THE SAINT-AVERTIN CONNECTION BETWEEN ATLANTIC HSL AND SEA HSL, A SECTOR HYDRAULICALLY CONSTRAINED

DESIGNED TO BE ROBUST AND RESILIENT AGAINST HEAVY RAINS & FLOOD RISK

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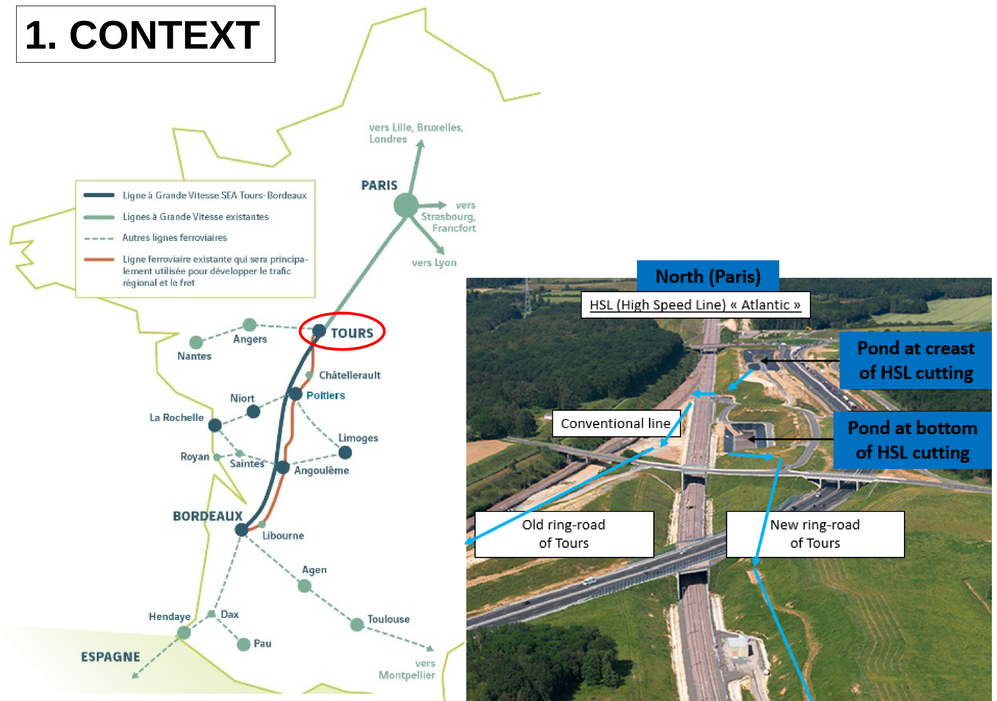
1. CONTEXT



Issues:

- A low point (no gravity outfall)
- Existing drainage networks (regulation required)
- Vulnerability / trafficability

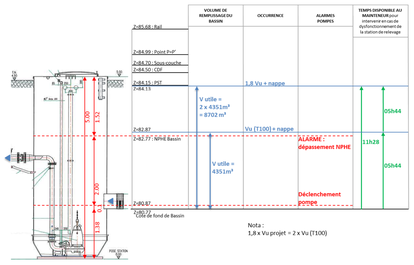
Standards require risk analysis and specific studies:

- French high speed lines standards (2006 + 2008)
- European common safety methods (CE 352/2009)

➔ Design at T100 years + check until 1.8xT100

2. RISK ANALYSIS (bottom of cutting)

Fréquence d'une Situation Dangereuse					
	Fréquent $P \geq 10^{-3}$ /h	Indésirable	Inacceptable	Inacceptable	Inacceptable
	Probable $10^{-4} \leq P < 10^{-3}$ /h	Acceptable	Indésirable	Inacceptable	Inacceptable
	Occasionnel $10^{-5} \leq P < 10^{-4}$ /h	Acceptable	Indésirable	Indésirable	Inacceptable
	Rare $10^{-7} \leq P < 10^{-5}$ /h	Négligeable	Acceptable	Indésirable	Indésirable
	Improbable $10^{-9} \leq P < 10^{-7}$ /h	Négligeable	Négligeable	Acceptable	Acceptable
	Invraisemblable $P < 10^{-9}$ /h	Négligeable	Négligeable	Négligeable	Négligeable
Niveau Criticité du risque		Insignifiant	Marginal	Critique	Catastrophique
		Niveau de Niveau de Gravité d'une Situation Dangereuse Fréquence			



a) Analysis of flood risk in nominal situation = with correct maintenance

"Derailment following a flood event" at the highest level of gravity

Frequency of occurrence T100 + 2xFAILURE (hourly probability):

P = 1.49.10-14

b) Flood risk analysis in case of general failure = absolute case with T100 + no pumps/alarms

Failure + T100: Storage volume T100 in 5h44 with water level in the pond

Failure + pond filled T100 + T100: 2nd V100 in 5h44 with water level < track

3. SPECIFIC STUDIES (top of cutting)

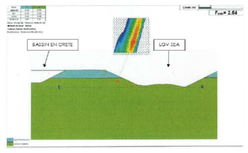


Figure 7. Stabilité en statique du talus de la voie ferré – bassin rempli au maximum

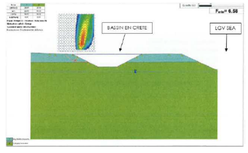
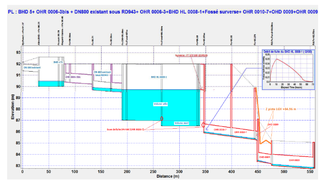
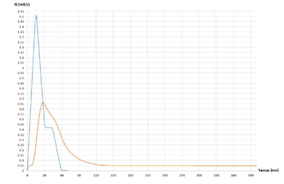
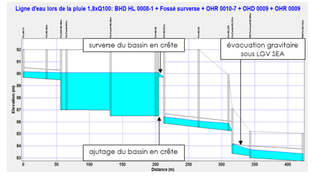


Figure 8. Stabilité en statique du talus du bassin – bassin rempli au maximum

Geotechnical verification of the stability (static, critical, seismic)







Hydraulics / Hydrologic check and adaptation

4. CONCLUSION / FEEDBACKS:

- **This case-study is an example of methodology for the choice of the scenario until extreme occurrences**
- **Specific hazard areas has to be monitored closely as soon as possible due to long processing times**