Golden Sunlight Soil Covers on Waste Rock and Tailings

By
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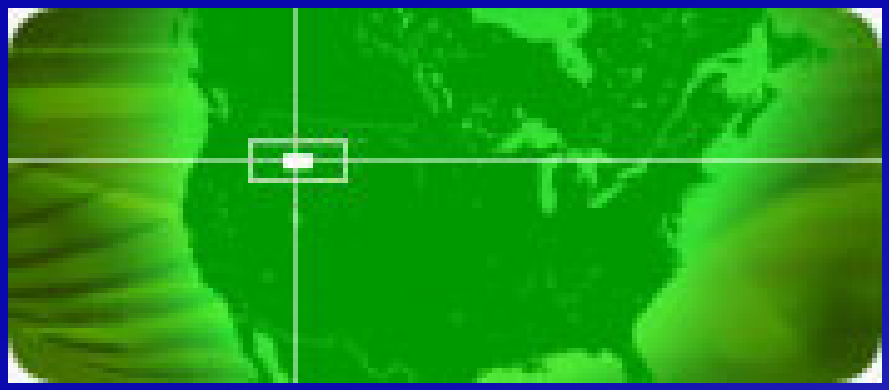

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Objective

- Use of numerical modelling to evaluate the performance of cover systems installed on the waste rock dump and tailings area under different weather and vegetation conditions.

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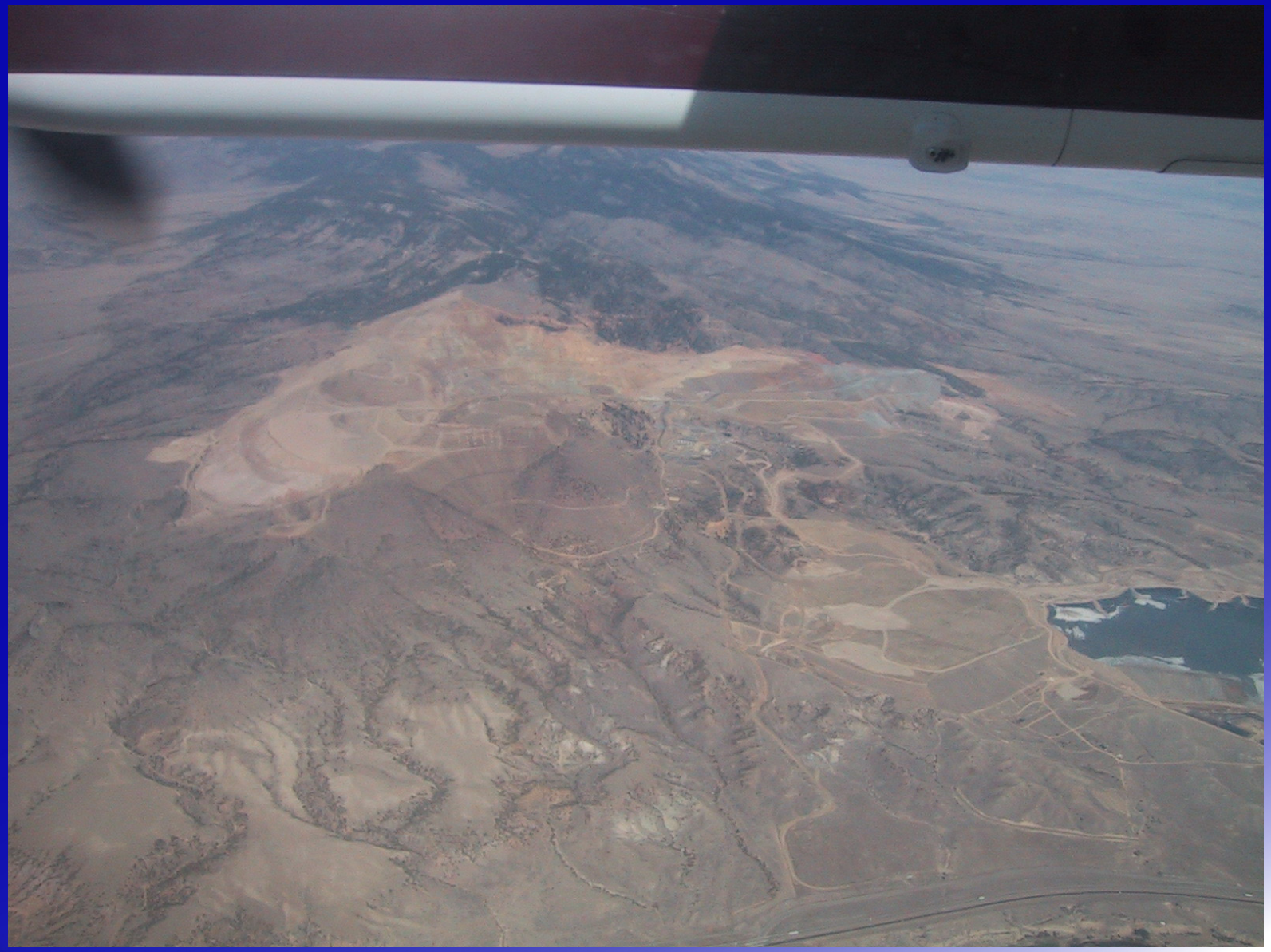

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Modeling input data

- Laboratory testing program
  - Grain size distribution
  - Saturated hydraulic conductivity
  - Estimated SWCC
- Weather data from local weather station
- Suction and temperatures profile from TC sensors.

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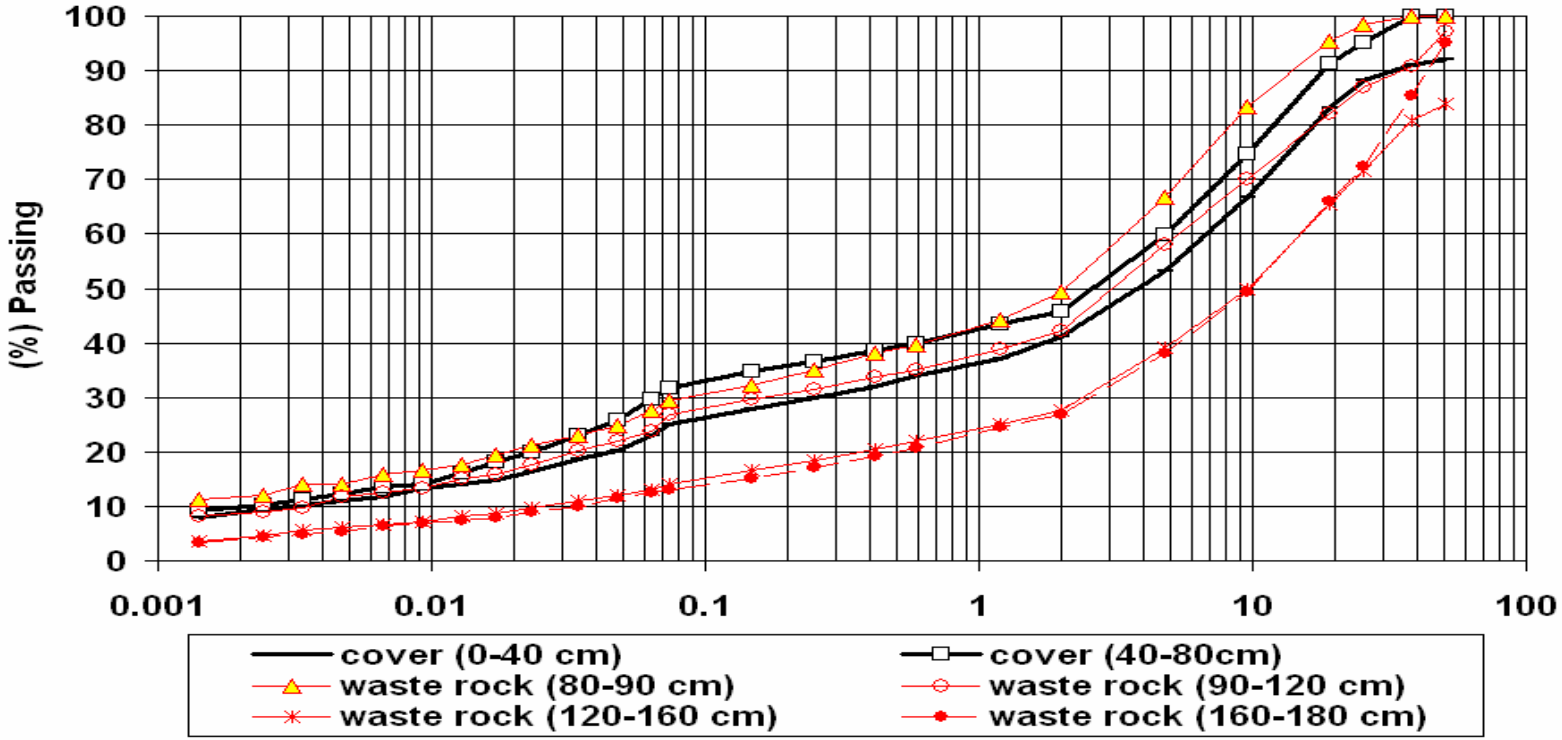
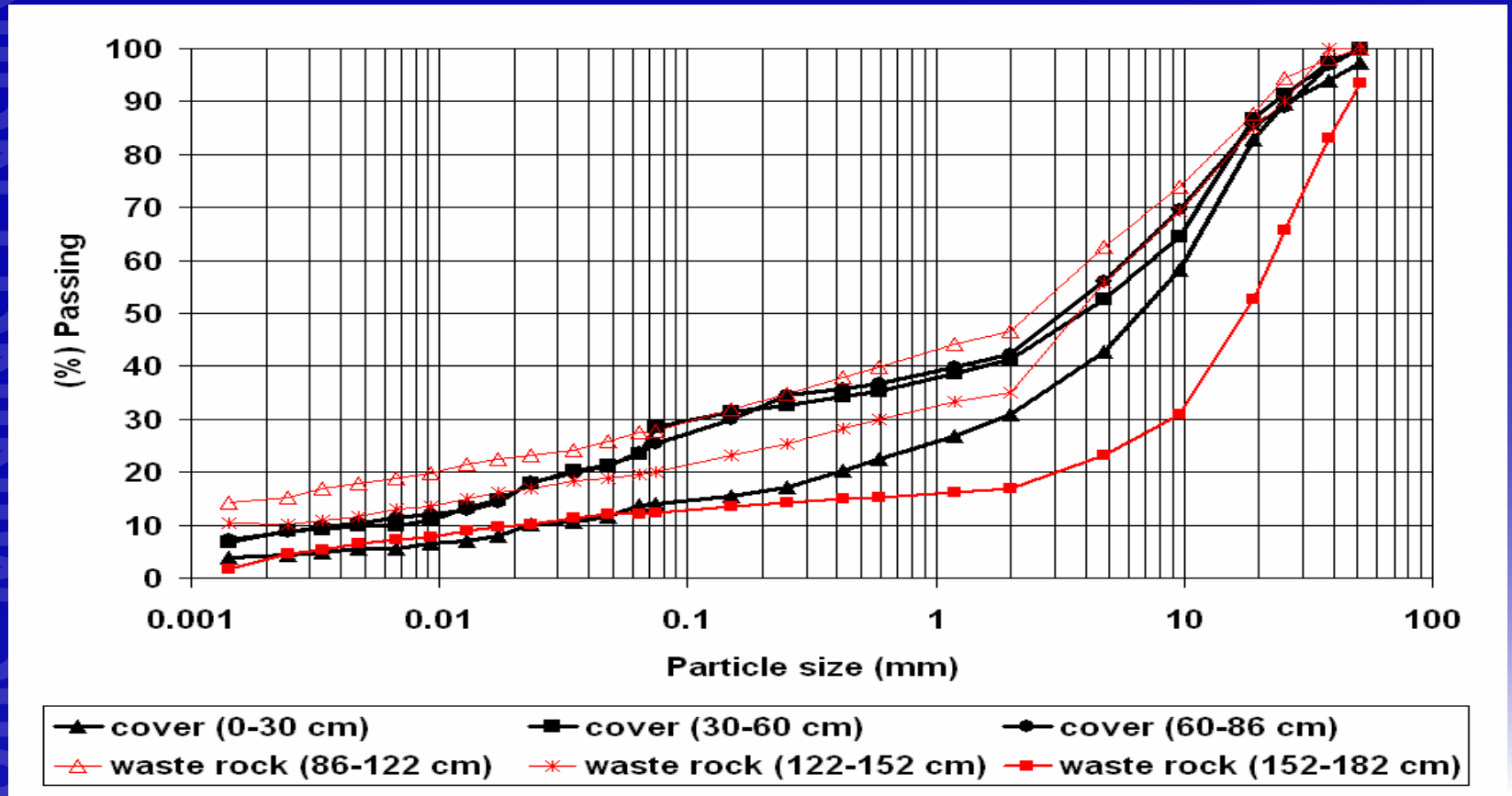
Laboratory testing program

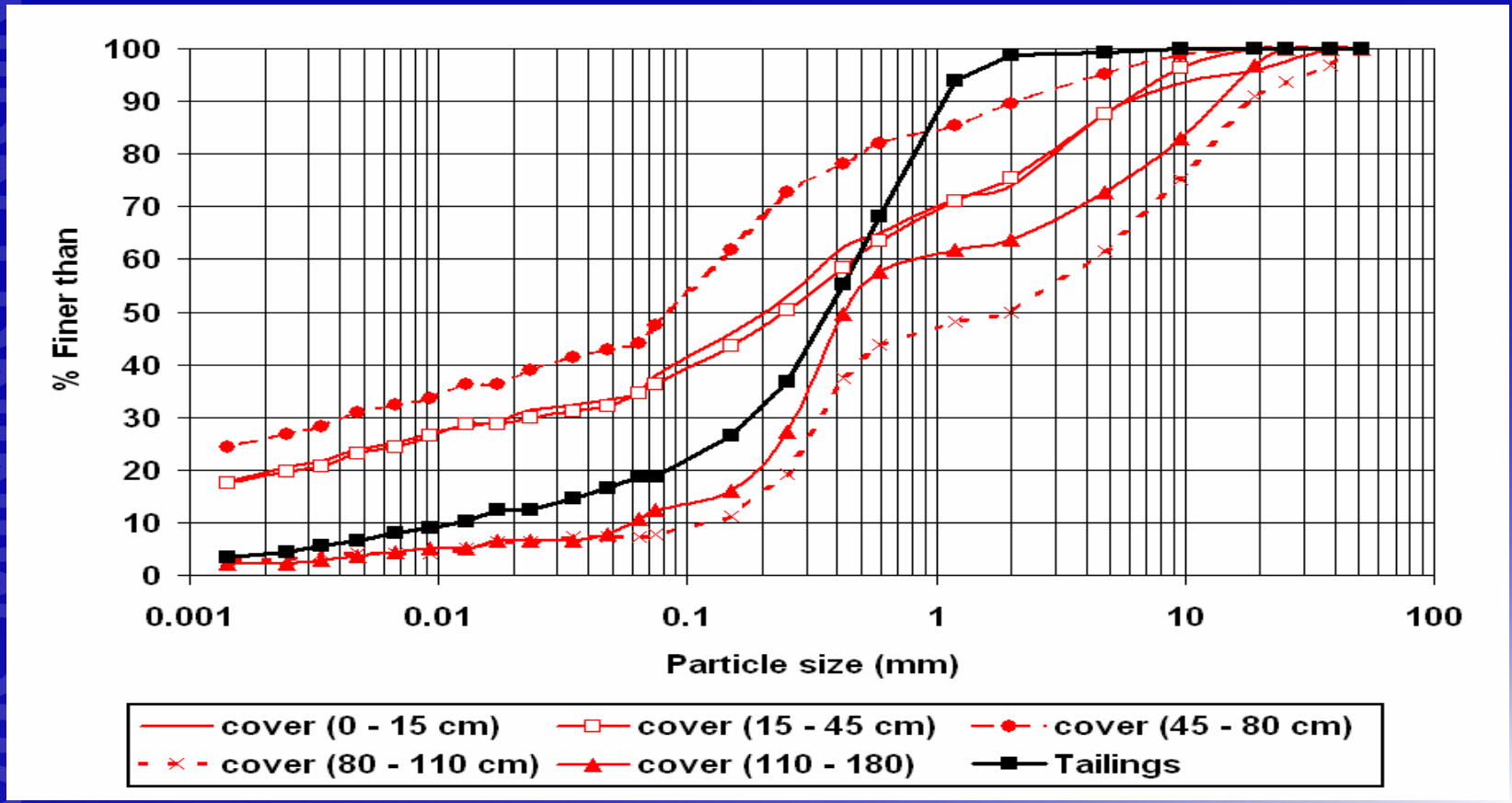
Grain size – Waste rock – Main Station



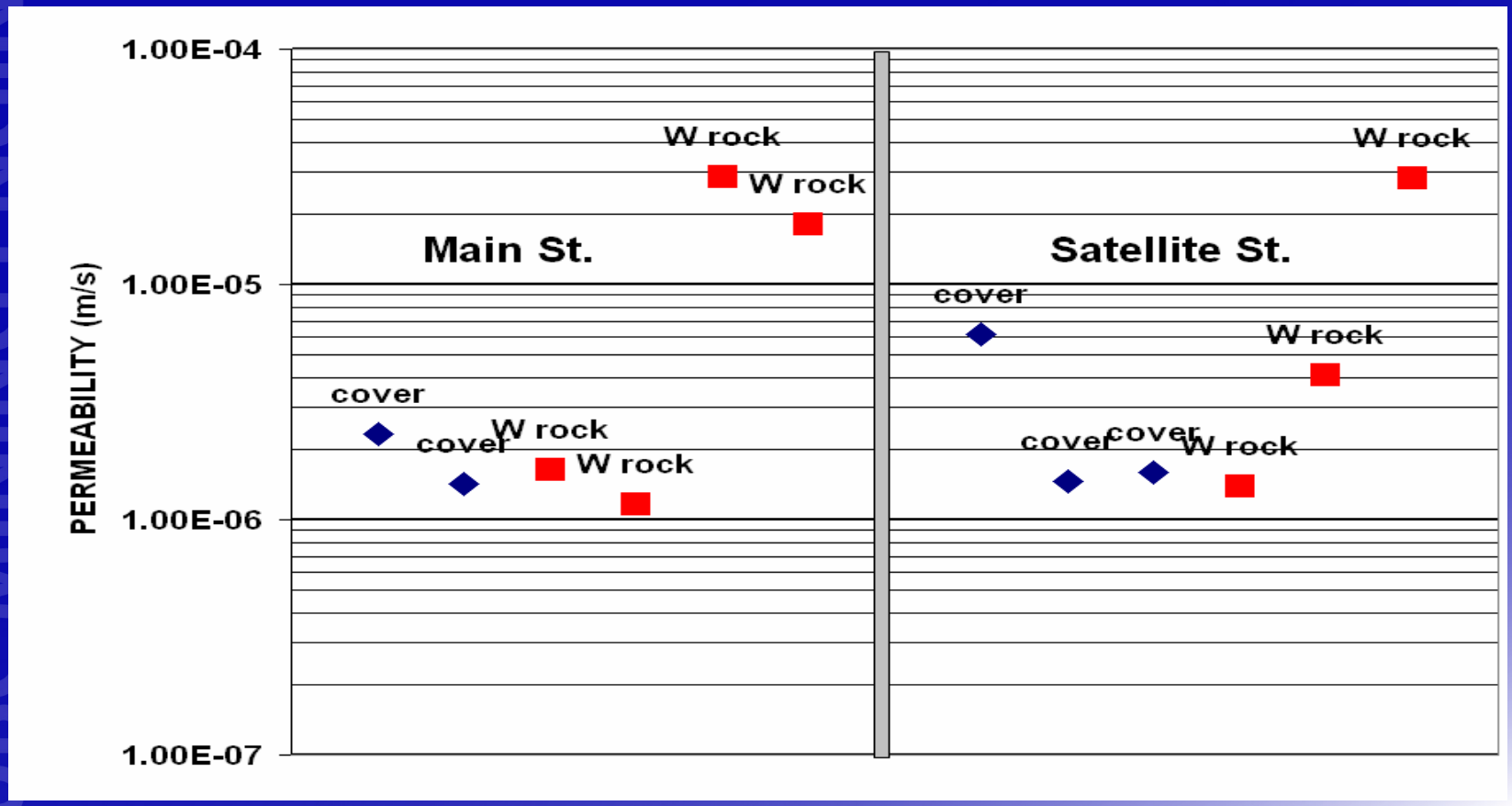
Grain size – waste rock – Satellite st.



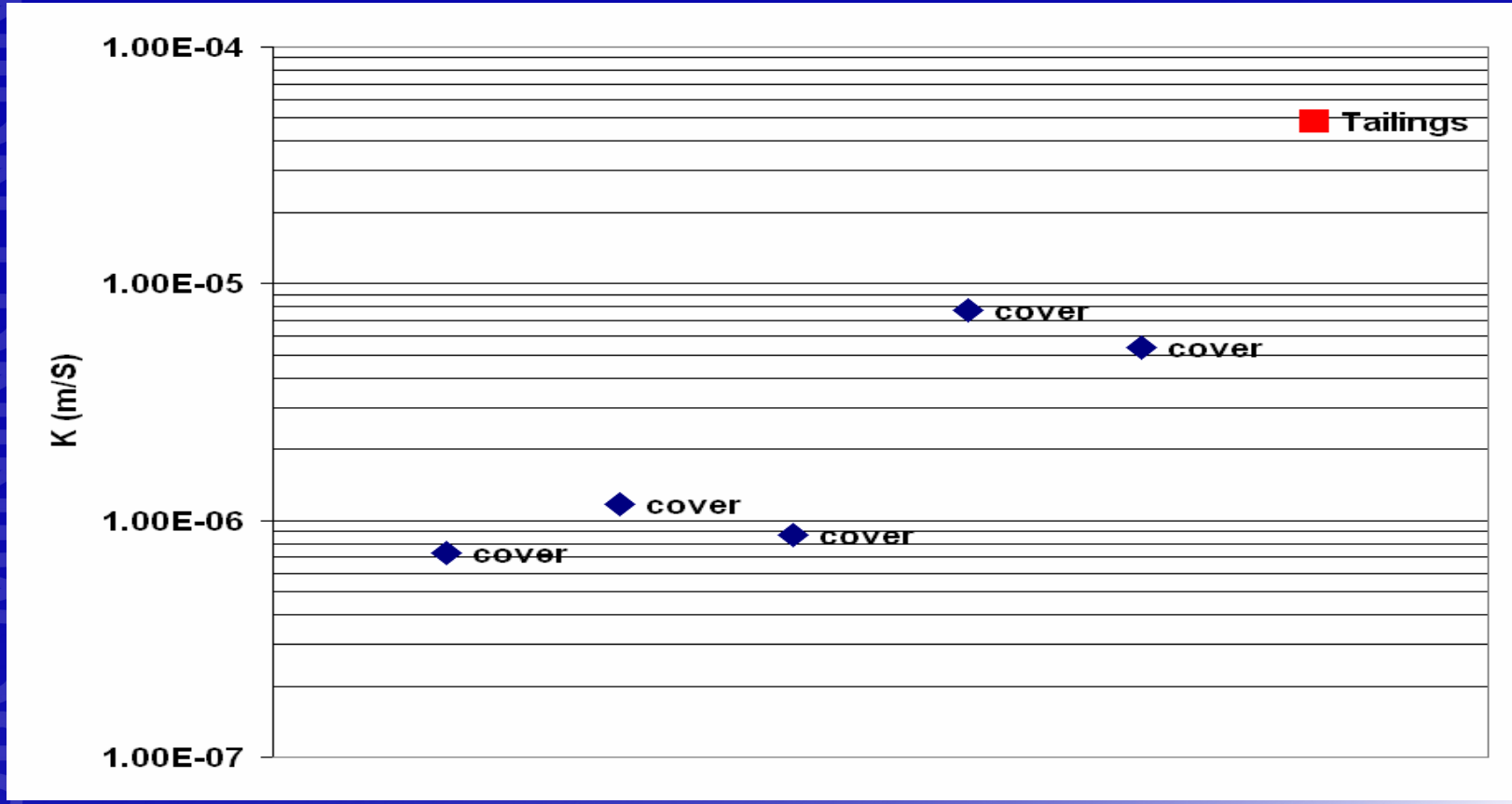
Grain size – Tailings area



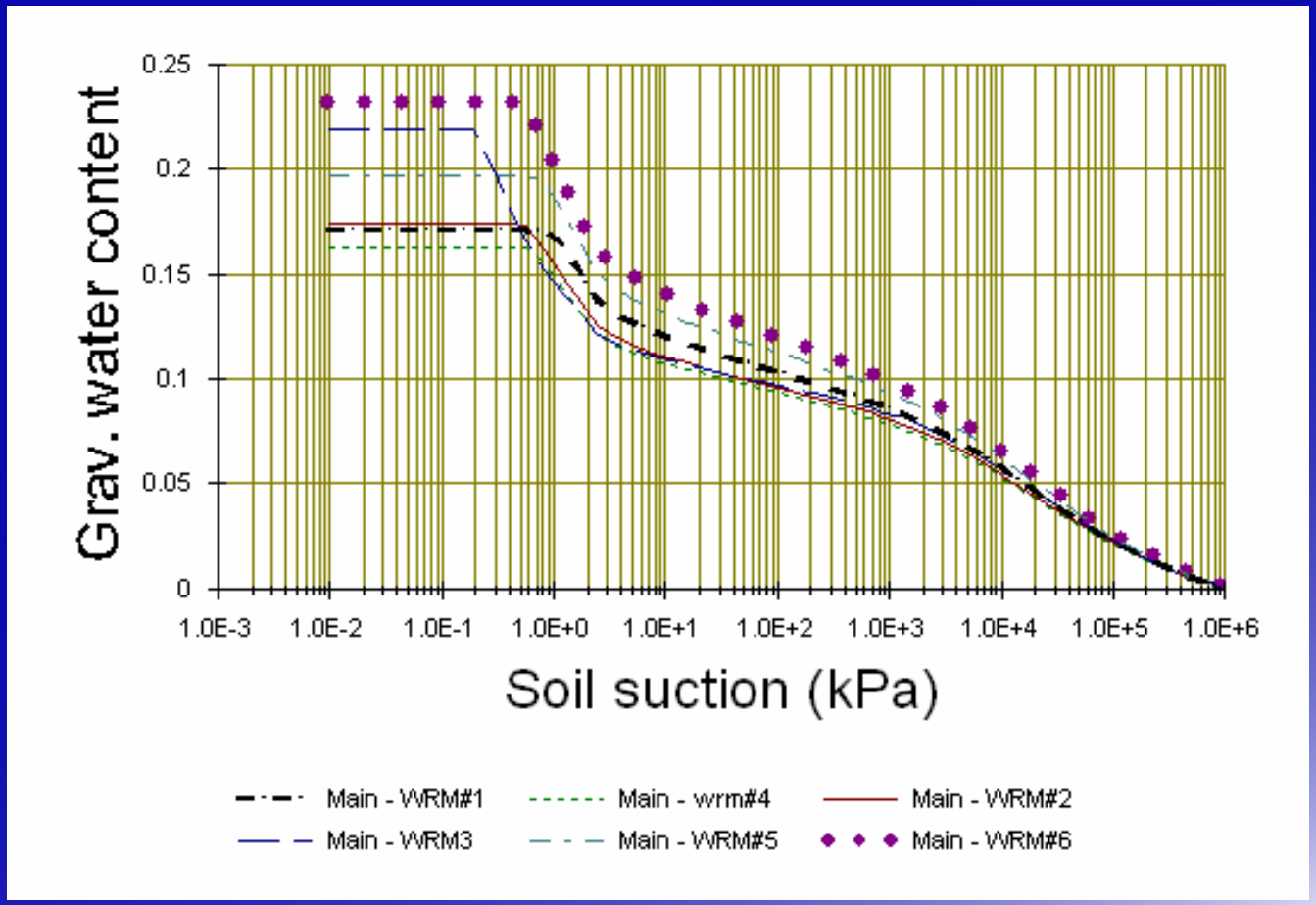
K Sat. – Waste rock



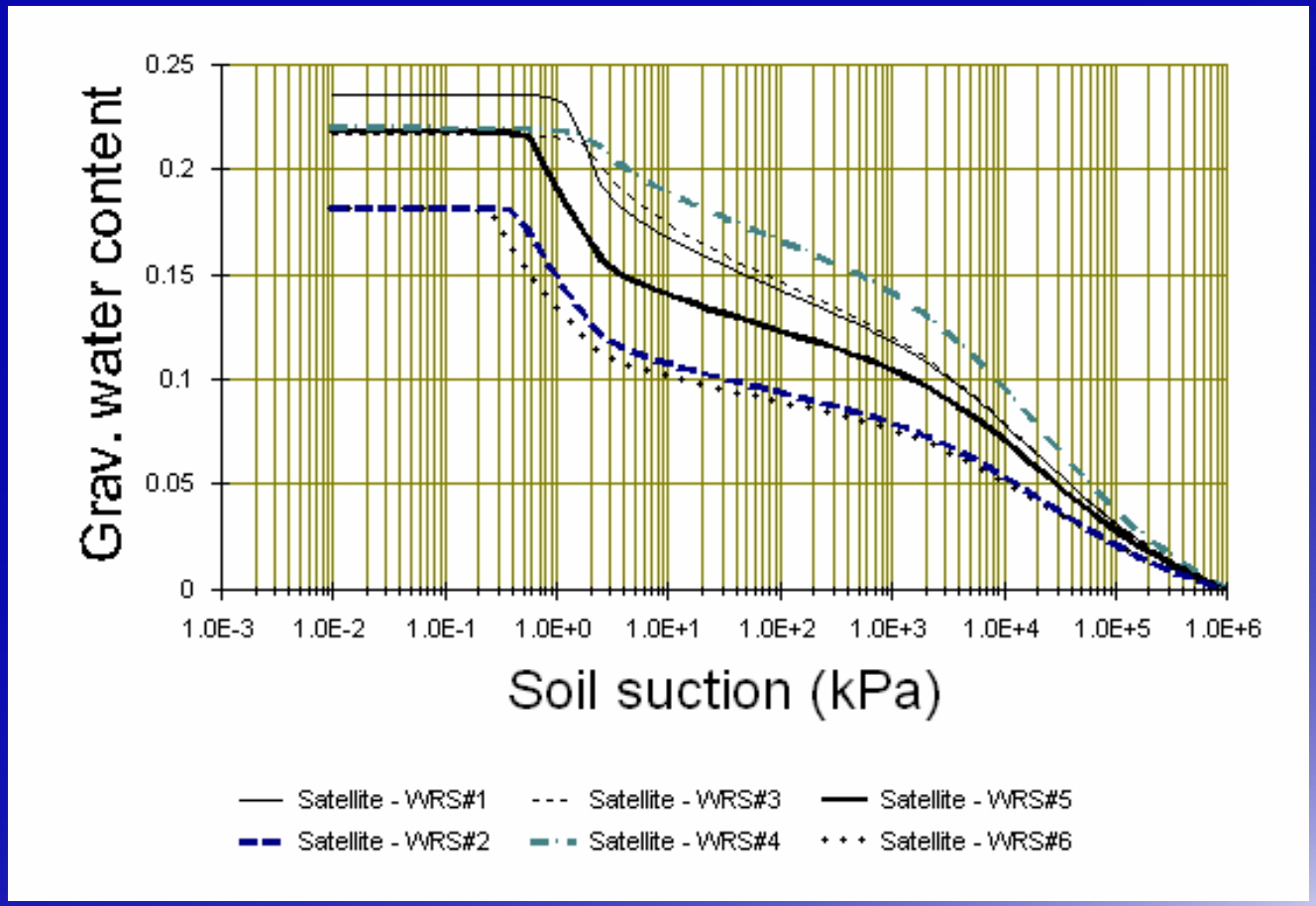
K sat - Tailings



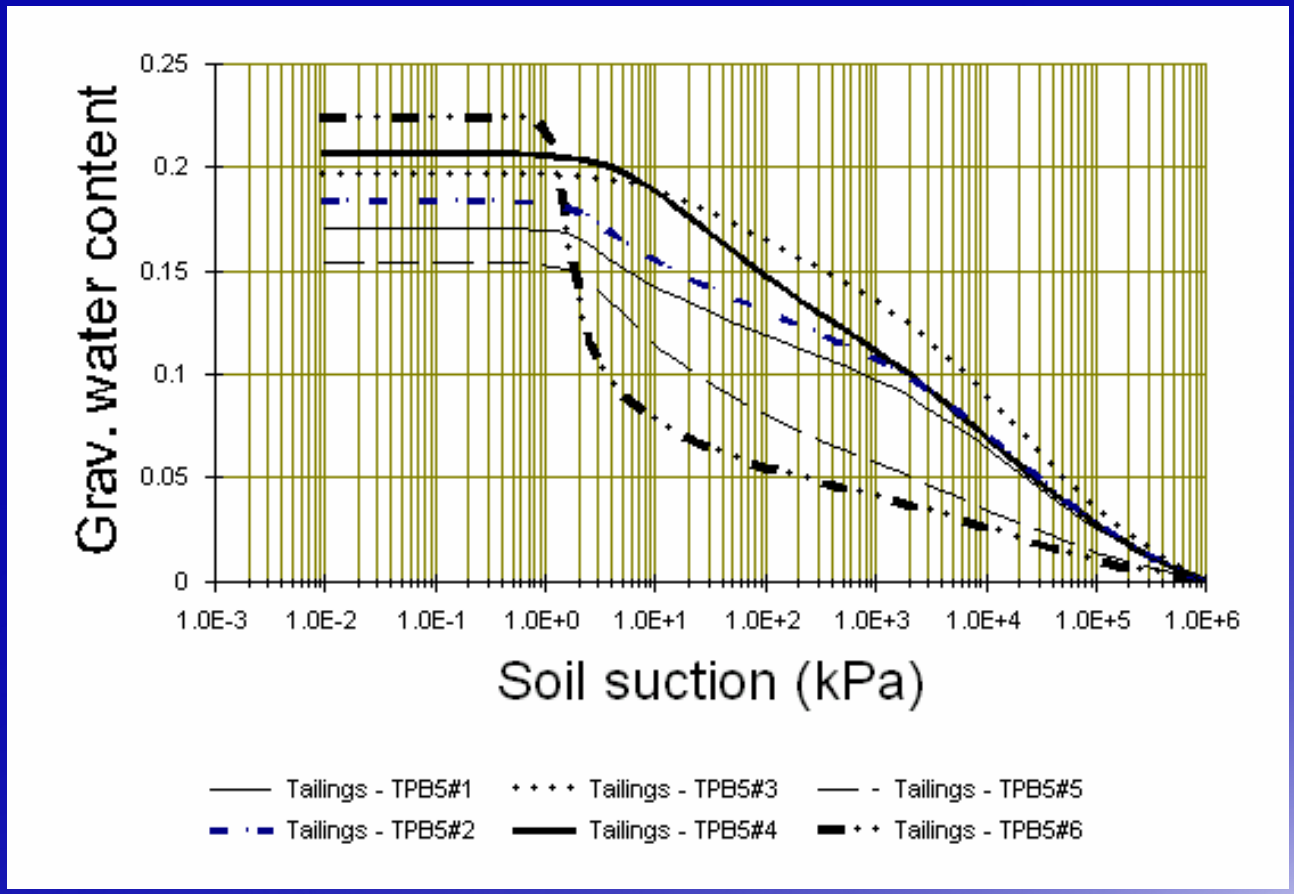
Estimated SWCC – Waste Rock Main station



Estimated SWCC – Waste Rock Satellite station



SWCC – Tailings area



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Numerical Modeling

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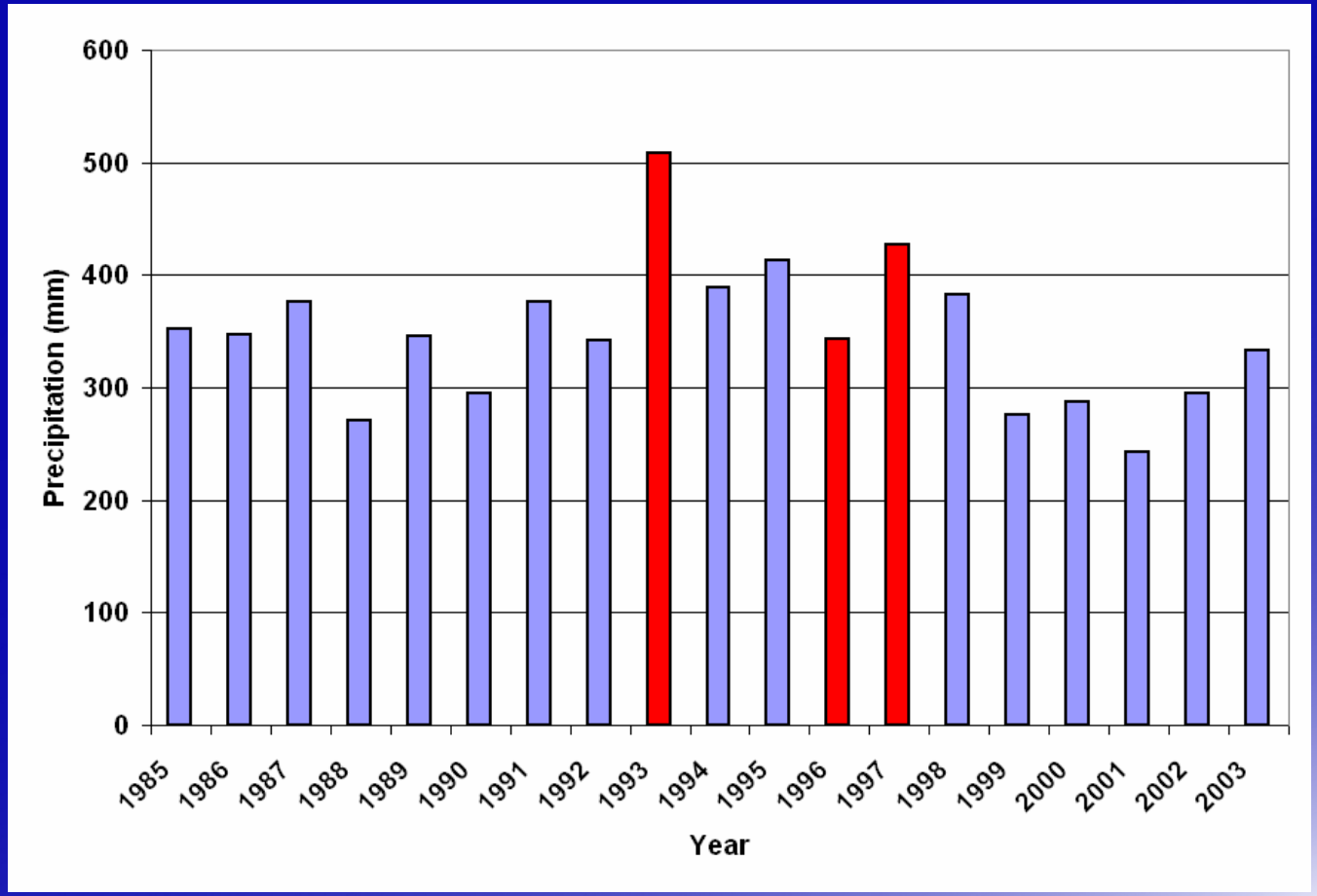
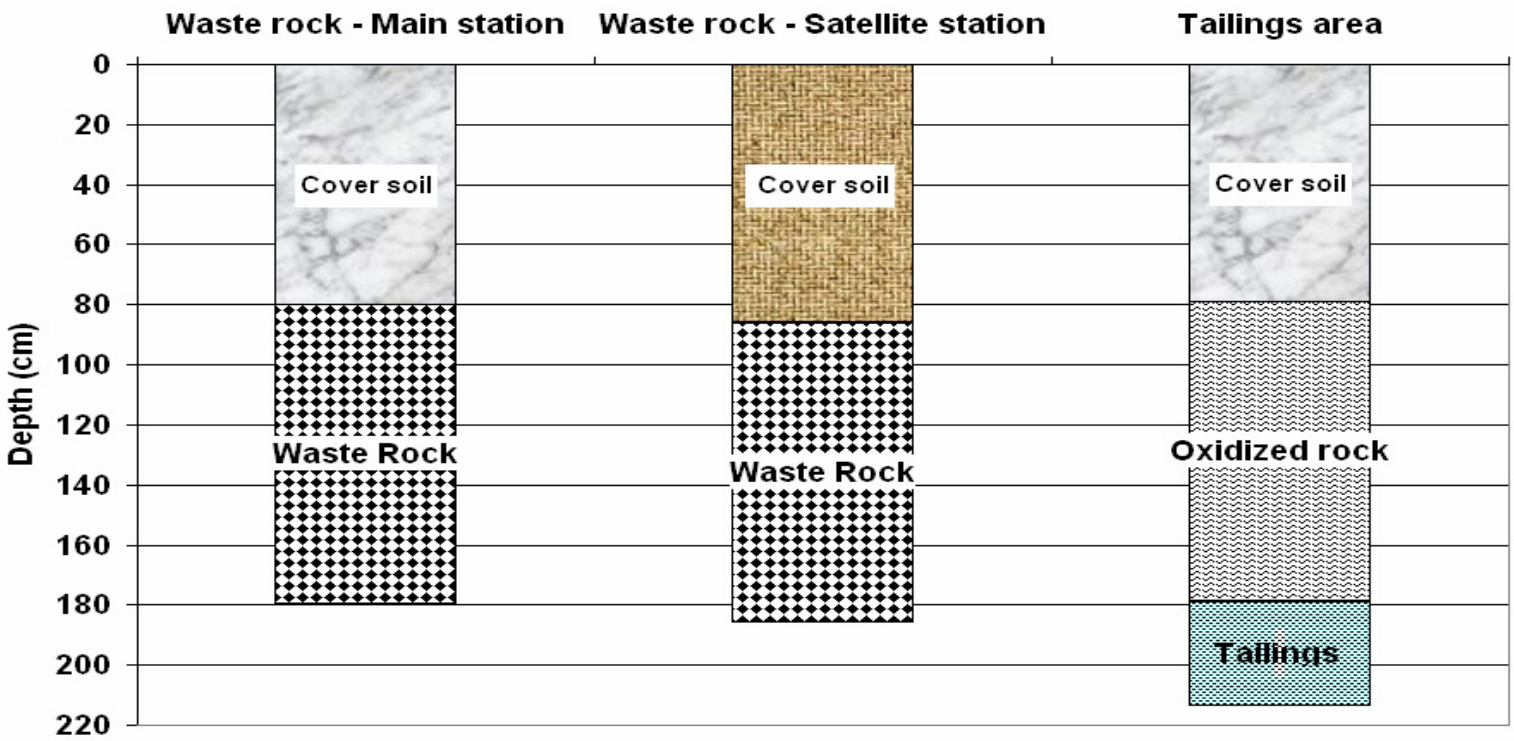
Numerical Modeling

- One-dimensional Model Soil Cover
- Influence of rain
  - Typical year case – 348 mm of rain / snow
  - Wet year case – 425 mm of rain / snow
  - Very wet year case – 539 mm of rain / snow
- Influence of vegetation
  - No vegetation, poor, good and excellent condition
- Initial suction profile

Precipitation history



Simulated profiles



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- Results -
Initial suction profiles calculated by the model

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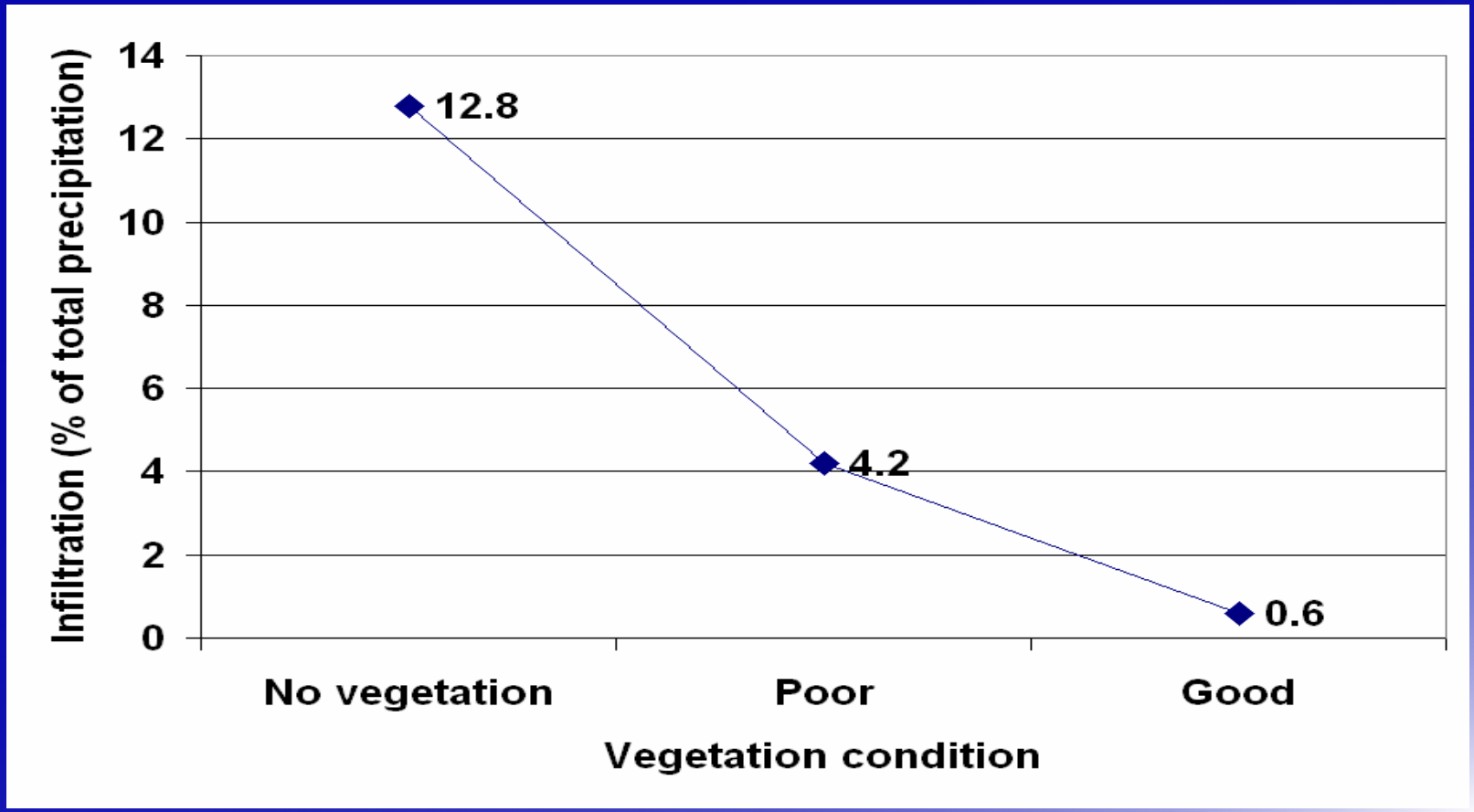
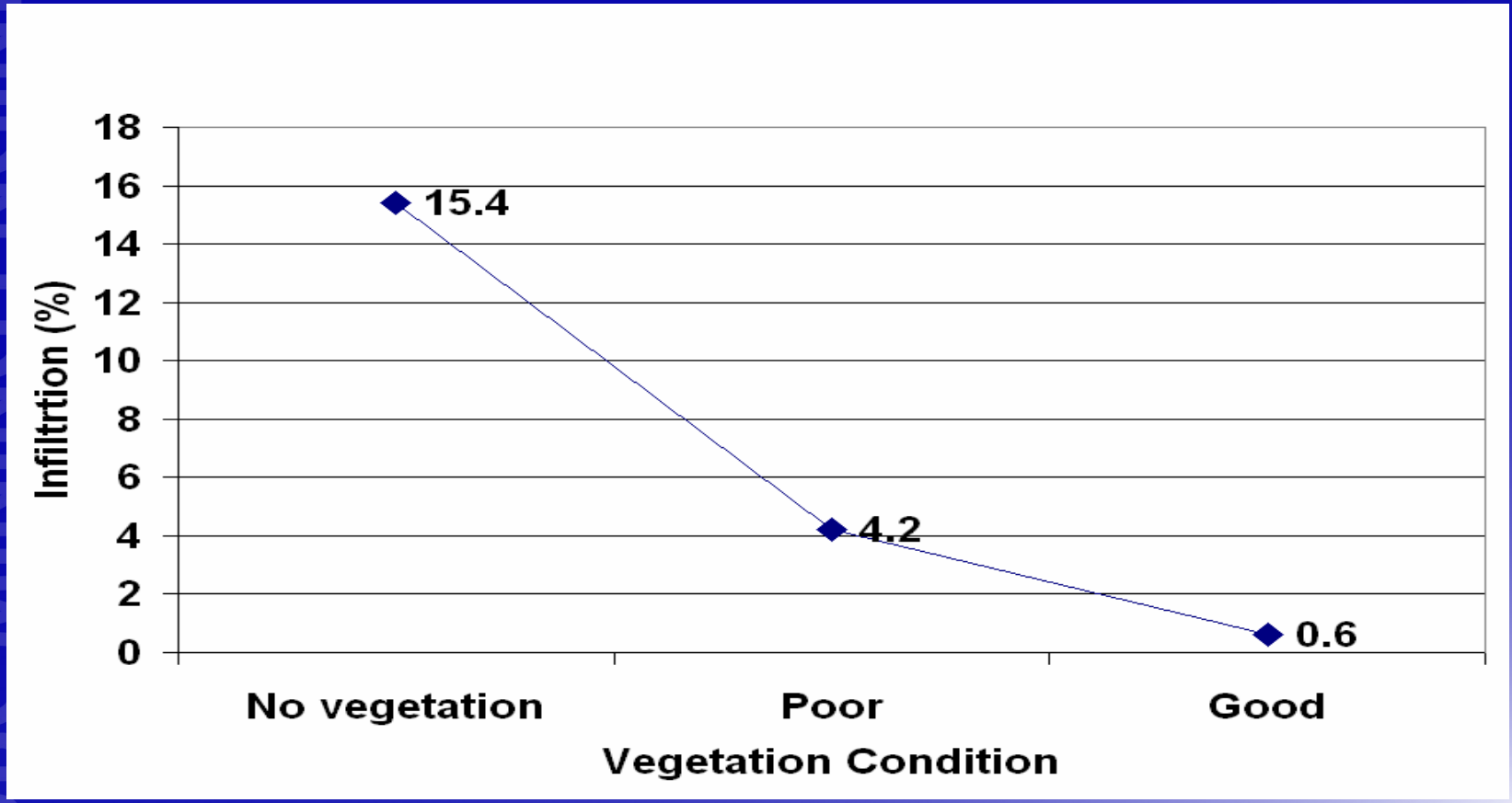
Waste rock cover

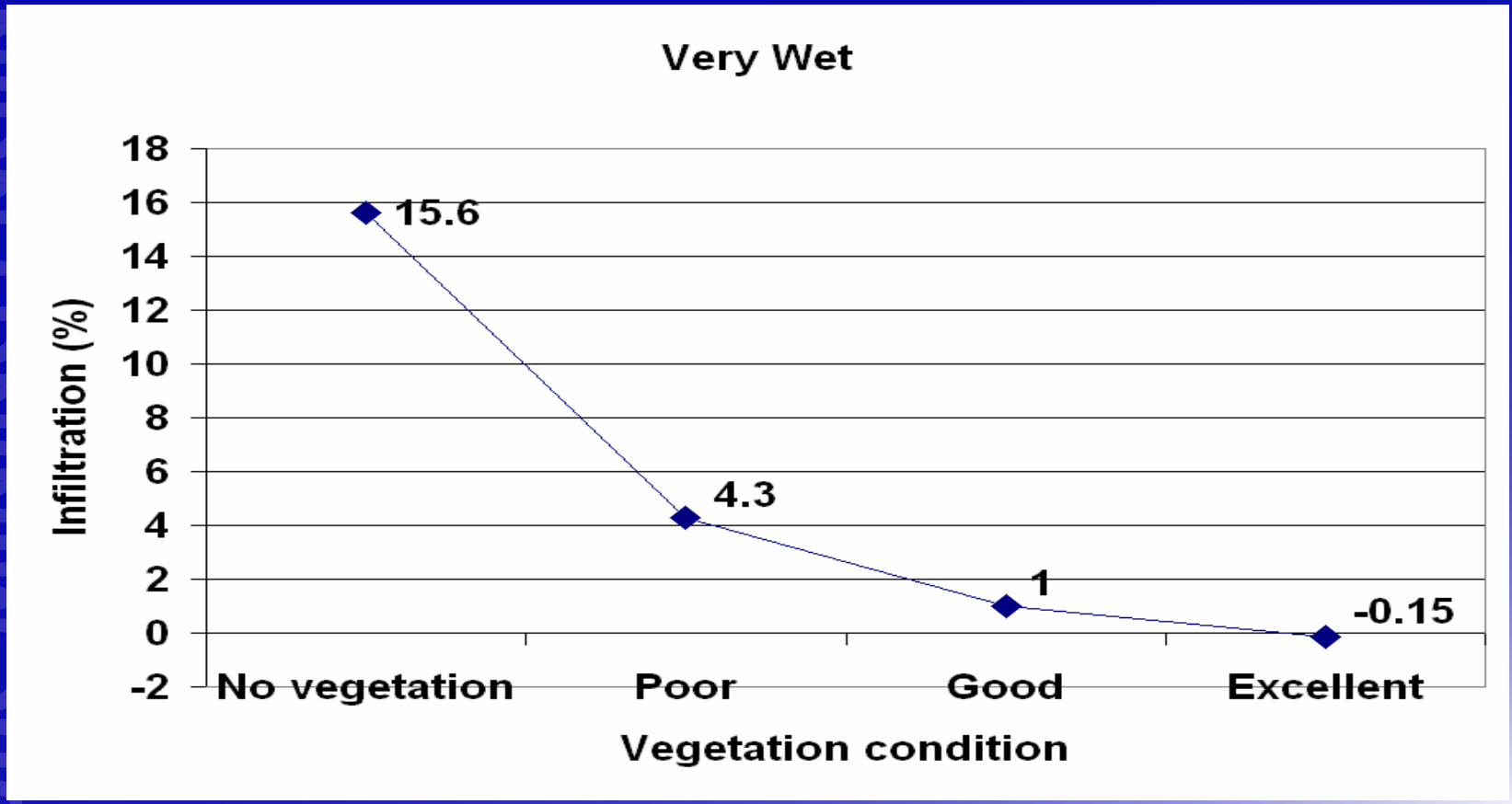
Waste rock – Infiltration in typical year



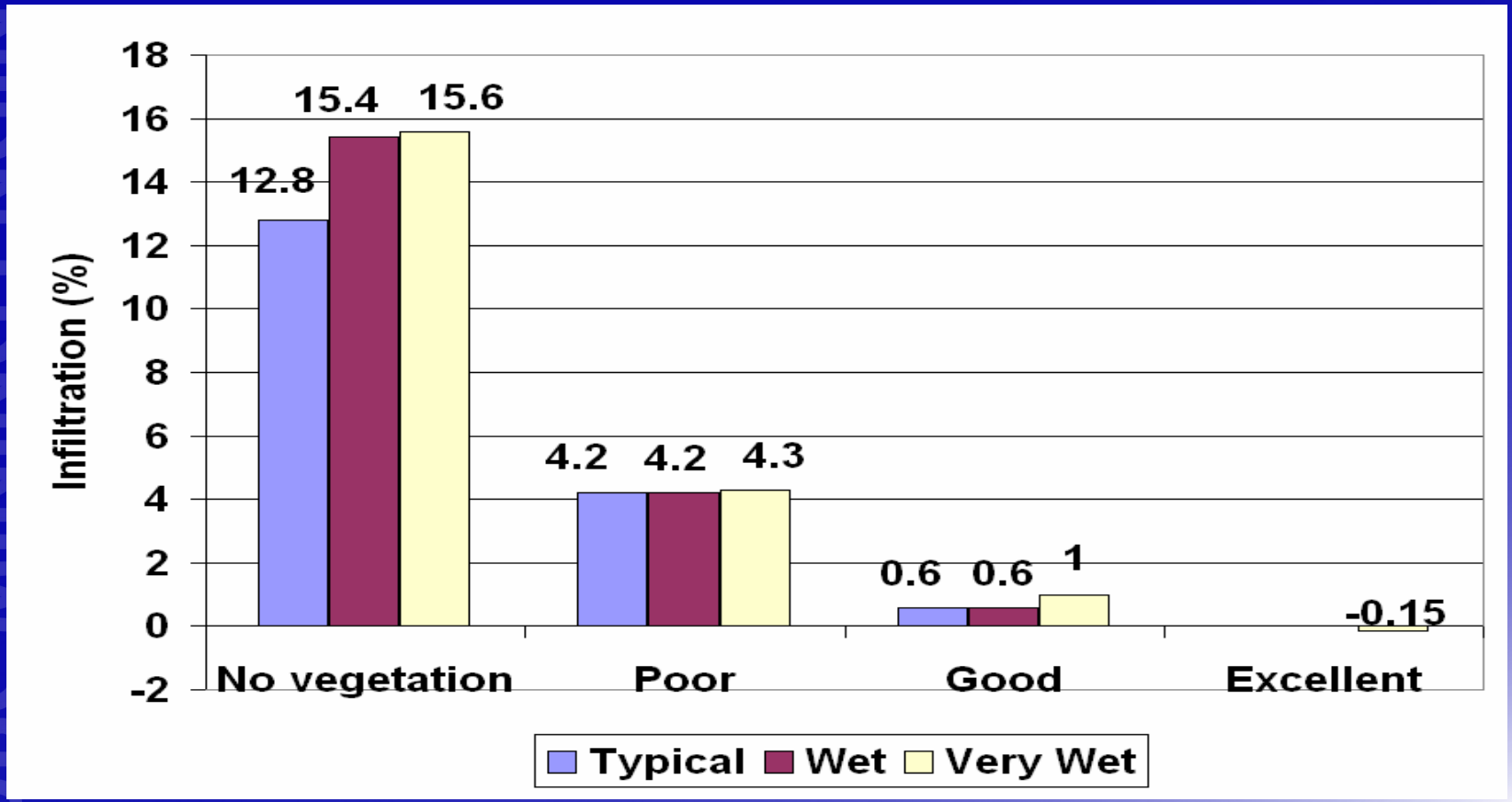
Waste rock infiltration in wet year



Waste rock infiltration in very wet year



Summary


18
16
14
12
10
8
6
4
2
0
-2
Infiltration (%)
12.8
15.4
15.6
4.2
4.2
4.3
0.6
0.6
1
-0.15
No vegetation
Poor
Good
Excellent
Typical
Wet
Very Wet

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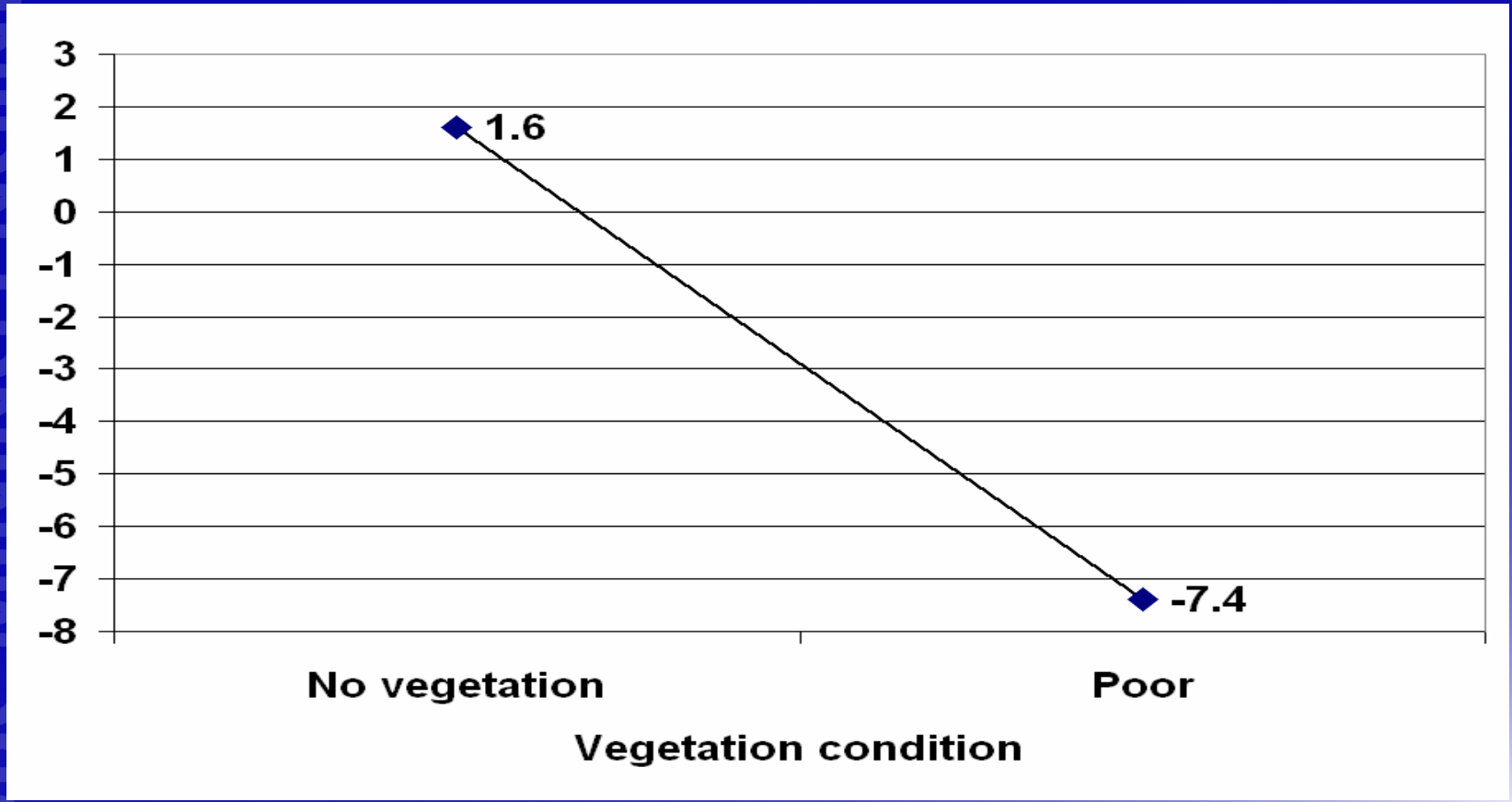
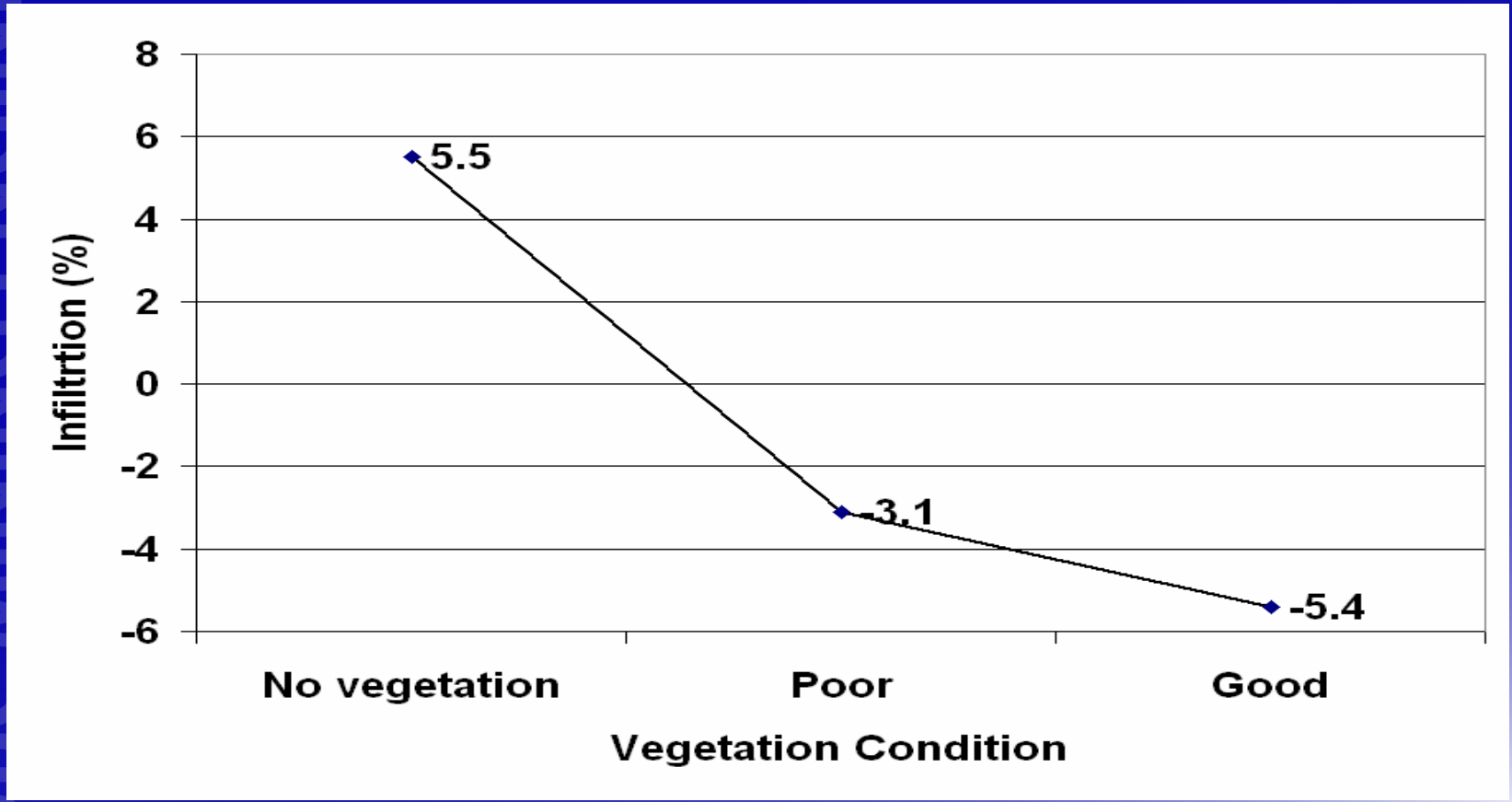
Tailings cover

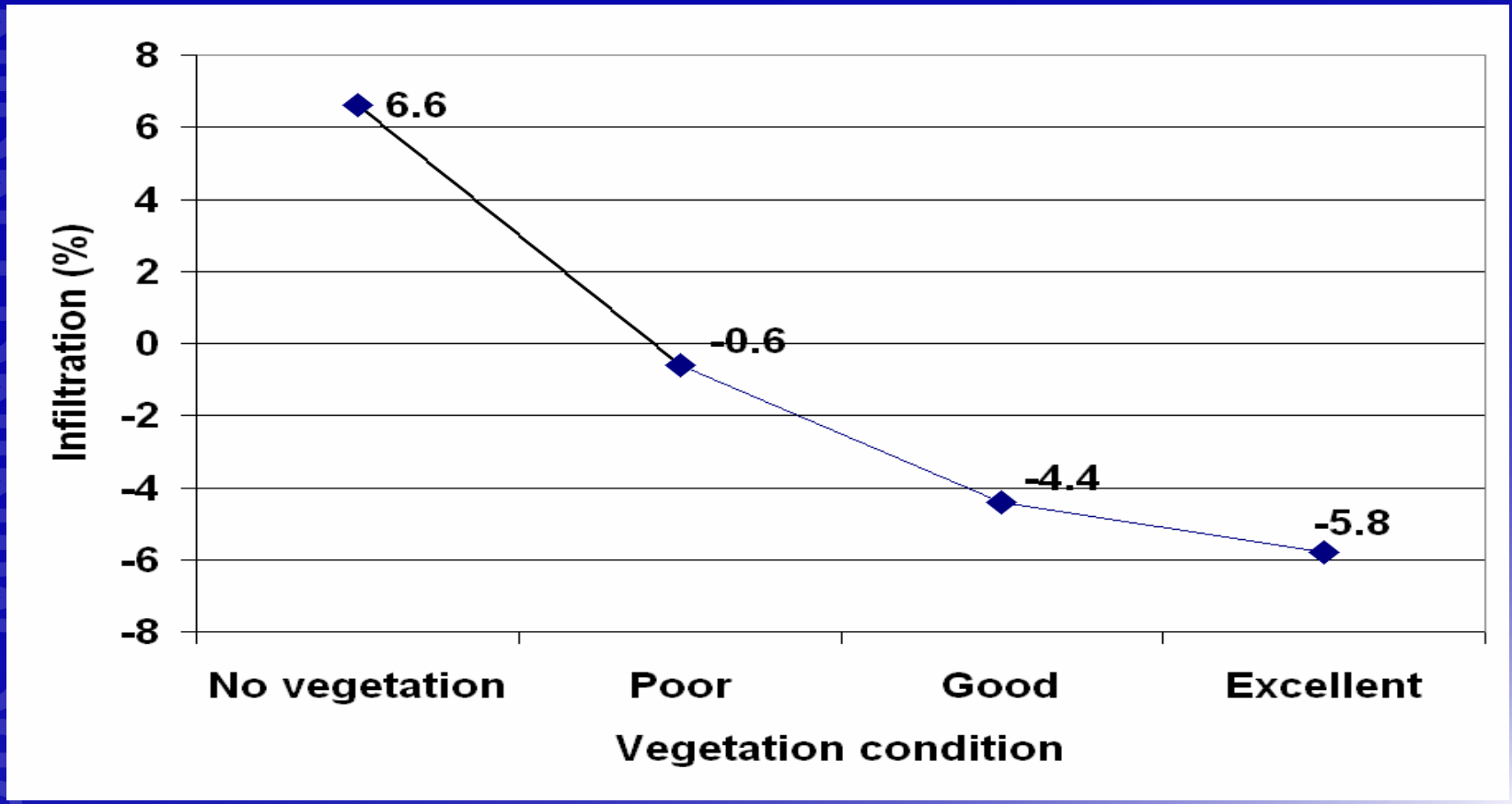
Tailings – Infiltration in typical year



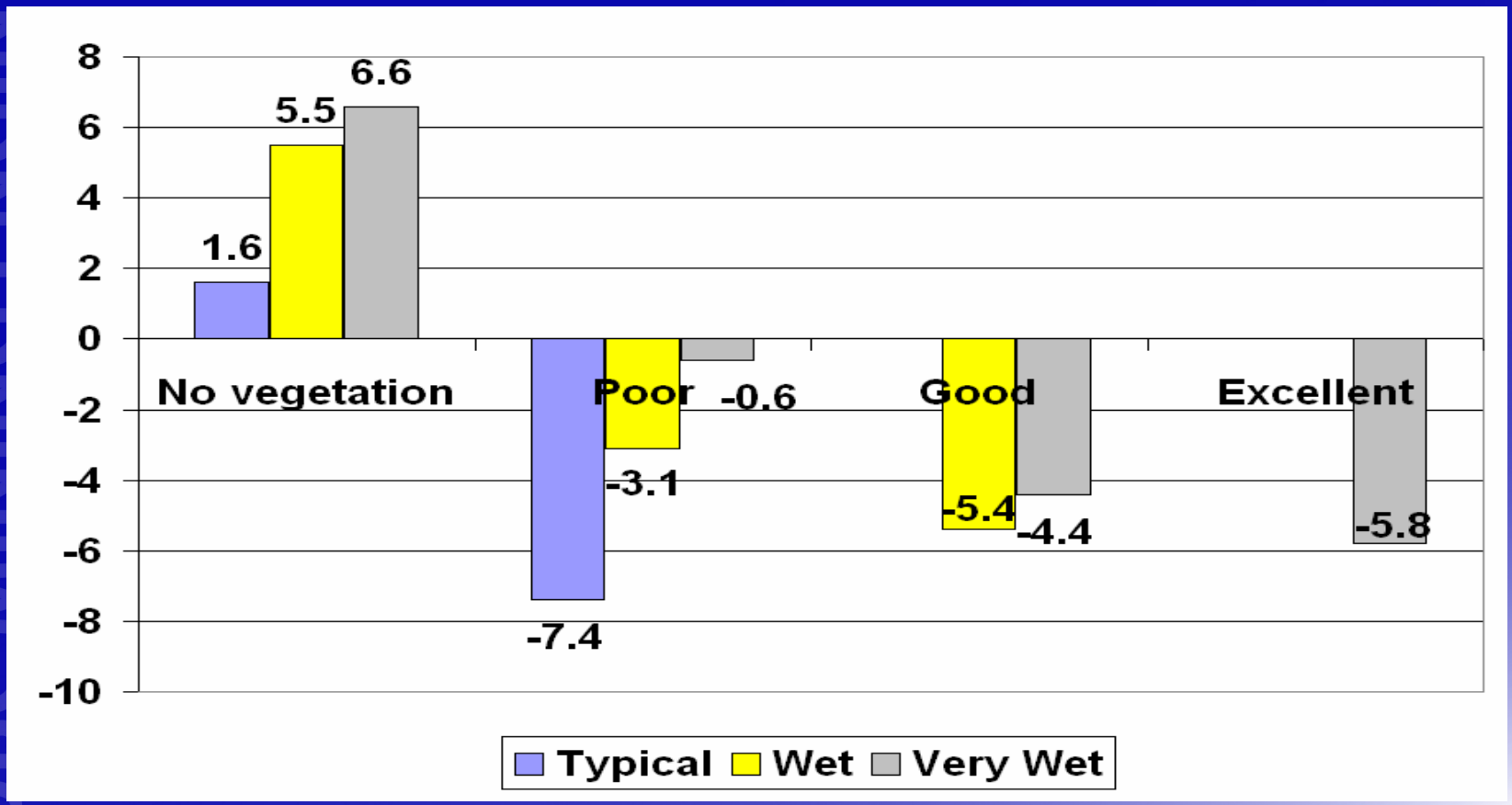
Tailings – Infiltration in wet year



Tailings – Infiltration in very wet year



Tailings infiltration summary



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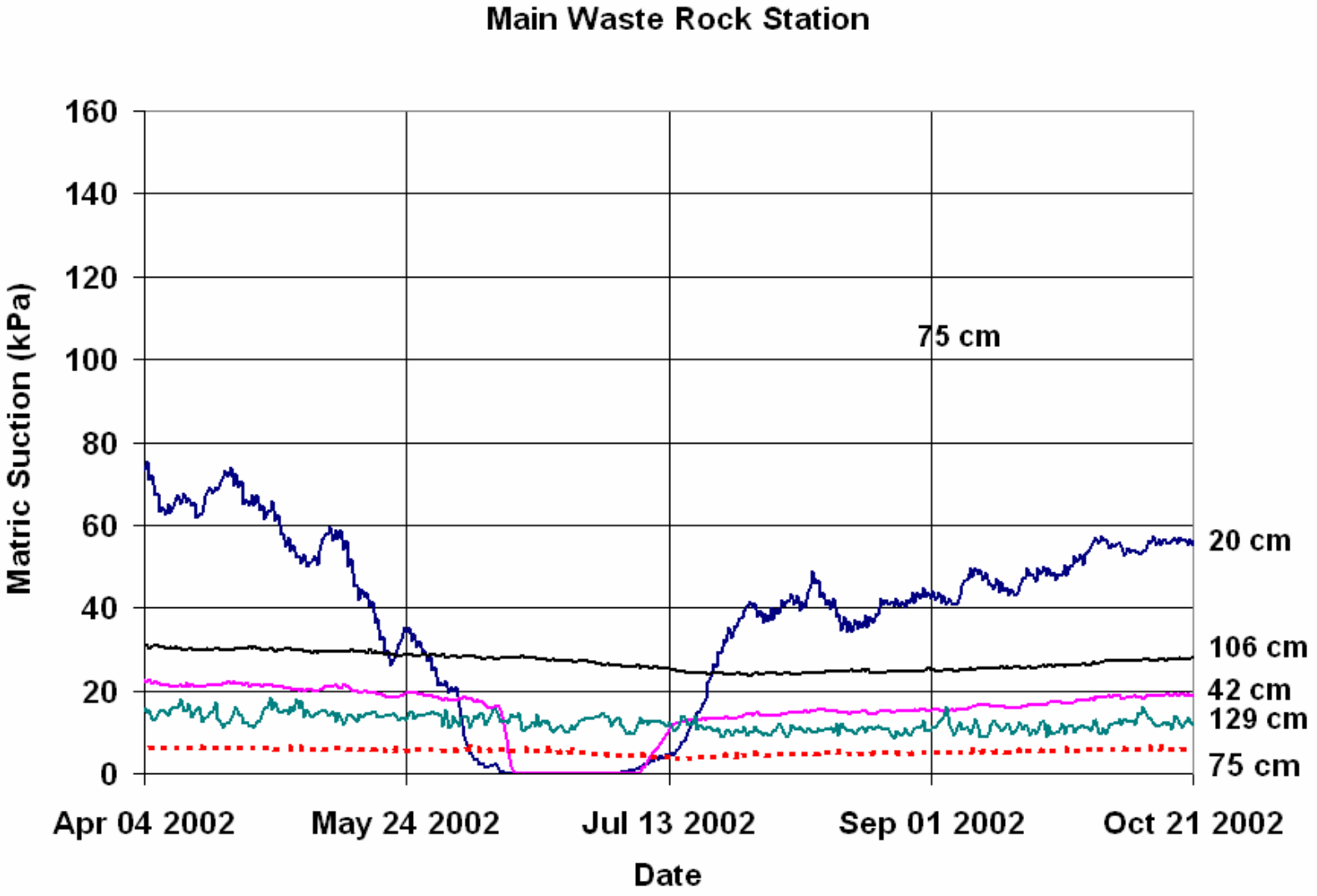
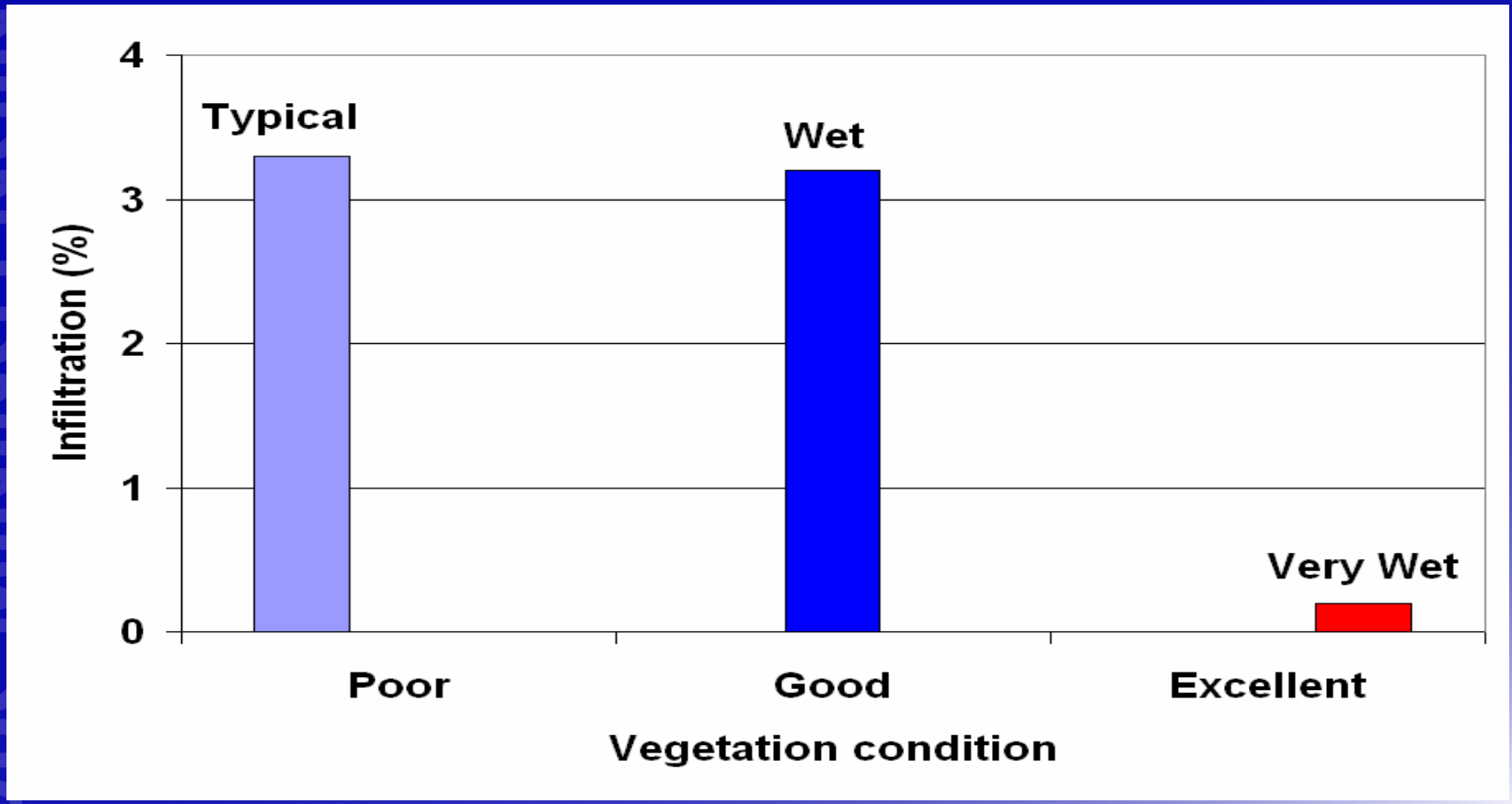
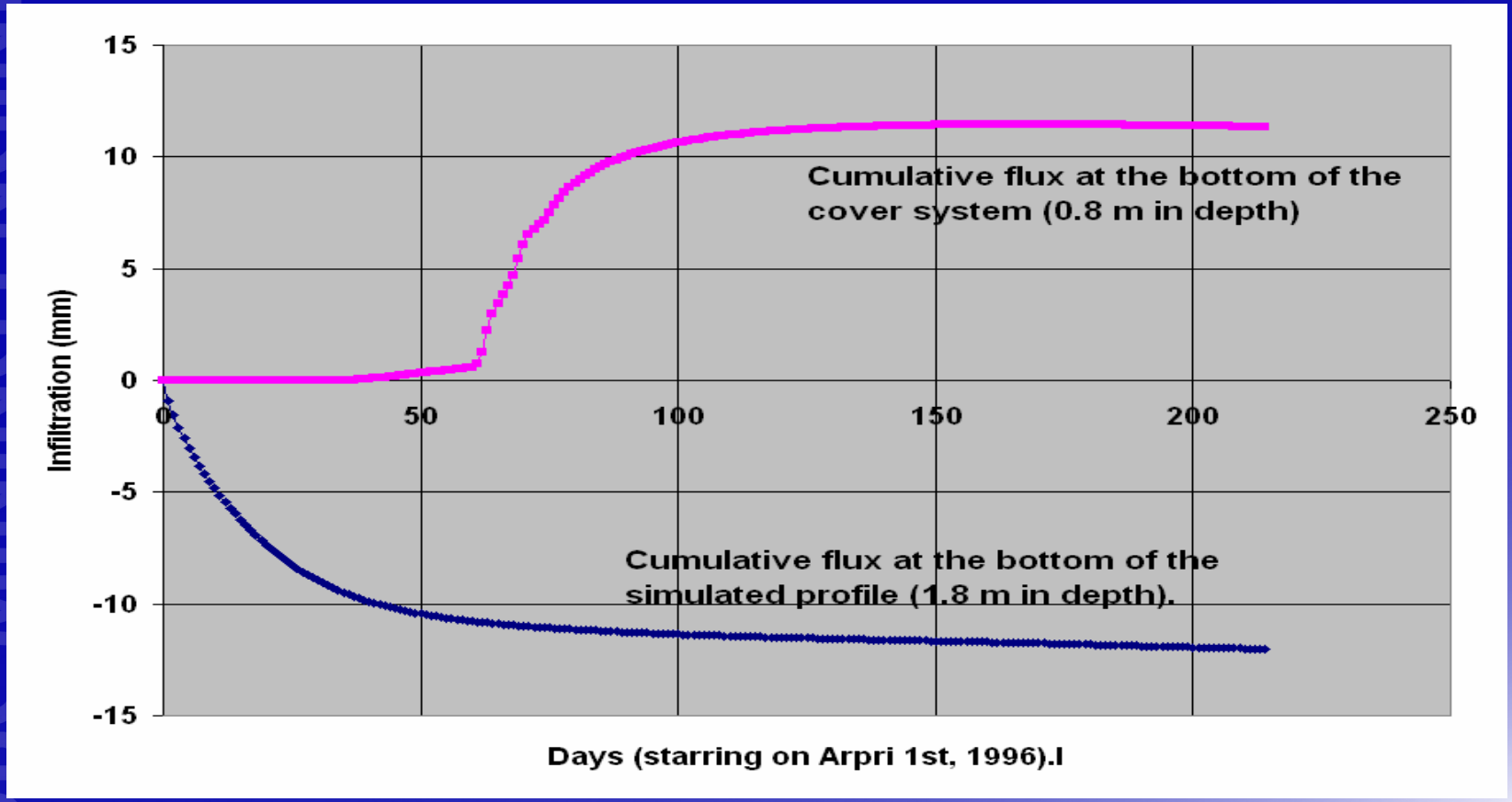
- Results -
Suction profiles from TC sensors – Waste rock


Main Waste Rock Station
Matric Suction (kPa)
160
140
120
100
80
60
40
20
0
Apr 04 2002
May 24 2002
Jul 13 2002
Sep 01 2002
Oct 21 2002
Date
75 cm
20 cm
106 cm
42 cm
129 cm
75 cm

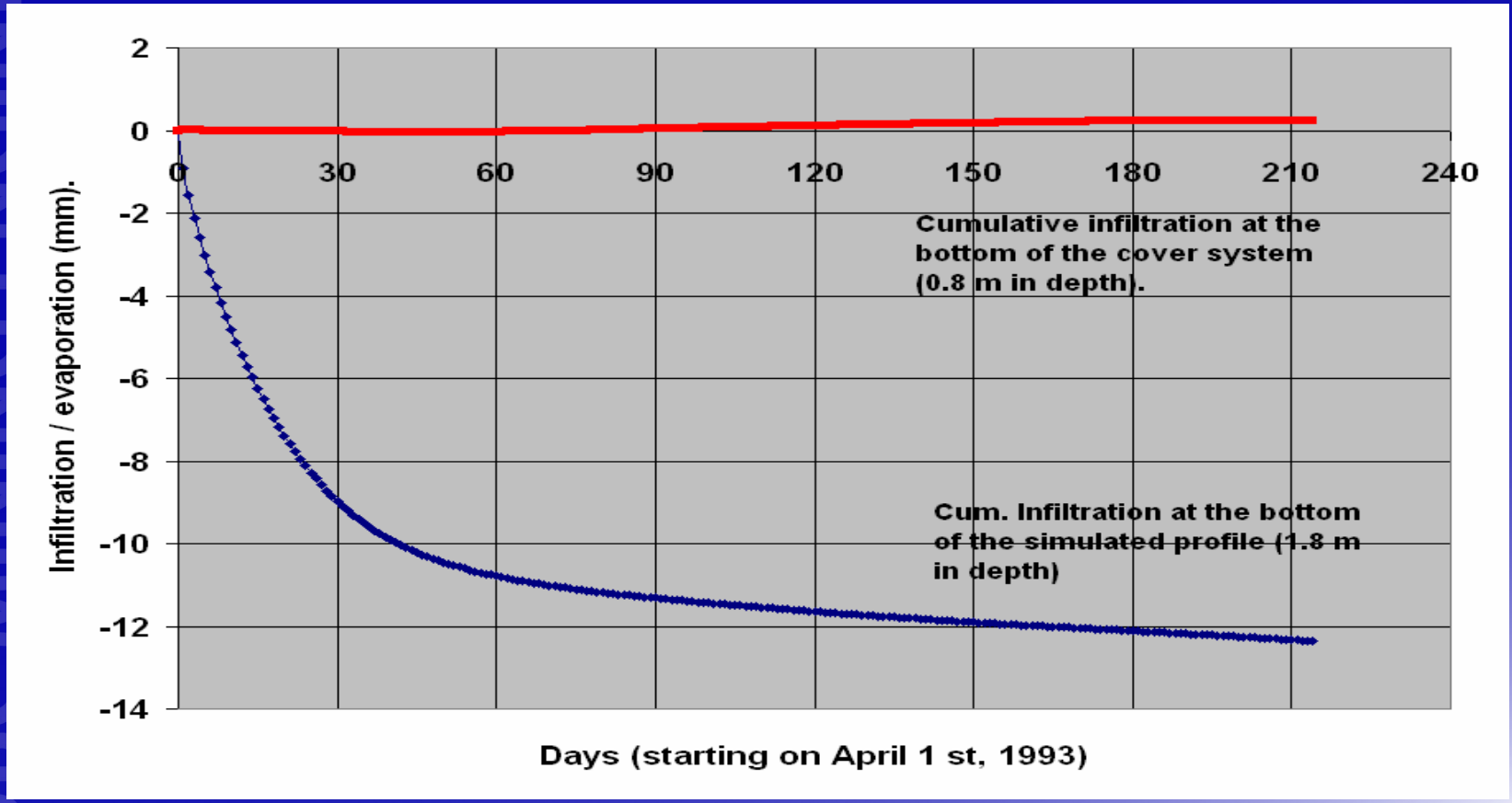
Infiltration summary



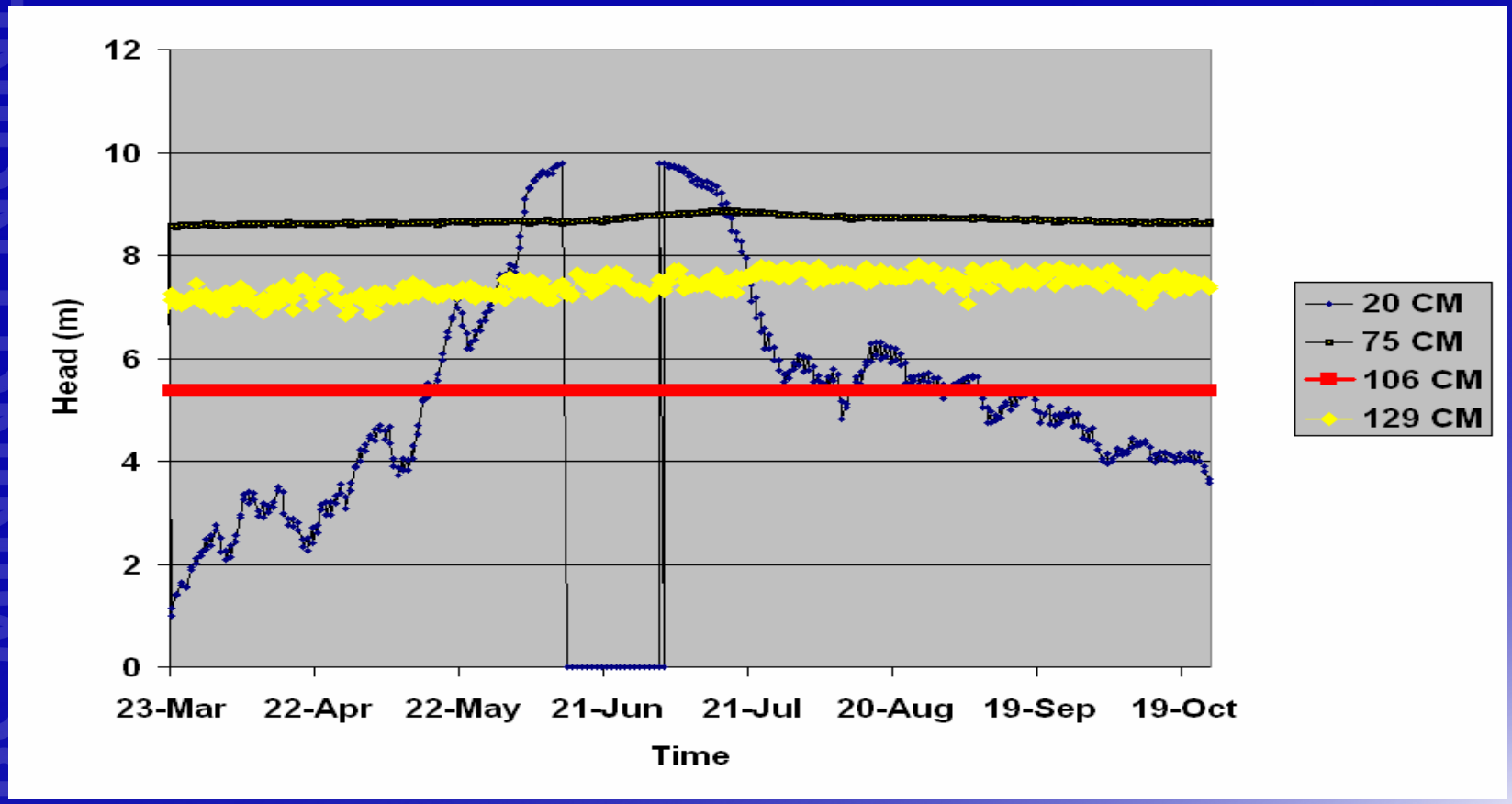
Infiltration evolution in typical year



Infiltration evolution in very wet year



Hydraulic Head



Conclusions

- On the waste rock dump, the performance of the cover system is strongly influenced by the vegetation condition.
- If the vegetation is preserved in good conditions, low infiltration is expected.
- On the tailings area, the finer material and the higher thickness cause the cover to be less dependant on the vegetation condition.
- Low infiltration expected

Conclusions

- The simulation showed the existence of different patterns of infiltration with upward flux from the waste rock dump in spite of infiltration through the bottom of the cover system.
- TC sensors suction profile supports the modeling results.
- Despite the modeling results, field monitoring of the infiltrations is recommended.

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