Estimating Project-Specific Restoration Costs

Terri Thomas, Presidio Trust, P.O. Box 29052, San Francisco, California 94129; tthomas@presidiotrust.gov
Garrett Lee, Golden Gate National Recreation Area, Building 201 Fort Mason, San Francisco, California 94123; garrett_lee@nps.gov
Anna Fenton-Hathaway, Presidio Trust, P.O. Box 29052, San Francisco, California 94129; afenton-hathaway@presidiotrust.gov

Introduction

Golden Gate National Recreation Area has planned and implemented restoration projects for the past 25 years, accumulating a greater understanding about restoration tasks and costs over this time. One lesson learned is that restoration costs are typically underestimated because they fail to address necessary maintenance costs. Often, hidden costs such as plant propagation or transportation are not fully realized until project implementation.

Accurate cost estimation is important for several reasons, including determining necessary replacement costs when mitigation is required, making accurate funding requests for projects, and drawing cost comparisons between the National Park Service (NPS) and commercial vendors. This final reason is becoming more pressing due to the current NPS trend toward outsourcing and contract support, which are often seen as cost-saving measures.

Background

Golden Gate National Recreation Area has the good fortune of a large and active volunteer base to support restoration activities. Volunteer programs in habitat restoration began in 1983 and have grown to levels of 200,000 volunteer-hours per year in natural resources management alone. As volunteers have become integral to the park's restoration efforts, it has become increasingly important to quantify the total effort required for restoration projects—and to estimate the cost savings volunteers provide.

The park's restoration database was designed in 1996. It had five main goals: to better track the status of over 80 restoration sites, to document the different types of work conducted at each site, to document the habitat restoration and monitoring work conducted by volunteers, to demonstrate tangible evidence of the importance of volunteer support within the natural resources program, and to enable communication among staff and volunteers by documenting restoration and propagation techniques and methods.

The initial section of the restoration database, called "work performed," took three months to develop and two years in practice before becoming fully functional and widely used by field staff. It was originally developed in Microsoft Access Version 2 and was converted to Microsoft Access 97 in 2000. Sections on best management practices, monitoring, and nursery activities have since been added. This paper will focus on the database's work performed section.

The work performed section captures three types of data: hours spent working; activity type (e.g., mapping, planting, removing exotic plants, seeding, installing irrigation, installing erosion control, or monitoring); and work group type (e.g., school groups, volunteers, Americorps members, contractors, or staff). All restoration field activities are documented by project site and date on standardized parkwide field forms. Due to the initial inconsistencies in documenting, the first few years of data are not as reliable as those from the last several years. Now that staff and volunteers understand the importance of the database and are better practiced at data entry, approximately 95% of the field work is documented through the database.

Cost Estimating Using the Restoration Database

NPS has used the database to get a better

grasp on the amount of field work required for successful restoration. Data were analyzed and compared for three restoration projects in the Presidio: the Feral Dunes restoration, the Crissy Marsh restoration, and the Inspiration Point viewshed enhancement project. Field implementation costs were estimated using average unit costs for staff time based on current (fiscal year 2003) salary scales and an approximated constant to determine the value of volunteer time ($^1/_2x = y$, where x is the amount of work a typical staff completes, y is the amount of work a typical volunteer completes, and $^1/_2$ is the approximated constant). This cost tracking has realized several database goals, including:

- Ascertaining the differences in cost between habitat types. From restoration database analysis, we were able to document an approximate 2:7 cost ratio between restoration in dune scrub habitat (the Feral Dunes and Crissy Field projects) and restoration in serpentine grassland habitat (the Inspiration Point project). This is attributable to the differences in soil substrates: dune sand soils are generally uncompacted and easy to work in, while serpentine soils are more consolidated, making the work more difficult. (Serpentine soils often include bedrock conditions, further complicating the planting.)
- Documenting follow-up maintenance needs after restoration. The data reflect both how intensive maintenance is required in the initial years after restoration, and the decreasing yet essential need for maintenance over time. Analysis of the Feral Dunes project suggests that maintenance costs peak in the first two to three years after initial restoration, but persist over time in decreasing amounts. The analyzed projects were all implemented within the last seven years, and continue to show maintenance needs to differing extents. One project in the park at Milagra Ridge was only considered stable after about 15 years.
- Making comparisons between previously conducted restoration projects and proposed projects. With the recent revision of NPS funding call requirements, the database serves a vital new role: to conduct cost comparisons between proposed projects and completed projects of similar scope and scale. For the fiscal year 2004–2006 servicewide funding call, the database's cost tracking analyses were used to estimate the cost of a proposed project in a similar habitat type. By adding current fee schedules from outside contractors to the equation, in-house restoration costs can be compared fairly with outsourcing costs. Conducting this type of cost-effectiveness analysis will become increasingly important as the NPS begins outsourcing the work that is currently conducted in-house.
- Estimating the value of volunteers to the park. The estimated value of the work conducted by volunteers in is now being officially quantified and recorded. The savings in field work from volunteers is substantial, ranging from 20% to 70% in the three analyzed projects.

Restoration Tasks Not in the Database

The restoration database only documents and estimates costs for work performed in the field. Identifying all other project tasks and costs is an important next step. These additional activities might include planning, site analysis, compliance, contracts, public outreach, project management, seed collection and propagation, data entry, reporting, supplies, and equipment. A *restoration costs worksheet* is being developed to capture all the potential elements of a restoration project, from inception through implementation and maintenance (Table 1).

The comprehensive restoration worksheet comprises over 70 tasks, and is designed to address hidden costs up front. It is divided into eight main sections: general planning, site-specific planning, project compliance, pre-implementation, project outreach and education strategy, implementation, maintenance, and monitoring and analysis. Subtasks

Table 1. Comprehensive restoration worksheet

I. **GENERAL PLANNING**
1) PROJECT MANAGEMENT
2) DATA COLLECTION AND DETAILED SITE ANALYSIS
3) PROJECT MANAGER (GS-9)
4) AERIAL PHOTOS
5) BASELINE SOIL TESTING
6) HYDROLOGIC ANALYSIS
7) GROUNDWATER MONITORING
8) WELL INSTALLATION
9) SUBSTRATE ANALYSIS
10) SLOPE AND ASPECT ANALYSIS
11) BASELINE PHOTO MONITORING
12) SPECIAL STATUS SPECIES INVENTORY
13) BASELINE BIOLOGIC INVENTORY AND MONITORING
14) EXISTING CONDITIONS VEGETATION MAPPING
15) REFERENCE SITE VISIT/MONITORING
16) ARCHEOLOGY
17) CULTURAL RESOURCE INVENTORY
18) LAND ACQUISITION AND/OR PERMITTING
19) BACKGROUND LITERATURE REVIEW AND OTHER INFORMATION GATHERING

II. SITE SPECIFIC PLANNING
20) GOALS AND OBJECTIVES
21) SUCCESS CRITERIA
22) PROJECT IMPLEMENTATION DESIGN (specification development, educational strategy)
23) MONITORING PROGRAM DESIGN
24) PEER REVIEW OF PLAN
25) EXPERIMENTAL DESIGN
26) VERIFY AVAILABILITY OF EQUIPMENT AND VEHICLES
27) CONTINGENCY PLANNING PERCENTAGE
28) PEER REVIEW OF EXPERIMENT DESIGN

III. PROJECT COMPLIANCE
29) NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)
30) CORP OF ENGINEERS 404
31) NATIONAL HISTORIC PRESERVATION ACT (NHPA)
32) MIGRATORY BIRD TREATY ACT
33) ENDANGERED SPECIES ACT (USFWS/NMFS)
34) RESEARCH AND COLLECTION PERMIT
35) ENVIRONMENTAL PROTECTION AGENCY (EPA)
36) CLEAN AIR ACT (REGIONAL BOARD)
37) CLEAN WATER ACT (REGIONAL BOARD)
38) PUBLIC REVIEW AND LOCAL NEIGHBORHOOD INPUT

IV. PRE-IMPLEMENTATION
39) CONTRACT PREPARATION
40) ADMINISTRATION & PROCUREMENT
41) PLANT PROPAGATION
42) PLANT AND SEED PALETTE
43) PROPAGULE COLLECTION
44) PLANT SALVAGING
45) NURSERY PROPAGATION
46) SCHEDULING - COORDINATING COMPONENTS & SEQUENCING
47) TIMING FOR BIRD NESTING, WINTER RAINS, ETC

V. PROJECT OUTREACH AND EDUCATIONAL STRATEGY
48) DEVELOP PUBLIC AWARENESS SIGNS AND BROCHURES
49) PUBLIC AWARENESS ROVING
50) ENVIRONMENTAL TRAINING FOR CONSTRUCTION WORKERS
51) BIOLOGICAL MONITORING & PUBLIC EDUCATION DURING HEAVY EQUIPMENT CONSTRUCTION

VI. IMPLEMENTATION
52) PROJECT MANAGER
53) CONTRACT ADMINISTRATION & PROCUREMENT
54) VEGETATION REMOVAL
    i) SALVAGE AND STORAGE OF LOGS
    ii) CHIPPING, HAULING AND DISPOSAL
    iii) LANDSCAPE FABRIC INSTALLATION
    iv) OTHER PLANT REMOVAL TREATMENT AND DISPOSAL
55) FINAL GRADING
56) SOIL PREPARATION
    i) SOIL TURNING
    ii) SCRAPING
    iii) SOIL IMPORTATION
    iv) SOIL AMENDING
    v) SALVAGE AND STORAGE OF TOPSOIL
    vi) WEED CONTROL IN STOCKPILED SOIL
    vii) REPLACE TOPSOIL
    viii) RIPPING/DISKING
    ix) AUGURING
    x) DRAINAGE AND EROSION CONTROL

57) EROSION CONTROL
    i) SILT FENCE INSTALLATION
    ii) STRAW WADDLES INSTALLATION
    iii) STRAW BALES INSTALLATION
    iv) STRAW MULCH
    v) STREAMBANK PROTECTION

58) REVEGETATION
    i) SET UP PLANTING DESIGN IN THE FIELD

Table 1 *(Continued)*

- ii) TRANSPORTATION OF PLANTS
- iii) SEEDING
- iv) OUTPLANTING
- v) HERBIVORE PROTECTION
- vi) TEMPORARY IRRIGATION
- vii) WATER CONNECTION & BACKFLOW INSTALLATION
- viii) ABOVE-GROUND DRIP SYSTEM
- ix) ABOVE-GROUND SPRINKLER SYSTEM

59) RESOURCE PROTECTION
- i) INSTALL TEMPORARY FENCING AND FLAGGING OF SENSITIVE RESOURCES
- ii) INSTALL TEMPORARY PUBLIC AWARENESS SIGNAGE DURING CONSTRUCTION
- iii) PERMANENT PERIMETER FENCING
- iv) PERMANENT SIGNAGE

60) INVASIVE PLANT COMTROL
- i) HAND REMOVAL
- ii) MECHANICAL REMOVAL
- iii) DEBRIS BOX DISPOSAL
- iv) HAULING AND DISPOSAL
- v) WEED SUPPRESSION
- vi) HERBICIDE APPLICATION

61) EXPERIMENT SET UP

VII. MAINTENANCE

62) PROJECT MANAGEMENT
63) FIELD TECHNICIAN
64) CONTRACT ADMINISTRATION & PROCUREMENT
65) INFRASTRUCTURE MAINTENANCE
66) EROSION CONTROL
67) IRRIGATION AND IRRIGATION
68) FENCE
69) SIGNS
70) PLANT MAINTENANCE
- i) INVASIVE PLANT CONTROL
- ii) REPAIR HERBIVORE PROTECTION
- iii) SUPPLEMENTAL PLANTING
- iv) SPOT HERBICIDE APPLICATION
- v) INFRASTRUCTURE REMOVAL
- vi) EROSION CONTROL, IRRIGATION AND PLOTS

VIII. MONITORING & ANALYSIS

71) PROJECT MANAGEMENT
72) CONTRACT ADMINISTRATION & PROCUREMENT
73) MONITORING
- i) PHOTO-MONITORING
- ii) RESTORATION SUCCESS CRITERIA
- iii) WILDLIFE POPULATIONS
- iv) SOIL SITE CONDITIONS
- v) SENSITIVE SPECIES
- vi) HYDROLOGY
- vii) DATA ENTRY

74) DATA ANALYSIS AND FINAL REPORT

can easily be left in broader categories or described in more detail. The worksheet will be continually refined in order to capture all the elements of restoration. Additional research is necessary to develop accurate unit costs for many of the elements presented in Table 1.

Although it demonstrates an attempt to estimate costs objectively, the restoration costs worksheet still requires the subjective input of an experienced individual who can assess staff competency and approximate hours worked. The following factors can significantly influence restoration costs, and are best addressed by experienced staff:

- The location of a project, which affects costs depending on travel involved, equipment access difficulties, or limited access to infrastructure such as roads or water.
- The size of a project, which is subject to economies of scale. The average cost per acre is lower for larger areas.
- The complexity of a restoration, which affects costs depending on whether the project is one of habitat creation or enhancement.
- Site quality and adjacent conditions, which affect costs associated with invasive exotic plant control, trespassing, grazing, etc.
- Compliance issues, which can affect costs depending on the sensitivity of the natural and cultural resources involved.
- Prior experience and knowledge in the type of plant community being restored,

which influences the efficiency of the project.
- Multiple-use factors such as bisecting trails, which can increase project costs.

Conclusion

Using the database to track restoration projects in Golden Gate National Recreation Area has yielded valuable insights into understanding project cost variations and accurate cost estimating, including habitat type factors, post-restoration needs, and maintenance. It has also been a useful tool in making cost comparisons for proposed projects. Using the database to analyze and compare cost effectiveness will become even more important as NPS faces new decisions about outsourcing restoration work. Volunteer work may gain more prominence as a cost-saving measure in these future analyses, and the database will prove invaluable in these comparisons, as it has helped quantify the monetary value of volunteer work conducted in the park.

Although it supplies vital information in terms of simple cost comparisons, the scope of the restoration database remains limited. It only covers some pieces of the restoration puzzle, and requires intense effort to develop and maintain. A more complete picture of restoration costs is still needed. Developing detailed, park-specific restoration cost worksheets may be a more realistic solution for parks across the country.