1

SOME BACKGROUND ON THE SUBJECT OF SITE GRADING

SITE GRADING INFORMS DESIGN

Inspired landscape designs contain at least one vital ingredient: an inspired grading design. Many designers consider landscape grading as the generative basis for many of their successful landscape site designs. The ambition of this text is to present an approach to grading that will prepare students not only to grasp and master concepts of landscape site grading but to develop site-grading and drainage design solutions that are both practical and aesthetically pleasing. Students reading this text will appreciate that the underlying approach considers grading as an integral component of site design. Design should be in their thoughts as they walk from their design studio class and into the classroom where their grading course is held. Just as they spend their design studio class time and their evenings striving to develop exciting and inspiring landscape design solutions, they should experience this same enthusiasm in the hours they spend developing grading assignments.

Cultures throughout history have modified the native landscape to accommodate their activities and to facilitate their survival. The Native Americans who settled in what is now Bandelier National Monument in New Mexico found a river valley suitable for habitation and managing their crops (Figure 1.1-A). Modifications of the existing landscape were required to enable them to adapt to the landscape they found. In some cases the modifications

were substantial, and in other cases little change was required. In contrast, the designers of Teardrop Park, a high-rise residential development in Lower Manhattan, New York City, were challenged with making substantial modifications of the existing ground to realize the award-winning site design (Figure 1.1-B). In both cases the resulting landform seems natural—that is, it does not appear that very much modification of the existing ground occurred, while in fact a great deal of site grading was required.

Figure 1.1-A Bandelier National Monument, New Mexico

Figure 1.1-B Teardrop Park, New York City

Figures 1.2-A and 1.2-B provide an example of a utilitarian application of site grading to accommodate human activities. What appears as a flat lawn area is in fact a sophisticated site-grading design with subtle slopes to disperse rainwater. The site also required an equally sophisticated soil preparation and underground drainage system to support a healthy lawn capable of withstanding a large crowd.

Site grading is an integral aspect of specialized landscape designs. Elaborate and aesthetically pleasing landforms are developed in designs for specialized uses such as golf course greens, skateboard parks (Figure 1.3-A), and outdoor event spaces (Figure 1.3-B). Site grading is as much an art form as a disciplined application of specific practical and functional considerations.

Figure 1.2-A Bryant Park, New York City, in the early morning

Figure 1.2-B Bryant Park, New York City, later in the afternoon

Figure 1.3-A Alamosa Skate Park in Albuquerque, NM

Figure 1.3-B Stern Grove Amphitheater, San Francisco, CA

LET'S BEGIN

Some time ago, someone gave me a round metal badge (see Figure 1.4) with the message "Time for Design." I have long forgotten who gave me the badge and the organization behind the badge. For the last several years I have worn the badge at the first few class meetings of the introductory site-grading course I teach. I have found that students generally

do not think of grading as having much to do with design, at least at the beginning of the course. Their impression is that design studio is about design, and the site-grading course is about math. When they come to the grading class they turn off the design side of their brains. It seems they set aside what they have learned in design studio when working on grading exercises and projects. I go out of my way, during the early meetings of the landscape site-grading course, to stress the importance of design and to explain, verbally and with visual examples, how site grading is fundamental to achieving creative as well as functionally appropriate, responsive landscape designs. The process of grading and the exploration of reshaping the land can inform design.

THE IMPORTANCE OF GRADING IN DESIGN

Students readily understand the need for, and importance of, design studio courses in the curriculum. And of course they spend most of their waking hours—including late into the night—on their design projects. When a design project is due, students will be working on their designs in my grading class. I have worked to figure out how to reprogram design students to understand and believe in the importance of landscape site grading during their academic preparation, because they will surely come to realize grading's important role after graduation, during their early professional careers.

Figure 1.4 Grading involves design and can be the generative basis of an outstanding site design

I have given all this a lot of thought, asking why grading often takes a back seat to design and some other courses. I have come up with a number of possible explanations. A majority of design students are visual learners, but grading texts do not approach the subject of landscape site grading in visual terms. The nonvisual approach used in existing textbooks employs

left-brain content in presenting the material, and walks students through grading as basically problem solving, learning to apply mathematical formulas. Another explanation that I can get my arms around—one that is not so slippery to defend—is that students do not necessarily understand what it means to be a well-rounded and effective professional landscape architect or designer. So it is important, in the introductory grading course, to describe the context of grading in the continuum of academic preparation and professional practice. Students must be taught that grading is not an accessory but a key element in the design process, leading through design development, contract drawing preparations, and finally to the building of their projects. Grading can be the generative basis of arriving at a design concept. Given the generative potential of site grading, an introductory course in grading should be approached as a design activity. Like design, grading can be approached as a reiterative process and not a straight-line process with a beginning-to-end trajectory. Additionally, students should think of grading as the framework for design. Solving site-grading problems, like design, is a process grounded on in a body of knowledge that students must come to understand and master. Another parallel to design: Site grading involves the mastery of representational graphic skills necessary for clearly communicating a design intention, as well as for problem solving. Lastly, I alert students to the fact that in order to become licensed professionals they will have to successfully pass all portions of a landscape architecture licensure examination (a national examination administered by individual states) that tests for competency not only in planning and design but also in grading, drainage, professional practice, history, plants, and topics unique by state in some cases[1].

1 Most states require an additional section to the LARE (Landscape Architect Registration Examination) to test the knowledge and competency of candidates in topics unique to the individual state. For instance, Alaska requires candidates to take and pass an arctic engineering course, while California and other Southwestern states test candidates for water management and plant selection considering drought conditions.

Site grading is typically taught as a stand-alone course in the technology stream of a landscape architecture or allied discipline curriculum. While this approach will most likely continue, there is a growing consideration for greater integration of site grading, and technology in general, with the design studio stream. This book is written to address the ambition to achieve a greater integration of design and site grading by placing emphasis on the design implications of site grading and presenting the material visually as well as textually. In considering how to approach writing this text, the author recognizes that students enter a program with an academic preparation and set of life experiences influenced greatly by computer and other technology.

A PICTURE IS WORTH A THOUSAND WORDS

Walking around a high school or college campus, one will quickly notice that most of the students' heads are tilted downward as they walk across campus or sit amongst their friends, with thumbs flying, either texting or doing Google searches. College students come into academic life well versed in and adept at a range of computer skills, and they expect the computer to be their primary means of doing their course assignments, including those in landscape architecture studio courses. While these students are highly computer literate, they may not have a sound grasp of the physicality of the world. I mean by this, that they may not understand concepts of scale or have knowledge of the physical attributes of the material world they pass through every day (such as its dimensions, construction materials and details, and design codes). This statement may not ring true for everyone, but it would benefit students to give them more hands-on experience of the materials they will be working with in solving for grading solutions. This text attempts to provide as close a hands-on experience as possible of the physical elements that a course in grading must address for the students. Actual examples, photographed in the everyday landscape, are integrated with the text (as in Figures 1.5-A and 1.5-B).

Figures 1.5-A and 1.5-B are examples of the type of diagrams that have been developed throughout the book. Photograph A shows

an undulating grass area with hypothetical contour lines superimposed. Image B is the same location with just the contour lines, as might be found in a grading plan.

The information superimposed on the photographs is descriptive, to help the reader better visualize the information presented; it is not meant to be, in Figure 1.5-A for instance, the actual location or contours of the particular site photographed.

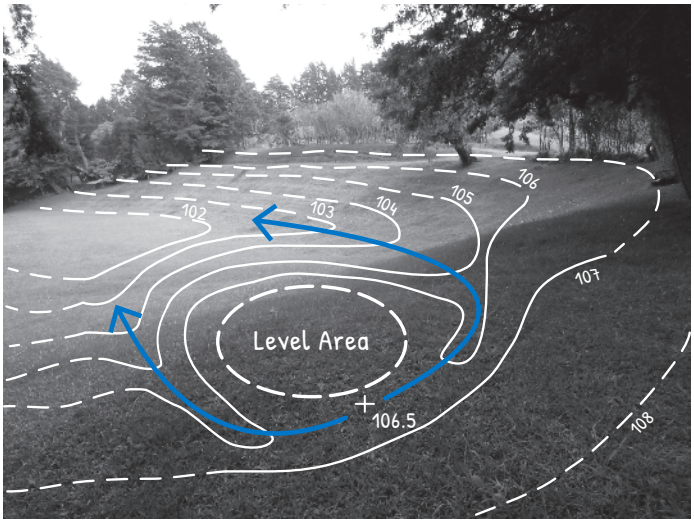

Figure 1.5-A Contour lines superimposed on a landscape

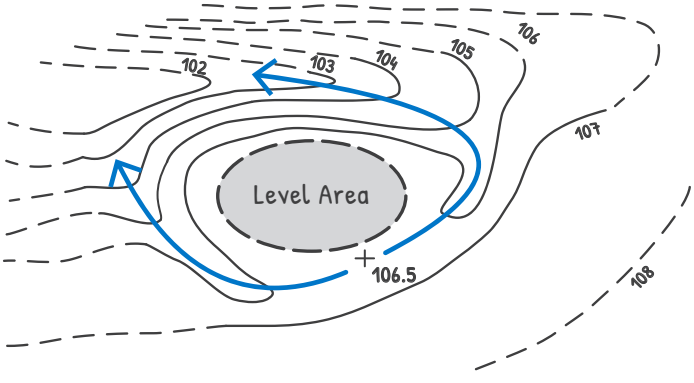

Figure 1.5-B Contour lines as they might be shown in plan view without the photograph

GAINING AN ESSENTIAL GRASP OF SITE-GRADING CONCEPTS

The impetus for this text is to present the technical material necessary to prepare students of landscape architecture and allied design professions in the art and science of grading and drainage, following a more accessible, visual approach. The goal is to provide students with an essential grasp of the material necessary to understand and master site grading. The students will also learn to solve simple as well as complex grading and drainage problems. The approach to achieving these goals emphasizes learning and understanding what is necessary through visualization, rather than relying on an approach that emphasizes problem solving through mathematical calculations. The primary approach of design education is an emphasis on a visually

based problem-solving process, and this approach has its parallel in grading and drainage education. If the students are to believe the message on my "It's Time for Design" badge, then it seems a visual approach to learning site grading would be appropriate. At least the students would see the parallels between design and grading more readily. That is my hope and was the basis of developing the textbook Landscape Site Grading Principles.

The three images in Figures 1.6 through 1.8 were selected to present the range of public park spaces where site grading and design are integral to the projects. In all three projects, site grading was the generative force of these projects' success. They have become popular urban recreation and passive open space retreats in dense urban areas.

Site grading has become increasingly important, particularly in many specialized and emerging areas of site design. For instance, Figure 1.9, a skateboard park located in Albuquerque, New Mexico, represents a project type that has become very popular. Site grading is the foundation in the design of this kind of recreation venue. In golf course design, the more successful projects—those that challenge the golfer—are the result of carefully considered grading design. Athletic fields for all sports require the application of sound grading principles that not only contribute to the success of play but also facilitate successful ground maintenance.

Figure 1.6 Brooklyn Bridge Park, New York City
MICHAEL VAN VALKENBURG ASSOCIATES

Figure 1.7 Water Works Park, Phoenix, AZ
CHRISTY TEN EYCK, LANDSCAPE ARCHITECTS

Figure 1.8 Lucasfilm's Letterman Digital Arts Center campus, at the Presidio, San Francisco, CA
LAWRENCE HALPRIN, LANDSCAPE ARCHITECT

Figure 1.9 West Side Skate Park, Albuquerque, NM
MORROW REARDON WILKINSON MILLER, LANDSCAPE ARCHITECTS

Landscape Site Grading Principles was written for an introductory course in site grading for students in landscape architecture and architecture, as well as for majors in horticulture and landscape construction. Also emerging is a plethora of certification and two-year courses in landscape architecture from various providers, including community and technical colleges and nontraditional providers. *Landscape Site Grading Principles* can either serve as the primary required text for an introductory course in landscape site grading or be considered as a supplement to other required texts. *Landscape Site Grading Principles* has been written to serve both purposes.

WHAT THE STUDENT NEEDS TO KNOW ABOUT SITE GRADING

Site grading plans must not only solve practical requirements and meet various governmental standards but also create landforms that contribute to the aesthetic ambitions of overall landscape site design and architectural design concepts. *Landscape Site Grading Principles* will provide students with the necessary background knowledge and problem-solving

skill set to develop site-grading plans that meet the standards of care expected of design professionals.

WHAT DOES THE STUDENT NEED TO KNOW ABOUT GRADING?

1. Be familiar with drafting conventions and the use of architectural and engineering scales.
2. Be able to read topographic maps and be able to identify landform features such as hills, valleys, steep and not-so-steep terrain, and drainage patterns. Also, the student should be able to determine elevations of any point or feature from a topographic map.
3. Be able to visualize three-dimensional landscape from contours given on a topographic map or map prepared by a land surveyor.
4. Be able to create a land surface, path, or built program feature that has a prescribed or intentional slope.
5. Be able to manipulate (change or modify) contours in order to create desired landforms and sloping surfaces. Also, the student must be able to manipulate contours so as to direct the flow of surface water in a desired direction, such as away from the entrance of a building.
6. Be able to assign spot elevations in plan and on sections.
7. Be able to calculate the volume of earth moved within a project site and determine the volume of earth or other soil or rock material that needs to be transported to or off the project site.
8. Be able to prepare (draw) grading plans following graphic conventions so that the contractor knows what to build. The grading plans must be of sufficient detail, and of course accuracy, that the contractor can prepare with confidence a cost estimate for doing the required work as depicted in the drawings and other contract documents.
9. Be knowledgeable about and understand various and pertinent design standards and legal requirements associated with grading. This knowledge base may include functional design requirements of minimum and maximum slope for various program elements such as recreation fields, parking and circulation, and handicap access (standards for persons with ambulatory and other physical disabilities).

10. Be able to develop grading designs that fall within project budget constraints, while meeting client program and functional requirements.

11. Be able to prepare grading plans that meet standards of care related to meeting public health, safety, and welfare design standards—that is, grading plans that limit and reduce the chance of public harm such as physical injury.

The eleven points in this list may appear daunting to the student taking an introductory grading course. Through the process of academic preparation, internship, and other forms of professional practice experience, students will achieve mastery of what a landscape architect is required to know and perform. Start with little steps, steps that build on one another, while acquiring the knowledge, skills, and tools necessary for preparing increasingly complex and challenging grading problems.

The building blocks for building competency in designing[2] (solving) grading plans for a project begin with being able to read topographic maps, including understanding scale and understanding various frames of survey reference such as datum terms of elevation and grids. After learning how to read a topographic map, one needs to learn principles of working with contours, spot elevations, and slopes to arrive at grading solutions. The student will also learn to visualize alternate grading design solutions, using and manipulating contour lines and calculating spot elevations toward creating landscape site-grading solutions. Finally, students should learn and follow the graphic conventions necessary for preparing the grading plans and drawings that provide the contractor with instructions. Grading plans and drawings are the landscape architect's instruments for conveying design intent, or what the contractor is expected to build, following the directions contained in the plans and support documentation.

2 The word "solving" is commonly used to describe what a student does when given a grading assignment. The word suggests the use of mathematics and formulas and therefore may reveal why students find it convenient to separate grading from studio design. "Design," as a verb, is often used to mean solving a problem. The use of numbers and the employment of numerical calculations, while implicit to solving grading and drainage problems, is not implied in solving or creating design solutions. So, perhaps we should ask the students to develop a design solution for a grading assignment, as opposed to "solving" the proposed problems that make up the assignment.

Professional Relationships

The preparation of site-grading plans involves the collaboration of many disciplines. The typical team of consultants might include a landscape architect, civil engineer, land surveyor, architect, geotechnical engineer, and structural and electrical engineers. Professional land surveyors prepare the site survey and what serves as the base drawing for much of the site-grading work required. The base drawing prepared by a land surveyor documents existing conditions, including at a minimum:

- Property lines, servitudes, and easements
- Large trees and other significant vegetation
- Topography
- Structures
- Other on-site physical features requested by the client or the project prime consultant

Landscape architects, civil engineers, or both in collaboration, typically prepare site-grading plans. How the two collaborate will vary by project. It is common for the landscape architect to prepare a preliminary site-grading plan during the schematic and design development phases of a project. The landscape architect will have prepared a preliminary site design, then will develop a preliminary grading plan. These plans set the foundation of the landscape grading, including the earth forms, slopes, and critical elevations of hardscape areas and structures. The civil engineer may then take over in the design of storm water systems, principally sizing catch basins and belowground piping systems determined by runoff and infiltration calculations and the sizing of drainage channels. The civil engineer may also do the final site-grading design of roads and parking lots. Assignment of responsibilities is established during the negotiation of the professional services contract and may also be dictated by local or state laws that specify the responsibilities for "stamping"[3] the construction document drawings.

3 "Stamping" refers to professional licensure and the disciplines required to prepare various construction documents as defined by individual state licensure laws. By stamping or signing a technical plan, the individual or firm represented by the stamp becomes responsible for its accuracy and the health, safety, and welfare issues promulgated by the state.

Figure 1.10 is an example of a schematic design where grading is clearly an important element of the design. This plan was included in the review package submitted to the public client and was used to inform the park stakeholders at a public meeting.

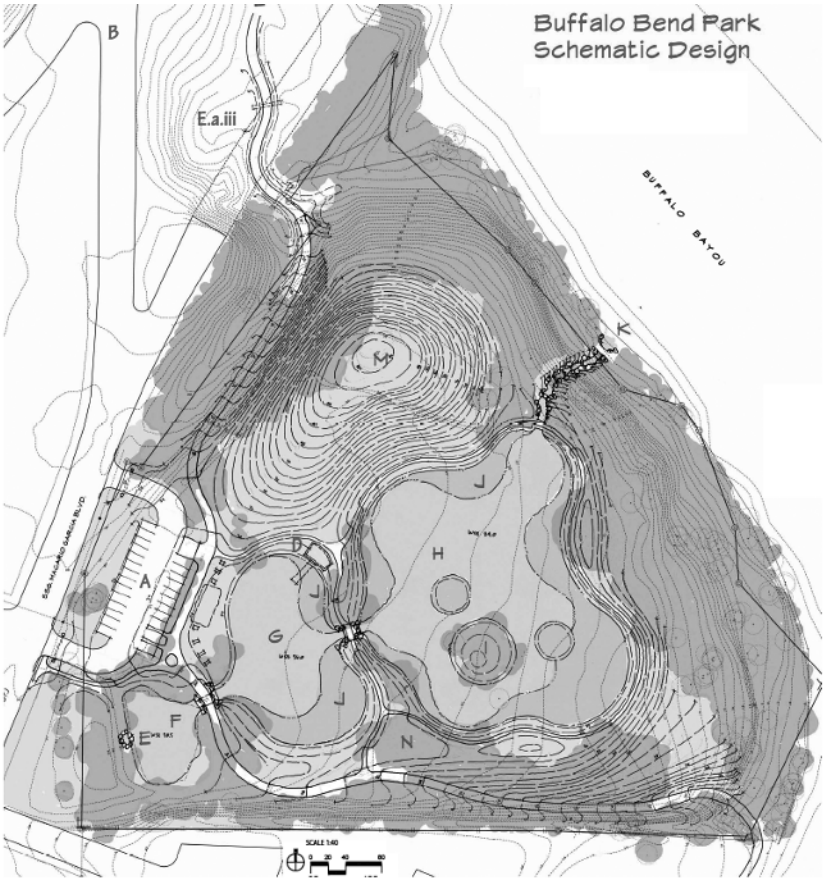

Figure 1.10 Buffalo Bend Park, Houston, TX
SCHEMATIC DESIGN PLAN COURTESY OF THE SWA GROUP

The Basic Structural Approach to This Book

The primary subject of this book is site grading: an introduction to the principles of landscape site grading for the visual learner. The first few chapters introduce background subject matter before focusing on the topic of site grading itself. Increasingly, as university-based landscape

architecture and allied design programs have shifted emphasis from analog to digital representation, much of the material included in the early chapters of this book has dropped out of mainstream design curricula. For instance, drafting as a subject, together with documentation conventions, has for the most part been integrated into technology or early design courses. Map reading, drafting, and land surveying as stand-alone required course subjects have been folded into other courses and given, for the most part, cursory coverage. The content remains important, however, in considering the contents for this book it was felt that a basic introduction to the subjects of drafting or documentation conventions, map reading, and land surveying should be included, in order to better prepare students for the larger subject of site-grading principles. Students will increase their knowledge, understanding, and skills in all three topics as they fulfill internship requirements and as they advance their capabilities as part of their professional development.

Avoiding redundancy is one of the tenets discussed in Chapter 4, which discusses drawing and documentation conventions. The reader may notice that a topic is covered in more than one chapter, contrary to the tenet on avoiding redundancy. However, when this occurs, it is an effort to provide cohesion where crossovers between related subjects merit some repetition.

Let's get started!