VISUALIZING THE FUTURE: SURFACE MINING[1]

by

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Abstract. Computer visual simulations are used to portray proposed landscape changes with true color, photo-realistic quality, and high levels of accuracy and credibility. This sophisticated technology is a valuable tool for planners, landscape architects, architects, engineers, environmental consultants, government agencies and private operators in the design and planning of surface mining operations. This paper presents three case studies where computer visual simulations were used in surface mine operations and reclamation planning in the western United States.

The Black Pine Mine (Pegasus Gold) in southern Idaho is a gold mine located near an interstate highway. The mine is highly visible from this and other roadways. Computer visual simulations were developed which accurately and realistically depicted the mining operations over a five-year time frame and reclamation for a ten-year time frame. These images were successfully used in the permitting and EIS process.

The Barrick Mercur gold mine (Barrick Resources USA) is located in west central Utah. The mine has been in operation since the turn of the century. The consultants were asked to develop computer visual simulations showing the proposed re-contouring and revegetation of the major heap leach dump for a five-year time frame. The grading design and computer visual simulation images were developed by the consulting landscape architects and were used in the closure permitting process.

The Rattlesnake Hills Quarry (Umetco Minerals) is located in central Wyoming. The quartzite rock produced would be used for capping an abandoned uranium mine, also in Wyoming. The consultants were asked to develop computer visual simulations showing the proposed hillside excavation and reclamation of this major quarry over a 10 to 20-year time frame. The images were used in the environmental analysis completed for the project.

This presentation describes the development criteria, process, and use of the computer visual simulations on these three projects. Several computer visual simulations are shown, with detailed discussion of the technical aspects of their development. The issues of computer visual simulation accuracy, bias, credibility, ethics, and realism is discussed with emphasis on application in real world situations. The use of computer visual simulations as a tool in the planning and design of surface mining operations is presented, along with discussion of their use in project permitting and public involvement.

Additional Key Words: visual simulation, visual resource management, scenic analysis, landscape architecture.

Introduction

Computer visual simulations are used to portray proposed landscape changes with true color, photo-realistic quality, and high levels of accuracy and credibility. This sophisticated technology is a valuable tool for planners, landscape architects, architects, engineers, environmental consultants, government agencies and private operators in the design and planning of surface mining operations.

Visual Simulation Issues

There are several issues related to the use of visual

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simulations in the analysis and management of surface mining impacts on visual resources (Ellsworth, 2001). These include accuracy, operator bias, credibility, ethics, and realism.

Accuracy is the issue, which most people consider to be of the highest importance in the development of computer visual simulations. However, research by Ellsworth and Watzek (1994) shows that most people are unable to detect inaccuracy of one important variable, scale, within ranges of up to plus or minus 15%. Most long-term surface mining projects lack sufficiently accurate data about extent of final excavation and reclamation during the operating years. Therefore, this inability of people to detect relatively high levels of inaccuracy in computer visual simulations is often consistent with the inaccuracy of the available data.

Operator bias may include the purposeful misrepresentation of one or more aspects of the proposed mining operation with the intent to mislead the observer. This unethical, intentional conduct may or may not be apparent to the casual observer. Inadvertent operator bias may results in the omission of important aspects of the excavation or reclamation operations from the visual simulation. Inexperience or poor visual simulator training is often to blame. A skilled visual simulation specialist will avoid these biases by possessing a good understanding of graphic arts (basics of perspective, foreshortening, distance, value, and color) and a familiarity with the design, construction, and reclamation issues of the proposed surface mining operation.

Credibility is closely related to the issues discussed above and to realism. It is sometimes called ÒlegitimacyÓ (Sheppard 1989). A realistic computer visual simulation will leave the viewer with a sense that everything is Òin the right placeÓ. The visual simulation specialist needs highly developed technical skills with the computer hardware and software, and understanding of graphic and perceptual principles, and great skill with the use of photographic equipment (film or digital) in order to produce highly realistic, and therefore credible, visual simulations. Unfortunately, these same skill sets also allow the unethical misuse of these very same technologies, as we are all aware.

The true test of these issues lies in the technical skill and professional ethics of the person producing the visual simulation. Simulation specialists should also be experienced in computer graphic technology and principles of landscape design.

The Computer Visual Simulation Images

Three case studies in the western United States illustrate the value of computer visual simulations for surface mine operations and reclamation planning. Several full color visual simulation slides will be shown for each project. Unfortunately, these cannot be acceptably reproduced in the conference proceedings by the standard xerographic process. Please contact the author directly regarding full color high quality prints.

Black Pine Gold Mine Project

The Black Pine Gold Mine, a cyanide heap leach operation, is located in southeastern Idaho, near the town of Burly on U.S. Forest Service land. The mine operators contracted with Ellsworth and Associates, landscape architects, inc., to produce a series of computer visual simulations of the proposed reclamation, revegetation, and erosion control activities for use in their closure permit application. The permitting process followed the applicable laws and regulations of the State of Idaho and the federal government. The computer visual simulations were developed in concert with the reclamation engineers and with the Sawtooth National Forest landscape architects.

The visual simulations represented proposed mine expansion activities and reclamation over a 10-year time frame, with revegetation density success rate of 50 to 70% on slopes regraded not to exceed 1.5:1. Each visual simulation was done in late summer, during mid-day, from photographs taken by EALA staff on site.

The visual simulation of the mine exploration road shows a variety of grasses, forbs, and shrubs that could reasonably be expected.

The visual simulation of the rehabilitation of the mine haul road emphasized landform regrading on steep slopes, therefore some slumping and dispersion after slope stabilization is portrayed. The existing drainage was considered important, and is shown restored in the visual simulation.

Barrick Mercur Gold Mine Project

The Barrick-Mercur Gold Mine is located in west central Utah, near the town of Tooele. This cyanide heap leach process mine is located near U.S. Forest Service and BLM land. The mine operators contracted with Ellsworth and Associates, landscape architects, inc. to produce a series of computer visual simulations of the proposed reclamation, erosion control, and revegetation activities. Visual simulations represented proposed mine expansion activities and reclamation over a 10-year time period. EALAÕs landscape architects were asked to first design, then simulate a new landform for the heap leach area, which would be visually similar to the natural land forms of the area. EALA staff also developed the conceptual revegetation and landform design for the existing administrative and ore processing facilities.

The first visual simulation illustrates the full extent of the new landform in panorama, and shows the potential for revegetation and erosion control on the slopes. The visual simulation shows the flat top of the leach area re-contoured and shaped to resemble the surrounding landscape.

The next visual simulation shows a view of the north side of the landform. The proposed drainage and adjusted road alignment are also visible. Pockets of snow were simulated to show the shape and form of the proposed drainages.

The third visual simulation was used to communicate the intent of the mine operator to leave the site with an acceptable landform, revegetated, and without erosion problems. The existing access road was conceptually designed, meeting grade at the upper and lower ends.

Rattlesnake Hills Quarry Project

The Bureau of Land Management required Umetco Minerals to produce an environmental assessment for their proposed Rattlesnake Hills Quarry in central Wyoming. The company was in the process of reclaiming and closing its nearby Gas Hills Uranium Mine and Mill to comply with regulations promulgated under the federal Uranium Mill Tailings Radiation Control Act of 1978. This would require stabilizing approximately 10 million tons of radioactive mill tailings by placement of earthen, vegetative, and rock cover durable for a minimum of 200 years (1,000 preferred). Quartzite rock on BLM land in the Rattlesnake Hills was determined suitable for these purposes. Approximately 500,000 cubic yards would be excavated from the 145-acre site over about three years.

An Environmental Assessment (EA) was initiated for the mineral sale. Using the BLMÕs Visual Resource Management (VRM) system, two Key Observation Points (KOPÕs) were established by Ellsworth and Associates, landscape architects, inc. in consultation with state and federal agencies. Computer visual simulations were developed, and used in the VRM Contrast Rating analysis process to determine the visual acceptability of the project.

The view from KOP#1 is 3/4 mile from the proposed quarry, looking south. The proposed highwalls, talus slopes, and pit floor revegetation are visible in this view. The visual simulation shows the proposed ÒstainingÓ of the exposed rock surfaces to blend with the naturally weathered rock color and texture. The visual simulation from KOP#2 is 1.5 miles away looking East. This view shows how the proposed quarry slopes, highwalls, and revegetation will closely resemble the natural landforms seen directly south (to the right in this view) of the quarry.

The visual simulations were used to determine the amount of contrast in form, line, color, and texture between the existing landscape and the proposed quarry operation. This Contrast Rating analysis is the important last step in the BLMÕs VRM process. The landscape architects thereby determined that the project met the requirements of the designated Visual Management Class for the area.

Summary

Photo-realistic computer visual simulations are a very valuable tool in the design and planning of surface mining operations. When used ethically and with care, they can result in representative, realistic, bias-free, and credible representations of surface mine future conditions. They can be effective communication tools for explaining the mine operatorÕs intentions, and as indispensable analysis tools for assessing the visual impacts of surface mining operations on public and private lands.

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