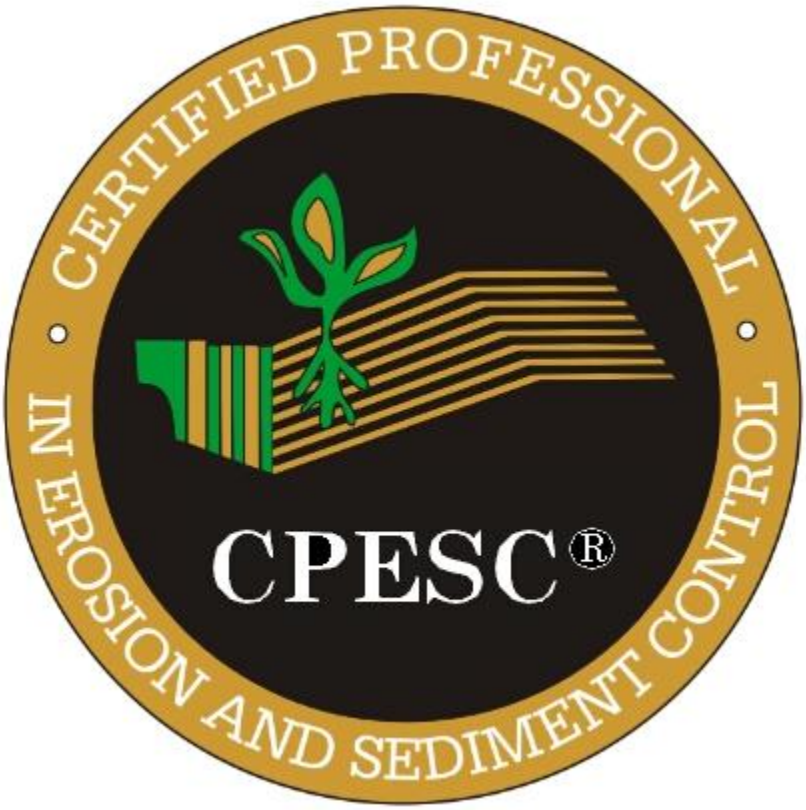

CPESC Syllabus

Australasia

2 August 2012

PREAMBLE

The purpose of this document is to provide details related to competency areas, performance objectives or syllabus relevant to the Certified Professionals in Erosion and Sediment Control (CPESC) program. The public demands evidence of professional competence from persons whose activities affect the physical, social and economical well being of people throughout the world. This includes the fields of erosion and sediment control before, during and following site disturbance activities. Government authorities are now insisting that such professionals must be able to show evidence of their qualifications and abilities. The CPESC program aims to achieve this.

Under the umbrella of CPESC, Inc., the Australasian Chapter of the International Erosion Control Association (IECA (Australasia)) certifies individuals based on a thorough examination and review of their educational, scientific and service activities. Together with CPESC, Inc., IECA (Australasia) strive to continually strengthen the certification program to challenge candidates, to strengthen their performances and to meet changing environmental issues.

CPESC certification recognises scholarly knowledge and practical experience in the fields of erosion and sediment control. In Australasia, certified professionals:

- meet proscribed educational and practical experience standards
- have passed rigorous qualifying examination(s)
- are considered by their peers to excel in erosion and sediment control practices
- keep up-to-date with changing technologies and legislative requirements through ongoing training and professional development
- subscribe to the code of ethics.

The following competency areas identify the basic principles of erosion and sediment control that should be known by all candidate CPESCs:

- legislation and regulation
- soil erosion processes
- sedimentation
- estimating erosion rates
- soils
- site and soil management
- erosion control measures
- works in and near watercourses
- water diversion and management
- sediment control measures
- planning for erosion and sediment control
- site inspection and maintenance.

These competency areas are reviewed periodically and revised to reflect changing technologies and legislative requirements.

The competency areas should be used by:

- CPESC candidates as a tool to identify their training needs, courses to explore and as a measure for their preparedness to take the CPESC exam in Australasia
- course developers as an outline of topics to cover in their training programs
- CPESC exam preparers as an outline of topics on which they will base their questions.

By mastering the competencies, one will possess the knowledge deemed important to CPESCs.

CPESC Requirements

The following statements outline the broad requirements for CPESC accreditation and applicants will be assessed on these to ensure they meet all requirements.

Detailed requirements expanding on key areas of knowledge are contained in the Competencies section overpage.

EXPERIENCE

- At least 3 years' industry experience in erosion and sediment control plus tertiary qualifications in a relevant field (otherwise, 7 years' experience).
- Experience using and applying best-practice erosion and sediment control techniques to real-world situations.
- Experience in preparing peer-reviewed plans for erosion and sediment control.
- Commitment to Ongoing Professional Development.

KNOWLEDGE AND CAPABILITY

- Detailed knowledge of soil erosion processes and impacts, and how human activities impact or are affected by these.
- Very high level knowledge of the fundamentals of erosion and sediment control, with the ability to apply and adapt these to a wide range of land development types.
- Knowledge and understanding of soil physical and chemical properties as they relate to erosion and sediment control including revegetation.
- Knowledge, ability and experience with best-practice manuals and guidelines relevant to the applicant's area(s) of expertise and in their geographic area of operation.
- Knowledge of construction site hydrology and hydraulics as it applies to sizing temporary drainage and sediment control structures, also including an ability to identify the design criteria for erosion and sediment control structures to cater for specified storm events.
- Ability to select appropriate erosion and sediment controls, including an understanding of how and why they work (or don't work) in any given situation.
- Demonstrated ability and experience with effectively communicating erosion and sediment control issues to a wide range of audiences.
- Knowledge of relevant legislation and policies governing erosion and sediment control in the applicant's geographic area of operation.

ENDORSEMENT

- Endorsement by four referees, at least two of which are from outside the applicant's company (assuming none are CPESCs. A CPESC-accredited referee counts for two non-CPESC referees).
- Adherence to a strict code of ethics.

COMPETENCIES

A CPESC should have sound knowledge of the following topics *as they relate to erosion and sediment control in their geographic area of operation*.

1. **Soil erosion processes**
    a. Rainsplash, sheet, rill, gully, tunneling, slump, mass movement, channel, scour, wave, wind (saltation, suspension, creep).
    b. Natural vs accelerated erosion rates
    c. Impacts of soil erosion
    d. Aggradation, accretion, detachment, undercutting, widening, suspension.

2. **Sedimentation**
    a. Stokes law, application of for erosion and sediment control
    b. Sediment yield and sediment delivery ratio
    c. Impacts of sedimentation and dust.

3. **Estimating erosion rates**
    a. Equations for estimating erosion (e.g. RUSLE)
    b. R, K, LS, P and C factors
    c. Erosion risk assessment
    d. Shear stress, flow velocity.

4. **Soils**
    a. Soil sampling and testing methodology for erosion and sediment control
    b. Physical properties relevant to erosion and sediment control
        i. Soil texture
        ii. Soil profile description (horizons)
        iii. Soil structure, pedality and coherence
        iv. Particle size analysis
        v. Clay morphology
        vi. Surface condition (e.g. rough, hardset, water repellent).
        vii. Waterholding capabilities
        viii. Runoff vs infiltration characteristics.
        ix. Bulk density
        x. Compaction
        xi. Erodibility
    c. Chemical properties relevant to erosion and sediment control
        i. Dispersion
        ii. Sodicity
        iii. Fertility (key plant nutrients N, P, K) and organic carbon content
        iv. pH (including impacts on nutrient availability and ion solubility)
        v. EC

vi. CEC and major cations.

d. Soil preparation for rehabilitation
    i. Surface roughness
    ii. Topsoil replacement and keying
    iii. Fertilizers and ameliorants, selection and application.
    iv. Optimum moisture content.

5. Legislation and regulation

a. Relevant government regulations concerning pollution
b. Relevant best-practice guidelines and recommended practices
c. Responsibilities under relevant legislation for erosion and sediment control
d. Principles of due diligence

6. Site and soil management

a. Minimise disturbance (spatial and temporal)
b. Access control including shaker grids, rumble pads, wheelwash etc
c. Stockpiling
d. Staging
e. Site and soil constraints analysis as they relate to erosion and sediment control and rehabilitation, including all soil properties detailed in 4, above, plus:
    i. Topography (slope gradient, slope length, drainage pattern, aspect)
    ii. Climate (rainfall, evaporation, temperature)
    iii. Landform (e.g. floodplains, riparian lands, hillslopes, footslopes etc).
    iv. Landform processes and drainage (e.g. salinity, acid sulfate soils, groundwater, recharge vs discharge).
f. Planning for erosion and sediment control (also see Section 10 below).

7. Erosion control measures

a. Vegetation
    i. Annuals, perennials, bi-annuals etc.
    ii. Cereals, legumes, shrubs, trees, grasses etc.
    iii. Species selection
    iv. Cool-season vs warm-season species suitability
    v. Basic vegetation morphology and desirability (or otherwise) for erosion control (e.g. tussock grasses vs cereals)
b. Seeding (temporary and permanent)
    i. Sowing techniques
    ii. Desirable vs undesirable characteristics of various seed types and application methods
    iii. Basic germination requirements and conditions.
c. Mulching and compost
    i. Benefits of application
    ii. Undesirable side-effects of organic mulches

iii. Suitable locations for application (e.g. not under channel-flow conditions).

d. Benching
e. Water diversion/management (see also Section 8 below)
    i. Catch/diversion drains
    ii. Check structures
f. Contouring (both rural and urban situations)
g. Track-walking
h. Grading
i. Erosion control blankets/mats
    i. Desirable vs undesirable characteristics of various types (e.g. biodegradable vs non-biodegradable; mesh vs mat)
    ii. Use in concentrated/channelized flows or not
    iii. Pinning/stapling.
j. Limiting slope length
    i. Methods to limit slope length and purpose
k. Hydromulching/hydroseeding
    i. Ingredients and purpose of each
    ii. Suitability of use (e.g. not in channelized/concentrated flows).
l. Hydraulic soil stabilizers
m. Rock-lining
n. Chemical dust retardants
o. Wattles/logs
p. Turfing
q. Windbreaks and windbreak fencing
r. Surface wetting for dust suppression
s. Effect of surface cover on C-factor

8. Water diversion and management, plus watercourses

a. Basic stream morphology including stream bed, banks, channel, slope.
b. Weirs – types and purposes (e.g. V-weirs, bendway weirs etc).
c. Principles of ‘clean’ and ‘dirty’ water
d. Design criteria for diversion and catch drains including:
    i. Catchment delineation and sizing
    ii. Calculation of flow volumes, depths and velocities
    iii. Understanding of:
        1. IFD charts
        2. roughness coefficients
        3. travel time (aka time of concentration)
        4. runoff coefficient
        5. antecedent moisture condition
        6. design storm
        7. ARI
        8. peak discharge
        9. hydrographs (rising/falling limbs)
        10. rainfall depth

11. rational equation
12. soil runoff/infiltration characteristics
13. impervious surfaces

iv. Critical velocity for erosion control measures
v. Shear stress

e. Temporary waterway crossings (bridges, fords, culverts)
f. Works on floodplains and in riparian areas
g. Works in tidal areas
h. Stabilisation and rehabilitation of channel/concentrated flow areas
i. Temporary diversion of natural watercourses around work areas.
j. Drop-down structures (e.g. off fill batters or waste rock emplacements).
k. Energy dissipaters
l. Level spreaders
m. Water pumping and discharge
    i. Pump inlet and outlet considerations
    ii. Water quality discharge criteria (TSS vs Turbidity)
    iii. Site dewatering
    iv. Reuse of trapped water onsite (e.g. for dust suppression)
    v. Flocculation (see Sediment Basins, Section 9d)

9. Sediment Control Measures

a. Stormwater drain inlet protection
    i. Suitability
    ii. Effectiveness
    iii. Installation
    iv. Maintenance
b. Sediment basins, traps, fences, bunds, filters, wattles or sumps
    i. Suitability
    ii. Effectiveness
    iii. Installation
    iv. Placement
    v. Sizing and/or capacity
    vi. Soil considerations (i.e. particle sizes and dispersibility)
    vii. Design criteria (e.g. batters, inlets, outlets, depths, freeboard, compaction, baffles, sediment type)
    viii. Water treatment (settling and/or flocculation), including soil chemical/physical properties affecting water quality.
    ix. Flocculation techniques and reagents.
    x. TSS vs Turbidity
    xi. Maintenance and dewatering.
c. Sediment and turbidity curtains (suitability and effectiveness).
d. Mobile treatment plants, settling tanks and other technologies.
e. Turf and vegetation filter strips.

10. Planning for Erosion and Sediment Control

a. Essential communications
b. Responsibilities
c. Components of a plan
d. Understanding of construction processes
e. Assessment of site and soil constraints
f. Selection of erosion controls
g. Selection of sediment controls
h. Drainage and water management strategies
i. Stabilisation and rehabilitation strategies
j. Timing of installation, maintenance and removal of control measures
k. Timing and maintenance of stabilization and rehabilitation measures.

11. Site inspection and maintenance

a. Site auditing, inspection and monitoring
b. Modification/addition to plans
c. Checking correct installation of controls
d. Maintenance of all temporary controls
e. Maintenance of stabilization and rehabilitation works
f. Reporting protocols
g. Discharge and receiving environment monitoring.