

Integration of GIS Analysis Methods, Visualization and Landform Manipulation Tools for Land Reclamation Within the Watershed Characterization and Modeling System (WCMS)



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Presentation organization

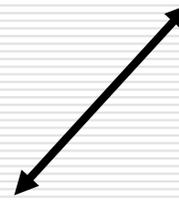
- Background
 - WCMS integration tools
 - Visualization
 - Landform Manipulation Tools
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INTEGRATION OF DIFFERENT TOOLS

GIS BASED LANDFORM /
HYDROLOGIC
CATEGORIZATION
TOOLS (WCMS)

VISUALIZATION - MULTI-
VIEW CAPABILITY DURING
PLAN DEVELOPMENT AND
REFINEMENT

LANDFORM AND
VEGETATION PLANNING
TOOLS



□ INTEGRATION - WHAT DOES IT MEAN?

- MINIMAL REQUIREMENTS FOR DATA TRANSLATIONS, CONVERSIONS AND REFORMATTING
 - ACCESS TO TOOLS THROUGHOUT THE SOFTWARE - TOOLS ON DEMAND
 - EVENTUAL OUTPUT TO OTHER ENGINEERING AND CAD SOFTWARE
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Reclamation Plan

Pre-Design

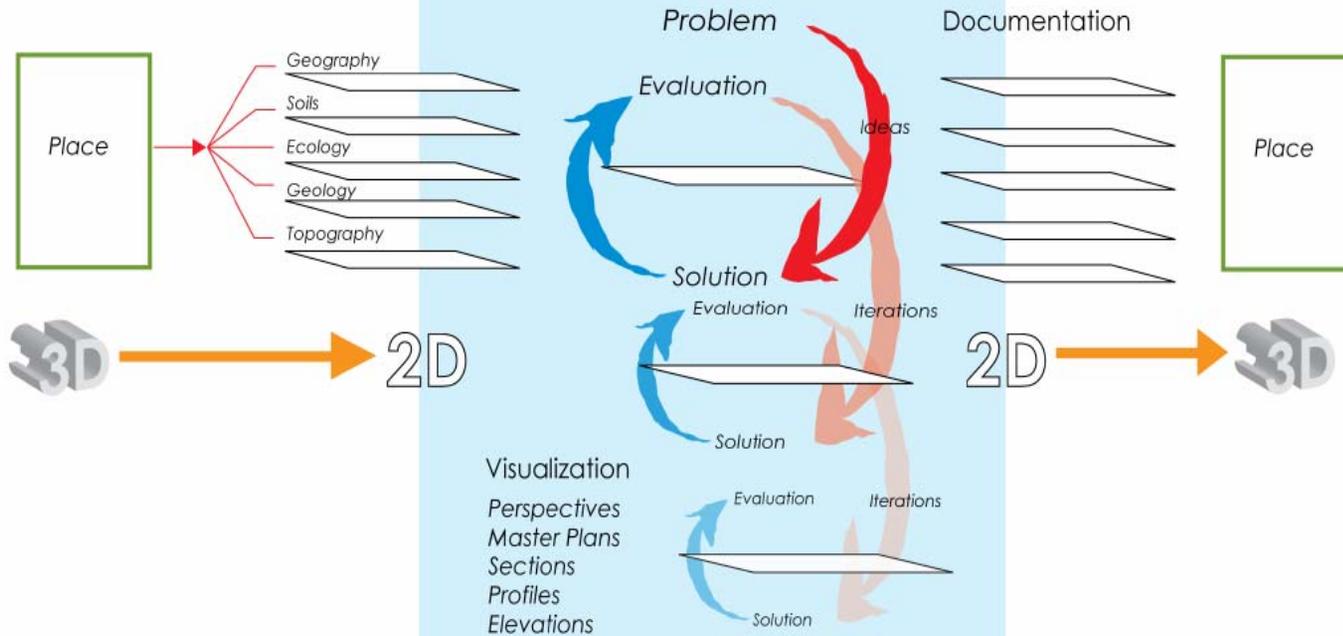
3D information gathered and Represented in 2D

Design

Landform Design

Development

Building the design in the actual environment



Real

Conceptual

Real

Reclamation Plan

Pre-Design

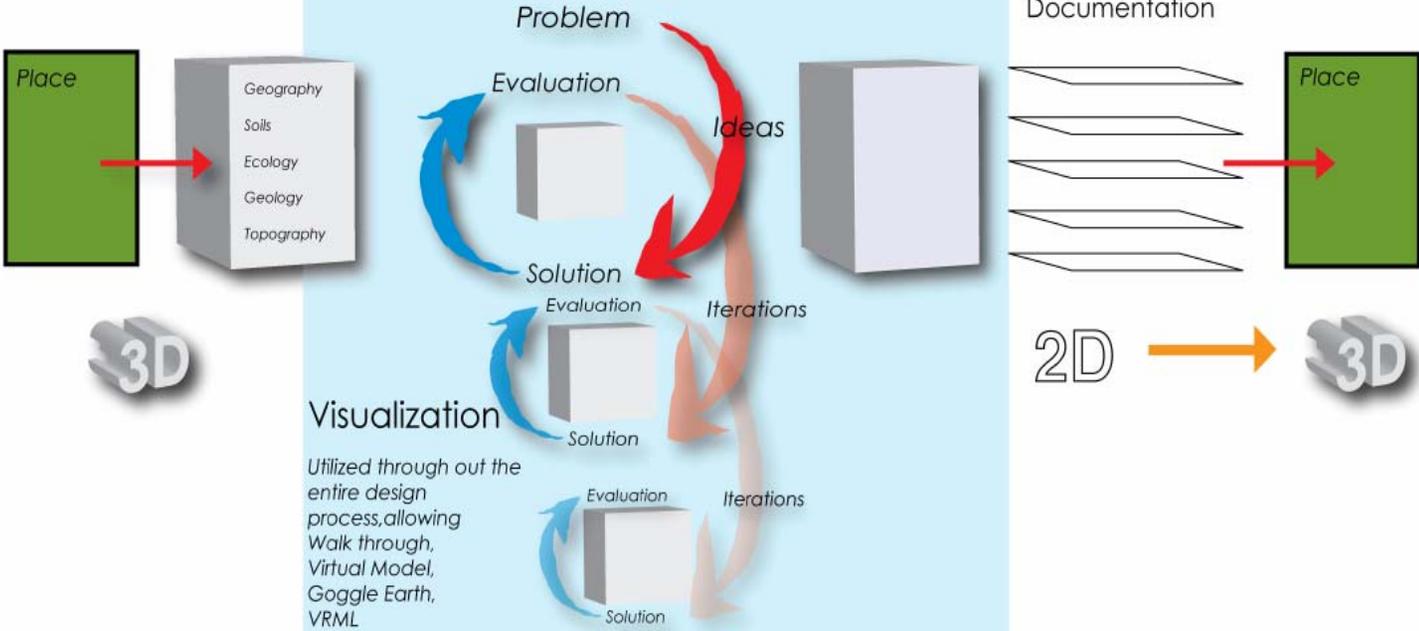
3D information gathered and Represented in 3D Model

Design

Landform Design

Development

Building the design in the actual environment



Real

Conceptual

Real

□ A BRIEF HISTORY

- MANY OF OUR IDEAS CAN BE TRACED TO TO DEVELOPMENT OF ECOSITE - SOFTWARE FOR CREATIVE LANDFORM MODIFICATION IN SURFACE MINE RECLAMATION PLANNING INITIALLY DEVELOPED IN 1980
 - DEVELOPED TO RESPOND TO MOUNTAINTOP MINING, FINAL CUT LAKE AND WESTERN MINING REGS (ALLUVIAL VALLEYS) THAT WERE IN PLAY AT THE TIME
 - SOME USE - THOUGH SIGNIFICANT REGULATORY AND BOND ROADBLOCKS LIMITED USE - PARTICULARLY IN THE EAST
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GIS BASED LANDFORM / HYDROLOGIC CATEGORIZATION TOOLS

- WCMS PRESENTS A WORKABLE BASE OF FUNCTIONALITY - SUITE OF TOOLS TO UNDERSTANDING LANDFORM / HYDRO INTERACTIONS
 - WATERSHEDS
 - DELINEATION - ON THE FLY - SIZE, POSITION AND STREAM CRITERIA
 - CHARACTERIZATION - MEAN, MEDIAN AND EXTREME PARAMETERS
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□ LANDFORM

- PARAMETERS- SLOPE, ASPECT, ELEVATION
 - LANDFORM TYPES
 - CONCAVE AND CONVEX SLOPES
 - RIDGE, FLAT, VALLEY, TERRACE, OTHERS
 - RIPARIAN ZONE
 - OTHER TOPOGRAPHIC INDICES SUCH AS MOISTURE INDEX'S
 - VOLUMETRICS ON EXISTING AND PROPOSED CONDITIONS
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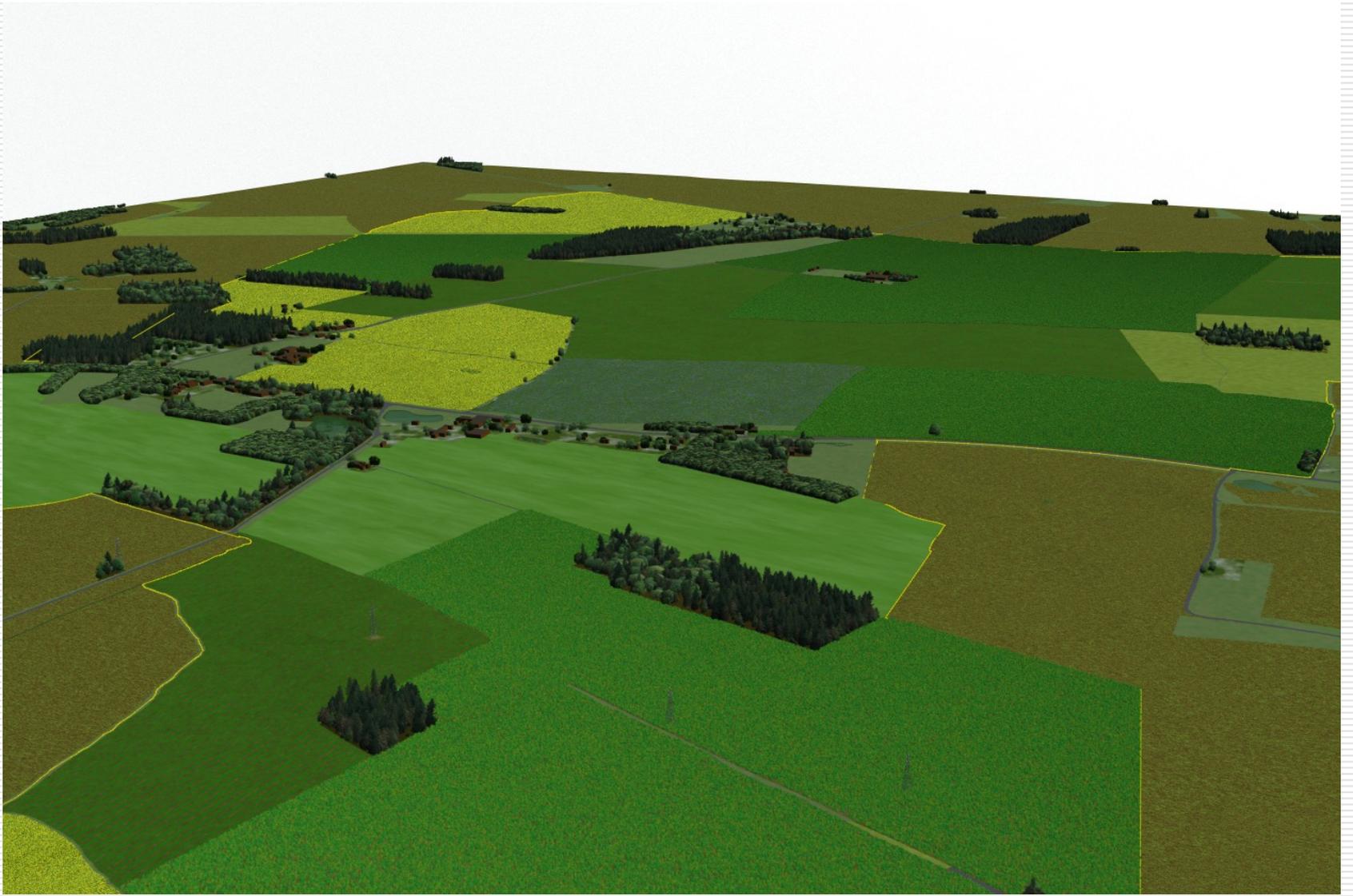
□ OVERLAND FLOW

- FLOW ACCUMULATION AND DIRECTION
 - RAINDROP TOOLS
 - CORRECTION OF DEM'S
 - SYNTHETIC NETWORKS
 - INTEGRATION OF KNOWN AND SYNTHETIC NETWORKS
 - STREAM CHANNELS
 - CROSS SECTIONS AND PROFILES
 - SINUOSITY MEASURES
 - SIMPLE MASS BALANCE MOVEMENT OF MATERIALS
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□ MODELING - HSPF

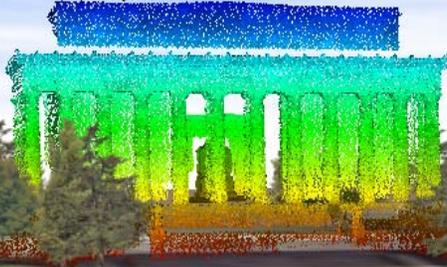
Landscape visualization - state of the state

- ❑ Landscape construction and rendering software
 - ❑ GIS integrated landscape construction software
 - ❑ GIS embedded landscape construction software
 - ❑ Comprehensive "situational awareness" software
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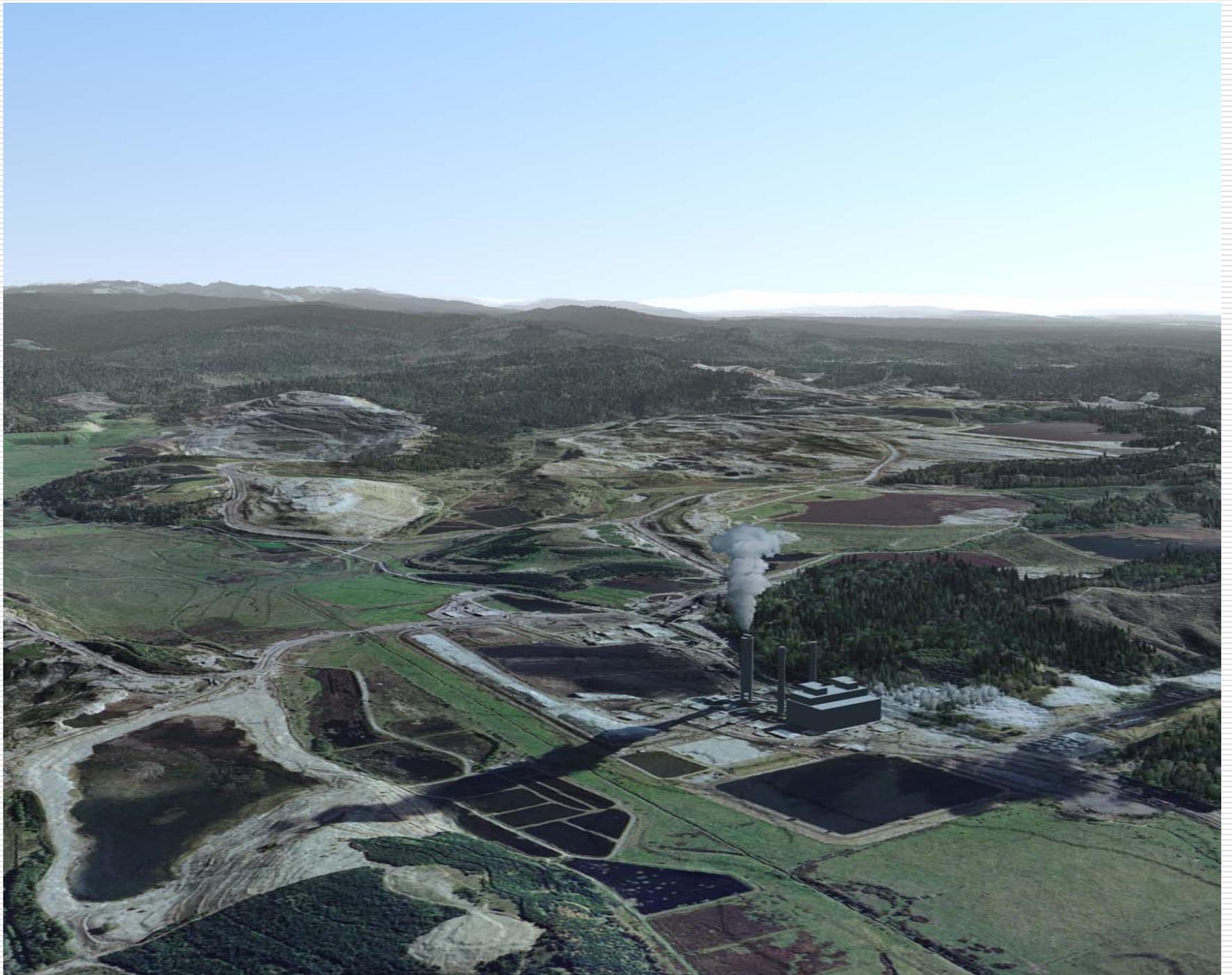






TERRASIM















□ Our work

- Tied to vegetation issues
 - Climate change impacts
 - Invasive species impacts

 - Ecological rules
 - Species mixes and distribution
 - Mortality and replacement
 - Potential impacts of invasives
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Summary

- ❑ Wide variety of tools available
 - ❑ GIS links are critical for reclamation use
 - ❑ Export to engineering applications is key for reclamation planners

 - ❑ Near real-time integration of various tools is currently lacking - except people are starting to get closer.
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□ What does this graphic represent?

- Visualization of topographic change in near real time
 - Also changing the DEM in near real time - can export to GIS and CAD for evaluation
 - Framework can be adapted to rule based and experimental changes
 - Slope changes
 - Elevation changes
 - Landforms
 - Others
 - Results can then be examined with GIS analysis and/or exported to engineering software
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Concept - reclamation planning toolbox

- Integrate GIS tools / visualization tools with active design tools
 - GIS - inventory and analysis and modeling proposed changes as developed in near real-time
 - Link to visualization
 - Understanding existing environments
 - Understanding changes as developed
 - Understand solutions and export to:
 - GIS data bases
 - CAD and engineering software
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Improved toolsets for:

Landform manipulation

Vegetation

Landform manipulation

- Support pre-engineering methods
 - Manipulating landform in the 3d visualization environment
 - Landform manipulation
 - Smart tools - push / pull for points, linear features and areas
 - Set and floating spot elevations
 - Design guidelines - e.g. max slopes, landform insertion - e.g. terraces etc.
 - Proposed landform characterization and testing
 - Flow accumulation and direction grids for proposed landforms
 - Specialized functions
 - Landform classification - slopes, valleys, terraces
 - Topographic moisture indexes
 - Slope and aspect
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Vegetation

- ❑ Improved libraries
 - ❑ Growth site - forest vs. specimen
 - ❑ Seasonal and age differences
 - ❑ Site quality and ecological rules
 - ❑ Potential disturbance regimes - invasives
 - ❑ Improved drawing efficiencies and deployment
 - ❑ Smarter use of billboards and 3d vegetation
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Summary

- ❑ Toolbox is framework for development and is not envisioned to ever be a completed system
 - ❑ Plans for system developing the system and developing a prototype data base for a portion of southern WV - mountaintop mines
 - ❑ Searching for a western surface mine for development.
 - ❑ Work in the next year will concentrate on landform tools
 - ❑ Geomorphic landform design
 - ❑ Landform design tools
 - ❑ Hydro-geomorphic surface water system design
 - ❑ Hopefully can generate interest for moving into mining applications environments.
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