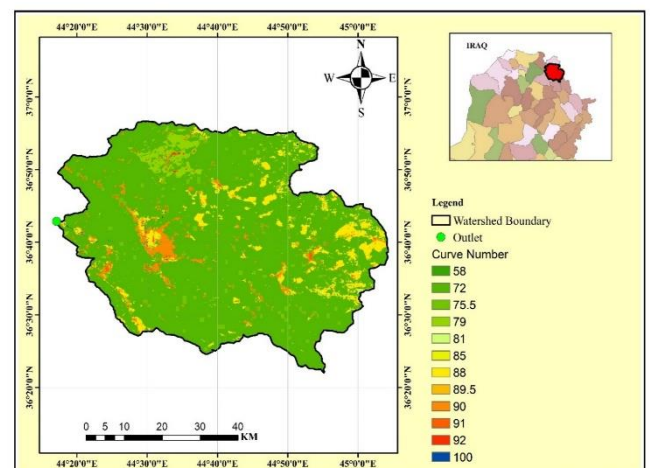
**Importance of Flood-Routing in Spillway Design**

Flood routing is the procedure by which the temporal distribution of flood discharge is evaluated at a downstream of a reservoir, considering the effects of storage, attenuation, and travel time. The process of flood routing is crucial in the spillway design of dams for several reasons, such as determination of spillway capacity, which is the main function of each spillway. In the process of flood routing in reservoirs, the maximum reservoir level reached can be evaluated, which is a very critical analysis to prevent overtopping, which is considered the main source of earth and rockfill dam failures. It quantifies surcharge storage (temporary flood storage), which can be used to optimize spillway dimensions. It can be used to define normal water level, maximum water level, and emergency flood level, and it can be used to design downstream structures such as energy dissipaters and the downstream channel.



**Preparation of Curve Number Grid Map of Rawanduz River Basin**

A Curve Number (CN) map was developed for the Rawanduz River Basin to estimate surface runoff. GIS techniques were used to integrate land use, soil types, and topographic data. Landsat 8 satellite imagery supported land cover classification, while hydrologic soil groups were identified. The SCS-CN method was applied to calculate how rainfall is divided between runoff and infiltration. Low runoff potential was found in forested areas, while high runoff was observed in residential zones. The resulting CN map provides a valuable tool for flood risk assessment and watershed management. The study demonstrates the effectiveness of GIS-based hydrological modelling for water resources planning.



This monthly newsletter is released by the **Department of Water Resources Engineering-College of Engineering** at **Salahaddin University**. If you wish to contribute a topic, please contact us using the email provided in the header.