Post-mining Land-use Planning and Design: a Multiplicity of Choices and Options

by

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Abstract. Surface mine reclamation planning and design is a topic of interest to landowners, reclamation specialists, citizen groups, and regulatory agencies. Over the past eleven years an international group of 30 land-use planning and design reclamation specialists developed a 501 page camera-ready manuscript concerning post-mining land-use planning and design. This collaborative group notes that efficient and effective post-mining land-use planning and design requires an understanding of the possible configurations affiliated with the landscape, training in the fundamentals of planning and design, and skill in the technological tools of planning and design. Post-mining land-use planning and design usually demands that the reclamation specialist be proficient in detail design, site design, site planning, landscape planning, and design development. In addition, the reclamation specialist who works upon a post-mining land-use plan should be familiar with mining, mineral processing, mining operations, land-use zoning, local ordinances, and site development regulations. Finally, reclamation specialists should be well acquainted with the characteristics and requirements of each general land-use type and be capable in orchestrating these land-use types in a multiple land-use setting.

Additional Key Words: landscape architecture, urban planning, design process, design programming, resource development, mine engineering

Introduction

Over the past eleven years, members of the American Society of Landscape Architects, the Canadian Land Reclamation Association, and the American Society for Surface Mining and Reclamation collectively worked together to produce a manuscript addressing post-mining land-use planning and design. As editor of that manuscript, it is my intent to highlight some of the key planning and design principles expressed by this team.

The fundamental body of knowledge concerning physical planning and design of exterior environments (including surface mine reclamation) is contained within the profession of landscape architecture, where the development of land (including profitability for the client), the preservation of resources (knowing when not to develop), management (sustaining optimum use across time), and public safety and welfare are all addressed. Until recently, much of this knowledge base has been held by planning and design professionals on an almost proprietary basis. Nevertheless, it is recognized by many professionals that information concerning planning and design needs to be shared among citizens, professions, and disciplines so that collectively collaborative decisions can be achieved that reflect the best multi-disciplinary effort to generate a meaningful reclaimed landscape. It is in this spirit that the following ideas are presented to inform, induce dialogue, and to promote thoughtful post-mining land-use planning and design.

There Are Many Potential Configurations For The Reclaimed Post-Mining Landscape

Post-mining land-use planning and design addresses the contents and configuration concerning the reconstruction of a disturbed environment. However, as the late Robert Dorney, an eminent ecologist from Waterloo University stated, the "cure" (reclamation) can be worse than the "disease," (surface mining) (Dorney 1984). No matter how well-intentioned a reclamation policy or treatment might be, unless one designs for the complete ecological and social context of the post-mining landscape, projects in the name of reclamation may inflict greater damage than the environmental quality problems associated with surface mine operations or with orphan mines.

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Original contour mandates, abandoned mine legislation, soil productivity requirements, and land-use composition allocations by themselves do not make good reclamation and as Dorney indicated, can generate their own special kind of problems. In addition, some disciplinary-based specialists have myopic and limited perspectives concerning the nature of reclamation, believing that reclamation is only the act of revegetation, or approximating the original contour, or limiting acid mine drainage, or minimizing soil erosion. While each of these issues is important to understand and consider, they do not constitute the whole of post-mining reclamation. In many respects it is helpful to consider the post-mining landscape as a plastic environment that can be reconfigured into many different possible formations, containing many different features (Burley and Thomsen 1988).

Be Proficient In The Fundamentals Of Planning And Design

Planning and design are professional activities that are difficult to learn by just being smart and reading books on the subject. Studying planning and design usually requires individuals to "do" planning and design and then obtain advice from seasoned practitioners/ academics to fully develop abilities in the planning and design arena. Usually a novice carries much intellectual baggage, bad habits, and misunderstandings concerning planning and design theories that need to be unlearned. Then the individual can be intellectually rebuilt into an architect, landscape architect, planner, interior designer, or engineer. Typically it takes three to five years for this transformation to occur. In addition, states, provinces, and federal governments regulate who is allowed to practice by demanding academic qualifications, internships, and the passing of rigorous exams to obtain a license, a journey from beginning to end that may take 8 to 10 years to complete. Each person who completes this journey is knowledgeable concerning the planning and design processes (Burley 2000), being able to see the bigger perspective regarding the completion of a project and to see the relationship of the smaller details to the broader context. Individuals can use these processes as a tool to generate solutions to complex issues and to assess alternatives.

In reclamation planning and design the five design settings common to landscape architecture are the most applicable. The first setting is the detail design setting, where the size, location, and shape of hardscape (structures, paving, and curbs) and softscape site construction materials (vegetation areas, ponds, and streams) are specified. They are composed to form such features as soil profiles, erosion control devices, vegetation installations, lighting, paving, fences, security systems, swales, ponds, water control devices, recreation amenities, wildlife amenities, and signage. The second setting is site design, where the relative locations of site features are orchestrated and communicated. Site design includes such activities as site grading, vegetation planting, road alignment, site hydrology, structure placement, site utilities, and site layout. The third setting is site planning. In site planning, the early stages of site design are invoked and the products developed in site planning can be abstract, fluid, and conceptual. During site planning, site inventory, programming, site analysis, synthesis, and concept development across numerous alternatives are examined. The fourth setting is landscape planning, where the integration of numerous sites are assessed for their landscape ecological patterns and relationships across the landscape. Regional transportation, watershed hydrology, land-use planning, forest management, regional park planning, regional agronomic and horticultural planning, visual quality management, and regional wildlife planning are typical topics related to landscape planning. The fifth setting is design development where design across scales is integrated and developed from the regional setting to site details. Knowledge and experience in planning and design with these settings, issues, and topics comprise much of the academic and professional activity that is common to landscape architecture and affiliated with post-mining lands-use planning and design.

Understand Mining, Mineral Processing And Mining Operations

In many respects, reclamation specialists are a blend of disciplines and professions. One of the ingredients in this blend concerns a firm understanding of mining, mineral processing, and mining operations. In the planning and design arena, learning about mining would be associated with the programming portion of the design process. While programming for some types of activities can be relatively short and quick, learning about mining takes more time and education. Just as it is important to know about planning and design, similarly, landscape architects, planners, and natural resource professionals need to know about the processes of mining and mineral processing. This type of information greatly assists in understanding profitability in the mining process, constraints and opportunities affiliated with the types of landscapes that are mined, the layout and configuration of facilities to process minerals, and a knowledge about the by-products of mining and processing that may be helpful in creating post-mining landscape configurations. Landscape architects, planners, and natural resource professionals who are

serious about reclamation have earned degrees in mining engineering or in academic programs oriented to surface mining and reclamation. In addition, the annual meetings of the American Society of Surface Mining and Reclamation, the Canadian Land Reclamation Association, and at times the American Society of Landscape Architects offer continuing education opportunities by sponsoring field trips to surface mining operations and processing plants. These field trips merit attendance. Over the years, attendees have observed taconite processing operations, phosphate mining activities, surface coal mining reclamation, remedies for acid mine drainages, silver and copper mining operations, extensive sand and gravel operations, and numerous sites reclaimed to a wide variety of land-uses ranging from rare bird habitat to urban development. Consequently, learning about mining, mineral processing, and site operations makes good sense for reclamation specialists who expect to be involved in post-mining land-use planning and design (Burley and Bauer 2000).

Know Site Development Laws, Regulations, And Ordinances

The regulation environment is an integral part in planning and design and thus it is important in reclamation planning and design, and essential in coordinating multiple land-uses. Like the planning and design programming necessary to develop mineral mining and processing, the regulation environment is also a programming activity. The regulation environment establishes the ground rules related to being a good neighbor to adjoining properties and establishes the rules for the development of land in a coordinated, publicly informed manner. In some respects surface mined land is like any other parcel of land being developed because much of the landscape during development is highly disturbed. Even simple parcels of land being developed have to consider permitting, site inspections, certificates of compliance, approval by planning commissions, posting of bonds, public hearings, placement of excavated substrate, working with toxic materials, preserving topsoil, addressing compaction during construction, site hydrology, soil erosion, balancing the cut and fill of substrates, vegetation establishment, visual quality, temporary facilities, site transportation, pollution reduction, and a profitable land-use—all of which may be involved with the regulation environment. Being a good neighbor and practicing thoughtful management of the required regulation environment is often essential to minimize time delays and litigation. Sometimes for the reclamation specialist, managing the regulation environment is much more time consuming and requires more experience than actually developing the reclamation plan, illustrating the importance of knowing the regulation environment.

Learn The Fundamentals Of Landscape Stabilization

Site planning and site design concerning landscape stabilization is a topic of great interest to civil engineers, agricultural engineers, mining engineers, landscape architects, horticulture specialists, and reclamation specialists. Just like surface mining is a transitional land-use from a pre-mining land-use to a post-mining land-use, so too is landscape stabilization a transitional condition from a pre-mining stabilized landscape to a post-mining stabilized landscape. One of the key principles in managing the disturbed environment is to disturb no more of the landscape at any one time than is necessary, a concept that is widely practiced in the construction industry. Another key principle is to conduct progressive reclamation, where the landscape is reclaimed as the surface mining proceeds across the landscape, a concept widely promoted by the late Ken Schellie (Burley and Bauer 2000). Effective site stabilization should be coordinated with the intended post-mining land-use so that flumed fines can possibly be used as topsoil, sediment ponds are located to accommodate the post-mining design, and leachate piles, potentially chemically reactive materials, and toxic materials are positioned in the post-mining landscape where they are stable and not intruding on the rest of the environment.

Become Familiar With The Requirements For A Variety Of Land-Uses

To design for post-mining land-uses means that one is familiar with the programmatic requirements for a variety of activities, including agriculture, rangeland management, forestry, commercial sites, housing, industrial development, wildlife habitat, recreation, landscape art, and landscape aesthetics. Many reclamation specialists who became interested in surface mine reclamation and became involved in reclamation activities were hired for their expertise in a particular land-use such as forestry management, housing development, or creating wildlife habitat. Because of the multiplicity of potential land-uses and the individual specialists with expertise in various aspects of these land-uses, during the development of a specific landscape site design and the preceding site planning phase, a multidisciplinary team is often required. While a landscape architect or planner may have a strong sense of the overall objectives and coordination of the project, the details often reside with a team of specialists who provide input and assess alternatives in a search for the best solution. One of

the problems with this necessary approach is that it often takes time to find the right mixture of professionals who are compatible as a team, work well together, and understand each other. For this reason, associations like the American Society for Surface Mining and Reclamation, the Canadian Land Reclamation Association, and the American Society of Landscape Architects offer opportunities to gain perspective concerning the beliefs and ideas associated with various individuals and professions. Annual meetings provide a great opportunity to learn about the interests of various disciplines and professions and to network across these disciplines and professions. Attending these meetings and taking college courses addressing each of these land-use specialties will help one become versed in the programmatic requirements of post-mining land-uses.

Learn To Integrate Multiple Uses Across The Landscape

Ecologists are always quick to mention that everything is connected to everything else, and this is an important principle to apply when developing a post-mining land-use plan. A reclamation plan should not be done in isolation, but in some industries it often is done in isolation, especially rural areas. It seems that the aggregate industry and the phosphate industry have emerged as leaders at coordinating their post-mining landscape efforts with the surrounding landscape.

I attribute the integrated land-use planning and design success that the aggregate and phosphate industries have to the strong land-use planning counties and municipalities containing these industries. For example, sand and gravel mining often occurs adjacent to urban development where there is a current land-use zoning plan and regulations concerning transportation, dust control, erosion control, setbacks, densities, dimensions and related issues. Communities have a long history of developing multiple land-use plans, integrating land-uses, accommodating the needs of citizens, and protecting natural resources. In addition, some counties (e.g. Polk County, Florida), and a few states (e.g. Hawaii) are quite capable in orchestrating the development of land across numerous interests. Several arms of the United States Federal government are also quite capable in developing multiple land-use plans such as the US Forest Service and the National Park Service. Both have a long tradition of hiring landscape architects and planners to develop their multiple-use land-use plans. At times the U.S. Federal Government has mandated original contour, soil productivity, or other restrictions concerning some industries in some regions. However, mandating prescriptions to land-use may not be as effective as developing municipal and county land-use zoning plans. Such zoning plans may reflect more experience and flexibility towards multiple land-use coordination and a fair amount of common sense built along with a commitment to local concerns via elections and appointments. Often, new agencies and programs that enter the land-use planning arena lack the experience and institutional wisdom that local and regional planning agencies have. At times they may lack the commitment to the local population that municipal, township, and county governments may possess.

Acquire Skill In Planning And Design Technology

Besides having an understanding across knowledge bases (planning and design, mining, mineral processing, mining operations, land-use and development laws and regulations, specific requirements of various land-uses, and issues related to multiple land-uses), reclamation specialists interested in post-mining land-use planning and design should have a strong grasp of the technology affiliated with planning and design.

The contemporary planning and design tools include GIS (Geographic Information Systems), visual modeling software, and presentation software. In addition, landscape engineering software related to site hydrology, earthworks, soil erosion, CADD, and software supported by the Federal government related to surface mining and reclamation. However, for land-use planning and design purposes, GIS has become an essential component (Burley *et al.* 1992) for developing landscape suitability analysis, landscape alternatives, spatial assessment, calculating compliance, and representing the plan in map form (see Burley 1999 for an illustrative example). In addition, the presentation of design proposals through the use of visual presentation software tools (Burley and Brown 1992) has brought a degree of realism and objectivity that has not been possible in the past (see Keefe and Burley 1998 for an illustrative example). Without training and ability with these tools, reclamation specialists interested in post-mining land-use planning and design will not be as efficient and effective.

Summary Perspective

Post-mining land-use reclamation planning and design is a topic that is not widely published but which has a knowledge base grounded in the landscape architectural literature, supported by a body of information concerning design theory, design process, design fundamentals, and construction technology. In an international collaborative effort, 30 reclamation specialists have developed a manuscript providing their insight into post-mining land-use planning and design.

In the manuscript we note that in many respects, creating a reclamation plan is a professional art, relying upon science for pertinent technical information. Over the last 100 years, perceptions concerning what constitutes reclamation have changed and now reflect environmentally cognizant sensibilities and contributions from a broad array of specialists. While the practice of landscape architecture and related reclamation planning and design is often limited to state registered individuals, it is important that others be familiar with the knowledge bases that comprise environmental planning and design. Thus I would strongly recommend that an individual interested and committed to post-mining land-use planning and design should first obtain a professional degree in a planning and design profession such as landscape architecture. In addition, I would urge earning a companion degree related to reclamation/mining engineering, professional experience, and professional registration. Many of the authors of the post-mining land-use planning and design manuscript have practiced what they preach by obtaining professional design degrees, degrees related to mining, reclamation, and natural resources, acquired professional practice experience, and obtained professional registration and certification, preparing themselves to serve as post-mining land-use planning and design reclamation specialists.

In closing, post-mining land-use planning and design is a topic with a multiplicity of choices and options concerning education, experience, and possible post-mining landscape configurations. In addition, the diversity of environments across the globe where mining occurs and the breadth of minerals mined offer intellectually interesting opportunities for post-mining land-use planning and design. To learn more about these choices and options, it is recommended that one examine the forthcoming published document where one can read in detail about these issues and examine the extensive literature cited in this forthcoming publication.

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