PROGRAMME SPECIFICATION	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MSc
4	**Programme Title**	MSc in Applied Hydrogeology
5	**Programme Code**	5153F/5153P
6	**Programme Accreditation**	CIWEM, Geological Society, RICS
7	**QAA Subject Benchmark(s)**	Engineering
8	**FHEQ Level**	Level 7
9	**Last updated**	April 2011

10 Programme Aims

1 To provide opportunities for candidates with first degrees in a range of scientific and engineering disciplines to enhance their knowledge of the nature, occurrence, characterisation and management of ground water;

2 To provide a theoretical and practical quantitative training very relevant to the needs of the water and environmental engineering industries;

3 To offer experience in the planning and execution of an extended research project (this does not apply to the diploma);

4 To provide experience of dissertation writing and other presentational and generic skills relevant to employer's needs;

5 To satisfy the professional development needs of the individual and of his/her employers;

6 To provide a programme which meets the QAA Frameworks for Higher Education Qualifications descriptor for Masters degrees (7).

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. The programme outcomes have references to the benchmark statements for Engineering (E).

Knowledge and Understanding

On completing the programme students should:

A1 A sound scientific understanding in key subject areas such as hydrogeology, hydrogeochemistry and hydraulics of porous media;

A2 An advanced knowledge and understanding of selected components of ground water assessment, hydrostratigraphy and contaminant hydrology;

A3 An understanding of the theoretical basis for methods of analysis and modelling, covering both flow and geochemical aspects of hydrogeology;

A4 An understanding of the regulatory and socio-economic aspects of ground water management within an overall context covering land use, surface water and ground water;

A5 Knowledge of specific examples of ground water assessment and management,

drawing on experiences from developing countries, major public supply aquifers in industrialised countries, and the remediation of ground water pollution associated with post-industrial dereliction.

Teaching and Learning Methods

Essential material is taught through lecture classes in Semester 1, supported by a combination of tutorials, practical classes, coursework and site visits. Most of the theoretical basis is taught using the same detailed material used for distance learning programmes, which provides a solid foundation for subsequent development. The basic concepts and understanding are applied to case studies in modules in Semester 2, helping to develop deeper understanding and the wider contexts of applied hydrogeology. Coursework exercises provide the opportunity for reflection and consolidation of learning. The dissertation project provides the opportunity to develop the depth of understanding further in one particular field.

Assessment Strategy

Formative assessment occurs through tutorial examples and coursework. The primary means of assessing knowledge and understanding is the closed book examination. This is supported by assessed written coursework.

In-depth individual learning frequently forms part of the project, which is assessed by dissertation, poster, oral presentation and viva voce examination.

Intellectual Skills

On completing the programme students should be able to:

B1 Plan, execute and report on a significant piece of research related to a deeper analytical understanding of a problem or application which is evaluated according to explicit and measurable criteria;

B2 Select and apply appropriate mathematical methods for modelling and analysing relevant problems;

B3 Use scientific principles in the development of mathematical and environmental solutions to practical problems in ground water management;

B4 Use scientific principles in the modelling and analysis of hydrogeological and hydrochemical aspects of ground water management;

B5 Select and apply appropriate mathematical methods for modelling and analysing problems in ground water management;

B6 Create new products or methodologies or research outputs through synthesis of ideas from a wide range of sources;

B7 Produce solutions to problems through the application of mathematical and water environment knowledge and understanding.

Teaching and Learning Methods

Intellectual skills are developed initially through tutorials in which underpinning knowledge and understanding is translated into the ability to select and apply appropriate analysis tools. This is further developed through coursework, where the student applies analysis tools to real-world problems and data sets. Field visits help further to relate learning to real-world environments and problems. Learning is consolidated through development of individual research, including ability to identify problems and provide resolutions to these problems. Development of the key skills required to enable the individual research is through tutorial exercises focussed on specific skills in planning, research, and critical analysis.

Assessment Strategy

Closed-book examinations are used to assess intellectual abilities.

Assessed coursework provides further opportunities to demonstrate intellect and ability.

The project is assessed by thesis, poster, oral presentation and viva voce examination, and provides final evidence of the levels attained.

All skills are necessary to complete coursework and project requirements successfully.

Practical Skills

On completing the programme students should be able to:

C1 Use relevant field and laboratory measurement equipment;

C2 Carry out experimental field and laboratory work;

C3 Plan, execute and report on a research project;

C4 Use IT tools and hydroinformatics technologies;

C5 Design ground water infrastructure and schemes for ground water management;

C6 Carry out practical testing of design ideas through computer simulation with technical analysis and critical evaluation of results;

C7 Search for information and develop ideas further;

C8 Select and apply appropriate engineering design and environmental techniques taking account of industrial, legislative and commercial constraints.

Teaching and Learning Methods

Learning is developed through teaching of basic skills including hydroinformatic and modelling skills and field exercises. Basic design principles are taught and practised as workshop practical exercises. These basic skills are practised in case study applications and in the dissertation project, where students are expected and encouraged to develop their own experimental approaches to test ideas, and to apply appropriate techniques and evaluate the results.

Assessment Strategy

Outcomes C1–C8 are not explicitly assessed but are necessary for the successful completion of coursework and project requirements.

Transferable/Key Skills

On completing the programme students should be able to:

D1 Manipulate and present data in a variety of ways;

D2 Use methods based on scientific evidence in the solution of problems;

D3 Use creativity and innovation in problem solving;

D4 Communicate effectively (including by written, oral and poster media);

D5 Learn independently in a range of situations, preparing for lifelong learning;

D6 Use general IT skills;

D7 Manage time and resources effectively.

Teaching and Learning Methods

Outcomes D1-D7 may be introduced through examples in lectures and tutorials. D1-D5 are developed further through coursework. Extensive use of practical examples enables the building of key skills.

Subsequently, the principal development of transferable skills occurs through involvement in the project, for which specific skills in data manipulation, communication, resources planning,

etc are taught, and all skills are necessary to complete the dissertation.

N.B. A generally lower level of ability will be expected of Diploma students. In particular the dissertation need not involve a strong research element (C3) or extensive problem-solving (D2 and D3).

Assessment Strategy

Skills D1–D3 are essential to complete examinations and assignments to a satisfactory standard.

Acquisition of D4 and D5 is demonstrated during assessment of coursework and of the project.

Outcomes D6 and D7 are essential for satisfactory completion of the coursework and the project. Completion of the project also requires command of outcomes D1–D5. The assessment of the dissertation covers integration of all key and transferable skills, providing an overall assessment of a student's skills which are of key relevance to employers.

The above Learning Outcomes have been compared with the QAA Frameworks for Higher Education Qualifications Descriptor for a qualification at Masters (7) level. They are believed to meet or exceed the requirements of that Descriptor.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

1. Programme structure

The programme of study is as defined below.

Module code	Descriptive Title	Credits	MSc	Mode of Study
CEG8501	Quantitative Methods for Engineering	10	Comp	Block
CEG8503	Hydrosystems Processes and Management	20	Comp	Block
CEG8505	Climate Change: Earth System, Future Scenarios and Threats	10	Comp	Block
CEG8605	Aqueous Geochemistry	10	Comp	Block
CEG8511	Ground Water Assessment	10	Comp	Block
CEG8106	Groundwater Contamination and Remediation	10	Opt	Block
CEG8507	Borehole Design, Construction and Operation	10	Comp	Block
CEG8512	Integrated River Basin Management	10	Comp	Block
CEG8516	Groundwater Modelling	10	Comp	Block
CEG8608	Contaminated Land	10	Opt	Block
CEG8599	Project and Dissertation in Water Resources	80	Comp	-

Block = a residential course taken full-time during a week at Newcastle, sometimes with subsequent coursework.

Comp. = compulsory; Opt = optional (the usual route through the course is CEG8106 but CEG8608 may be substituted for this if desired)

Candidates may select alternative modules to those listed above to a maximum of 20 credits and with the approval of the Degree Programme Director.
Note: If a candidate is a graduate of Newcastle University the candidate is not permitted to take a module which has already been taken as part of another programme.

The normal undergraduate year, extending from the middle of September to the middle of June, is approximately 31 weeks, arranged in three terms and currently divided into two Semesters. In contrast, the MSc year occupies nearly the full 12 month period, with the

summer period (June-August) essentially constituting an additional semester.

Every MSc student studies 180 credits over the academic year. The academic courses, comprising 100 credits, are taught in Semesters 1 and 2, and the 80 credits associated with the project are notionally allocated to part of the second semester and the third semester.

Diploma students study 120 credits, of which the dissertation accounts for 40 credits. The taught courses are the same as those taken by the MSc students.

During the first two semesters, the primary aims of enhancing knowledge of the ground water environment and ground water infrastructure (A1, A2, A4, A5) are met through a range of appropriate technical modules. These include compulsory as well as optional modules with a strong IT (hydroinformatic) content. A common minimum level of mathematical skills (A3, B2) is ensured through the compulsory module in Quantitative Methods for Engineering, taken at the start of the course.

Intellectual skills (B2–B7) are developed initially in the lectured modules but are further reinforced through coursework. Coursework also develops practical skills (C7, C8) and a range of transferable skills (D1–D7).

The project, which forms a substantial part of the programme, may involve individual acquisition of knowledge and abilities (A1–A5, B1–B7).

Project planning and execution (B1, C3) is practised throughout the summer period. Experience is also gained of practical skills (C1–C8). Satisfactory completion of the dissertation and examinations requires strong command of transferable skills (D1–D7).

Key features of the programme (including what makes the programme distinctive)

The Applied Hydrogeology programme is now established as one of only a few of its type in the UK and is the only one to be able to offer all of full-time, part-time and flexible learning modes of delivery for the same programme. The course curriculum is distinctive in that it offers a broad-based approach to hydrogeology, including aspects of socio-economic understanding, catchment science, thermogeology (ground source heat energy), etc, in addition to the more traditional engineering aspects of the subject. It has a solid foundation on the development of numerical and problem-solving skills which is attractive to industry

It places practical hydrogeology within a context of sustainable water resource management and recognizes the emergence of climate change as a central challenge and context for the water sector.

It retains direct relevance to the water sector through reference to such context as the EU Water Framework Directive and the UK's Groundwater Regulations.

Programme regulations (link to on-line version)

http://www.ncl.ac.uk/regulations/programme/2010-2011/civg.php

13 Criteria for admission

Entry qualifications

Students wishing to be accepted on to the MSc course should have a good (2.ii Honours or better) first (Bachelor) degree in a relevant science or engineering subject (or the equivalent qualification from outside the UK). Some proficiency in chemistry is also required, normally at GCSE Grade 3 or above in a relevant subject. While A-level mathematics, or equivalent, provides a good basis for taking the course, it is not essential. Proficiency in English is required (foreign students are required to have an IELTS score of 6.5).

Admissions policy/selection tools

All applicants, standard or non-entry, will be considered based on their academic qualifications and their relevant technical industrial experience.

Non-standard Entry Requirements
Candidates with other equivalent qualifications and/or relevant industrial experience will be considered for entry.

Candidates who do not have A-Level (or equivalent) in Mathematics should discuss their mathematical ability with the Degree Programme director at the time of application.

Additional Requirements
None.

Level of English Language capability
IELTS 6.5 (or equivalent)

14 Support for Student Learning

The Student Services portal provides links to key services and other information and is available at: https://my.ncl.ac.uk/students/

Induction
During the first week of the first semester students attend an induction programme. This includes three days of field visits which provide stimulus and context for the formal teaching. Students will also be given a general introduction to University life and the University's principal support services and general information about the School and their programme, as described in the Degree Programme Handbook. The International Office offers an additional induction programme for overseas students.

Study skills support
Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined in the Programme Specification. Some of this material, e.g. time management is covered in the appropriate Induction Programme. Students are explicitly tutored on their approach to both group and individual projects.

Numeracy support is available through Maths Aid and help with academic writing is available from the Writing Centre (further information is available from the Robinson Library).

Academic support
The initial point of contact for a student is with a lecturer or module leader, or their tutor (see below) for more generic issues. Thereafter the Degree Programme Director or Head of School may be consulted. Issues relating to the programme may be raised at the Staff-Student Committee, and/or at the Board of Studies.

Pastoral support
All students are assigned a personal tutor whose responsibility is to monitor the academic performance and overall well-being of their tutees. In addition the University offers a range of support services, including one-to-one counselling and guidance or group sessions / workshops on a range of topics, such as emotional issues e.g. Stress and anxiety, student finance and budgeting, disability matters etc. There is specialist support available for students with dyslexia and mental health issues. Furthermore, the Union Society operates a Student Advice Centre, which can provide advocacy and support to students on a range of topics including housing, debt, legal issues, etc. The University Accommodation Office may be able to provide advice on accommodation and the International Office can provide advice to international students.

Support for students with disabilities
The University's Disability Support Service provides help and advice for disabled students at the University - and those thinking of coming to Newcastle. It provides individuals with: advice about the University's facilities, services and the accessibility of campus; details about the technical support available; guidance in study skills and advice on financial support arrangements; a resources room with equipment and software to assist students in their

studies.

Learning resources
The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), and Information Systems and Services, which supports campus-wide computing facilities.

All new students whose first language is not English are required to take an English Language Proficiency Test. This is administered by INTO Newcastle University Centre on behalf of Newcastle University. Where appropriate, in-sessional language training can be provided. The INTO Newcastle University Centre houses a range of resources which may be particularly appropriate for those interested in an Erasmus exchange.

The MSc course has access to specialist laboratories within the University and also extensive field facilities.

15 Methods for evaluating and improving the quality and standards of teaching and learning

Module reviews
All modules are subject to review by questionnaires which are considered by the Board of Studies. Changes to, or the introduction of new, modules are considered at the Board of Studies and/or the School Teaching and Learning Committee. Student opinion is sought at the Postgraduate Staff-Student Committee and/or the Board of Studies. New modules and major changes to existing modules are subject to approval by the Faculty, Teaching, Learning and Student Experience Committee.

Programme reviews
The Board of Studies conducts an Annual Monitoring and Review of the degree programme and reports to he Faculty, Teaching, Learning and Student Experience Committee. The FTLSEC takes an overview of all programmes within the Faculty and reports any Faculty or institutional issues to the University Teaching and Learning Committee.

External Examiner reports
External Examiner reports are considered by the Board of Studies. The Board responds to these reports through he Faculty, Teaching, Learning and Student Experience Committee. External Examiner reports are shared with institutional student representatives, through the Staff-Student Committee.

Student evaluations
All modules, and the degree programme, are subject to review by student questionnaires. Informal student evaluation is also obtained at the Postgraduate Staff-Student Committee, and the Board of Studies. The National Student Survey is sent out every year to final-year undergraduate students, and consists of a set of questions seeking students' views on the quality of the learning and teaching. The results from student surveys are considered as part of the Annual Monitoring and Review of the programme and any arising actions are captured at programme and School / institutional level and reported to the appropriate body.

Mechanisms for gaining student feedback
Feedback is channelled via the Postgraduate Staff-Student Committee and the Board of Studies.

Faculty and University Review Mechanisms
The programme is subject to the University's Internal Subject Review process. Every five years degree programmes in each subject area are subject to periodic review. This involves both the detailed consideration of a range of documentation, and a two-day review visit by a review team which includes an external subject specialist in addition to University and Faculty representatives. Following the review a report is produced, which forms the basis for a decision by University Teaching and Learning Committee on whether the programmes

reviewed should be re-approved for a further five year period.

Accreditation reports
The degree programme is accredited by the Joint Board of Moderators (Institution of Civil Engineers, Institution of Structural Engineers, Chartered Institution of Highways and Transportation, and the Institute of Highway Incorporated Engineers) as meeting the requirements for Further Learning for a Chartered Engineer (CEng) for candidates who have already acquired an Accredited CEng (Partial) BEng (Hons) or an Accredited IEng (Full) BEng/BSc (Hons) undergraduate first degree, for intakes up to 2011. See http://www.jbm.org.uk/ for further information.

The programme is also accredited by the Chartered Institution of Water and Environmental Management (CIWEM, http://www.ciwem.org/education/accreditation) as contributing to the academic requirements for the appropriate CIWEM membership grade for students that graduate from the Programme from 2006-7 to 2012-13.

The programme is also accredited by the Royal Institution of Chartered Surveyors (RICS, http://www.rics.org.

Additional mechanisms

16 Regulation of assessment

Pass mark
The pass mark is 50%.

Course requirements
Progression is subject to the University's Masters Degree Progress Regulations, Taught and Research and Examination Conventions for Taught Masters Degrees. Limited compensation up to 40 credits of the taught element and down to a mark of 40% is possible and there are reassessment opportunities, with certain restrictions.

The University employs a common marking scheme, which is specified in the Taught Postgraduate Examination Conventions, namely:

Summary description applicable to postgraduate Masters programmes		**Summary description applicable to postgraduate Certificate and Diploma programmes**	
<50	Fail	<50	Fail
50-59	Pass	50 or above	Pass
60-69	Pass with Merit		
70 or above	Pass with Distinction		

Role of the External Examiner
An External Examiner, a distinguished member of the subject community, is appointed by Faculty Teaching and Learning Committee, following recommendation from the Board of Studies. The External Examiner is expected to:

i. See and approve assessment papers
ii. Moderate examination and coursework marking
iii. Attend the Board of Examiners
iv. Report to the University on the standards of the programme

In addition, information relating to the programme is provided in:

The University Prospectus: http://www.ncl.ac.uk/postgraduate/

The School Brochure http://www.ncl.ac.uk/marketing/services/print/publications/ordering/

Degree Programme and University Regulations: http://www.ncl.ac.uk/regulations/docs/

The Degree Programme Handbook: (available on the web internally)

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

Annex

Mapping of Intended Learning Outcomes onto Curriculum/Modules

Module		Type	Intended Learning Outcomes			
			A	B	C	D
CEG8501	Quantitative Methods for Engineering	Compulsory	3	2, 5	4	1, 4, 6, 7
CEG8503	Hydrosystems Processes & Management	Compulsory	1, 3	2 – 7	1, 2, 4 – 8	1 – 7
CEG8505	Climate Change: Earth System	Compulsory	1	2 – 7	4 – 8	1 – 7
CEG8605	Aqueous Geochemistry	Compulsory	1	2 – 7	4 - 7	1 – 7
CEG8511	Groundwater Assessment	Compulsory	1 – 5	2 – 7	4 – 8	1 – 7
CEG8106	Groundwater Contamination and Remediation	Optional	1 – 5	2 – 7	4 – 8	1 – 7
CEG8507	Borehole Design, Construction and Operation	Compulsory	1 – 5	2 – 7	1, 2, 4 – 8	1 – 7
CEG8512	Integrated River Basin Management	Compulsory	1 – 5	2 – 7	4 – 8	1 – 7
CEG8516	Groundwater Modelling	Compulsory	1 – 3	2 – 7	4 – 8	1 – 7
CEG8608	Contaminated Land	Optional	1 – 3	2 – 7	4 – 8	1 – 7
CEG8597	MSc and Project Dissertation (Diploma)	Compulsory	2, 3	2 – 4, 7	1, 4, 7	1, 2, 4-7
CEG8599	MSc and Project Dissertation (MSc)	Compulsory	2, 3	1 – 7	1 – 8	1 – 7