



# Course 400. Crew Leadership: Project Management

Learn the steps for estimating time and materials, and setting up a work project. Learn about trail triage: how to prioritize and what techniques to use when total trail reconstruction to ideal specs is not an option. Understand environmental concerns and policies that may impact projects. Learn what to look for when scouting a trail and how/when to schedule work. Develop advanced knowledge of project layout and trail (re)construction.

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## STUDENT SKILL OUTCOMES:

- A basic understanding of trail eyes and trail triage.
- How to identify trail work tasks that need to be done.
- Ability to identify which tools are needed to do a trail job, about how many people, and how long they will take to complete a job.
- The confidence to undertake the projects described during the course.

## KEY TERMS:

trail triage, trail eyes, trail reconstruction, step-over, trail analysis, tread reconstruction, trail relocation

## TOOLS NEEDED PER 8 STUDENTS:

1 clinometer, 24 pin flags, 4 rolls of flagging tape, 4 marking pens, 1 measuring tape, 1 shovel, 1 Pulaski, 1 small rock bar or pick mattock, tennis ball or orange; and 4 copies each of sample and blank JHAs.

## WORK SITE REQUIREMENTS:

A section of trail near a trailhead that needs a variety of work, from brushing and log out to drainage structures and perhaps a special project (rock wall, stump removal, poor stream crossing).

## TRAIL MAXIMS:

“Develop and enjoy the mixed curse of trail eyes.”  
“You’ll never see trails the same way again.”

## HANDOUTS:

- Project Planning form
- Project Scouting form

- Tailgate Safety Session and Tool checklist
- Project Report

## KEY CONCEPTS:

- 1) Annual Maintenance vs Trail Rehabilitation
- 2) Trail Triage - Setting Priority of Projects:
  - Major Safety Concerns
  - Resource Damage
  - User Convenience
- 3) Typical Basic Maintenance Needs
  - Vegetation, Structures, Signs, Tread, Drainage
  - When should work be done?
- 4) Scouting the Trail
  - What to look for
  - Project Scouting Form
  - How to report
- 5) Estimating Work
  - Assess trail for needed maintenance or reconstruction
  - Project resource estimates:
    - Number of workers needed
    - Time needed to complete
    - Materials needed and native resource availability
    - Who will do the work?
    - Tool list plus transport considerations
- 6) Common maintenance needs:
  - Priorities
  - When should work be done?
- 7) Environmental concerns
- 8) Reporting Promptly

## BACKGROUND


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**Note:** All forms mentioned in this course are available at <http://pcta.org/volunteer/crew-leader-center/>

When a trail has not been maintained for a number of years and/or was poorly designed, it often has a variety of tread and drainage problems. Such problems could include some or all of the following: **slough and berm**, **cupped tread**, **gullying**, **slipped tread**, insufficient **outslope**. If a trail needs many of these repairs, it likely needs a complete makeover, known as **trail reconstruction**. Such reconstruction is a major undertaking, usually involving an experienced crew working a considerable amount of time to combine **tread reconstruction**, installation of various **drainage structures** and, if necessary, design and construction of **trail relocations** or **realignment**.

Prior to beginning such work, a crew leader carefully assesses and completes a log of all the work to be done. Such a log includes an estimate of the number of trail workers needed, with which particular skills, and how many days of each are needed. Also included are the tools and materials needed, a map, and any special concerns, such as the best time of year to conduct the work or special safety precautions.

Fortunately, complete reconstruction is often not needed and just a few items of trail work are critical. In such a case, a crew leader still needs to assess the work carefully, to properly prepare for a work party. The "Project Scouting Form" is used by PCTA crew leaders for such **trail analysis**. As you'll see, tasks to be completed can be as simple as cutting brush, logging out, or cleaning drainages for a section of trail.

 **Trail Eyes:** Of course, to be able to conduct such trail analysis requires that a crew leader can see all the work to be done. This takes practice and the development of keen trail eyes.

As a crew leader evaluates the range of project options, they should consider which projects are the best fit for the group of volunteers they are likely to recruit. Obviously, they need to select projects that are matched to the skills and endurance of the volunteers with whom they will be working.

### 1. Annual Maintenance Versus Trail Reconstruction/Rehabilitation

It is important to distinguish between annual maintenance needs and **rehabilitation** or **reconstruction**.

Simply put, annual maintenance (covered in the next section) is the work that needs to be done each year to keep the trail open, safe and functional. Doing this work in a timely manner will prevent problems from worsening and becoming major projects. Examples of maintenance include logging out, brushing, tread work, cleaning drains and replacing an existing sign.

There is much confusion over the terms rehabilitation and reconstruction. You will find the two used interchangeably. They both refer to bringing the trail up to standards, performing deferred maintenance and making necessary fixes to the trail and trail structures. Clarification can be necessary to ensure agency partners that by the term **reconstruction**, you do not imply that you will be relocating the trail; but rather simply fixing or "rehabbing" the existing trail in its current location. Examples include installing new trail signs, redigging sloughed tread, drainage installation or reconstruction, rebuilding or realignment of tread and removal of major obstructions. Rehabilitation typically requires a significant amount of time devoted to a short length of trail. For example, if five volunteers spend eight hours brushing a quarter-mile of trail this would be considered rehabilitation because if annual maintenance was conducted, this work would be unnecessary.

### 2. Trail Triage :

Because there is almost always more trail work to be done than trail workers to do it, crew leaders must constantly decide what work to tackle now and what can be postponed until later.

**Trail Triage** has three levels of priority; level one being the most important work:

- Level 1: hazardous conditions
- Level 2: correcting trail damage
- Level 3: restoring trail to standards

**Note:** It is important to communicate with land managers and PCTA staff regarding priorities in a specific area.

**Level 1 Priority:** The highest priority trail work eliminates substantial safety risks on the trail that could injure a trail user. Examples include:

- Relocating a trail to avoid a new active rock slide
- Filling new holes in a trail or bridge deck that could break a horse or person's leg, especially in dim light
- Replacing a washed out or collapsed bridge, if the stream is unsafe to ford
- Extreme brush growing over a trail that causes users to lose their way
- Narrowed tread on a steep slope
- Trees or rocks protruding into the trail

Until such hazards can be remedied, at minimum they should be posted at nearby trailheads and on the PCTA website. In extreme cases it is necessary to close the trail until the hazard is removed.

**Level 2 Priority:** If there are no major safety risks on a trail, then the next priority should be to reduce unacceptable resource damage on the trail. Examples include:

- A failed drainage that is causing gullying of a trail, especially if sediment is washing into a nearby lake or stream, thus harming aquatic life
- A boggy portion of trail that is causing users to create a much wider trail or multiple trails, especially if sensitive plants or animals live in the area
- A failed bridge or blowdown that is causing users to create new trails, especially in sensitive habitat, such as along streams
- Brush or logs on the uphill side of a trail, pushing users away, causing them break down the outside of the tread

**Level 3 Priority:** The lowest priority work on a trail serves simply to improve user convenience. Examples include:

- Brush, saplings, or limbs growing just a little into the trail corridor on flat ground
- Logs across a trail that can be step-overs
- A failed bridge in an easily-forded wilderness setting; etc.

Even on a day of routine trail maintenance (clearing blowdown, cutting brush, and cleaning drainages), trail crews often must make decisions about what to do that day and what to leave for later. If they know they will only have one day to work on the trail and it will be a year or more before another crew returns, they must make many on the spot decisions about which branches and logs to cut and which drainages to clean. Of course, those that cause the most inconvenience to users or are closest to causing resource damage should be the highest priority.

### **3. Typical Basic Maintenance Needs: (Adapted from PNTA)**

When assessing trail maintenance needs, the following groups of general maintenance categories should be considered. Some of the more common maintenance activities required to remedy deficiencies identified during the annual trail evaluation could include:

#### **Vegetation Maintenance:**

- Brushing/clearing areas
- Remove fallen trees/branches
- Hazard tree removal
- Slope re-vegetation
- Back slope grooming
- Vista maintenance

- Poison oak/ivy removal

All side branches extending into the trail clearing should be cut flush with the parent branch or stem, leaving no stubs. This is safer, lasts longer, and also allows for the wound to heal naturally.

Small trees and shrubs within the tread should be grubbed out to prevent tripping. Holes should be filled and compacted. Trees and brush outside the tread (but inside the trail clearing) should be cut as close to the ground as possible, leaving no sharp or pointed stumps or stems.

Fallen branches and trees should be removed except for a few large trees/logs near access points. On larger logs, remove a section only the width of the tread to further restrict unwanted use. In high use sections of the trail or near camping areas, dead or dying trees that have a high possibility of falling across the trail or camping area should be removed.

### **Structure Maintenance:**

- Bridge repair
- Cribbing/retaining wall repair
- Barrier/guardrail repair
- Step repair
- Fence/gate/style repair
- Shelter repair

The major consideration in structure maintenance is safety. Bridges, stiles, boardwalks and all support structures should be routinely inspected to ensure safe conditions and intended function. The trail crew should provide minor maintenance of structures. Deficiencies requiring major efforts should be planned as a separate project. Unsafe structures should not remain unattended. If work must be temporarily deferred, an alternate trail route should provide a bypass of the hazard.

### **Sign Maintenance:**

- Sign repair/rehabilitation
- Sign replacement
- Blaze repainting and maintenance
- Cairn repair
- Barricade/closure device repair

Signs are probably the quickest way to leave the trail user with a positive impression. If signs are high quality, well maintained, and properly located, other trail problems which are harder to solve are often overlooked. Consistent signage is the quickest way to increase the trails identity and the public's support for the trail.

For more information on signing, please refer to 208 Trail Signage and Installation.

Other objectives are to:

- Provide positive exposure of the trail to attract more users,
- Educate the user about the trail through trailhead kiosks,
- Reassure the user that he/she is on the right trail and will not get lost,
- Control trail usage and create a safer, more enjoyable, environmentally friendly experience
- Balance aesthetic considerations to avoid "sign pollution."

### **Tread Maintenance:**

- Grading/outsloping tread
- Spot surfacing
- Turnpike repair/cleaning
- Surface replacement
- Surface repair: slough, berm, cupped/gullying tread, slipped tread
- Remove loose rocks

When tread repair is needed; it should be restored to the original design condition, free of loose stones, rock points, stumps, and roots. Attention should be given to dips and out sloping so that water does not collect on the trail.

### **Drainage Maintenance:**

- Cleaning/repairing structures
- Culverts/waterbars
- Grade dips/drainage ditches
- Replacement of existing structures
- Culverts/under drains
- Install additional drainage structures
- Waterbars/culverts/grade dips

Proper drainage protects the trail from erosion damage. Trails should be routinely inspected to ensure that all culverts, dips, waterbars, drainage ditches, etc., are free of debris and ready to function properly at all times – especially during the rainy season or spring runoff. Routine maintenance is not only necessary, but valuable in terms of labor, material, and money saved on emergency repairs, and in the number of days the trail is useable. If repairs are necessary, they should meet or exceed the original construction specifications.

Think about which of these basic needs your project may encompass and shaping your project plan.

**Scheduling Annual Maintenance and Projects:** On average, most trail segments need maintenance about three times a year. This varies greatly based on local soil, vegetation and weather conditions so consult with your local PCTA and agency staff.

Early Season – Depending on where you are on the PCT, this time frame may vary as much of the trail is under snow. This may be the maintenance period that involves the most work. The objective is to get the trail ready for the spring hikers and riders. In addition to general trail cleanup, some of the more important tasks are to:

- Remove tree limbs and fallen trees from the trail, and prune encroaching limbs as needed.
- Make sure that all signs and trails emblems are in place and well maintained.
- Inspect for standing water in the trail and take corrective action.
- Carefully inspect all bridges – immediate safety needs should be met and tasks that are too large for immediate action noted.
- Maintain all trailheads, campsites, and other support structures.
- Keep a list of larger jobs or those that require different tools that will require attention at some other time.
- Schedule time for major projects that were identified – round up tools and helpers.
- Pick up litter.

Mid-Summer – Early July is a good time to take care of annual growth so that the trail is kept clear and relatively easy to travel. Weeds and briars should not assault the trail user. The bulk of your projects can be accomplished during this time, with most of the trail accessible and the largest numbers of volunteers. Some of the key jobs for mid-summer are to:

- Cut all weeds, brambles, briars, and brush encroaching on the trail. On sections of the trail that pass through fields or other places receiving direct sunlight, this may have to be done on a more frequent basis – perhaps monthly throughout the summer.
- Prune all brush and overhanging limbs that have grown into the trail clearing – all blazes and signs must be visible
- Complete the larger jobs that could not be completed the previous spring.
- Maintain and improve waterbars, drainage ditches, and all trail structures.
- Be alert for noxious or exotic plant species – remove, kill, or inventory them for future vegetative management projects.
- Pick up litter.

Fall - Fall maintenance is geared toward preparing the trail for the winter months. Many of the lower

elevation sections of the PCT can still be worked at this time. If you're scheduling a project in these "shoulder" months, be sure to have a backup plan in case of inclement weather. This is a time to:

- Finish any uncompleted jobs and recheck signs – replace and repair as necessary.
- Fall is the best time for rebenching or drainage rehabilitation. Snow will compact the soil.
- Contact land managers to thank them for their support.
- Start planning project for the next year.
- Pick up litter.

#### 4. Scouting the Trail:

When scouting a section of trail, it is essential to collect accurate data of current trail conditions and needs. A useful resource is the PCTA's "Project Scouting Form." Check with local agency personnel to see if they have site or agency specific guidelines to scouting reports. For example, XXYZ National Forest may have a standardized form for you to submit before considering any work or XXYZ State Park may have a number of sensitive archaeological sites in the area and require GPS points of any rock quarrying sites. Bottom line, it will save you time and resources to know before you go and get the complete and accurate report the first time around.

It is also necessary and prudent to understand a particular trail's user group(s). While the PCT accommodates hikers and equestrians, you may find yourself scouting a mountain bike trail or an ADA accessible trail. The differences in these trails are many, as is the maintenance necessary and the scouting details.

**Monitoring Trail Conditions:** For routine maintenance, a detailed trail condition assessment may not be necessary. However, there may be sections of the trail where it is not possible to complete all maintenance immediately or where more help, in terms of labor and/or money is needed. For example, during a routine walk through, a severely eroded, rather lengthy trail section may be noted. Since the best solution for a severely eroded trail section may be to relocate it, the work may not be within the capabilities of the maintaining group to correct immediately. In that case an assessment is needed so that the major needs can be made known. With this information at hand, funding or labor may be found to assist in correcting the problem. A maintenance assessment can also serve as a basis for applying for Challenge Cost Share funds. One way to accomplish an annual trail assessment and document heavy maintenance needs, or just provide information on the condition of the trail, is through the use of a trail assessment or inventory form. Agencies may require you use their forms (from Pacific Northwest Trail Association).

Basic scouting can be broken down into inventory, assessment and prescription:

- **Inventory:** accurate basic information about the trail; i.e. location of access point/trailhead, dimensions and locations of existing structures, etc.
- **Assessment:** an objective perspective of what exists on the trail and how that measures against the trail's standards. For example, corridor is only brushed to six feet high and standards call for ten. Estimating the priority levels occurs here.
- **Prescription:** what should be done to meet standards (refer to Section VI. Estimating Work) For example: "a six person crew is needed for one week to construct a rock retaining wall in a 20 ft. section 1/2 mile south of ABC Trailhead."

When scouting, take thorough detailed notes that can be easily understood by others. For example: "There are logs that need to be removed" is not nearly as informative as "1.4 miles from ABC Trailhead, two 28" cedar logs across the trail, would require one hour of crosscut work." Likewise, "eroded tread" does not convey nearly as much information as "tread gullying for 30 yards; needs four or five rock check dams to repair, native material available onsite."

Consider mapping your locations, either by marking a topographic map or taking GPS points. This step can be incredibly helpful both in informing necessary personnel and enabling you to hand over the work to someone else if/when necessary.

Photos to accompany your notes are incredibly useful. Take them frequently and from multiple angles.

Keep notes of what photos correspond to specific locations and if possible, note GPS position for later reference. Photos should include a measure of scale, such as an average height volunteer or a tool marked with duct tape at regular intervals.

Consider the use of pin flags or flagging tape to designate where you intend to work. You may use a variety of colors to designate different tasks. For example, red pin flags could indicate a realignment of a section and pink flagging tape could indicate trees that must stay. Whatever system you decide, be sure it is clear to all those working with you.

## 5. Estimating Work:

Once you have selected projects that are appropriate for your crew, estimate how many volunteers you will need to accomplish the tasks in the time you have available. One way to estimate the amount of labor needed is to break down the project into tasks you could do yourself with one less-skilled volunteer. Then estimate how long it would take the two of you, taking into account travel time, safety talks, breaks and some trail fun. If it appears the total project would take the two of you six days, then  $6 \times 2 = 12$  volunteers needed to do the project in one day, assuming good volunteers, good weather, and good leadership.

If you usually have a 10-20% no-show rate for volunteer projects, best to add a few more volunteers for the project. Remember that in most Wilderness areas group size is limited to 12. Also, with a larger group, be sure to include enough assistant crew leaders to maintain a 1:4 ratio of skilled to less-skilled labor to maintain quality and safe work.

If the project you plan to do is complex, invite a skilled agency person to join you for a site visit and to help with work estimation. There is a wide array of factors that affect how much work volunteers can do. Consider asking the following questions when scouting a project: (adapted from *Lightly on the Land*, page 24)

- How long will it take for the crew to travel to the worksite from a trailhead or camp?
- What tools will be needed and how will they be transported?
- What building materials will be required? Are they on site? If they must be moved a distance, how will they be moved?
- Will the agency provide any on-site personnel in the form of work supervisors or laborers?
- Will the site be closed to public use? Is the crew likely to lose time waiting for trail users to pass?
- How will you re-direct trail users safely through or around you work site?
- When work is complete, how much time will be required to close down the project, clean up the area carry out tools and gear and store equipment?
- Are there seasonal patterns of heat, cold, precipitation, or other environmental conditions that could affect production? Will the crew require time to acclimate to a high elevation before being able to work at full strength?
- Can a crew complete the project safely? If you have concerns about what you see, time estimates become secondary to finding a safe way of doing the work or abandoning the project and locating another that is more appropriate.
- How many volunteers can safely operate in the project area without being crowded? This is particularly important on switchbacks and steep slide slopes
- Will the project engage the interest of crew members and leave them with a sense of accomplishment?
- Can the site accommodate a variety of projects allowing volunteers to swap out from more “high energy” tasks?
- Will the crew members transport their gear and provisions to camp?
- Where is the camp located? Shortening the end of day hike as much as possible will keep motivation high.
- Is there a backup project if they finish the work ahead of schedule?
- Will your project require pack stock assistance? How many?

Additionally, add at least 10% more time and volunteers to your estimate to allow for final details that make a good project into a great one.

Assess what materials will be needed for the project and examine the project setting to see if what you need is available. Is there suitable rock or trees for waterbars or check dams? Do you need to make plans for a certified tree feller to drop any needed trees if no recently blown down ones are available. Do you need to bring in pressure treated posts? Do you need to haul in gravel for turnpikes?

Once you have a good idea of what your project will be, you can locate the appropriate JHA(s) for the job and know what PPE the tasks will require.

### **Who Will Do the Work?**

A project may be better suited to one group or another. While scouting keep in mind the physical ability and specific skills necessary to complete a project. Will you need packer support for the project to transport gear and materials? How long and difficult is the hike? Should the workforce be a volunteer crew, a corps crew or a professional agency crew? Estimating these factors beforehand will allow you to better advertise your project.

### **How Many Tools Will We Need?**

Basic information on tools, use and safety can be found in 107 Hand Tool Field Maintenance and 304 Crew Leadership: Managing Volunteers as well as in the terminology section.

When scouting a project, be sure to note what tools are needed. Can brush be cut with loppers and handsaws or would it be more productive to have a brush saw? Will this project be in a designated Wilderness area, eliminating the potential for power tools?

Remember that each job has a proper tool and to use them for their intended purpose. For example a shovel is designed for digging and moving dirt. Using it to chop roots is not only dangerous for the tool but for the safety of the person using it. Many accidents are caused by using tools improperly.

Estimate to bring 2 tools per person. This should cover all of your needs. Also consider how tools will be transported. Will you need to prepare the tools for pack stock? If you are carrying the tools; how far? Know the abilities of your group and their limits as far as transport.

A useful resource is the "Tailgate Safety Session and Tool Checklist." This document will allow you to record which tools you are bringing on a project to ensure you leave the site with everything you came with. This task can be easily given to any volunteer on the project.

## **6. Environmental Concerns:**

Two of the most important factors to consider when designing or maintaining a section of trail are sustainability and durability. Building a proper trail at the onset may be more difficult but in the long run is a wise decision as it will lead to less maintenance later.

- **Sustainability:** The trail should cause as little impact to the surrounding natural features as possible. It must cross the land without causing soil erosion, path widening, vegetative trampling, or spoiling the natural qualities of the area.
- **Durability:** The trail must be able to withstand heavy use over long periods of time with minimal maintenance. Rock is preferable to timber for construction as it is more durable. Side hill construction will take longer initially but prevent major erosion issues later. Initial trail design should take advantage of the natural features on a trail to ensure drainage rather than relying on maintenance intensive structures.

In addition, when scouting a problem section of trail; return to the trail triage knowledge. Is it a safety issue? Is it a resource issue? These factors are more important than having a trail that is "easy" to walk, though user enjoyment and experience should not be forgotten.

**NEPA:** The National Environmental Policy Act (NEPA) is designed to provide a thorough understanding



of environmental impacts of a project. (Text adapted from the America's Byways Resource Center Vistas newsletter from the September/October 2009 issue.)

**What Is The National Environmental Policy Act?** The National Environmental Policy Act (NEPA) was enacted into law in 1969. NEPA establishes policy, sets goals and provides a means for carrying out the policy. NEPA contains "action-forcing" provisions to make sure that Federal agencies act accordingly to the letter and spirit of the Act (40 CFR 1500.1 (a)). The NEPA process is intended to help public officials make decisions that are based on an understanding of environmental consequences, and take actions that protect, restore and enhance the environment. Among other things, NEPA requires all Federal agencies to:

- Assess the environmental impacts of major Federal projects decisions such as issuing permits, spending Federal money or actions taken on Federal lands
- Consider the environmental impacts in making decisions
- Disclose the environmental impacts to the public
- Consider public input on the proposed action and environmental impacts

Several states have also enacted "little NEPAs" or State Environmental Quality Acts that have somewhat similar requirements for State-proposed or -funded projects.

**How Does NEPA Affect My Project?** Federal NEPA requirements will need to be followed if you are proposing a project on Federal land, or that will use Federal money. Similarly, if your project is within a State that has State Environmental Policy Act (SEPA) laws' and only uses State funds, you may be required to follow State regulations.

NEPA can help make better decisions. By carefully examining a proposal and its environmental effects along with alternative ways of accomplishing your project, you may find a more effective less costly or less impactful way of accomplishing your objectives.

NEPA can impact your project's timeline and readiness. The more complex and/or controversial the project, the longer NEPA may take to complete. The NEPA process for simple projects may only take a few days, while complex and/or controversial projects may take a year or longer.

NEPA can affect your project's costs. In many cases, a Federal agency may take on the costs of completing the NEPA analysis for a project on its lands. But some agencies charge for the preparation of NEPA documents for projects proposed by outside groups. So it is important to meet and partner with any affected Federal agencies in the early planning stages of your project.

**What are the Different Kinds of NEPA Documents?** Federal agencies use three types of documents and environmental reviews to address NEPA requirements. Because state-level (little NEPA) requirements vary by state they are not listed here.

- A Categorical Exclusion (CE) is normally completed for small, routine projects where the agency has a record that demonstrates that this type of project normally does not result in significant environmental impacts, either when considered by itself, or along with other related actions. Analysis and documentation can often be done in a few days.
- An Environmental Assessment (EA) is prepared for proposed actions when the agency needs to study the issues and environmental impacts of the project before determining whether an Environmental Impact Statement (EIS) is necessary. If the project does not have significant impacts, the EA process concludes with a Finding of No Significant Impact (FONSI). If the project does have significant impacts, an EIS is prepared. A FONSI presents the reasons why the agency concluded there are no significant environmental impacts projected to occur when the project is implemented. Analysis and documentation often take several months or longer.
- An Environmental Impact Statement (EIS) is prepared for proposed actions that do have significant environmental impacts. The requirements for an EIS are much more detailed than for an EA or a CE. A Record of Decision (ROD) is published to state the decision, identify the alternatives considered, identify the preferable alternative, and discuss any mitigation, monitoring and enforcement measures. Analysis and documentation may take a year or longer.

Ideally, the environmental assessment (EA) process is adopted prior to action taken anywhere along

the trail. When this cannot be done, trail advocates should take positive steps to minimize potential impacts. However, the general guidelines listed below should be followed:

- Design considerations for trail layout fall into one of two major categories: user and environmental. These may often be in conflict with each other. When conflict exists, error should be on the side of environment rather than on the side of user convenience or desire.
- When locating or relocating a trail, key places where the trail must pass should first be identified. These could be campgrounds or campsites scenic view areas, the best stream crossing sites, historical sites, connection spots with other trails, water sources, etc. Next, these locations should be marked on a topographic map or aerial photo. The best way to connect these features, considering slope, soil, and other factors should then be determined.
- Local experts and agency officials should be contacted to learn what fragile soils, threatened or sensitive species, cultural and historical resources, and other opportunities or concerns occur in the corridor. This consultation process should determine if an EA is necessary and minimize passing through any areas of concern.
- Quality of trail construction plays a significant role regarding impact on the environment. When a trail is located and constructed so that it requires minimal maintenance, there is less present and future environmental impact. Considerations such as slope, proper drainage, etc. are important factors.
- The standards for the trail, structures, and support structure are designed to protect the environment as well as the user. They should be followed closely to ensure environmental protection.
- In order to avoid damage or destruction of historic or prehistoric resources, the project must comply with the requirements of the National Historic Preservation Act and the Archaeological Resources Protection Act when it occurs on state or federal lands or when it involves state or federal money or personnel. Project approval regarding historical and archaeological concerns usually rests with the State Historic Preservation Office (SHPO).

A cultural resource survey conducted by trained archaeologists is usually required prior to any earth disturbing activity. In some states an agreement is reached with the SHPO to wait until the initial trail is established before doing the survey, because:

- Trail construction normally involves a minimum amount of earth disturbance.
- Most construction is done by hand tools, and
- Slight adjustments to the actual alignment are made during the actual construction (to avoid trees, boulders, etc.).
- However, whenever more than minimal earth disturbance is contemplated (e.g., when constructing a parking area, digging footings for bridge abutments) an archaeological survey and SHPO approval are required prior to project initiation.

## 7. Report Promptly

After any scouting, it is essential that you report in a clear, concise and timely manner. All necessary forms can be found at <http://pcta.org/volunteer/crew-leader-center/>

Complete and send in the PCTA's Project Report Form and signed project paperwork: volunteer sign-in sheet, JHAs, and volunteer profile forms. (Refer to the Project Paperwork Summary.) Be sure that all participants are given credit for their hours and all accomplishments are noted. Make notes of any work left incomplete, so future leaders know the status of work in an area. And send along any photos of your work!

## TEACHING TIPS & TECHNIQUES:

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With the students, visit a trail that needs a variety of work. Working in pairs, assign each team a section of trail to flag all the work that they see needing to be done. Have each team present their results and then ask the other teams if they see any additional work to be done.

Ask each team to independently figure out how to estimate trail project distances and project

measurements without a tape measure. Give them only the hint that from finger tip to finger tip of their outstretched arms roughly equals their height, as does two natural steps. Using this knowledge, ask them to make a basic ruler from a tool handle.

Next, ask each team to identify and pin flag a section of trail that they estimate would occupy a crew of 4 volunteers for at least 4 hours. Have them make a work plan. Then discuss as a group, asking, "What other factors need to be considered when estimating how much time a project will take?" Things such as driving distance, hiking distance, likely weather, tools, materials, volunteers' experience and fitness, dangers to mitigate, setting up camp, and many other factors must be considered. Thus, four hours of work may be all that you can hope for in an 8-hour day.

To help students understand trail triage, next tell them that they will have only two volunteers to work on the project for four hours and make a new work plan. Have them present the project again justifying which portion of the project they decided to do and which to leave out.

Ask students to brainstorm a list of trail projects that would be high priority for public safety. Ask them to brainstorm a list that would reduce critical resource damage.

Never miss a chance to tell trail workers that the best way to understand drainage issues is to walk trails on a rainy day, the rainier the better. Encourage students to get a pair of rubber boots and an umbrella, in addition to rain gear, so they can be comfortable examining closely how water interfaces with trails. Ask them to notice how water sheets off hillsides, accumulates in small rivulets and then crosses an outsloped tread, or follows one with berm, carrying loose sediment to drainage structures. The ultimate goal is by seeing water they gain the ability to "think like water" and possibly "see water running down the trail, even on sunny days."

**Using a Clinometer to measure grade exercise:** Review using a clinometer. Students should practice how to hold and sight through the instrument. Have students note which side displays degrees and which displays percent grade (usually marked with a % symbol) as well as the location of the cross hairs. Tools needed are a clinometer(s), partner, flagging, sloped ground, pen and paper

- 1) Divide the group into partner teams. Each pair should have a clinometer and flagging.
- 2) Stand face to face with your partner on level ground and look at them through the clinometer.
- 3) Tilt your head and the instrument until the cross hair is at 0%.
- 4) Note where the crosshair touches on your partner's body. This is your eye level on your partner and the point you can use when measuring slopes.
- 5) Have your partner walk 10-20 feet away. (preferably on a slight slope)
- 6) Sight through the clinometer to the target point on your partner.
- 7) Read and record that grade.
- 8) Have your partner mark that spot with flagging. Mark the spot you are standing with a different flag.
- 9) Repeat for several points.
- 10) Switch roles and have your partner find eye level on you.
- 11) Repeat steps 5-9 using the same flagged locations, only switching roles (you walk ahead while your partner reads and records grade from your flag).
- 12) Compare readings and discuss.

## REFERENCES

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*Lightly on the Land: The SCA Trail Building and Maintenance Manual.* 2005. Robert Birkby. The Student Conservation Association and Mountaineers Books. The entire book is a tremendous resource for crew leaders, including work estimation on pages 145-6.

*Pacific Northwest Trail Association's Trail Maintenance Manual.* <http://www.pnt.org/>

*Trail Construction and Maintenance Notebook.* 2007. Woody Hesselbarth. USDA Forest Service. Setting priorities and trail triage are addressed at [www.fhwa.dot.gov/environment/](http://www.fhwa.dot.gov/environment/)