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## Introduction:

DHI Sverige AB received a task from Sverigehuset to perform calculations of characteristic water levels, i.e. Highest High level (HHV), Mean level (MV) and Lowest Low level (LLV) in a golf course by Söderån, Kungsbacka.

## Method and result:

A simulation with the hydrologic model MIKE11 NAM and the hydraulic model MIKE11 HD (DHI, 2016) [2] was conducted to calculate the required water levels. Daily precipitation data was taken from Rossared station, using SMHI data base [1]. This station should be the most representative for the area of interest. Daily ambient air temperature was taken from Göteborg.

First, the hydrologic model MIKE11 NAM was used to simulate a period of the last 33 years in order to calculate the runoff in Söderån. Figure 2 shows the simulated hydrograph during the considered timespan.



Figure 1: Simulated discharges in Söderån over the last 33 years.

Then, hydraulic modelling using MIKE 11 HD was done for a period that covers minimum, average and maximum discharges. The discharge values are shown in Table 1. The corresponding water levels are shown in Table 2 at different model locations (chainages) within the area of interest. All elevations are reported in RH 2000.

In addition to the above three elevations, discharge and water level for a 100-Year rainstorm event (100 year return period) combined with normal sea water level is included in Table 1 and 2, respectively. These values have been calculated in a previous investigation by DHI in 2015 [3].

The area of interest (i.e. golf course by Söderån) is shown in Figure 2 [4].

The location of the calculation points (chainages) in MIKE11 HD model is illustrated in Figure 3.

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Figure 2: Outline of the golf course by the Söderån.



Figure 3: Location of calculation points (chainages) in the area of interest as described in MIKE11 HD model.

Table 1: HHQ, MQ and LLQ over 33 years and HHQ from 100-Year rainstorm

Discharge	[m3/s]
Lowest Low discharge(LLQ)	0.003
Mean discharge(MQ)	0.12
Highest High discharge (HHQ)	2.62
100-Year rainstorm	7.28

Table 2: HHV, MV and LLV over 33 years, and HHV for 100-Year rainstorm

Chainage [m]	HHV [m]	MV [m]	LLV [m]	100-Y Rainstorm [m]
96	2.12	1.19	1.1	3.3
530	2.12	1.1	0.8	3.3
950	2.11	1.1	0.8	3.3
1098	2.11	1.1	0.8	3.3

## Conclusion

For the center point within the area of interest (chainage 530 m), the following characteristic water levels have been calculated based on a simulated period of the last 33 years:

HHV = 2.1 m MV = 1.1 m LLV = 0.8 m

The water level of 3.3 m for the 100-Year rainstorm event, which was calculated in a previous study [3], is included as a reference to highlight that water levels could be higher than the reported HHV during extreme rain events.

## References:

- 1. http://opendata-catalog.smhi.se/explore/
- 2. <u>DHI</u> (2016). MIKE11 A modeling system for Rivers and Channels. User Guide. MIKE by DHI 2016.
- 3. DHI, Slutrapport Söderån. Översvämningsrisker längs Söderå, DHI, Växjö, 2015-09-21, till Kungsbacka kommun
- 4. Adopted from Norconsult<sup>®</sup> email of 02/11/2016, Göteborg, Sweden