

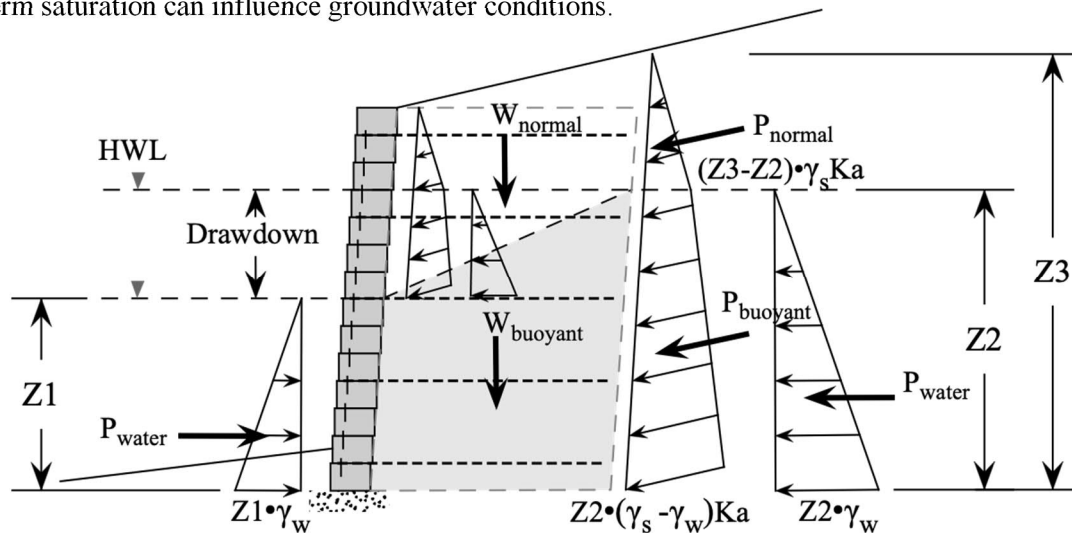
# Drawdown Analysis

Wall structures constructed adjacent to water can experience a wide range of conditions and instability as water levels rise and fall. The extremes may run from a simple retaining structure constructed along a relatively static pond to a flood stabilization project and where the structures are in the dry 99% of the time yet completely submerged a few times a year.

Clearly, the risk associated with water applications can be significant. Therefore, the design should be addressed in a comprehensive and conservative manner. Building codes do not typically address water applications due to their unique nature and expect that the engineer will provide the correct solution for the conditions based on standards of practice.

As a guide, excerpts from the 2015 AASHTO code says "For structures along rivers and streams, a minimum differential hydrostatic pressure equal to 3.0 ft of water shall be considered for the design .... or alternatively rapidly draining backfill material such as shot rock or open graded gravel can be used as backfill...". Keystone generally recommends free draining reinforced zone backfill such as #57 stone wrapped in a geotextile to the high water level for walls that would be subject to varying water levels.

It is important to properly address internal and external stability of a reinforced soil structure for the drawdown condition when applicable. Internally, the hydrostatic pressure differential can be eliminated by the use of free draining backfill. Externally, high water that effectively raises the groundwater table reduces the effective weight of the mass (buoyancy) and increases driving forces due to the water level imbalance. Global stability and foundation stability must also be reviewed against the varying water conditions when long term saturation can influence groundwater conditions.



**Typical Design Section**

## Drawdown Design Guidelines

- 3' drawdown condition is a typical design requirement when required.
- Drawdown evaluation can utilize lower safety factor for combined loading analysis. (COE Guideline FS > 1.33).
- Drawdown condition affects wall between normal water and high water elevations as level is varied. Global stability condition can be worse with submerged toe.
- Liberal use of free draining backfill material minimizes internal drawdown conditions and associated pressure differentials.