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Introduction

Definition of Assessment

The Norm

Within Technical Education

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Definition of Assessment

The Norm

Assessment in itself is not complicated to define. Put very simply, it is the measurement of knowledge and ability as related to a given subject. Educators have always been involved in the process of assessment as a means of knowing how well a student has mastered what they have been taught. Often the primary tool of assessment has been the written test, which, when graded, indicates a level of proficiency. Students pass or fail based on their grade. However, written tests and grades are not necessarily the best indicators of whether a student can perform well in the work place.

Within Technical Education

In the realm of technical education, the term and concept of assessment are being taken well beyond the written test and subsequent grade. Assessment reflects the knowledge of, and ability to perform at a certain level of competency based on industry skill standards for a particular job. Skill standards were developed for five natural resource/environmental technical areas in **the 1999 *Natural Resource/Environmental Technology Skill Standards Manual***. This companion document will be referred to, and utilized, throughout this assessment manual.

Thus, in technical education, being able to meet standards or performance criteria, from the industry perspective, is at the root of assessment. As long as an individual can meet the standards, it doesn't matter where they learned the relevant knowledge, skills and abilities, although there is often the assumption that most people will receive their training and education in school. Other options are on-the-job training or self-study. Self-study might include on-line delivery.

Today's workplace requires much more of an employee than it did even twenty years ago. No longer is the individual only responsible for a specific set of tasks. Now, they must practice total quality management, participate on various committees, and help train their peers. A set of social or "team" skills is required, including good communication in both written and verbal formats, cultural diversity awareness, supervision, leadership and basic management skills. These types of skills and behaviors are known as SCANS skills. SCANS stands for Secretary of Education's Council on Achieving Necessary Skills, and refers to an extensive process that nationally established five levels of various basic skills and qualities deemed necessary for success in the workplace. Assessment of relevant levels of these skills is included in at least two of the models depicted in this manual.

Reasons for Assessment

In teaching there is often a difference between what gets taught and what is actually learned. **Assessment** is considered an excellent tool in bridging that gap because it **focuses on what is *learned* rather than what is *taught* by the educator**. Assessment (or evaluation) criteria are known to the student from the beginning of a course, which fosters continuous improvement and the ability to not only meet academic standards,

(measured by competency and/or mastery), but also to perform well on the job. Using a variety of assessment strategies and tools provides a truer picture of the individual's ability and knowledge.

How Is This Accomplished?

Instead of strictly focusing on knowledge, skills and abilities as criteria for learning and assessment, the emphasis is on ***performance indicators.*** Performance indicators relate to skill standards **and describe how we know when a key activity or critical function has been performed well in the workplace**. For instance, if the key activity is performing minor equipment repair, one might need to know about maintenance, safety, hazardous materials and the mechanical function of the equipment. However, the performance criteria might be that " repair is completed in an accurate and timely manner, and equipment is returned to proper use and function".

This bears some thought so that we realize the difference between the academic and industry viewpoints. **Academia primarily focuses on teaching** so students know facts, concepts, principles, etc., and are able to demonstrate knowledge either physically or through testing. This approach represents the *technical knowledge, skills and abilities* column in the skill standards manual. **Industry focuses on performance indicators.** These are the assessment criteria that industry uses to identify when a particular task is performed well by an employee. These are found in the 'performance indicators' column of the Skill Standards Manual.

Common Terms Defined

Assessment Strategy – A method used to gather direct and indirect evidence of proficiency. It may use one or more tools. The strategy measures the performance indicator and includes the relevant knowledge, skill and abilities.

Assessment Tool – A subset of an assessment strategy. It provides evidence that verifies one or more performance indicators. For example, capstone/portfolios constitute an assessment strategy; whereas, written exams, oral presentations and peer evaluations are assessment tools.

Capstone – An assessment strategy chosen for this manual, which encapsulates prior coursework, and allows for internalization of SCANS skills. Generally utilized towards the end of the second year of a two-year college program. The equivalent would be a senior project in high school.

Critical Work Function – A general job duty, or description of a major job responsibility.

Demonstration/Dialogue – An assessment strategy chosen for this manual that is used at the first-year level of a college program, or, when on the job less than six (6) months.

Internship or Cooperative Work Experience – An assessment strategy chosen for this manual that provides transition from academia into the work place.

Key Activity – A task within a critical work function.

Passport – A document that shows that an individual student/worker completed assessments and is certified for a particular skill standard. The contents of the passport are also kept in a central databank.

Performance Indicator – That which tells us that the task has been performed well (examples: “done in a timely, safe and correct manner”, or, “all scientific protocol are followed”). *Having evidence or being able to verify that the performance indicator has been achieved, is the essence of assessment.*

Portfolio – A hard copy, or collection, of successfully completed assessments tools.

Skill Standards – The knowledge, skills, abilities and behaviors required to perform a particular task, or set of tasks, related to a major critical work function. These standards are agreed upon by technicians and managers from the private and public sectors, academia, labor and tribes (thus the standards to which all workers are held accountable are consistent throughout the industry).

Skill Standards Assessment – Measuring, evaluating or otherwise determining that a specific task is being done well and meets industry standards. It is the gathering of evidence that shows proficiency. Successfully completing the workforce assessment can lead to technical certification.

Purpose/Use of Assessment Manual

Background

Several years ago the U.S. Departments of Education and Labor worked cooperatively to develop methods through which the technical educational field could more effectively mirror what skills, knowledge and abilities were needed on the job. Their efforts were on behalf of producing a more highly trained, and globally competitive, work force. Their intent has been to utilize the community college system in this endeavor. ***The Skill Standards Manual* (June 1999)** was developed with the help of many industry people who perform the technical work described therein. Therefore, the skill standards manual originated **from the industry, not the academic, viewpoint.** It describes what is important to know, and be able to do, in a given technical job area. The measurement, or assessment of that knowledge and ability is reflected in the **performance indicators** associated with a given task or key activity, and may be either direct, or indirect, in nature. Evaluating the performance indicators, and evidence thereof, is the essence of an assessment. Various types of assessment may be used to evaluate the same work function, activity (task), or behavior, although some assessment strategies (and tools) are better suited to certain tasks than others.

This ***Skill Standards Assessment Manual*** can be used in designing assessments, strategies and tools (or competency measurements) for any technically-based critical work function. The assessment strategies delineated in this manual pertain to natural resource/environmental work activities. Although they are particularly useful for these career areas, the strategies, tools, formats, models, and templates can be easily adapted to other career areas.

Purpose

This document provides a guide for gathering evidence that describes or validates how well a task is performed (in other words, if the performance criteria are met). Performance criteria are statements describing that a particular task, or key activity, has been done to the acceptable industry standard. The concepts and principles are applicable to other disciplines as well. Readers are encouraged to adapt our examples to their own needs. Potential outcomes of using this manual might include new (or modified) curriculca, based on workforce skill standards; better prepared students for the workplace; and workers who can accumulate evidence of their performance, knowledge, skills, and abilities, which may lead to better evaluations, greater responsibilities, faster promotions and higher pay.

How To Use This Manual…

This document is to be used in conjunction with the Skill Standards Manual that was developed around the critical work functions and key activities associated with the five following natural resource/environmental technician positions: Environmental, Fisheries, Forestry, Natural Resources and GIS (Geographic Information Systems). Together, the two documents provide strategies, tools, templates and information that can be used in

both industry and academic settings to assess student/worker competency, while performing a given task or set of tasks.

In order to utilize these various assessment strategies, it is desirable to have the skill standards already developed. It is possible to develop assessments from an academic viewpoint; however, those assessments measure the "knowledge, skill and ability" (central column in the *Skill Standards Manual*), and not the performance indicators (the column to the right of the Key Activity). The evidence gathering should focus on measuring "how well the task is performed" (see the example below). This is an **industry approach** to measuring a student's or worker's competency. While performance criteria do include the pertinent knowledge, skill and abilities (KSA) required to perform a given key activity (task), they are also tied to industry's expectation of a "job well done".

To use this Skill Standards Assessment Manual, you should:

- Obtain a hard copy of the 1999 Natural Resource/Environmental Technology Skill Standards Manual, or use the State Board for Community and Technical Colleges (Skill Standards) website. An order form for the manual is included at the end of this manual. The SBCTC's website address is: www.SBCTC.ctc.edu**. Skill standards are part of Workforce Education and can be found at: wa-skills.com. Click on *Projects and Contracts*, and *Env/Natural Resources.***
- Gain a working knowledge of the principles of skill standards.
- Understand the definitions and uses of assessment strategies and tools.

Steps: Using Table 1 (below):

1) **Choose** a **critical function/key activity** from the Skill Standards Manual that you would like to assess.
2) **Identify** what the **performance indicators** are for that key activity (2nd column from left).
3) **Choose** an **assessment strategy** (one of the three offered in this manual) that will be utilized in gathering the evidence of a job well done.
4) **Determine** what **tools** you will need (i.e. check off sheet, written exam, self, peer or work co-op supervisors evaluation forms).
5) **Publicize to students** what the performance indicators are, the overall objectives, where and when the evidence will be gathered, what is expected, how to prepare, and what the levels of proficiency are.

Table 1. Example From Skill Standards Manual (Page 64)

Fisheries Technician			
Critical Work Function: E – Operate Equipment			
KEY ACTIVITY	***Performance Indicators*** ***How do we know when the task is performed well?***	***Technical Knowledge*** ***Skills, Abilities, Tools***	***SCANS Skills and Personal Qualities*** ***Employability Skills***
E3 Operate, construct, repair & maintain field equipment	• Tools/equipment are constructed according to specifications. • Permits accompany equipment to field. • Operating manuals are adhered to. • Safety, repair & maintenance procedures are followed. • Equipment is stored and transported properly. • Equipment is calibrated per manufacturer's instructions.	• Knowledge of permitting laws & regulations. • Knowledge of calibration techniques. • Knowledge of safety, repair and maintenance procedures.	• Translate blue prints. • Develops creative solutions. • Follows set of directions. • Interprets blueprints, drawings, and diagrams. • Uses basic carpentry and mechanics.

Another Example: (Refer to page 129 of the 1999 Skill Standards Manual)

1) GIS Technology, Critical Work Function: *Create Maps and Other Products* (B), Key Activity: *Design layout* (B2)
2) Performance indicators to be verified*: layout is thorough, accurate, complete, containing appropriate data layers…*(all)
3) Capstone/Portfolio
4) The finished product will be primary evidence; supervisor's/instructor's written evaluation; self and peer evaluations will complete the assessment.
5) (Example) Teams of three students each will design a layout in class describing forest fires in the Okanagan region in the last 100 years, including vegetation and soil type, fire incidence, and landowner. Map must include all symbols, be accurate, complete and uncluttered. Final maps will be assessed (in writing) by both the instructor and a Weyerhaeuser Co. GIS supervisor.

Methodology

Previous Document – Skill Standards Manual

Gap Analysis

Assessment Tools

Previous Document – Skill Standards Manual

In 1997 The State Board for Community and Technical Colleges solicited grant proposals for the development of skill standards in 17 different technical career areas. One of the grants was awarded to the Northwest Natural Resources Technology Consortium (NNRTC) through Grays Harbor College. *The Natural Resource/ Environmental Technology Skill Standards Manual* was developed (June 1999) using an industry-driven, job analysis process.

Toward the goal of having a better-prepared technical workforce, the NNRTC took the next step by utilizing the skill standards developed during the previous grant awards to develop a manual of assessment strategies and tools. The process for developing this second manual utilized instructors from four different community or technical colleges, all of whom taught natural resource/environmental courses. These colleges included: Green River (Geographic Information Systems), Centralia College (Forestry), Clover Park (Environmental Tech), and Grays Harbor (Natural Resources and Fisheries).

Gap Analysis

Each of the instructors utilized the *Skill Standards Manual* in performing a gap analysis. They reviewed all the relevant courses that they currently taught (in each of the five career areas) and determined whether there were gaps between what they were teaching and the skill standards for their respective fields.

In addition they looked at what basic SCANS skills were, or were not, embedded in their courses. They also determined what achievement levels of SCANS skills were relevant for their students from the survey in the Skill Standards Manual **(Appendix A)**.

Assessment Strategies/Tools

Then they determined what assessment strategies and tools they wanted to use to evaluate the performance indicators in their various disciplines. It was decided to develop three strategies. The strategies were based on how much knowledge the student/worker had. One strategy **(demonstration/dialogue)** was relevant for a student/worker who had been on the job or in school less than six months. Another strategy (capstone/portfolio) reflected proficiency of more than a year in school or on the job. The third strategy (internship or cooperative education) simulated transition into the work place. Each instructor followed guidelines in the development process but retained "academic freedom" in designing their individual strategies.

Specific assessment tools (i.e., **oral and written exams**, **professional quality final** r**esearch reports**, **written supervisor's/instructor's evaluations**, **and self-evaluations**) were also developed.

Gap Analysis

Why It Was Done

The term "gap analysis" means examination of the gap between industry skill standards and curriculum taught. Professionals in the private and public sector, educators, labor and tribal workers were interested in discovering the differences between what was being taught in high schools and community colleges and what knowledge and abilities were actually needed and utilized on the job. The ultimate goal was to eliminate the 'gaps' in curriculum, and once discovered, to update curriculum to meet the needs of industry. The result was to provide a better-educated, more effective technician for the workplace.

Other interests of the group were to provide more accurate job descriptions, upgrade job titles, improve methodology for student and employee evaluations, and provide the opportunity for advancement in the work place based on performance criteria.

How It Was Done

Since the *Environmental/Natural Resource Technology Skill Standards Manual* had included a current assessment of job skills for five technical positions, it was used as the baseline against which the curricula were measured. Instructors from four different local community colleges, representing the five different technical environmental/natural resource fields, each reviewed the content of their relevant college courses. As each course was reviewed, the content was evaluated to determine if it was also aligned with specific skill standards.

When the industry/education committee met, they discussed different approaches to take in developing this assessment manual. All of the committee members had participated in the development of the Skill Standards Manual and were familiar with their particular discipline and its critical work functions/key activities. Committee members felt it would be prudent for educators to review their individual curricula to determine if they were relevant, current, and inclusive of the developed skill standards. The term "**gap analysis**" was coined to address those parts of the skill standards that **were or were not** currently included within the curriculum of each of the five natural resources/environmental areas.

The gap analysis not only considered critical technical work functions and key activities, but also included SCANS skills at the appropriate level. It was generally thought that SCANS skills were either not taught, or possibly "embedded", within the curriculum. As a rule, an instructor in environmental science teaches relevant technical or scientific courses, not topics such as responsibility, teamwork, cultural diversity, basic math, and self-worth (all part of SCANS skills). However, committee members thought this to be an important issue, and decided that the inclusion of SCANS skills was critical to the success of individuals in the work place. It was decided to directly address SCANS skills within the curriculum, via individual course topics and assessment modalities.

The gap analysis directly asks, “Is this taught within your existing curricula and where”? It also asks which of the three chosen assessment strategies is best suited to evaluate the performance criteria of a particular key activity. The “comments” section allows the instructor to add additional information about that activity, such as: what evidence is gathered to assess that performance indicator; or, what evaluation tools are currently being used (or will be used). Remember, performance indicators are directly linked to the knowledge, skills and abilities necessary to do that particular job well.

The following pages include a skill standards gap analysis and written discussion of results completed for fisheries technology (at Grays Harbor College). Examples of gap analyses for environmental, GIS, and natural resource technician programs can be found in **Appendix B.**

Fisheries Technician Gap Analysis

Critical Work Function And Key Activity	*Task addressed in Curriculum (Yes or No) & Course #*	*Assess Strategies* *I*	*P*	*OD*	*O*	*Comments*
A: (Collect Biological Data) A1 Identify species	**YES** FISH-215, 220, 221, 220, 258/59		X	X		Oral presentations and oral quizzes
A2 Collect, quantify and measure aquatic specimens	**YES** FISH-215, 220, 221	X	X	X	X	Presentations, reports, exams, seminaring, and peer teaching/learning
A3 Execute field population and harvest surveys	**YES** FISH-215, 220, 221, 222, 258/59	X		X	X	Peer teaching, co-op work experiences, exams, and capstone courses
A4 Conduct interviews	**OCCASIONALLY** FISH-121, 221, 220, 258/59	X		X		Demonstrations by guest speakers, seminaring, and mock interviews
A5 Review literature and previous research	**YES** FISH-222, 220, 221, 258/59		X	X		Research reports, presentations, in-class activities, and competencies

Legend: I – Internship; – Capstone/Portfolio; OD – Observed Demonstration/Dialogue; O - Other

Critical Work Function And Key Activity	*Task addressed in Curriculum (Yes or No) & Course #*	*Assess Strategies* *I*	*P*	*OD*	*O*	*Comments*
B: (Collect Habitat Data) B1 Collect substrate samples	**YES** FISH-220, 221, 100, 258/59	X	X	X		Seminaring, learning objectives, use of McNiel sampler
B2 Characterize physical habitat	**YES** FISH-221, 220, 215, 100, 222	X	X	X		Learning objectives, demonstrations/presentations, field notebooks/journals and data sheets
B3 Measure water column dynamics	**YES** FISH-221, 220, 100, 222, 258/59	X	X	X	X	Field trips, out of doors training, take home essay exams
B4 Collect water quality data	**YES** FISH-220, 221, 222, 258/59					Statistics, chemical concentration problems
B5 Conduct riparian area surveys	**YES** FISH-221, 220, 121, 258/59			X		Seminaring, Bio 109 as an elective, keep in contact with co-op supervisors
B6 Review literature and research	**YES** FISH-220, 221, 222, 258/59		X	X		See comments for A5

Legend: I – Internship; – Capstone/Portfolio; OD – Observed Demonstration/Dialogue; O - Other

Critical Work Function And Key Activity	***Task addressed in Curriculum (Yes or No) & Course #***	***Assess Strategies***				***Comments***
		I	***P***	***OD***	***O***	
C: Perform Laboratory Analysis C1 Prepare samples for analysis	**YES** FISH-220, 221, 225, 222, 258/59	X		X		Exams, Review MSDS data sheets, encourage a HAZMAT course
C2 Sort, classify and/or sort samples	**YES** FISH-215, 222, 221, 220, 258/59	X		X		Plankton counts, large woody debris measurements, time management
C3 Determine age of specimen	**YES** FISH-215, 220, 221, 258/59	X		X		Guest speakers, teamwork training, summarizing data
C4 Log/catalog samples	**YES** FISH-215, 221, 220, 222, 258/59	X	X	X	X	Student demonstrations, field notebooks, data sheets, CQI training
C5 Maintain inventory	**OCCASIONALLY** FISH-220, 221, 258/59	X		X		Encourage HAZMAT training, student demonstrations
C6 Read fish tags	**YES** FISH-215, 220, 221, 222, 258/59	X		X		Hands-on training, guest speaker, field notebooks, completion of data sheets
C7 Write reports	**YES** FISH-215, 220, 221, 222		X	X	X	Research, create, and edit resumes, reports, meeting agendas/notes, seminaring

Legend: I – Internship; – Capstone/Portfolio; OD – Observed Demonstration/Dialogue; O - Other

Critical Work Function And Key Activity	*Task addressed in Curriculum (Yes or No) & Course #*	*Assess Strategies*				*Comments*
		I	*P*	*OD*	*O*	
D: Assist in Statistical Analysis D1 Enter, verify and edit data	**YES** FISH-220, 221		X	X		Encourage keyboarding elective, include as criteria for co-op
D2 Analyze, sort, retrieve and plot data	**YES** FISH-220, 221		X	X		Statistics, experimental design, goals, objectives and design taught
D3 Write Reports	**YES** FISH-121, 215, 220, 221,222, 258/259	X	X	X	X	Interim and final reports for Weyco-Briscoe research projects. Use CBE style manual and Style Manual in Bio journals
D4 Maintain database	**YES** GIS-102, 150, Fish - 220,221	X		X		Data base skills learned in GIS 102,150 are applied in all fisheries courses, especially Fish 220, 221

Legend: I – Internship; – Capstone/Portfolio; OD – Observed Demonstration/Dialogue; O - Other

Critical Work Function And Key Activity	*Task addressed in Curriculum (Yes or No) & Course #*	*Assess Strategies*				*Comments*
		I	*P*	*OD*	*O*	
E: Operate Equipment E1 Operate vehicles	**YES** FISH100, 220, 221, 258/259	X		X	X	As relates to trailering and launching 17" motorized boat, is learned and demonstrated by all fisheries students
E2 Operate, repair and maintain lab equipment	**YES** FISH- 221, 220, 222, 258/59, Chem 101	X	X	X	X	Encourage co-op supervisors to have students learn and follow company policies, HAZMAT regs, etc.
E3 Operate, construct, repair and maintain field equipment	**OCCASIONALLY** FISH-220, 221, 258/59				X	Encourage students to take CAD or blueprint course as an elective

Legend: I – Internship; – Capstone/Portfolio; OD – Observed Demonstration/Dialogue; O - Other

Narrative of Results of GAP Analysis for the Integration of Skill Standards in Existing Fisheries Technology Curriculum

Between 1996-99, with financial support from the National Science Foundation's NW Center for Sustainable Resources (NSF/NCSR), and the Washington State Board for Community and Technical Colleges (SBCTC), curricula for eight (8) fisheries courses in the Grays Harbor College's Fisheries Technology Program were "enhanced" to include both technical skill standards and SCAN skills. Other desired (NSF/NCSR) outcomes were to increase the levels of math, science, statistics and technology in each of these courses, and to adapt them to a wide variety of audiences (i.e., Native Americans and re-training of displaced timber workers and fishers) and delivery systems (i.e., on-line and interactive TV).

Most of the 25 fisheries technology job functions/tasks identified by our focus group, including both foundational (SCANS) and technical skills, are currently included in these revised curricula. **The scientific and technical revisions of these curricula (NSF/NCSR), and the development of skill standards and assessments (SBCTC), were developed concurrently.**

The following is a brief summary of where in our fisheries program, students learn and are assessed, re: the five (5) functional areas of the Fisheries Technician position. The entire gap analysis (including current means for assessment and comments) is found in **the matrix** prior to this summary.

Function A: Collect Biological Data

Nearly all tasks, including identifying species; collecting, quantifying, and measuring aquatic specimens; executing field, population and harvest surveys; and reviewing literature and previous research, are being addressed through existing curricula. Students learn both technical and SCAN skills that support this function (and related tasks) in FISH 215 Fisheries Biology, FISH 220/221 Chemical and Biological Field and Laboratory Methods, and in FISH 258/59 Co-operative Work Experience. Collecting biological (and chemical) data is regarded as one of the **most important** technical (and foundational) skills our students learn; therefore, these skills are taught and assessed in six (6) out of the nine (9) fisheries courses offered in this program.

Task A4, that of conducting resource user interviews, is a major task under this functional area that is not adequately addressed in the curriculum. Feedback gained from our Fisheries Technology Advisory Committee members at our June 1999 meeting, re: interviews, suggested that students practice mock user interviews in the classroom, and also practice through seminaring. This might also be a suggested "learning objective" for a co-op experience, since "simulated" or actual interviews might be done best in a "real world" setting.

Function B: Collect Habitat Data

We were able to answer "yes" with regard to each of the gap analysis tasks found within this fisheries technician job function. Again, FISH 220 and 221 – Chemical and Biological Field and Laboratory Methods classes included all of the skill standards and assessments related to tasks B1 – B6. These "capstone" learning communities lend themselves well to alternative forms of assessment (demonstration; written self-, peer-, and instructor-evaluations, and final written and oral presentations of research conducted by the students themselves).

Function C: Perform Laboratory Analysis

We were also able to answer yes to nearly all skill standards related to performing laboratory analysis. The skill related to the tasks required to perform this functional area (for a fisheries technician) is learned initially, in freshman-level courses such as: BIOL 101 – General Biology, CHEM 101 – Introduction to Chemistry, and Geology 101 – Physical Geology. These skills are put into "real world" practice in the two (2) sophomore – level "capstone" courses: FISH 220 – Chemical Field and Laboratory Methods and FISH 221 – Biological Field and Laboratory Methods.

One set of skills not covered adequately in our curriculum is **Task C5 – Maintaining inventory.** One possible way we might build this skill set into our curriculum would be to have student inventory and reorder missing chemical reagents found in HACH Chemical Kits during FISH 220 and 221. We could also have students conduct an actual inventory of all equipment and supplies at our on-campus Aquaculture Center each year (part of learning outcomes for FISH 122 – (Advanced Aquaculture). Another possibility would be to recommend **maintaining inventory** as a major learning objective for FISH 258/259 Co-op Work Experience, especially when students do internship at local fish hatcheries.

Function D: Assist In Laboratory Analysis

Most of the skills required to perform the tasks related to the about job function are learned in first–year courses: CIS 102 – Introduction to Microcomputers, CIS 150 – Spreadsheets, ENGL 101 – Expository/Argumentative Writing, and ENGL 250 – Technical Writing.

Students refine and integrate these same skills during their second-year during our "capstone/learning communities" (FISH 220/221 – Chemical and Biological Field and Laboratory Methods). Students are required to choose a field research project in which they collect, analyze and present physical, chemical and biological data. They build data bases using contemporary computer software (i.e., EXCEL). They create graphs and tables for written and oral reports using appropriate statistical software (i.e., STATISTIX). And finally, students present their findings orally to general and professional audiences using multi-media software (i.e., Power Point).

Function E: Operate Equipment

The basic skills for operating equipment, including 4-wheel drive pickup trucks, 15 – 75 horsepower outboard engines, and physical, chemical and biological sampling equipment are learned in FISH 100 – Small Boat Operation, and FISH 220 and 221 – Chemical and Biological Field and Laboratory methods.

During the small boat operations course, students are required to safely operate towing vehicles, and boat trailers carrying 17 ft. Boston Whalers. They learn to hook up, trailer, launch and operate these boats on the Chehalis River and in Grays Harbor. They also learn to use electronic instruments such as LORAN-C, depth finders, GPS, VHF and CB radios, and radars.

Students are also responsible for learning and demonstrating competency (assessment) using over 30 physical, chemical and biological data collection instruments (i.e., electronic flow meters; dissolved oxygen, salinity and pH meters; and electroshocking equipment). Students become “expert” in the use of 3-4 of these instruments each quarter, then teach them to the rest of the class. All students are required to demonstrate a high level of competency in these operational skills by the end of the quarter, as well as applying them while collecting data for “real world” field research projects (undertaken during our two-quarter “capstone” series).

Types of Assessment

Assessment Pyramid
Demonstration/Dialogue
Capstone/Portfolio
Internship/Co-op Work Experience

Assessment Pyramid

Figure 1 describes the relationship of the three assessment strategies chosen for this project for a community or technical college curriculum; however, it could be easily adapted for high school use. Although the three choices did not intend to parallel the level of knowledge, competency or progress through a two-year program, it was discovered as the instructors met and revised their approaches to assessing their students. Lower tiered strategies may move along with a student (or employee) as their knowledge and proficiency increases.

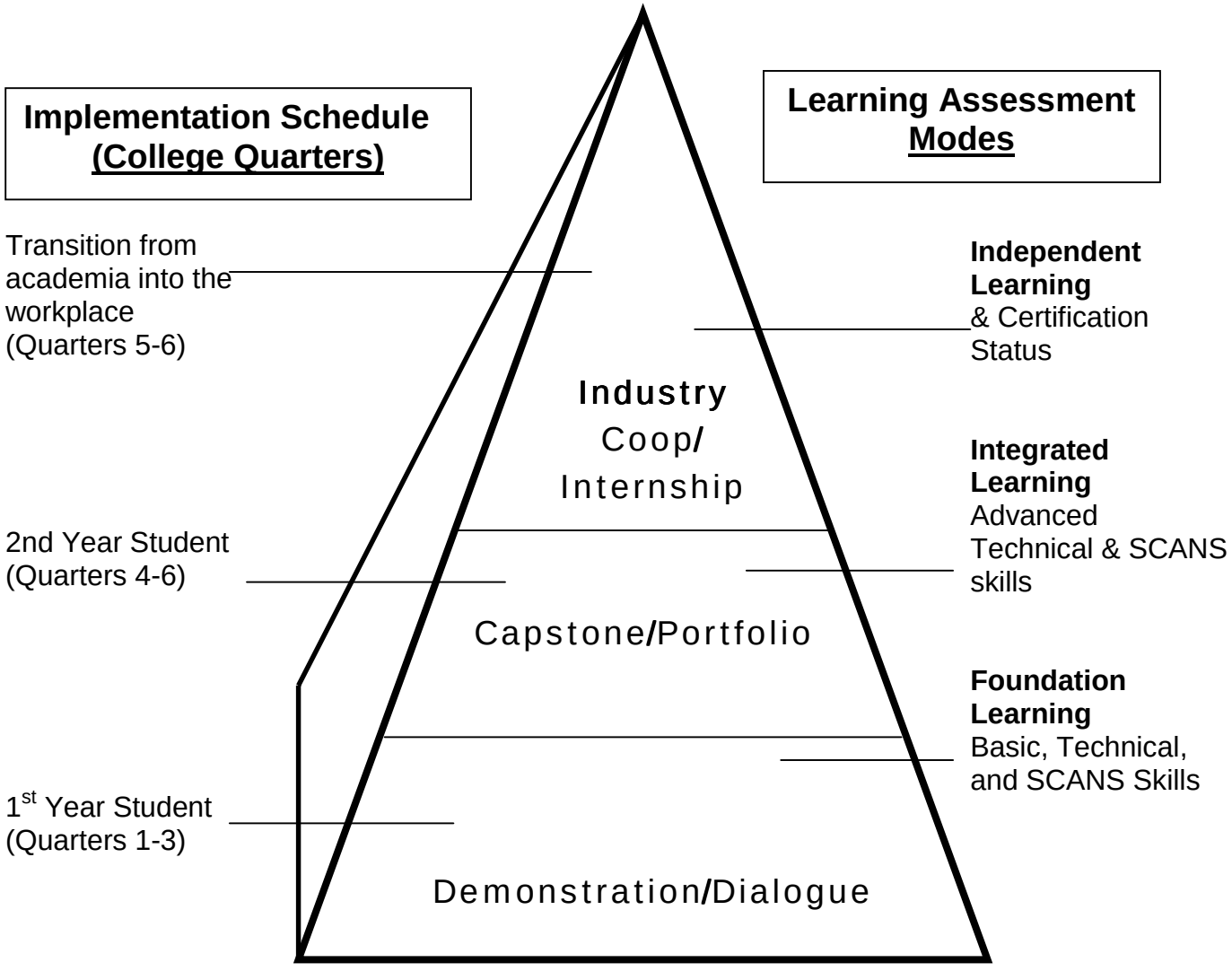

Figure 1. Assessment pyramid that describes the hierarchy of strategies to be utilized during a typical 2-year natural resource/environmental technology program.

Demonstration/Dialogue Assessment Strategies & Tools

Environmental Technology
Fisheries Technology
Forestry Technology
GIS Technology
Natural Resource Technology

Demonstration/Dialogue Assessment Strategies & Tools

Strategies

At the beginning of either a school program or a new job there is much to learn. Within a school curriculum students must take both basic courses (i.e., math, chemistry, speech) and technical courses (i.e. fisheries, environmental sampling, timber cruising, and GIS mapping). Within the work place, a new employee is often overwhelmed with company-specific practices and procedures to learn and apply. In either environment, the information and skills to be learned are the foundations upon which success or failure is built.

The demonstration/dialogue strategies were chosen as assessment options because they address foundational skills and information. These strategies can specifically measure the level of competency of a student or employee for a given skill or task. Not only does the student/worker discover how well they know and can demonstrate the task, but they also learn exactly where they are deficient, and can concentrate their efforts for improvement. One additional value of this strategy is that the dialogue accompanying the demonstration indicates the level of understanding of background information associated with the task and not just whether a person can complete the appropriate steps.

The student or employee is given an initial exposure to the task prior to any assessment of their ability or knowledge. They are given the appropriate information, an outline of procedures, lectures, instructor demonstrations, etc. Assessment of progress is laid out within the sequence of the course or job training process, so students or employees are able to plan ahead, study and practice. Sample levels of competency/achievement are found on page 31 of this manual.

Tools

The tools are the means used to actually measure or record the assessment strategy. Examples of tools appropriate for recording demonstration /dialogue might include:

- Bar Coding (An electronic check-off sheet using a bar-code scanner)
- Check off sheets that list steps (or skills) to complete a work activity (task)
- Personal notes
- Rating sheets (self or peer)
- Video tape of the demonstration/dialogue

A template appropriate for demonstration/dialogue is included in **Appendix C.**

The following pages include examples of demonstration/dialogue assessments for the five environmental/natural resources technologies.

Environmental Technology
Assessment Strategy: Demonstration/Dialogue
Critical Work Function: C – Analyze Samples **Key Activities**: C3 – Analyze field and laboratory samples **Performance Indicator**: Proper analysis procedures & protocols are followed
Curriculum: Clover Park Technical College; Course: ENV 251 Air Pollution Monitoring

Competency – Follow proper analysis procedure for sulfur dioxide detection.
Sub-competencies: (1 – 4)

1. Assemble necessary equipment
   Steps:
   - gather all equipment
   - assemble sampling pump and impinging tube
   - add 10ml of absorbing solution to impinging tube
   - make sure that the long tube is immersed in the absorbing solution
   - cover the impinging tube with aluminum foil, to protect from light

2. Operate sampling equipment according to SOP
   Steps:
   - sample at 1.0 liters per minute for 30 minutes
   - after 30 minutes, turn off pump
   - fill the small test tube to the line with the absorbing solution from the impinging tube
   - add one level measure of sulfur dioxide reagent #1 with the 0.25g spoon
   - cap the test tube and shake vigorously to dissolve the powder
   - use a 1ml pipette and add 1ml sodium hydroxide to the small test tube
   - cap and invert several times to mix
   - use the other pipette to add 2ml of sulfur dioxide passive bubbler indicator to a large test tube
   - pour the contents of the small test tube into the large test tube containing the indicator
   - cap and invert the tube 6 times
   - wait 15 minutes

3. Generate and record data
   Steps:
   - after 15 minutes, place the test tube in the sulfur dioxide passive bubbler comparator
   - match the color sample to a color standard
   - record index number from the comparator
   - record the value in PPM from the calibration chart for the comparator index number obtained

4. Disassemble, clean up and store equipment
   Steps:
   - disassemble pump and impinging tube
   - clean impinging tube, pipettes and test tubes
   - put materials in kit box and store properly

Fisheries Technology
Assessment Strategy: Demonstration/Dialogue
Critical Work Function: B – Collect Habitat Data **Key Activities:** B2-B5 – (See below**)** **Performance Indicator:** (See below)
Curriculum: Grays Harbor College; Course: FISH 221 – Biological Field and Laboratory Methods; Week 2, Field Exercise #3: Measuring Stream Discharge

The Fisheries Technician job function, tasks and accompanying skill standards, will be partially demonstrated and assessed using the field exercise presented in this section:

Job Function B – Collect Habitat Data

Task B 2 – Characterize Physical Habitat

Task B 3 – Measure Water Column Dynamics

Task B 4 -Collect Water Quality Data

Task B 5 -Conduct Riparian Area Survey

Following classroom and field instruction, students are required to demonstrate and provide dialog regarding the following **competencies, sub-competencies** and **steps** associated with **collecting habitat data,** and specifically, **measuring stream discharge:**

Stream Discharge Laboratory Exercise

In this field exercise, students learn an industry-developed methodology for determining the discharge of a stream. Discharge is an important physical component of a riparian area survey. In order to obtain comparable data concerning habitat characteristics, future surveys of the same segment should be conducted at a discharge similar to that of the original survey.

This protocol for measuring stream discharge has been taken from the Northwest Indian Fisheries Commission's (NWIFC) Ambient Monitoring Program. Learner outcomes, technical knowledge, performance criteria and foundational (SCAN) skills developed during this field exercise, are listed below:

Learner Outcomes (Objectives):

The purpose of this field exercise is for the learner to master measuring stream discharge by:

- Learning and applying the NWIFC's Ambient Monitoring methodology for measuring stream discharge

- Independently performing the steps to achieve these competencies and sub-competencies
- Building an inventory of technical knowledge, skills, abilities and tools needed to safely measure stream discharge with precision and accuracy
- Efficiently and effectively using the equipment needed to complete this field measurement
- Working as a member of a team to accomplish this task

Technical Knowledge (Skills, Abilities and Tools):

Technical knowledge, skills, abilities and appropriate use of tools and equipment that learners must achieve at the highest level, include the:

- Ability to work in adverse weather conditions
- Knowledge and application of basic first aid
- Knowledge and effective use of the Marsh McBirney flow meter and depth measuring rod
- Importance of precision and accuracy in making field measurements
- Knowledge and practical application of stream characteristic definitions such as “wetted channel”
- Ability to measure and synthesize flow data from multiple “cells” across the entire stream width, to calculate total stream discharge at that sample station
- Ability to perform tasks sequentially
- Ability to use numerical data to illustrate physical stream characteristics

Performance Indicators (How Do We Know When The Task Is Performed Well?):

Specific technical skill standard criteria, that allows the learner to know when the task they are learning is performed to agency, industry or Tribal standards, include the following:

- Sample sites are accessed safely
- The sampling is completed accurately and precisely within specified timelines and budget

- Appropriate collection protocols/methodologies are followed; and appropriate tools and equipment are used to complete the task
- Specialized tools are transported to the site; they are operated, safely and efficiently
- Relevant laws/policies are adhered to
- All steps in procedure are sequentially followed
- All observations, measurements and calculations in field notebooks and/or appropriate field data sheets are recorded accurately
- Student utilize surface area and stream flow data to calculate stream discharge

SCAN Skills (Personal Qualities and Foundational Abilities):

Personal qualities and abilities that industry determined to be “foundational” for entry-level fisheries technicians collecting habitat data include the following:

- Follows rules, policies and procedures
- Considers risks and implications of the work they are doing
- Writes legibly in notebooks and on forms; accurately uses mathematical concepts, formulas and techniques
- Demonstrates honesty, ethical behavior, and professionalism
- Examines data for relevancy, precision and accuracy
- Summarizes/integrates information
- Uses materials, supplies and equipment safely and efficiently
- Works independently with minimal supervision
- Works well in teams

Competencies
Stream Discharge Measurement Methodology

The following competencies support the Stream Discharge Measurement Methodology. Competencies are numbered below, with required intermediate steps. Equipment required for this skill is indicated below.

Competency:

Demonstrates the stream discharge measurement procedure

Competency Statement:

At the end of the quarter the learner consistently demonstrates at an achievement level 5, ability to take accurate stream discharge measurements by following the stream discharge methodology.

Equipment:

Fiberglass tape (metric)
Stadia rod (metric)
Flow meter
Wading rods for flow meter
Survey forms

Competencies:

1. Selects a suitable location within the stream segment being surveyed with adequate depth and smooth laminar flow.

Steps:

- Explore segment for an area of stream that is relatively free of turbulence and flow obstructions such as large rocks, logs and aquatic vegetation.
- Ensure that both sides of the stream can be reached easily so measurements can be made with accuracy.

2. Extends a fiberglass measuring tape across the wetted portion of the stream channel, perpendicular to the direction of flow.

Steps:

- Stretch a fiberglass tape across the wetted portion of the stream channel.
- Ensure tape is perpendicular to flow.
- Check wetted channel width definition to ensure correct portion of stream channel is measured.
- Anchor fiberglass tape above the wetted edge area.

3. Notes the distance on the tape corresponding to the water's edge on each side of the channel.

Steps:

- Find correct survey form.
- Write wetted channel width in correct place on survey form.

4. Assembles, calibrates and tests flow meter to ensure it is working properly.

Steps:

- Put together flow meter according to manufacturer instructions.
- Calibrate flow meter according manufacturers instructions. Flow meter must calibrate accurately before any measurements are taken.
- Test flow meter in sections of the stream to ensure it is working accurately.

5. Divides stream cross section into cells, placing cell boundaries wherever noticeable breaks or discontinuities in velocity and depth occur, making sure that no one cell represents more than 10% of the total discharge.

Steps:

- Noting the distance across the wetted channel, look at 15-20 smaller units that this area could be divided into.
- Decide upon the exact number of units according to the size and character of the channel. Ensure that each of these units each have no more than 10% of the total discharge. These units are to be called cells.
- Check and ensure that the size of each cell is appropriate so that depth and velocity measurements taken at the center of the cell represents conditions throughout the cell.

6. Operating flow meter to manufacturer specifications, place the flow meter assembly in the center of each cell.

Steps:

- Check extended tape to find the center of each cell.
- Place flow meter in the center of each cell according to the tape measurements.

7. Records the distance along the tape at each station where the measurements are taken.

Steps:

- Choose one stream bank to start taking measurements from.
- Write down on survey form the distance along the tape where the measurement will be taken.

8. Record the depth and width of each cell.

Steps:

- Read from extended tape the width of each cell.
- Write width in survey form.
- Measure with stadia rod depth of each cell from surface of substrate to stream surface.
- Write depth in survey form.

9. Take flow measurement at appropriate level in the water. (.6 meter of the distance from the water surface to the stream bottom in cells with water depth less than 2.5 feet; for depths greater than 2.5 feet, take 2 measurements – at .2 and .8 of the total depth)

Steps:

- Ensure members of survey team are downstream from flow meter.
- Place flow meter in center of each cell.
- Measure water depth from substrate to surface of water.
- Calculate appropriate level in water for flow meter to be placed when flow measurement is taken.
- Place flow meter at appropriate level for channel depth.
- Take flow velocity measurement according to manufacturers instructions.

10. Record the flow velocity of each cell

Steps:

- Select appropriate survey form.
- Document flow velocity of each cell in appropriate box on survey form.
- Check to see that data for each cell is entered in correct place on survey form.

11. Calculate the discharge of each cell.

Steps:

- Multiply cell width by water depth to produce cross sectional area.
- Multiply the flow velocity of each cell as measured by the flow meter, by its cross-sectional area.
- Check all calculations to ensure correct measurement units are consistently used.

12. Check all steps have been performed and calculate the total discharge of the stream by adding together the discharges of each cell.

Steps:

- Check to ensure flow velocity has been measured for every cell across the stream.
- Check discharge has been calculated accurately for each cell.
- Add together all discharges for all cells.
- Put total discharge in appropriate place on survey form.

Achievement levels:

Absent – 0
Observed procedure - 1
Attempted procedure with instructional assistance – 2
Attempted procedure without instructional assistance – 3
Completed procedure accurately & within timelines with instructional assistance – 4
Completed procedure accurately & within timelines without instructional assistance – 5

To achieve mastery of these skills, the learner must perform consistently, at a level “5” by the end of their training (i.e., at the end of the quarter, semester or program).

Forestry Technology
Assessment Strategy: Demonstration/Dialogue
Critical Work Function: E Collect Data **Key Activities**: E6 - Collect Mensuration Data, H2 – Mark and Cruise Timber **Performance Indicator:** Collected data is accurate, legible, correct Appropriate field methodology is followed
Curriculum: Centralia Community College; Course: FORE 221: Timber Measurements

Students will demonstrate on paper and in the field the steps to fixed and variable plot sampling.

Strip Plot Sampling

Written Demonstration

Step 1- Determine what percentage the cruise will be and the strip width.

- Describe the criteria for determining strip cruise percentage
- Demonstrate the technique of establishing sample plot size
- Determine the direction of the strips across the topography

Step 2- Calculate the strip spacing in chains.

- established at equally spaced plot intervals using an aerial photo and or topographic map

Field Demonstration

Step 3 - Conduct the inventory.

- Demonstrate how to establish the and measure strip plot centers
- Demonstrate how to determine the direction of each plot using a hand compass
- Demonstrate pacing techniques to measure distance along plot centers
- Demonstrate how to measure tree height using a clinometer and or relaskop
- Demonstrate how to measure a trees diameter using a diameter-tape and a relaskop
- Demonstrate how to properly tally the measurements using the appropriate form
- Select several trees to be tariff trees.
- Measure the total height in feet and the diameter to 1/10 of a foot of all tariff trees

Written Demonstration

Step 4 - Calculate summary data

- Using the appropriate formula calculate the total strip plot acres
- Calculate the total tract area
- Calculate the actual cruise percentage
- Use the appropriate tariff volume table to calculate individual tree and plot timber volumes
- Calculate the plot expansion factor
- Calculate the total timber volume

Line-Plot Sampling

Written Demonstration

Step 1. Determine the dimensions and shape of the plot sample

- Determine the shape of the plot
- Determine the plot size
- Calculate the plots radius or length of sides

Step 2. Calculate total sample area.

- Determine the sampling intensity
- Calculate the total area to be sampled

Step 3. Determine number of plots.

- Calculate the number of plots based on total sample area and the area of each plot

Step 4. Determine distance between lines and plots.

- Using an aerial photo and or topographic map determine the line spacing
- Calculate the plot spacing

Field Demonstration

Step 5. Conduct the inventory

- Demonstrate how to find the corner of the inventory tract
- Demonstrate how to measure and establish the line spacing
- Demonstrate how to measure to the center of a plot
- Demonstrate how to measure the dimensions of a plot

- Select the appropriate number of form class trees
- Measure the form of each form class tree
- Determine which species to sample
- Demonstrate how to measure tree height to a 6 in top using a relaskop
- Demonstrate how to measure a trees diameter using a diameter-tape and a relaskop
- Demonstrate how to properly tally the measurements using the appropriate form
- Demonstrate how to measure borderline trees

Step 6. Calculate summary data

- Using the form class tree data determine the proper Form Class Number
- Select the proper form class table
- Determine the volume for each sample tree
- Calculate the total tract volume

Variable Plot Cruising

Written Demonstration

Step 1. Choose a Basal Area Factor and calculate Plot Radius Factor.

- Demonstrate how to select a Basal Area Factor
- Calculate a Plot Radius Factor

Step 2. Choose the Point of Observation for the Sample Trees and Tally Trees.

- Describe the criteria for choosing the Point of Observation
- Describe the criteria for choosing tally trees

Step 3. Determine the number of Sample Points and Spacing.

- Describe a method of determining how sample points are located
- Determine cruise intensity
- Describe the criteria for determining the sample point dimensions
- Calculate the number of sample points
- Determine line spacing using an airphoto and or topographic map
- Calculate the sample point spacing

Field Demonstration

Step 5. Inventory the Stand.

- Choose an instrument for tallying trees
- Choose how many points will be V-BAR sample points

- Demonstrate how to locate the plot sample lines
- Demonstrate how to measure the distance between points
- Demonstrate how to use a compass to orient the plot lines
- Demonstrate how to measure the diameter of the tree at the observation point.
- Demonstrate how to measure tree height to a 6 inch top
- Demonstrate how to calculate “in” and “out” trees using a relaskop and a prism
- Demonstrate how to tally the number of trees using the appropriate forms
- Demonstrate how to use the Plot Radius Factor to determine if a tree is “in” or “out”
- Select the appropriate number of Form Class trees
- Measure the form of each Form Class tree

Written Demonstration

Step 6. Determine volume per acre.

- Calculate Basal Area per acre (BA/a).
- Calculate the average Volume-Basal Area Ratio
- Using the appropriate table determine the V-BAR of each sample tree
- Calculate the Average V-BAR
- Calculate the volume per acre
- Calculate the total volume for the cruise area

GIS Technology
Assessment Strategy: Demonstration/Dialogue
Critical Work Function: A – Perform Data Acquisition & Maintenance **Key Activities**: A4 – Capture Spatial and Attribute Data **Performance Indicator**: Digital layers are properly registered
Curriculum: Green River Community College; Course: GIS 201

Ability to use digitizer and digitizing tools

Students will be given oral presentation of digitizing techniques. The instructor will demonstrate the digitizing process and techniques. Students will be given portions of USGS quads to practice and develop digitizing techniques. Using a map supplied by the instructor, passage of competency will be achieved by demonstrating to the instructor the following:

1. Defining digitizing procedures (written).

Steps:

- Is there an order established for digitizing features?
- Is there a naming convention established for features?
- Is there a tracking system established?

2. Map preparation.

Steps:

- Are tics clearly marked and have unique values?
- Do all arcs intersect and are intersections clearly marked?
- Does each polygon have a start node clearly defined?
- Do all polygons close and does each have a single label point with a unique ID?

3. Digitizing procedure (tics).

Steps:

- Arcedit started.
- A ticcov is created (arcedit: create ticcov).
- Tic positions are entered and tic value entered using number buttons on digitizer keypad.
- After tics are entered, a boundary is established using digitizer puck.
- Work is saved (arcedit: save).
- Digitizing work is visually checked on computer.
- Digitized tics correspond to tics on map manuscript.

4. Digitizing features from map manuscript.

Steps:

- A digcov is created using ticcov tics (arcedit: create digcov ticcov).
- Tics are registered using digitizer keypad (arcedit: coord dig default).
- RMS error is LE .005.
- Node environment is set prior to digitizing (arcedit: nodesnap closest .05).
- Drawing environment is set (arcedit: de arc node labels id).
- Arcs are digitized (arcedit: ef arcs; add).
- Record is kept of digitizing process (which arcs and nodes have been digitized).
- Work is saved.
- Labels are added (arecedit: of labels; add) and labeled properly.
- Upon completion of digitizing, work is saved, coverage is drawn to screen and visually checked for errors against manuscript (arcedit: de arcs node errors labels ids; draw).
- Arcedit is exited.
- In arc, coverage is cleaned (arc: clean <in digcov> <out digcov>).

Natural Resources Technology
Assessment Strategy: Demonstration/Dialogue
Critical Work Function: A - Collect Field/Site Data and Observations **Key Activities**: A2 – Conduct Plant Sampling **Performance Criteria**: Sampling plan is followed precisely; Field notes/information collected are clear, complete and accurate; Proper sampling techniques and scientific methodologies are followed; Appropriate equipment is utilized safely.
Curriculum: Grays Harbor College; Course: NR 240 – Watershed Ecosystems II

Student provides a demonstration and dialogue of each step described below:

1. Identify a log, as defined in the monitoring procedure.

Steps:

- Describe physical criteria for determination of a log.
- List equipment needed for log determination.
- Describe “pick-up” technique for determination of separation of broken pieces of large trees.
- Check pieces of wood for greenery and decides whether it is dead or alive.
- Check piece of wood for a root system that is wholly or partially detached and no longer capable of supporting the log’s weight.
- Measure diameter of piece of wood.
- Check diameter measurements against log definition criteria.
- Check that piece of wood intrudes into bankfull channel.

2. Identify a rootwad, as defined in the monitoring procedure.

Steps:

- Describe physical criteria for determination of rootwad.
- List equipment needed for rootwad determination.
- Measure length of piece: Compare with criteria.
- Measure diameter at base of stem: Compare with criteria.
- Check for roots detached from original position, and/or stability of piece.
- Check for intrusion into bankfull channel.

3. Identify a large debris jam, as defined in the monitoring procedure.

Steps:

- Describe physical criteria for determination as a debris jam.
- List equipment needed for debris jam determination.
- Check each piece within accumulation against log and rootwad criteria.
- Check contact between pieces.
- Check number of qualifying pieces in contact against numerical criteria for jam.

4. Count each qualifying piece of wood in the stream segment.

Steps:

- Identify where to start Large Woody Debris (LWD) Survey.
- Walk in an upstream direction and count qualifying pieces according to criteria.

5. Assigns each piece of large woody debris to a category based on size characteristics (small log, medium log, large log, rootwad).

Steps:

- Describe where size category measurements should be taken on logs and rootwads.
- Measure size at appropriate place for log and rootwad.
- Compare measurement of piece to size category.
- Assign each piece to a category based on its size characteristics.

6. Record accumulations of 10 or more pieces as large debris jams.

Steps:

- Count number of qualifying pieces in contact
- Records accurately as a debris jam

7. A. Determine the lowest channel zone (1,2,3,4) into which each piece extends (Level 1). *OR*
   B. Measure the extent to which each piece extends into each of the zones of the channel (Level 2).
   C. Measure diameter of each piece; determine wood type, stability and function for each piece of LWD (Level 2).

Steps:

- Describe zone classification system of survey with respect to wetted and bankfull channel.
- Observe position of piece with respect to zones.
- Classify/measure the piece/zone information at appropriate level of detail for survey.
- Measure piece diameter at appropriate position with correct equipment.
- Examine piece for features of wood type.
- Assign type of wood determination (conifer/deciduous/unknown).
- Determine stability by survey criteria.
- Examine immediate area for evidence of association of piece with pool formation.
- Determine pool presence by use of Habitat Unit Survey Pool Criteria.
- Assign appropriate letter for pool forming function.

8. Tally each piece in the size category and channel location zone on the survey form.

9. Document information about large woody debris in each individual survey reach in the sequence of reference point survey reaches.

Steps:

- Perform all steps necessary to accurately count all qualifying pieces in first survey reach.
- Document all subsequent survey reaches with same level of accuracy.
- Check all segment numbers, reference point numbers and detail level of survey (1 or 2) to ensure accurate information is collected throughout survey.

10. At the end of the survey, tally all pieces to have a summation of the total number of large woody debris pieces surveyed within each reference point survey reach.

Capstone Portfolio
Assessment Strategies & Tools

Fisheries Technology
Forestry Technology
GIS Technology
Natural Resource Technology

Capstone/Portfolio Assessment Strategies and Tools

Strategies

A 'capstone' class offers the opportunity to utilize all of the knowledge and skills that students have gained from previous classes in an integrated format. It often combines course work from different disciplines. Students not only get to review and fine-tune their previous knowledge and skills but also are required to apply their learning in 'real-world' situations. Whether they can perform to industry skill standards is evaluated in the capstone course. From an industry viewpoint, the capstone is being able to 'do the job well'. This means an employee possesses enough knowledge and skills (and can apply them) to be successful in a particular job.

The capstone class also focuses on successfully meeting the industry-agreed-upon levels of SCANS skills. As mentioned earlier, *SCANS* stands for Secretary's Commission on Achieving Necessary Skills. They were developed by a special commission through the Departments of Education and Labor in the early 1990's. The commission determined five levels of competency in seven basic areas. These areas include: **basic skills, thinking, personal qualities, resources, information, interpersonal skills, systems and technology**. For the development of skill standards, industry members all agreed that SCANS skills were extremely essential, but often lacking in many technical workers. This encouraged instructors to objectively and subjectively build them into their capstone courses, and not assume they were 'embedded' in other learning formats, or being taught to their student by other instructors at their high school or college.

For both industry and academia, evidence that "the job is being done well" can be found in the portfolio of the capstone course. Whether it is developed during the capstone course, or accumulated by the worker, the portfolio contents are the evidence that demonstrates competence. Critical review of the evidence (outcome assessment) indicates competence and achievement of the skill standard.

Tools

Contents (tools) of the portfolio (the assessment strategy) will be assessed for competency (level of achievement) of the skill standard. They may vary according to job criteria or among different instructors, based on their personal preferences. Included in a student's/worker's natural resource/environmental portfolios, one might find the following tools as evidence:

- A professional quality research report
- Video or slide presentation
- Power point oral presentation
- Written evaluations (self, instructor and peer)
- Data sheets
- Resume & application letter
- Completed math/statistics sets
- Journal and/or field notebook
- Business plan
- Scope of work for research project
- Project tasks & timelines (computer generated)
- Newspaper articles (student written)
- Maps

Fisheries Technology
Assessment Strategy: Capstone/Portfolio
Critical Work Function: All – Technical knowledge, skills, abilities, tools & SCANS skills **Key Activities**: A3 – Conduct soil sampling **Performance Indicator**: Assessed through portfolio contents and grading Proper analysis procedures & protocols are followed
Curriculum: Grays Harbor College; Course: Fish 220 & 221, Chemical and Biological Field and Laboratory Methods

Purpose

This two-quarter capstone course sequence allows students to learn, practice and assess the basic concepts, skills, techniques and tools used in natural resource/environmental technologies. The primary goal of these field and laboratory courses is to have students learn the techniques of biological and chemical sample collection, analyses and reporting of results, while collaborating with instructors, fellow students and industry professionals in a "real world" research project. Precision and accuracy of analytical performance and adherence to the basic principles of the scientific method are emphasized. Proper use of glassware, instrument calibration, quality control and laboratory safety are also major aims of these courses. The learning community model incorporated in these capstone courses encourages the integration of ecological, economic, political and social concepts and issues, essential to the resolution of critical water quality, fisheries and habitat issues facing our watersheds today. This model also promotes self-confidence, responsibility, leadership, teamwork and continuous quality improvement.

Project planning and management, leadership, supervision and teamwork are often essential to the success of a field research project, as are data collection, analysis and presentation. In other words, it requires strong basic (SCAN) skills to effectively implement technical skills in the work place. While many of these basic skills (writing, math, critical thinking, problem solving, responsibility, ethical behavior, time management, teamwork, leadership and continuous quality improvement) are often learned on the job, their basics can be developed and practiced in the classroom, laboratory and field. This two-quarter ecosystem study allows students to put into practice all the technical and SCAN skills they have acquired during their previous 4-5 quarters, thus the term "capstone". The **capstone course format** along **with observed demonstrations and portfolios** produced by the students are **assessment strategies**. The contents of the portfolio are **assessment tools**.

Course Objectives

This course provides students with the analytical skills frequently used in fisheries, natural resources and environmental technologies. Through field and laboratory instruction in modern physical, chemical and biological techniques and instrumentation, students will be able to collect, analyze and report water quality data with a high degree of precision and accuracy. Responsibility for maintaining high standards of analytical

performance, quality control and safety are major learning outcomes. Near the middle of each quarter, a 6 -7 week, team driven, "real world" research project, conducted at a nearby watershed, allows students to apply all techniques, methods and skills learned in the first 5-6 weeks of each term. Upon completion of these courses students will be able to demonstrate necessary skills required for entering the natural resources/environmental technician field. Specifically, students will:

1. Use tools of project planning, project management, teamwork, leadership and continuous quality improvement to plan and execute a "real world" watershed monitoring project, including: goals and objectives, a scope of work, and timelines, using contemporary project planning software.

2. Demonstrate they understand and can use the scientific method in a field research study.

3. Possess a high degree of skill, precision and accuracy, while performing the following water quality tests: barometric pressure, dissolved oxygen, fecal coliform, pH, B.O.D., temperature, total phosphates, nitrates, turbidity, total solids, conductivity, salinity, ammonia, hardness, alkalinity and discharge (water velocity).

4. Work safely, both individually and in teams, in a supervised lab and field setting.

5. Express themselves creatively through their field notebooks and journals, seminars and written and oral presentations of research reports.

6. Improve their esteem and self-confidence while working in teams as leaders and followers.

7. Finally, produce a professional quality **portfolio** (assessment strategy) including the following evidence of mastery (assessment tools) of basic (SCAN) and technical skills learned in this course:

- Resume and letter of application
- Field notebook and journal
- List of chemical and biological end products (field and lab learning outcomes)
- Completed math/statistics problem sets
- Project goals, objectives, tasks (scope-of-work)
- Project tasks and timelines (Gantt/PERT diagrams)
- Evidence of seminar participation
- Final research report
- PowerPoint presentation to a professional/general audience
- Examples of articles written for newspapers
- Peer evaluation
- Self evaluation (written)
- Instructors evaluation of student (written)

Capstone Ecosystem Study

The following is an outline for planning and teaching a two-quarter, "capstone" course for a natural resources/environmental technology program. Examples of several non-traditional assessment tools (some of those included in the portfolio described above) are found in Enclosures 1-9, pp 49-60.

Schedule:

Throughout the research study (weeks 7-11) students will work on developing the following SCAN skills:

Project Planning – Research Project

- Brainstorming – Affinity and Tree Diagrams
- Defining the Scope-of-Work
- Developing Tasks and Timelines
- Prioritization of Tasks
- Assignment of Personnel

    1. Individual Assignments
    2. Team Assignments

Project Management – Research Project

- Leadership and Supervision
- Teamwork
- Continuous Quality Improvement (CQI)

Weeks 8-11 are devoted to the research study itself. Students have a fair amount of say in the design of their research project (i.e. when and where they meet as teams and as a class, and to some degree the "end products" [learning outcomes] they complete as individuals and as a class). **Enclosure I** is a required list of "end products".

Learning Community/Linked Courses:

The overall delivery of the research study takes on the characteristics of a "learning community". It will either be a formal one, which is team taught by two or more faculty, or an informal one, where two or more faculty "link" their individual courses together (i.e. Fish 221 – Bio Field and Lab Methods, ENGL 250 – Tech Writing, and NR 240 – Watershed Ecosystems), to accomplish learning outcomes that jointly satisfy the requirements of each of the individual courses. Students may be enrolled in just one (1) or perhaps all of the linked courses.

Marketing and Advertising:

Learning communities, if they involve team teaching of multiple courses, often require campus-wide marketing and advertising. **Enclosure 2** is an example of an ad that can be made into a poster, included in the college's course catalog, or run in the local newspaper. It is important to inform and educate all divisions of the college (admissions, counselors, faculty staff, administrators, etc.) about your learning community at least one quarter before it is taught. Planning by the faculty co-instructing a learning community should start at least two (2) quarters in advance. **One year is not too far out!**

Course Objectives and Timelines:

During the first week of the learning community, faculty and students will develop course objectives (requirements) that look much like those listed in **Enclosure 3.** A corporate mission statement is also formulated at this time **(Enclosure 4)**. The mission statement will continue to be developed throughout the quarter.

Brainstorming is used extensively during the first two weeks to develop an **affinity diagram, tree diagram** and a set of timelines for the research study. These are all continuous quality improvement (CQL) tools that allow student to practice management, leadership, teamwork, organizational facilitation, listening and following skills. Other quality management tools used are **flow diagrams, fish bone diagrams and multi-voting (nominal group technique)** for gaining consensus (not included as an enclosure). **The Memory Jogger Plus** is an inexpensive pocket guide for students to learn these management and leadership tools.

Seminars:

Seminaring is a key ingredient of a learning community. One of the major goals of our learning communities is to explore ecological and technological issues from various (i.e. organizational, historical, economic, social and political) perspectives. **Enclosure 5** gives students a guide to the readings required, a schedule, and our grading policy.

Assessment:

Assessment is usually different (and more comprehensive) in a capstone learning community, than a traditional class. Some of the assessment tools used include: a written self-evaluation by each student **(Enclosure 6)**; an instructor-written evaluation **(Enclosure 7);** comprehensive peer and instructor evaluations **(Enclosure 8)** and a portfolio which includes all of the "end-products" (learning outcomes) including a final research report (not included) and a checklist for conducting a public or professional oral presentation **(Enclosure 9).** This portfolio has proven very useful to a student/graduate for: 1) application to a 4-year college or university; and 2) applying for a job. It tends to provide a much more comprehensive assessment of a student than just a grade on a transcript.

Summary:

Since each capstone learning community is "student-driven," there is no single outline to use as an example. Students are allowed many choices during the quarter. Faculty must relinquish the control or authority normally held in traditional courses. This does not mean, however, that the students will not be productive, or, that instructors just "kick back" and hope learning will occur. The opposite is most often true. Once the synergy of the community "kicks in" (this often happens in the 3rd – 5th week of the quarter, when students finally accept the fact that they are 100% responsible for their own learning, **near miraculous learning occurs**, and learning outcomes are accomplished within the prescribed timelines. All of this requires much 'risk taking' on the parts of both the faculty and students making up the community.

References:

Brassard, M. 1989. **Memory Jogger Plus.** First Edition. GOAL/QPC. 13 Branch Street, Methuen MA 01844.

Department of the Navy. **1992. Handbook for Basic Process Improvement.** Chief of Naval Operations Executive Steering Committee and the Department of the Navy's TQL Office, Washington, D.C.

Fish 221 – Biological Field and Lab Methods
Spring Quarter 2001
List of End Products
(Learning Outcomes)

A. The following is a list of "end products"(learning outcomes) to be completed by each student enrolled in FISH 221. Students should pay close attention to specific due dates of each end product. Materials submitted after the due date will be considered late and down-graded accordingly. The requirements are as follows:

End Products	Due Date	Date Assessed	Grade Earned
Complete biometrics problem (through standard deviation) on codfish trawl sampling	5/3/01	_____	_____
Computer solution to codfish problem	5/10/01	_____	_____
Participate in eight (8) seminar	(by end of qtr)	_____	_____
Prepare computer-generated goals, objectives, tasks and timelines for research project	5/20/01	_____	_____
Participate in writing one (1) USFWS Grant Application (Alder Creek, WEYCO-Brisco Ponds or Fry Creek) and secure permits (optional)	(by end of qtr)	_____	_____
Complete one (1) Ambient Monitoring Research Report (Habitat and Water quality Team Report)	6/11/01	_____	_____
Write one (1) news article for the Timberline, Daily World and/or Fish Ladder	(by end of qtr)	_____	_____
Prepare a video and/or slide presentation for Alder Creek or Fry Creek research project.	6/7/01	_____	_____
Serve as facilitator, recorder, reporter and timekeeper of at least three (3) different seminars	(by end of qtr)	_____	_____
Attend one (1) Chehalis Basin Fisheries Task Force, Trout Unlimited or Poggie Club meeting	(by end of qtr)	_____	_____
Make two (2) public slide, PowerPoint and/or video-presentations of your habitat/stream enhancement research project	6/14/01)	_____	_____

**Suggested groups to make presentations to might include: Aberdeen City Council, Grays Harbor Commissioners, Poggie Club, Trout Unlimited or the Chehalis Basin Fisheries Task Force.

Enclosure 1

End Products (cont'd)	**Due Date**	**Date Assessed**	**Grade Earned**
Demonstrate understanding of epiphyton, macrophyton, macroinvertebrate, fish, reptiles, birds and mammal sampling and/or bioassay procedures	6/14-16/01	_____	_____

B. Demonstrate mastery using the following biological field and laboratory methods, techniques and instruments:

Method, Technique, Instrument	**Date Due**	**Date Assessed**	**Grade Earned**
Electroshocking	_____	_____	_____
Surber Sampler	_____	_____	_____
Ponar Dredge	_____	_____	_____
Plankton Sampling/Counting	_____	_____	_____
Beach Seining	_____	_____	_____
Otter Trawling	_____	_____	_____
Ambient Monitoring			
RMZ Study	_____	_____	_____
Large Wood Debris	_____	_____	_____
McNeil Sediment Sampling	_____	_____	_____
Stream Typing	_____	_____	_____
Discharge	_____	_____	_____
Fry Planting/Feeding	_____	_____	_____
Invertebrate Density/Diversity Study	_____	_____	_____

"Man, Machine, and Nature"
Spring Quarter
GHC Learning Community

COURSE STRUCTURE

"What's a learning community"?
A learning community merges several classes, including the students, instructors, and curricula, so that the participants can work as a team, and begin to see connections between their efforts.
It's a chance to learn outside a traditional classroom, a chance to work with fellow students to explore issues, and develop professional solutions to real-world problems.
"Man, Machine, and Nature" merges courses in science, English, and microcomputer applications. The central task: to research Grays Harbor river ecology – its history, current efforts to address its problems, and possible guidelines for preserving the resource.
In this project, students may serve as field researchers, writers, or data processing experts – their efforts united in a coordinated, hands-on effort to make a difference.

STUDENT OBJECTIVES

Beyond meeting the requirements of the courses they've registered for, all students will meet objectives in roughly four categories:

Communications:
- Communicate in writing with peers in technical and non-technical fields
- Listen and speak in work place and seminar settings
- Read and digest technical and non-technical, issues-oriented materials
- Learn basic literature-searching procedures and become familiar with professional journals, indexes and other resources in their fields

Cooperation and problem solving:
- Cooperate with peers in technical and non-technical fields in order to complete a task
- Delegate and schedule tasks, develop leadership and consensus-building skills
- Integrate skills, noting the connections among different people's jobs
- Take charge of their own learning and learn from one another
- Identify resources and resource people, self-evaluate, and think creatively

Issues exploration:
- Explore the ethics of ecology, technology, work, research and writing
- Gain awareness of the complexities of ecological conflict
- Recognize the agencies and businesses, laws, economic realities, personal interests, and political ramifications affecting a current Grays Harbor environmental issue

Enclosure 2

Student-Developed
Program Objectives

1. To learn about and practice effective leadership, management and interpersonal relationship skills – supervision, planning and organization, plan implementation, progress tracking, communications, coordination and cooperation.

2. To gain confidence and 'critical' skills through practice of all five elements of language – reading, writing, speaking, thinking, and listening.

3. To gain perspectives on local and global social, technological and natural resource issues from a review of historical and contemporary writings, videos and discussions (seminar and guest speakers). To be comfortable with answers to those questions regarding these issues that are often incomplete and ambiguous.

4. To learn about and practice state-of-the-art techniques related to:

   -biological and chemical field and laboratory sampling and recording of data
   -experimental design; and analysis of laboratory and field collected data utilizing existing data base statistics and graphics software.
   -literature searching
   -technical writing for local and state agencies using prescribed formats
   -grant writing
   -production of slide/tape, video and poster presentations
   -beginning through advanced word processing of general and technically written letters and reports
   -organizational work plans and progress evaluations

5. To learn the 'art' of seminaring, especially, how to think and speak critically and ask good questions of texts, teachers, our fellow students and ourselves.

6. To gain perspectives on our own bias by considering the views of others.

7. To learn and practice the different stages of the writing process (general and technical) – gathering materials, shaping it in writing, revising what one haws written and editing it for publication and public presentation.

8. To practice working with others in exploring ideas, solving problems, and aiding others in development of basic skills.

9. To experience delight, excitement, fear rapture, astonishment, and a host of other emotions that creative writing, thinking, and risk-taking can awaken.

10. To become better aware of and develop a personal framework of regarding ethics in the work place, journalism, our scientific endeavors, and conservation of natural resources.

11. To explore through works of literature and textbooks, fundamental questions or our values, epistemologies, and lives in relation to technological change.

12. To learn to participate effectively and comfortably in an oral exchange of ideas about significant literary works, to be able to listen and to formulate ideas spontaneously and communicate them to others in large and small groups.

Enclosure 3

Corporate Mission

_____Corporation, a multi-tired environmental consulting firm, specializes in state-of-the-art fisheries and water quality research; superior quality technical reports, and multi-media public awareness presentations.

Our primary focus is to assist local planning agencies to make sounder decisions regarding their natural resources. This is accomplished by considering all influences (social, economic, political and biological) on final environmental decisions and policies. Clients range from local Port /districts and county governments to state and federal resource agencies and tribes.

Currently, we are tasked to develop off-channel gravel pit pond construction criteria for Grays Harbor County. The Washington Department of Fisheries, Washington Department of Ecology and local gravel miners are co-participants in this research. If successful, our findings will allow local miners to continue to harvest low-cost gravel, while creating additional spawning and over-wintering habitat for wild salmonid enhancement.

Our research efforts are totally supported through corporate-generated grants. We are respected in the community for our company's accuracy and integrity in reporting, flexibility to adjust to change, our ability to facilitate consensus between opposing interest groups, and fairness in considering needs for both industry and the ecosystem.

Enclosure 4

Man, Machine and Nature

Seminaring on the Issues

A series of seminars, held each Friday afternoon, will focus on a broad variety of issues, which relate to and directly impact our Learning Community's central fish-enhancement reporting tasks.

Required Texts:

Each seminar will be based on a selection of readings from one of our three core texts:

Organization and human dynamics:

Boone and Bowen, The Great Writings in Management and Organizational Behavior 2nd Edition, Random House, Inc., 1987.

Ecological issues and fisheries enhancement:

Bruce Brown, Mountain in the Clouds, Simon & Schuster, Inc., 1982.

Technological issues

Albert Teich, Technology and the Future, 5th edition, St. Martins Press, 1990.

Seminar Schedule:

Seminars are scheduled from 1 p.m. to 2 p.m. each Friday; however, if a seminar features a guest participant (such as, our first one on April 6 and our fourth one on April 27), the session will usually begin during the lunch hour.

The proposed schedule of seminar topics follows:

Organizational dynamics……	April 6
Grays Harbor issues	April 13
Fisheries issues	April 20
Fish enhancement	April 27
Technological impacts	May 4
Issues in technology	May 11, 18, 25
Organizational dynamics	June 1

Students will receive advance notice of the required readings for each seminar in order that those selections can be read, and notes can be prepared, to allow for each member's full participation in the Friday seminar.

Seminar Grading Policy

Learning Community members may enroll in one of three one-credit courses, BA 291, Biol 291, or Engl 291, each entitled Special Project. This will allow students to receive recognition on their Grays Harbor College transcripts for seminar participation.

Participation in all nine seminars will earn the student a "C" (satisfactory) grade. A "B" (above average) grade can be earned by preparing one seminar paper in addition to any other required seminar papers. An "A" (excellent) grade may be earned for preparing two seminar papers in addition to any other required papers. Non-participation in any one of the seminars will result in a "D" (below average) grade.

During the first week of the Learning Community, each member will receive guidelines for preparation of seminar papers.

Enclosure 5

Sample Self-Evaluation

Chemical Field and Lab Analysis Class

I probably learned more from this class than from any of my other classes this quarter. Just learning the water quality tests alone would have been somewhat of an accomplishment. But instead I learned a practical and, I think, realistic application of the tests. I became proficient at running the tests without contaminating the results or accidentally introducing more of the product I was testing for. I am probably strongest and most reliable in testing for dissolved oxygen using the HACH kit, and weakest in using the barometer at the hatchery. I was present when it was explained but I didn't fully comprehend the concept and the opportunity to use the equipment did not come up.

I learned quite a lot about leadership in the class too. Not just from my own actions but from observing the way other people in the class interact. This was the first group project I have worked on. I expected some of the ways the different personalities related but there were times I was surprised. I feel I did a good job of getting involved in the work that needed to be done, but in hindsight, I wish I had tried to get the group to delegate some of the work to those who would not involve themselves. At the time this project was first explained to the class I didn't know what to expect, so I followed the students who were more experienced in this type project. Now that I understand what can be expected and where a project like this should lead, I feel I could do a fair job of setting the course and/or direction of the next project. And, hopefully excel in keeping the group more focused and collected.

I feel good about the way my resume and cover letter turned out. I already had a resume in my personal files but nobody had critiqued it before, so I didn't know where it was weak. The cover letter was a great accomplishment for me. I always avoided applying for jobs that required cover letters because I didn't have a clue to what was expected. The cover letter wasn't hard to write at all, but I acquired a lot of confidence in my cover letter ability. Next time I need to send a cover letter out it will be easy! In fact, I sent one out last week. My first!

I think I put forth much effort in this class and if I had to do it again I could do a better job. I don't know that my effort deserves an "A", especially since I missed so many classes, but I do fell I definitely did "B" work.

Enclosure 6

Chemical Field and Laboratory Methods (6 credits)
Winter Quarter 2001

Name:_____

Course Description

During winter quarter 2001_____was enrolled in FISH 220 – Chemical Field and Laboratory Methods. This six (6) credit class was designed to train students in a wide variety of chemical and ambient monitoring methodologies, tools, and techniques, including:

- Laboratory balances and triple beams
- YSI oxygen meter
- Orion Oxygen meter
- Winkler method for dissolved oxygen
- YSI, temp, salinity, conductivity meter
- HACH kits (all methods)
- Weiss saturometer
- Mercurial barometer
- Discharge (flow meter)
- Ammonia
- Suspended solids
- Nitrate
- Turbidimeter
- pH meter
- Nitrite
- Phosphate
- Hardness
- Settleable solids

At the beginning of the quarter, students learned the basics of quality assurance and quality control in the field and laboratory. We discussed, and later practiced, the importance of precision, accuracy, and ethics in collecting, analyzing and reporting physical and chemical data.

We seminared on the following topics throughout the quarter:

Leadership Secrets of Attila the Hun
Multiple Working Hypothesis/Strong Inference

Students attended the U of W Center for Streamside Studies (the Annual Review of research presented by faculty and graduate students. Students also attended a six (6) hour Ambient Monitoring training session on **Spawning Gravel Sediment Analysis** at the NW Indian Fish Commission, Olympia, WA.

Learning out comes for each student included the following "end products":
- State and Federal Job Application forms
- Resumes and Cover Letters
- Facilitation of at least one (1) seminar
- One (1) water quality/ambient monitoring research study and word processed report
- One (1) team oral presentation to a live, professional audience

- Filming, scripting, editing titling and providing voice-over for one (**1**) video about our "capstone course"
- Maintaining a field notebook and journal throughout the quarter
- The submission of a portfolio of achievements (end products) completed during the quarter
- Preparation of a self evaluation and peer evaluation at the end of the quarter

The water quality/ambient monitoring research study was the primary focus of this course. Students mapped their study area and collected, analyzed and reported on the physical and chemical data. They work processed preliminary and final reports of their findings and presented their results in and oral "Power Point" presentation. Students were also required to produce a video tape of their research study.

A major component of this 'experience' was the introduction of various total quality management/leadership concepts, tools and techniques including:

- A five hour (5) low ROPES course
- How to conduct a meeting
- Leadership by consensus
- Fishbone diagrams (cause and effect)
- Goals and objectives
- Tasks and timelines (Gantt chart
- Brainstorming
- Team building
- Affinity diagrams
- Tree diagrams
- Project management

The human development aspect of this course was very special. All students, and the instructors, learned about teamwork in the workplace; discovered and accepted individual strengths and weaknesses, and achieved "quality" in everything we did.

*This enclosure also would include an instructor's written evaluation of each student's performance during the class and their grade.

Enclosure 7

Fish 220 – Chemical Field and Laboratory Methods
Instructor Assessment of Performance
Winter 2001

Students	Seminaring	Lab/Field Part.	Project Planning	Teamwork	Leadership	Research Report (1st draft)	Research Report (Final draft)	Video Script/ Filming	Oral Presnt.
Julie									
Ben									
Sean									
Terry									
Sarah									
Carol									
Amy									
Fred									

Students are rated by the instructor using the following criteria: zero (0) being the lowest, and five (5) the highest.

Enclosure 8

Fish 221 – Biological Field and Laboratory Method
Spring Quarter
Oral Presentations

Checklist for a Successful Meeting

Before the Event -

_____Firm up the entire program well in advance; one to two months, if possible.

_____Be certain speakers know their topic and time requirements.

_____Outline program contents for publicity channels, including places and dates.

_____Complete planning for all physical facilities:

a. Meeting spaces; lunch and break areas.
b. Adequate exhibit spaces.
c. Registration supplies and personnel.
d. Audio-visual equipment and assistants.
e. Signs and bulletin boards for guidance of invited guests and speakers.
f. Invitations to guests, presenters and the media.

_____Line-up community support and participation.

_____Line up staff of hosts and hostesses.

_____Line up printing or copying of brochures and programs.

_____Arrange for photography and photographer.

During the Event –

_____Make sure someone is in charge; that everyone knows his or her responsibilities.

_____Start sessions on time; announce at the beginning that this will be standard procedure.

_____Keep sessions and speakers on schedule.

Enclosure 9

Forestry Technology
Assessment Strategy: Capstone/Portfolio
Critical Work Function: C – A through H **Key Activities**: C3 – 3 quarter process **Performance Indicator**: SCANS skills are at appropriate levels
Curriculum: Centralia Community College; Course: Forestry 223

Course Structure:

This capstone course is designed to take the technical forestry skills students learn and tie them together with other essential learning and job skills. Leadership and organization are essential elements in any job, as are data collection, analysis, and presentation. Many of these skills can only be learned on the job, but their basics can be developed and practiced in a classroom and field setting. This course is split into three separate, two-credit classes designed to expose forestry technology students to the fundamentals of leadership and organization and how they are applied in a job environment. The three classes are sequential and encourage students to develop their own style of leadership and organization and then practice these skills in the subsequent classes. The course starts with Leadership and Organization, moving to Data Collection and Analysis, and then Forestry Presentation.

1st QTR 10 – 20 hrs - Leadership and Organization

Description:

Leadership and organization are two of the most essential components of a successful career. Just having technical forestry skills is not enough. Students need to be able to take that information and use it effectively by applying good leadership and organizational skills. This class will expose students to some of the principles and fundamentals of leadership including ethical and moral courage, coaching subordinates, and communications. Organizational skills will also be taught and practiced such as line and staff organization, scheduling, and critical path analysis. Students will investigate job market opportunities and develop a business plan

Students Will:

- Understand the negotiation processes
- Understand and develop standards
- Moderate discussions
- Follow rules policies and procedures
- Identify conflicts
- Recognize ethical issues
- Understand system/ organization/hierarchy
- Recognize ethical issues
- Understand decision-making process
- Efficiently manage time
- Demonstrate honesty
- Work to improve team skills
- Analyze work requirements
- Utilize brainstorming techniques
- Considers risk implications
- Recommend action plan

- Clarify communications
- Understand requirements of the tasks
- Accept responsibility for own behavior
- Acquire supplies and equipment
- Set well defined/realistic goals
- Consider risk/implications
- Prepare basic report
- Actively participate in team activities
- Demonstrate awareness of diversity
- Volunteer for special assignments
- Coach others to apply related concepts
- Respect the rights of others
- Apply rules/principles to process and procedure.
- Accept constructive criticism
- Identify training needs
- Encourage/support individuality
- Prioritize daily tasks
- Recognize differences/biases
- Identify relevant details, facts, and specifications
- Apply self-management skills
- Identify own strength/limitations
- Prepare schedule
- Match talent to position
- Perform routine record keeping
- Respond to customer needs
- Provide accurate communications

Outputs: Personal journal, self-evaluation, peer evaluation, results of two interviews (including questions), and a business plan

2nd QTR 10 – 20 hrs – Data Collection and Analysis

Description:

Using the skills developed in the previous class, students will act as a business. They will collect field data, and then analyze and process this data using a variety of database systems and spreadsheets. The data analysis will be used not only to make forestry management decisions and also as a basis for other data collection requirements. All information gathered would be used during the third class as part of a formal presentation.

Students Will:

Analyze work requirements

- Apply processes to new information
- Confirm information
- Consider risk implications
- Demonstrate commitment to self-improvement
- Demonstrate honesty
- Demonstrate trustworthiness
- Efficiently manage time
- Follow proper procedures
- Gather information
- Identify goals and constraints
- Identify needs for data
- Identify problems
- Interpret and summarize information
- Obtain data
- Pay attention to detail
- Perform basic computations
- Perform basic data entry
- Perform given set of tasks
- Perform routine record keeping
- Prepare basic report
- Prepare Schedule
- Prioritize daily tasks
- Propose simple technological solutions
- Qualifies/analyzes information
- Recognize patterns and relationships
- Record information accurately
- Record numerical data
- Select appropriate information
- Summarize and integrates information
- Translate mathematical data
- Understand requirements of the tasks
- Understand the information
- Use materials in a safe and efficient manner
- Utilize brainstorming techniques
- Utilize integrated/multiple software
- Utilize previous training or experience to predict outcomes
- Work with minimal supervision

Outputs: Field journal, data collection sheets, spreadsheets, data analysis, and forest management decisions

3rd Qtr 10 – 20 hrs - Forestry Presentation

Description:

Students Will:

- Accept constructive criticism
- Address audience/purpose
- Analyze persona/societal implications of decisions
- Apply appropriate principles, laws, and theories to situations
- Create original documents
- Defend own beliefs/viewpoints
- Demonstrate commitment to self-improvement
- Demonstrate composure
- Demonstrate honesty
- Demonstrate trustworthiness
- Design charts and graphs
- Efficiently manage time
- Encourage/support individuality
- Establish rapport with co-workers and customers
- Explain concepts
- Follow rules, policies, and procedures
- Follow up on assigned tasks
- Identify problems
- Identify relevant details, facts, and specifications
- Integrate multiple items of data
- Interpret information
- Interpret positions on issues
- Paraphrase summarizes generalizes existing ideas
- Prepare basic report
- Present basic ideas, information

- Prioritize daily tasks
- Propose simple technological solutions
- Provide accurate communication
- Qualifies/analyzes information
- Recommend action plan
- Respond assertively
- Suggest system modifications/improvements
- Summarize and integrates information
- Understand requirements of the task
- Understand decision-making process
- Understand standards
- Use logic to draw conclusions
- Utilize integrated/multiple software

Outputs: Oral and written presentations, and portfolio

Student portfolios will include cumulative evidence from the above three classes, representing 30-60 hours of class time:

Personal journal
Self-evaluation
Peer evaluation
Business plan
Field journal
Data collection sheets
Data analysis
Oral presentation evaluation
Written project report

GIS Technology
Assessment Strategy: Capstone/Portfolio
Critical Work Function: C – A through E **Key Activities**: SCANS Skills and Knowledge Skills & Abilities **Performance Indicator**: Proper analysis procedures & protocols are followed
Curriculum: Green River Community College; Course: GIS 202 Arc/Info Applications

Purpose:

The purpose of this course is to bring together the knowledge, skills, and abilities you have gained not only in GIS courses, but from other courses as well, and integrate these into a GIS project. You will be part of a team that is responsible for developing and implementing a project from start to finish, reporting your results in appropriate communicative formats, and critically assessing your results as well as other's.

Learning Objectives:

Specifically, upon completion of this course you will be able to:

- Identify a spatial question
- Design and implement a GIS analysis project to answer that question
- Identify and use various data sources
- Document your results
- Present your results in a public forum and answer questions concerning your project
- Identify and discuss generic problems pertaining to GIS project design and implementation.

Methods of Evaluation

Typically your project will consist of various steps. Listed in **Attachment 1** are the minimum steps you are required to follow, along with those tasks, technical knowledge, and foundation skills upon which you will be evaluated for each step. The specific products, upon which you will be evaluated, along with the due dates, are listed in **Attachment 2**.

The products you are required to produce will be in the form of written documents, maps, charts, tables, and oral presentations. Evaluators will consist of the instructor, your peers, other faculty, and outside GIS professionals.

The instructor will evaluate all products. Your peers will evaluate all oral presentations, and other faculty and outside GIS professionals will evaluate your final oral presentation.

Internal oral presentations will take place at the end of each step. The purpose of the internal presentations are to discuss your progress to date, describe any problems you may be having, answer questions and receive comments from the instructor and your peers.

The final presentation will be formal as if you are presenting your work at a professional organization meeting. You may use whatever methods of communication you think appropriate to support your presentation. Your audience will be comprised of your peers, other faculty, and outside GIS professionals.

Project Steps (Attachment 1):

Tasks, Technical Knowledge, and Foundation Skills

1. Determine project objectives

Steps:

Determine data needs/format & evaluate sources

Technical Knowledge

- Understanding to different data formats
- Ability to perform basic research

Foundation Skills

- Interprets/integrates information
- Researches additional information sources
- Integrates multiple items of data
- Assist in task management

Technical Knowledge

- Ability to determine needs
- Ability to identify goals and objectives
- Ability to develop timelines
- Ability to coordinate multiple tasks

Foundation Skills

- Follows rules/policies/procedures
- Monitors and adjusts task sequence

2. Build the database

Steps:

Integrate data from various sources

Technical Knowledge

- Knowledge of varying data qualities.
- Knowledge of appropriate scales.
- Ability to transform data between data formats and platforms.
- Knowledge of software tools for joining maps and data sets
- Ability to merge database table

Foundation Skills

- Creates data gathering processes
- Presents basic ideas/information

Create metadata

Technical Knowledge

- Understanding of and ability to locate local, state and federal mandates regarding metadata standards
- Knowledge of GIS vernacular

Foundation Skills

- Follows processes and procedures
- Examines information/data

3. Analyze the data

Steps:

Manipulate data

Technical Knowledge

- Knowledge of databases and data manipulation tools.

Foundation Skills

- Analyzes the data.
- Retrieves stored information and data.
- Recognizes accuracy of information.
- Pays attention to details.

Perform tabular/spatial analysis

Technical Knowledge

- Knowledge of database design and relationships.
- Knowledge of general spatial query procedures (union, intersect, identify, buffer, etc.).
- Knowledge of general tabular manipulation procedures (query, join, relate, cursors, etc.).

Foundation Skills

- Extracts information and data.
- Interprets and summarizes information.

Perform basic programming

Technical Knowledge

- Understands basic programming concepts (e.g., conditional statements, looping, variables).
- Ability to write simple programs/scripts.
- Knowledge of appropriate documentation standards.

Foundation Skills

- Applies rules/principles to processes/procedures.
- Analyzes logic/rule/principles.

4. Present the results

Steps:

Design layout

Technical Knowledge

- Knowledge of cartographic production techniques

- Ability to pay attention to detail
- Knowledge of appropriate fonts, color, data sets, and scales
- Knowledge of output devices
- Understanding of basic concepts of artistic visual presentation

Functional Skills

- Designs charts, maps, graphs
- Visually analyzes relationship between parts and whole

Report results

Technical Knowledge

- Ability to use good client communication skills

Functional Skills

- Creates detailed supporting documents
- Communicates clearly.

Specific Products and Due Dates (Attachment 2):

Week 1
We will discuss course structure, requirement, and timelines. Teams should already have been formed during last quarter in GIS 250. At this time, the team should decide which project to pursue. You should begin the process for completing end products.

Week 2
Starting Wednesday, begin class presentations. By Friday, hand in project objectives.

Determine Project Objectives
Steps:

- Document detailing project and objectives
- Presentation to class

Week 3
Begin developing data base (a great deal of this work should already have been completed last quarter in GIS 250).

Week 4
By Friday of the 4th week, hand-in data base products.

Build Database
Steps:

- Identify the layers needed to create the map(s)
- Identify map features for each layer
- Identify the attributes and symbols for each feature
- Identify look-up tables and relate item
- Identify scale and projection
- Identify data sources

- Identify format of data and procedures needed to convert data into Arc/Info format
- Develop a data dictionary. Items to include:
  –layer names
  –map features and symbols
  –map scale and projection
  –data source of each feature
  –metadata for each feature as supplied by source
  –procedures for converting data
  –look-up tables and associated data tables

Week 5
Begin data analysis. This will be your most involved and time-consuming step.

Week 7
By Friday of this week, hand in data analysis products.

Data Analysis
Steps:

- Document detailing:
  – Computational procedures
  – AMLs

Week 8
Begin designing and prototyping final products. Final products are due on Monday of Week 10. Formal presentations will also begin on Monday of that week. A schedule of team presentations will be determined on Monday of Week 8.

Week 10
Design Layout and Formal Presentation
Steps:

- Sketch of final products
- Draft plot of final product
- Final products
- Make formal presentation to class and invited outside audience

Natural Resources Technology
Assessment Strategy: Capstone/Portfolio
Critical Work Function: A - Collect Field/Site Data and Observations **Key Activities**: A7 Conduct Research **Performance Indicator**: Research is appropriate, conducted in an efficient and timely manner, ethical
Curriculum: Grays Harbor College Course: NR 240, Watershed Ecosystems ll

Purpose: The purpose of this capstone course is to allow students to put into practice many of the writing, research and presentation skills learned in the first year, foundation-building courses (e.g., English, computer applications and speech).

1: Field journal

Maintain a detailed and accurate field journal

Students will:

- demonstrate an understanding of goals of keeping a journal by creating a list of objectives of journal-keeping.
- demonstrate accuracy of journal entries by comparison with master example.
- demonstrate ability to record events/activities in correct chronological order (i.e. in the order they happen, or are accomplished).
- demonstrate ability to translate field work into written journal entries in a manner that is clearly understandable, (e.g. so activity described in entry could be repeated with accuracy).

2. Information search

Complete an information search and present in written format

Students will:

- demonstrate the layout and operation of library information retrieval systems in an oral briefing.
- demonstrate the selection of keywords for the search.
- demonstrate an understanding of the inter-library loan and request process, as evidenced by obtaining an item.
- demonstrate ability to place literary resources into written bibliography.
- identify the resources most useful and pertinent to issue as evidenced by assignment
- describe other information sources used.

3. Field guide

Develop a field guide to sustaining specific natural resources

Students will:

- detail goal of developing a field guide and how this will be achieved.
- detail team organization to achieve tasks.
- demonstrate knowledge of field guides currently in use by describing the format, structure and goals of selected example field guides.
- demonstrate an understanding of the motivation and goals of potential user groups by listing motivations of different user groups towards natural resources.
- research relevant information appropriate to sustaining the resource, the different user groups, potential impacts and combine with appropriate maps/graphics to convey the message.

4. Presentation

Prepare and give presentation of specific subject

Students will:

- collectively develop a written plan, which includes the steps to be accomplished in order to give an informative presentation, how the presentation will be executed, and time lines.
- demonstrate ability to combine information search results and use for presentation.
- demonstrate familiarity with chosen visual equipment by demonstration during planning stages.
- describe reasons for selecting specific equipment for use in presentation.
- execute a structured and planned presentation with appropriate length, content, visuals and information.

Internship/Co-op
Assessment Strategies & Tools

Environmental Technology
Fisheries Technology
Forestry Technology
GIS Technology

Internship/Coop Assessment Strategies and Tools

Strategy

Skill standards are an excellent guide for what should be taught in high schools and community colleges in order for students to be successful and employable in the work place. One method for assessment of these standards can be "on-the-job", and provide direct feedback for certain duties not easily assessed in an educational setting. It is an opportunity for the instructor, and employer, to work together to determine if formal secondary and post-secondary instruction is indeed meeting the needs of an industry.

A cooperative work experience (internship) can also result in permanent employment. The internship is an excellent transition tool for moving out of the academic and into the work environment. Employers have the opportunity to network with college faculty and students, finding new, qualified employees. They can also influence curriculum if courses currently being taught are not meeting industry's needs.

The responsibility for finding the internship may be that of the faculty or the individual student. Internships may be either paid or unpaid, but either way, they provide valuable experience to the learner for their future employment. Incorporating skill standards (both technical and SCANS) into internships/co-ops has proven to be a **highly effective assessment strategy.**

Tools

The following pages are examples of co-op work experience evaluation forms used in community/technical college environmental, fisheries, forestry and GIS technology programs throughout Washington State.

An important aspect of a cooperative learning experience or internship is its documentation. This documentation becomes the "evidence" of the job done to skill standards. Therefore it is important for students, instructors and employers to have convenient forms that accurately reflect the type and quality of work a student is performing.

If it were possible, having a database of skill standards would be ideal. Employers would be provided the appropriate skill standards (critical functions and key activities) relevant for a particular intern/coop job. *The Environmental Technology Internship Strategy* (p 76 of this manual) is an example. Simple forms could be downloaded that include the performance indicators for the relevant tasks. They would be used to assess student work habits, proficiency and overall success.

The next example for Fisheries Technology (pp 78-85) includes a sample letter from the Co-op Coordinator (usually an instructor) to the Co-op Supervisor (usually an industry,

agency or Tribal employee), that introduces the student and outlines the skill(s) to be learned. It also includes an Appraisal of Student Performance, to be completed by the Supervisor, that focuses on the basic (SCANS) skills.

Next, the example for Forestry Technology (pp 86-90) provides a Student Learning Agreement, a Supervisor's Evaluation Form and a Self-Evaluation Form.

And finally, a uniquely different co-op work experience format is offered for GIS Technology (p 91).

Environmental Technology
Assessment Strategy: Internship/Co-op Work Experience
Critical Work Function: E - Perform Maintenance & Repair **Key Activities**: E3 – Keep calibration and maintenance records **Performance Indicator**: Records are current, complete, timely, accurate and available
Curriculum: Clover Park Technical College Course: Env. 264 Adv. Lab Technique

The calibration and maintenance of equipment may best be assessed during an proper records are to be kept, the internship provider is ideally suited to review those internship where a student is using equipment daily for an extended period of time. If records. The following form will assist the internship provider in assessment.

Calibration and Maintenance Records Evaluation

Performance Indicators	outstanding	satisfactory	acceptable but needs improvement	not satisfactory	not applicable
Records are current					
Forms are complete					
Forms are completed in a timely manner					
Records are accurate					
Records are available					
Documentation shows instrument was maintained and calibrated according to specifications					

Critical Work Function: C - Analyze samples
Key Activities: C1 – Receive Samples; C2 – Prepare Samples
Performance Indicator: Holding times are not exceeded

Holding times are not exceeded

Performance Indicators	outstanding	satisfactory	Acceptable but needs improvement	not satisfactory	not applicable
Receipt date/time is recorded					
Maximum holding time is recorded					
Actual holding time is recorded					
Sample is prepared for analysis on time					

Critical Work Function: Collect Samples
Key Activities: B3 – Collect information/samples for biological analysis
Performance Indicator: Samples are labeled, handled, stored and transported properly

Samples are labeled, handled, stored and transported properly

Performance Indicators	outstanding	satisfactory	acceptable but needs improvement	not satisfactory	not applicable
Samples are labeled properly					
Samples are handled properly					
Samples are stored properly					
Holding times are not exceeded					
Samples are stored at the proper temperature					
Samples are transported properly					
Samples are not broken/contaminated during transport					

SAMPLE LETTER TO CO-OP WORK SUPERVISOR

October 1, 2001

Randy Aho
Hatchery Complex Manager
Washington Dept. of Fish and Wildlife
4203 Aberdeen Lake Road
Aberdeen, WA 98520

Dear Randy,

Scott Peterson has requested to perform co-op work experience at your Aberdeen Lake Hatchery during Fall Quarter 2001. Scott has taken both FISH 122 and 222 – Introduction To, and Advanced Aquaculture, and has done some volunteer work at our on-campus hatchery (spawning fish, picking eggs, cleaning raceways, and fin clipping juvenile coho before release). I feel Scott can do an excellent job for your agency.

We are especially interested in your input to Scott's learning objectives this quarter (please note page 8 of the Co-op Work Experience Contract). Three tasks that Scott could use on-the-job training in record keeping, inventorying and purchasing procedures in addition to his regular assigned duties. Enclosed are skill standard evaluation sheets (with related assessment criteria) for each of the above on-the-job training areas. These were tasks (and related skills) identified by you and fellow workforce representatives, when we developed skill standards, assessment tools and strategies for the fisheries technician position in 1998-99. These are also training areas that we don't focus too much in our classes and fieldwork. I'm sure Scott would benefit greatly from any opportunities to train and work in these areas. Thank you very much.

Please feel free to call me anytime (360) 538-4177 to discuss Scott's progress in meeting these work objectives. I will also plan to visit your work site at least once during this quarter.

You will note too, that I have enclosed a revised Supervisor's Final Evaluation (page 10 of the Contract) based upon the Skill Standards Criteria developed during the 1998-99. A copy of the final Skill Standard Manual has been included for your review and use. Thanks very much again for your help in developing these skill standards, and for supporting GHC's co-op work experience program.

Sincerely,
Don Samuelson, Instructor
Fisheries/Natural Resources

Fisheries Technology
Assessment Strategy: Internship/Co-op Work Experience
Critical Work Function: SCAN Skills **Key Activities**: SCANS skills at appropriate levels for job description **Performance Indicator**: All relevant to job duties and tasks
Curriculum: Grays Harbor College; Course: Fish 258/259

Evaluation of Foundation/SCANS skills

Student's Name:_____
(LastFirstM.I).
Assignment:_____ Supervisor:_____

Date Started:_____ Date of Evaluation:_____

Appraisal of Student Performance
Please evaluate co-op worker and check appropriate box (Use below number that best assess competency-rating criteria for that skill/quality)

1 = Poor, **2** = Fair, **3** = Good, **4** = Above Avg., **5** = Excellent, **6** = Not Observed

Foundation Skills and							
Personal Qualities	1	2	3	4	5	6	
Basic Skills							**Rating Criteria**
Demonstrates Effective Reading Strategies							Probes, qualifies, analyzes, interprets, and summarizes information
Demonstrates Effective Writing Strategies							Composes/edits simple documents & letters; Completes forms
Applies Arithmetic Processes							Converts numerical data and Predicts arithmetic results
Applies Mathematics Processes							Summarizes, interprets, and translates mathematical data; uses formulas
Demonstrates Effective Listening Skills							Interprets, clarifies, and influences communication
Demonstrates Effective Speaking Skills							Presents basic ideas/info.; actively discusses & explains concepts
Thinking Skills							
Applies Creative Thinking/Generates Ideas							Utilizes brainstorming; demonstrates creative thinking process & solutions
Applies Decision Making Strategies							Gathers & analyzes situation/info; compiles multiple viewpoints
Recognizes and Solves Problems							Examines & analyzes information/data; recommends plan

1 = Poor, **2** = Fair, **3** = Good, **4** = Above Avg., **5** = Excellent, **6** = Not Observed

Foundation Skills and Personal Qualities	1	2	3	4	5	6	**Critical Competencies**
Thinking Skills cont.							
Demonstrates Visualization							Analyzes relationship between parts/whole and process/procedure
Knows How to Learn							Investigates and applies new learning techniques/tools; interprets symbols
Applies Reasoning Skills							Analyzes logic/principle & examines information for relevance & accuracy
Personal Qualities							
Demonstrates Responsibility							Monitors standards; follows through on tasks; pays attention to detail
Demonstrates Belief in Self Worth							Accepts responsibility for own behavior; understands impact to others
Demonstrates Sociability in Groups							Shows empathy; encourages others to cooperate; modifies own behavior
Demonstrates Self-Management							Sets and adjusts goals, demonstrates commitment to self improvement
Demonstrates Integrity/Honesty							Analyzes personal/societal implications of actions & recommends course

Management of Time and Resources							
Manages Time							Prepares schedule and prioritizes, monitors, and adjusts tasks
Manages Money							Performs routine record keeping
Manages Materials/ Facilities							Acquires/distributes supplies and equipment; maintains inventory
Manages Human Resources							Distributes/analyzes work assignments; recognizes job tasks

1 = Poor, **2** = Fair, **3** = Good, **4** = Above Avg., **5** = Excellent, **6** = Not Observed

Foundation Skills and Personal Qualities	1	2	3	4	5	6	**Critical Competencies**
Management and Use of Information							
Acquires/Evaluates Information							Predicts outcomes; analyzes, integrates, and compares data
Organizes/Maintains Information							Analyzes organization of information; applies processes to new information
Interprets/Communicates Information							Prepares basic summaries, reports; Interprets/analyzes info.
Uses Computers to Process Information							Locates/retrieves/manipulates information; utilizes multiple software
Interpersonal Skills							
Participates as Team Member							Works to improve team skills and encourages/supports team members
Teaches Others							Conducts task-specific training and coaches others to apply concepts
Serves Customers							Demonstrates commitment to customer orientation & analyzes customer needs
Exhibits Leadership							Leads by example and demonstrates commitment to excellence
Negotiates Agreements							Moderates discussion, demonstrates composure, and interprets concerns
Works with Diversity							Recognizes/supports the value of diversity
Understanding the Management of Systems							
Understands System							Analyzes system configuration and follows processes & procedures
Monitors/Corrects System Performance							Adjusts/monitors system operation and troubleshoots system problems

1 = Poor, **2** = Fair, **3** = Good, **4** = Above Avg., **5** = Excellent, **6** = Not Observed

Foundation Skills and							
Personal Qualities	1	2	3	4	5	6	**Critical Competencies**
Understanding the Management of Systems (cont.)							
Improves/Designs Systems							Suggests system modifications and improvements
Use of Technology							
Selects Appropriate Technology							Analyzes task/technology relationship and understands technological results
Applies Technology to Task							Understands operation/interaction; analyzes technology output
Maintains/Troubleshoots Technology							Identifies/corrects malfunctions/failures; troubleshoots failures

ACHIEVEMENT OF MAJOR WORK OBJECTIVES:

Did the trainee:

Meet the original Co-op work objectives co-established at the beginning of this quarter?

_____

_____

What other major learning outcomes were met by the trainee this quarter? _____

_____

ATTENDANCE: (Please circle one)

EXCELLENT	SATISFACTORY	UNSATISFACTORY
(Regular)	(Occasional absences)	(Excessive absence)

ADJUSTMENT: Did the trainee:

Understand the specific duties of his/her work?_____

Fit in well with regular employees?_____

Show an interest in his/her work?_____

Contribute toward the welfare of your organization?_____

Comments (if any):_____

_____

FINAL EVALUATION SUMMARY

1. After a quarter of observation, would you want this student working for you on a temporary or permanent basis?_____
   _____
2. How do you think the student represented the school while on the job?_____
   _____
3. Student's Major Strengths:_____
   _____
4. Student's Major Weaknesses:_____
   _____
5. Suggestions:_____
   _____
   _____
6. Comments:_____
   _____
   _____
7. I recommend a letter grade of_____that describe the overall performance of this student this quarter. Plus or minus grades can be used here too (i.e., B+, C-, etc.).

Supervisor_____**Date**_____

We appreciate your assistance in helping to provide student trainees for our community and the work force. Thank you.

Forestry Technology
Assessment Strategy: Internship/Co-op Work Experience
Critical Work Function: All relevant to job including SCAN skills **Key Activities**: SCANS skills at appropriate levels for job description **Performance Indicator**: All relevant to job duties and tasks
Curriculum: Centralia College; Course: Forestry 258/259 – Co-op Experience

Course Description

An internship allows students to apply classroom learning to on-the-job forestry settings. Credit is earned based on the level of experience and the student's individual learning objectives. Prior to the start of the internship each student works with college instructors and perspective job supervisors to develop a set of learning objectives that will provide a positive learning and work environment. Students can participate for a maximum of ten credits (up to 5 credits per quarter).

Course Objectives

The objectives of the internship are:

- To become familiar with the forestry work environment
- To work with a supervisor and other forestry professionals
- To learn more about a career in forestry
- To gain an better understanding of the forestry occupational environment
- To improve the job skills
- To apply forestry skills learned in the classroom
- To gain specific technical knowledge and experience not available in the classroom

Assessment

Students will be evaluated based on the learning objective agreement, self-assessment, and supervisor's evaluation.

Learning Agreement(See p. 86)

Self Assessment (See p. 89

Supervisor's Evaluation(See p. 88)

Learning Agreement

Forestry Technology Internship

Student Intern:_____

Internship Provider:_____

Internship dates: _____to _____

General Description of the Student's Duties:

Learning Objectives

Objective #1

Objective #2

Objective #3

Objective #4

Objective #5

All persons concerned jointly agree to the following working conditions:

The students agree to:

- Perform all assigned tasks related to the learning objectives
- Perform those assigned tasks by the instructor and the on-site supervisor
- Maintain a log of hours worked and progress of learning
- Maintain communication with instructors according to the agreed upon schedule
- Notify the faculty coordinator and of any revisions in the contract

The instructor agrees to:

- Provide teaching support and guidance by communicating with the student regularly and by reviewing the student's log
- Maintain communication with the work site supervisor throughout the internship
- Visit the work site at least once for a conference with the student and supervisor
- Review the student and employer evaluations to assign a grade for the internship

The Employer agrees to:

- Provide the student with normal supervision and guidance as needed in his performance of the tasks described in the Learning Objectives
- According to a pre-arranged schedule, communicate periodically with the student and instructor concerning the student's performance and learning achievement
- Provide student and instructor with a copy of the final evaluation of the student's performance

Internship Supervisor:	Instructor:
_____	_____
(printed name)	(printed name)
_____	_____
(signature)	(signature)
Date:_____	Date:_____

Supervisor's Evaluation

Forestry Technology Internship

The following are the minimum supervisor evaluation requirements. Other evaluation criteria should be added as deemed necessary by the supervisor, instructor and student.

Student:_____

Evaluator:_____

Date:_____

	Outstanding	Satisfactory	Needs Improvement	Unsatisfactory	Not Observed or Applicable
Technical Skills:					
The student demonstrates technical understanding and skills that are applied to completing assigned tasks.					
Quality of Work:					
The student consistently produces the required work.					
Responsibility:					
The student demonstrates responsibility in their execution of internship job functions.					
Flexibility:					
The student successfully alters activities to meet new situations.					
Initiative:					
The student finds/begins new activities to meet new situations.					
Attitude:					
The student demonstrates a good attitude regarding internship responsibilities					
Cooperation/Teamwork:					
The student demonstrates the ability to work cooperatively or as part of a team.					
Dependability:					
The student can be depended upon to perform assigned tasks.					
Attendance/Promptness:					
The student maintained a good record of attendance and promptness.					

Self Evaluation

Forestry Technology Internship

The student should evaluate his or her own performance using the following criteria. Other evaluation criteria can be included if considered necessary by the instructor and student.

Student:_____

Evaluator:_____

Date:_____

	Outstanding	Satisfactory	Needs Improvement	Unsatisfactory	Not Observed or Applicable
Technical Skills:					
The student demonstrates technical understanding and skills that are applied to completing assigned tasks.					
Quality of Work:					
The student consistently produces the required work.					
Responsibility:					
The student demonstrates responsibility in their execution of internship job functions.					
Flexibility:					
The student successfully alters activities to meet new situations.					
Initiative:					
The student finds/begins new activities to meet new situations.					
Attitude:					
The student demonstrates a good attitude regarding internship responsibilities.					
Cooperation/Teamwork:					
The student demonstrates the ability to work cooperatively or as part of a team.					
Dependability:					
The student can be depended upon to perform assigned tasks.					
Attendance/Promptness:					
The student maintained a good record of attendance and promptness.					

GIS Technology
Assessment Strategy: Internship/Co-op Work Experience
Critical Work Function: All relevant to job including SCAN skills **Key Activities**: SCANS skills at appropriate levels for job description **Performance Indicator**: All relevant to job duties and tasks
Curriculum: Green River College; Course: GIS 177-179 – Co-op Experience

Purpose:
The purpose of the co-op program is to give students GIS experience in a work environment. The objectives of the program are:

1. To become acquainted with people in a professional setting;
2. To work with others in the student's field of interest;
3. To adjust to specific aspects of a career; and
4. To improve and enhance skills acquired in class.

Procedure:
1. Student contacts Coop Ed Office to discuss work interests, review resume (if already prepared); provide office with contact numbers and/ or email address.

2. After internship opportunity is identified, student interviews with potential employer.

3. Upon beginning internship, student and supervisor completes a 'Cooperative Education Training Agreement' Form. Form is reviewed and signed by instructor and Dean of Technology.

4. During period of internship, supervisor submits progress and evaluation reports.
5. Upon completion of internship, supervisor submits final evaluation and evaluations on selected foundation skills and workplace competencies. These skills and competencies have been identified as being of critical importance for successful job performance in today's workforce. These skills and competencies are being evaluated by the employer because they are not easily assessed in the classroom and, as noted above, they are oriented for workplace success.

6. Upon completion of internship, the student submits an 'Assessment of Cooperative Education Work Experience' form.

Forms previously mentioned are available through Green River Community College GIS Technology Program.

Appendices

SCANS Skills Employer Survey (A)

Gap Analyses(B)

Environmental Technology

GIS Technology

Natural Resource Technology

Templates (C)

Fisheries Capstone Assessment Tools (D)

Appendix A – SCANS Skills Employer Survey

This survey represents the average ratings from natural resource/environmental technicians for 37 foundation skills (SCANS) and personal qualities. Responses are rounded to the nearest 0.01. At least 25 respondents from each of the five (5) clusters are included in this survey (n =130). A Likert scale from 0 = skill not important, to 5 = skill critical, was used. The far right column of the graph describes critical competencies appropriate for the mean numerical rating of each SCAN skill.

Foundation Skills and Personal Qualities	***0 1 2 3 4 5***	***Critical Competencies***
Basic Skills		
Demonstrates Effective Reading Strategies (3.05) **Average Rating**		*Probes, qualifies, analyzes, interprets, and summarizes information*
Demonstrates Effective Writing Strategies (2.70)		*Composes/edits simple documents & letters; completes forms*
Applies Arithmetic Processes (3.24)		*Converts numerical data and predicts arithmetic results*
Applies Mathematics Processes (2.45)		*Summarizes, interprets, and translates mathematical data; uses formulas*
Demonstrates Effective Listening Skills (3.08)		*Interprets, clarifies, and influences communication*
Demonstrates Effective Speaking Skills (2.30)		*Presents basic ideas/info.; actively discusses & explains concepts*
Thinking Skills		
Applies Creative Thinking/Generates Ideas (2.65)		*Utilizes brainstorming; demonstrates creative thinking process & solutions*
Applies Decision Making Strategies (2.75)		*Gathers & analyzes situation/info ;compiles multiple viewpoints;*
Recognizes and Solves Problems (2.98)		*Examines & analyzes information/data; recommends plan*

Foundation Skills and Personal Qualities	*0 1 2 3 4 5*	*Critical Competencies*
Thinking Skills cont…		
Demonstrates Visualization (2.83)		*Analyzes relationship between parts/whole and process/procedure*
Knows How to Learn (2.43)		*Investigates and applies new learning techniques/ tools; interprets symbols*
Applies Reasoning Skills (2.63)		*Analyzes logic/principle & examines information for relevance & accuracy*
Personal Qualities		
Demonstrates Responsibility (3.75)		*Monitors standards; follows through on tasks; pays attention to detail*
Demonstrates Belief in Self Worth (4.30)		*Accepts responsibility for own behavior; understands impact to other*
Demonstrates Sociability in Groups (3.88)		*Shows empathy; encourages others to cooperate; modifies own behavior*
Demonstrates Self-Management (3.43)		*Sets and adjusts goals, demonstrates commitment to self improvement*
Demonstrates Integrity/Honesty (3.58)		*Analyzes personal/societal implications of actions & recommends course*
Management of Time and Resources		
Manages Time (2.90)		*Prepares schedule and prioritizes, monitors, and adjusts tasks*
Manages Money (1.75)		*Performs routine record keeping*
Manages Materials/Facilities (2.55)		*Acquires/distributes supplies and equipment; maintains inventory*
Manages Human Resources (1.50)		*Distributes/analyzes work assignments; recognizes job tasks*

Foundation Skills and Personal Qualities	*0*	*1*	*2*	*3*	*4*	*5*	*Critical Competencies*
Management and Use of Information							
Acquires/Evaluates Information (2.43)							*Predicts outcomes; analyzes, integrates, and compares data*
Organizes/Maintains Information (2.35)							*Analyzes organization of information; applies processes to new information*
Interprets/Communicates Information (2.40)							*Prepares basic summaries, reports; Interprets/analyzes info.*
Uses Computers to Process Information (2.45)							*Locates/retrieves/manipulates information; utilizes multiple software*
Interpersonal Skills							
Participates as Team Member (3.03)							*Works to improve team skills and encourages/supports team members*
Teaches Others (2.00)							*Conducts task-specific training and coaches others to apply concepts*
Serves Customers (2.80)							*Demonstrates commitment to customer orientation & analyzes customer needs*
Exhibits Leadership (2.25)							*Leads by example and demonstrates commitment to excellence*
Negotiates Agreements (1.83)							*Moderates discussion, demonstrates composure, and interprets concerns*
Works with Diversity (2.88)							*Recognizes/supports the value of diversity*
Understanding and Management of Systems							
Understands System (1.93)							*Analyzes system configuration and follows processes & procedures*
Monitors/Corrects System Performance (1.66)							*Adjusts/monitors system operation and troubleshoots system problems*

Foundation Skills and Personal Qualities	***0***	***1***	***2***	***3***	***4***	***5***	***Critical Competencies***
Understanding and Management of Systems (cont.)…							
Improves/Designs Systems (1.80)							*Suggests system modifications and improvements*
Use of Technology							
Selects Appropriate Technology (2.53)							*Analyzes task/technology relationship and understands technological results*
Applies Technology to Task (2.15)							*Understands operation/interaction; analyzes technology output*
Maintains/Troubleshoots Technology (1.93)							*Identifies/corrects malfunction /failures; troubleshoots failures*

Appendix B – Gap Analyses

Environmental Technician
GIS Technician
Natural Resource Technician

Environmental Technician Gap Analysis

Critical Work Function And Key Activities	Task addressed in Curriculum (Yes or No) & Course #	Assess Strategies I	P	OD	O	Comments
A: Conduct Field Investigations A1 Assist in designing an investigation	**YES** ENV-110, 105, 232, 127, 138, 234, 128, 139, 101, 090, 112, 240		**X**			
A2 Collect field data	**YES** ENV-139, 132, 110, 251, 127, 237, 230, 128, 123, 105, 112, 240, 222, 232			**X**		
A3 Collect background information	**YES** ENV-243, 139, 132, 110, 251, 138, 230, 236, 240, 090			**X**		
A4 Conduct field observations	**YES** ENV-243, 139, 132, 110, 251, 138, 230, 236, 240, 090			**X**		

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

Critical Work Function And Key Activities	Task addressed in Curriculum (Yes or No) & Course #	Assess Strategies I	P	OD	O	Comments
B: Collect Samples B1 Collect information/ samples for physical analysis	**YES** ENV-243, 139, 132, 110, 251, 222, 232, 128			**X**		
B2 Collect information/ samples for chemical analysis	**YES** ENV-243, 110, 251, 232, 233, 137, 240			**X**		
B3 Collect information/samples for biological analysis	**YES** ENV-243, 132, 110, 232, 251, 136, 237			**X**		
B4 Collect information/samples for radiological analysis	**YES** ENV-134, 137, 108, 128, 240, 090			**X**		

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

Critical Work Function And Key Activities	Task addressed in Curriculum (Yes or No) & Course #	Assess Strategies I	P	OD	O	Comments
C: Analyze Samples C1 Receive samples	**YES** ENV-137, 110, 251, 128, 237, 251, 090, 240	**X**				
C2 Prepare sample	**YES** ENV-110, 237, 232, 134, 240,			**X**		
C3 Analyze field & laboratory samples	**YES** ENV-110, 237, 136, 132, 236, 240, 233			**X**		

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

Critical Work Function And Key Activities	Task addressed in Curriculum (Yes or No) & Course #	Assess Strategies I	P	OD	O	Comments
D: Process and Report Data D1 Perform data entry	**YES** ENV-121, 102, 110, 251, 123, 237, 250, 136, 222, 128, 112, 240	**X**				
D2 Analyze, sort, retrieve & plot data	**YES** ENV-136, 123, 237, 250, 110, 251, 102, 128, 240, 242, 112,		**X**			
D3 Write technical reports	**YES** ENV-236, 123, 237, 250, 102, 128, 240, 242, 112		**X**			
D4 Update database	**YES** ENV-102, 222, 237	**X**				

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

Critical Work Function And Key Activities	Task addressed in Curriculum (Yes or No) & Course #	Assess Strategies I	P	OD	O	Comments
E: Perform Maintenance and Repairs E1 Perform preventive maintenance (on equipment)	**YES** ENV-237, 136, 134, 137, 105, 112, 090, 240	**X**				
E2 Perform minor equipment repair	**YES** ENV-237, 134, 230, 136, 240, 251	**X**				
E3 Keep calibration & maintenance records	**YES** ENV-110, 108, 236, 090, 110, 230, 237	**X**				

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

GIS Technician Gap Analysis

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
A1: Determine data needs/format & evaluate sources											
	Understanding of different data formats		X	X							
	Knowledge of business function										X
	Ability to perform basic research					X		X			
	Ability to evaluate user business needs										X
	SCAN Skills										
	Prioritizes daily tasks					X		X			
	Interprets/integrates information					X		X		X	
	Demonstrates commitment										X
	Researches additional information sources					X		X			
	Integrate multiple items of data					X		X			
A 2: Contact data custodian for structure, accuracy, etc.											
	Technical Knowledge										
	Ability to utilize good interviewing and communication skills							X			
	Understand meaning of accuracy and precision			X	X						
	Understanding of data types.			X	X			X			
	Understanding of and ability to locate local, state, and federal mandates regarding data acquisition.			X				X			
	SCAN Skills										
	Develops data gathering processes					X		X			
	Selects methods of communication										
	Presents basic ideas/information					X		X			
	Analyzes group/individual response.					X		X			
	Analyzes customer needs.							X			

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
A 3: Utilize geodetic control.											
	Technical Knowledge										
	Understanding of ability to utilize concepts of projections, scale, and coordinate systems.		X	X	X					X	
	Ability to utilize projection concepts within specific software.		X		X						
	Understand meaning of accuracy and precision		X	X	X						
	Ability to register data to the geodetic control.				X						
	Knowledge of variation in accuracy in utilizing geodetic control.			X							
	Understanding spatial references.			X	X						
	Knowledge of coordinate geometry.				X						
	SCAN Skills										
	Demonstrates commitment to accuracy					X			X	X	
	Follows processes & procedures										
	Interprets mathematical data										
	Examines information/data.										
A 4: Capture spatial and attribute data											
	Ability to use digitizer and digitizing tools				X						
	Knowledge of coordinate geometry			X	X					X	
	Knowledge of database structures and relationships			X	X						
	Ability to read paper maps and photos.									X	
	Knowledge of and ability to use GPS software technology and spatial analytical tools.										X

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
	Prioritizes daily tasks.					X		X			
	Interprets/integrates information					X	X			X	
	Demonstrates commitment to accuracy					X	X			X	
	Researches additional information sources					X		X			
	Integrate multiple items of data.					X		X		X	
A 5: Integrate data from various sources											
	Technical Knowledge										
	Knowledge of varying data qualities.			X							
	Knowledge of appropriate scales.		X	X	X					X	
	Ability to transfer data between data formats and platforms.				X						
	Knowledge of software tools for joining maps and data sets.		X		X						
	Ability to merge database tables.		X		X						
	SCAN Skills										
	Creates data gathering processes.					X		X			
	Selects methods of communication.										
	Presents basic ideas/information.					X		X		X	
	Analyzes group/individual response.					X		X			
	Analyzes customer needs.							X			
A 6: Create metadata											
	Technical Knowledge										
	Knowledge of GIS vernacular.			X							
	Knowledge of relevant business terminology.										
	Understanding of and ability to locate local, state and federal mandates regarding metadata standards.			X				X			X

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
	SCAN Skills										
	Understands system organization & hierarchy										X
	Demonstrates commitment to excellence.										X
	Follows processes & procedures.				X				X		
	Interprets mathematical data.										X
	Examines information/data					X		X		X	
A 7: Maintain spatial and attribute data - cont.											
	Knowledge of data capture procedures.				X						
	Knowledge of quality control procedures.				X						
	Knowledge of database structures and relationships.			X	X						
	Knowledge of varying types of data (imagery, tabular, point, line, and polygon.		X	X	X						
	SCAN Skills										
	Interprets symbols, diagrams and schematics.				X					X	
	Visually analyzes relationship between parts and the whole.				X					X	
	Translates mathematical data.										X
	Summarizes/paraphrases information.							X	X		
	Contrasts conflicting data.							X	X		

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
A 8: Assist in maintenance scheduling & implementation											
	Technical Knowledge										
	Knowledge of sources and source update schedules.										X
	Knowledge of user needs.			X				X			
	Knowledge of and ability to utilize appropriate forms of communication.										X
	Knowledge of appropriate people to be notified.										X
	SCAN Skills										
	Follows a set of instructions.				X				X	X	
	Creates original documents.										X
	Applies self-management skills.					X		X			
	Prepares schedule.					X		X			
	Outlines maintenance procedures.										X

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
B 1: Determine purpose and use of map or products											
	Knowledge of business function.										X
	Understanding of and ability to perform user interviews.					X		X			
	Ability to communicate clearly					X		X			
	Ability to evaluate business needs.										X
	Ability to estimate production timelines					X		X			
	Ability to evaluate scope of work.					X		X			
	SCANS skills										
	Moderates discussions.										X
	Recognizes the value of diversity.										X
	Explains concepts.			X	X			X			
	Poses critical questions.						X	X			
	Applies rules & principles to situation.				X		X	X	X	X	
B 2: Design layout											
	Technical Knowledge										
	Knowledge of cartographic production techniques.				X					X	
	Ability to pay attention to detail.				X					X	
	Knowledge of appropriate fonts, color, data sets and scales.		X		X					X	
	Knowledge of output devices.		X		X					X	
	Understanding of basic concepts of artistic visual presentation.		X		X					X	
	SCANS skills										
	Proposes simple technological solutions.					X					
	Demonstrates creative thinking process while solving problems.					X		X			
	Visually analyzes relationship between parts and whole.		X		X					X	
	Designs, charts, maps, graphs.		X		X					X	
	Works with minimal supervision.					X		X			

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
B 3: Review & disseminate map product											
	Technical Knowledge										
	Ability to utilize good client communication skills.							X			
	Ability to evaluate time commitments.					X		X			
	SCANS skills										
	Establishes rapport with coworkers and customers.					X		X			
	Demonstrates sensitivity to customer concerns & interests.										X
	Examines information & data for relevance and accuracy.					X		X			
	Draws on experiences and prior knowledge.					X		X			
	Communicates appropriate verbal, non-verbal messages.					X		X			
B 4: Determine data sets and output format											
	Knowledge of and ability to use large and small output devices (printers, plotters, etc.).				X	X		X			
	Knowledge of presentation software and graphic file formats.		X		X					X	
	Knowledge of relevant data.										X
	Knowledge of basic statistics.										X
	SCANS skills										
	Summarize mathematical data										X
	Analyze situation/information.					X		X			
	Utilize brainstorming techniques.					X		X			
	Analyze technology output.										X
	Identifies appropriate technology.			X							

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
B 5: Manipulate data											
	Technical Knowledge										
	Knowledge of databases and data manipulation tools.			X	X			X			
	SCANS skills										
	Analyzes data					X		X			
	Recognizes accuracy of information					X		X		X	
	Manipulates information.				X	X					
	Pays attention to detail.		X	X	X	X	X	X	X	X	
	Retrieves stored information and data.		X		X	X	X				

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
C 1: Perform image & raster processing											
	Basic knowledge of various imaging/raster formats (TIFF, Jpeg, Bil, Sun Raster, Mr. Sid.			X			X				
	Ability to rectify imaging/raster to vector data sets and vice-versa.						X				
	SCANS skills										
	Understands information.					X		X		X	
	Selects appropriate categories.		X							X	
	Obtains data relevant to the task.					X		X			
	Performs basic computations				X					X	
C 2: Perform tabular/spatial analysis											
	Technical Knowledge										
	Knowledge of database design and relationships.			X	X			X			
	Knowledge of general spatial query procedures (union, intersect, identity, buffer, etc.)			X	X						
	Knowledge of general tabular manipulation procedures (query, join, relate, cursors, etc.)		X	X	X						
	SCANS skills										
	Sets numeric parameters										X
	Extracts information and data.		X		X	X					
	Interprets and summarizes information.					X		X		X	
	Maintains a positive self-image.										X
	Contrasts conflicting data.							X		X	

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
C 3: Perform linear network analysis											
	Technical Knowledge										
	Basic knowledge of linear referencing systems.			X	X						
	Ability to use preexisting dynamic segmentation data structures.										X
	Ability to use geocoding tools.		X								
	SCANS skills										
	Utilizes networks.			X							
	Determines variables and constraints.					X		X			
	Analyzes operational problems					X		X			
	Sets well defined realistic goals					X		X			
C 4: Report results											
	Technical Knowledge										
	Ability to utilize good client communication skills.							X			
	Ability to evaluate time commitments.					X		X			
	Communicate orally and in written format.					X		X			
	SCANS skills										
	Creates detailed supporting documents.					X		X			
	Communicates clearly in written and verbal formats.					X		X			

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
D 1: Answer impromptu questions											
	Assess user knowledge.							X			
	Ability to communicate effectively					X		X			
	Knowledge of business and appropriate technical tools (e.g. software, developed applications, platform, operating systems).			X	X						
	Understanding of and ability to apply good customer service ethic.										X
	Ability to troubleshoot and solve problems.					X					
	SCANS skills										
	Actively participate in discussion.			X	X			X			
	Recognizes differences/biases.				X			X			
	Recognizes customer needs.							X			
	Displays enthusiasm and positive attitude.										X
	Listens attentively.	X	X	X	X	X	X	X	X	X	
	Responds appropriately to others.	X				X		X			
D 2: Develop user guides											
	Technical Knowledge										
	Ability to perform technical writing.					X		X			
	Ability to translate technical jargon.					X		X			
	Understanding of the problem and solution.					X		X			
	Knowledge of word processing software.	X				X		X			
	Ability to create and import graphic illustrations.		X							X	
	SCANS skills										
	Synthesizes information					X		X			
	Writes simple documents.					X		X			
	Understands the decision making process.	X		X	X						
	Selects and applies learning tools.										X
	Accepts constructive criticism.					X		X		X	

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
E 1: Assist in task management											
	Ability to determine needs.					X		X			
	Ability to identify goals and objectives.					X		X			
	Ability to develop timelines					X		X			
	Ability to coordinate multiple tasks.					X		X			
	SCANS skills										
	Volunteers for special assignment.										X
	Values own individuality.										X
	Follows rules/policies/procedures.				X				X	X	
	Monitors and adjusts task sequence.				X				X	X	
	Adjusts schedule as required by supervisor.										X
E 2: Report & document status of tasks											
	Technical Knowledge										
	Ability to function as part of a team.								X		
	Ability to communicate effectively and in a timely manner.					X		X			
	Ability to communicate in verbal and written format.	X		X		X		X			
	SCANS skills										
	Distributes work assignments.										X
	Completes tasks.	X	X	X	X	X	X	X	X	X	
	Records information accurately.			X		X		X			
	Completes forms/surveys, etc.										X
	Selects appropriate information										X

TASK	Technical Knowledge	GIS 101	GIS 120	GIS 200	GIS 201	GIS 202	GIS 220	GIS 250	GIS 255	GIS 260	GAP
F 1 : Use PC computers and platforms											
	Ability to learn and utilize various peripherals (e.g., printers, plotters, scanners, CD writers).		X		X						
	Understanding of and ability to operate within defined system security parameters.										X
	Basic knowledge of word processing, spread sheet, graphic, database and GIS software.	X	X	X		X		X		X	
	Ability to function within and between various operating systems (e.g. Windows 9x, Windows NT, UNIX).				X	X					
	Ability to navigate across various networked devices including LAN, WAN and Internet applications.					X					
	SCANS skills										
	Understands computer operation.			X							
	Performs basic data entry.				X						
	Identifies need for data.					X			X		
	Integrates multiple platforms.				X						
F 2: Perform basic programming											
	Understand basic programming concepts (e.g. conditional statements, looping structures, and variables).				X				X		
	Ability to write simple programs/scripts.		X						X		
	Knowledge of appropriate documentation standards.			X							
	SCANS skills										
	Predicts arithmetic results.										X
	Applies rules/principles to process/procedure.				X		X	X	X	X	
	Analyzes logic/rule/principle.				X		X	X	X	X	

Natural Resources Technical Gap Analysis

Critical Work Function and Key Activities	***Task addressed in Curriculum (Yes or No) & Course #***	***Assess Strategies***				***Comments***
		I	***P***	***OD***	***O***	
A1 Conduct biological and chemical water quality sampling	**NO**			X		Addressed in FISH 220/221
A2 Conduct plant sampling	YES NR-120			**X**		
A3 Conduct soil sampling	NO			**X**		Include exercise in taking an accurate soil sample
A4 Conduct wildlife, fish and stock sampling	YES NR-120, 140			**X**		
A5 Calculate species densities	YES NR-120			**X**		
A6 Conduct field mapping	YES NR 120			**X**		
A7 Conduct research	YES NR-120, 140		**X**			

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

Critical Work Function and Key Activities	*Task addressed in Curriculum (Yes or No) & Course #*	*Assess Strategies*				*Comments*
		I	*P*	*OD*	*O*	
B1 Assists in road and trail management	NO	**X**				Co-op work experience is the best vehicle for learning these skills
B2 Investigate permit applications	YES NR-140		**X**			
B3 Assist in plant propagation and acquisition	NO	**X**				Co-op work experience with a native plant nursery is the best vehicle for learning these skills
B4 Assist in restoration and mitigation projects	YES NR-120, 140		**X**			

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

Critical Work Function and Key Activities	*Task addressed in Curriculum (Yes or No) & Course #*	*Assess Strategies* *I*	*P*	*OD*	*O*	*Comments*
C1 Enter, verify, edit data	YES NR-240			**X**		
C2 Analyze retrieve, sort, plot data	NO		**X**			Completing a series of TFW monitoring surveys taught in NR 240 over several seasons to enable data retrieval, analysis of trends and plotting of this data to illustrate these trends.
C3 Write reports	YES NR-120, 140		**X**			

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

Task (#)	*Task addressed in Curriculum (Yes or No) & Course #*	*Assess Strategies* *I*	*P*	*OD*	*O*	*Comments*
D1 Repair and maintain equipment and instrumentation	YES NR-140	**X**				
D2 Operate vehicles and equipment	YES NR-240			**X**		
D3 Perform basic instrument calibration	YES NR-140			**X**		

KEY – I = Internship P = Portfolio OD = Observed Demonstration O = Other

Appendix C – Templates

TECHNOLOGY

Assessment Strategy:

Critical Work Function
Key Activities:
Performance Indicator

Curriculum:; Course

Competency Example – substitute your own exercise (competencies, steps, etc).
Sub-competencies: (1 – 4)

1.
Steps:

- gather….
- assemble….
- add….
- make….
- cover…

2. Operate sampling equipment according to SOP
Steps:

- sample…
- after 30 minutes…
- fill the small test tube…
- add one level…
- cap the test…
- use a 1ml pipette…
- cap and invert…
- use the other pipette…
- pour…
- cap and invert.
- wait…

3. Generate and record data
Steps:

- after 15 minutes
- match the color
- record index number
- record the value in PPM from …

4. Disassemble, clean up and store equipment
Steps:

- disassemble pump…
- clean impinging tube…
- put materials in…

ENVIRONMENTAL TECHNOLOGY

Assessment Strategy: Demonstration/Dialogue

Critical Work Function: D – Process and Report Data
Key Activities: D3 – Write Technical Reports
Performance Indicator: Writing is thorough, correct and complete

Curricula: Clover Park Technical College Course: Technical Writing 214

Use a modification of the Boeing Assessment

Place an X anywhere on the line between the descriptors so that it best reflects your perspective regarding the portfolio.

Incomplete with missing or partial pieces Included ----------Complete with all appropriate pieces

Inaccurate with some pieces being misrepresented----------Accurate with all information included

Low quality with unclear and unrefined components----------High quality of work with clear and refined components

Superficial representation of work----------Complex and in-depth representation of work

Errors in surface features (spelling, grammar) ----------Control of surface features

Few references ----------Many pertinent references

Peer Assessment for Team Projects

Fill out the assessment form for each member of your team. You may remain anonymous

Team member:

Skill/ Activity	Outstanding	Satisfactory	Acceptable but needs improvement	Not satisfactory	Not applicable
Attendance at team meetings					
Participation at team meetings					
Initiative/ willingness to take on work					
Information communicated effectively					
Information communicated in a timely manner					
Records are accurate, complete and legible					
Assigned tasks are performed					
Assigned tasks are completed on time					
Encourages other team members					
Demonstrates commitment					

Please provide any additional comments that you would like to make:

Ordering Information

For additional copies of the ***Natural Resources/Environmental Technologies Skill Standards Manual***, please fill out and detach or photocopy this order form and return it to:

Highline Community College – Omni Building
C/O Skill Standards Resource Center (25-5A)
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Des Moines, WA 98198-9800

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