



Tocal Virtual Farm

and the 2023 Technology 7-8 syllabus

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Information for teachers

Tocal is a 2200-hectare property in the NSW Hunter Valley managed by the NSW Department of Primary Industries and Regional Development. Farm enterprises on Tocal include commercial dairy, beef, egg, honey, stock horse and sheep.

We are fortunate to have access to a great deal of information about the property which we used to create the Tocal Virtual Farm. The combination of production data, spatial data and virtual reality 360 videos gives students virtual access to the Tocal farm.

Syllabus context – Agriculture and Food Technologies

The Tocal Virtual Farm provides students with detailed and immersive experiences of commercial beef, dairy and egg production as well as horse and sheep breeding enterprise, providing a context for completing the agricultural outcomes in the Agriculture and Food Technologies component.

The work that students put into this component of the syllabus can be used as a basis for completing the food technologies outcomes. For example, if students investigate the possibility of growing citrus fruit on Tocal they can then look at the nutritional value of that fruit, the impact on nutrition of cooking the fruit, and also how to change a cake recipe to contain less sugar.

Digital technologies outcomes can be delivered in combination with this project. For example if students were to propose an aquaponics enterprise on Tocal they can look at the food technologies outcomes as they have in the citrus example. They can also go on to plan, build, code and test the reticulation system.

Resource description

This workbook includes an investigation of agriculture on Tocal and can be completed using the [Tocal Virtual Farm](#).

Field work

The site investigation activities are very similar to the workbook that students complete when they visit the property for field work.

If you have access to another property or rural area near your school, you could complete activities like the site sketches in the field however they are easily completed by moving around or zooming in on the aerial imagery.

To add value to your students' learning you could also complete the soils and water testing activities that are marked as optional in the workbook.

Completing the mapping exercise

The mapping exercise can be completed on a number of platforms using the Tocal Virtual Farm.

ESRI have made ArcGIS available for educational use so you can request a free licence for this purpose. Students will need to set up an account.

ESRI ArcGIS for schools <https://esriaustralia.com.au/gis-for-schools>

Google MyMaps is another option. Students will also need to create an account for this platform.

Google My Maps <https://www.google.com/maps/about/mymaps/>

Glossary

Term	Definition
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
Agriculture	The science or practice of farming, including cultivation of the soil for the growing of crops and the rearing of animals to provide food, fibre, fuel and other products.
Consumer	People who buy and use a product to satisfy their needs or wants, for example people buying fruit to consume or eat.
Economy	Financial measure of business success.
Enterprise	A business or company intended to create income – in this document we specifically mean an agricultural business.
Extensive agriculture	A type of farming characterised with growing animals or plants over large areas of land or at low stocking rates. Extensive farming systems characteristically have lower inputs of labour and feed and lower production per unit area, as compared to intensive agriculture systems.
Industry	Production activities associated with a particular product or range of products
Intensive agriculture	A type of farming characterised with growing animals or plants at high stocking rates and densities. Intensive farming systems characteristically have higher inputs of labour and feed and high production per unit area, as compared to extensive agriculture systems.
Irrigation	Irrigation is the artificial supply of water to soil and plants to increase growth.
Management	<i>Management</i> involves activities surrounding organising and co-ordinating a plan or strategy to accomplish an objective. Things that are managed or controlled in agricultural management are resources: money and finances, natural resources such as soil and water, technology, labour, animals and plants and humans.
NSW DPI	New South Wales Department of Primary Industries
Primary Industry	Industries including mining, agriculture and forestry, which are concerned with obtaining or providing natural raw materials for conversion into commodities and products for the consumer.
Product	
Producer	A person who produces goods, products or services. Farmers are producers.
Spatial data	Recording and conveying geographic data, including location or extent, of features within a location
Sustainability	An approach to farming which produces profitable high quality products without depleting or degrading the environment or natural resources, for example soil and water.
System	A set of units that interact, react and depend on themselves and the living and nonliving parts of an environment, for example a natural ecosystem. In agriculture a farm system consists of many interacting units such as plants, animals, climate, soil, weeds, pest and diseases and management practices which operate within a boundary.

Agricultural technologies design portfolio

View this thought-provoking video <https://www.youtube.com/watch?v=jxiYsgyn1yU>

Write down what you think the video is about:

.....

.....

.....

How does it make you feel about the future? Why?

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.....

Discuss your responses with the rest of the class. Did other people think like you?
Were there different ideas? Why could this be the case?

.....

.....

With this video in mind consider the following statistics about food security and the future of food production from the Food and Agriculture Organization of the United Nations (<http://www.fao.org/3/a-i6887e.pdf>).

- The World's population is expected to grow to 9.7 billion by 2050 (currently 7.5 billion). Check it right now here:
http://www.theworldcounts.com/counters/shocking_environmental_facts_and_statistics/world_population_clock_live
- Two thirds of the world is expected to live in urban areas.
- Climate change is a threat to cropping, livestock production and fisheries.

So what is going to need to change in the future? And who is part of the solution?

.....

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Where are we now?

View the ABARES website. <http://www.agriculture.gov.au/abares/>

How valuable is food and fibre production to Australia's economy? Consider both the economic value of the agricultural commodities and employment statistics.

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What are the most valuable industries?

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View the AgriFutures website <https://agrifutures.com.au/>

Identify some of the emerging trends in rural industries that AgriFutures are currently considering? Explain.

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If you have an interest in a particular industry, you can search the [Rural Research and Development Corporation](#) website for emerging trends and future predictions.

Do you think that food and fibre production is a future focussed career?

Will the demand for food and fibre continue into the future and are there technological innovations still to be designed in this industry? If your answer is yes to either of these, keep reading...

Consider the Tocal Virtual Farm

[<https://www.tocal.nsw.edu.au/farm-and-facilities/tocal-farms/tocal-virtual-farm-navigation>]

The property

Tocal covers 2200 hectares and contains a range of natural ecosystems from rainforest remnants and wetlands to dry sclerophyll forests.

Annual rainfall

Mean = 972 mm, Median = 749 mm.

Soils

Soils form a complex pattern across the property. This can be simplified by looking at the soil landscapes, that is the uplands or hills with erosional soil landscapes, the floodplain with alluvial (made up of materials left by rivers) soil landscapes, the midslopes with colluvial (loose earth accumulated at the base of a hill usually moved by gravity) soil landscapes and the vestigial soil landscapes that remain as evidence of volcanic activity. Each of the soils represents different production and management opportunities.

Beef

Beef cattle are run over an area of 1775 hectares, made up of prime pasture, medium pasture and poor pastures as well as bushland. The average herd size is 900 head – ranging between 700 and 1100 depending on the time of the year and seasonal conditions. The breeding herd averages 450 Brangus cows and one Angus, six Brangus, one Charolais and four Ultrablack bulls. Our main market is the sale of yearlings on local stores market – around 400 head per year.

Dairy

The Dairy covers an area of 328 hectares. The herd is 290 head (mainly Holstein Friesian) of which approximately 200 are milked twice daily. Our average weekly production is 52,000 litres/week.

The pasture on the dairy is Kikuyu based, oversown in early autumn with ryegrass, white clover and red clover with some chicory and plantain and fertilised with N+P+K regularly as well as selective use of nitrogen and poultry litter. Some paddocks are limed.

Eggs

Free-range eggs are produced under contract to Pace Farms on an area of 86 hectares. The hens are housed in five sheds covering an area of 8,762m². The sheds have the capacity to house 90,000 hens and we currently run Isa Brown hens. The hens have access to 15 hectares for free ranging.

Sheep

Total runs a self-replacing Dohne flock of 300 ewes on an area of 100 hectares. This is a demonstration flock used for student training. The flock produces over 1 tonne of wool per year as well as prime lambs. The sheep are guarded by a Maremma dog named Dunedoo.

Horses

Australian Stock Horses are bred at Tocal for student training and stock work. At any one stage Tocal will have over one hundred horses on the property from young foals, yearlings, breakers, work plant horses and broodmares. Foaling begins around August and the foals are weaned and handled at 5 months.

Property details

Property Name	
Location	
Owners / managers	

History

(see the [People on Tocal StoryMap](#))

Total is on the lands of which Aboriginal people/s?

.....

Why was Tocal such a valuable location for them?

.....

.....

Who was the first land grant given to? And how much land was granted?

.....

How did Tocal come to be an agricultural college run by the NSW government?

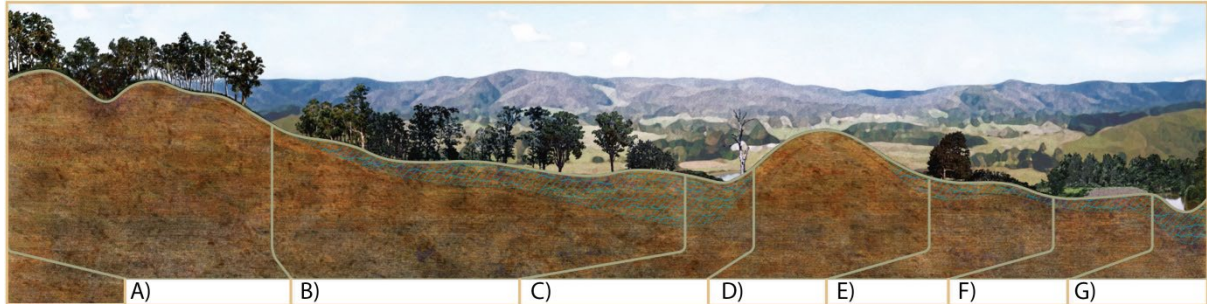
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Physical and biological resources on the farm

Landscapes

(see the [Topographic Landscapes on Tocal StoryMap](#))



Label the topographic landscapes of Tocal in the transect A)-G) and describe their landuse.

Landscapes

A.	.....
B.	.....
C.	.....
D.	.....
E.	.....
F.	.....
G.	.....

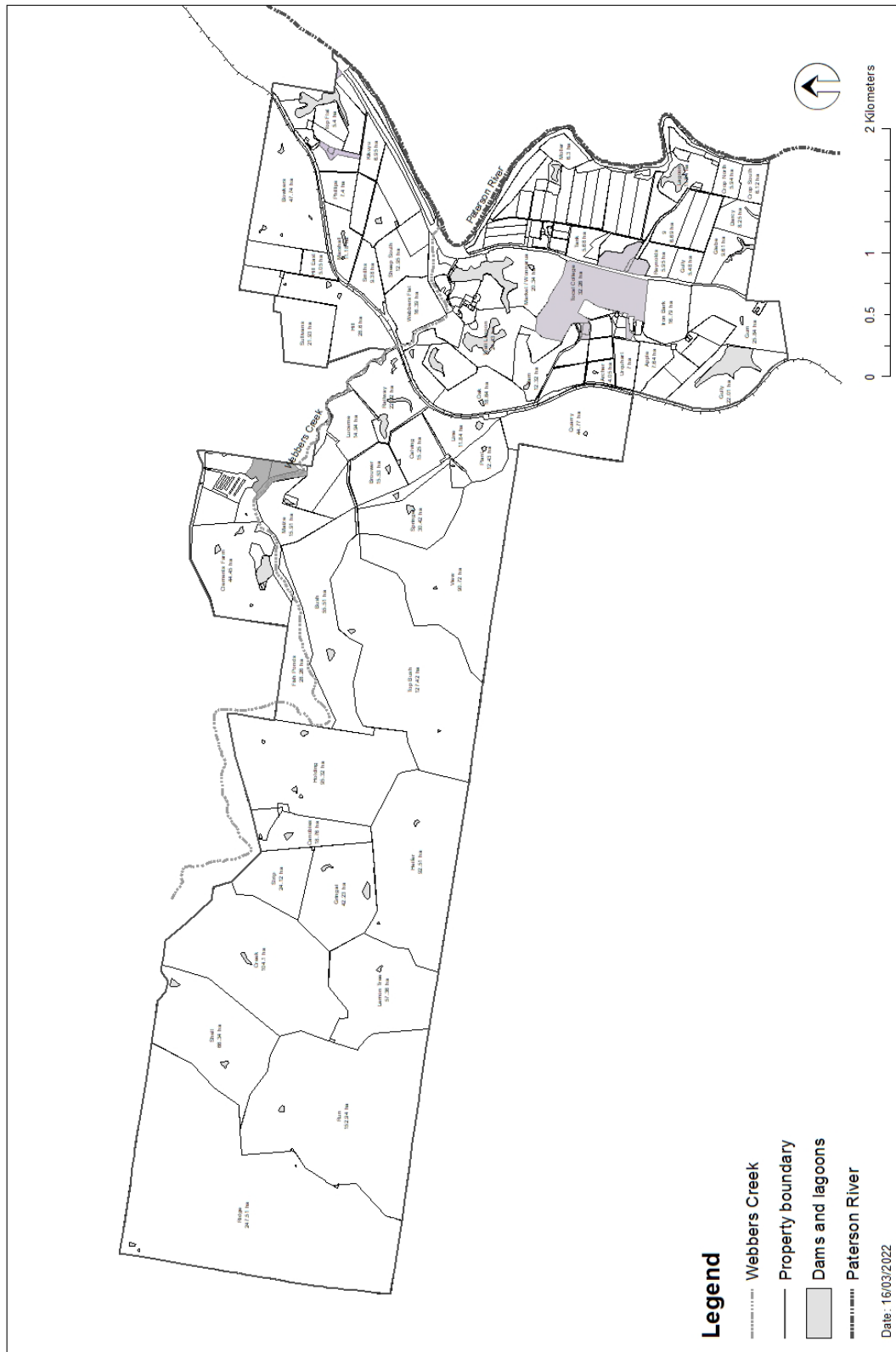
Landuse

A.	.....
B.	.....
C.	.....
D.	.....
E.	.....
F.	.....
G.	.....

Total property map

Indicate on the map where the different farm enterprises are run and the topographic landscapes. Include a key.

Total property



Enterprises

	Size	Production	Pasture/vegetation	Water	Infrastructure	Staff
Beef						
Dairy						
Eggs						
Sheep						
Horses						

This information is available in the story maps, the Tocal Property and Farms document and also the VR experiences available through our YouTube channel – all links available on

<https://www.tocal.nsw.edu.au/farm-and-facilities/tocal-farms/tocal-virtual-farm-navigation>

Site investigations

Using the [Tocal web map](#) choose three sites to investigate.

Click on a paddock and zoom into a site in that paddock.

Site/paddock name:

Date:

Paddock size:

Enterprise:

Slope (use the topographic landscapes to help you decide)

Can you see evidence of erosion? Yes No

Is water available? (can be seen on the aerial image) Yes No

How is it provided?

Dam River Trough

Is there irrigation in this paddock? Yes No

Notes:

.....

Site/paddock name:

Date:

Paddock size:

Enterprise:

Slope (use the topographic landscapes to help you decide)

Can you see evidence of erosion? Yes No

Is water available? (can be seen on the aerial image) Yes No

How is it provided?

Dam River Trough

Is there irrigation in this paddock? Yes No

Notes:

.....

Site/paddock name:

Date:.....

Paddock size:

Enterprise:

Slope (use the topographic landscapes to help you decide)

Can you see evidence of erosion? Yes No

Is water available? (can be seen on the aerial image) Yes No

How is it provided?

Dam River Trough

Is there irrigation in this paddock? Yes No

Notes:

.....

.....

.....

Sustainability(see the [Key Management Goals Story Map](#))

List the six categories that the key management goals fall under:

1.

2.

3.

4.

5.

6.

Why are the following factors important aspects of ecological management on farms?

Weather and Climate

.....

.....

.....

Soils

.....

.....

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Water

.....

.....

.....

Vegetation and weeds

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.....

Organisms – native and pest species

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.....

.....

Pollution control

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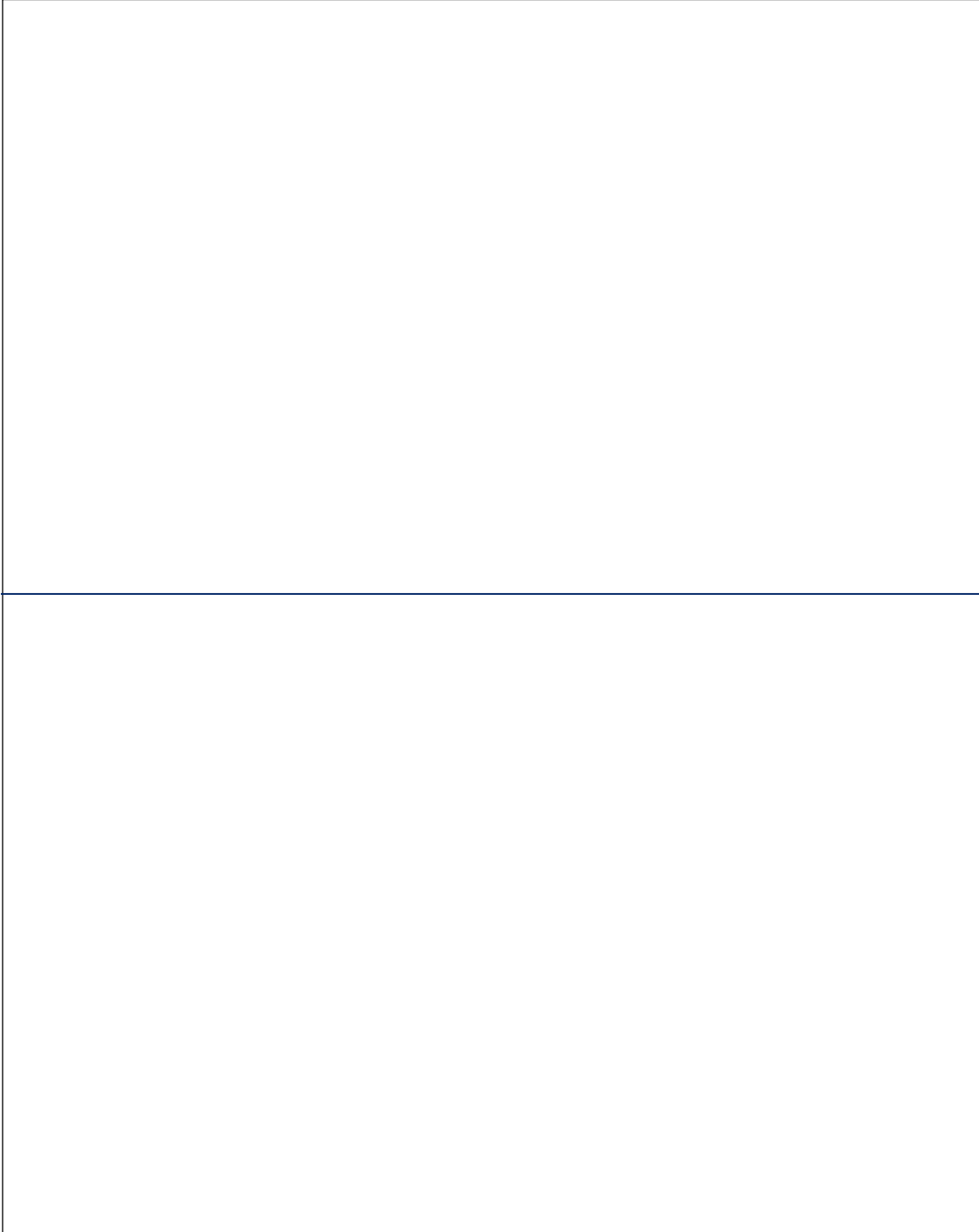
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What are the potential sources of pollution?

- | | |
|---------|---------|
| 1. | 4. |
| 2. | 5. |
| 3. | |

Site sketch

Draw a comparison between two different sites that you can see on the aerial imagery. You may choose to compare a site with high levels of infrastructure with a farm landscape or compare the dairy landscape to an area at the back of the property that is closer to a natural state.

A large rectangular box divided into two horizontal sections, intended for a site sketch. The top section is approximately 50% of the total height, and the bottom section is the remaining 50%. The box is empty, with only a thin black border.

Label the sites and annotate your sketch with notes about the different features on the sites.

Reflection:

What surprised you in your investigation of the Tocal farms and why?

What's the most important thing you learned from this activity and why do you think so?

What do you want/need to learn more about and how will you do it?

Soils (optional activity)

Site name: Date and Time

.....

	Poor	Fair	Good
pH	pH5 or lower	pH 5.5	pH 6 to 7
Ground cover	Less than 50%	50-75%	More than 75%
Infiltration	More than 7 minutes	3 to 7 minutes	Less than 3 minutes
Compaction	Wire probe will not penetrate	Wire probe penetrates to less than 20cm	Wire probe easily penetrates to 20cm

Colour of surface layer: subsoil:

Texture of soil: subsoil:

Comments and Observations:

.....

.....

Water quality (optional activity)

Site name: Date and Time

Last rainfall: within 24 hrs 1-7 days more than 7 days

Type of rainfall: light medium heavy

Test results:

Air temperature	
Water temperature	

	Poor	Good	Ideal	Good	Poor
pH	<6	6-7	7	7-8	>8

	Poor	Fair	Good	Very good
Salinity ($\mu\text{S}/\text{cm}$)	>800	400 - 800	<400	
Turbidity (NTU)	>30	15-30		≤ 10
Available phosphate (mg/L)	≥ 0.45	0.15 - <0.045	0.06 - <0.15	<0.06

Comments and Observations:

.....

.....

Technology in farming

Research three new innovations in agriculture and describe how they are helping to make farming more efficient.

Device / innovation:

.....

How does it make farming more efficient and/or sustainable?

.....

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Device / innovation:

.....

How does it make farming more efficient and/or sustainable?

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Device / innovation:

.....

How does it make farming more efficient and/or sustainable?

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Alternative enterprises for Tocal

Your job now is to identify four new options for food or fibre production on Tocal. You should include two emerging industries like hemp or pomegranate production or a staple product with long term industry acceptance like rice or wheat (look further afield than just these four there are many more alternatives).

Research the growing requirements for the products, what does it need in terms of soil, water, climate, equipment and personnel. Consider also the possible social licence issues associated with the industry. Tocal is quite close to Paterson and rural community of approximately 350 people and is surrounded by many small rural landholders. Consider whether the enterprise you are researching is likely to cause conflict with surrounding residents.

The NSW Department of Primary Industries provides information about gaining approval for intensive industries as well as a guide to which enterprises may need approval from Council. (<https://www.dpi.nsw.gov.au/agriculture/lup/development-assessment>).

Tocal includes land in both Dungog Shire Council and the Maitland City Council so you may need to check both of their websites as well.

What are the four enterprises you will research?

1.
2.
3.
4.

Record your findings on the following pages.

Enterprise 1:

Growing requirements

Soil:

.....

.....

Is this the same as the soil on Tocal? Yes No

Water:

.....

.....

.....

Available on Tocal? Yes No

Would it involve irrigation? This could limit where it can be produced. Yes No

Climate (rainfall, temperature, frost resistance etc):

.....

.....

.....

Does Tocal have a suitable climate? Yes No

Topography (slope, aspect etc):

.....

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Does Tocal have a suitable area? Yes No

Equipment / Personnel:

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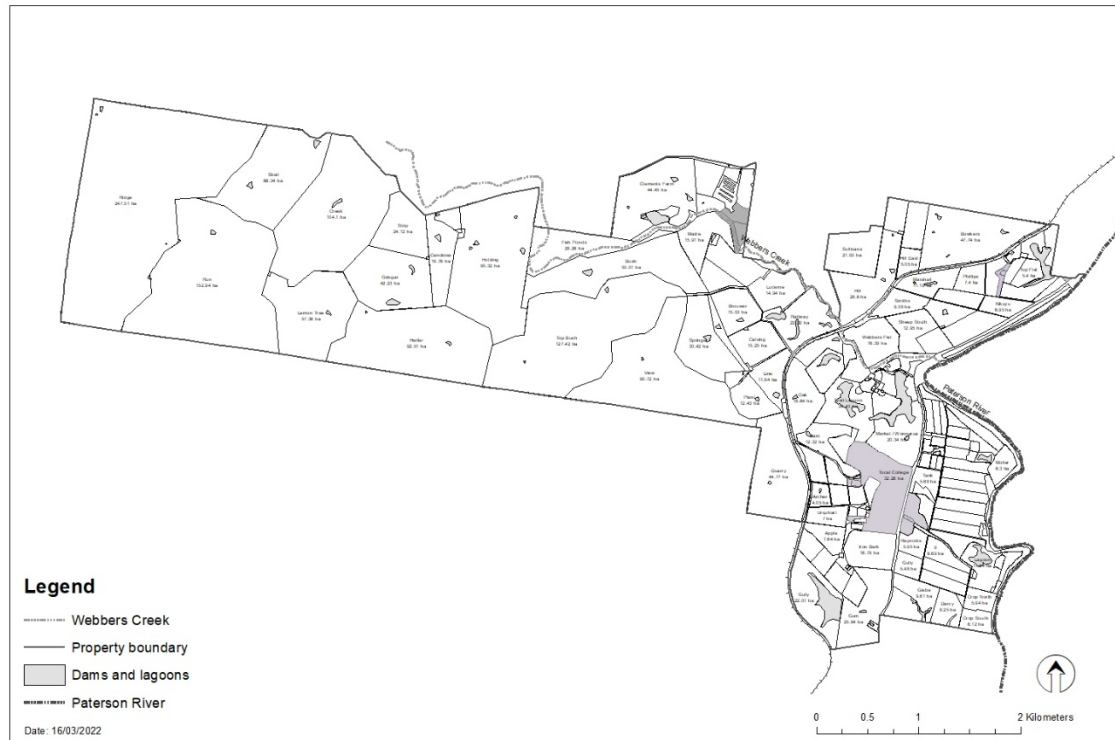
.....

Available on Tocal? Yes No

Is there a suitable site for it on Tocal? Yes No

If yes, mark it on this map

Tocal property



Does you need to gain approval to produce this on Tocal? Yes No

Who from?

.....

Is it an option for an alternative enterprise on Tocal? Yes No

Enterprise 2:

Growing requirements

Soil:

.....

.....

Is this the same as the soil on Tocal? Yes No

Water:

.....

.....

.....

Available on Tocal? Yes No

Would it involve irrigation? This could limit where it can be produced. Yes No

Climate (rainfall, temperature, frost resistance etc):

.....

.....

.....

Does Tocal have a suitable climate? Yes No

Topography (slope, aspect etc):

.....

.....

.....

Does Tocal have a suitable area? Yes No

Equipment / Personnel:

.....

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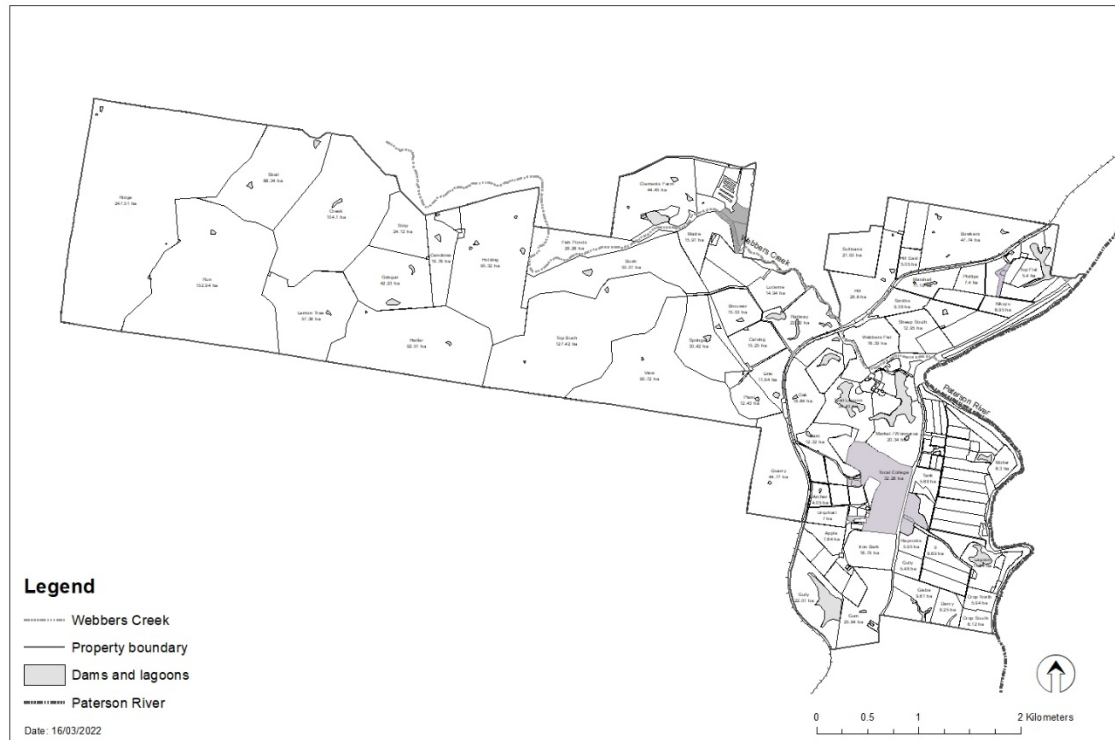
.....

Available on Tocal? Yes No

Is there a suitable site for it on Tocal? Yes No

If yes, mark it on this map

Tocal property



Does you need to gain approval to produce this on Tocal? Yes No

Who from?

.....

Is it an option for an alternative enterprise on Tocal? Yes No

Enterprise 3:

Growing requirements

Soil:

.....

.....

Is this the same as the soil on Tocal? Yes No

Water:

.....

.....

.....

Available on Tocal? Yes No

Would it involve irrigation? This could limit where it can be produced. Yes No

Climate (rainfall, temperature, frost resistance etc):

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Does Tocal have a suitable climate? Yes No

Topography (slope, aspect etc):

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Does Tocal have a suitable area? Yes No

Equipment / Personnel:

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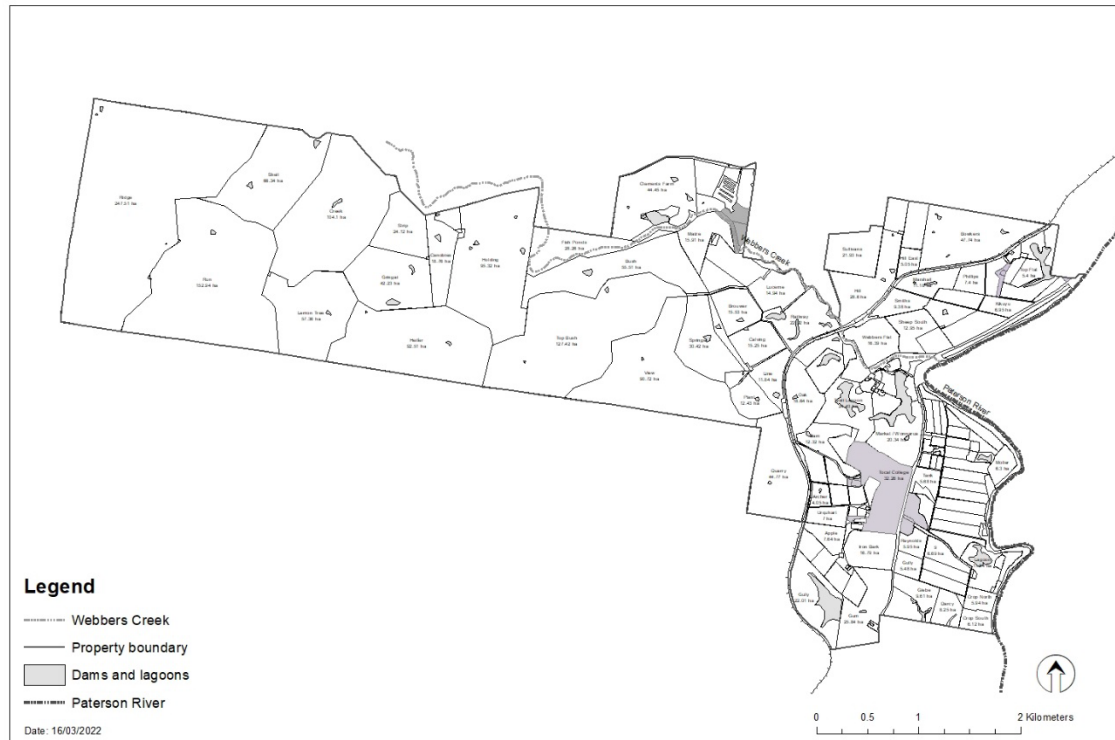
.....

Available on Tocal? Yes No

Is there a suitable site for it on Tocal? Yes No

If yes, mark it on this map

Tocal property



Does you need to gain approval to produce this on Tocal? Yes No

Who from?

.....

Is it an option for an alternative enterprise on Tocal? Yes No

Enterprise 4:

Growing requirements

Soil:

.....

.....

Is this the same as the soil on Tocal? Yes No

Water:

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Available on Tocal? Yes No

Would it involve irrigation? This could limit where it can be produced. Yes No

Climate (rainfall, temperature, frost resistance etc):

.....

.....

.....

Does Tocal have a suitable climate? Yes No

Topography (slope, aspect etc):

.....

.....

.....

Does Tocal have a suitable area? Yes No

Equipment / Personnel:

.....

.....

.....

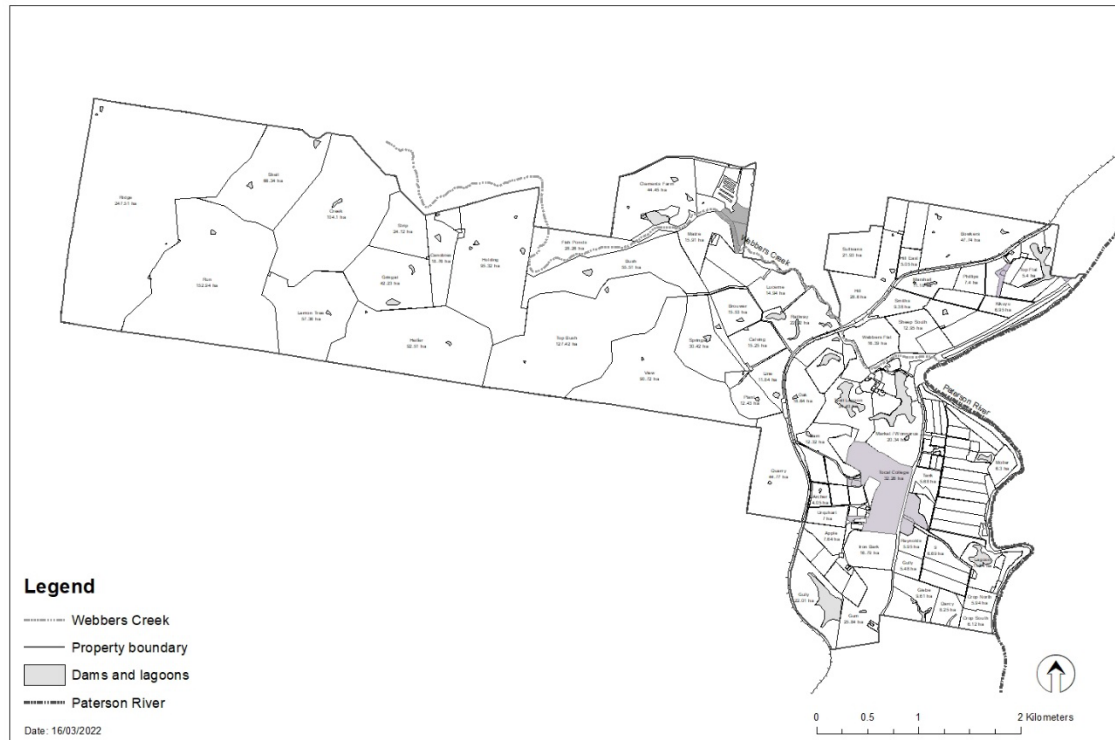
.....

Available on Tocal? Yes No

Is there a suitable site for it on Tocal? Yes No

If yes, mark it on this map

Tocal property



Does you need to gain approval to produce this on Tocal? Yes No

Who from?

.....

Is it an option for an alternative enterprise on Tocal? Yes No

Once you have completed your research choose one of the enterprises to pursue.

If none of the products you investigated are suitable you will need to consult with other students to choose an appropriate alternative.

Decision:

Is there an available space for it? How do you know?

Contact the organiser of a local or school garden or public space to see what process they follow when they would like to make changes to the space. Is there a committee that discusses these? What factors do they take into consideration?

Notes from discussion:

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Who would you need to discuss this with if you decided you wanted to try your new enterprise on Tocal? See the People section of the Tocal Property and Farm document.

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Assuming you have negotiated with staff and gained approval to develop this new enterprise on Tocal you now need to plan for its establishment and what is required to ensure its success.

What will need to be done to the site to ensure success?

Are there any earthworks required? Do you need to install any infrastructure? eg irrigation, sheds, stock yards, fencing

How is the product harvested and sold/distributed?

What equipment or connections with other businesses are required?

Sketch a plan of the site



Map your enterprise

Using mapping software that is available in your school or one of the online mapping platforms (including Google My Maps or ESRI Story Maps) map your enterprise on a map of Tocal. The boundary and paddock layers, amongst others, are available to download from <https://www.tocal.nsw.edu.au/farm-and-facilities/tocal-farms/tocal-virtual-farm-navigation>.

Include notes about the suitability of the site and any preparation works that are required on the map.

Provide a link to your map here:

Note: you will need to either make it public or share your map with your teacher to enable them to view and assess it.

Calendar of operations

To complete the planning process consider the first twelve months of your new enterprise, what will need to be done? eg if you are planning fruit trees what do they require throughout the year? You may need to prune or fertilise the trees. At what stage will you plant them? If you plant young (tubestock) how long will it be before you can expect fruit? If you plant mature trees, how much more money will the establishment cost be?

Plan the next twelve months on the calendar. For longer term production you need to plan further than establishment in the first 12 months so use the second calendar for what you will need to do throughout the year once the enterprise is established and productive (give an indication of which year that will be eg citrus fruit may not production fruit for five years so the second calendar is year 5)

Year 1	Activities				
Month					
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

Year	Activities				
Month					
January					
February					
March					
April					
May					
June					
July					

August					
September					
October					
November					
December					

Evaluation:

What did you learn about agricultural industries and food and fibre production that you think everybody should know?

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What technologies are involved in this product and how is it changing the industry?

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Careers

What do you think the future holds for this industry?

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What skills do you think you would need to be able to run this enterprise successfully?

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Check out <http://www.careerharvest.com.au/> for more information about the skills and careers in agriculture.

Notes:

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Appendix

Syllabus content

Outcomes

TE4-SDP-01 explains relationships between sustainability, design and production

TE4-PDP-01 describes the practices and processes of designers and producers

TE4-PPM-01 applies processes in the planning, management and production of projects

TE4-DES-01 communicates and evaluates design ideas and solutions

Food and agricultural practices context

Identifying and defining food and agricultural practices

- Identify the characteristics and properties of food, fibre and agricultural products
- Describe food and agricultural industries in New South Wales
- Outline factors affecting the design of food and agricultural practices

Researching and planning ideas and solutions

- Investigate how Aboriginal and Torres Strait Islander Peoples select and use plants and animals to improve nutrition
- Compare Aboriginal and Torres Strait Islander Peoples' sustainable resource management practices with emerging agricultural practices
- Describe how food and agricultural products are grown, harvested, manufactured, packaged and distributed
- Investigate current and emerging technologies used to improve quality in production and distribution
- Explain social, ethical and legal considerations associated with food and agricultural production
- Investigate nutritional needs of individuals and groups with specific needs
- Describe community food initiatives used to contribute to sustainability
- Apply critical and creative thinking to assess ideas for quality food and/or agricultural solutions
- Create written texts to document food production processes and/or agricultural practices

Producing and implementing processes, solutions and projects

- Use equipment, tools, techniques, technologies and processes to develop practical skills
- Select food preparation techniques, production skills and/or agricultural practices to make solutions and projects
- Demonstrate safe practices when selecting and using tools, technologies and processes
- Document design processes when producing food and agricultural projects

Testing and evaluating food, tools, practices and technologies

- Work collaboratively to test, modify and improve food and/or agricultural products
- Evaluate how ingredient selection and preparation techniques enhance the nutritional value of food
- Explore agricultural practices to assess the impact of changing conditions, improve the quality of production and reduce waste
- Justify the selection of equipment, tools, technologies and processes when developing food and/or agricultural solutions
- Use factors affecting design to evaluate the quality of food and/or agricultural solutions