Quantifying the unknown

Hydrogeological & contaminant transport characterisation of an urban landfill extension | Wellington, New Zealand

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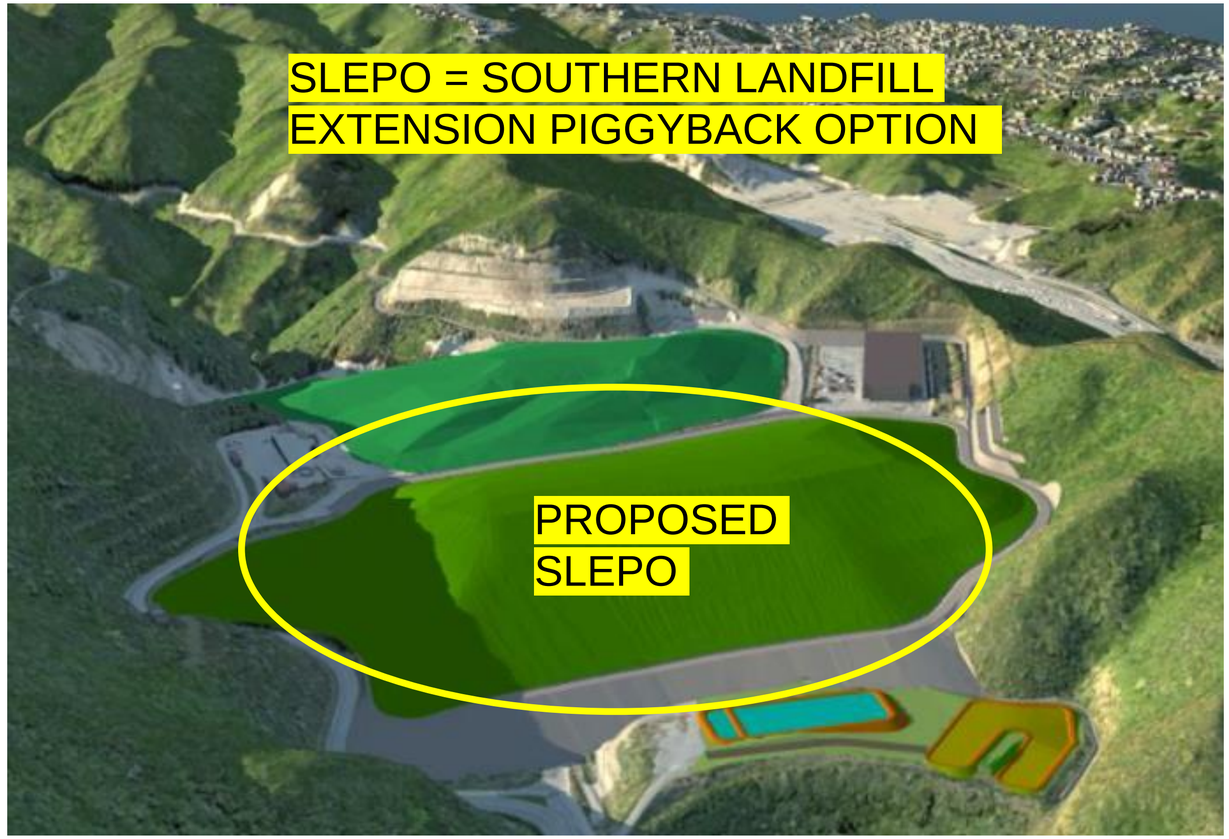
Tonkin & Taylor Ltd

The Project – WCC Southern Landfill & SLEPO

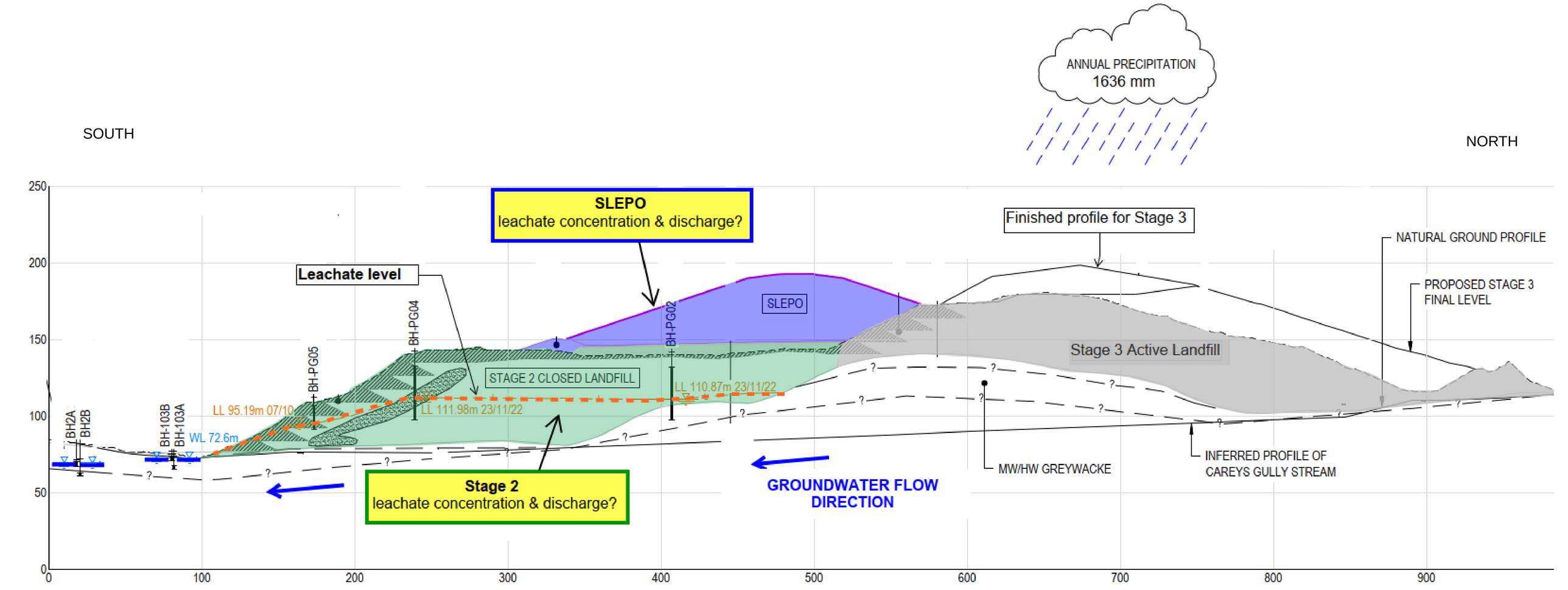
Site location

The Project – Southern Landfill & SLEPO

Purpose of the assessment?

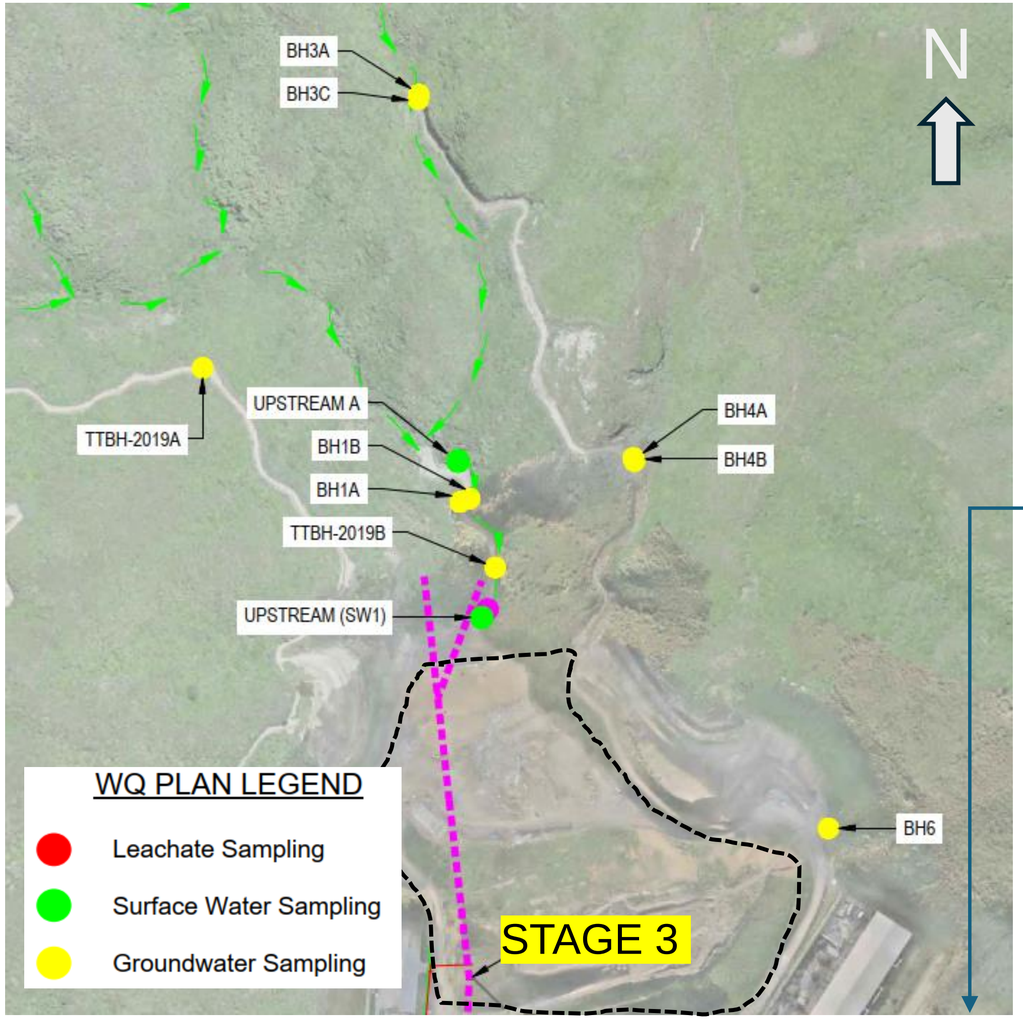


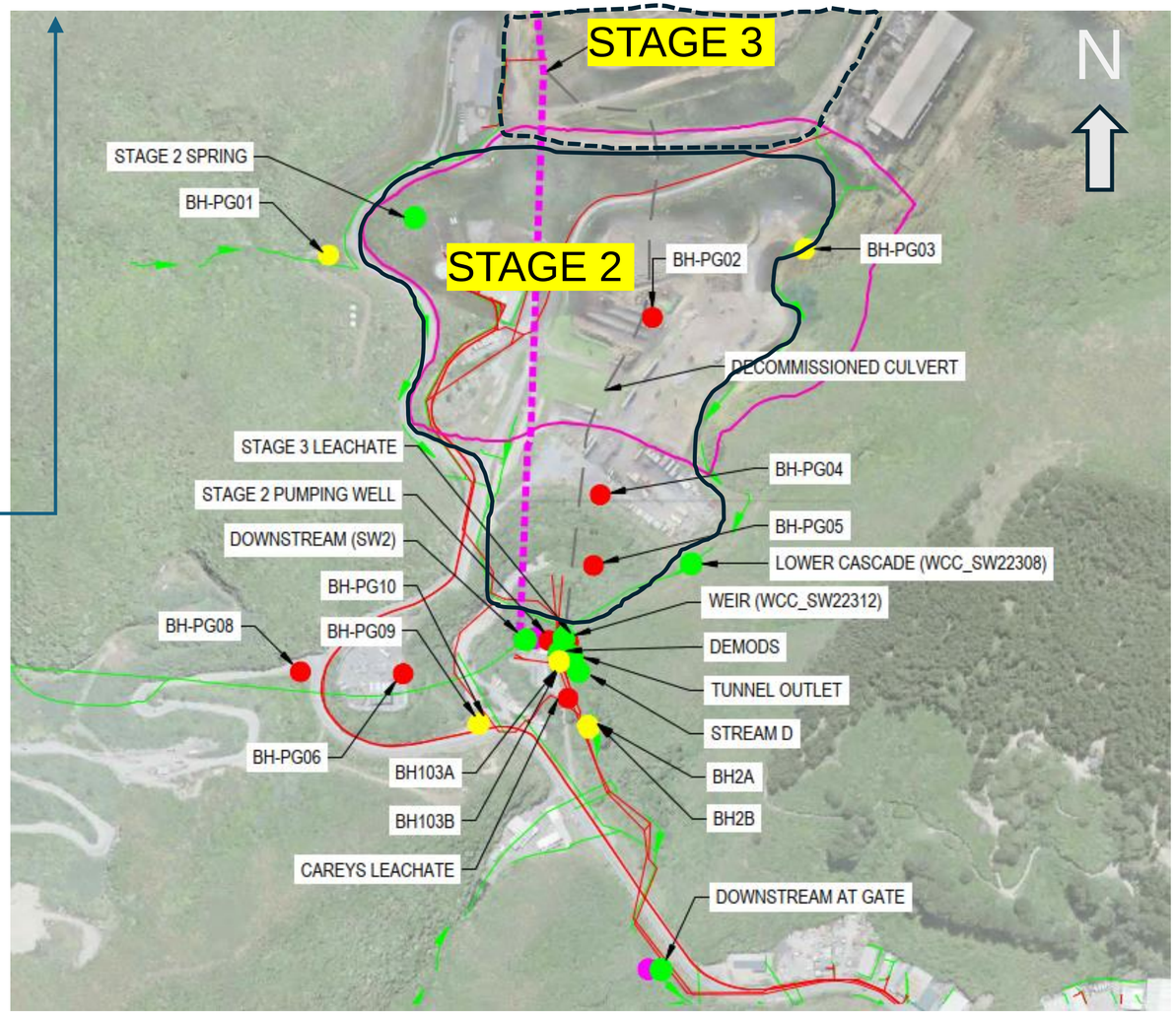
Objective – Assessment of leachate discharge



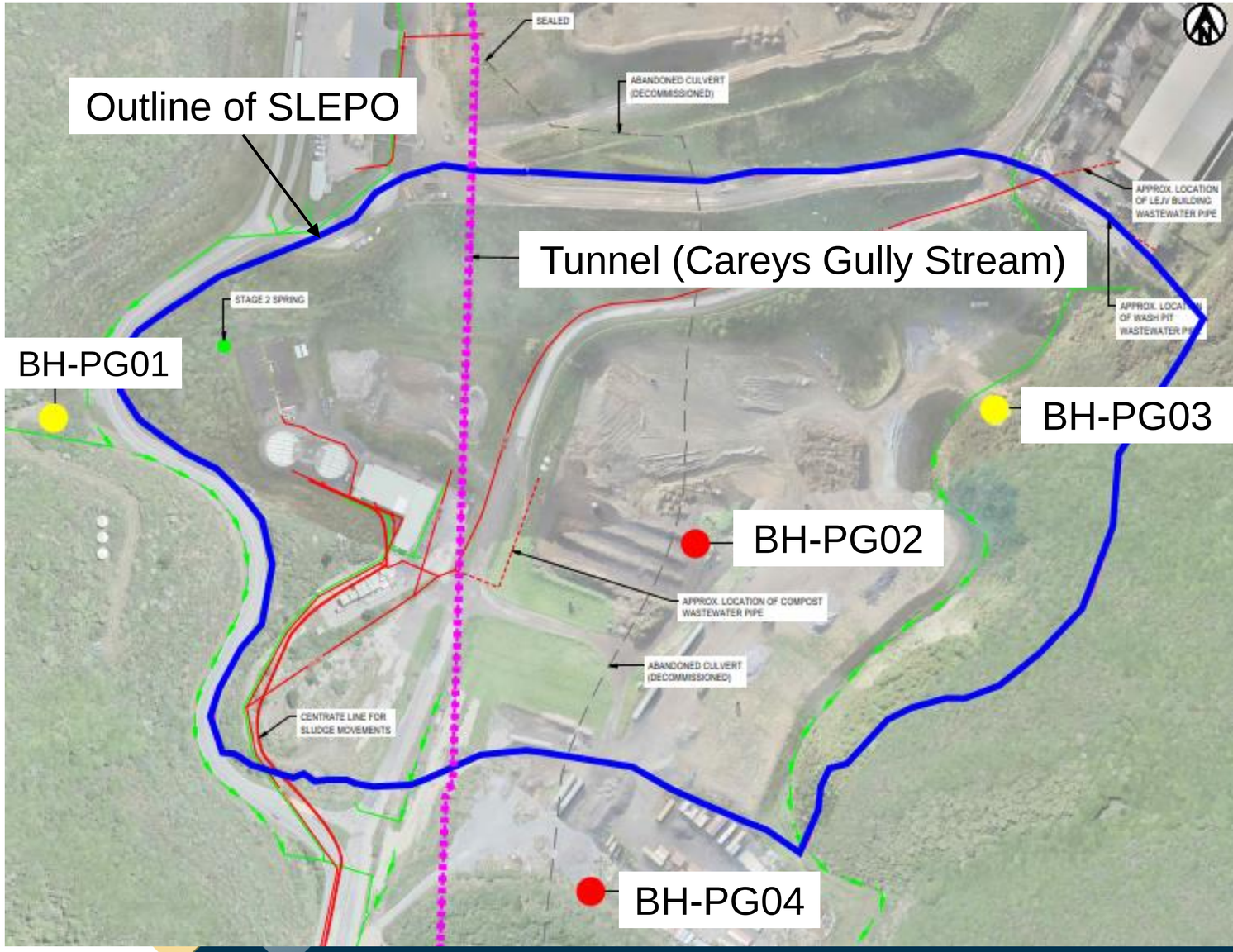
Site setting

Existing & new monitoring wells

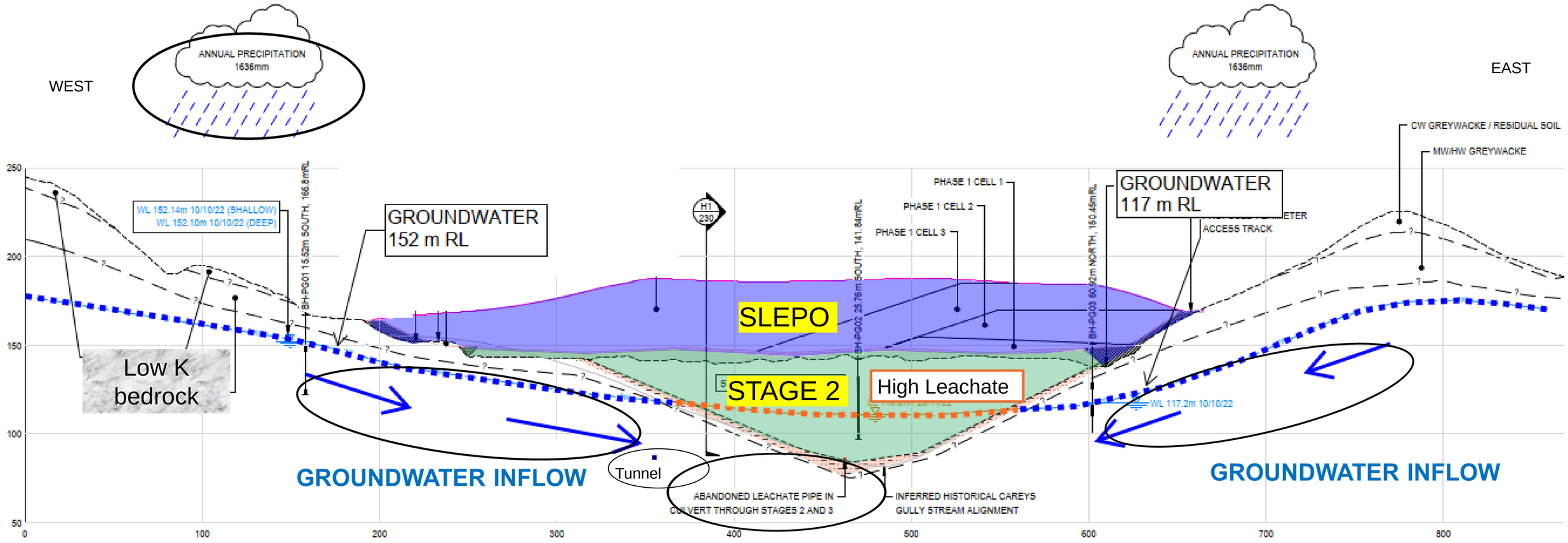




Groundwater monitoring



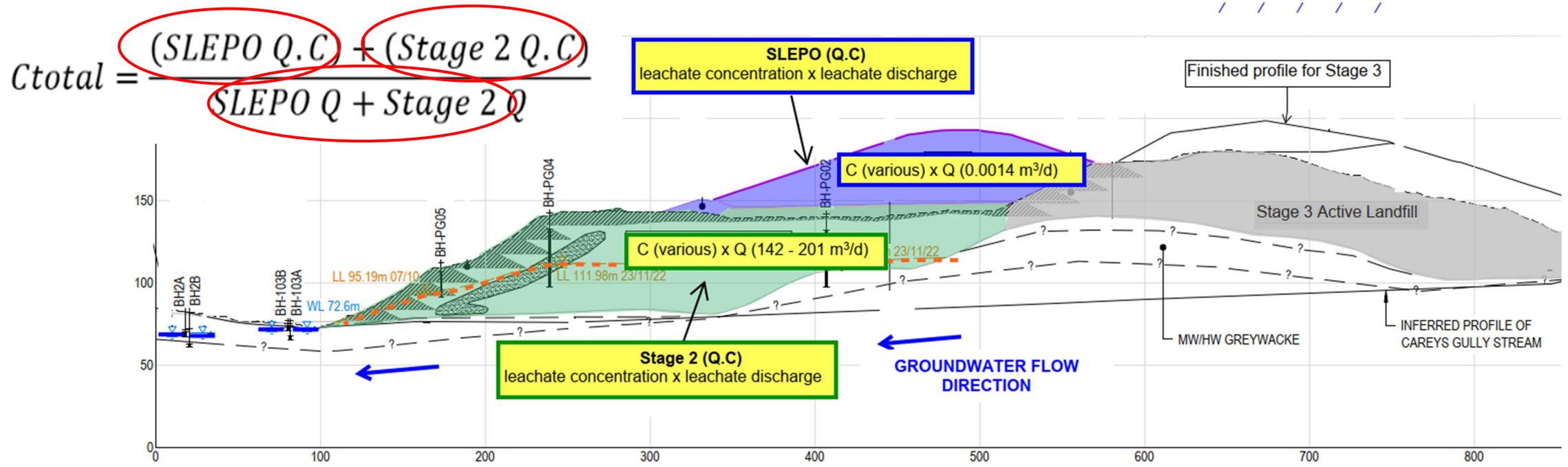
Hydrogeological conceptual model



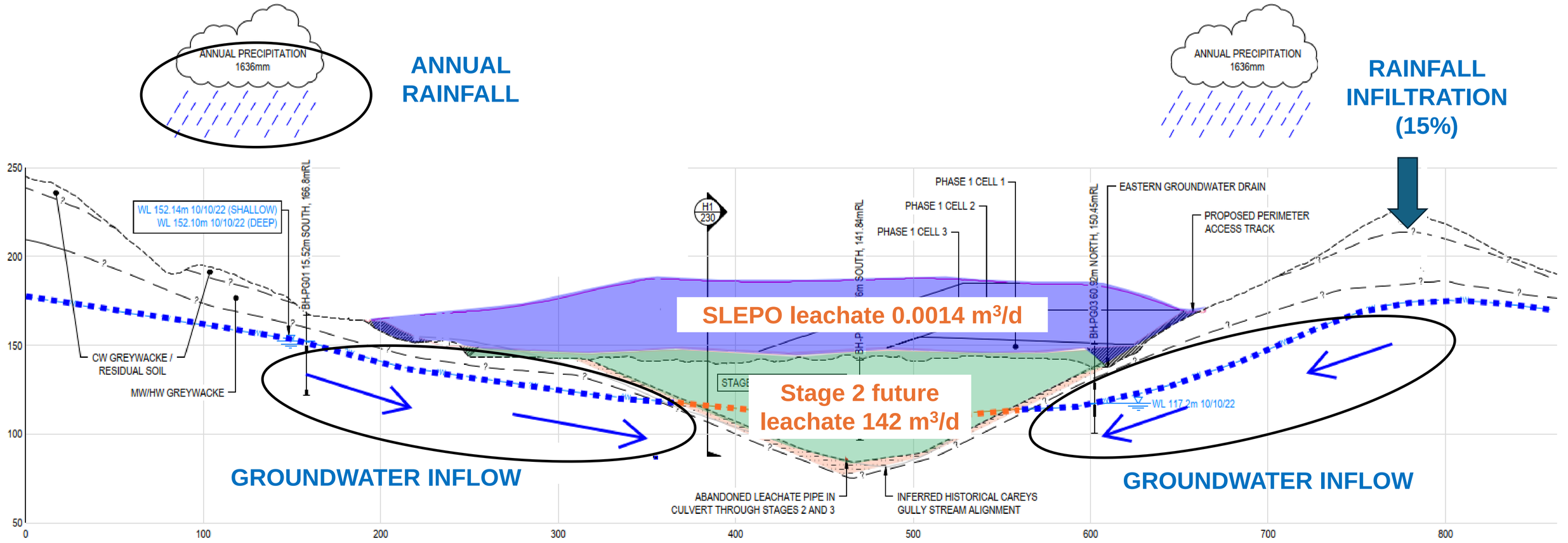
Assessing contaminant transport

- Contaminant mass discharge approach
- **Md = Q .C** Q = total discharge

$$Ctotal = \frac{(SLEPO\ Q.C) + (Stage\ 2\ Q.C)}{SLEPO\ Q + Stage\ 2\ Q}$$

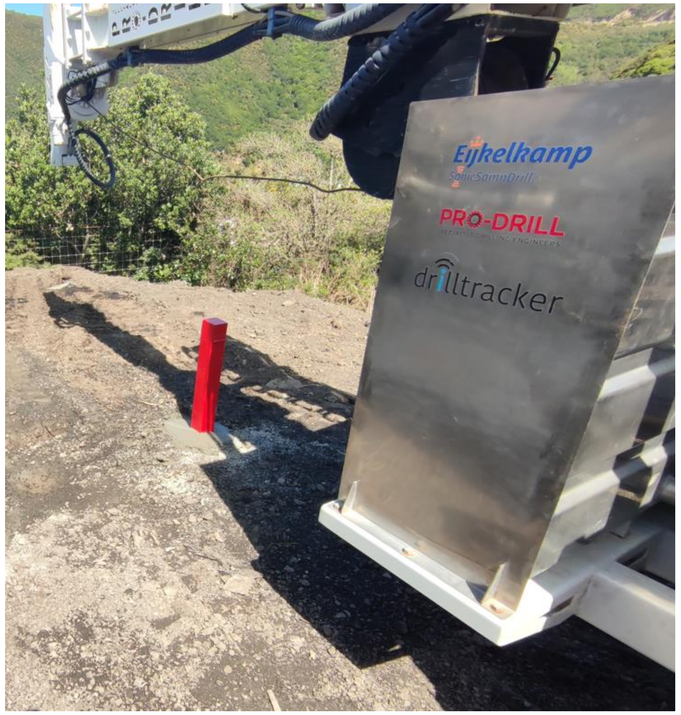


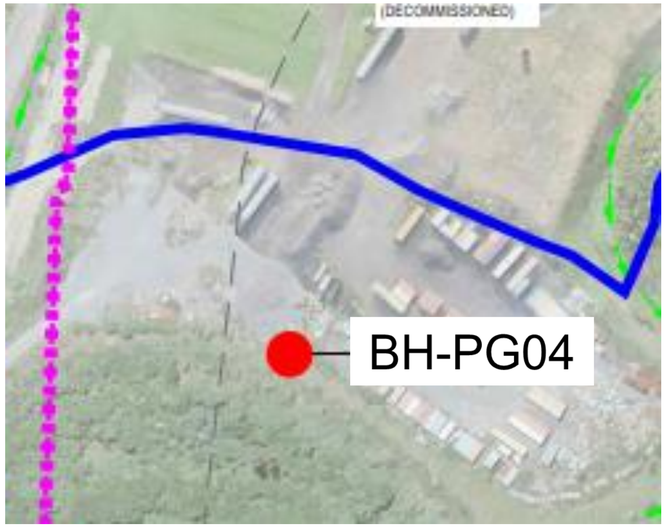
Groundwater inputs & leachate discharge



Leachate discharge concentration

- **Stage 2** baseline leachate quality at BH-PG 04
- **SLEPO leachate** “expected” leachate concentrations compiled from:
  - an active Wellington lined landfill (for higher-end concentrations), and
  - other NZ landfill datasets / WasteMINZ guideline ranges where required





Summary of inputs

Input			Unit	Value	Source & notes
SLEPO	Predicted leachate concentration	SLEPO C	mg/L	**various**	From active lined landfill & other NZ datasets
	Discharge of leachate seepage	SLEPO Q	m^3/d	**0.0014**	HELP model
Stage 2	Current leachate concentration	Stage 2 C	mg/L	**various**	Measured at Monitoring well PG-04
	Estimated current leachate discharge	Stage 2 Q	m^3/d	**200**	HELP model, incl. infiltration through cap, groundwater inflow and 50% discharge from Stage 3
	Predicted future leachate discharge	Future Stage 2 Q	m^3/d	**142**	HELP model, as above but reduced infiltration inputs due to capping by SLEPO
Total	Total future leachate discharge	Total Q	m^3/d	**143**	Sum of SLEPO & Future Stage 2
	Total future leachate concentration	Total C	mg/L	**various**	Sum of SLEPO & Future Stage 2

Results of mass discharge assessment

- SLEPO leachate small vol. & strong conc.
- Stage 2 leachate large vol. & dilute
- Results cf ANZG (80% freshwater species)
- Exceedances in SLEPO, Stage 2 & combined leachate
- No significant increase in contaminant conc. Stage 2 + SLEPO = negligible results
- Chromium – v. small increase < ANZG
- Assessment doesn't include retardation and attenuation of contaminants

Contaminant	Assessed Leachate Concentration		Total Concentration Stage 2 + SLEPO	ANZG trigger levels (80% freshwater species)
	SLEPO C	STAGE 2 C	C Total	
	mg/L	mg/L	mg/L	mg/L
Arsenic	0.852*	0.0053##	0.0053	0.36
Barium	6.4	6.4	6.4	-
Cadmium	0.001*	0.0011##	0.0011	0.0008
Chromium (III)	1.43*	0.00290##	0.00291	*0.0033*
Lead	0.033*	0.0141##	0.0141	0.0094
Copper	0.063*	0.0127##	0.0127	0.0025
Nickel	0.175*	0.0022##	0.0022	0.017
Zinc	1.4*	0.162##	0.162	0.031
Mercury	0.01	0.01	0.01	0.0054

Conclusions

- Closed hydrogeological system
- Groundwater hydraulically connected with leachate levels at Stage 2
- Stage 2 has large leachate volumes and diluted by groundwater inflows
- SLEPO predicted very small discharge volumes, leachate stronger
- Mass discharge assessment to determine effects of SLEPO on Stage 2
- Discharge of contaminants from SLEPO into Stage 2 shown to be negligible

Any Questions?