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Contaminated Soils

Government of Aragon

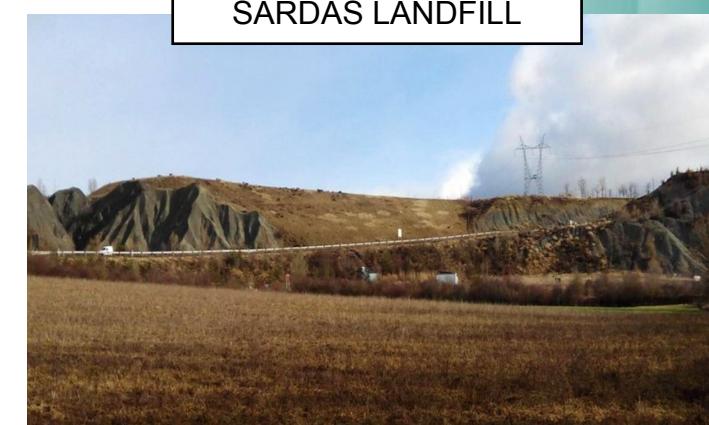
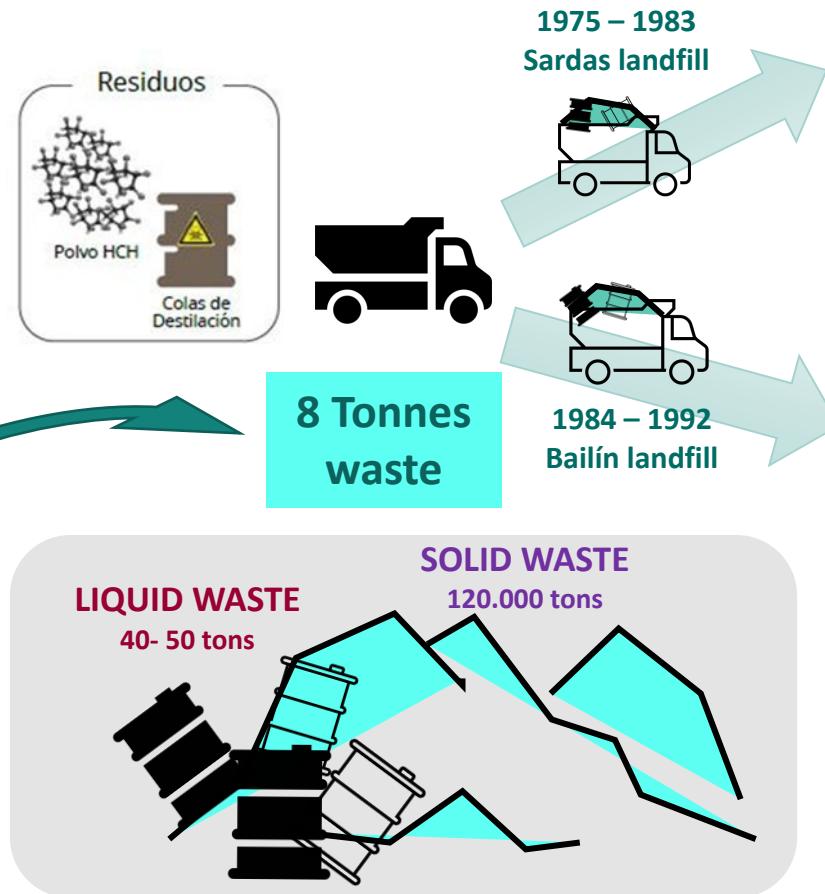
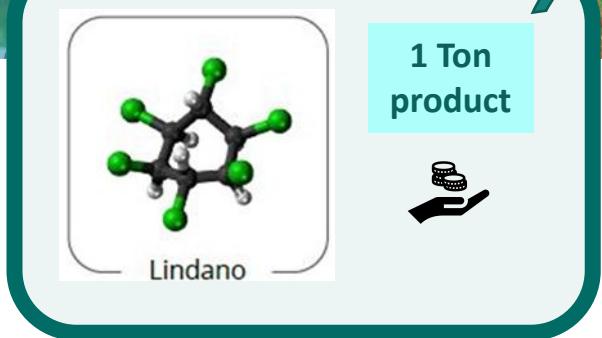
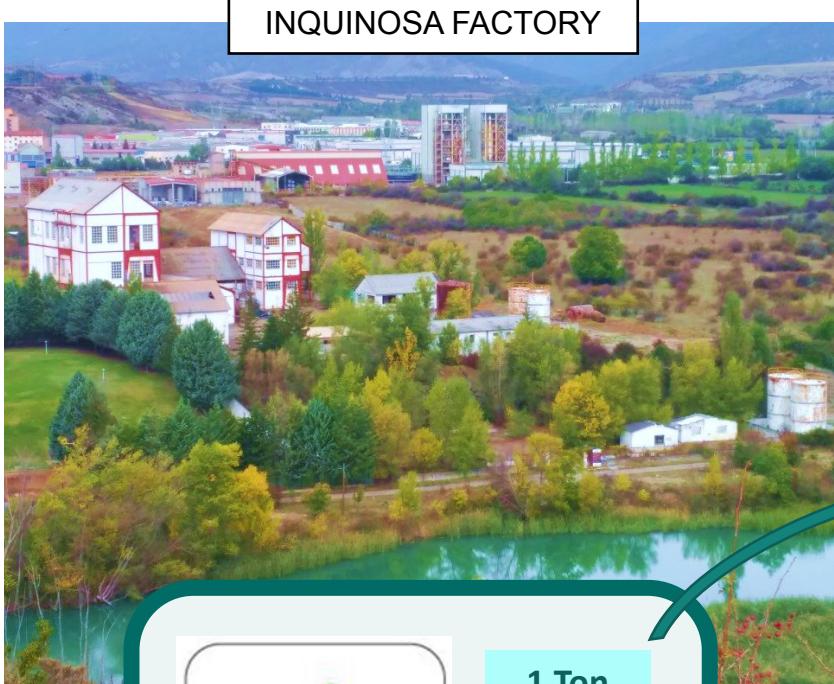


# CASE STUDY OF THE INFLUENCE OF GEOLOGY AND THE PRESENCE OF DIFFERENT MATRIXES ON THE APPLICABILITY OF HCH REMEDIATION TECHNOLOGIES

Cano, E, Fernández, J, Net, J., Velilla, S.M., Monge L., Arjol, M.A.

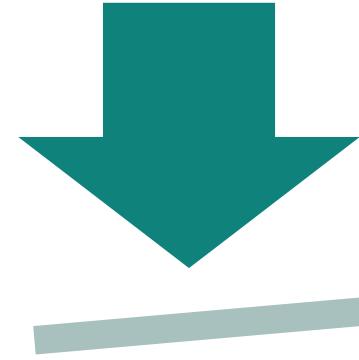


# Three polluted sites



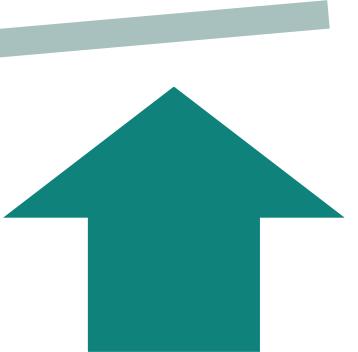
(landfill dismantled in 2014.  
Waste transferred to a new  
safety landfill)

# Three polluted sites



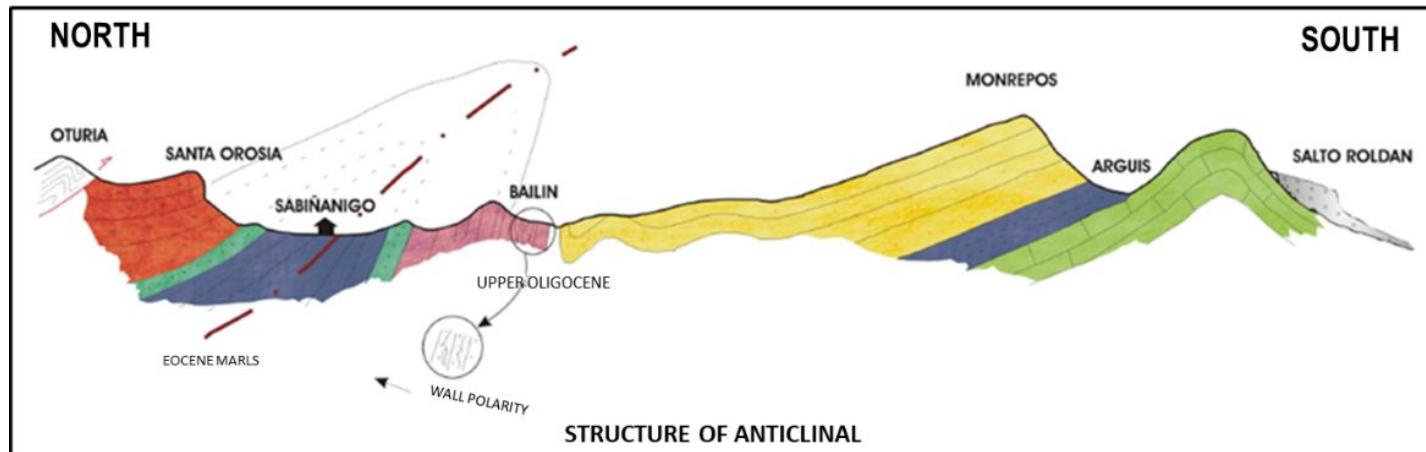
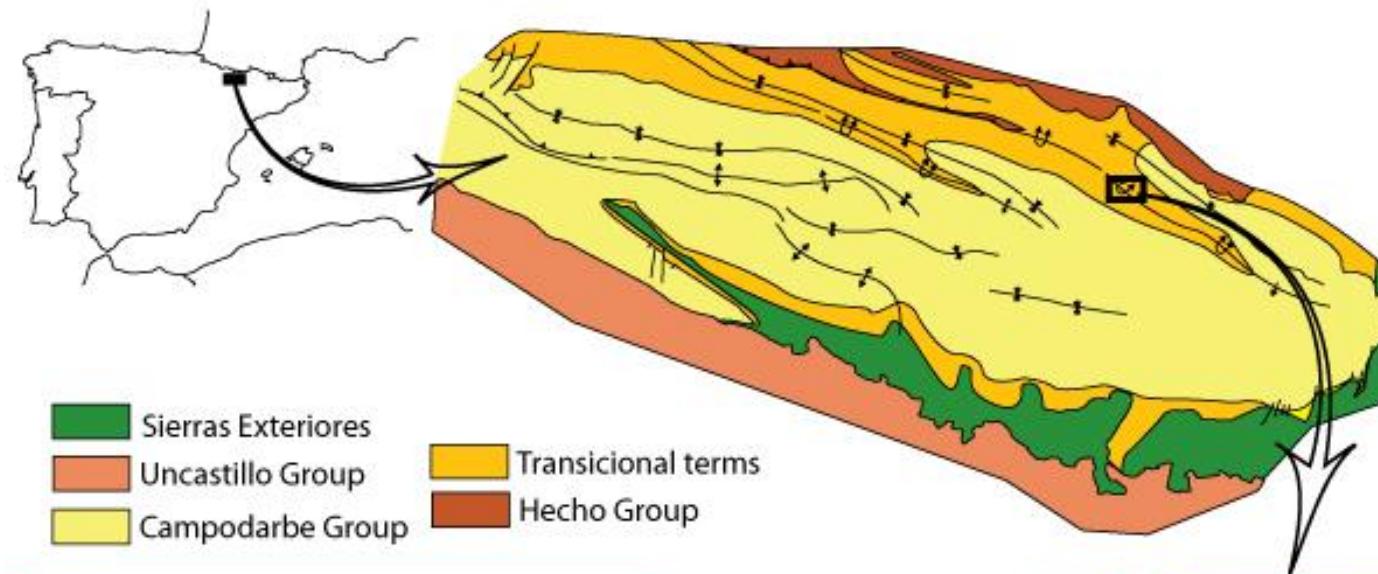
**Same origin  
Nearby sites**

Different phases of pollutants  
Variable geology  
Different matrixes



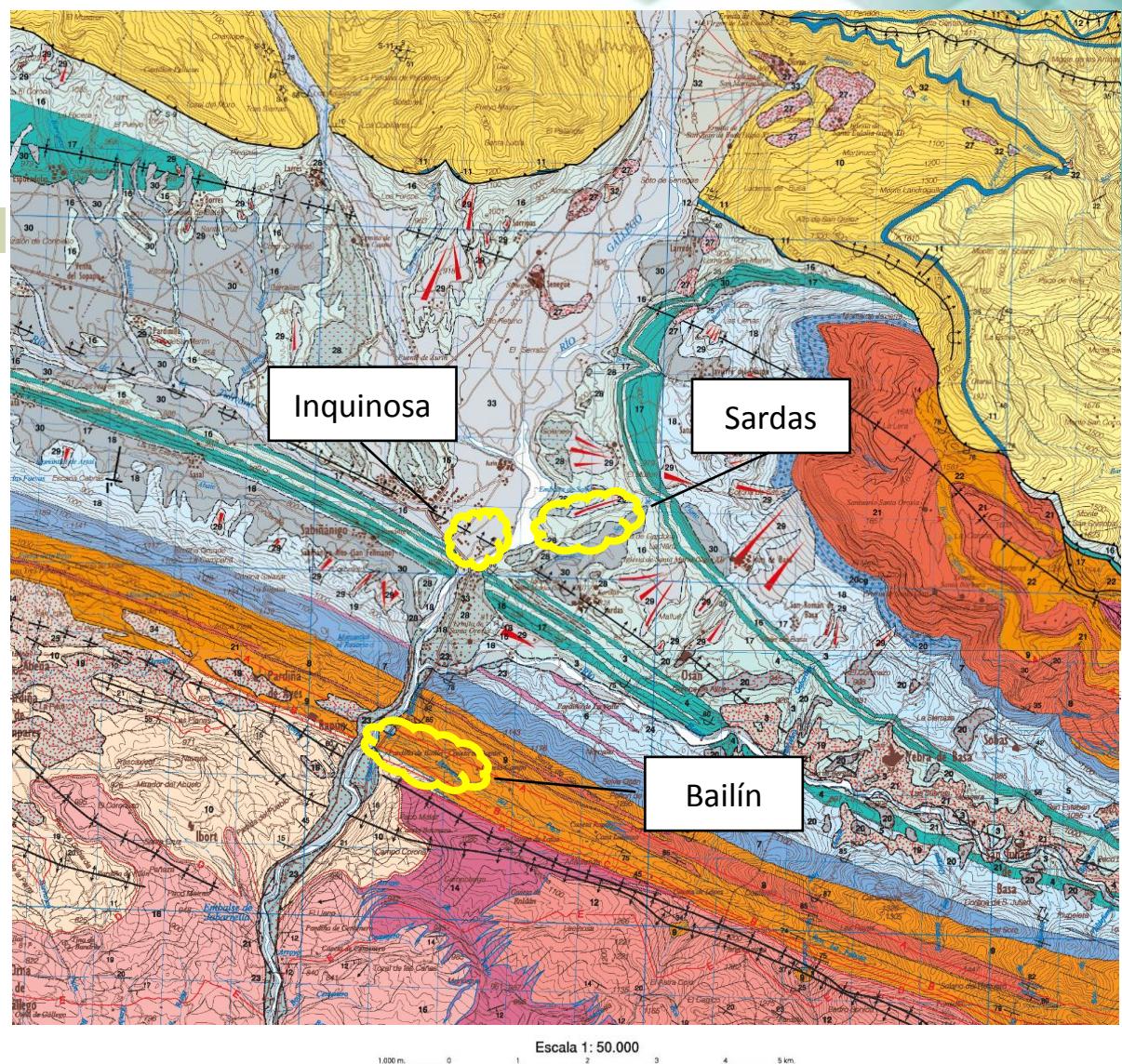
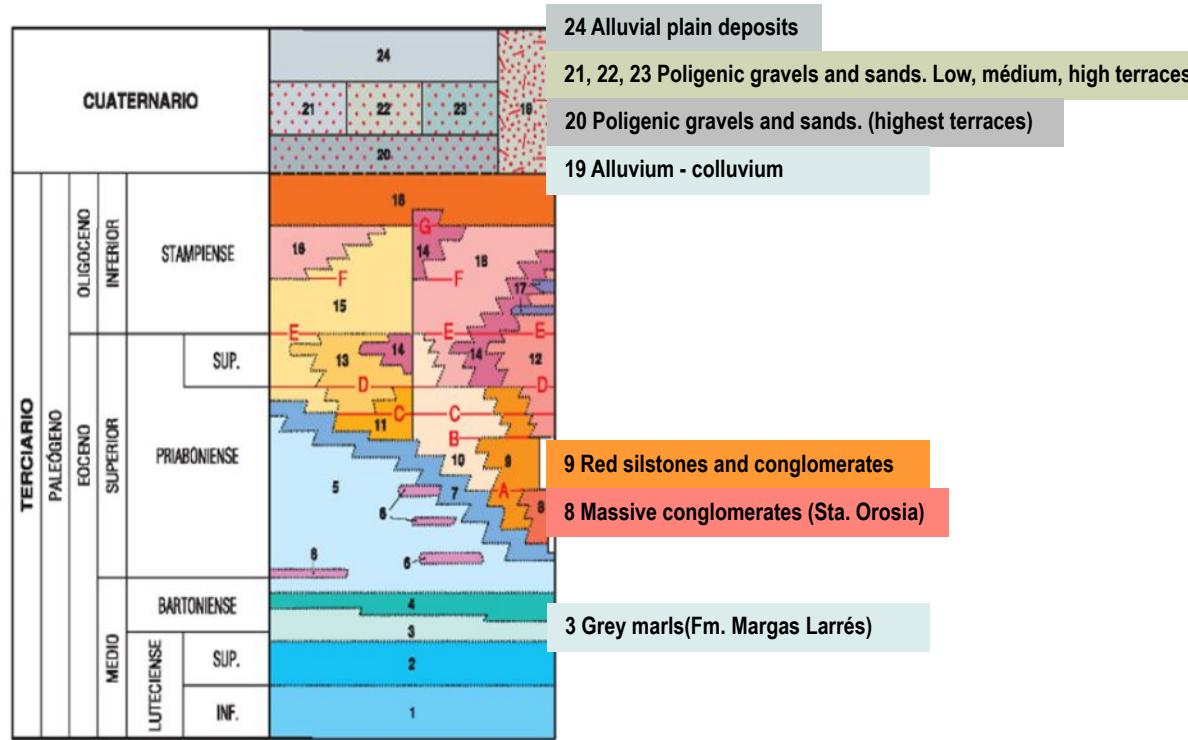
**Need of wide range of remediation  
solutions**

# Geological overview

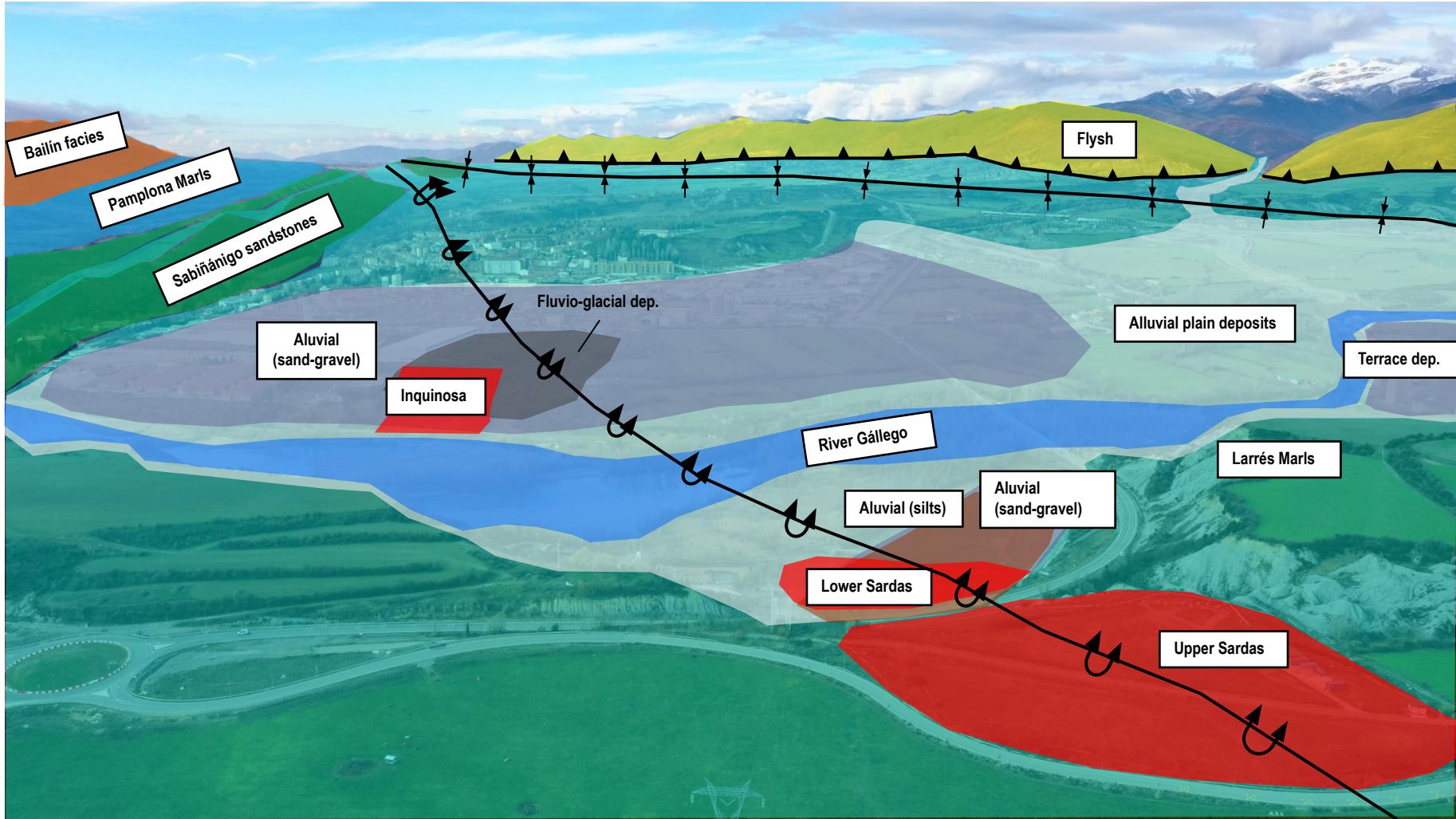




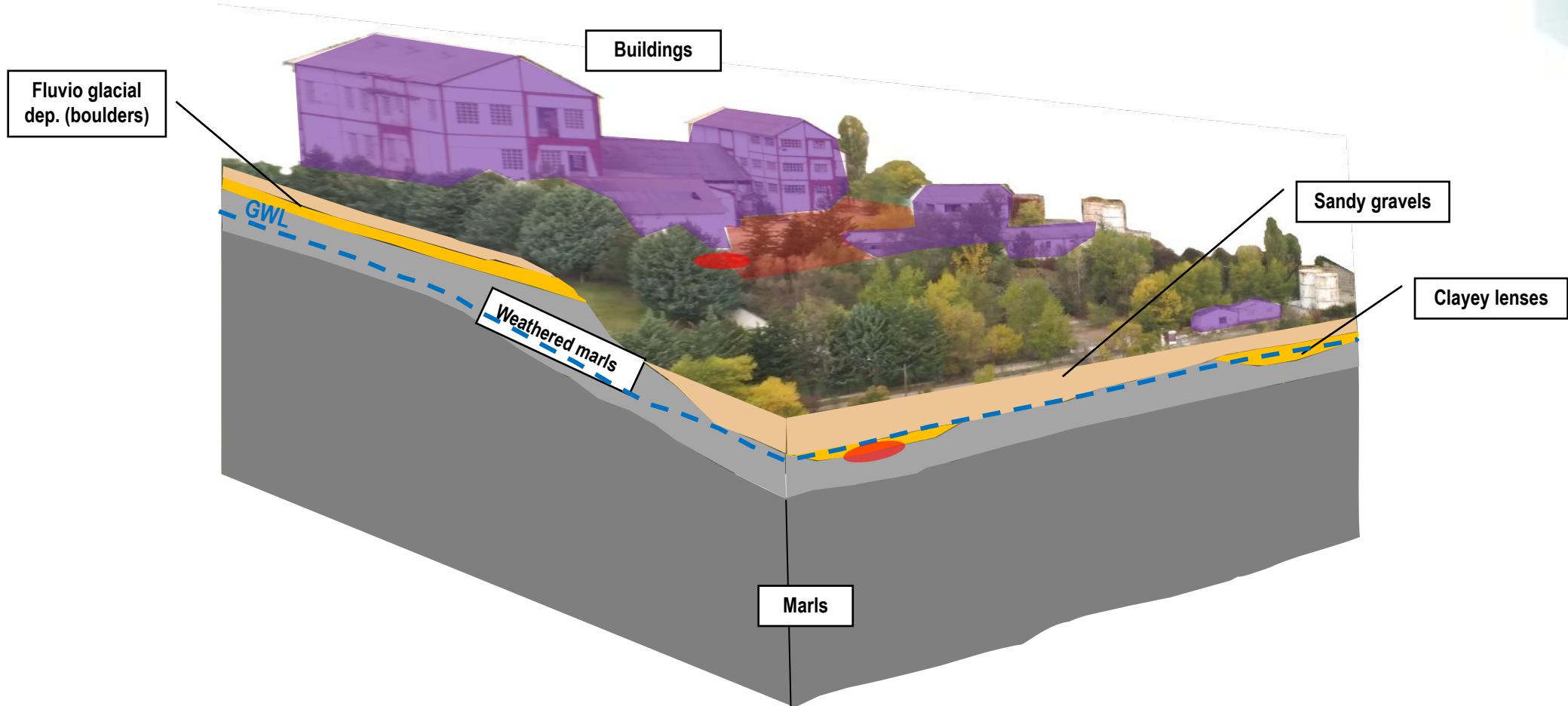
# Geological overview



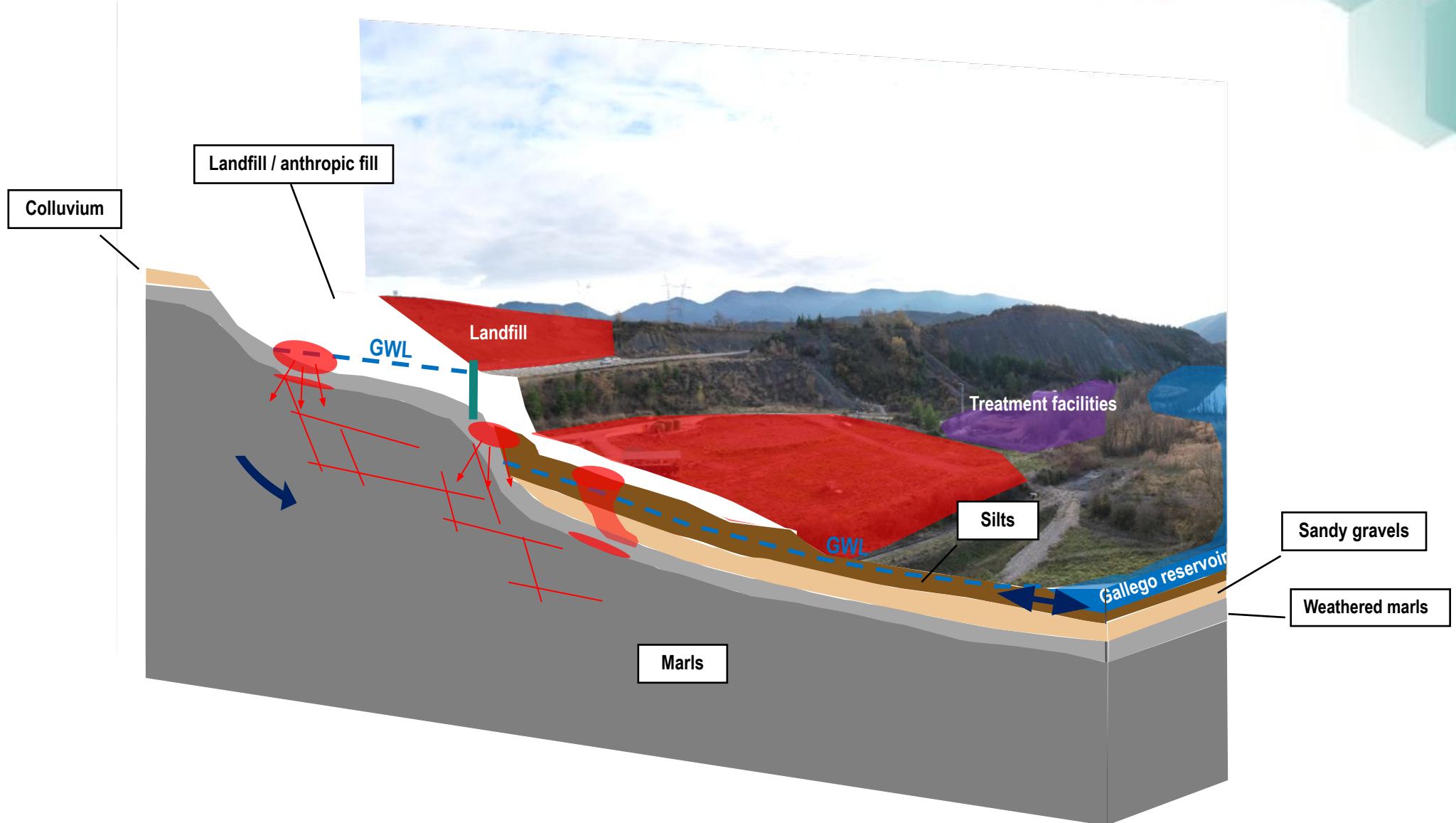
# Sites geology



# Inquinosa factory



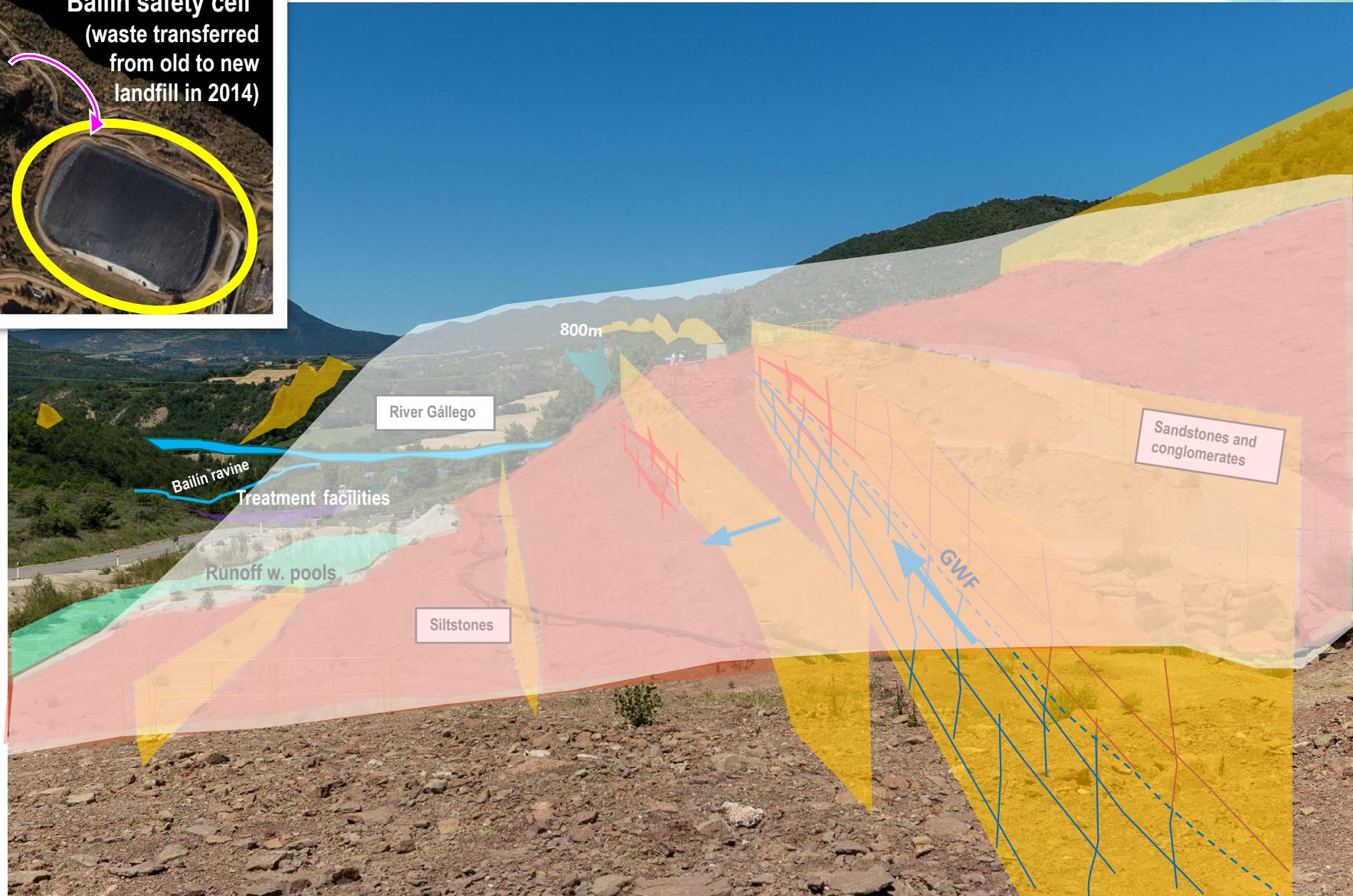
# Sardas landfill



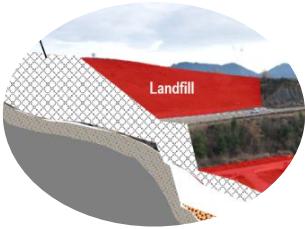
# Bailin old landfill



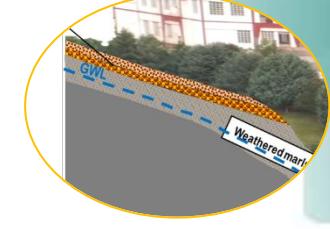
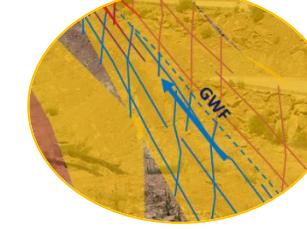
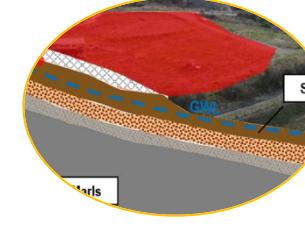
Bailín safety cell  
(waste transferred  
from old to new  
landfill in 2014)



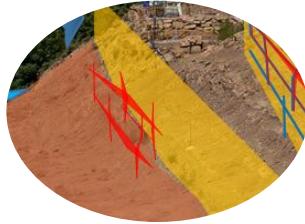
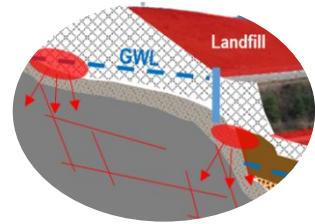
# Matrixes variability



Solid HCH – Pure waste



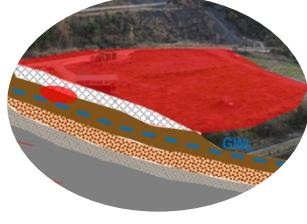
Dissolved HCH - Groundwater



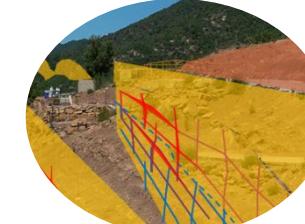
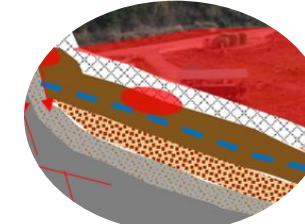
Free DNAPL



Dissolved HCH – leachates / sludges



Adsorbed HCH - rock / soil vadose zone



Non pumpable / Residual DNAPL

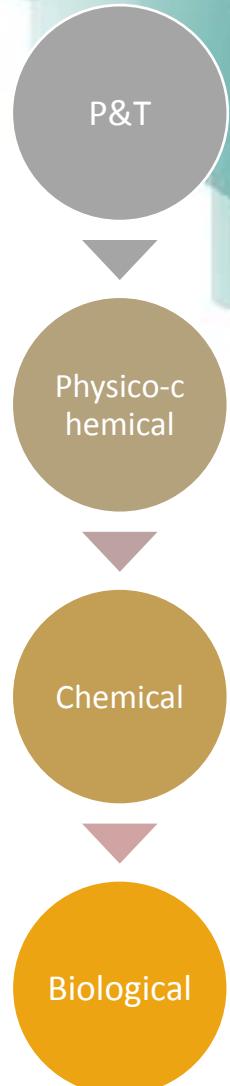


Granular / adsorbed HCH – sediments / debris

# Remediation (train of technologies)



Pollutant concentration	Phase	Site	Matrix	Geology	Technology
+ + + + + + + + + +	Solid HCH	Bailin-Sardas	Pure waste	Anthropic fill	Phase 1: isolation Phase 2: elimination. Cost-effective technology ? <span style="color: green;">1</span>
		Bailin	Saturated rock	Sandstones – fractured aquifer	Pump & Treat <span style="color: green;">2</span>
	Free DNAPL	Sardas	Saturated anthropic fill	Landfill	
		Bailin	Rock	Sandstones – fractured aquifer	SEAR <span style="color: green;">3</span> S-ISCO <span style="color: green;">4</span>
		Sardas	Soil	Silts	SEAR <span style="color: green;">3</span> Electrorremediation <span style="color: green;">5</span>
				Sands-gravels	SEAR <span style="color: green;">3</span> S-ISCO <span style="color: green;">4</span>
			Saturated anthropic fill	Landfill, road embankment	Pump & treat <span style="color: green;">2</span> SEAR <span style="color: green;">3</span>
	Dissolved HCH	Sardas	Sludges	Storm pool sediments	Electrorremediation <span style="color: green;">5</span> bioremediation <span style="color: green;">6</span>
		All sites	Leachates	Pumped water	Alkaline hydrolysis <span style="color: green;">7</span> activated carbon <span style="color: green;">8</span>
		Bailin	Groundwater	Sandstones – fractured aquifer	ISCO <span style="color: green;">9</span> creation <span style="color: green;">10</span> bioremediation <span style="color: green;">6</span>
		Sardas	Groundwater	Detrital aquifer	
- - - - -	Absorbed HCH	All sites	Vadose zone	Variable geology	Infiltration + bio-phytoremediation ? <span style="color: green;">11</span>
- - - - -	Granular HCH		Soil	Sediments	Bio-phytoremediation (technosols) <span style="color: green;">12</span>





# THANK YOU FOR YOUR ATTENTION

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Gobierno de Aragón

