SURFACE MINE RECLAMATION SETTINGS: FACILITATING LANDSCAPE PLANNING, DESIGN, AND MANAGEMENT EDUCATION[1]

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Abstract. Landscape planning, design, and management educators are interested in assigning educational studio projects which facilitate the development of students to create meaningful environments. We have employed the use of surface mines in Minnesota, Colorado, and Michigan for educational purposes for a combined total of eighteen years and we believe that they make excellent projects at the university level in the studio classroom. Surface mine projects are valued environments to teach students about housing, wildlife and fisheries, city centers, agriculture, forestry, recreation, multiple land-use planning and design, design development, and site design because the landscape is completely altered and can become something different in the post-mining land-use phase. In addition, we apply the principles developed by Ken Schellie that surface mining is a transitional land-use, promote simultaneous excavation and rehabilitation, encourage the use of mining operations to create land for post-mining land-uses, suggest that the post-mining land can be more valuable than the pre-mining landscape, encourage the search for integrating multiple post-mining land-uses, and indicate that surface mine planning results in fewer delays, efficient mining, and increased profits. We would like to share these projects with the meeting attendees.

Additional Key Words: environmental design, landscape architecture, higher education, natural resources

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Introduction

In the higher education learning environment, landscape planning, design, and management educators are interested in assigning educational studio projects which facilitate the development of students to create meaningful environments. The studio setting is an interactive classroom where students work upon design projects, creating primarily drawings and physical scale models to represent their planning, design, and management intentions. Educators teaching in the studio higher educational setting critique students' efforts and advise the students as they develop their ideas. For the instructors, there is a constant search for suitable projects at the advanced level, that gives the students the opportunity to apply current basic knowledge of site grading, drainage, soils, plant materials, wildlife management and design development to various environments for human use and enjoyment.

In this search for projects comprised of 60 hectares or more, we have discovered that surface mine development and reclamation projects offer these integrated planning, design, and management opportunities for programming and designing a wide range or single uses such as county or regional parks or golf courses as well as mixed uses such as planned unit developments, new towns, office parks, health care facilities, schools, and related land-uses. Therefore, in our academic careers as educators, we have employed the use of surface mines in Minnesota, Colorado, and Michigan for educational purposes for a combined total of eighteen years and we believe that they make excellent projects at the university level in the studio classroom. In this paper, we describe the approaches that we use to meet our educational objectives and list the benefits that we see from using surface mine projects in the design studio.

The use by instructors of surface mines as educational settings for landscape planning, design, and management studio projects has been somewhat prevalent in landscape architecture programs across the United States and Canada for the last 20 years, but has not been abundantly reported or described heavily in the literature. At the 1992 American Society for Surface Mining and Reclamation Annual Meeting, held in Duluth Minnesota, Burley (unpublished, as poster abstracts were not included in the proceedings at that time) presented a poster illustrating student projects from Minnesota, Colorado, and Michigan that he had supervised in the classroom. These projects were enteries in surface mine reclamation competitions, currently sponsored by the National Stone, Sand & Gravel Association. The format for these competitions included visiting the mine site to learn about surface mining, preparing a presentation board addressing mining operations, a presentation board concerning site beautification, a presentation board concerning site reclamation, and a narrative describing the entire project that included a cost estimate. For example, Zimmerman (1991) presents the work of the three winners for the 1991 competition. That year, the winners were from landscape architecture programs at Colorado, Michigan, and Pennsylvania. In 2001, the winners were from North Dakota and Indiana (Edwards 2001). Burns (1983) discusses the merits of the reclamation competition and draws positive conclusions about the benefits of the competition. The predominant literature that does exist about surface mine studio projects feature the winners of these competitions and is provided in trade magazines and industry newsletters such as Landscape Architecture (1989). Nevertheless, the literature concerning these efforts is spotty, inconsistent, and primarily promotional. Therefore, we were interested in preparing an article which illustrated a more academic and reflective perspective concerning the use of surface mine projects in the design studio.

Methodology

We have employed surface mine projects in the landscape architectural studio setting in two formats. The first format is noted in the introduction of this paper and is based upon the requirements for a student design competition sponsored by various organizations, currently sponsored by the National Stone, Sand & Gravel Association, where the students create three specific design boards and compose a written narrative to accompany the boards. Current posting of these requirements can be found in: http://www.nssga.org. The second format is land-use planning and design development format where the students build models at two different scales, thereby refining their ideas as they change scales from a more coarse land-use planning scale to a more fine site design scale. In both formats, a site visit is mandatory (Figure 1).

Both formats employ traditional design process methodologies and the Ken Schellie fundamentals of surface mine planning and design both described in Burley (2001). This process is a methodological paradigm embraced primarily by architecture, landscape architecture, and interior design to search for and develop suitable solutions. As noted by Burley (2001) planning, design, and management professionals believe this process facilitates the development of planning, design, and management solutions for reclaiming surface mines. Therefore, students are required to employ the design process to learn about mining operation, pre-mine planning, surveying, excavation, earth sculpting, eco-environmental design, community design, materials applications, and equipment capabilities and use.

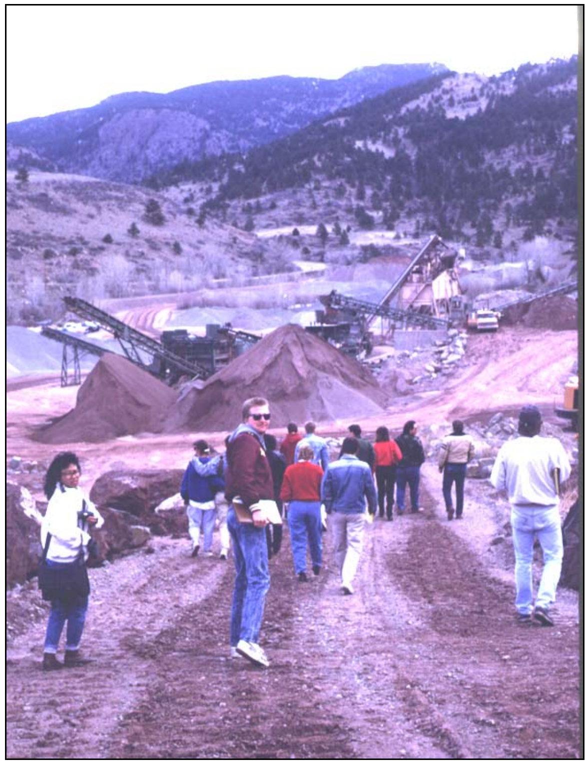

Figure 1. Students visiting a mine site in Colorado, 1988 (copyright 1988 © Jon Bryan Burley, all rights reserved, used by permission).

In the second format, a written studio Design Project Statement given by the instructor to the students begins with a brief introductory overview of a mine site's location and the cultural, social and land-use context within which the design responses of the students will occur. Students are encouraged to develop creative, conceptually based design ideas for post-mining land-uses which result in a vision for what the property has the potential to become. These introductory overviews also state a development typology derived from the learning objectives of the course and are stated in broad and general terms, e.g., "to create a vision for the property which explores applying the principles of The New Urbanism in a Planned Unit Development Proposal" (Gibbs Planning Group 1998, Wentling and Bookout 1998, Katz 1994, Calthorpe 1993, Corbett 1981) or "to design a park-like campus environment that will set the framework for a technology/smart-park" or "to create master plan concepts for a functional, artistic and inspirational corporate campus which is also a landscape art and sculpture garden."

The general overall project assignment is then outlined for the students. The intent of the assignment is stated in both broad and specific terms leaving the details of the requirements to be covered in the statement of <u>Design Guidelines and Program</u> for the site. Students are asked to, "design a planned unit development for the mine site which is (the student's) concept driven vision of what the post-mine site has the potential to be." The students then use the required and suggested reading materials (see Burley 2001 for list) and design criteria provided by the "clients" (the instructor, the governmental agency(ies) involved, the mining company, the developer, and occasionally professional landscape architectural consultants) and the information students themselves gather from site inventories, analyses, and syntheses to design the site according to the <u>Design Guidelines and Program</u> and guided by their design concepts.

The <u>Design Guidelines and Program</u> state explicitly what students must include in the design. At the same time the program is not limited to only those elements specified, allowing each student the opportunity to revise and expand the program. Thus the student can respond to additional development potentials revealed by their inventory, analysis, synthesis and concept development steps in the design process (Burley 2001). Program requirements for a "planned unit development proposal based in the principles of the new urbanism" on a mine site could include 100,000 to 750,000 square feet of commercial space; 75,000 to 1,000,000 square feet of professional office space; 200 to 1500 residential dwelling units; all related open space systems, recreational facilities and natural features; all circulation systems including entry and exit character, associated parking, mass transit stops, service functions, bike paths and walking trails; connection of the designed site to its local and regional context; design of post-mine land forms as art; and design of the site to be accessible to people with ambulatory differences. The range of required land-uses written into the program depends on several factors including site location, size of the site, type of mine operation and "client" input.

Students then express their concept driven design ideas in a two, three or four part graphic and model building experience. Part I of the typical project assignment requires the student to submit and present on one presentation board for critique a set of written goals and objectives, a written design concept or philosophy statement, and a written final program list. Further requirements of the first presentation board include graphically depicted inventory, analysis and synthesis diagrams, two preliminary design alternatives or site related functional use diagrams, and preliminary design character sketches showing how the concept might be applied in major and minor forms and design detail elements. The oral critique of this first presentation board checks the accuracy of the inventory, analysis and synthesis diagrams and then focuses on the application of the design concept or philosophy in the design alternatives. This results in the selection of the "most appropriate" alternative for development into a master plan for the post-mine site. The selected "most appropriate" design alternative is then developed into a post-mine site master plan as Part II of the assignment. This is done by way of building a site master plan model at a scale which has ranged from 1:1,200 to 1:720 depending on the total size of the site. A representative fraction of 1:1,200 (1"=100') is the more common scale employed. As students implement their design concepts/themes at 1:1,200 they manipulate landform and overburden replacement as well as vegetative context through grading, drainage and general planting design. This is done to create appropriate physical structure for mixed-use new urbanist town centers and a variety of residential, professional office, health care, and recreational environments. The focus at this scale is on the general physical structure of the site and its uses and, especially, the transitional spaces between uses and the open space systems of the site. Instructor guidance is frequent in the form of student requested desk critiques, throughout the 1:1,200 scale master plan model building process to completion. A final critique of the 1:1,200 scale model includes selection of one area of focus which students then detail through the design development process at 1:120 (25.4 mm = 3.048 m or 1"=10') scale. This design detail model is Part III of the assignment. The size of the area selected in the master plan model for the 1:120 scale model is typically representing 182 m (600') x 91 m (300') to 272 m (900') x 152.25 m (500') of the site. This size model attempts to allow the student to show how their choice of materials, landform design, vegetation, site art, site circulation, parking, levels of enclosure, (Spreiregen 1965) and open space, combine to further develop the design concept/philosophy/theme/character and ambience of place in the final proposed three-dimensional environment. These detail models reveal the architectural styles of various building types, surface materials in hard space and soft space (Trancik 1986), scale of spaces and places, transitions between public and private space, and the character of various site amenities such as fountains, stairways, sculpture, murals, sidewalks, pedestrian ways, lighting, retaining walls, clock towers, gateways, signage and others. Part IV of the assignment then asks the student to further clarify their design intent by graphically presenting, on a second board, a design detail elevation at 25.4 mm = 3.048 m, four (4) sequential character sketches to show how it feels to move through a portion of their design detail area and, optionally, any other perspectives, sections, elevations, or plan details which also reveal the character of the place they have created.

Based upon these frameworks, students then generate their products and complete their projects.

Results

Competition Products

An example of the first presentation board is illustrated in Figure 2 from an entry with a mine located in Minnesota. The illustration presented is the configuration of the board before color rendering is added and mounted photographs are added to the board. This board addresses the regional setting, land-use issues, current operations, operations impacts, sand and gravel demand, site features, and an analysis of post-mining land-use potential.

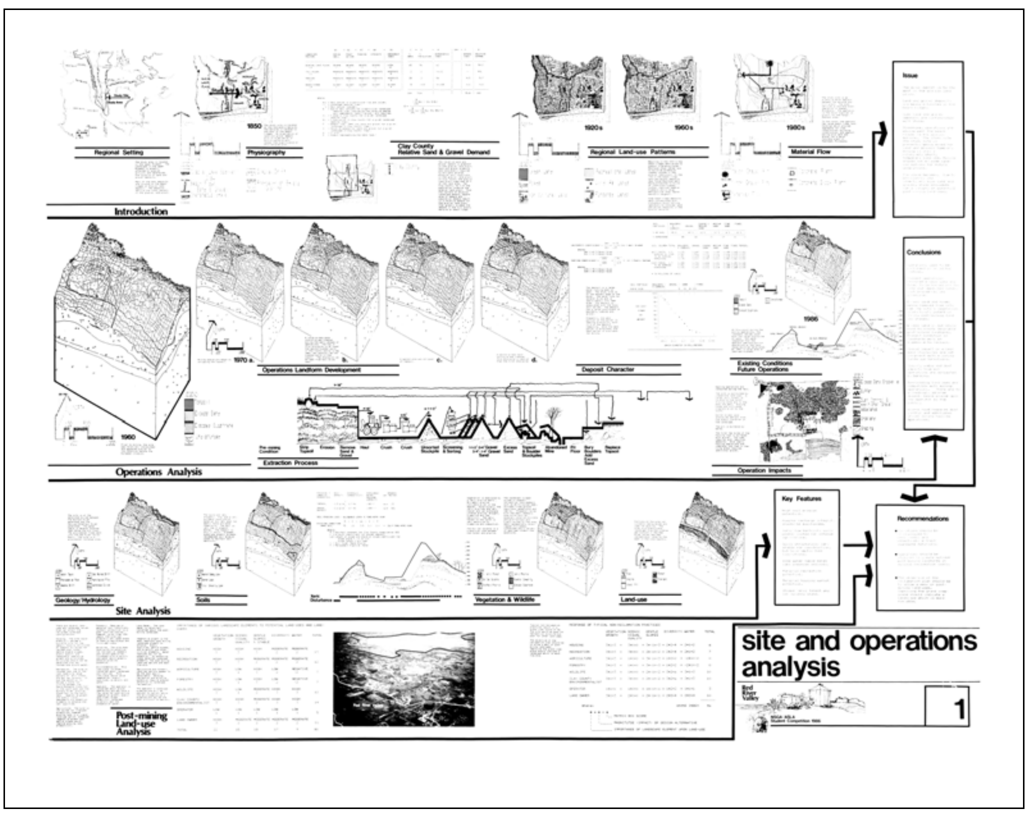

Figure 2. Presentation board illustrating a basic understanding of site operations and regional context (copyright 1986 © Jon Bryan Burley, all rights reserved, used by permission). Examine the board for general layout and organization, not specific unreadable details.

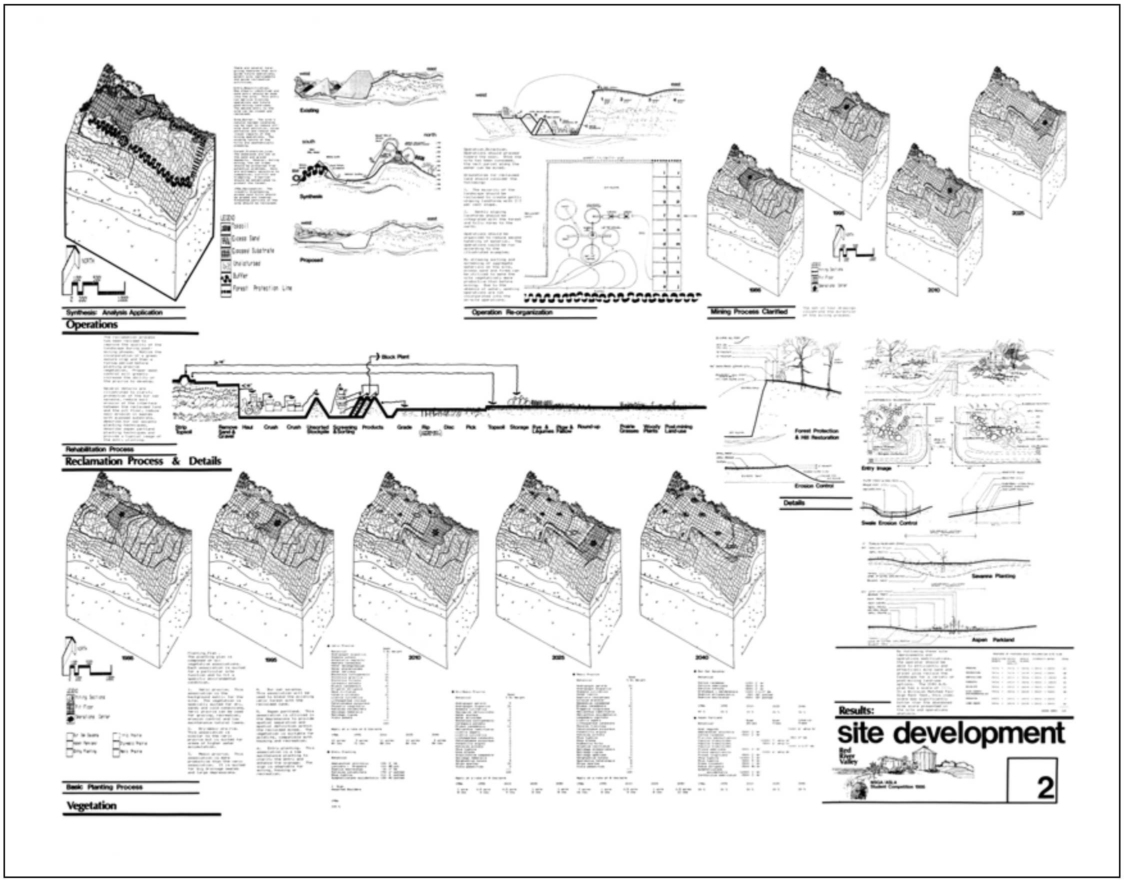

Figure 3. Site development drawings site beautification, operations efficiency, progressive rehabilitation, erosion control, and revegetation (copyright 1986 © Jon Bryan Burley, all rights reserved, used by permission).). Examine the board for general layout and organization, not specific unreadable details. The figure was scanned from a large presentation board.

The second board (Figure 3) depicts approaches to make site operations more efficient, how to protect natural resources, and how the operator can continue to be a good neighbor during the extraction process. This board concludes with an evaluation concerning how much better the site will be for post-mining land-uses once these suggestions are implemented. Based upon the student developed impact analysis matrix, the score changed from 46 to 124. Since students can use whatever analytic tools that they have learned in their coursework, this student utilized an impact analysis matrix where site development criteria are generated. The criteria then can be used to compare various landscape treatments, in this case, between post-mining land-use plans. The differences in scores are relative, where scores within 10 to 20 points indicate similar results and scores differing by more than 50 points indicate that one treatment is highly different (usually better) than another design. So in this case the alternative developments in board two suggest significant improvements.

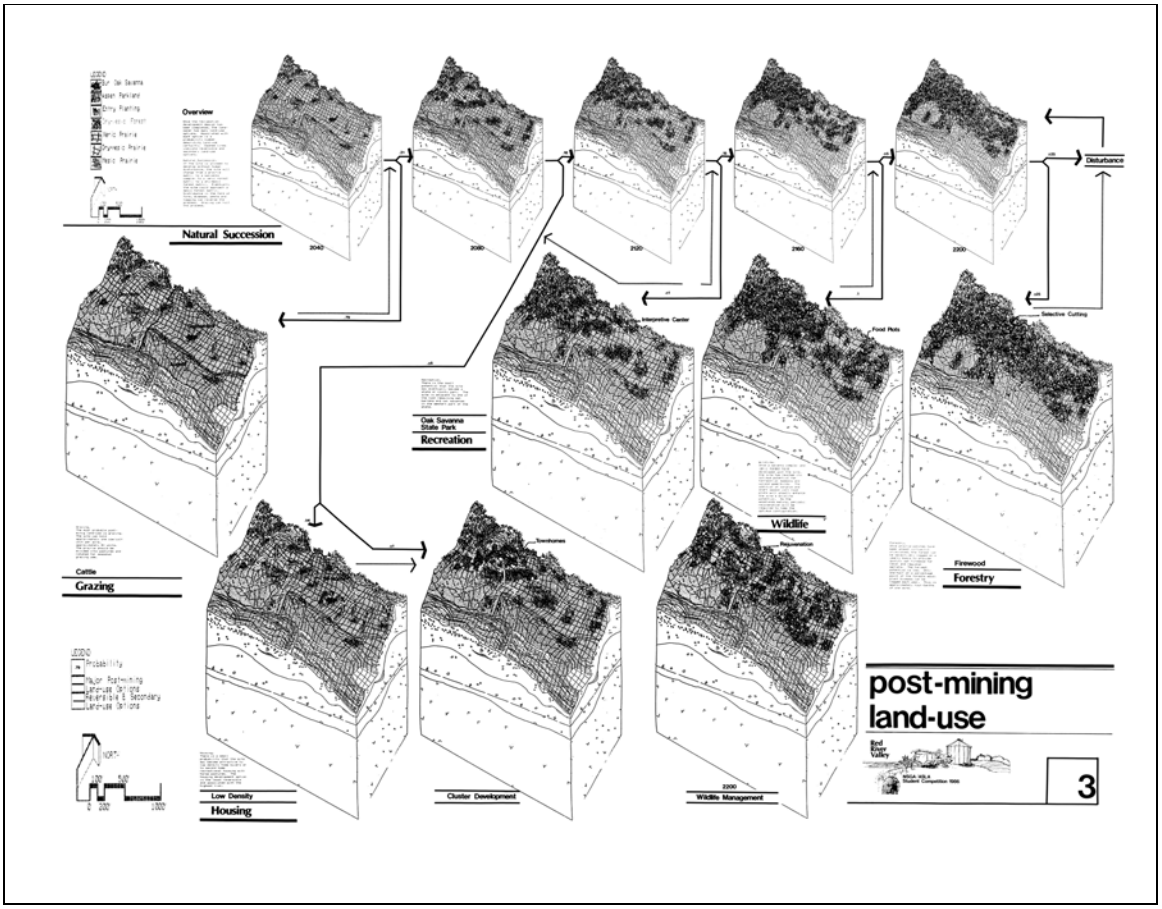

Figure 4. Post-mining land-use plan(s) from 2040 to 2200 (copyright 1986 © Jon Bryan Burley, all rights reserved, used by permission).). Examine the board for general layout and organization, not specific unreadable details.

The final presentation board (Figure 4), illustrates the development of the post-mining landscape from 2040 through 2200 AD. In this example, the landscape is allowed to naturalize. Through time, the student predicts that the site will reach optimum conditions for a variety of land-uses including: grazing, recreation, wildlife, forestry, and housing. Based upon the desired land-use, the landscape can be managed to perpetuate the optimum spatial configuration for the selected land-use.

Non-competition Projects

In the non-competition projects, models are an essential learning component. Figure 5 is an example of the site model at a representative fraction of 1:1,200. The model illustrates the spatial configuration for community form, land form, water form, open space system, and a recreational amenity. This construction is based on orchestrating of the land, water and vegetation during the mining process. In this case, single use residential environments radiate from the mixed-use new urbanist town center which truncates the west finger of the surface water body with a civic and office building. This west finger of the water body is bracketed on the north and south by mixed-use commercial/residential/office structures and "urban" public open space directly on the water's edge. These waterfront open spaces are then linked to the open space system of the whole site both by easements along the waterfront and through "gateways" defined by the semi-circular form of the mixed-use buildings. The open space system links to recreational amenities such as a hiking/biking trail (not visible in this image) and an eighteen hole golf course, identifiable by the white balls signifying tee boxes for the holes. The student(s) here has clearly thought about the sites structure in a holistic manner and given the opportunity for continuing development of their concept at the next scale.

Figure 5. Scale model of proposed reclaimed mine, 25.4 mm = 3.048 m (1"=100'), (copyright © Paul E. Nieratko, all rights reserved, used by permission).

Figure 6. Scale mode of proposed reclaimed mine, 25.4 mm = 3.048 m (1"=100'), (copyright © Paul E. Nieratko, all rights reserved, used by permission).

Figure 6 is another example of the 1:1,200 scale model, again showing student design response at this more broad scale in community form, land form, water form and open space planning. In the model the mixed-use commercial/residential/office buildings (color code: yellow) also contain one level of parking and are formulated around a town square (the town square, community green, courthouse square and human scale streetscapes are hallmarks of new urbanist design). This town square is linked to single and mixed-use residential (color code: violet), office (color code: orange) and open spaces of this site by way of a major cross-axis of pedestrian ways (color code: pink). This open space system focuses upon constructed wetlands, surface water, woodlands and native grass areas to create habitat and circulation corridors for wildlife on and through the site. The larger buildings in the left foreground (color code: red) are an outpatient surgery clinic, senior assisted living, and associated medical offices prescribed in the program. These have been located nearer a regional arterial roadway, which passes the west boundary of the site, to minimize the impact of automobile movement and lessen cut-through traffic potentially disruptive to the wildlife corridors. In this example, ball-head pins represent potential locations for positioning art in the landscape. The students here again have thought about integrating uses of the site in a way which allows work at the next scale to clarify their concept.

Figure 7. Scale model of reclaimed surface mine, 1"=10', (copyright © Paul E. Nieratko, all rights reserved, used by permission).

Figure 8. Scale mode of streetscape of reclaimed surface mine, 1"-10', (copyright © Paul E. Nieratko, all rights reserved, used by permission).

Figure 7 is an example of Part III of the project, the 1:120 scale detail model. At this scale details begin to become evident including materials choices, integration of circulation types, positioning of site amenities, architectural character, planting design, and the interface between hard space and soft space. Note the details in the architecture of the two and three level mixed-use commercial/residential/office structures: fanlight mullioned doors and windows, running bond (brick) and concrete finishes with climbing vines and concrete cornices, arcaded first levels and a streetscape punctuated by vest pocket parks. Note also the details in the site's open spaces: the boardwalk and gazebo at water's edge, the brick plaza with umbrellas and café tables, the brick sidewalks, split-rail fencing and transitional gateways, the clock tower with pyramidal cupola, park benches, globe street and pedestrian area lighting and the ornamental plantings in the park space and at the edge of the streetscape. Students thus express the intended final character of the places they are creating.

Figure 8, also a 1:120 scale model, looks down a streetscape to reveal, once again, details in the architecture and open spaces, demonstrating a different manipulation of enclosure and scale. Here Georgian style brick facades with Flemish diagonal bond, elongated running bond and modified rosette detailing under the folded-plate rooflines set the character of the place. These details are nicely complemented by brick paving for pedestrian movement and stamped-concrete parallel parking bays. The parking bays are broken up by sidewalk bump-outs to create appropriate size root wells for street trees and rest areas for pedestrians along the shopping street.

Discussion

We believe that the use of mine sites in studio instruction allows students the opportunity to apply and integrate current basic knowledge of site grading, drainage, soils, plant materials, wildlife management and design development to various environments for human use and enjoyment. The large scale (typically more than 60 hectares) of mine sites offers the opportunity to program and designing wide ranging single uses such as county or regional parks or golf courses as well as mixed uses such as planned unit developments, new towns, office parks, health care facilities, schools, forested lands, rangelands, wildlife habitat, and related uses. In the design process students have the opportunity to learn about mining processes, pre-mining planning, surveying, excavation, earth sculpting, eco-environmental design, community design, materials applications and equipment capabilities and use. This is a complex set of activities to accomplish. We believe that such projects are most suitable for juniors, seniors, and graduate students because of the long and complex list of abilities that students are expected to integrate.

We also believe that while students are learning, students are also provide for a land owner and sometimes others (mining company, or state, county, township or municipal government) with visions for post-mining site uses, composition, and the opportunity to market those visions.

Cooperative efforts between these concerns can result in efficiency and profitability in all phases of the mining process -- from pre-mine planning through all operations into post-mining rehabilitation, construction, sales, occupancy and post-occupancy site maintenance and management.

In the post-mining phases of the site, the students' plans (in model form) can have positive economic effects on a community by generating jobs in local construction and permanent jobs within the structure of the post-mining land-use--whether that post-mining land-use is housing, wildlife and fisheries, a planned community with retail, commercial and business use, or a recreational amenity or a combination of use types. Students thus benefit and further their professional skills to create meaningful environments through the use of "real sites," surface mine reclamation sites, in the higher educational studio setting. Students learn to plan and design large scale sites with multiple uses, for multiple clients, with interconnections between those uses within the site design process. Post-mining phases of the site can be successful if pre-mine planning follows a known process of simultaneous excavation and rehabilitation to prepare for post-mine site use. Visions for post-mine site uses, generated through cooperative professional design efforts, and if successfully implemented, can create cleaner environments, more efficiently functioning communities, and improve the quality of life for residents of the site's overall regional or community context.

The combination of these four parts of the studio assignment/project can elucidate for a community, mine company or developer the post-mining potential of the site "at hand." At the same time students learn to plan and design large scale sites with multiple uses and interconnections between those uses within the site design process.

Conclusion

Based upon our experiences, we believe there are three points to remember about these student design activities. First, studying surface mining is an excellent forum for advanced landscape designers, because it necessitates the integration of a broad range of planning, design, and management, challenging the student to apply their skills. Second, because surface mine projects usually result in a nearly complete disturbance of the landscape and earth movement, surface mine projects allow the student to use their ingenuity to completely re-grade the site and devise a completely new landscape configuration. We believe that devising a new landscape configuration is a good experience and is in contrast to other studio projects where massive site grading is not encountered in the classroom. Finally, we believe that these projects illustrate the intrinsic post-mining potential that exists on a surface mine and focus issues on the spatial configuration of the landscape. Post-mining land-use designs include various combinations of housing, commercial, industrial, agricultural cropland, grazing land, wildlife habitat, forested land, theme parks, landfills, zoological gardens, recreational lands, and many other uses.

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