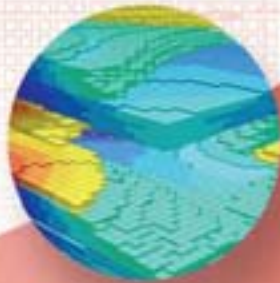


CARLSON MINING

PLANNING, ENGINEERING, OR AUTOMATING
GET THE TOOLS YOU NEED



Autodesk[®]
Authorized Developer



Authorized
IntelliCAD[®] Technology
Consortium Member



Carlson[®]

INTRO TO MINING

Carlson Mining

The acknowledged choice of the U.S. coal mining industry, Carlson Software provides legendary ease-of-use, combined with powerful features and AutoCAD®-based – **and now also IntelliCAD®-based** – graphics, all at a low cost and with FREE technical support.



Courtesy Olga Liferova, Moscow, Russian Federation

Carlson Mining: Built to Meet Your Needs

Carlson Software's corporate office location in Maysville, Kentucky, explains, in part, the company's emphasis on mining solutions. Maysville borders the rich coalfields of Eastern Kentucky and is within a 5-hour drive of virtually all mines in the Appalachian and Illinois coal basin. Through the preparation of 13 coal permits during 1981 and 1982 prior to forming Carlson Software in 1983, it became clear to me that there was great interest in automation of processes such as mine projection and as-built mapping, pond design, valley fill design, geologic modeling, overburden and strip ratio calculations, stability analysis and reserve studies.

From the beginning, Carlson Software focused on both surveying and mining applications. As early as February 1984, a mine projection routine was developed for the Apple computer to produce mine map plans. The very first purchaser, Ingram Coal Company of Pike County, Kentucky, used this program for mine mapping on Apple equipment. Word spread up and down John's Creek and throughout the county, and one-by-one, other mines followed. The software moved to DOS and later to Windows. A major breakthrough came in 1988 when, having just learned Autolisp

the previous weekend, I taught James Copely of Brooks Run Coal in Birch River, West Virginia, how to program in Autolisp. Jim, in turn, quickly created the beginnings of a "take-up" note mine entry program inside AutoCAD®. Carlson then took this kernel and, with permission, overhauled and expanded it into the full mine mapping solution in AutoCAD that launched the Carlson Underground Mine Mapping program. This spread quickly through the entire Appalachian and Illinois basin. Many hours were spent adding in the subtle changes requested by individuals such as Darrell Trent (Eastern Coal, now Patriot) and Mike Ross (Foundation Coal) as well as company-driven improvements from Black Beauty Coal, Mapco, and others, all helping to finalize the routines.

From there, we added full geologic modeling, surface mine design routines and equipment scheduling. Mine engineers from Kentucky and West Virginia seeded the software into the Gillette, Wyoming, basin, and the federal Office of Surface Mining added their recommendations through the TIPS program headed at that time by Linda Wagner and Joe Galetovic. Through these additional connections, Carlson

Software spread through the entire United States coal market and has expanded beyond coal into the phosphate, iron, limestone, aggregates, granite, clay and even the hard rock markets.

—Bruce Carlson
President and Founder
Carlson Software

"Carlson is always looking for ideas and ways to improve the software and has always been right there to help each user and take their suggestions and input. That input is basically put into the programs and shared with everyone."

—Darrell Trent
(Carlson Software user since 1990)
Director of Engineering Processes
Patriot Coal Corporation



For more information call or visit: 800-989-5028 • 606-564-5028 • www.carlsonsw.com • mining@carlsonsw.com

Manage drillhole data, plus calculate strata models, quantities & qualities

DRILLHOLES

Get seamless operation. Carlson Geology can utilize almost any type of data, importing nearly any known ASCII drillhole format and more than 30 fixed drillhole formats from other companies and programs.

Produce accurate models. Quality attribute equations of unlimited parameters coupled with unlimited grid sizes and resolutions enable users to produce detailed models of any size.

Automate your data. Drillhole correlation and fence diagrams are readily developed with automated macros to update the strata names. All labels are user-defined – encode collar, strata and bed data along with lithologic information and unlimited quality parameters.

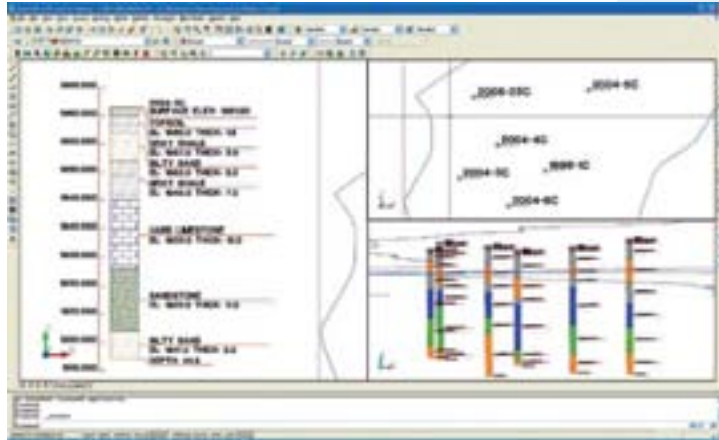
Turn out reports quickly and easily. The powerful Hole Manager program stores drillhole data so queries on drillholes for various statistics are quickly run. 2D and 3D diagrams of the geologic model allow for observation from any desired viewpoint.

Differentiate by quality and tonnage.

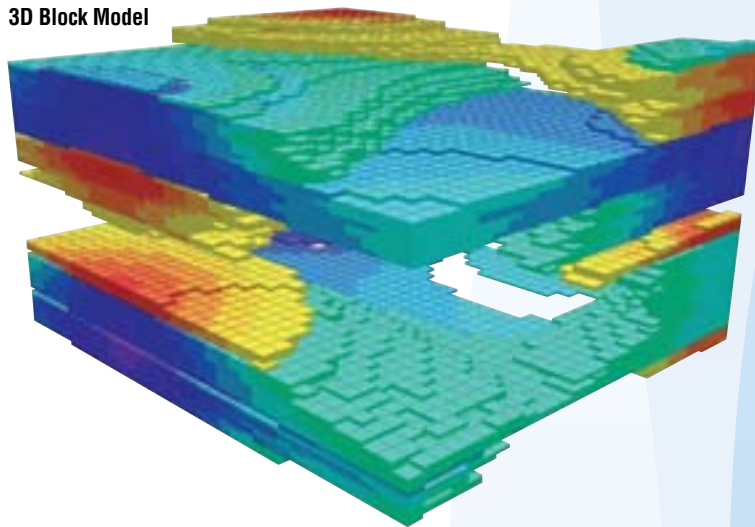
“Split Bed” allows for division of large coal, limestone and ore seams into beds defined by elevation, thickness or quality and/or grid surfaces, allowing for compositing of qualities and tonnage calculations for each bed zone.

Analyze for compliance. “Parameter Compliance” examines drillholes for compliance against parameter specifications for ore attributes, highlighting drillholes that pass. Ore bodies can then be broken down into types of ore based on filtering raw drillhole data through parameter compliance files that are associated with specific ore characteristics. This enables mapping of the grades of ore.

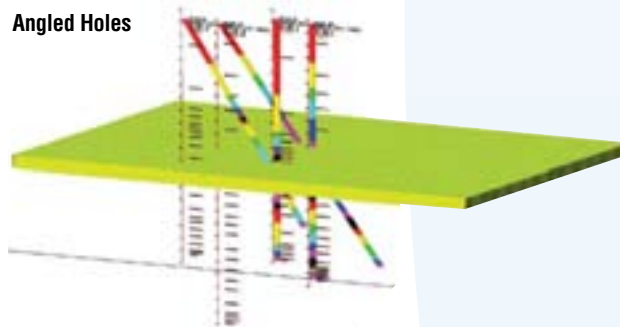
Drill Holes View



3D Block Model



Angled Holes



ISOPACH MAPS

- Utilize your correlated and validated drillhole data and generate isopach maps complete with custom colors and naming.
- Translate highwall, pit and underground mine survey information into more accurate structure modeling.
- Generate maps from stored models or directly from screen-selected drillholes.
- Update entire sets of grid files and isopachs when new drillholes are added from new drilling programs.

GRIDDING

- Supports all the major geological modeling techniques, including triangulation, inverse distance, Kriging, polynomial and least squares.
- Get error reporting and recommendations for best modeling method for the attribute gridded.
- Quickly modify gridded surfaces within defined areas, including grid-to-grid algebraic operations, merging, nulling, extrapolating, and changing resolutions.
- Get real-time verification of the grid values with the cursor.

BLOCK MODELS

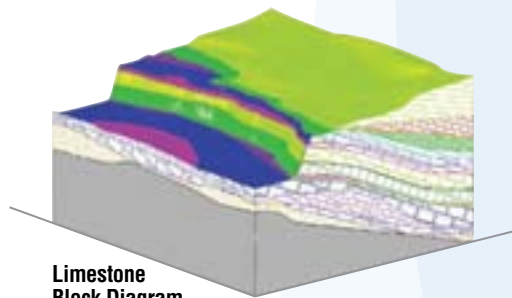
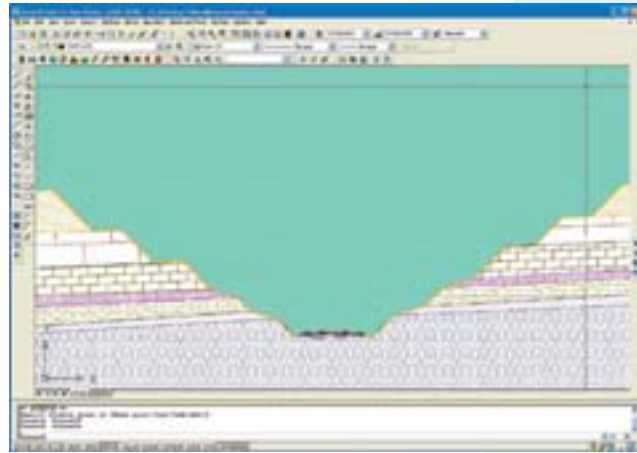
Allows user to define modeling method: by 3D inverse distance, Kriging, or discrete. The block model can then be further analyzed and displayed through user-entered grade parameter files, viewed in 3D and cross sections and used for reserve calculations of the different grades.

RESERVES

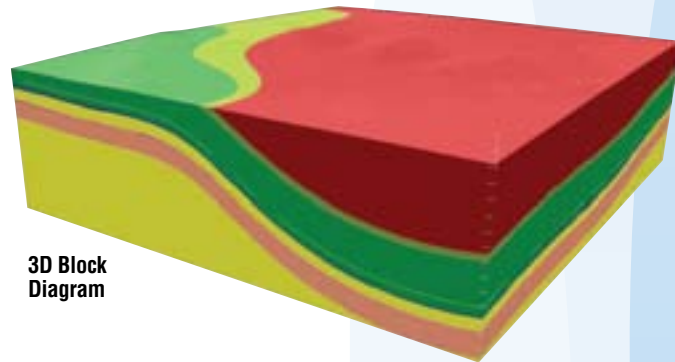
Calculate the reserve for each pit and bench instantly with the 3D Surface History. And play it back in real time for 3D mine simulations.

- Calculate the reserve for each pit and bench instantly with the “Surface History Report.”
- Output a custom report, with optional GIS links, with the “Reserve Classification” command. Include tonnage, overburden, strip ratio, area mined, qualities, periods equipment, and cost in user-defined formats.

Road Side Geology

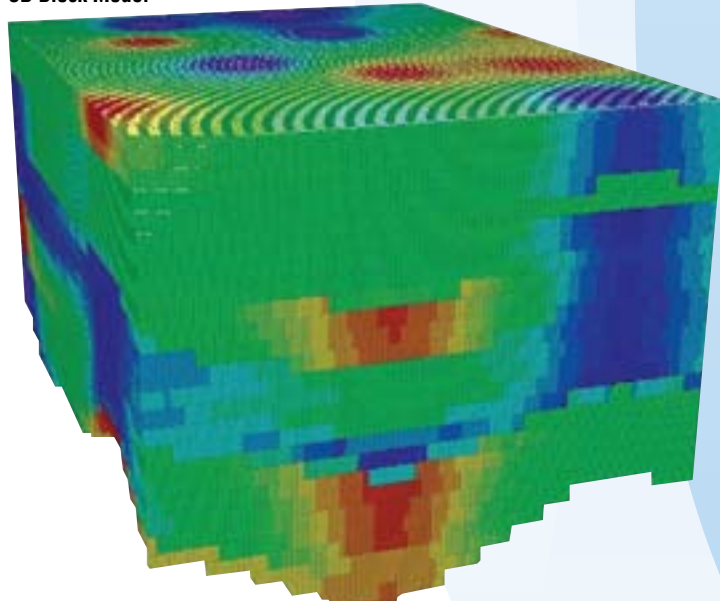


Limestone Block Diagram



3D Block Diagram

3D Block Model



Get all the tools for precise designing and scheduling of the mine projections

Mine Projections & Layout: Create complete mine projections and ventilations in seconds vs. hours, thus saving both time and money with Carlson Underground Mining. Get the power to draft the mine automatically from the note entry.

Individualize your design with the following:

- Choice of pillar designation and preferred method of locating pillars and rib lines
- Ability to choose ventilation directions including automatically placing stops, man-doors and escape ways
- Option to enter mine survey notes by azimuth or in a spreadsheet-type dialog with the ability to configure (and set as default) your own style of note entry
- Use the full array of mine symbols from the Mine Symbol Library or define your own to create the final map

GENERATE TONNAGE REPORTS

- Computed by either average or grid-based methods
- Coal thickness isopach maps created in conjunction with or independent of drillhole data
- Intelligent layering allows program to auto-detect perimeter, pillars, and coal sections
- Hatching of mining areas provides accuracy back-up check
- Automatically sets boundaries by user-defined criteria including property or lease ownership

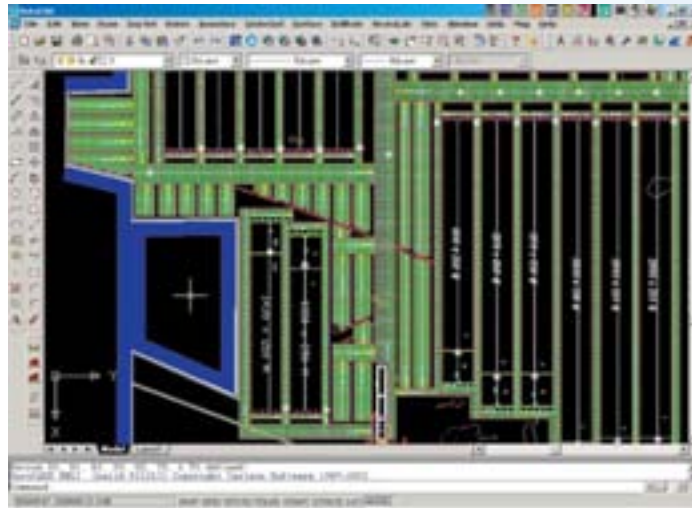
Determine Underground Mine Reserves complete with quality attributes, thickness, and grades calculated and displayed using user-defined parameters, such as:

- tonnage
- qualities
- overburden
- periods
- strip ratio
- equipment
- area mined
- cost

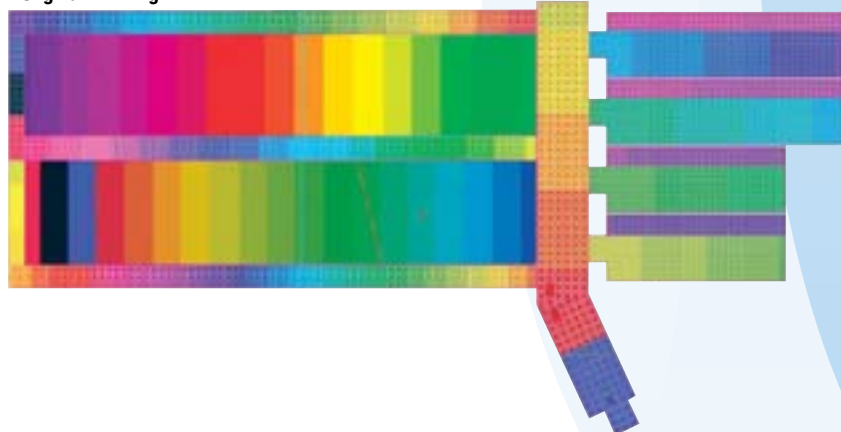
Timing is everything! Precedence is critical in underground mining. Carlson Mining's timing routines provide valuable information to help assign equipment to reduce idle time and increase production rates by avoiding illogical, delaying layout elements and precedence. Retreat mining may be part of the schedule, splitting the panels by advance and retreat.



Longwall Planning



Longwall Mining



Carlson Basic Mining Module Both Affordable and Upgradable

Looking for the basics at a low price? The Carlson Basic Mining Module provides exactly what you need. It's the perfect AutoCAD®/IntelliCAD® mining add-on to Carlson Civil and is geared to the "occasional" miner.

Features include:

- Basic drillhole entry
- Reserves and fence diagrams (on-the-fly only)
- Underground mine mapping
- Layout
- Quantities

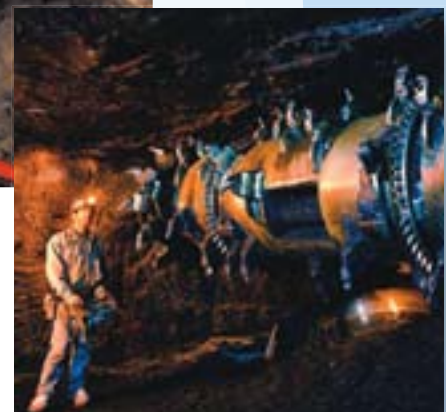
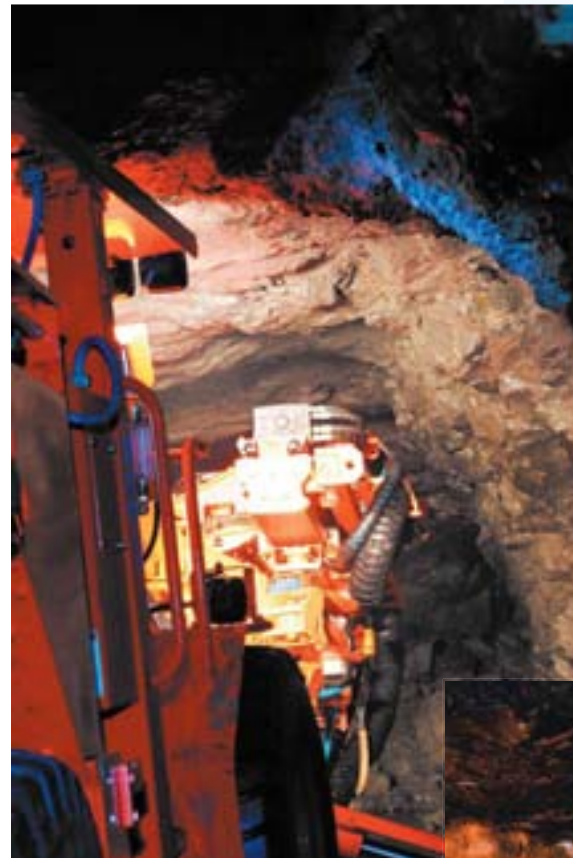
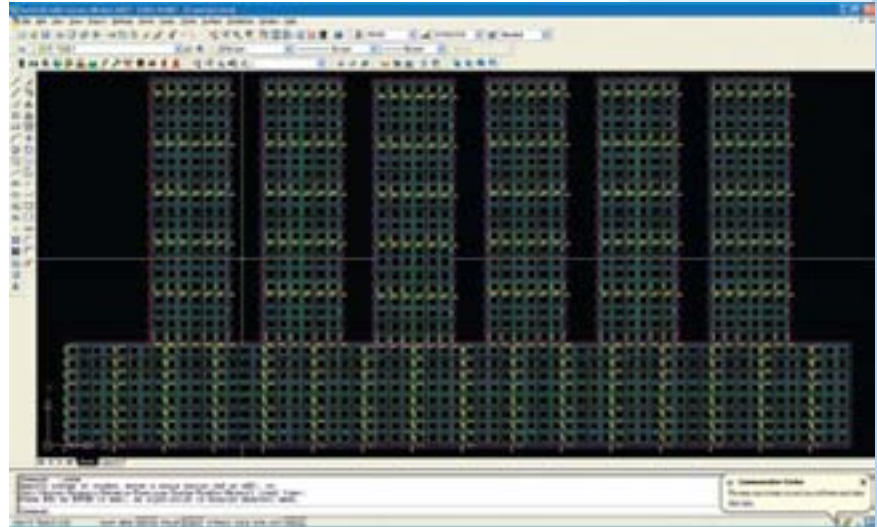
With strong roots in the coal mining region of the U.S. Appalachians, this software module was developed with direct and valued input from mine workers.

SDPS

Subsidence Deformation Prediction System

SDPS is a niche program developed through the Virginia Poly-Technical University. Carlson Software is the world's only distributor of this high-end program to predict and represent the settlement of the surface topography due to underground mining. Use it to generate isopachs and subsidence based on depth of mining, geological characteristics and mine design parameters.

Advanced Projections



SURFACE MINING

COMBINE COMPLEX MINE DESIGN WITH PRECISE SCHEDULING AND TIMING

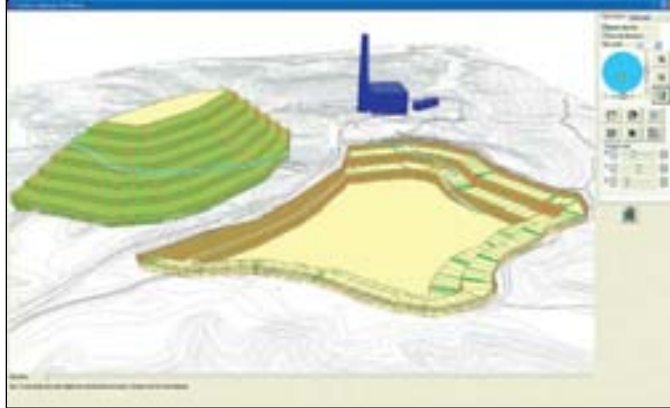
Pit Design & Layout. Get intelligent routines for complex surface mining techniques and design. The layout can be of any shape. Automatically subdivide the pits further and identify by ownership for instant lease and royalty calculations.

Find the most efficient mine design by testing layouts in plan, section, and 3D view:

- Create 3D pits with varied bench parameters on different sides of the pits
- Change the slope, width, and height of the benches as the pit advances through different material or depth
- Design pits to go down and in, or up and out from the starting baseline (perfect for quarry design)
- Automatically size 3D Spoil and stockpiles with Design Spoil Pile with options for varying the elevation or sliding a side to get to the targeted volume. Design back fill dumps to advance the pit with full simulation.
- Obtain pit optimization by using Define Fill/Cut to have 3D benched pits descend into the ore zone
- Select the slope and starting location to have ramps automatically carved into the pit even with switchbacks
- Obtain pit optimization placement and depth from the block models converted to cost models via Lerch-Grossman algorithm

Design Regrade. Design in cross section view for balanced cut and fill sections of final pit and spoiled surface. Convert these perfectly balanced cross sections to fully 3D plan view to produce your Post Mine Topography.

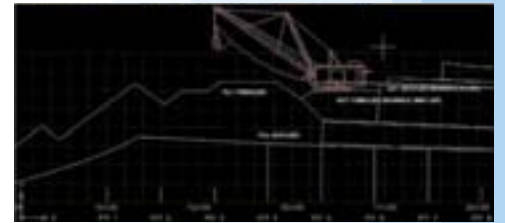
3D Pit and Stockpile Design



Reporting & Graphics for all Carlson Mining Modules

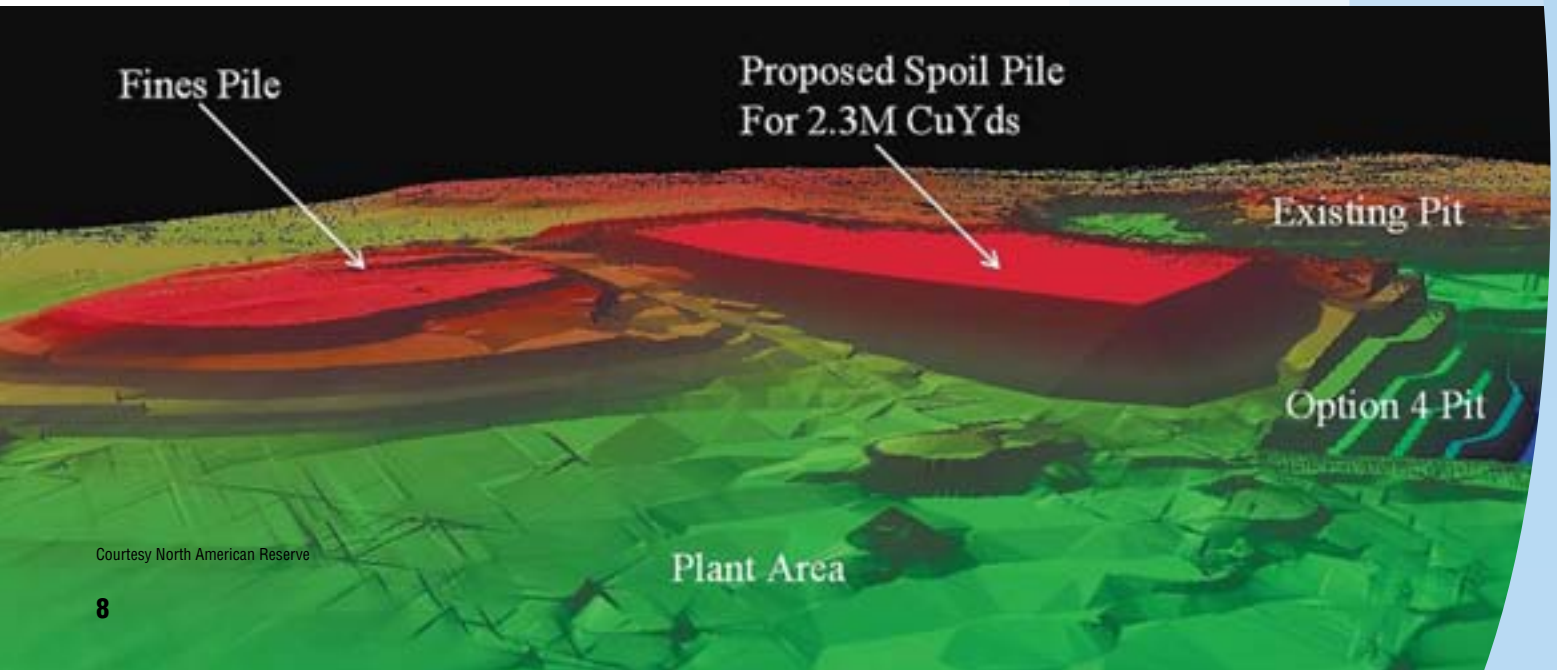
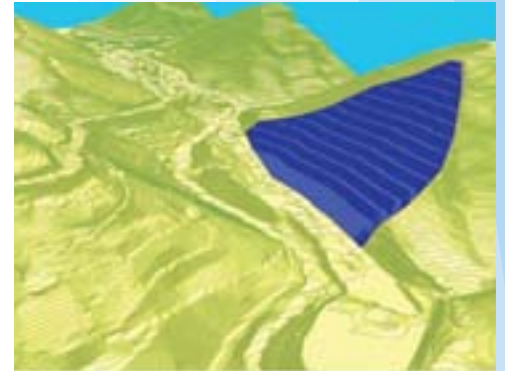
Report formats are easily constructed and saved for recall for specific applications or different mine sites. The detailed reports can be directly linked and exported to Microsoft Excel or Access for spreadsheet and database presentation. Zones of mining can be user-defined with any color scheme in the form of solid fill or hatching. Report formats can be named, saved, and recalled with drawings and dialog boxes incorporated into documents via simple cut and paste methods.

Dragline Range Diagram



Courtesy Brian Groff, Bucyrus, Mt. Sterling, Ky.

3D Benches



Carlson specializes in modeling surfaces – any finished landform can be created from the initial contour map

Use Carlson to:

- Integrate geologic and surface modeling with plan view, 3D view, and section view mine layout routines;
- Get accurate calculations of overburden, ore quantities, strip ratios, rehandle, and, ultimately, cost;
- Easily convert any road or ditch centerline, dam, building pad, pit or other defined object into a final terrain.

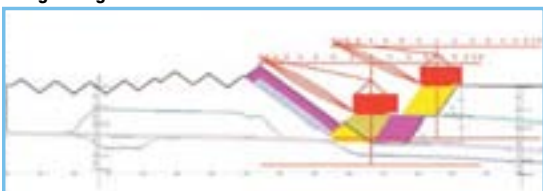
CUSTOMIZE SCHEDULING

With Carlson, you can accurately schedule and monitor your mine

- Base surface mining rates on overburden removal or ore tonnage
- Apply equipment calendars/usage to individual or collective fleets
- Create multiple calendars to explore “what if” scenarios
- Get color-coded view to highlight the production timing and statistics
- Base timing on calendar periods or tonnages or on volumes of overburden
- Set production requirements per user-defined time periods
- Attach precedence requirements to any timing blocks
- Base benches on strata, elevation, or quality
- Automatically create 3D surfaces of each period scheduled to simulate the mine progression.

Get interactive Range Diagram options for detailing dragline sequences and associated volumes. Control dragline height, reach, and digging depth limits. Combine dozer push analyses with cast blasting, shovel, and dragline analysis to obtain the optimal combination of equipment and mining sequencing.

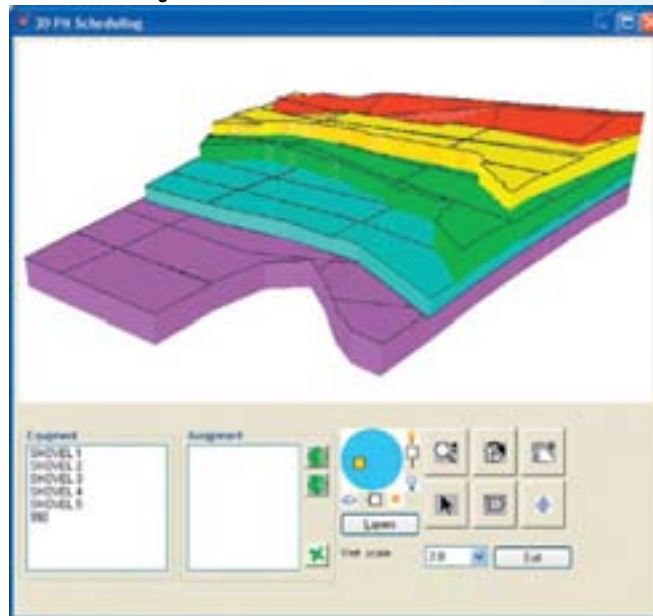
Range Diagram



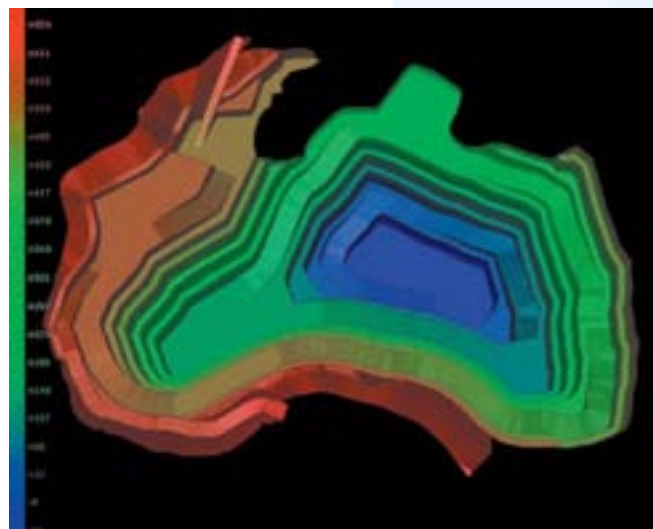
3D Dragline



3D Pit Scheduling



3D Pit



Get the total picture to improve mine efficiency and lower costs

Incorporate 4D and 5D into your mine planning

Use Carlson Mining's new Mine Financials module to apply 4D and 5D (time and cost) computing directly to your real-life mine scenarios. Enables scheduling and tracking all mining resources and activities – work crews, in-use and non-assigned equipment, supplies, fuel, labor and miscellaneous costs – to determine the most cost effective and efficient way to achieve your desired result.

Individualize to location, task, and equipment

Decide where and when you wish to begin mining and Carlson Mine Financials will estimate when you can expect to be complete and how much it will cost. Costing is completely individualized as it is driven by mine plan, mine characteristics (difficulty factors) and additional factors that control the production. The software can compute not only how fast a deadline can be accomplished, but how many and exactly which pieces of equipment will be needed based on a hard-stop deadline.



Identify the various mining equipment vehicles such as shovels and continuous miners – they have production rates assigned to them, whether by tons, cubic yards or linear foot of advance – and then time-based projections can be computed based on the terrain models, depths and ability of the equipment.

Sales Contracts

Contract ID	Contract Name	Contract Type	Contract Status	Contract Start Date	Contract End Date	Contract Value	Contract Units	Contract Rate
CONTRACT 1	CONTRACT 1	CONTRACT 1	CONTRACT 1	CONTRACT 1	CONTRACT 1	CONTRACT 1	CONTRACT 1	CONTRACT 1
CONTRACT 2	CONTRACT 2	CONTRACT 2	CONTRACT 2	CONTRACT 2	CONTRACT 2	CONTRACT 2	CONTRACT 2	CONTRACT 2
CONTRACT 3	CONTRACT 3	CONTRACT 3	CONTRACT 3	CONTRACT 3	CONTRACT 3	CONTRACT 3	CONTRACT 3	CONTRACT 3
CONTRACT 4	CONTRACT 4	CONTRACT 4	CONTRACT 4	CONTRACT 4	CONTRACT 4	CONTRACT 4	CONTRACT 4	CONTRACT 4
CONTRACT 5	CONTRACT 5	CONTRACT 5	CONTRACT 5	CONTRACT 5	CONTRACT 5	CONTRACT 5	CONTRACT 5	CONTRACT 5
CONTRACT 6	CONTRACT 6	CONTRACT 6	CONTRACT 6	CONTRACT 6	CONTRACT 6	CONTRACT 6	CONTRACT 6	CONTRACT 6
CONTRACT 7	CONTRACT 7	CONTRACT 7	CONTRACT 7	CONTRACT 7	CONTRACT 7	CONTRACT 7	CONTRACT 7	CONTRACT 7
CONTRACT 8	CONTRACT 8	CONTRACT 8	CONTRACT 8	CONTRACT 8	CONTRACT 8	CONTRACT 8	CONTRACT 8	CONTRACT 8
CONTRACT 9	CONTRACT 9	CONTRACT 9	CONTRACT 9	CONTRACT 9	CONTRACT 9	CONTRACT 9	CONTRACT 9	CONTRACT 9
CONTRACT 10	CONTRACT 10	CONTRACT 10	CONTRACT 10	CONTRACT 10	CONTRACT 10	CONTRACT 10	CONTRACT 10	CONTRACT 10

Cost Register

Cost Item	Production Quantity	Unit Cost	Total Cost
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00
Production Supplies	1000.00	10.00	10000.00

Figure 1: Carlson Mine Financials

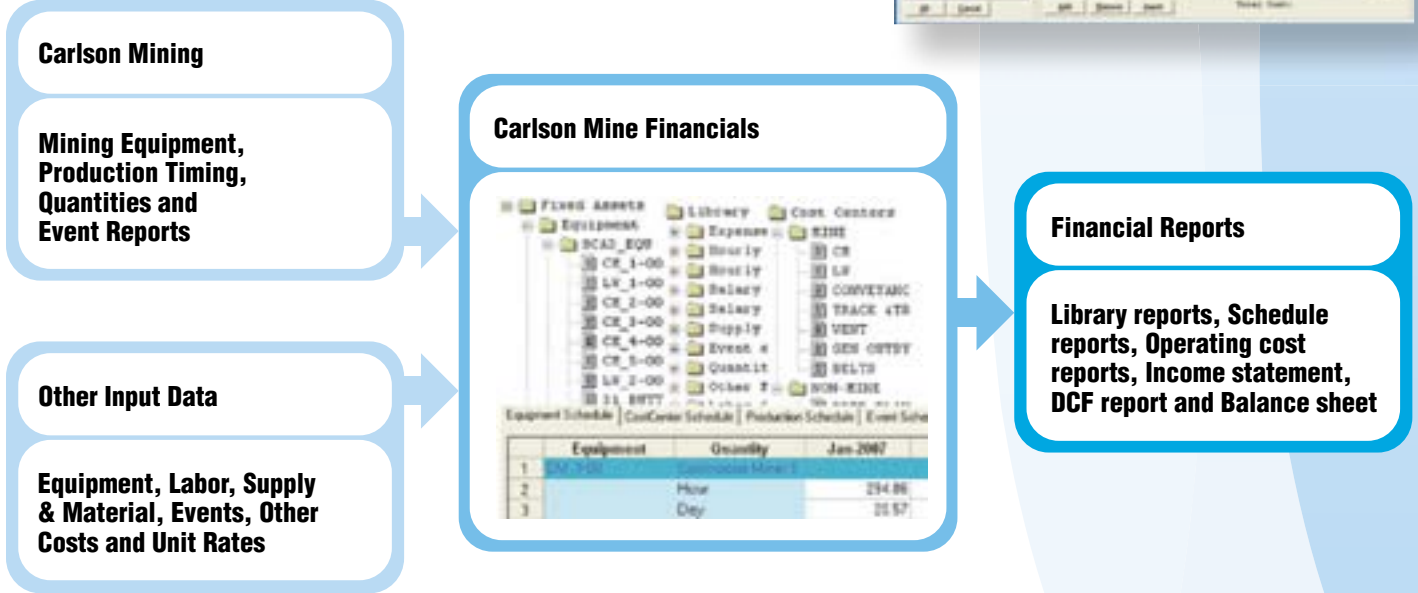


Figure 2: Carlson Mine Financials Overview



Intuitive Data Flow

Carlson Mine Financials, a full financial analysis program, takes its output from the underground and surface mine scheduling routines found in Carlson Mining. The flow of data is always from top to bottom and left to right and all top items are defined before moving on. The ASSETS section serves as input to the LIBRARY section, which serves as input to the COST CENTERS section. The REPORTS section organizes and collects all this inputted data to create a variety of cost and financial reports.

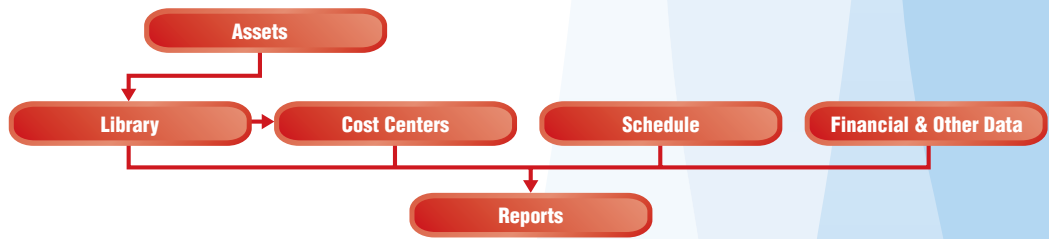
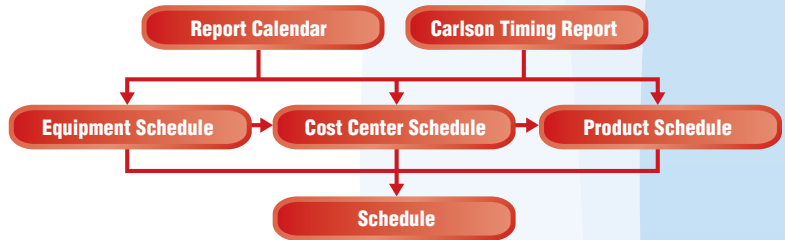


Figure 11: Data flow for Schedules



Customize your reports

Both the timing and the content of reports generated by Carlson Mine Financials can be customized to meet your needs. Define your own budgeting and reporting periods and the reports will be available as determined by you.



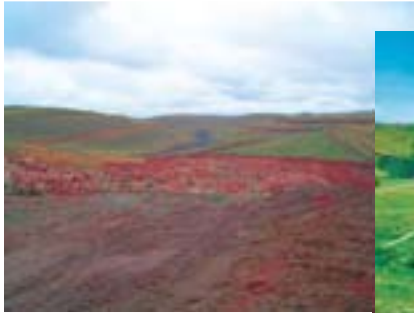
Natural Regrade – the ‘GREEN’ way to reclaim disturbed lands

Return disturbed land to its natural, self-maintaining state...

You'll quickly accomplish what takes nature thousands of years.

With traditional land reclamation.

The stability that mature, natural landforms have is not achieved using uniform slopes with artificial water conveyances and expensive erosion control gimmicks that are both difficult and costly to maintain.



With Carlson Natural Regrade.

Fluvial geomorphic principles are used to make an aesthetically pleasing, natural, and stable landform that thrives despite the strong and often uncontrollable forces of nature.

Harmonize with nature and **SAVE!**

Allows designers to identify the type of drainage network, i.e., stream channels and valleys, which would tend to form over a long time given the site's earth materials, relief, and climate to achieve a stable landform, and to design and build that landform. The resulting slopes and stream channels are stable because they are in balance with these conditions. Rather than fight the natural forces that shape the land, GeoFluv™ helps the user create a landscape that harmonizes with these forces. And it *costs less* to implement, too – repeatedly, project costs come in below estimates for traditional methods – and it does not require expensive long-term maintenance and repair.

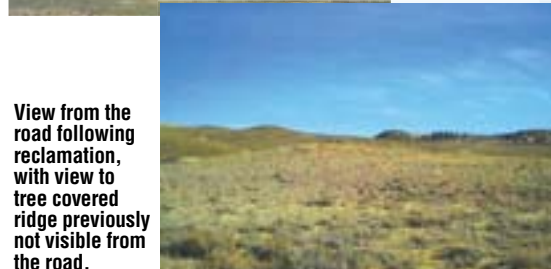
Do it right the first time with Natural Regrade for mine reclamation. Those in the future will thank you. Here's why:

- Resultant design will not only meet, but exceed environmental standards
- Reclaimed land will encourage wildlife and plant diversity
- Natural beauty of the reclaimed land will be returned, actually enhancing the local view shed
- Design will provide maintenance-free stability against erosion; true sustainability
- Water quality on reclaimed land will be comparable or better than surrounding undisturbed lands

Natural Regrade to the rescue – re-do past failures and achieve sustainability



View from the county road of eroding 3:1 slope before reclamation.



View from the road following reclamation, with view to tree covered ridge previously not visible from the road.

Utilizing Carlson Natural Regrade, the Wyoming Department of Environmental Quality, Abandoned Mine Land Division (AML) Project 16N, Phase 3, successfully stabilized an eroding spoil dump, enhanced the local view shed, created habitat diversity and provided a significant source of fill material for highwall hazard mitigation efforts.

“The benefits of this project will be enjoyed by generations to come.”

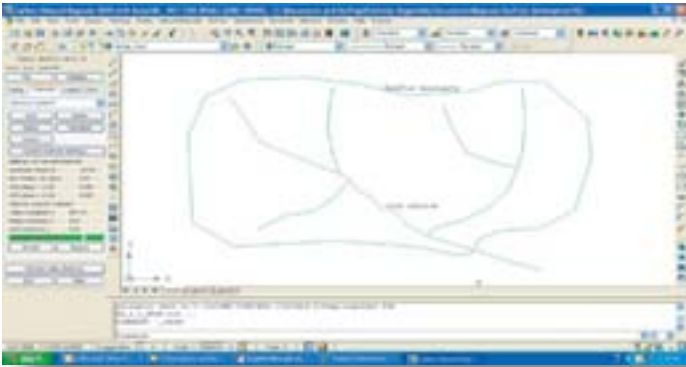
—Rick Chancellor

AML Division Administrator
Wyoming Dept. of Environmental Quality,
Abandoned Mine Land Division

NATURAL REGRADE FOR THE FUTURE

**There is something new happening in landform design.
It's the future. It's natural.** *Be a part of it.*

Named a "TIPS Core Software" in 2007 for mine reclamation design and review use by the U.S. Dept. of the Interior's Office of Surface Mining, Reclamation and Enforcement.



GeoFluv™ dialog box leads the user through the process

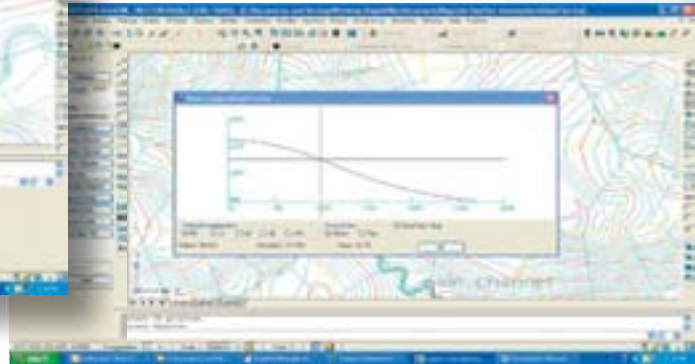


GeoFluv™ integrated 3D channel network using local empirically-determined drainage density

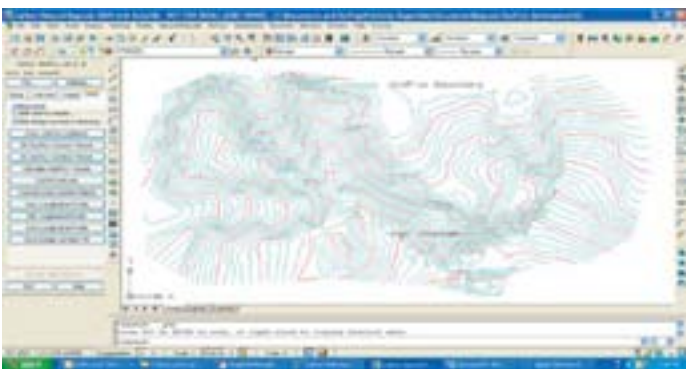
Natural Regrade automatically sets channel confluences to grade and has improved trimming in 2009



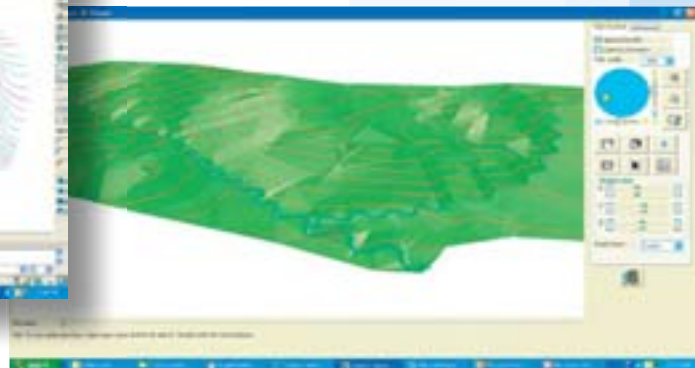
Plan view and cross-sectional channel geometry based on bankfull discharge has additional floodprone area



GeoFluv™ creates complex slope profiles with convex-to-concave inflection point determined locally



Natural Regrade creates a design for a stable landform that satisfies user inputs



Powerful 3D viewer aids final design editing of the draft landform



Natural Regrade is ideal for integrating with Global Positioning System and machine control, for example Carlson Grade, to simplify and speed construction and reduce costs. The need to survey and stake the designs in the field is eliminated using these technologies.

Planning, constructing, or improving a mine? Turn to Carlson survey-related solutions

Go from data collection through data processing leading to design

Carlson's survey solutions include Carlson SurvCE and Carlson Field for data collection, the Carlson Surveyor/Surveyor+ or CarlsonMINI handheld data collectors and the office software chosen by more surveyors than any other, Carlson Survey. Designed with the end-user in mind, Carlson surveying solutions will seamlessly update the monthly mine plans to its current position for easy month-end calculations.

Carlson Survey Increase production with this intuitive survey solution

Take your choice with Carlson Survey - either Carlson Survey for AutoCAD®, with built-in IntelliCAD®, or Carlson Survey embedded with AutoCAD OEM engine.

Carlson Survey represents more than 25 years of progress by Carlson Software in this complex area of work. With Carlson Survey, you'll get:

- Drivers to connect with virtually every manufacturer's proprietary hardware and software;
- Versatile and intuitive raw data editing and processing;
- Network Least Squares – ability to simultaneously process and adjust networks of traverse, level and GPS data, handling the special conditions of triangulation, resection and trilateration;
- The easiest and most powerful Field-to-Finish utility for automatic generation of linework and symbol placement;
- Legal description and deed writing and reading; and
- A full compliment of COGO tools for every survey application.

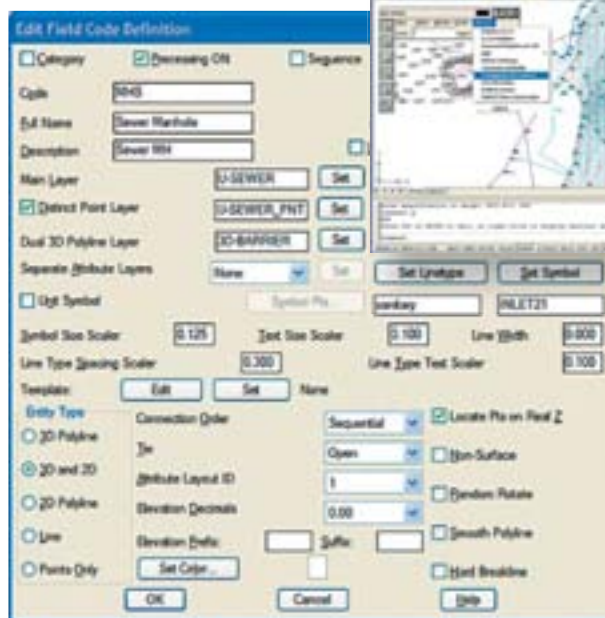
Carlson Field*

Designed for GIS work. Allows the collection of data associated with identifiers such as wells, sumps, power lines, artifacts and other standard GIS elements.

- Plots points with symbols selected from symbol library
- Plots linework. Field-to-finish is completed in the field

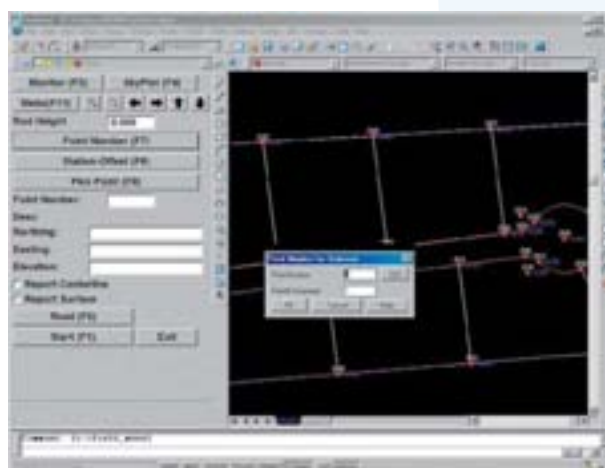
- Does stakeout by point, station and offset, and road template
- Works with most major brands of total stations and GPS equipment
- See your points and linework as data is collected
- Ability to place text on your drawing and contour in the field to verify that you have taken enough points
- Designed for GIS work. Allows the collection of data associated with valves, manholes, power poles and other standard GIS elements.

Field-to-Finish Code Definition



Contouring and Volume

GPS Stakeout Mode



CARLSON SURVCE, DATA COLLECTION

Carlson SurvCE

Powerful features to help you do more in less time

Links seamlessly with Carlson Survey, Carlson Civil and Carlson Mining for all office applications.

Powerful Data Collection

Exclusive routines provide enhanced functionality – collect and utilize all the data you need for both big and small projects.

Fast & Easy

Frequently used tasks are readily available with one tap with new and simple tab-based menu.

Compatible

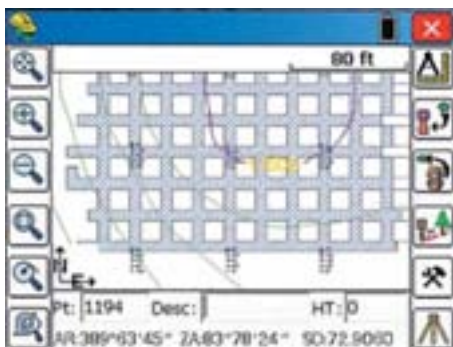
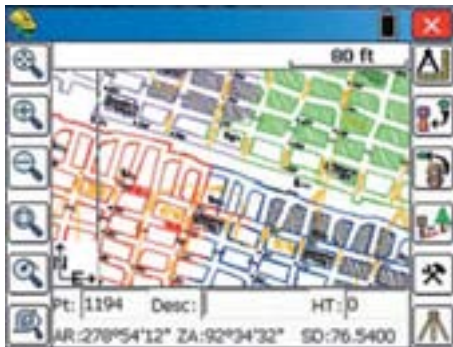
Supports the widest range of popular and new-release RTK GPS and conventional/robotic total stations.

Read in LandXML

Supports LandXML points, DTM, graphics, alignments, profiles and sections.

Built-in Tech Support

Questions in the field are quickly answered – the entire users manual is available in the program. Like having a 400-page manual at your fingertips.



Carlson Surveyor/Surveyor+ Rugged and reliable data collectors

Here's the speed you want with the reliability that you need in the fast, incredibly durable, and powerful Carlson Surveyor+/Surveyor data collectors. Both are completely ruggedized, with an IP67 water and dust resistant Ingress rating. Both versions of the handheld computer are encased in magnesium housing, in essence, a "full metal jacket." Weighing just two pounds, the Carlson Surveyor line offers up to 1 gigabyte of memory with the option to expand.

The Surveyor and Surveyor+ keyboard is sized to work with even the largest or gloved hands, while the backlit control keys provide ease and convenience. They are light and easy to grip, being thinner front to back than other data collectors when resting on a table top. Use it for surveying, stake out, construction layout

and more. The easy-to-use tab-based menu and advanced graphics in Carlson SurvCE 2.0 work perfectly on the Carlson Surveyor, enhancing its usability. Two styles of USB connectors are located on top, again for the convenience of the user. The 3.5-inch diagonal backlit screen offers color QVGA resolution of 240x320 pixels.

CarlsonMINI

The CarlsonMINI is a field computer that is compact and lightweight, yet tough and resilient. Less than 4 ½ by 7 inches and weighing just slightly more than a pound, the CarlsonMINI offers lightning-quick processing with a touch screen and high-contrast color display. IP-67 Ingress-rated and MIL-STD-810F-rated for water, humidity, sand and dust, vibration, altitude, shock, high temperature, low temperature, and temperature shock. Comes complete with Carlson SurvCE.



Do More, Do It Better

Automate. Combine Carlson Civil, Carlson Hydrology, and Carlson GIS with Carlson Survey and you'll have the most powerful and comprehensive set of design/drafting tools to automate all facets of designing or upgrading your mine.

Tackle Complex Challenges.

Technologically advanced, yet renowned for their ease of use, Carlson civil-related solutions quickly allow users to tackle complex challenges in site and/or road design with hydrology/hydraulic aspects completely integrated.

Design Dynamically. The fully dynamic design environment – changes made in one aspect of the design are reflected in real time in other related aspects – provides users with seamless, faster utilization of the programs. Choose to set the controls to Automatic, Prompt, or turn them off completely.

CARLSON CIVIL

Get the Ability to Use Your Creativity to the Fullest

Choose for roads, ramps, pits, ditches, and more for all your terrain detail

Define your project folder to suit your organization and then personalize your drawings with your own annotation style.

Change your design and all surfaces and volumes automatically update in real time.

Explore “what if” design ideas with a simple drag and drop.

Edit with a double click and change the design in any way.

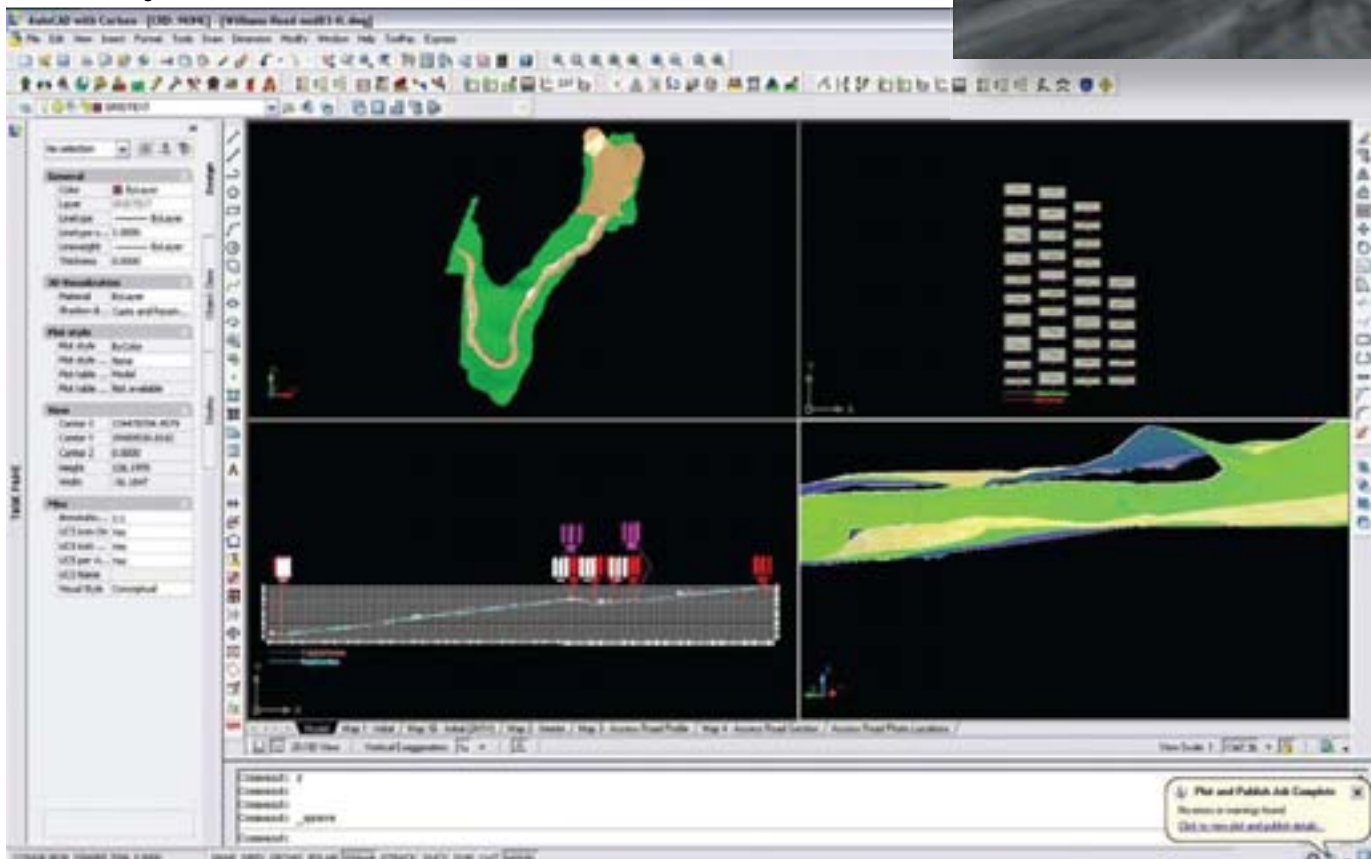
Highlights of Carlson Civil for Mining include:

- Quick volumes by TINs or Grids;
- RoadNET for Haul roads and complex ramp designs;
- Design Pad Template for any site work, projection planes, simple ramps;
- Cross Sections and Profiles for Design, with ability to convert to plan view in 3D; and
- Slope analysis routines for reclamation design to stay within spec.

3D Drive Simulation



Haul Road Design



Courtesy Ben Langenfield, Greg Lewicki & Assoc., Parker, Colo.

CARLSON HYDROLOGY

Calculate Runoff Coefficients based on Layers

Here's the automation you need with full 3D design feeding into flow calcs

Add, remove or move structures, change pipe slopes and sizes, invert elevations – let the program compute runoff coefficients from layers, compute the exact catchment area from the 3D model, and run rainfall events through your fully designed system.

An alliance between Carlson Software and HydroCAD® is now helping to meet users' needs, giving them access to HydroCAD's extensive rainfall libraries and stormwater chamber specifications. Software linkages are under development that will allow data to be moved from Carlson Hydrology into a HydroCAD model.

Highlights of Carlson Hydrology for Mining include:

- Analyze the watershed for the desired storm event to calculate the Curve Number, Time of Concentration, Flow Distance and ultimately the Peak Flow.
- Calculate and draw the hydrographs.
- Build the structures to detain and re-route the storm runoff.
- Build Ponds and spillways comprised of channels, weirs, pipes and culverts.
- Draw the stage-storage and stage-discharge graphs of the various structures.

CARLSON GIS

Get the highest level of robust automation and ease-of-use

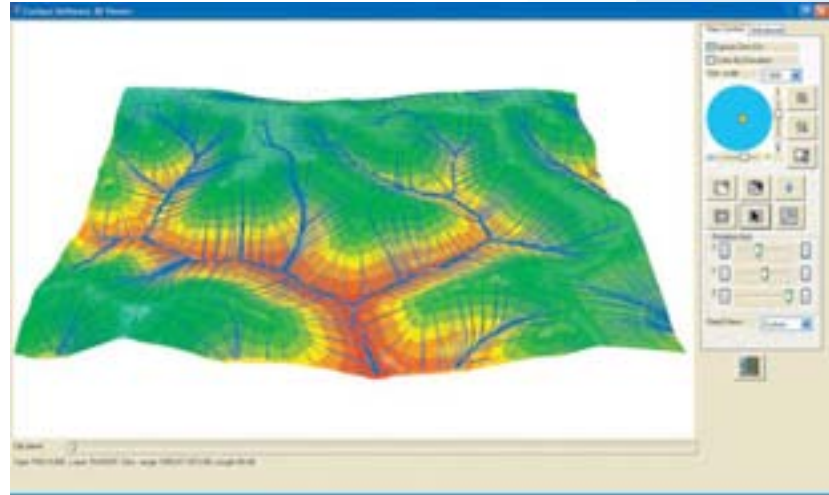
Enhance your data capture, linking, and labeling, import/export of SHP files & more

Obtain data directly from ESRI – immediately perform preliminary engineering studies, hydrological studies, and planning analysis.

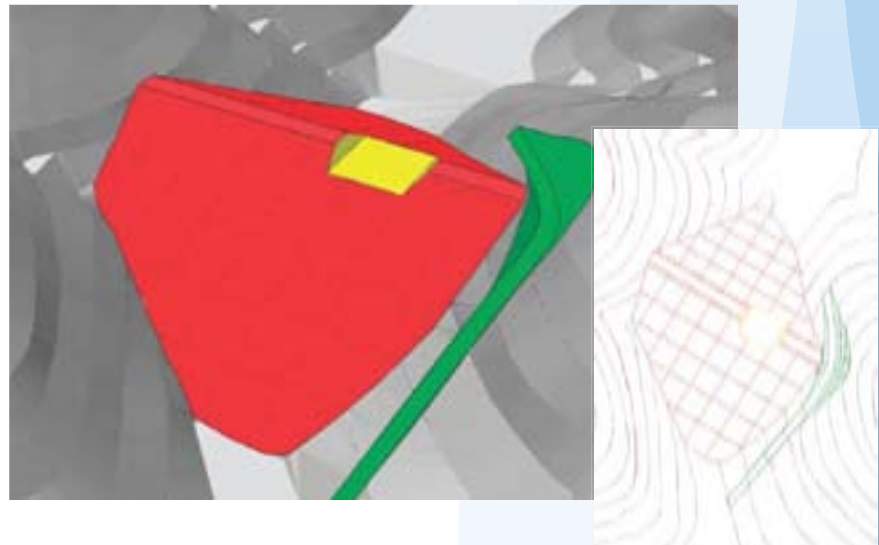
Highlights of Carlson GIS for Mining include:

- Use it to link objects in the drawing to the external database for queries;
- Objects such as ownership boundaries, leases, mineplans and properties can be linked to the database where all of the quantities, tonnage and ore quality can be easily queried and retrieved for various reporting.

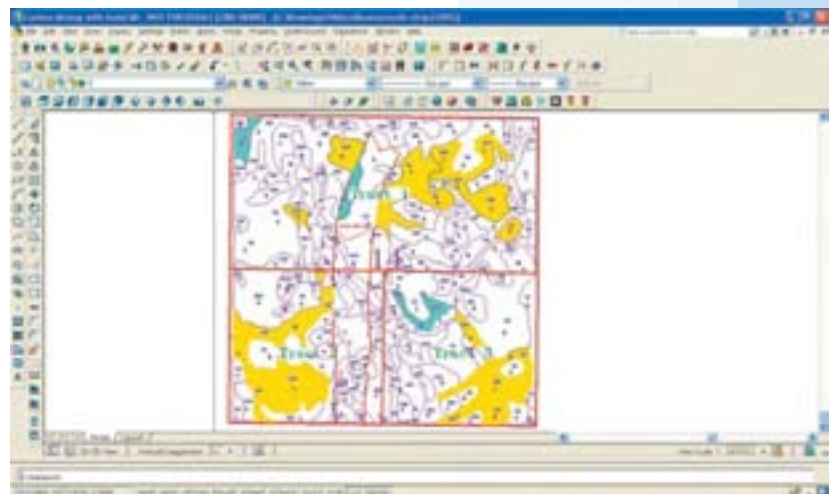
Runoff Tracking



Valley Pond



GIS Soil Map



CARLSON GRADE/ COMMAND & CONTROL

Carlson Grade 3D GPS/GNSS Machine Guidance & Automation

One powerful software package for all your needs

- DOZERS
- LOADERS
- EXCAVATORS
- COMPACTORS
- GRADERS
- BARGES
- DRILLS
- SCRAPERS
- BUCKETWHEELS
- SHOVELS
- FOREMAN TRUCKS

Carlson Grade is Carlson Software's unique machine guidance product designed to work with all equipment in need of grade control.

Supervisors – you'll always know what's going on with real-time position and height inspection capabilities.

Heavy equipment operators – you'll know your grade and location without the need for stakes and in severe weather conditions.

The screen is mounted in the cab allowing heavy equipment operators to respond quickly and accurately to cut/fill and position information. They can instantly check their design performance and achieve the proper grade with the first pass. This means no more excessive movement and tramping of the machine, so less maintenance and lower costs.

Combine Carlson Grade with Carlson's Command & Control, and your process and equipment performance can be monitored and analyzed helping to save both time and money.

Benefits and Features

- Easy to use
- On-the-fly road and ramp (slope) design
- Supports most RTK GPS using a ruggedized touch screen computer
- Useful for grade check in a supervisor's vehicle
- Multiple views in profile, section and plan
- Uses AutoCAD drawings and Carlson Civil surfaces, no conversion necessary
- Real-time monitoring back at the office with Command & Control
- Creates logging file for real-time or future analysis
- Optional tilt sensors provide more accurate position and elevation
- Optional lightbars give the operator more indication of cut or fill
- Multi-purpose: one system for all equipment and applications (dozer, grader, excavator, drill, etc.)
- Fast, improved graphical response
- On-board Mission Planning Satellite Forecast and Almanac
- Multiple design layers
- Specialized features for construction, mining and landfill applications



CARLSON TruckPRO Haul Truck Management

See where each truck is loaded from, and dumping to. This ensures the correct grades of ore are delivered as needed. Real time color-coded unit icons signify if it is loaded or empty and ore quality values are displayed, so the unit can be properly guided for position.

Benefits and Features

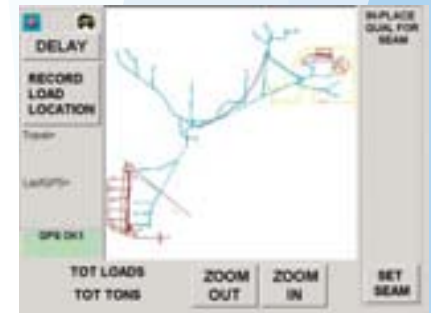
- Reduced idle time
- Increased productivity
- Lower dilution
- Improved blending and stock pile management
- Enhanced recovery
- More accurate tracking for improved planning
- Comprehensive electronic reporting across the network
- Road speed analysis can lead to better roads for haulage
- Reduced staking
- Low cost alternative
- Password login screen
- Loading information and payload screens
- Plan view positions for routing and loading position
- On-site support

CARLSON Command & Control Remote Site Management

Connect all machines on the mine to see real time volumes back in the office (any office). Maximize productivity at the mine by finding the units that work most efficiently and use them to help correct those that don't.

Benefits and Features

- Real-time analysis - great for 'Just-In-Time' operations
- Executives have data at fingertips
- Analyze single or multiple vehicles
- Flexible reporting for different departments
- Increased productivity
- Aids "Best-Practice" evaluations
- Low cost alternative
- Easy to learn
- On-site support
- Color by shift or period
- Multiple dozers on screen working at the same time
- Easy graphs for elevation change
- Simultaneous plan and profile views
- Flexible reporting of aspects such as push lengths and slopes, rehandle and volumes per hour



Courtesy Olga Liferova, Moscow, Russian Federation



CARLSON MINING USER LIST

<p>Alaska University of Alaska Alaska Division of Mining, Land & Water Usibelli Coal Mine</p> <p>Alabama Alabama Dept. of Industry Alabama Surface Mining Comm Carmeuse Lime Company Chevron Mining, Inc. Drummond - Birmingham Drummond, Jasper Eagle I, LLC Jim Walters Resources #4 Jim Walters Resources #5 McGehee Engineering Corp. New Actin Coal Mining, Inc. Perc Engineering Perry Supply Co. Pinoak Resources, LLC TASK Engineering Management In Twin Pines Coal Vulcan Materials Company</p> <p>Arkansas Heidttman Mining Hoffman & Associates</p> <p>Arizona Anderson Mining Bronco Energy Brown & Caldwell Navajo Abandoned Mines Program Salt River Materials Group URS Washington Division</p> <p>California BHA Inc Chemical Lime-Natividad Colmenares, Martin Dutra Materials San Rafal Quar Kotaska, Brian Northstar Surveys, Inc. Vulcan Materials Company</p> <p>Colorado Agapito Associates Inc, Ames Arch Western Bituminous Group Bowie Resources LLC Bureau of Indian Affairs CKG Design Group, LLC Colorado Div of Minerals & Geology Colorado School of Mines Dodd & Dodd Consulting E3 Consulting, LLC Epp & Associates Fossil Rock, LLC Geosurv Golden Eagle Minerals Gunesch Group Consulting LLC Gunnison Energy Corp Oxbow Hollberg, Kurt (OC) John T. Boyd Company Lafarge Mountain & Mineral Surveying MWH Denver MWH Westminster Nagenast Brothers LP Office of Surface Mining & Rec Oxbow Carbon & Minerals Peabody Coal - Twentymile Pincok Allen & Holt Steve Korte Geological Service J.E. Stover & Associates, Inc. Rio Tinto - ColoWyo Coal Trapper Mining Inc. URS Washington Division Victor Graphics-Dan Syperma Weeminuche Construction Western Fuels Association Inc. Western Fuels New Horizon Mine Wiley Consulting</p> <p>Florida Adams Engineering, Inc. Britt Surveying, Inc. Mosaic Fertilizer, LLC Florida Rock Industries North American Coal PCS Phosphate</p> <p>Georgia Martin Marietta Materials, Augusta Martin Marietta Materials, Duluth</p> <p>Iowa Highland Geocomputing Iowa Dept. of Agriculture Martin Marietta Materials Inc.</p> <p>Idaho Idaho State University Jesse Bird</p> <p>Illinois Akin Energy</p>	<p>Black Beauty Wildcat Hills/Cot Delta Engineering & Associates Energy Plus Services Foundation Coal Illinois Opera Freeman Energy Corporation Freeman United Coal Mining Corn Hillsboro Energy Illinois Department of Natural Resources Illinois Department of Natural Resources Mach Mining, Inc. Midwest Reclamation Resources Office of Surface Mining & Rec Patriot Coal - Marissa Peabody Coal - Gateway Mine Prairie State Generating Company LLC Southern Illinois University Vulcan Materials Weir International Mining Consultants White County Coal Corp. White Oak Resources Williamson Development, LLC.</p> <p>Indiana Anderson Surveying ATC Associates Black Beauty Headquarters Black Panther Mining LLC BUZZI UNICEM USA Five Star Mining Company, Inc. GEOSEV Gibson County Coal, LLC Indiana DNR Lutgring Brothers, Inc. Marshall Miller & Associates Mulzer Crushed Stone Olliver & Associates Patriot Coal - Hawthorn Patriot Coal - Lynnville Solar Sources Solar Sources Solar Sources Underground Sunrise Coal, LLC Templeton Coal Company Triad Mining Vigo Coal</p> <p>Kansas Kansas Dept. of Health & Envir Sumner County Road & Bridge</p> <p>Kentucky Abbott Engineering West Virgin Adams Engineering, Inc. Adams, James R. & Assoc. Alden Resources, LLC. Alliance Coal LLC Alpine Consulting and Engineering American Engineers Appalachian Fuels , LLC Appalachian Land Co. Appalachian Mining & Engineering Armstrong Coal Company, Inc. Associated Engineers, Inc. Beech Fork Processing Begley Lumber Bell County Coal Corporation Berwind Land Company Black Mountain Resources, LLC JE Black-Earth Sciences Bladesoe Coal Company Blue Diamond Coal Company Booth Energy Bucyrus - Minserso Cam Mining LLC Campbell, James S., Inc. Carbontronics Fuels Management Carmeuse Lime Company Maysville Carmeuse Lime Company Butler James Caudill Engineering CBC Engineers & Associates Ohio CBC Engineers & Associates Hazard CBC Engineers & Associates Lexington CBC Engineers & Associates Hurricane Central Appalachian Mining Clintonville Elkhorn Mining Coal Production Engineering Coal Services Group Sidney Coal Services Group Inez Cumberland Valley Engineering Donald Cooke, PE, LS Duke Engineering Elk Horn Coal Company, LLC Endris Engineering Engineering Consulting Service Environmental Design Consultants Environmental Resources Management Excel Mining Company Green River Collieries, LLC Hanson Aggregates Louisville Hazard Community and Technical HICON Construction LLC Hopkins County Coal Howard Engineering & Geology</p>	<p>James River Coal Service Co. Jigsaw Ent. LLC Kentucky Department of Surface Mining Kentucky Dept. of Natural Resources Kentucky River Properties, LLC Lauren Land Company Leeco, Inc. Leo Miller & Associates Lexington Coal Company Logos Engineering Maffet Surveying Marshall Miller & Associates McCoy Elkhorn Coal Corp. Meade Engineering Company Miller Bros. Coal, LLC Mine Management Consultants Morgan Worldwide Consultants National Coal Corporation Office of Surface Mining & Reclamation P & A Engineering Patrick Processing, LLC Patriot Coal - Bluegrass Coal Co. Patriot Coal - Camp Patriot Coal - Dodge Hill Mine Patriot Coal - Midwest Perry County Coal Phoenix Coal Corporation Pike Letcher Land Company Pike Technical Services, Inc. Pine Branch Coal Sales Premier Elkhorn Coal Company R.M. Johnson Engineering Hindman R.M. Johnson Engineering Lexington Rif e Coal Company River View Coal Morganfield River View Coal, LLC Robert Brashear Sapphire Coal Company Scotty's Construction Southeast Technology Inc. Summit Engineering Summit Engineering, Inc. Summit Engineering, Inc. Synergy Engineering Services, TECO Coal Corporation Te Engineering Co., Inc. TEE Engineering Co., Inc. University of Kentucky University of Kentucky Walturm Engineering Warrior Coal LLC Webster County Coal LLC Xinergy Corporation</p> <p>Louisiana Red River Mining Co.</p> <p>Maryland Highland Engineering Maryland Dept. of Natural Resources MDE-WMA Mettiki Coal LLC</p> <p>Maine Algeo, Leo University of Maine</p> <p>Michigan David P. Smith & Associates Edward C. Levy</p> <p>Missouri APAC Central Co. Arch Coal Chemical Lime Company - St. Gen Delta Companies Marston & Marston, Inc. Mississippi Lime Co. Missouri Department of Natural Resources Patriot Coal - St. Louis Peabody Holding Company, Inc. University of Missouri-Rolla</p> <p>Mississippi Mississippi Lignite Mining Co. Mississippi State</p> <p>Montana Montana Tech of the University Rio Tinto - Spring Creek Coal Spectrum Engineering W.B.I. Holding, Inc. Western Energy Rosebud Mine Westmoreland Resources Inc. Sarry</p> <p>North Carolina Hanson Aggregates East Hedrick Industries PCS Phosphate Vulcan Materials Company</p> <p>North Dakota BNI Coal Limited Center Mine Coteau Propertes Company Dakota Westmoreland - Beulah Mine Falkirk Mining</p>	<p>North Dakota State Public Service</p> <p>New Hampshire North American Reserve, LLC University of New Hampshire</p> <p>New Jersey Blithen Mining Associates, PC Murphy & Hollow Associates</p> <p>New Mexico BHP San Juan Coal Intrepid Potash NM Mosaic Potash Company Peabody Coal - Lee Ranch Coal Co. Public Service of New Mexico Washington Tru Solutions</p> <p>Nevada Barrick Gold Chemical Lime Company Rinker Materials University of Nevada, Reno</p> <p>New York Erie Community College Hanson Aggregates Jamesville HZH Consultants Reddan Surveying Inc.</p> <p>Ohio Arch Materials LLC Batavia B & N Coal, Inc. CESO, Inc. DeLong, Joe East Fairfield Coal Eastham & Associates Fairmount Minerals LTD Jack A. Hamilton & Associates, Kent State University Linn Engineering, Inc. Ohio American Energy Alledonia Ohio American Energy Powhatan Point Ohio AML (Cambridge) Ohio AML (Jackson) Ohio AML (New Philadelphia) Ohio Dept of Natural Resources Penn-Ohio Coal Co. Sands Hill Coal Company, Inc. Stantec Consulting Serv. - Buchannon West Virginia Resources Inc. W-H & Associates</p> <p>Oklahoma Oklahoma Abandoned Mine Land Oklahoma State University Okmulgee United States Gypsum Company</p> <p>Pennsylvania Alexander & Associates Amfire Mining Co. LLC Apletage Services Buzzi Unicem USA Cagle Surveying Carmeuse North America Service Civil & Environmental Consultants CME Engineering, Inc. Consol Energy-Pittsburgh David Yeosock, LLC Donohue Surveying Earthres Group Inc. EarthTech, Inc. Essroc Cement Corp. Foundation Coal Pennsylvania Ops. Glenn O. Hawbaker, Inc. GPS-Tech Graymont (PA) Inc. Jason Tarnowski, PLS John T. Boyd Company Keystone Consulting Engineers, Michael Baker Jr., Inc. Mohney & Associates Musser Engineering, Inc. Office of Surface Mining & Reclamation PA DEP Hawk Run District Mining PA Dept. Environmental Protection PA Dept. Environmental Protection PA Dept. Environmental Protection Parkwood Resources PBS Coals Penn State University PinnOak Resources, LLC Robindale Energy Services, Inc Rosebud Mining Company Skelly & Loy, Inc. Szalankiewicz Engineering LLC TJS Mining, Inc.</p> <p>South Dakota American Colloid Company Bentonite Performance Minerals</p> <p>Tennessee AMEC Earth & Environmental APAC Tennessee, Inc. Carmeuse O-N Minerals Central App Consulting, LLC</p>	<p>Cumberland Coal Co., LLC Dynatec Mining Corporation Franklin Industrial Minerals General Shale Brick, Inc Geo/Environmental Associates IRTEC John Hoff & Associates Kentucky Cumberland Coal Company Mountainland, LLC Nashville State Tech Comm. College National Coal Corporation OSM Tennessee Field Office Penn Virginia Resources Sevier County Utility District The Rogers Group, Inc. Vulcan Materials Company Xinergy Corporation</p> <p>Texas ACME Building Brands Aderman Mine Planning Services American Gypsum Company Chemical Lime Company Dean Word Company Hanson Aggregates Easton Hanson Aggregates Irving Luminant - Dallas Luminant - Big Brown Luminant - Martin Lake Luminant - Monticello Mine Luminant - Oak Hill Martin Marietta North American Coal Corp. Sabine Mining Company San Miguel Electric Cooperative, Inc. Texas Railroad Commission Texas Westmoreland Coal-Jewett</p> <p>Utah Andalex Resources, Inc. Arch Skyline Mine Arch Soldier Canyon Mine Blue Mountain Energy Energy West Mining Company Interwest Mining Norwest Corporation Simplot Phosphates LLC Staker & Parson Talon Resources Inc. Utah State BLM</p> <p>Virginia A & G Coal A.T. Masey Coal Company, Inc. Abingdon Spatial Technologies, D.R. Allen & Associates Alpha Natural Resources - Coeburn Alpha Natural Resources - Cleveland Alpha Natural Resources - Abingdon Alpha Natural Resources - Brinks AMVEST Minerals Services, Inc. Appalachian Technical (Wise) Arch Cumberland River Coal Co. Materials Christopher Consultants Fairfax of VT Glamorgan Coal Resources, LLC Gress Engineering Hargrove Jewell Smokeless Coal Corp. Lone Mountain Processing-Clover Fork Lone Mountain Processing-Huff Creek Marshall Miller & Associates Maxxim Shared Services, LLC Rapoca Energy Company Red River Coal Co., Inc. Ritchie Equipment Summit Engineering, Inc. - Big Rock Summit Engineering, Inc. - Wise Terra Tech Engineering United Coal Company, LLC Virginia Tech VT-VCCER Wellmore Coal Corporation</p> <p>Washington TransAlta Centralia Mining Com</p> <p>Wisconsin Badger Mining</p> <p>West Virginia Accurate Surveying, Inc. Advanced Land Services, Inc. AE Associates Ltd Allighenry Surveys, Inc. Alliance Coal-Tunnel Ridge Alliance Consulting Inc. Alpha Engineering Services Alpha Natural Resources - Newburg AMVEST Ann's Run, LLC Apogee Coal Company, LLC Arch Eastern Region Berwind Land Company Blue Mountain Engineering Bluefield State College</p>	<p>Brook Trout Coal Brooks Run Mining Company, LLC Coal River Energy Coal River Energy LLC Coal-Mac, Inc. Consol Energy - AMVEST Consol Energy Consol Energy, Inc Consol of Kentucky Inc. Covey Engineering Criste Engineering Services Empire Consulting Engineering Services, Inc. Esmer & Associates, Inc. Foundation Coal West Virginia Gatling, LLC Geary Associates Greenbrier Minerals Greer Industries Hampden Coal Company, Inc. Heritage Technical Associates, Hobart Mining, Inc IGC Corporate, LLC IGG-Hunter Ridge Coal Company IMAGIN Natural Resources Infinity Coal Sales, LLC Jupiter Coal - Dallas Kanawha Eagle LLC Kenneth Kelly Surveying Ketchum, Alan King Coal Corporation L & W Enterprises, Inc. LA Gates Company Lincoln Land Consultants Magnum Coal Magnum Coal (Coyote Coal) Magnum Coal (Remington Coal) Magnum Coal Company Massey Coal Services Inc. Maxxim Shared Services MEPCO, LLC Mingo Logan Coal Company Mingo Logan Coal Company Mountain State Company MSHA Natural Resource Partners Natural Resource Partners Natural Resource Partners New Millennium Tech Service New River Engineering, Inc. Nicholas Energy Pardee Resources Patriot Coal - Big Mtn/Robinhood Patriot Coal - Charleston Patriot Coal - Federal Mine Patriot Coal - Harris/Pond Fork Patriot Coal - St. Louis Patriot Coal - Wells Complex Pocahontas Coal Co. Rayburn, Tom Republic Energy Resource Associates Speed Mining, Inc. Stagg Resource Consultants, Inc. Summit Engineering, Inc. Thunder Peak Enterprises Triad Engineering Consultants, Trinity Coal True Line, Inc. United Coal Company West Virginia Dept. Environment West Virginia Institute of Technology West Virginia University Westlake Inc. Wolfe & Associates</p> <p>Wyoming American Colloid Company Arch of Wyoming, LLC Arch Thunder Basin Coal Co. Bentonite Performance Minerals BLM - WY Casper Field Office Bridger Coal Company CDG Engineers Architects Plann Centennial Collaborative Chevron Mining Foundation Coal Belle Ayr Mine Foundation Coal Eagle Butte Mi General Chemical Company Integrated Technical Support Knight Technologies Inc. M.I. Swaco Mine Mine Engineers Inc. Nelson Brothers Mining Service Peabody Coal - Gillette Rio Tinto - Antelope Coal Rio Tinto - Cordero Rojo Rio Tinto - Gillette Coal Rio Tinto - Jacobs Ranch Simplot Smoky Canyon Mine Strathmore Minerals Trihydro Corporation Western Fuels-Dry Fork WWC Engineering Wyo-Ben, Inc. Wyodak Resources Dev. Corp. Wyoming DEQ Cheyenne Wyoming DEQ Lander</p>	<p>Wyoming DEQ Sheridan</p> <p>International</p> <p>Australia Centennial Coal Company GlobalPOS IMC Consultants Integra Coal Operations Karel CADNebo Central Coal North Goonyella Coal Mines Pty. Peabody Coal - Pacific Pty Limited Peabody Coal - Wilkie Creek Mine TR Baillie Consulting</p> <p>Belgium Carmeuse Group</p> <p>Bulgaria CAD Point Ltd.</p> <p>Canada Carmeuse Lime - Beachville LaFarge North America URS Washington Division - Northern Ltd Ronald Ho Grande Cache Coal Company Quinsam Coal Corporation Bridge View Enterprises Ltd</p> <p>China Asian-American Coal, Inc. Shanxi Asian American -Danning Energy</p> <p>Columbia Drummond Conсорcial Minero Unido, SA</p> <p>El Salvador Geoforerencia</p> <p>Ghana Anglogold Ashanti (Iduapriem) Ltd</p> <p>India Shotam Instruments Pvt. Ltd Integrated Coal Mine Limited, Pvt. Ltd Rungta Minmcc Consultancy BLA Industries, Pvt. Ltd. Shotam Instruments Pvt. Ltd.</p> <p>Indonesia BANPUA Coal Operations Indonesia</p> <p>Mexico MICARE MINERALES MONCLOVA S.A. DE C.V</p> <p>New Zealand GeoSystems</p> <p>Russia Alrosa Bererezovsky Open Pit BKO Borodinsky Open Pit Gornaia Company GT MORSTROJ IngGeo Kalinningradskie kar'ery Kansky Open Pit LUTEK Mugunsky Open Pit Nazarovsky Open Pit NIP Informatica Nerungrinsky Open Pit Severalmaz St.Petersburg Mining University Tajovla Tujovni Open Pit Upravlenie gornyh rabot VAMI</p> <p>Saudi Arabia Zenaty, Fadi</p> <p>Singapore Sea and Land Technologies</p> <p>South Africa R. D. Clark</p> <p>South Korea CheongPA Engineering</p> <p>Puerto Rico Polytechnic University of Puerto Rico</p> <p>Venezuela Paso Diablo Carbones de la Guajira SA</p>
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