Learning Guide
Part A - Course Outline

Introduction

Course – Infrastructure Project (Civil Engineering)

Welcome to the Civil Engineering Infrastructure Project, your major civil engineering design course. This course adopts a project based approach to learning. In other words you learn by being engaged in completing a major project.

Here you will become a member of a team assigned to complete a green suburb development task. This course brings together a number of learning outcomes from your previously completed courses. As you can imagine the tasks involved would draw your knowledge and skills from areas such as:

- land surveying
- earthwork calculations
- geotechnical engineering
- water resources management
- transport and roads
- structural design of infrastructure.

Your project is a government sponsored medium density township, to be used as a model township, brings state-of-the art approach to self sustaining sustainable townships. This course provides an opportunity for you to demonstrate your capabilities in a number of graduate attributes such as team work, research and investigation, planning, design and report writing. This course is an important element of each engineering graduate’s preparation prior to commencing a career as a graduate engineer.
Learning Outcomes

On successful completion of this course you will be able to:

- discuss trends in self-sustaining modern townships
- design a layout plan for a 29 hectare land development in a team environment
- develop the detailed design of one of the key civil works areas namely drainage, earthwork, roads water supply/waste water treatment, and the structural design of an infrastructure of your choice
- research and collate necessary data, information and guidelines
- prepare a proposal/report of a professional standard
- present and defend your work in a formal presentations/vivas

Conceptual Background

This course assumes that you have:

Completed a number of Civil Engineering courses to a level that enables you to accumulate and apply knowledge to develop and document a master-plan for a new township over an area of 29 hectare (650mx450m) of land.

Aims

The primary aims of the Infrastructure Project are to:

- demonstrate intellectual resourcefulness in an engineering environment
- demonstrate investigative, planning and design skills within a team
- demonstrate skills in interpreting and analysing design information
- demonstrate skills in communicating knowledge
- demonstrate presentation skills
- demonstrate time management and self organization skills
- enhance employability prospects.

Work must be carried out to professional industry standards and guidelines. It is recommended that the project outcomes are
documented and presented in a portfolio which can be carried to and shown in a job interview to impress your prospective employers.

**Part B - Assessment Schedule**

<table>
<thead>
<tr>
<th>Submissions/Activity</th>
<th>Notes</th>
<th>Marks Awarded (%)</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project commencement activities</td>
<td>Consortium: Team formation and setting-up. Conceptualising, discussing and formulating your team’s master-plan by the consortium members.</td>
<td>-</td>
<td>Latest by Week 2 Manage by team members</td>
</tr>
<tr>
<td>Master plan proposal</td>
<td>By the consortium: Report Volume #1, presentation and CD.</td>
<td>20%</td>
<td>Week 5 Feedback for improvement through project meetings/during presentation</td>
</tr>
<tr>
<td>Civil Works Design</td>
<td>By the sub-team: Report Volume #2, presentation and CD.</td>
<td>60%</td>
<td>Week 10</td>
</tr>
<tr>
<td>Infrastructure structural concept development</td>
<td>Individual: Schematic layout and structural diagrams of your chosen infrastructure</td>
<td>10%</td>
<td>Week 13</td>
</tr>
<tr>
<td>Team play and leadership</td>
<td>Individual: Active participation, effective contribution, attitude and motivational skills</td>
<td>10%</td>
<td>Throughout the semester</td>
</tr>
</tbody>
</table>

The above table summarises key activities and critical timelines you have to meet in order to complete the course successfully. This course demands a high level of time management, team work skills and research skills throughout. Unlike exam-based assessments, you can not prepare yourself in a hurry to achieve higher grades. The quality of your project deliverables, on which you are assessed, will depend on
your individual capabilities and team play which require careful planning and execution of critical activities in an organised and orderly manner with proper co-ordination among the consortium and the team.

Therefore, it is absolutely important that you prepare and follow a strict time management schedule (a project plan), clearly identifying milestones. The table given above, the schematic representation of the mind-map given in Figure C1 and the project tasks given in the ‘Project Brief and Procedures Manual’ (Part C1) may help you to develop your time management schedule. Refer Part C1 - Project Deliverables – for more details.

**Assessment Tasks**

**Major Assessment 1: Master plan proposal**

<table>
<thead>
<tr>
<th>Title: Master Plan Proposal</th>
<th>20 %</th>
</tr>
</thead>
</table>

This submission has three deliverables.

- Master-plan proposal report – A quality printed submission comprising project proposal (max. 8 pages), two A3 size drawings of the green suburb and presentation slides compiled as one volume. This must be presented to the panel just before the presentation.

- Presentation - 15-20 PowerPoint slides (maximum). 20min presentation and 10min defence (questioning) of your proposal.

- Soft copies of the report, two A3 drawings, presentation slides and references of good practices (any evidence, including case studies, to support your proposal) should be compiled to one single PDF file. Must be submitted through Online Learning Hub (Online@RMIT) prior to the presentation.

Refer Part C1 – Project Task 2.4 – “What is expected of you in the master-plan submission” – for more details.
Major Assessment 2: Civil works design

<table>
<thead>
<tr>
<th>DUE: on or before commencement of week 10 workshop/workshop session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title: Civil Works Design</td>
</tr>
<tr>
<td>60 %</td>
</tr>
</tbody>
</table>

- Civil works design report (**no printed submissions accepted**) – a technical report including design computations and A3 size drawings (no page limit – depend on type of civil work undertaken) - Soft copies of the report, A3 size drawings, presentation slides and references of good practices (any evidence, including case studies, to support your proposal) should be compiled to one single PDF file. Must be submitted through [Online Learning Hub (Online@RMIT)](http://www.onlinelearning.hub/rmit) prior to the presentation.

- Presentation - 10-12 PowerPoint slides (maximum) and 10-15min technical presentation

Refer Part C1 – Project Task relevant to civil works – “**What is expected of you in the civil works submission**” – for more details.

Major Assessment 3: Structural concepts development

<table>
<thead>
<tr>
<th>DUE: on or before commencement of week 12 workshop session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title: Infrastructure structural concept development</td>
</tr>
<tr>
<td>10 %</td>
</tr>
</tbody>
</table>

By – Dr. Saman de Silva
• Infrastructure structural concept development – *(no printed submissions accepted)* - a schematic representation of infrastructure layout, proposed structural schemes with preliminary member sizes - schematic drawings (max. 3xA3 size) compiled to one single PDF file must be submitted through Online Learning Hub (Online@RMIT).

### Major Assessment 4: Team Play and Leadership

<table>
<thead>
<tr>
<th>No Submission – Assessed throughout the Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active participation, effective contribution, attitude and people skills</strong></td>
</tr>
</tbody>
</table>

• You will be observed throughout the project duration as if you are working on a real project task in your first appointment as a graduate engineer. You must make the best use of this opportunity to test yourself not only in your technical competence but also in your people skills, leadership and negotiation capabilities highly valued in the industry.
Part C: Learning Guide

This Learning Guide has two main sections:

1) Project Brief and Procedures Manual (see Part C1)
2) Reference Guide (Part C2)

This course uses a project-based method of learning. This means your learning happens around a project (similar to what you experienced in doing your dream home project in 3rd year, and three storey office building in 2nd year). In this course you will be assigned to develop a self sustaining “green suburb” master plan and civil engineering design associated with it as a member of a consortium. Also you will select a specific infrastructure to your liking within that township and complete a conceptual design of that structure as an individual.

When developing innovative concepts for integrated infrastructure associated with a modern township you need to use your learning outcomes and skills from a number of previously completed courses. This would be an opportunity for you to integrate some aspects of your learning in surveying, geotechnical engineering, water resources, transport and road infrastructure and structural design. Therefore you are required to re-visit what has been already learnt as well as to enhance your knowledge and skills through fact finding informative research in to “best practice” case studies. The best way to organise your learning, in project-based mode of learning, is to:

- clearly understand the project tasks in hand, and
- seek knowledge and resources to accomplish the project tasks.

This is exactly how a practicing civil engineer would approach the design when dealing with a project. It is expected that your project-based learning experiences gained during “Dream Home Project” and “Three storey building” would help you to get the correct mind-set.

What is expected of you?

The expected project outcomes are given in Part C1 (the Project Brief and Procedures Manual). To find path ways to complete the major project you need to follow Part C1 thoroughly including the mind-map provided.
Part C2 of the Learning Guide provides you with basic information, limited guidance to some external resources and directs you to research. There are seven “streams”, each contributing to project outcomes and assessable learning activities. Each of these “streams” represents an area of specialisation in civil engineering and you have already completed a number of relevant courses over the last couple of years. You are required to integrate and apply your learning from a number of such courses.

Figure C.1 is a mind-map to help you get organised. (more efficient way to navigate the mind map is available by visiting the website http://www.dlsweb.rmit.edu.au/eng1/PACE/Mindmapper/index.html)

Figure C.2 provides a schematic representation of the course structure.

Figure C.3 provides a printed copy of the Master Plan, as found in the online classroom.

This course involves a major research component and work within a large group (8-10).
Figure C.1: Mind-map
PART C1 - Project Brief and Procedures Manual

Project Brief:

You are a professional civil engineer attached to a consortium of engineers (8 to 10 people), developing a master plan for a new township development over a 29 hectare (450mx650m) land. Your consortium is competing to win this major land mark development. You were made aware, by the client, that at least one other consortium takes part in this competition to develop conceptual design proposals for the proposed township development.

The development is to adopt a state-of-the-art, self sustaining township for 2000 upper income bracket clients, with the theme of a “green and healthy suburb”. Consider a 50 year planning horizon with 1% annual growth of permanent residents. Water sensitive urban design and environmental sustainability are essential components of the development. Road infrastructure and amenities are positioned in an innovative approach to minimise road traffic, traffic noise and to encourage walking and cycling. The township is to be designed to improve the feeling of “commune” among the occupants.

Your team’s proposed master-plan would be assessed on the strengths of addressing the following key aspects:

- innovation and creativity in the township layout and planning philosophy
- ability to demonstrate that your proposal is in-line with world best practices of modern development concepts and trends. (At least benchmarked against one widely acknowledged modern township within Australia)
- green concepts and features – “water sensitivity”, “quiet suburb concepts”, “community wellbeing” and “waste recycling and comfortable living”. (The key is for you to benchmark the existing practice, establish targets for improvement and demonstrate that your design has achieved them)
- functionality and integrated infrastructure for efficient and environmentally sustainable operation
- civil engineering excellence

Your consortium would be provided with a base plan (a CAD drawing) of a 29 hectare traditional layout plan as a starting point. You team is required to either improve the layout given to align with the above...
requirements or to develop your own layout plan for the given area. You will also be provided with the land survey contour map of the proposed site (as a CAD file named “contour map” - typically at week 3, via the online classroom). The geotechnical information will be made available via the online classroom at week 3 (as a PDF file). It is also important to ensure that your proposed layout is in good agreement with the site conditions (land contours, harness natural sun light etc.). That way, your layout plan has a minimum impact on the natural ground formation and makes engineering sense to minimise earthwork volumes, facilitates drainage design, as well as to preserve natural habitat.
Overview

As evident from the “project brief” given above, the main objective of the project is to develop a sustainable modern township. This is your opportunity to integrate your prior learning.

You are expected to demonstrate your capabilities in both, conceptual design and verification of the conceptual design through numerical methods (back of the envelope type calculations). It is envisaged that your design must comply with standard industry design guidelines and you are encouraged to use appropriate design charts, design capacity tables, design tools and design codes. It must be emphasised that what is expected of you is only a conceptual design and you are not required to carry out detail design computations for every aspect of the township development unless specifically requested. However, you must be able to demonstrate that your design is conceptually feasible and constructible, and that the “master-plan” proposal has reached the “preliminary tender” stage, good enough to convince the client, and ready for “tender” stage design.

In doing so, the Infrastructure project expects you to enhance and demonstrate two key graduate attributes needed in civil engineering design. They are:

- your ability to utilise your prior learning in different fields of civil engineering and integrate them to make educated judgement to back-up your innovation and creativity (thinking out-side the square) in this township development
- your team and leadership skills; that is, your ability to contribute your capabilities and harness others’ capabilities within a complex team organisation where outcomes depend on collective wisdom.

In this project the above skills are essential from the inception. You may reflect on previous learning you have undertaken in engineering design, water resources, surveying, geotechnical engineering, roads and transport and integrate them in a real application. However, you will also find that when attempting to convert your theoretical knowledge to application there exist numerous gaps. You are required to use your research capabilities to bridge any such gaps you discover during
application. You will also encounter significant interface issues which require effective coordination and efficient communication.

Our experience through student feedback suggests that the teams and individuals who accomplish the learning outcomes successfully in this project gain a lot of confidence before their graduation.

One effective way to formulate your project is to have a couple of brainstorming sessions at the outset. The mind-map given would help lead you as well as provide your consortium with a starting point. This needs to be followed by investigating best practices through recent case studies especially in your region.

When cases relevant to your project vision are found, you may then research and collate more specific information to help you to develop a conceptual framework of your township.

You are also expected to reach out to a wide range of experts in their own areas of specialisation, both within and outside RMIT. Especially within RMIT, you need to work with lecturers who have taught you in structural design, surveying, geotechnical engineering and water resources areas.

By now you may have gone through the project description carefully, be able to explain the main requirements and constraints and you may have formed a consortium. You may have also identified your team members. If you have not done all of the above, it is advisable to do so now.

Aims of ‘Infrastructure Project’ – generic attributes

The generic and essential **graduate attributes** of the project are:

- open-mindedness and creativity (thinking out-side the square)
- conceiving a complex civil engineering development to finding solutions with minimum tutoring and incorporating learning outcomes of your degree program
- conceptualising and recognising more than one solution exists
- problem identification, formulation and solution
- to develop intellectual resourcefulness by going beyond confines of a classroom
- contribute and manage progress within a team environment.

By – Dr. Saman de Silva
Team composition and Organisation

Read in conjunction with “Project Task 1.2”. This is a group project. Your consortium must harness various skills of its team members to prepare an outstanding proposal. The group will develop project ideas, conduct brainstorming sessions and obviously delegate the accountability of the main deliverables. Although the final outcome is a well co-ordinated effort, the accountability of each major deliverable must be delegated. There are three project deliverables in the assessment. They are the master-plan proposal (by the consortium), civil works design (by the sub-team) and infrastructure layout and structural concept development (by the individual).

Please note: the most outstanding project teams typically comprise of committed team members facilitated by a proactive facilitator, complimenting each other.

You are required to carry out three different roles as an individual as well as a team member to succeed in this course.

1. You are an active team member of your consortium and should proactively contribute to develop an innovative master plan for the township.

2. You also belong to a sub team (2-3 people) that takes responsibility of a specific aspect of civil works design. Obviously this needs to be well co-ordinated with the master plan and the other sub-teams and can not develop independently. This is a good opportunity for you to specialise in any one of the civil design areas you may wish to. For example, your sub-team will be allocated with one of the civil works, namely: roads, drainage, earthworks or water supply and waste water treatment.

3. As an individual, you have responsibility to select and develop one of the infrastructures within the township. For example, the consortium members have collectively agreed to include a modern hospital, a school or a shopping complex within the township then you may select one of these infrastructures as your individual responsibility. The layout and structural concept development components of the selected infrastructure need to be developed by you in addition to your collective responsibility towards your consortium.
Identification of project tasks and your responsibilities

To be read in conjunction with the mind-map and the project tasks.

This is the most important first step (ready-set-go) towards a successful and enjoyable project experience. You must proactively take part in forming your consortium and have contact details of all members. Within your consortium identify one or two other members who wish to involve in the same area of civil works design to form your civil design sub-team. You need to be proactive to finalise the formation of your sub-team in the first week. You must also identify and discuss your preferred infrastructure design (which is your individual task) with your consortium members preferably within first two weeks and notify the supervisor, latest by the end of second week. If all consortium members work strictly to this time frame the identification and the allocation of responsibilities within the consortium is expected to be finalised latest by the second week workshop session. Proactive and efficient communication among the consortium members within first two weeks is therefore very critical (use all modes of communication, phone, e-mails, chat rooms etc.). You must participate in all team meetings (Ref. project team meeting schedule) and be able to “chair” at least one session and on request. If this does not progress as expected, due to any member not carrying out his/her responsibilities, then your consortium must engage your course manager for advice. In such situations course manager would determine and allocate the tasks and responsibilities for those who are not pro-active.

Following table summarises the time frame for setting up of team tasks and individual responsibilities.

<table>
<thead>
<tr>
<th>Allocation (commencement) summary</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form your consortium, establish contact details of all team members and inform course manager</td>
<td>During the first week</td>
</tr>
<tr>
<td>Finalise formation of your civil design sub-team and civil works design stream</td>
<td></td>
</tr>
<tr>
<td>Identify your preferred infrastructure project:</td>
<td>By the second week (at the latest)</td>
</tr>
</tbody>
</table>

By – Dr. Saman de Silva
• discuss with your consortium members
• notify course manager

Allocation of responsibilities:
• finalise within the consortium

By the second week workshop session (at the latest)

Your project will be identified by:
• your consortium – sub-team task and your preferred infrastructure project

For example:
• Consortium A – EW sub team – Hospital development.

This identification would be helpful for you, your consortium members and your supervisor and when agreed, will not be changed.

### Project allocation table

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Consortium</th>
<th>Sub-Team</th>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. X</td>
<td>A</td>
<td>EW - earthworks</td>
<td>School</td>
</tr>
<tr>
<td>Miss Y</td>
<td>A</td>
<td>RD – road design</td>
<td>treatment plant</td>
</tr>
<tr>
<td>Mr. K</td>
<td>A</td>
<td>DD – drainage design</td>
<td>Housing</td>
</tr>
<tr>
<td>Miss. P</td>
<td>A</td>
<td>WT – waste water treatment</td>
<td>Hospital</td>
</tr>
</tbody>
</table>
Project data

Refer to Section C2.

Assessments

Refer to Part B: Assessments, of the Learning Package.

Project deliverables

You will be involved in three formal submissions where you contribute either as a team member or as an individual. These three submissions represent three stages of the project progress and will happen throughout the semester. Each submission has specific requirements which are called deliverables. It is important to note that all submissions/deliverables are inter-related and need to be very well coordinated.

Three submissions evolve as the semester progresses and in some periods need to evolve as parallel activities. For example, latter stages of Submission 1 activities would overlap with commencement of Submission 2 and 3 activities.

Also your contributions to the team and leadership qualities will be observed throughout the semester by the course manager.

The three submissions and their deliverables, also mentioned under Section B, are:

Submission 1 (by the Consortium) deliverables

- Master-plan proposal report – A quality printed submission comprising project proposal (max. 8 pages), two A3 size drawings of the green suburb and presentation slides compiled as one volume. This must be presented to the panel just before the presentation.
- Presentation - 15-20 PowerPoint slides (maximum). 20min presentation and 10min defence (questioning) of your proposal.
- Soft copies of the report, two A3 drawings, presentation slides and references of good practices (any evidence, including case
studies, to support your proposal) should be compiled to one single PDF file. Must be submitted through Online Learning Hub (Online@RMIT) prior to the presentation.
Submission 2 (by the sub-team) deliverables

- Civil works design report (no printed submissions accepted) – a technical report including design computations and A3 size drawings (no page limit - depend on type of civil work undertaken) - Soft copies of the report, A3 size drawings, presentation slides and references of good practices (any evidence, including case studies, to support your proposal) should be compiled to one single PDF file. Must be submitted through Online Learning Hub (Online@RMIT) prior to the presentation.

- Presentation - 10-12 PowerPoint slides (maximum) and 10-15min technical presentation

Submission 3 (by the student) deliverables

- Infrastructure structural concept development – (no printed submissions accepted) - a schematic representation of infrastructure layout, proposed structural schemes with preliminary member sizes - schematic drawings (max. 3xA3 size) and design one pager on philosophy compiled to one single PDF file must be submitted through Online Learning Hub (Online@RMIT).

Design workshops and project supervision

These sessions are conducted in a design workshop format where your team interactively develop your project through discussions and project review meetings. Your supervisor may assist you and provide specific instructions at times, where appropriate, to keep up with the schedule.

Throughout the program a 2hr per week time slot is allocated for workshops. The purpose of these workshop sessions is to ensure your team is reaching your project milestones in an orderly manner and you are managing your time well. Your supervisor may also use this time to conduct short lecture sessions and to communicate issues, as appropriate. You must change your mind-set from traditional ‘what does my lecturer want me to do?’ to ‘how should we make our project a success?’ If you take this approach from the start - within the project guidelines and framework (like you have done in Dream Home Project and LS & HR structures) - the project will transform your student’s mindset to a professional engineer’s mindset. This in effect will enhance...
your graduate attributes and increase your likelihood of doing well within the industry.

Your course manager, also acts as your supervisor, will participate in project review meetings during workshop sessions.

It is important that you work closely with your team mates and the supervisor within a supportive and contributing manner to make the project a success and must reach sources of help and information within and outside the department and university as necessary. You will need to develop a professional approach to making appointments, and research your topic before attending project review meetings and demonstrate that you are duty bound.

These sessions will also provide the course manager an insight into your working ethics, commitment and team skills which forms part of the assessment.

In this project your work must be “audit ready” meaning that the supervisor may request to see your progress at any given time especially if your progress is deemed not satisfactory, or your team is not happy with your commitment and/or contribution. Such intervention may form a part of your assessment.

**Keeping to schedule**

The Infrastructure Project is a team activity and your progress cannot be tracked in a formal way.

The mind-map is provided to help you and your team to plan your project program and to meet project milestones. The weeks in which major milestones are required to be completed are highlighted by bold fonts. These are to be strictly adhered to and submissions must be on time. **Progress and time management is your responsibility.**

One of the most important skills you need to have is the management of time, planning and working to a program, and the ability to recover when the program is not adhered to or slips for any reason. If your team does not function well you must request the course manager’s involvement to assist with the situation as early as possible.
Submission of project report

The completed project documentation includes three volumes of submissions. All submissions must be electronic submissions and compiled reports must be in PDF format. However we also need the good quality printed version of the master plan proposal report so that assessors can brows through during you presentation. Exact dates and times of submission will be notified by your course manager within the week given in the activity calendar.

It is obvious that the delay in one report can impact and unsettle the project schedule and project progress. Therefore it is strongly recommended and very likely that the course manager would demand you to submit the reports even if they are not 100% completed in your opinion by the submission day and would assess you on the components you have completed (this is not different to collecting your exam papers on time and marking based on what you have attempted and completed). All late submissions need formal approval (it is recommended that course manager discourage late submissions to avoid pipe-line affect on the progress). If an application for Special Consideration is approved, then an alternative submission date can be arranged with the course manager. Late submissions with no approved Special Consideration will attract a 5% penalty per day. You must obtain minimum of 50% of the allocated marks for each component to obtain a grade for the subject.

Updates

During the semester, necessary updates, modifications or explanatory notes for the manual will be issued either as separate written handouts or instructions through e-mail.

It is your responsibility to ensure that you are aware of any notes or modifications issued.

Presentation

You will have a number of presentations and vivas/interviews during the semester to maintain the progress (Refer section B and the table below). Exact times and venues will be notified by the course manager.

The presentation sessions and the vivas are arranged as drivers to reach critical milestones and to share your experience and the outcomes of your project with your colleagues and the academic staff. Obviously
your performance is part of the assessment. You will also have an opportunity to defend your proposal and to showcase your experience, learning and graduate attributes gained through this course.

These sessions are included to improve your capabilities in facing interviews with your prospective employers.

**Key submissions and activities calendar**

<table>
<thead>
<tr>
<th>Submissions/Activity</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activities:</strong></td>
<td></td>
</tr>
<tr>
<td>Consortium formation</td>
<td>Latest by Week 2</td>
</tr>
<tr>
<td>Sub-team formation and identification of your civil design component (by you in consultation with consortium)</td>
<td>(Managed by the consortium and notified to the course manager)</td>
</tr>
<tr>
<td>Identifying, discussing and brainstorming on vision (by consortium)</td>
<td></td>
</tr>
<tr>
<td>Conceptualising your master-plan (by consortium)</td>
<td></td>
</tr>
<tr>
<td>Identifying your preferred infrastructure project with the consortium members and notifying the course manager (by you)</td>
<td></td>
</tr>
<tr>
<td><strong>Submission 1 (by consortium):</strong></td>
<td>Week 5</td>
</tr>
<tr>
<td>Master plan proposal - Report (Volume #1) and Presentation #1*</td>
<td>(Feedback for improvement during presentation)</td>
</tr>
<tr>
<td><strong>Submission 2 (by sub-team):</strong></td>
<td>Week 10</td>
</tr>
<tr>
<td>Civil Works Design - Report (Volume #2) and Presentation #2**</td>
<td></td>
</tr>
<tr>
<td><strong>Submission 3 (by individual):</strong></td>
<td>Week 12</td>
</tr>
<tr>
<td>Infrastructure Concept development – Schematic diagrams**</td>
<td></td>
</tr>
<tr>
<td><strong>Team play and leadership</strong></td>
<td>May conduct interviews as appropriate</td>
</tr>
</tbody>
</table>

* Presentation # 1 (master plan proposal) is 30min duration.
**Presentation # 2 (civil works) is 10-15min duration.
Project Tasks

Project Tasks (to be read in conjunction with the mind map) are designed to drive progress, achieve learning outcomes and show you a pathway to learn and research relevant material.

Part C2 of the Learning package – “reference guide” will assist you in identifying, researching and collating relevant information for each stream. These may come from pre-learning (courses you have already completed) as well as design guidelines and codes of practices relevant to Australia.

Project Task 1.1 - Getting started and understanding the task

It is essential that you have a thorough knowledge of the project requirements, procedural guidelines and the individual and team responsibilities.

Take time to read each section of the Project Brief, Procedures Manual, Activity Calendar and the Mind-Map carefully. It is important for you to see the pathway ahead at the start, even though you may not understand them fully in the first pass. It is important to understand the sequence of activities because this course is adopting project-based learning in a complex team environment. You may realise that to complete a project of this nature you are required to have a feel for the big picture.

Project Task 1.2 – Organising and setting up your consortium

The first step is to understand the tasks, the complex team environment within which your performance is measured and to identify your responsibilities. The mind map will help you and your team in this regard.

Each member of the consortia should be fully conversant with and have collective decision making in the stream 1 and stream 2 leading to the development of the township master plan and technical information needed for engineering the project. Talk to your colleagues within the consortium and form four sub teams taking responsibility of specialised
streams 3 to 6 (this will help you to specialise in your preferred area of civil engineering). However, it should be noted that streams 3 to 6 need to be very well coordinated by the sub-teams and cannot progress independently. Stream 7 is where you can demonstrate your individual capabilities where each student (you) is selecting and developing a structural concept for specific infrastructure within the township.

You must take proactive approach to form your consortium or to become a member of a consortium being formed (8-10 people). It is your responsibility to notify course manager/supervisor of your consortium, your civil works sub-team by the end of second week.

**Key attributes to project success**

As it happens in real life, the success of the project is determined by the wider skill-base and the commitments of each team member.

Keeping a motivated team is a valuable leadership quality and you can test your natural leadership capabilities in this respect and experience it. Obviously time management is essential and all forms of communication can be helpful. For example, good consortia would establish a list and contact details of all members and establish a “yahoo” group to facilitate communication. Such consortia also prepare a time line (Gantt chart) to be used during the next 12 weeks, including milestones (you may consider using ‘MS Project’ program to develop your Gantt chart).

The project requires a wide range of skills. The team members with demonstrated skills in following areas would be beneficial:

- conceiving a major development and conceptualising
- research into standards of practice and state-of-the-art
- computer literacy including CAD drafting
- numerical skills in analysis and design of civil works
- presentation, and
- technical report writing.

**Team communication**

Establish your team and organise contact details (e-mail and phone contacts) and agree on a weekly meeting time. Identify a facilitator and assume individual responsibilities within the consortia, sub-team and your individual task.
Online@RMIT will provide virtual space for team communication for chats, posting of your ideas, reports and sharing references, etc. Note that the project teams of major projects around the world today communicate through virtual means and are not necessarily available in person. This would be a good opportunity to test your skills in this mode.

The following chart may further help you to understand the organization structure of the project.

![Project Organisation Diagram](image)

Figure C.2 – Project Organisation
Project Task 1.3 – Selecting your Specialisation Stream and Infrastructure Project

As a consortium, go through the project brief and the mind-map. Discuss and carefully consider individual and team preferences. Decide on which specialisation stream to select and delegate responsibilities. Decide on, as individuals, which infrastructure project you would undertake. Set-up a meeting time with your course manager, finalise the project allocation and ensure you understand the organization and tasks in hand. Establish communication links with all members of the consortium.

Project Task 1.4 – Understanding your project brief

As a consortium, arrange a brain-storming session and discuss in detail the possible interpretations of the brief.

Use the mind-map and the basic township layout plan provided as guides. Note that the project brief is worded in such a way to provide some degree of freedom to accommodate your innovative and creative thinking. Note down all possible interpretations and sketch initial ideas.

As mentioned before the technical data such as contour map of the land, site investigation and geotechnical information will be released at different times during the semester. Refer Section C2 for more details. Note that the technical data provided here does not cover all your project needs. Effectively use the given data and seek more from your previous learning, as well as through research. Clearly note down the constraints within which you are supposed to operate. Develop a list of information/data needed to complete the project. Feel free to make reasonable assumptions, based on educated judgement, and clearly note down such assumptions with reasons behind your judgement/ assumption. Talk to as many industry contacts as possible to seek their views. If you have any doubts make sure you clarify them up-front and come to an early agreement with your course manager/ supervisor.
Project Task 2.1 – Learn about best practices by investigating case studies in Australia and around the world

Identify space and functional requirements of your township and infrastructure prior to land allocation and planning (population, planning horizon, socio-economic factors, integration of infrastructure, etc.).

Research on best-practices and learn from them. For example, use key words given in the project description to help your research; green suburbs, city within city concept, modern real-estate trends. Refer Part C2 for some useful references.

Project Task 2.2 – Organise and conduct two brainstorming sessions of all team members

With your team in place and research information in hand you must conduct at least two brainstorming sessions in critical thinking mode to conceive and conceptualise the township.

Make a printout of the base plan provided to you and critically examine what is “good” and what is “not so good” in that layout. Indicate changes you would propose on the printout. Always keep engineering constraints, constructability issues and future expansions in mind.

Bring your ideas to these sessions, share your views with colleagues, debate and agree on a final layout. For these sessions to be productive and successful you and your consortium need to aware of the infrastructure facilities and amenities which may be considered for incorporation, land size and access requirements.

Relative positioning of these amenities would determine efficient functioning of your proposed township. For example, if you intend to include a shopping plaza, a medical centre, school, recreational facility, sporting venue etc, you need to know the approximate building sizes, realistic land requirements and their relative positioning. This is where your research prior to the sessions may help. Visiting such facilities, getting photographs and collating information and layouts of such facilities (available to public) are quick and effective ways of making progress.
Please note that, the base master-plan provided to you is a starting point only and the indicated plot boundaries have no relevance to your planning. You may consider merging the plots by removing the boundaries, or combining subdivisions (group of plots) to match your needs. Your consortium is most welcome to develop an original plan, provided overall development is 450mx650m.

It is anticipated that the first session is conducted by the consortium and the second session should have your course manager/supervisor involved. This session can be used to delegate responsibility to team members with the agreement of the course manager.

**Team member roles**

As stated previously, all members of the consortium will be involved in (see figure C2):

- Planning of the township - Stream 1
- Interpretation site investigation information – Stream 2
- Conduct research

It should be obvious that the engineering for the proposed township - including the tasks involved - should match the skill base of the team members who volunteer to do specialisation streams (as mentioned previously, this should be decided by the team members and the course manager should be involved in the process). Streams three (3) through to six (6) involve engineering civil works design. Deliverables of each stream would be delegated to a sub-team of two to three members.

Civil works design involves,

- Earthworks – Stream 3
- Road network design – Stream 4
- Storm water drainage network design – Stream 5
- Potable water supply and waste water treatment network design – Stream 6

It may also help your learning, and the project, if you take your own initiative to be proactive to learn what the other sub teams are doing and even become involved by helping and co-ordinating between sub-team.
Proactive consortia add extra deliverables by their own initiative. For example, some consortia create virtual tours through their townships, marketing type brochures to “sell” their proposal at presentation.

**Infrastructure facilities**

At this stage individuals should be mindful of the infrastructure they wish to develop as individual projects. The best way to do this is, as a team, to develop a list of possible infrastructure facilities the consortium intends to incorporate in to the township.

It is useful to develop this list as a table with a number of columns so that you can discuss and include basic but critical information required for decision making. Information would include data such as block size, access requirements, integration and relative positioning of the facilities, etc. Please note that your master-plan should cater for 2000 initial occupants with 1% growth over a 50 year planning horizon and the demand on civil infrastructure. You may consider two stages of development, where provisions are made for stage II development to cater for growth in permanent residents. If this is the approach you wish to take, stage two work areas must be clearly indicated on the master-plan. The 29.25 hectare land must be wisely utilised. However, you would realise that only a selective and limited number of infrastructure facilities (equal to the number of members within the consortium) would be able to develop further by those who select them as their Stream 7 task.

**Project Task 2.3 – Matching your Master-plan layout to Site conditions**

By week 3 you will be provided with land survey data and a contour map (in a CAD file name “contour map”) for the proposed site.

When this information is made available, at week number 3 (typically via the online classroom) the main task is to ensure that your preliminary master-plan and the relative positioning of the amenities are in good agreement with the site conditions. If not adjustments may need to be made. This must be done in a way to minimise the cut and fill volumes of earthworks, utilise the natural formation of the land as much as possible to your advantage.
Through this exercise you will be able to finalise the orientation, access needs, inlets and outlets of services including water supply and treatment and storm water drainage. This would also enable you to identify the possible drainage outlet points, possible wet land areas, preliminary road formation levels, access to main roads, service provisions and formation levels of infrastructure facilities.

You need to overlay the contour map on the preliminary master plan (either using CAD or tracing paper). This task is to be accomplished by all in the consortium. It is important to have overlay printouts of land areas where individuals intend to develop their own infrastructure projects.

Project Task 2.4 – Master-plan proposal report and presentation

By Week 5 you are required to, as a consortium, formulate, finalise and submit your work on the master-plan.

This is a group submission. The work will then be presented and the proposal needs to be defended. Work will be assessed as a group activity. As mentioned before there are three deliverables. Delegation of responsibilities and work load among consortium members are essential and the co-ordination to produce a coherent volume of work is mandatory. What is expected of you in producing this volume of work is given under each deliverable.

These are minimum requirements. Our experience is that good teams exceed these minimum expectations and add creativity to make the submission more interesting and appealing.

What is expected of you in the Master-plan proposal submission?

This is a submission by the consortium and will be assessed as a group activity.

Master-plan proposal Report

1. Report must be concise and professional - 8 pages (maximum).
2. Contents should cover:
   a) Executive summary
   b) Project brief
   c) Planning vision and philosophy
   d) Innovative features (preferably marked up and labelled on an A4 size master-plan)
   e) Environmental duty statement
   f) A table providing critical information about all amenities (name & description, building size/foot print, land requirement, building height and number of levels)
   g) Preliminary estimates of demand and supply of all services.

3. Two A3 size drawings of the green suburb master-plan:
   a) Master Plan 1 (preferably colour print) – should show road layout, lot boundaries, foot prints of buildings and labels identifying the amenities.
   b) Master Plan 2 – should include contour overlay on the master-plan, exclude building footprints and labels, show site excavation boundary indicating preliminary formation levels of roads and sites (similar to a bulk excavation plan – no detail batter slopes needed at this stage).

4. References and one page extract of the best case study relevant to your work

**Presentation:**

15-20 PowerPoint slides (maximum):

All members must prepare for the 20min presentation and 10min defence of the proposal. Presentation should target non-technical audience comprising representatives from the client. (The team of presenters will be picked randomly from the consortium by the course manager and will be notified only on the day of presentation – meaning all should be prepared and confident enough to present on behalf of the consortium)
Online submission should include:
- A single PDF file compiling the items 1-4 listed under “master plan proposal report” given above.

Master-plan proposal will be assessed on
Read in conjunction with the mind-map
- evidence of modern sustainable township planning trends
- evidence of creativity and innovative thinking and critical inquiry
- evidence of realistic estimates of basic critical information of infrastructure needed (building size, site area)
- demonstrated capabilities in relative positioning and integration of amenities to achieve functionality and healthy living
- green features and thoughts on environmental sustainability such as water sensitive urban design features and vision on recycling and conservation.

The following check list, also given in Stream 1 of the mind-map, should provide an insight into the expected outcomes at the proposal stage.

1. vision & concept
   - sustainability
   - state-of-the-art
   - creating commune
   - commuting
   - innovative approach
   - integrated infrastructure

2. estimating needs
   - health and education
   - housing, community centres
   - water, building services, communication
   - transport, commuting,
   - trade, goods & services
   - leisure & recreation
3. researching/case studies
   - learn from world best practices
   - data, information, ideas
   - ideas adapt to Australian conditions

Project Tasks Relevant to Civil Works (Streams 3 – 6)

Civil works collectively refer to the design of road network, storm water drainage network, design of water supply and waste water treatment network and the earthworks - cut and fill volumes resulting from bulk excavation - associated with the project.

As mentioned before, each task will be delegated to a sub-team within the consortium. As you may recognise these streams represent key areas of specialisation in civil engineering. You may select an area you would like to specialise. However, it is also expected and strongly recommended to take your own initiative to learn areas other than what you have chosen by involving with and discussing among sub-team members.

In a project of this nature, the first phase begins with developing road infrastructure for site access and other service infrastructure in place. In other words you are just about to engineer the common civil infrastructure for the proposed township as a whole before developing individual sites and design building structures.

The completed master-plan provides a firm base for all sub-teams to work in a co-ordinated and collaborative way on their aspect of civil works design.

At this stage, it is recommended that all members should obtain a copy of the proposed layout of the township with the contour map. It will then become clear that the tasks delegated to each sub-team such as earth works, road works, drainage works, water supply and waste water treatment design can commence and proceed as parallel activities.

It should be noted however that although all these design activities can proceed concurrently as parallel activities careful coordination is required. For example the road side drains and drainage outlets such as culverts have a bearing on drainage design as well as on the road design and as such need careful co-ordination. Especially if any major
changes to the original master plan are deemed necessary, these will need to be discussed as a team and notify all involved in the project including your supervisor.

The project tasks relevant to each civil works stream are given below and you are expected to be fully conversant with all the tasks relevant to your sub-team.

What is expected of you in the civil works submission?
This is a submission by the sub-team and will be assessed as a group activity of the civil works sub-team.

Civil Works Report

1. Report must be a technical report with appropriate design computations (no page limit – depends on the area of civil works your sub-team undertakes).

2. Contents should cover:
   a) Civil works project brief
   b) Design philosophy and design guidelines with appropriate references
   c) A table providing critical design outcomes including information and design standards adopted giving
   d) Preliminary estimates of establishing demand and provisions of civil design aspects
   e) List of drawings

3. A3 size engineering drawings of the civil works design covering:
   a) Lay out plan
   b) Typical longitudinal sections and cross sections
   c) Construction details of associated works

Presentation:
10-12 PowerPoint slides (maximum):
All members must prepare for the 10min presentation and 5min defence of the civil works design. Presentation should target technical audience comprising senior engineering staff of your organisation. All sub-team members will take part in the presentation.

On line submission should include:

A single PDF file compiling the items 1-3 listed under “civil works report” given above. You should also include any additional design computations, estimates and results out-put files if design tools are used, spreadsheets developed by the team etc.

Civil works submission will be assessed on

Read in conjunction with the mind-map

• in line with the original master-plan proposal
• evidence that your civil works design can be implemented and well co-ordinated with other relevant areas of civil works
• evidence of appropriate industry guidelines being used in the civil works design with proper referencing
• evidence of creativity and innovative thinking and critical inquiry
• evidence of realistic estimates of basic design information with appropriate references to demonstrate industry standards have been used
• demonstrated capabilities in detail design of associated structures as per current industry practices.

Project Task 3.1 – Earth works

Sub-team 1 is responsible for earthworks design (stream 3).

Earth works design involves establishing preliminary formation levels for roads and individual sites and the estimation of earth moving requirements resulting from cut and fill volumes, also known as the bulk excavation. You may have, as a requirement in the master-plan
proposal, already established the preliminary formation levels for roads and individual sites.

This activity can be considered as an improvement or detail design of that aspect. It should be noted that pit excavations for building foundations, trenches for services and drainage network and drainage pits are not considered bulk excavation and therefore need not be included.

The following steps may help you to complete the earth work design:

The site contour map provided gives you the natural formation level of the development site.

Allow for 300mm scraping to account for site clearing and top soil removal. This material will be stock piled for later use in the landscaping. Bulk excavation involves both road network as well as individual development sites. Both areas must be accounted for in your design.

Use a preliminary formation level of the road network, already established during master-plan development stage, to develop longitudinal sections along the road net work. Depending on road formation levels at a given point, with respect to the natural formation (make sure to allow for 300mm top soil removal) you will either have a cut or a fill area.

Cut and fill areas can be easily identified by plotting the longitudinal section of the road indicating natural formation levels, and the proposed road formation levels as an over lay. Take cross sections at regular (equally spaced) change points of the road.

Development of cross sections requires establishing the width of the “road reserve”.

Road reserve width comprises of the pavement width, allowances for shoulders, road drainage, foot/bicycle paths and nature strips as you may require (if your master-plan is reasonably developed and detailed you may obtain this width directly from you master-plan CAD drawing).
Development of cross sections also requires batter slopes appropriate for cut and fill areas. Depending on the soil conditions, determine the stable batter slopes for cut and fill areas (refer to site investigation report). In some isolated areas you may need to adopt much steeper batter slopes than recommended due to geometric constraints which may require retaining the fill areas or stabilising the cut. Consider and recommend retaining walls or slope stabilising techniques such as shotcrete.

Select and design critical retaining or stabilising needs. (Discuss with your course manager and identify, if any, a case which you can handle.)

**Cut and fill volumes**

Estimating cut and fill volumes involve both roads and individual sites. You have incorporated the preliminary formation levels of roads and individual sites in your master-plan. The intention here is to optimise the already proposed values through a rigorous process.

Normally in earthworks design attempts are being made to balance the cut volume and fill volume to minimise disposal and excavation of new material for fills. This can be achieved by adjusting formation levels of sites and roads to optimise earth moving requirements.

It must be noted that for an accurate estimate of earthworks the geometric design of the roads (horizontal and vertical alignment) needs to be completed. But for this exercise you can proceed with preliminary road formation levels. If you are very keen then later, when the final design levels of the road surface are known, your estimates could be refined and compared (this is optional). It is possible to get estimates closer to 10% accuracy with preliminary estimates.

**Spread sheet as a tool**

The most effective ways to handle repetitive computations such as earthwork computations is to develop a spread sheet.

Note that CAD can plot cross sections and calculate areas of cut and fill. There is a range of software available, some which can be downloaded as trial versions, which can assist you to generate cross sections and calculate earthwork volumes.
Project Task 3.2 – Road Works

Sub-team 2 is responsible for the road network design (Stream 4) presented in the master-plan proposal.

A complete road design involves:

- traffic analysis
- geometric design (horizontal and vertical alignment of the road)
- earthworks
- intersection design
- pavement design, and
- road drainage network design.

However, you are not expected to be able to cover - due to time constraints - all aspects of road design from first principles and be able to detail them appropriately. You are encouraged to use design charts/aids, standard details from the industry and reasonable estimates within road design industry guidelines with appropriate references. The intention here is to expose you as widely as possible to the design of roads. Refer Section C2 for some useful learning resources.

The following steps may help you to develop the road design to a pre-tender stage:

**Primary, secondary and tertiary roads**

Identify primary, secondary and tertiary roads within the proposed road network and label them appropriately (some project teams even name the roads by their names for easy reference). Have reasonable estimates of traffic volumes and traffic loads based on population, frequency of use and the types of vehicles.
Lane widths
Determine lane widths. Define road type - one way, single or dual carriage ways. You may use industry standards, use similar existing case-studies or even collate evidence from site visits.

Speed limits
- Specify speed limits for primary, secondary and tertiary roads.

Alignment of the road
Carryout geometric design to finalise horizontal and vertical alignments of the road.
This is one of the major tasks to complete including preparation of industry standard drawings. You may use design aids, industry guides or software tools to finalise this task (preferably Australian design guidelines).

Design pavement
Carry out a pavement design for one of the primary/main roads. Develop a typical cross section to be used in the project as the standard section.

Road drainage network
Develop road drainage network and specify grades for road side drains, locations of drainage pits, culverts or waterways, etc. as per standard industry practice. You do not need to carry out a detail drainage design or computations. Co-ordinate and provide conceptual road drainage network established by your sub-team to the sub-team involved in the drainage design for detail analysis.

Major intersection
Identify one major intersection and carry out a geometric design of a roundabout or traffic island. Indicate main entrance to the block of land from main access road which can be later extended and connected to the site facilities.
**Signage, parking areas and pedestrian crossings**

Develop specifications, as per the current industry standards, for signage, parking areas and pedestrian crossings for the township development.

---

**Project Task 3.3 – Drainage Works**

Sub-team 3 is responsible for stormwater drainage design (Stream 5) for the proposed township.

Your consortium may have incorporated modern water sensitive urban design concepts and features such as stormwater harnessing and recycling, creating wet lands, retardation and sedimentation ponds etc. in to your master-plan proposal.

It is your responsibility to design and document the storm water drainage of the township in line with the proposal. This requires the design and detailing of your stormwater drainage network and associated structures.

Your drainage design should also include road drainage and should be compatible with the conceptual road drainage network proposed and developed by the sub-team 3 (road drainage is an area sub-team 3 & 4 should collaborate effectively). The following steps may help you to complete the design.

**Conceptual map - drainage network**

Develop a conceptual drainage network (drainage pipes and associated drainage structures) with proposed water sensitive design features in mind.

Your drainage network can be a combination of independent sub-networks or a series of loops interconnected. In the conceptual design you should be mindful of the provisions for maintenance interventions and also alternative routes in case of a major flood. The prime idea is guarding your township against flooding. Research on a case study will be a good starting point.
**Associated structures - transition pits, manholes, inlets and outlet structures**

In your conceptual network, identify and label associated structures such as transition pits, manholes, inlets and outlet structures.

Although at this stage you do not have specific design parameters of the associated structures such as pipe invert levels, pit depths and sizes, inlet and outlet invert levels, pipe diameters etc, identifying and labelling them would provide a good base for the detail design to follow. It is recommended that to extract the associated drainage structures identified in your conceptual network to a summary table indicating what critical design parameters you are looking for.

**Design - drainage network**

Carry out a drainage design to finalise pipe sizes, grades and invert levels of the drainage network.

This is one of the major tasks to complete including preparation of industry standard drawings. This is where your prior learning in water resources engineering would come in to play where you have learnt how to conduct a drainage design for a given site. What is expected of you is to apply this knowledge to your township.

You may use design aids, industry guides or software tools to finalise this task (preferably Australian design guidelines).

**Discharge points**

Refer site investigation report and the land survey drawing for council storm water discharge/spill connection points.

**Design - transition pits, manholes, inlets and outlet structures**

When the design process is completed you would have the answers for pipe diameters, grades of the pipes and invert levels (for both inlets and outlets) of the transition pits.

Please rationalise/standardise your design to have a fewer number of standard pits and pipe sizes from a cost and constructability view point.
Drawings

Produce CAD drawings, as per the industry standards, indicating critical design parameters.

Ensure each block of land is provided with the connection points to the stormwater system - preferably at the lowest corner of each block along side an access road - which can be later connected to the facility.

Project Task 3.4 – Water supply and wastewater Treatment

Sub-team 4 is responsible for water supply and wastewater network design (Stream 6).

This involves designing and documenting potable water supply network, wastewater treatment/re-cycling network and the stormwater treatment/re-use network for the proposed township. Your consortium may have incorporated modern strategies for potable water conservation through wastewater treatment and recycling strategies including stormwater harnessing and recycling for irrigation and selective domestic use. It is highly desirable to demonstrate that both the stormwater and waste water can be harnessed and be effectively re-cycled to conserve potable water.

In this exercise, we need you to conceptualise the whole township as one system and engineer this system as a stand alone self sustaining alternative source of water supply to supplant the potable water supply through the mains. You may recall, in your “Dream Home” design project learning we have considered the same concepts but limited to an individual block of land. This design is a further advancement in that respect.

Please note that the designing of stormwater harnessing, treatment and re-use network needs to be well co-ordinated with the sub-team 4 – stormwater drainage design team. This is because; engineering such a strategy would depend on two things. Firstly, the effectiveness in harnessing and storing the stormwater which are the responsibility of the Sub-team 4 - drainage design team. Secondly, the treatment and distribution are the responsibility of water supply and wastewater treatment design team – sub team 5.

In your civil works design what is expected of you is the civil engineering design of the network (not designing the structures for treatment plants or storage tanks; however, you may consider
structural design of these plants and storage tanks when selecting your individual infrastructure design in stream 7).

The following steps may help you to complete the design.

**Conceptual network – water and wastewater**

Develop a conceptual water supply and wastewater collection network for the township.

Your network would comprise mains, branches and secondary pipe lines. The pipe network should include dedicated pipe lines for each plot of the township to cater for both supply and collection.

Identify potable water supply in green, re-cycled water supply for selective use in purple, wast water collection line in grey and sewer lines in black. This may also indicate various associated accessories.

Your water supply and collection network can be a combination of independent sub-networks or a series of loops inter connected. In the conceptual design you should be mindful of the provisions for maintenance interventions and also alternative routes in case of damage. The prime objectives are to ensure less-interrupted supply and hygiene in case of a possible failure. Research on a case study will be a good starting point.

**Supply and discharge points**

Refer site investigation report and the land survey drawing for council potable water supply main and sewer mains connection points.

**Treatment facilities**

You may have allocated land for a stormwater treatment and re-cycling facility and a wastewater treatment and re-cycling facility in your master-plan proposal.

Incorporate these facilities as sub-loops to conserve potable water from the council main and to minimise wastewater and stormwater disposal volumes to the council main.
**Estimate**
Make preliminary estimates to quantify and demonstrate the benefits of such a system and establish demand and supply at various points of this integrated network.

These estimates must be simple back-of-the-envelope type estimates and no complex analysis is required.

**Identifying associated structures**
In your conceptual network, identify and label associated structures such as transition valves, manholes, fire hydrants etc.

Although at this stage you do not have specific design parameters of the associated structures such as pipe sizes, pressures, etc, identifying and labelling them would provide a good base for the detail design to follow. It is recommended you prepare a checklist for critical design parameters you are looking for.

**Design – pipe sizes, grades**
Carryout a design to finalise pipe sizes, grades, and invert levels of the wastewater (grey-line) and sewer (black-line) collection network.

This is one of the major analytical tasks to complete. This is where your prior learning in wastewater management would come in to play where you have learnt how to design a wastewater management network with correct pipe sizes, grades, etc. What is expected of you is to apply this knowledge to your township.

**Industry standards**
Pipe sizes for water supply network use industry standards (no calculations are required).

Assume water head (pressure) at council water main connection point is sufficient to cater for the highest service point of the township.

You may use design aids, industry guides or software tools to finalise this task (preferably Australian design guidelines). Ensure each block of land is provided with the connection points at the lowest point of the
block adjacent to the access road which can be later connected to the facility.

**Design outcomes**

When the design process is completed you would have the answers for pipe diameters, grades of the pipes and invert levels (for both inlets and outlets) of the transition pits of the grey and black lines.

Please rationalise/standardise your design to have a fewer number of standard pits and pipe sizes from a cost and constructability view point.

**Drawings**

Prepare CAD drawings, as per the industry standards, indicating critical design parameters for your potable water supply, wastewater collection and re-cycled water supply networks.

---

**Project Tasks Relevant to Infrastructure Concept Development (Stream 7)**

This is an individual task and you would complete the development of the selected key infrastructure by yourself.

Infrastructure concept development here refers to the selection of a building structure or a facility (school, hospital, housing, etc) and completing the interior layout design and preliminary structural schemes of that facility. This also involves developing the area within the site boundaries including access roads, parking areas, etc.

This task must be carried out as a parallel activity by your own while you are engaging and fulfilling your civil works design commitments as a sub-team member.

You are expected to develop your facility to a schematic stage. Your work within the site boundaries should be compatible with the proposed master-plan and all the civil works design such as road access, stormwater drainage discharge points, water supply and wastewater connection points, etc.
Project Task 4.1 – Infrastructure Layout

Finalise your preliminary spatial and functional needs - established during master-plan proposal stage - of the facility you have chosen to design. Develop a site layout plan for the facility.

You may have more than one building within the site and a number of access road/footpaths, parking areas, etc. You must be able to justify and debate how you have arrived at these needs. You have to consider the population, planning horizon, population growth and socio economical needs in arriving at these figures. The outcomes should be compatible with the summary table provided in the master-plan proposal.

*Service connections*

On your site layout indicate site drainage, access roads within the site and service connections to the facility. This aspect you need to cover only conceptually and therefore detail designs are not required. However, you need to ensure that, as mentioned before, your needs for infrastructure design, with respect to service connections are compatible with the provisions made in civil works design, especially water supply, wastewater discharge and stormwater discharge connections.

Project Task 4.2 – Interior layout Plan

Select the main building of the facility (if you have more than one building discuss and agree with the course manager) and develop an interior layout plan as per industry standards.

Develop a couple of elevations and sections through the building.

Project Task 4.3 – Structural Concepts and Schematics

Develop structural concepts for the building structure. This involves developing a structural framework to resist both gravity and lateral loads. Develop and draw schematic sketches for the concepts.
developed, identify and label the main structural elements clearly. Write a brief design philosophy to explain, qualitatively, how your proposed structural scheme intends to perform.

Also you need to propose preliminary member sizes for the key structural elements.

**Schematic drawings**
Prepare three A3 size drawings for site layout, interior layout and elevations of the building you have selected and the proposed structural sketches.

**What is expected of you in the infrastructure concept development submission?**
This is a submission by the individual and will be assessed as an individual activity.

**Schematic representation of your Infrastructure**

A3 size drawings of the proposed infrastructure structural works covering:

a) Overall lay out plan of the facility
b) A typical longitudinal section and a cross section of the overall facility
c) Interior layout of the building selected for detail design
d) Structural sketches of the building selected including preliminary sizes
e) One page of “dot” points broadly explaining how the structure resist lateral and gravity loads

**Online submission:**
- Items (a) – (e) compiled to a single PDF file must be submitted through Online Learning Hub (Online@RMIT).

**Infrastructure concept development submission will be assessed on**
- whether your design is in line with the original master-plan proposal and spatial and functional needs are realistic
• evidence that your infrastructure layout scheme can be implemented and well co-ordinated with relevant areas of civil works
• clarity of your structural concept design philosophy
• proposed structural scheme fits the purpose and the preliminary sizes proposed are realistic estimates
PART C2 – Reference Guide

Read in conjunction with the mind-map

Stream 1 - Master plan development

Data sources:
1. Green Suburb Mind Map (more efficient way to navigate the mind map is available by visiting the website http://www.dlsweb.rmit.edu.au/eng1/PACE/Mindmapper/index.html)
2. Base Master Plan (CAD drawing – provided in online classroom)
3. Contour Map (CAD drawing – provided in online classroom - Week 3)
4. Site Investigation Report (PDF file provided in online classroom – week 3)

References:

Stream 2 - Earth works - bulk excavation

1. Refer relevant sections and recommended texts from prior learning in Geotechnical Engineering
3. Refer pervious learning in surveying and recommended texts

Stream 3 - Road works design


[http://www.dur.ac.uk/~des0www4/cal/roads/index.html](http://www.dur.ac.uk/~des0www4/cal/roads/index.html)
- Refer Sections on traffic analysis, pavement design.

**Stream 4 - Stormwater drainage design**
1. Refer relevant sections and recommended texts from prior learning in Water and Waste Water Management

**Stream 5 - Water supply and waste water treatment design**
1. Refer relevant sections and recommended texts from prior learning in Water and Waste Water Management

**Stream 6 - Infrastructure design**
1. Refer relevant sections and recommended texts from prior learning in structural design courses:
   - Steel structures, Concrete structures 1 & 2 (2nd year design)
   - Long Span and High Rise Structures
   - Sustainable Infrastructure design (3rd year design)