**Stage 2 Earth and Environmental Science: Program 2: 20 credits**

This teaching program articulates with learning and assessment plan 2.

| **Week** | **Science Understandings** | **SIS** | **SHE** | **Resources** | **Assessment Tasks** |
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| Term 1 Week 1 -2 | Introduction to Stage 2**Topic 1: Introduction to Earth Systems*** Components and process of the systems: Hydrosphere, atmosphere, biosphere and geosphere & scientific concepts.
* Interactions between the systems – carbon, nitrogen, phosphorus and hydrological cycles. Interdependence of earth Systems.
 | * Practical Investigation: interaction of Earth Systems in the local area.
 | * Outline of key concepts of Science as a Human endeavour.
* SHE Investigation: Case study – Interactions of earth systems and local watercourse management.
* Designing an investigation
 | Refer to the attached document for a list of web-based resources by topic. | Formative Investigation design including:* a hypothesis or inquiry question
* types of variables
* dependent
* independent
* factors held constant (how and why they are controlled)
* factors that may not be able to be controlled (and why not)
* materials required
* the procedure to be followed
* the type and amount of data to be collected
* identification of ethical and safety considerations.
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| Week 3 | * Identifying and measuring change in in systems
* Patterns and changes over a variety of time scales
* Predicting future changes
 | * Introduction to field skills – sampling techniques, testing equipment, recording devices, data entry.
 | * Introduction to citizenship science for data collection, recording & use.
* The Precautionary Principal
 | Web Resources |  |
| Week 4 | * Inquiry into Earth systems
 | * Field Investigation: local area Earth Systems Inquiry.
* Scientific methods & measurable evidence.
 |  | Field excursion, KESAB water testing kits, lab resources published water quality data.  |  |
| Week 5 | * Consideration of local area findings and wider implications.
 |  | * Society and science.
* Inquiry into an example of how science influences and is influenced by social, economic & political viewpoints and practices.
 | Developments in water supplies and waste water management. | **AT 1 Practical Design Investigation:** **Riparian vegetation along a waterway**  |
| Week 6 | **Topic 2: Earth’s Resources*** Renewable and non-renewable resource use
* Costs and benefits of resource extraction & use, long & short term.
 |  | * SHE investigation: Issues associated with the extraction of one or more fossil fuels.
 |  |  |
| Week 7 - 8 | * Formation of mineral resources. Geological time scales.
* Exploration for resources (e.g. iron ore)
* Extraction and refining of resources
* Issues associated with mineral extraction and mine rehabilitation.
* Sustainability of resource extraction and use.
 | * Practical Investigation: Resource exploration & extraction techniques.
 | * SHE Investigation: Cradle to the grave measurement of resource impact.
 |  |  |
| Week 9 - 11 | * Environmental impacts of the extraction and use of mineral resources
 | * Collection and recording of data. Safety considerations for scientific inquiry.
 | * SHE Investigation: Case study of impacts of mining and production on ecosystems. Adelaide Brighton Cement.
 | Adelaide Brighton Cement web site downloadable documents & wetland. | **AT 2 Skills and Application Task: Topics 1and2** |
| Term 2Week 1 | **Topic 3 Earth’s Sustainable Future*** Renewable sources of energy and mineral resources
 | * Practical Investigation – generating, storing and using energy
 | * Pumped hydro for energy storage
* Society & energy resource demands, debates and change.
 | Web based researchAquifer water resource use. & recharge. DEW&NR web site |  |
| Week 2 | * Soil formation and structure
* Sustainability of soil and water
 | * Practical investigation – soil structure, texture & organic carbon.
 | * Development of sustainable soil management in Agriculture.
 |  |  |
| Week 3 - 5 | * Availability and quality of global fresh water
* Recycling of stormwater and effluent water
 | * Field Investigation wetlands and water quality.
 | * SHE Investigation: catchment management and water.
 | Department of Environment, Water & Natural Resources | **AT 1 Field Investigation on wetlands.** |
| Week 6 - 7 | * Pollution of groundwater and waterways
 | * Field Investigation – local catchment area and creek study
 |  | KESAB Water Quality Local, State & commonwealth Government materials  | **AT 1: SHE Investigation** |
| 8 | * Effective use of energy resources
 | * Collaborative investigation – estimate individual & class ecological footprint.
 | * SHE investigation – identify ways to reduce our ecological footprint
* Understanding of the complex ways in which science interacts with society.
 | Web ecological Footprint calculators. |  |
| 9. | * Renewable and non-renewable energy resource use and sustainability.
 |  | * SHE investigation – impacts of introducing renewable energy to local ecosystems
 |  | **AT 2 Topics Test Earth’s Sustainable Future** |
| 10 | **Topic 4 Climate Change*** The Carbon cycle
* Geological time changes the Earth’s atmosphere
* Natural Greenhouse effect and greenhouse gases
 | * Practical Investigation: modelling the evolution of the Earth’s atmosphere
 | * Scientific discovery and Greenhouse. Society & Greenhouse.
* Stratospheric ozone as an example of the interaction of science and society.
 | Web downloadable diagrams.DVD Crude-The incredible Story of OilUnderstanding Science Web site |  |
| Term 3Week 1 | * Astronomical cycles and sunspot activity
* Tectonic influences on Climate
 | * Investigation: Glacial & Interglacial periods
 |  | NASA Web resources |  |
| 2 | * Oceans absorb large amounts of solar radiation
* Ocean circulation
* Shallow and deep water ocean currents
* Thermohaline circulation
 |  |  | Web Resources | **AT 2 Skills and Applications Task:****Oceans**  |
| 3 | * Human activities and climate
* Enhanced greenhouse effect
 | * Investigation:
 |  | Web Resources |  |
| 4 | * Effects of climate change on Earth Systems
 | * Investigation: Modelling the Earth’s Energy balance
 | * SHE Investigation: Managing the health effects of climate change
 |  |  |
| 5 | Earth Systems study | * Design Earth Systems Study
 |  |  | **AT 3 Earth Systems Study**: Individual research question and plan for due |
| 6 | Earth Systems study | * Conduct Earth Systems Study\*
 |  |  | **Earth Systems study:** Design and risk assessment for due |
| 7 | Earth Systems study | * Analyse data and complete report
 |  |  |  |
| 8 | * Evidence for climate change
* Climate proxies
 | * Practical investigation: climatic analysis using foraminifera
* Practical investigation: oxygen isotopes – a proxy for sea surface temperatures
 |  | Web Resources |  |
| 9 | * Models for predicting climate change
* Local, national and international responses to climate change
 | * Prepare for Earth Systems Study
 | * SHE Investigation: Paris and the IPCC
 | UN Framework on climate Change Website | **External Earth Systems Study Due**. |
| 10 | Prep for oral presentation on climate change |  |  |  |  |
| Term 4Week 1 |  |  |  |  |  |
| Week 2 |  |  |  |  | **AT 2 Skills and Applications Task:****Climate change Presentation**  |

Adelaide Brighton Cement

<http://adbri.com.au/-/adbri/lib/pdfs-archived/2011/ar/ar2010_sustainability.pdf>

<http://www.adelaidebrighton.com.au/about-us/environment>

Pumped hydro for energy storage

<https://www.studentenergy.org/topics/hydro-power?gclid=COuSqdSY-tECFYKYvAodM7EFtQ>

<http://reneweconomy.com.au/no-batteries-needed-pumped-hydro-for-energy-storage-79785/>

Australian Government Education for a sustainable future

<https://www.environment.gov.au/system/files/resources/1b93d012-6dfb-4ceb-a37f-209a27dca0e0/files/sustainable-future.pdf>

Ecological Footprint

<http://www.arburypark.sa.edu.au/docs/ecological_footprint_poster.pdf>

[file:///C:/Users/default.D0908/Downloads/Addressing-Your-Classrooms-Carbon-Footprint-Teacher-Resource-Pack%20(1).pdf](file:///C%3A/Users/default.D0908/Downloads/Addressing-Your-Classrooms-Carbon-Footprint-Teacher-Resource-Pack%20%281%29.pdf)

WWW Calculator

<http://www.wwf.org.au/get-involved/change-the-way-you-live/ecological-footprint-calculator#gs.b7B4D7o>

NASA The Sun Spot Cycle

<https://solarscience.msfc.nasa.gov/SunspotCycle.shtml>

Climate Change & oceans

<https://www.esr.org/outreach/climate_change/basics/basics2.html>

Earth Observatory NASA Solar radiation & climate experiment.

<http://earthobservatory.nasa.gov/Features/SORCE/sorce_02.php>

Climate Change

<http://www.climateinstitute.org.au/?gclid=CLilm7XT_NECFQqavAodNngDpA>

<http://www.ucsusa.org/global_warming/science_and_impacts/science/scientific-consensus-on.html#.WJkMMLJ97cs>

Climate Change controversy

<https://en.wikipedia.org/wiki/Global_warming_controversy>