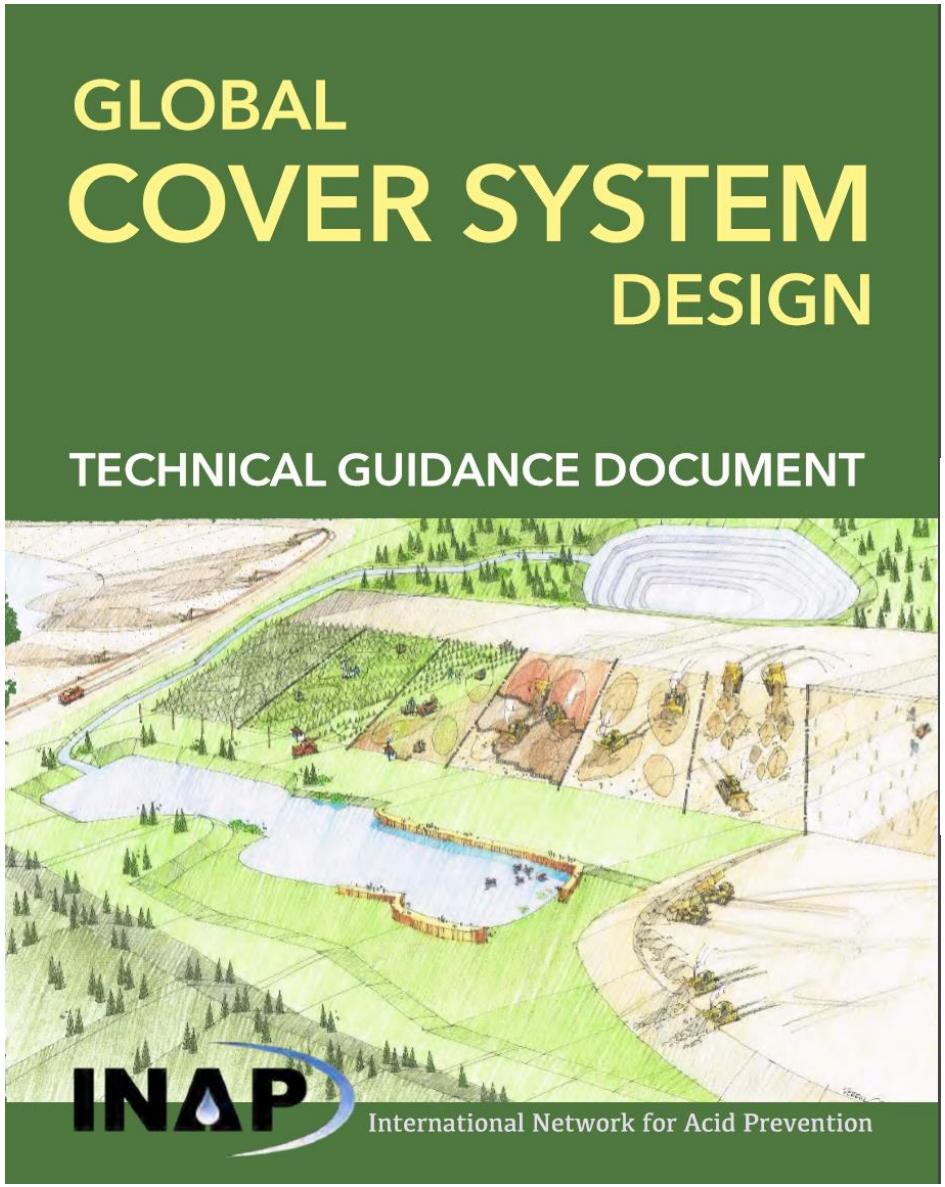

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Specialists in Geochemistry and Unsaturated Zone Hydrology

INAP

September, 2018

Guidance Document Framework

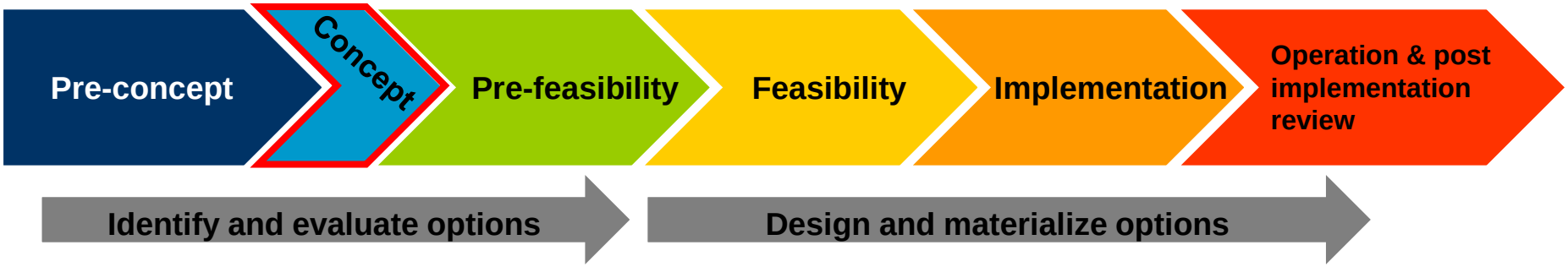
- ***Provides a framework for Front End Loading (FEL) engineering for improved conceptualization of cover system design, construction, performance, and monitoring***

- ***Context for Climate:***
  - ***Developing realistic conceptual understanding for what cover system cans achieve in terms of climate.***

- ***Context for management of oxygen and water***
  - ***Developing realistic conceptual understanding of what cover systems can achieve in terms of site specific geochemistry and evolution of pore water seepage.***

- ***Context for Landforms***
  - ***Developing a realistic conceptual understanding for what a cover system can achieve in terms of landform constraints.***
  - ***Geomorphic approach to landform design does not imply reducing slopes, concave etc.***

Front End Load Engineering



Current approach:

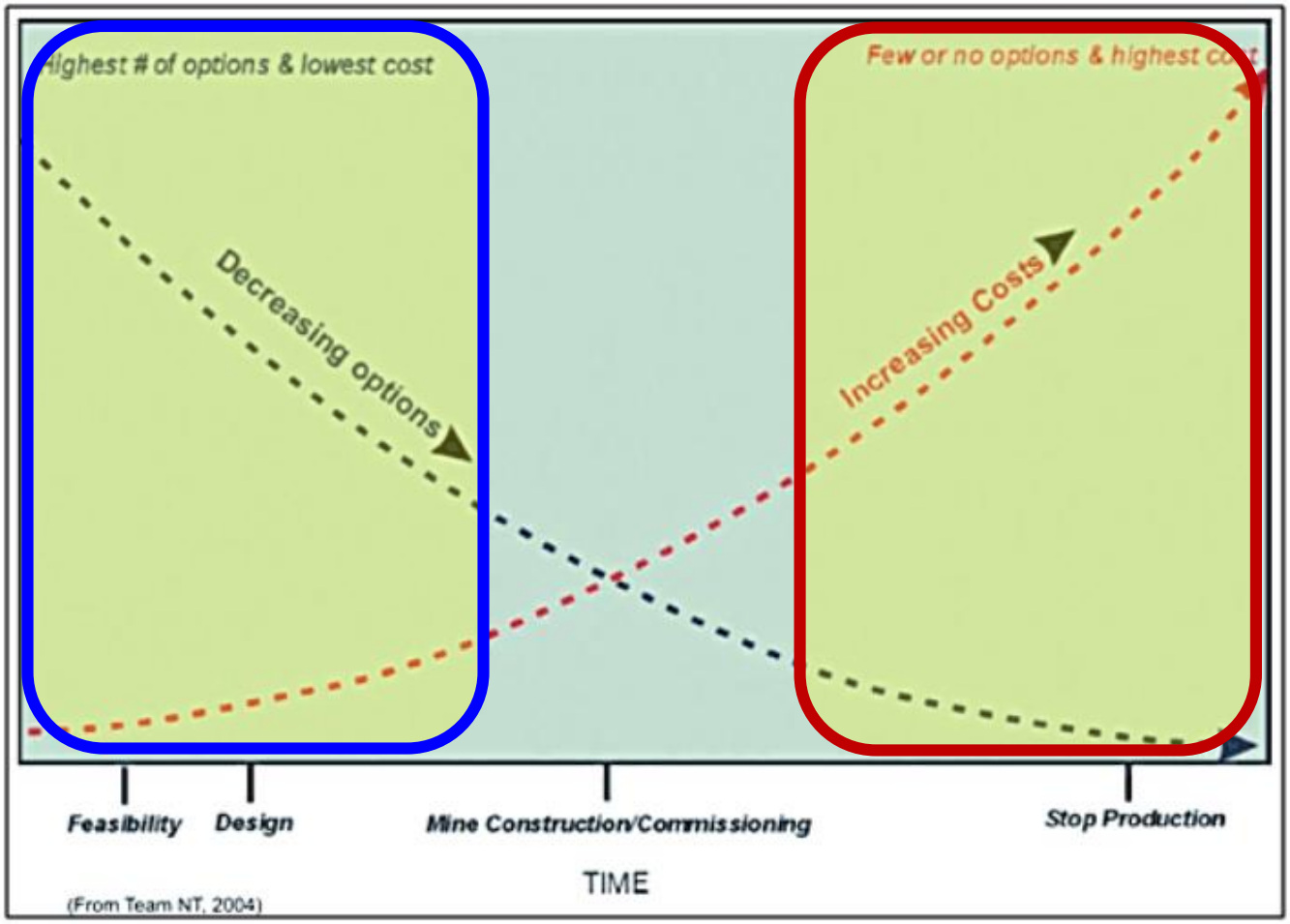
- ***Use of average climate***
- ***Unrealistic expectation for O_2 and H_2O management***
- ***Lack of appreciation for linkage between covers and landform***

By the time you get to site-specific detailed numerical modelling to support cover system design, you are very often already in a 'box' that severely limits alternatives

Getting out of the Box

Current typical approach makes one think they are functioning "here"

Figure 6-1: Options and Effectiveness with Time (TEAM NT, 2004)



When in reality they are functioning "here"

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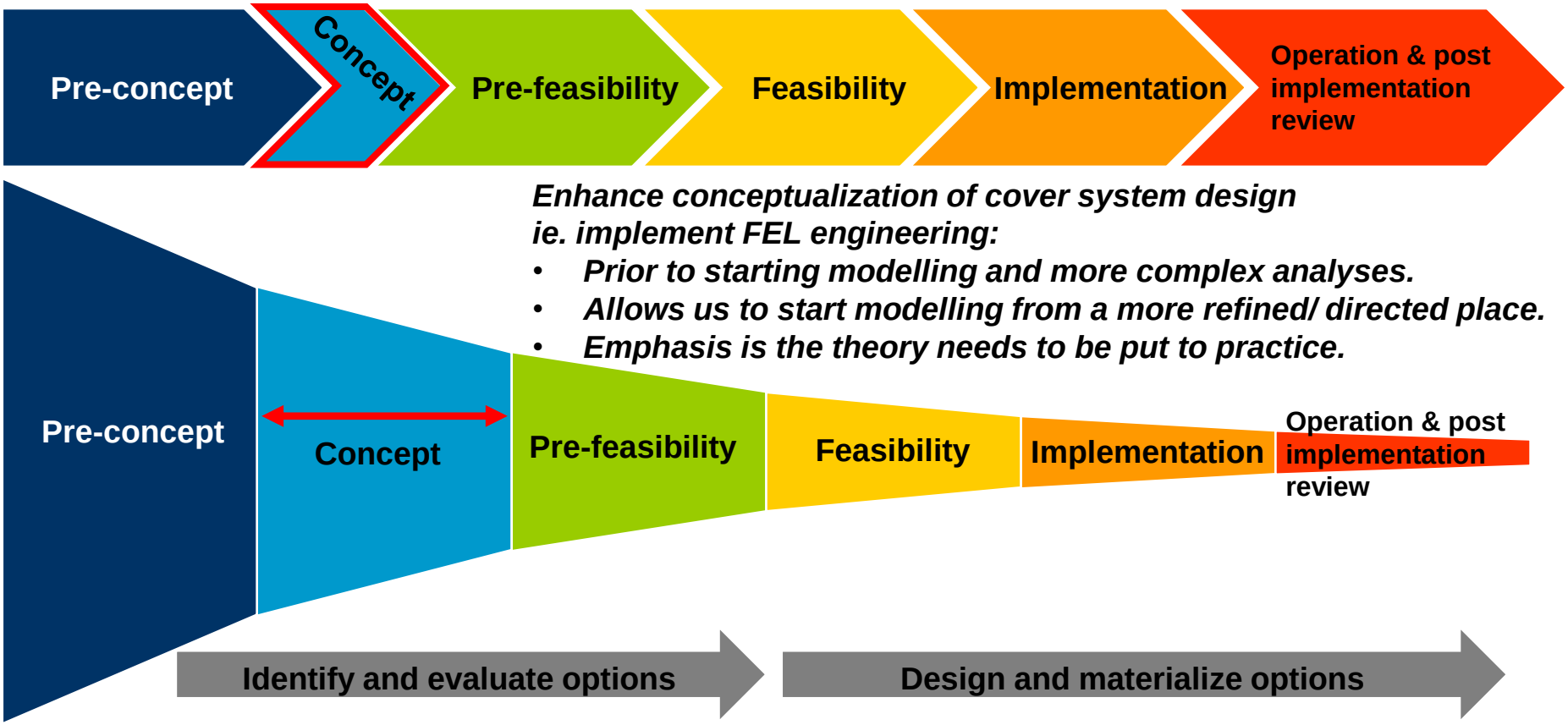
Front End Load Engineering



Cover System Design Approach

Cover Systems… a Continuum of Performance

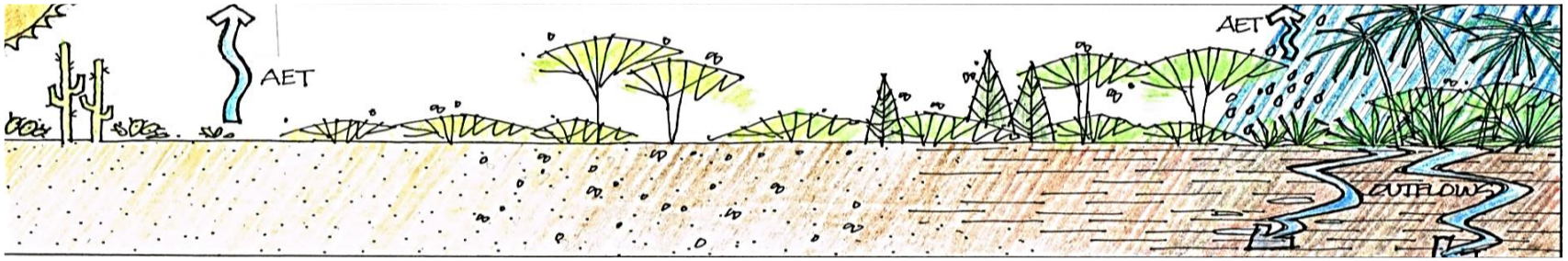
But… What does that mean in terms of informing on engineering and design?

- Link to being realistic about what cover can achieve in terms of site specific geochemistry and evolution of pore-water seepage

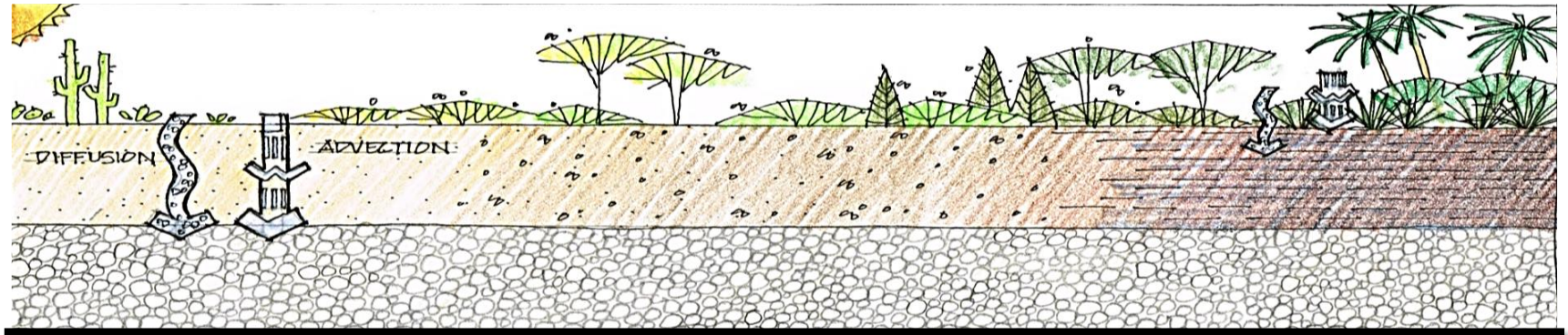
Climate Controls

Arid — **Temperate** — **Tropical**

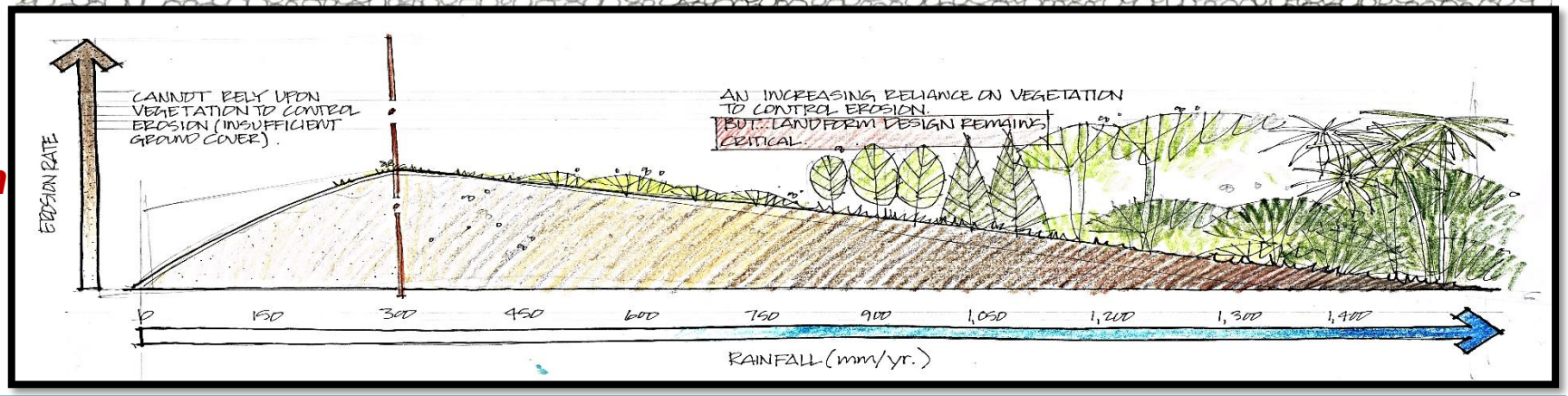
NP



O_2

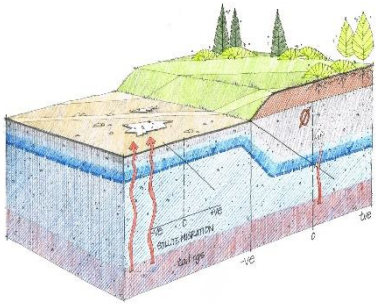


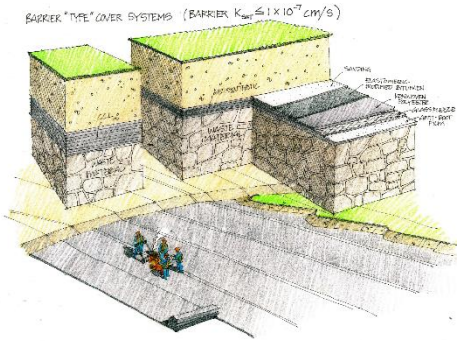
Erosion

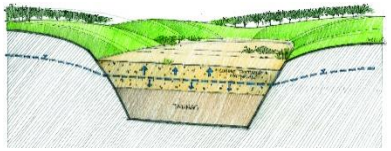


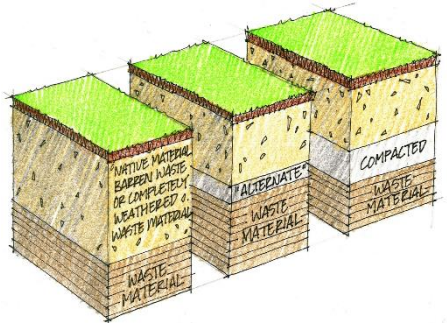
Cover System Alternatives

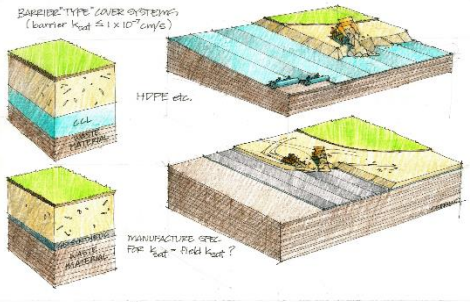
- General overview of cover system alternatives and their function.

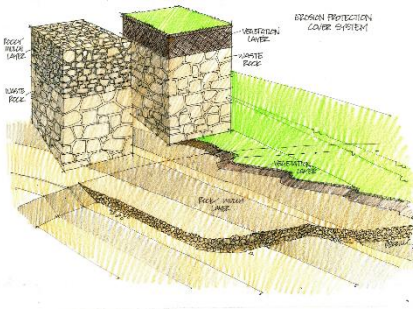


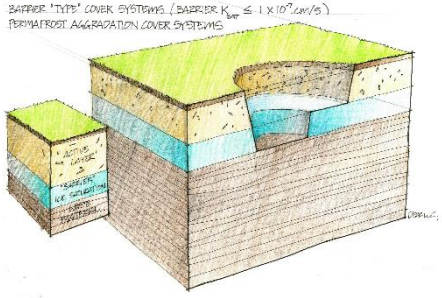


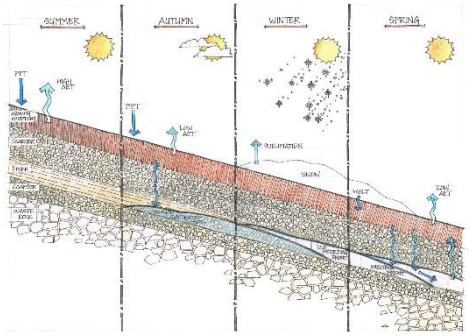












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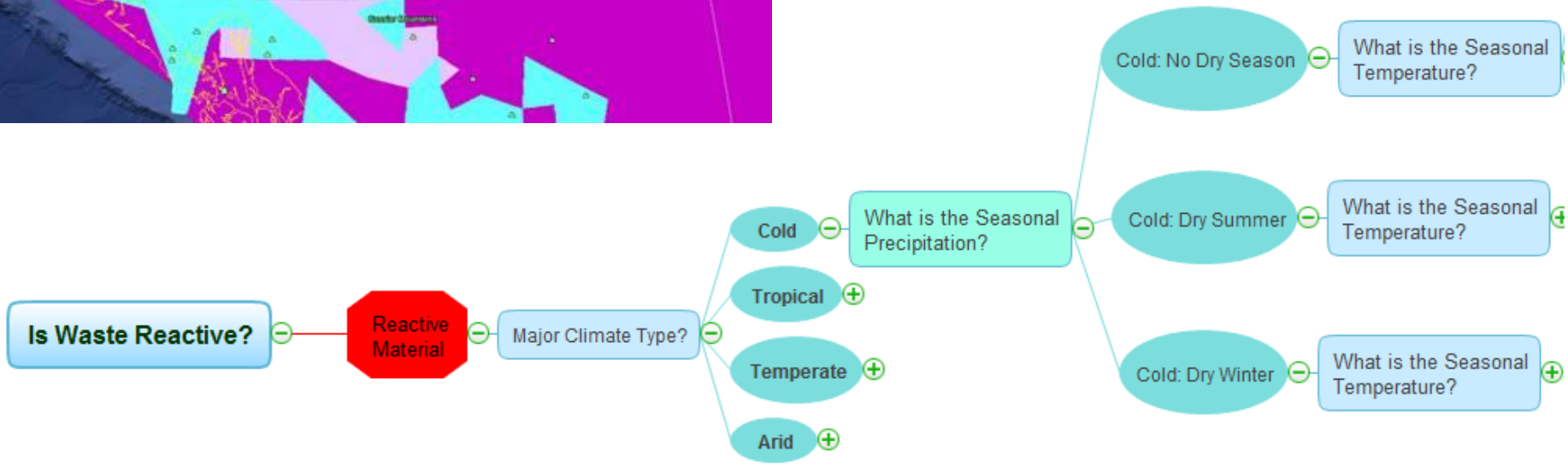
Seasonality

- Average approach will very often lead to misinterpretation of cover system performance.
  - Koppen-Geiger seasonality to address this
- A more appropriate climate framework that leads us to more realistic expectations for what a cover system can achieve and/or the most appropriate cover system
- Rapid ability for users to drill down to what concerns them and the issues facing their sites.
- Each junction of the decision tree referenced in text for users to seek clarification on the questions.

Decision Tree Tool

- ***Yukon Site: Currently Dsc***

  Cold: Dry Summer, Cold Summer



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Decision Tree Tool

- ***Yukon Site: Currently Dsc***

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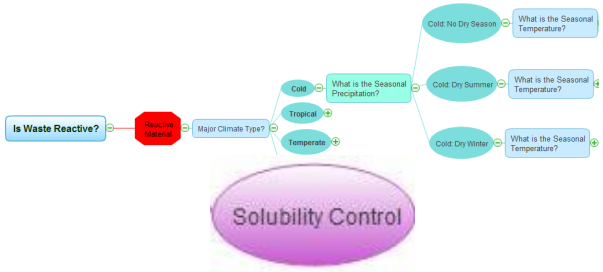
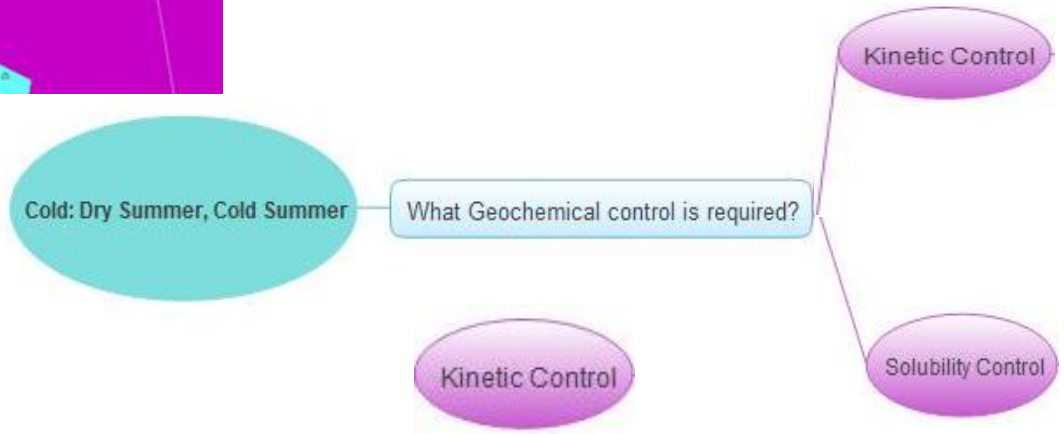
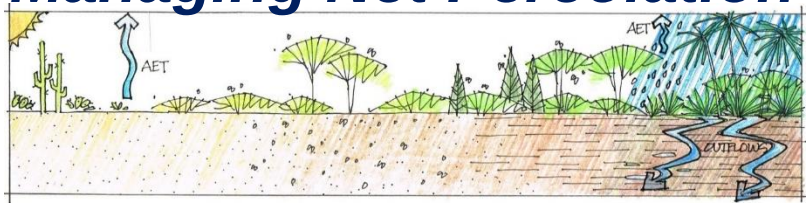
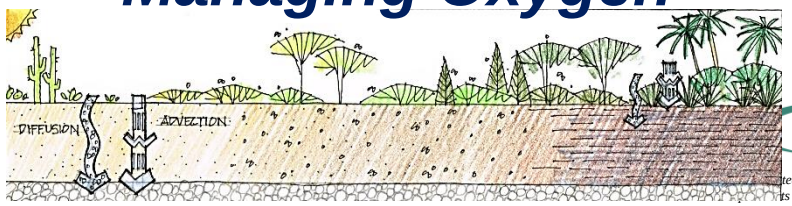




Managing Net Percolation



Managing Oxygen



Decision Tree Tool

- ***Yukon Site: Currently Dsc***

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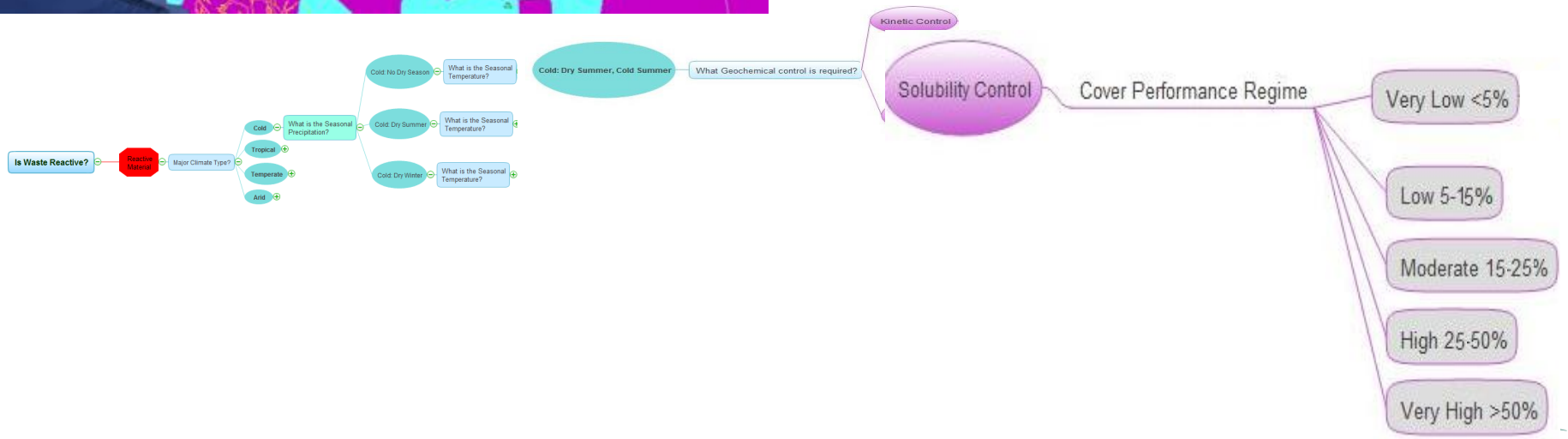

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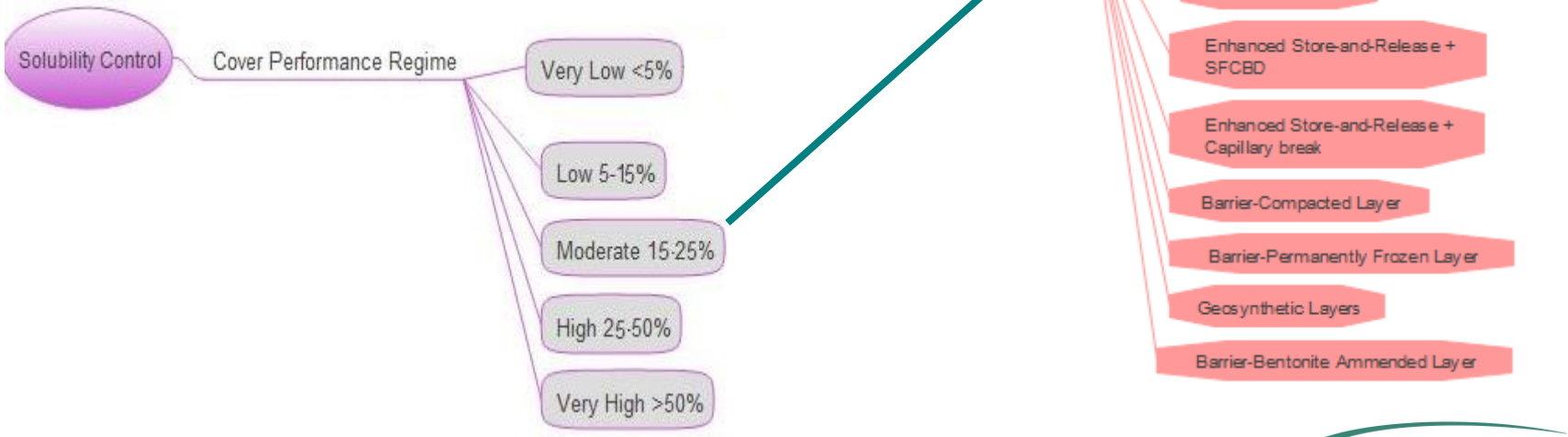
Decision Tree Tool

- ***Yukon Site: Currently Dsc***

Cold: Dry Summer, Cold Summer



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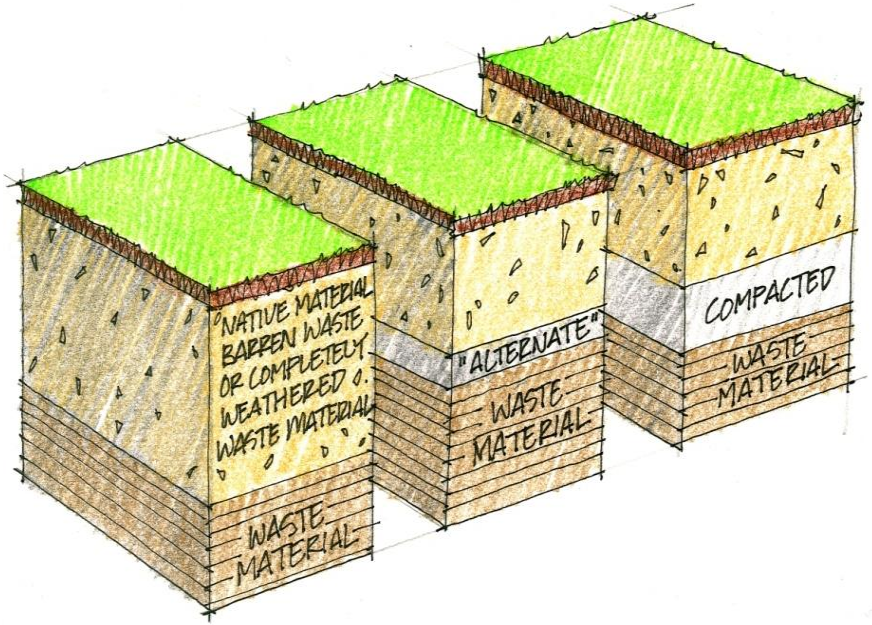
Decision Tree Tool

B_0 – Base Case Cover System

- *WR surface*
  - *"prepared"*

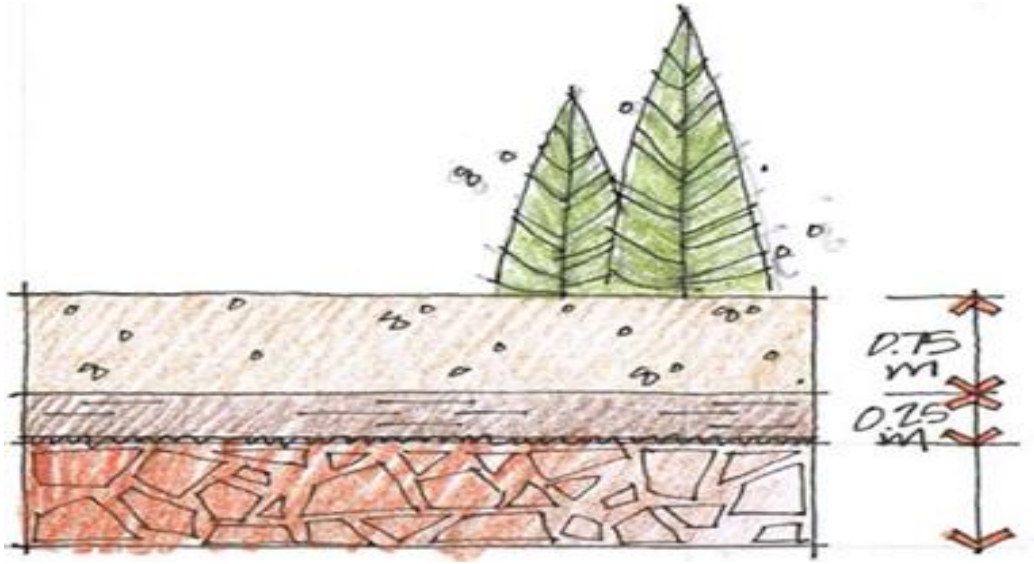
Enhanced Store and Release



Decision Tree Tool

B_0 – Base Case Cover System

- 0.75m Till-T1
  - "Coarser-textured"
  - "loose"
- 0.25m Till – T2
  - "finer-textured"
  - "loose"
- WR surface
  - "prepared"



Decision Tree Tool

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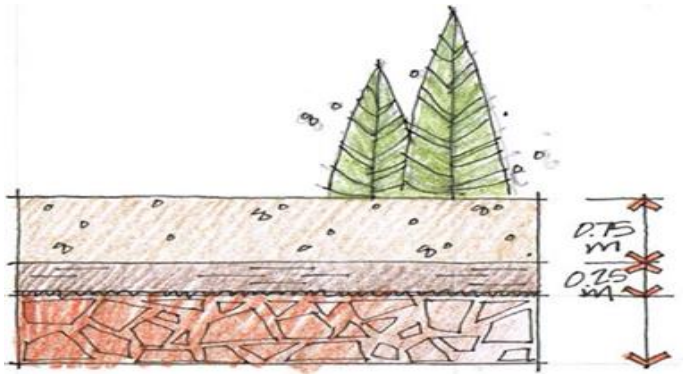
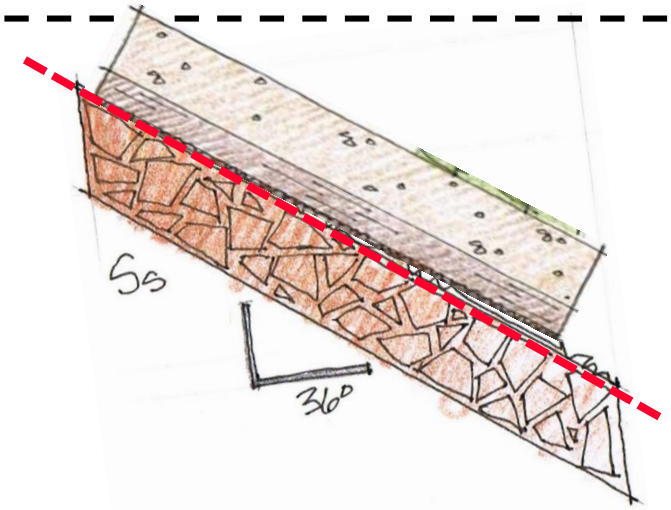
  - "loose"
- 0.25m Till – T2
  - "finer-textured"
  - "loose"
- WR surface
  - "prepared"



B_0 – Base Case Landform Design
- w/o enhanced conceptualization and linkage to cover system

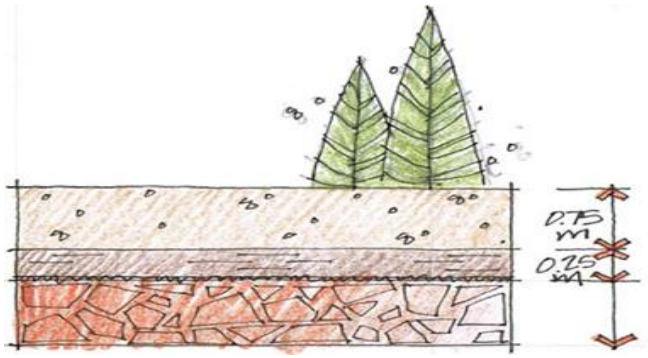
- WR surface
  - "prepared"
  - 2H:1V



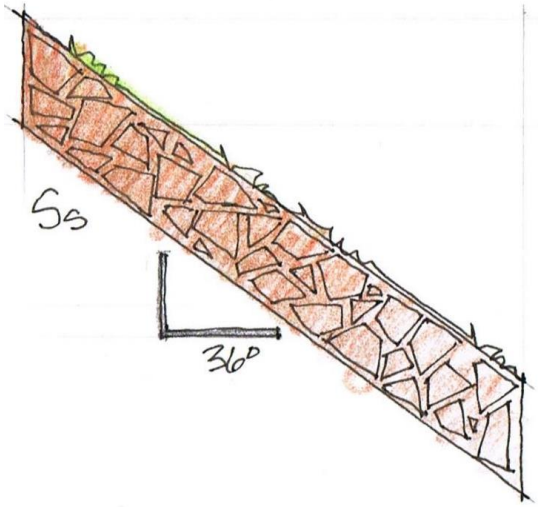
Decision Tree Tool

B_0 – Base Case Cover System

- *0.75m Till-T1*
  - *"Coarser-textured"*
  - *"loose"*
- *0.25m Till – T2*
  - *"finer-textured"*
  - *"loose"*
- *WR surface*
  - *"prepared"*



- *WR surface*
  - *"prepared"*
  - *2.75H:1V*



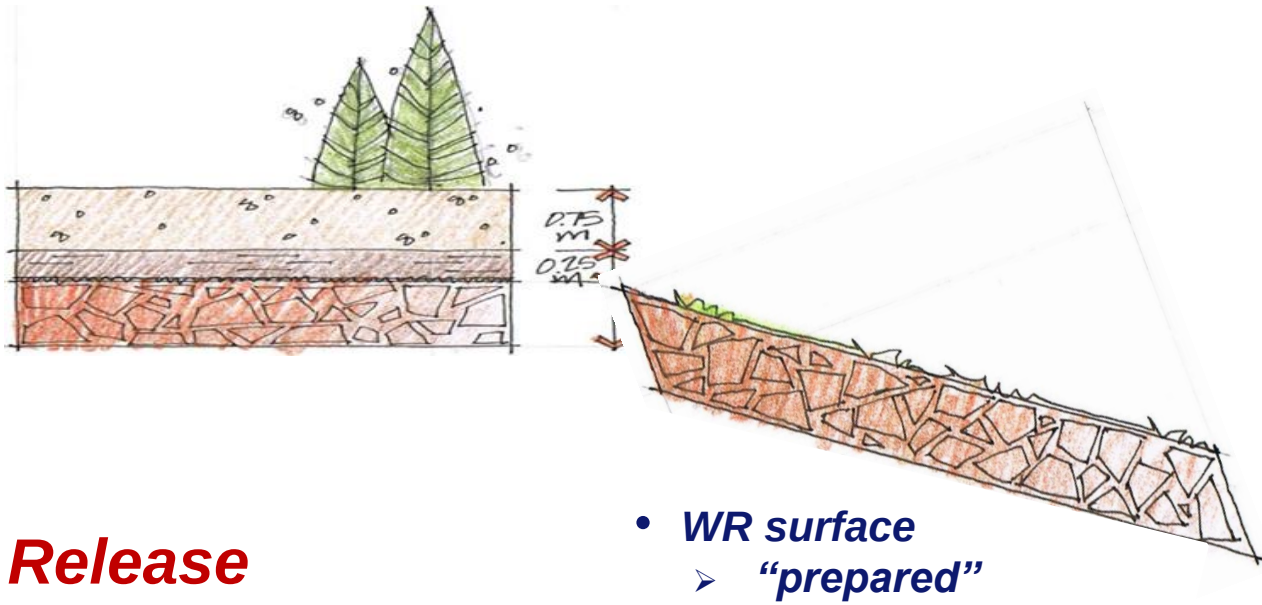
- *Landform Design w/ Enhanced Conceptualization*
  - *Toe and/or elevation constraints*
  - *Constructability*
  - *Geotechnical stability*
  - *Geomorphic stability*
  - *Stakeholder expectations*
  - *etc.*

- *Potential "Trade-Offs"…*
  - *Re-visit expectations / commitments?*
  - *Change design (cost? delays?)*
  - *Additional water treatment?*
  - *Move infrastructure (cost? delays?)*
  - *etc.*

Decision Tree Tool

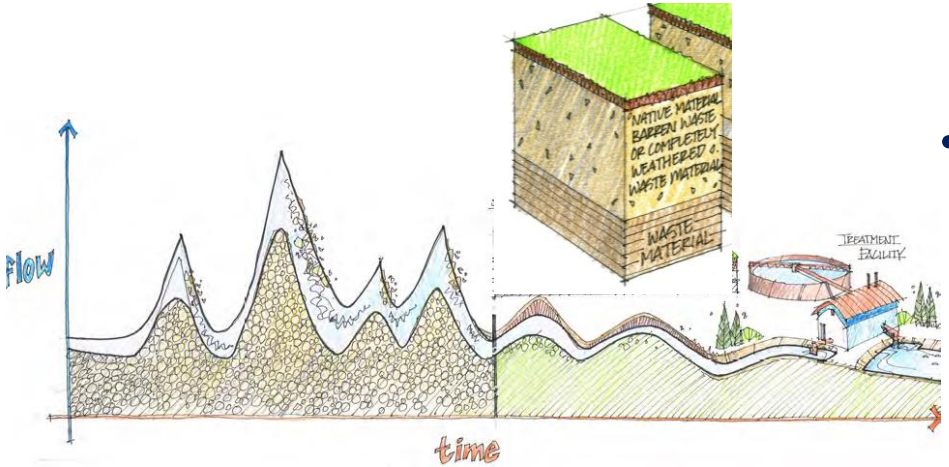
B_0 – Base Case Cover System

- *0.75m Till-T1*
  - *"Coarser-textured"*
  - *"loose"*
- *0.25m Till – T2*
  - *"finer-textured"*
  - *"loose"*
- *WR surface*
  - *"prepared"*



- *WR surface*
  - *"prepared"*
  - *2.75H:1V*

Moisture Store-and Release



- *Potential "Trade-Offs"…*
  - *Re-visit expectations / commitments?*
  - *Change design (cost? delays?)*
  - *Additional water treatment?*
  - *Move infrastructure (cost? delays?)*
  - *etc.*

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Where to get this

INAP

The International Network for Acid Prevention

Members Area

HOME | ACID DRAINAGE | PARTNERS | GARD GUIDE | ICARD | RESEARCH | NEWSLETTERS

Research

Research Projects

Over the years, INAP has instigated and funded a number of key acid drainage research projects to fill knowledge gaps. Cutting-edge technologies are studied, acid drainage (AD) measures at specific sites are examined, and literature reviews are undertaken to summarise AD state-of-the-art.

WHAT WE DO

INAP's objective is to reduce the liability associated with sulphide mine materials. This is pursued in three ways:

1. Networking and Information-sharing
2. Technology Transfer
3. Gap-driven Research

Global Cover System Design – Technical Guidance Document (November 2017)

The Global Cover System Guidance Document, like the GARD Guide, is intended as a best practice summary to assist mine operators, designers, and regulators to address issues where cover systems can be employed. This document builds on previous technical guidance documents on cover system design, construction, and performance monitoring. The Global Cover System Guidance Document will be of interest to individuals who are seeking more detailed information than what is outlined in Section 6.6.6 of the GARD Guide – Engineered Barriers.

A holistic framework for management of reactive materials during operations and at closure is the pillar of the document. The framework for cover system design is presented at a high level, suitable for readers with minimal technical background. It is presented at a conceptual level, using a hierarchy of climate, geology and materials, and topography, leading to an understanding of the patterns of water movement on a specific landscape. Ultimately, these elements will govern how cover systems perform, and it is up to designers to manipulate them to achieve desired performance.

This document presents a conceptual model of how cover system designs might affect contaminant and acidity loading. This model attempts to determine when the varying roles of the cover system design (e.g. control of net percolation or oxygen ingress), might influence loadings. Acknowledgment of these unique relationships provides an opportunity to optimize ML/ARD management in a cost-effective manner. Other key concepts discussed within the document are the role cover systems play over the life of the mine from early conceptualization to long-term performance monitoring considerations.

Application of the holistic framework is achieved through the use of a cover system design tool that walks users through relevant climatic factors to optimize cover system design alternative for a desired performance design criteria. This allows users to understand what a realistic objective is when developing cover system design alternatives based on site-specific climate conditions. Additionally, the tool refers to specific elements integral to the design where an in text commentary is provided. The tool helps identify where potential for management exists on the site, leading to the selection of the most appropriate form of prevention.

The information provided within the tool is not a replacement for site-specific classification and engineering required for cover system design. However, the tool is a means of beginning early conceptualization to help focus further investigation at a site level and to begin to form realistic expectations for cover system performance at an early stage of a project.

→ Click here for the final report (12.4 MB)

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Rainbow of Hope for Children

Habitat for Humanity Initiative

O'Kane Consultants are Proud Supporters of the:

The University of Saskatchewan Global Institute for Water Security

Mine Overlay Site Testing Facility (MOST)

University of Saskatchewan

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