



From Predictions to Reality: Unveiling the Hydrological and Water Quality Impacts of Mineral Sand Mining



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OVERVIEW

- Westland Mineral Sands - Nine Mile Mine:
 - first mineral sand consent application under a new regime (NPSFM 2020)
- Consent granted in 2022 with stringent water quality and hydrology conditions
- Now operational for ~2.5 years
- From prediction to reality: did we get it right?
- Learnings for future consenting and management





INTRODUCTION

Nine Mile Mineral Sand Mine

20,000 ha opencast operation located in Cape Foulwind south of Westport

Targeting Titanium Oxide, Ilmenite and Garnet from the Okari sand dunes

Currently employs 60 full time staff

Consent application lodged in 2021, publicly notified in 2022, granted in 2022



1. <https://www.wmsnz.com/>



Project name:	Westland Mineral Sands quarry
Date:	Date: 14/06/2021
Title:	Hydrology

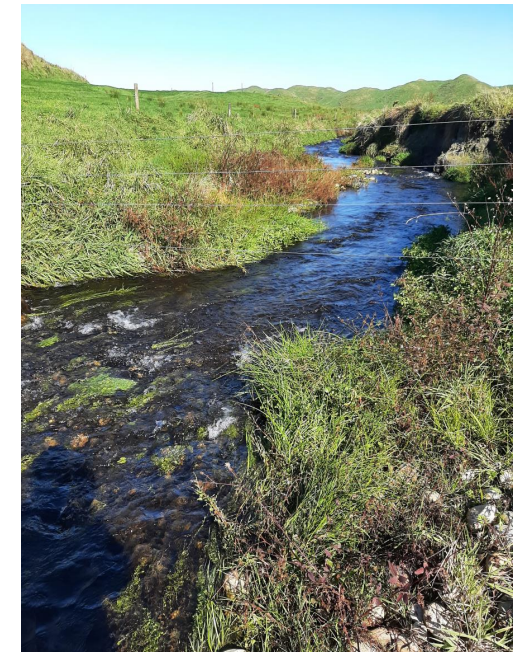


HEARING PROCESS - PERCEPTIONS

Submitters: 174 submissions, **110 opposed**, 34 requested to be heard.

Main water-related concerns:

Water contamination, protected wetlands





HEARING PROCESS - PERCEPTIONS

West Coast Regional Council: recommend **grant** subject to conditions.

Main concerns: effect of “wet” **mining below the water table on protected wetlands** → application modified to dry mining only.

Elevated concentrations of iron and manganese and other **metals** in **minewater discharges**

Sediment discharges to adjacent waterways



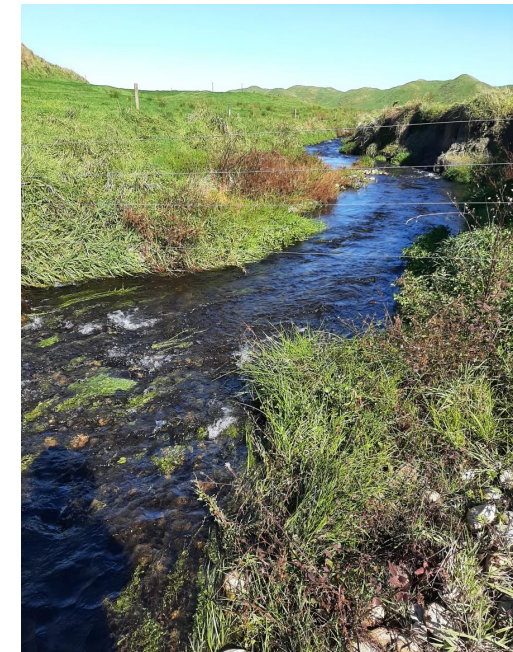


HEARING PROCESS - PERCEPTIONS

Hearing: Consent granted

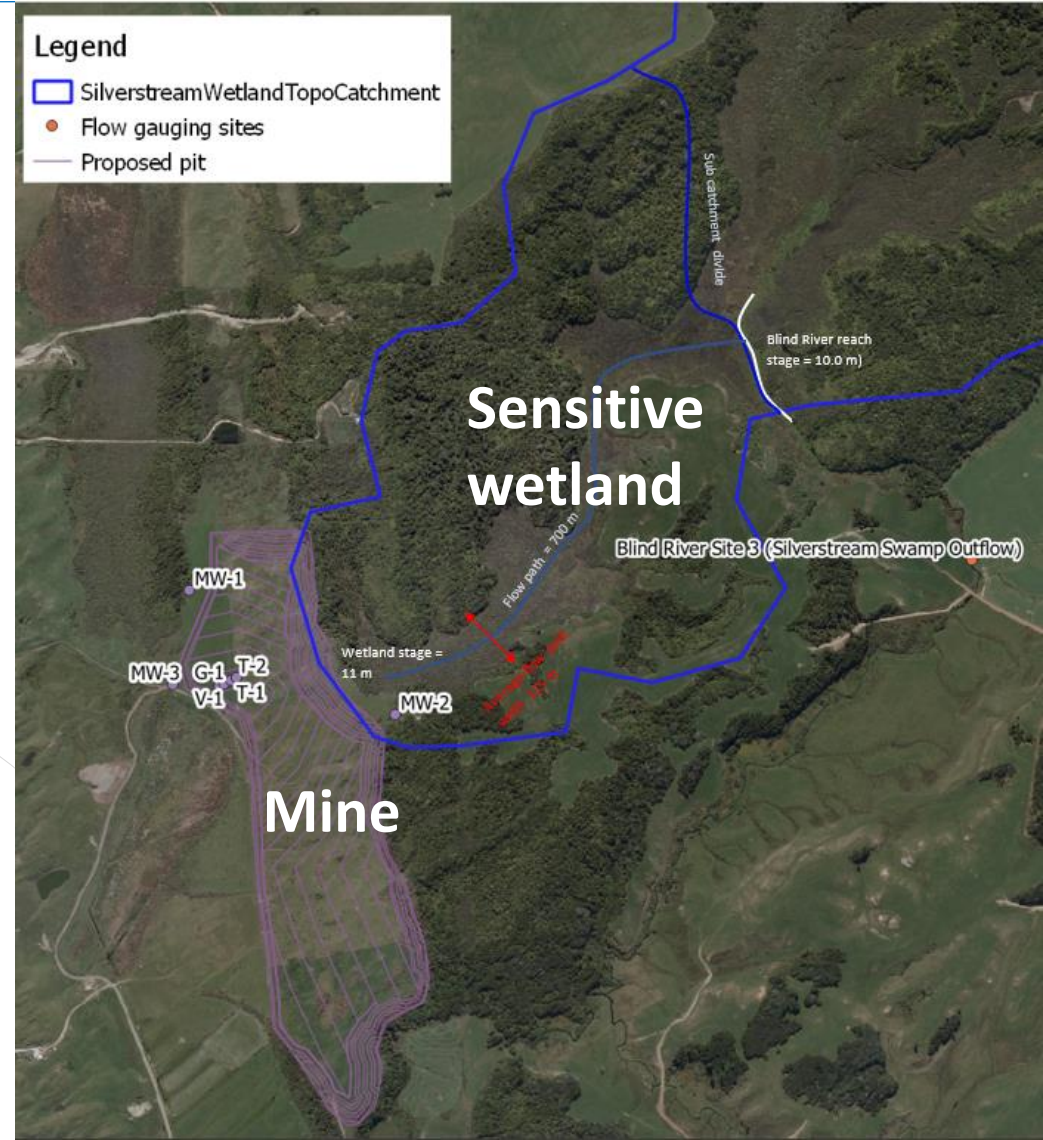
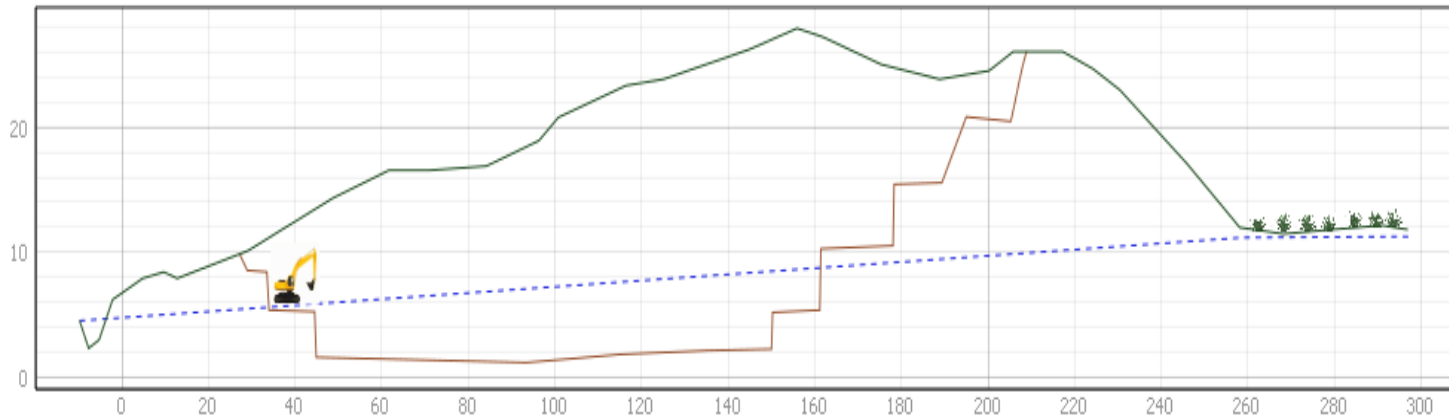
Water quality impacts from mineral process water and tails seepage discharge: **Te Mana o Te Wai** → **rigorous** water quality **monitoring and reporting**

Requirement for dry mining → **rigorous** groundwater level **monitoring and reporting**





EFFECTS ON SENSITIVE WETLANDS - CONCERNS



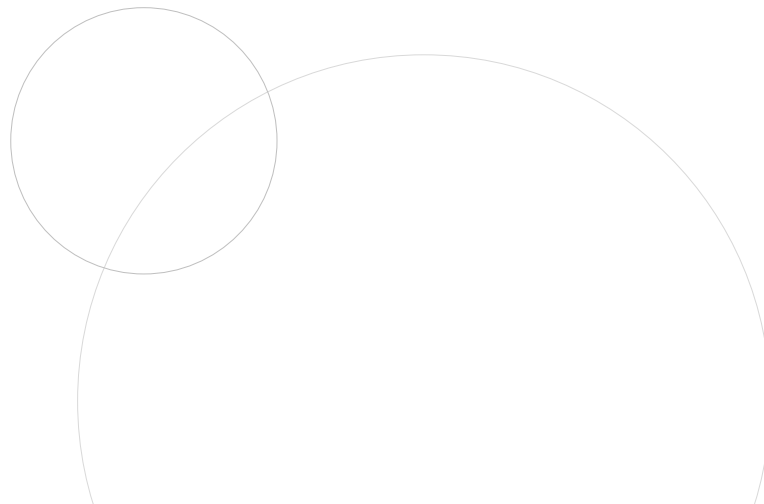
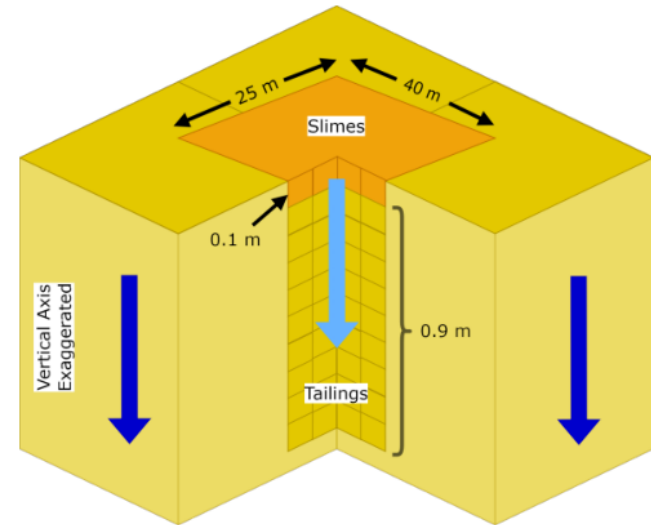


WATER QUALITY CONCERNS

Water quality impacts

Elevated metals concentrations in slimes seepage

Elevated metals concentrations in process water entrained in tails





CONSENT CONDITIONS

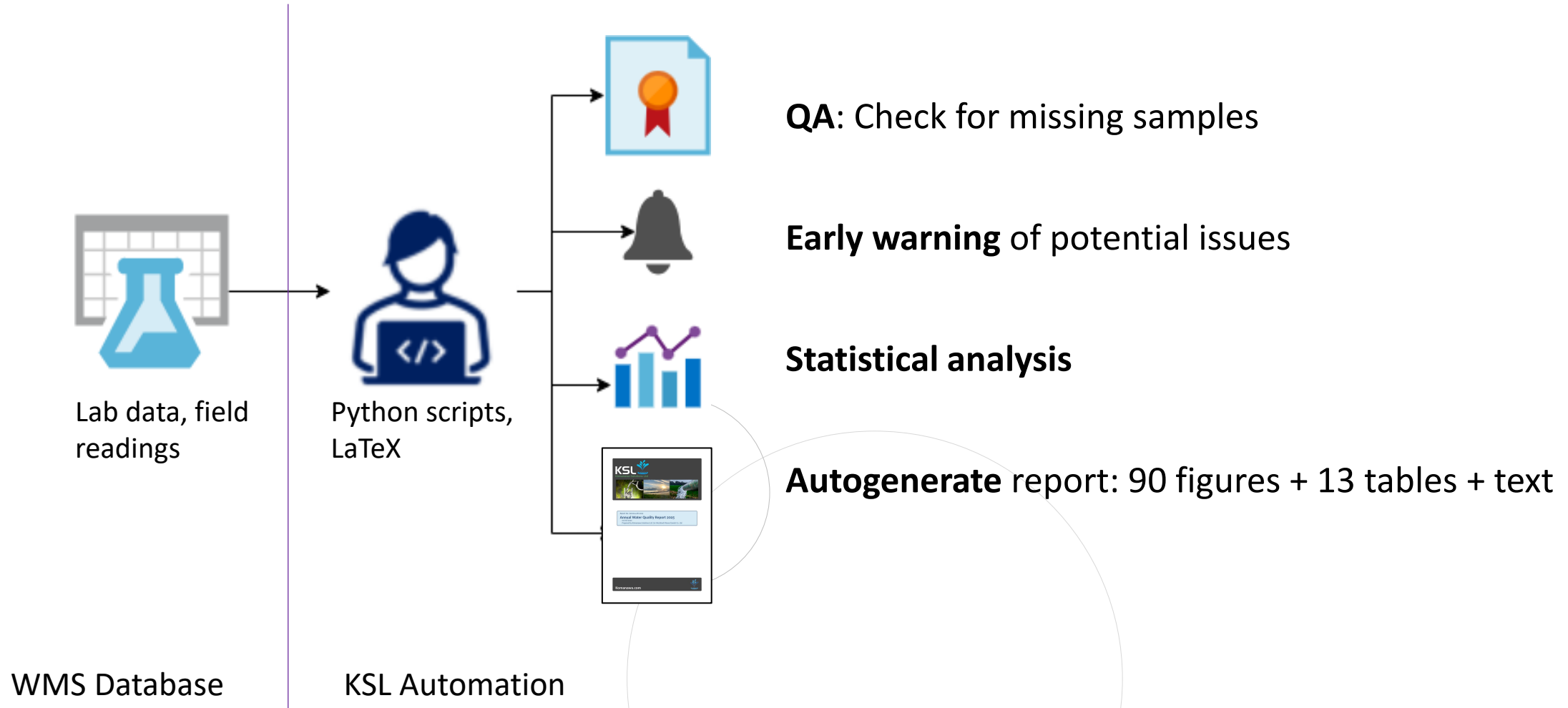
Consent granted with 10 main consent conditions for water quality management

- **Tails and slimes management**
- Water Management Plan **annual updates**
- **Stream WQ monitoring** at 2 upstream and 2 downstream sites + process water quality monitoring for 18 parameters
- **WQ limits** for downstream sites
- Limits on upstream – downstream **water quality changes**
- **WQ limits** for tails and slimes seepage water
- Visual impacts (change in colour, conspicuous oil etc.)
- Detailed conditions for **annual reporting**

Challenge 1: Annual compliance report = **134 pages** of text, figures and tables → **high compliance costs**

Challenge 2: One year of baseline monitoring not adequate to characterise natural variability → **risk of spurious non-compliance**

●●● SOLUTION: AUTOMATED REPORTING





AUTOMATED REPORTING

Time required for 130 page report reduced from 90 to 35 hours per year: **saving = 65 hours**

Reduced in annual compliance **cost**

Rigorous compliance **reporting**, reduced risk of unexpected impacts and issues

Reduced risk of spurious non-compliance

Minimised risk of human error in data input and processing

108 x trend analyses: expensive without automation

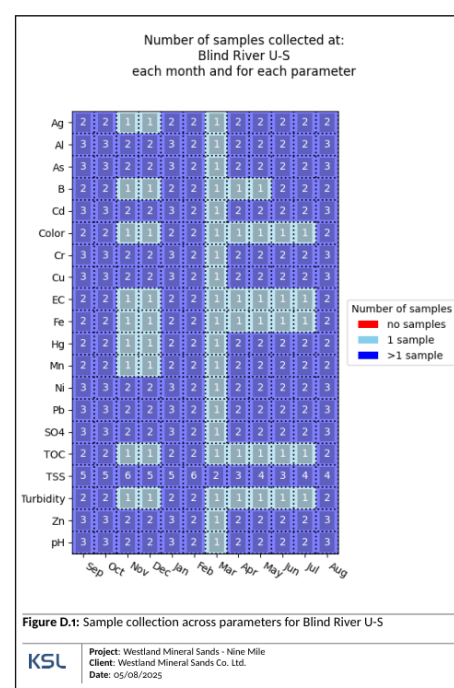
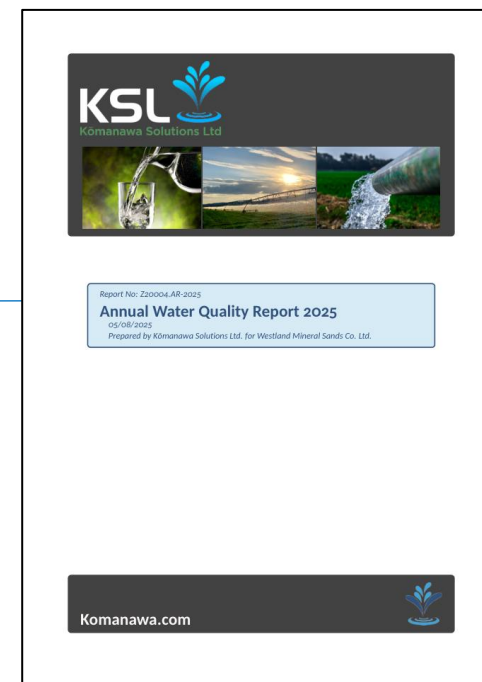


Figure D.1: Sample collection across parameters for Blind River U-S

KSL Project: Westland Mineral Sands - Nine Mile Client: Westland Mineral Sands Co. Ltd. Date: 05/08/2025



Parameter	W Drain Δ	Okari Swamp U-S	W. Drain b. ponds	Blind R. Δ	Blind River U-S	Blind River D-S
Al	no trend	decreasing	no trend	decreasing	no trend	decreasing
As	no trend	no trend	no trend	no trend	no trend	no trend
B	no trend	no trend	no trend	no trend	no trend	no trend
Cd	no trend	no trend	no trend	no trend	no trend	no trend
Cr	no trend	no trend	no trend	no trend	no trend	no trend
Cu	no trend	no trend	no trend	no trend	no trend	no trend
Pb	no trend	no trend	no trend	no trend	no trend	no trend
Mn	no trend	no trend	no trend	decreasing	no trend	no trend
Hg	no trend	no trend	no trend	no trend	no trend	no trend
Ni	no trend	no trend	increasing	no trend	no trend	no trend
Ag	no trend	no trend	no trend	no trend	no trend	no trend
Zn	decreasing	no trend	decreasing	no trend	no trend	no trend
TSS	decreasing	no trend	decreasing	decreasing	no trend	decreasing
Turbidity	decreasing	increasing	decreasing	decreasing	no trend	no trend
Color	no trend	no trend	no trend	no trend	no trend	no trend
pH	no trend	decreasing	decreasing	no trend	decreasing	decreasing
EC	no trend	no trend	no trend	no trend	no trend	no trend
SO4	decreasing	increasing	no trend	no trend	increasing	no trend
TOC	no trend	no trend	no trend	no trend	no trend	decreasing
Fe	no trend	no trend	no trend	no trend	no trend	no trend

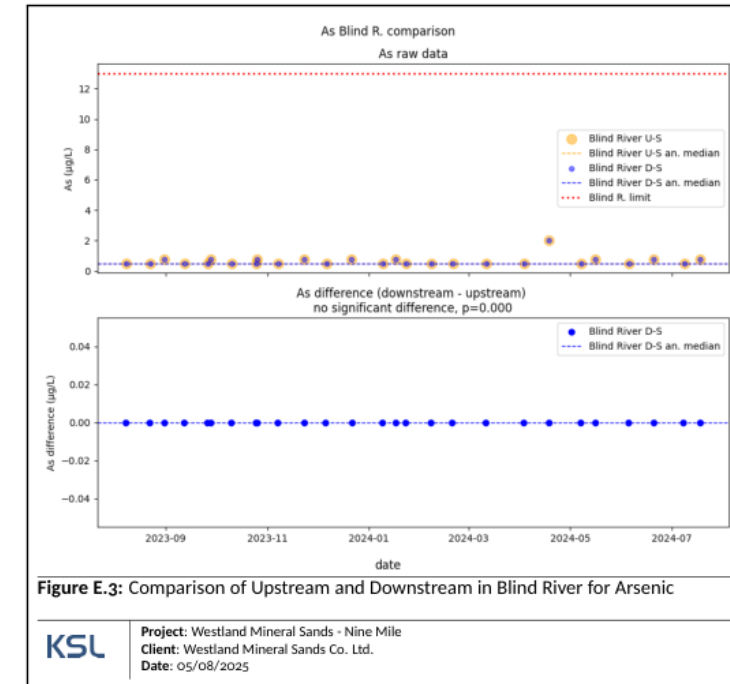
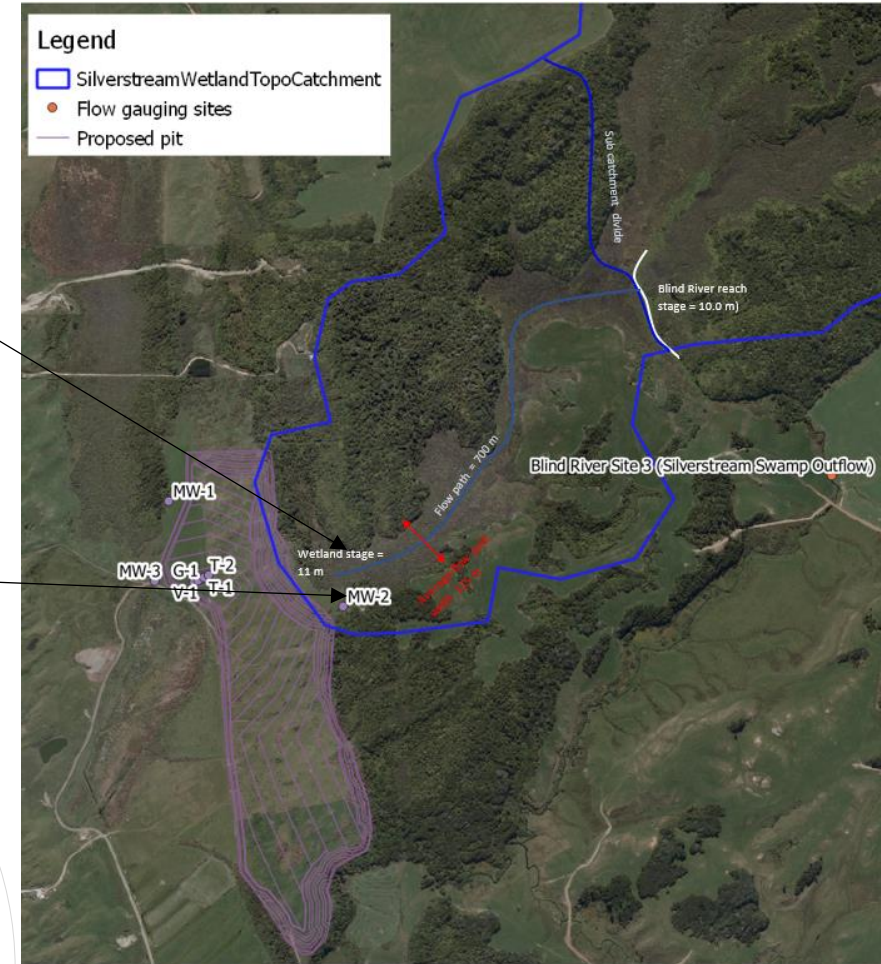
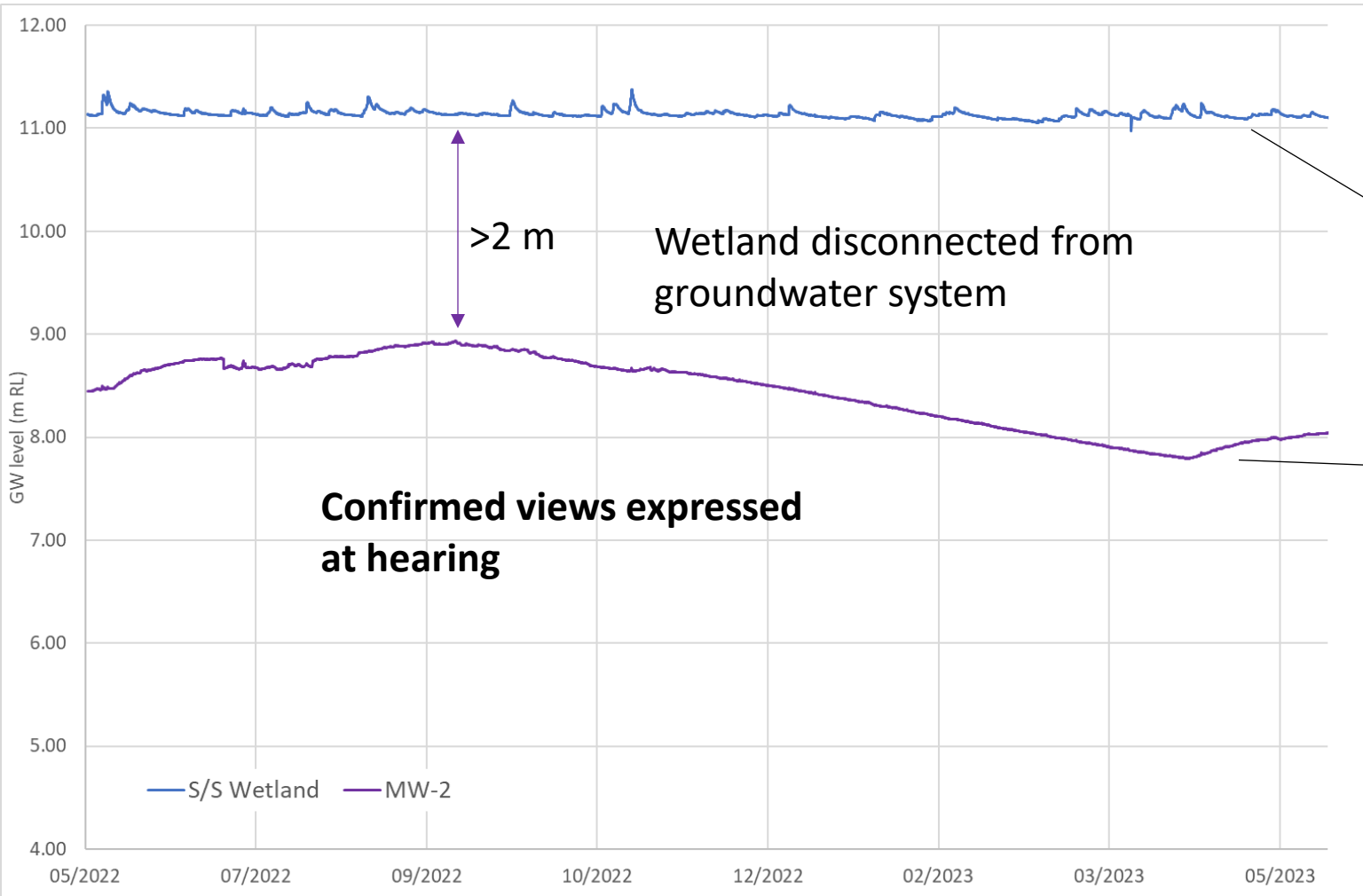


Figure E.3: Comparison of Upstream and Downstream in Blind River for Arsenic

KSL Project: Westland Mineral Sands - Nine Mile Client: Westland Mineral Sands Co. Ltd. Date: 05/08/2025



WHAT ACTUALLY HAPPENED?

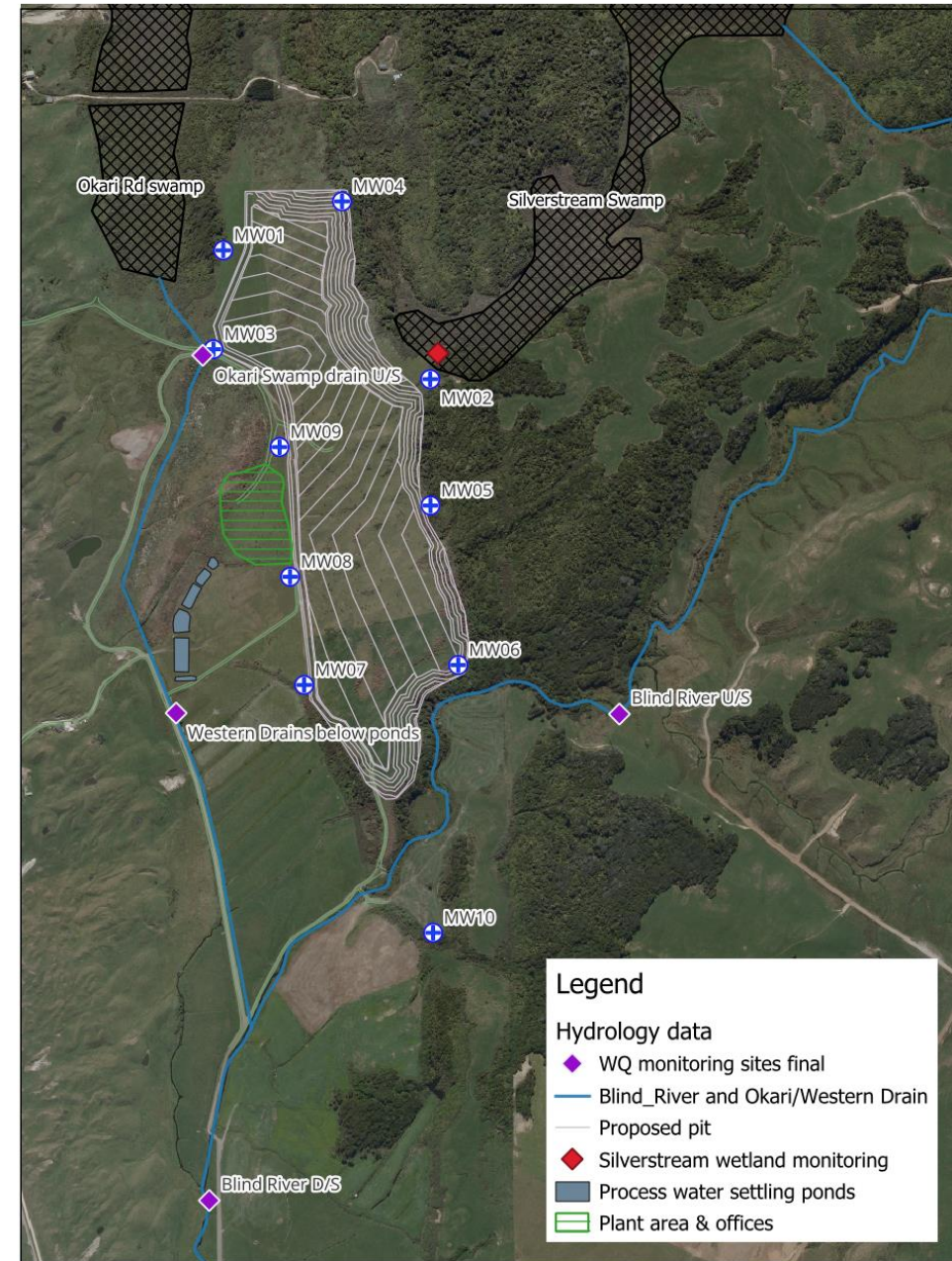
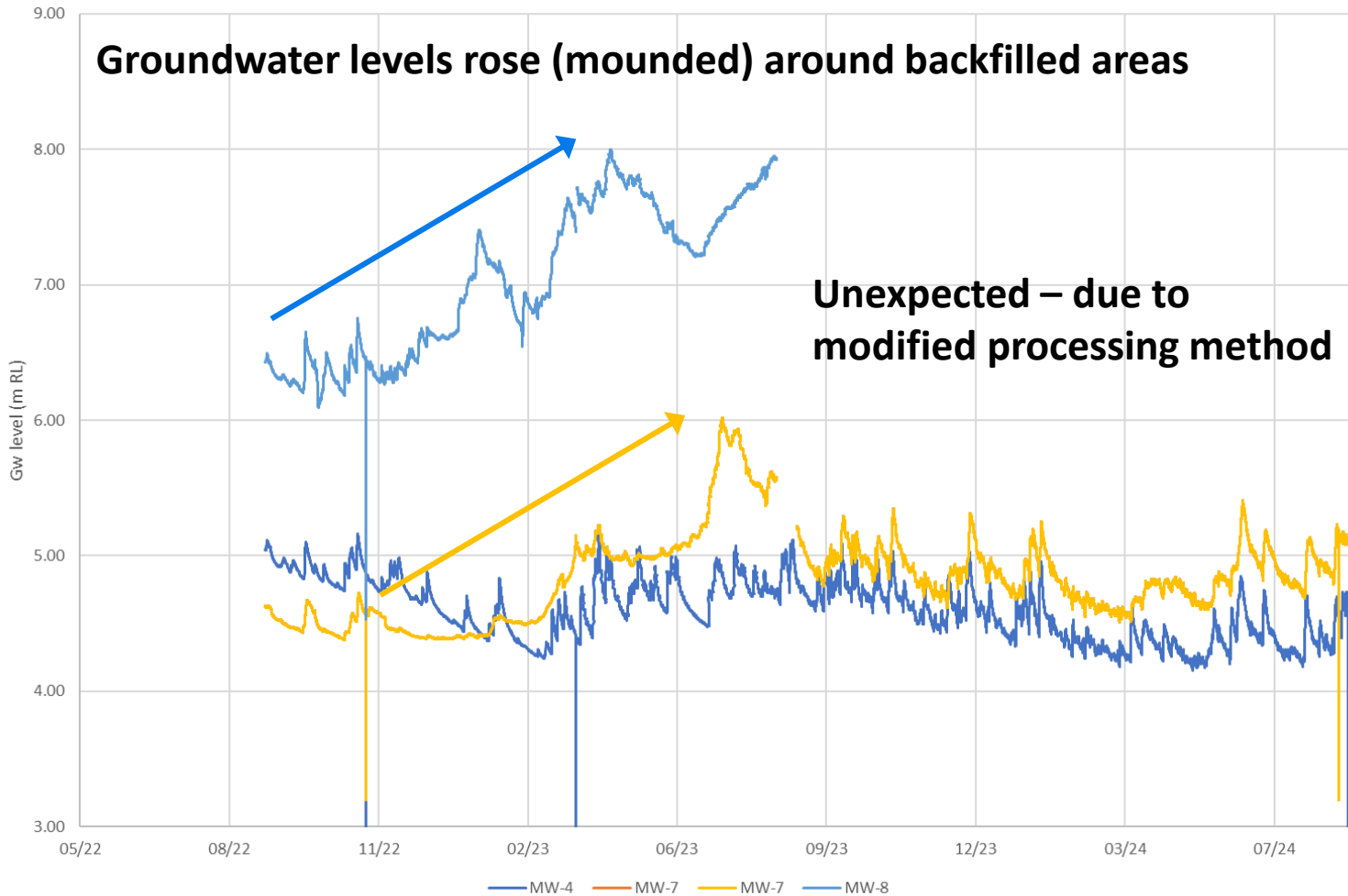




WHAT ACTUALLY HAPPENED?

Groundwater levels rose (mounded) around backfilled areas

Unexpected – due to modified processing method



	Project	Westland Mineral Sands
	Date	18/10/2024
	Title	Monitoring sites

0 100 200 m



WHAT ACTUALLY HAPPENED?

Water quality impacts

Upstream-downstream water quality differences were derived from **12 months of monitoring**

Differences were **exceeded** in subsequent years (natural variability)

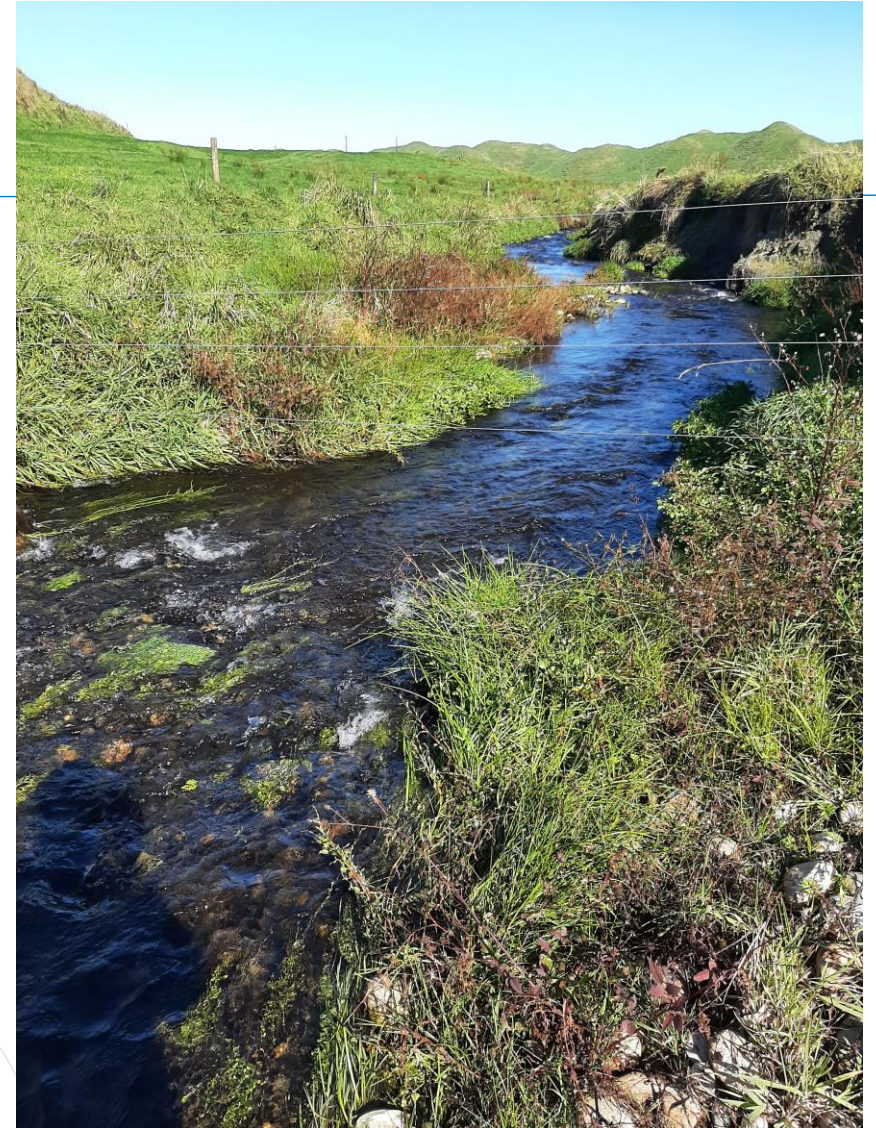
We anticipated this issue in the hearing process & built assessment method **flexibility into conditions**

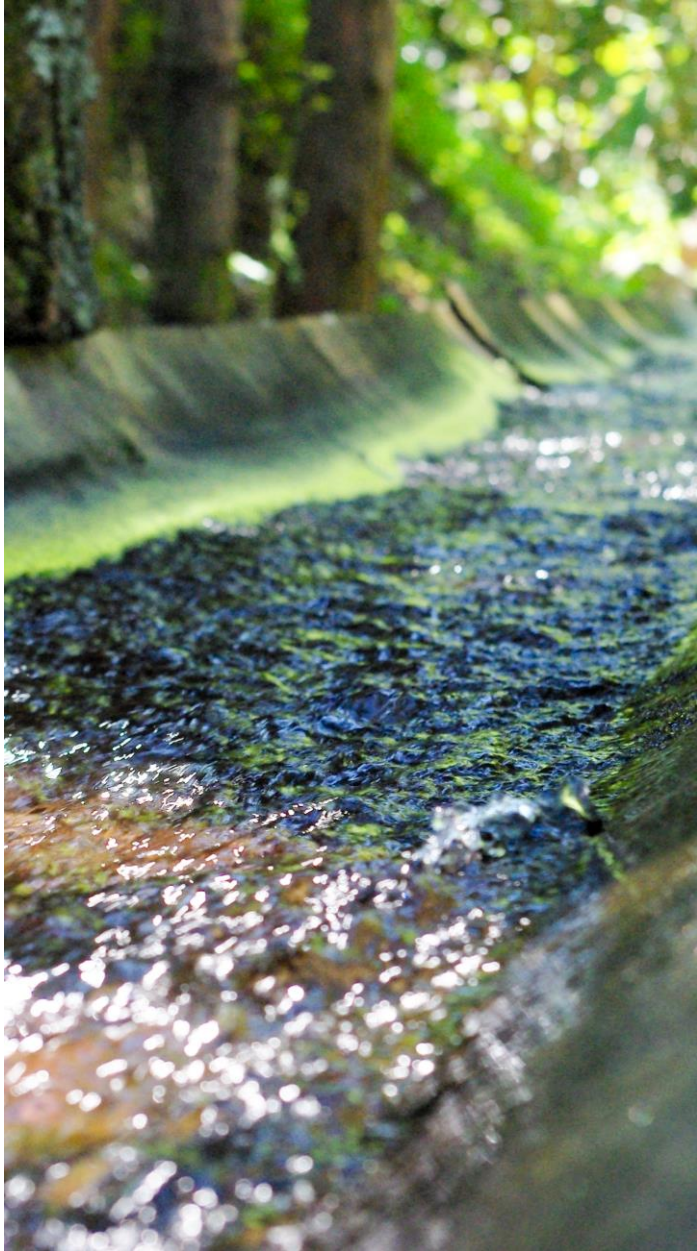
Revised method to account for statistical significance and **trend analysis**

No changes in downstream versus upstream **WQ** to date

No slimes generated

Process water quality significantly **below thresholds**, in line with our initial characterization and assessment





LEARNINGS

- Groundwater mounding is prevalent: water table depression has not occurred
- **No water quality issues** from mineral sand mining at Nine Mile
 - Process water and tails have proved innocuous
 - **Low slimes** content helps
- **Onerous consent conditions** have become commonplace with an associated cost burden and **risk** of reputation damage if non-compliant
- Data processing and report **automation** can **reduce costs** and **risks** significantly
- Striving for some **method flexibility** in consent conditions via a management plan approach is **key** where baseline characterisation is incomplete



THANK YOU



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[Komanawa.com](https://www.komanawa.com)

Thanks to:

Westland Mineral Sand Co

