The Alpine Fault and Our Active Faults

Geography 1.1 Demonstrate understanding of the spatial distribution of a phenomenon and its impacts on place

Ākonga Workbook : Internal Assessment 91932

Name: .....

Class: .....

Internal Assessment Due Date: .....

Toka Tū Ake EQC

AF8 ALPINE FAULT MAGNITUDE 8

Acknowledgements

This NCEA Geography Level 1 Resource, *The Alpine Fault and Our Active Faults* has been co-designed by the AF8 Programme and Illuminate Science with support from Toka Tū Ake EQC, Eagle Technology and kaiako from across New Zealand.

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AF8 [Alpine Fault magnitude 8] is a programme of scientific modelling, coordinated response planning, and community engagement, designed to build resilience to the next Alpine Fault earthquake. The AF8 Programme aims to share Alpine Fault hazard and impact science and preparedness information widely, through communication and engagement activities, to increase awareness, enable conversation and build societal preparedness to natural hazard events in Te Waipounamu our South Island.

af8.org.nz **@AlpineFault8**

Produced by the AF8 Programme and kindly sponsored by Toka Tū Ake EQC.

eqc.govt.nz/be-prepared/

Contents

Introduction

We will be exploring the **Alpine Fault and Our Active Faults** as part of Internal Assessment 91932.

This workbook will take you through everything you need to complete this assessment.

There are six sections, and we recommend completing each section as you go through the StoryMap.

- → Section 1: Plate Boundary
- → Section 2: Faults
- → Section 3: Risk
- → Section 4: Impacts
- → Section 5: Plan & Prepare

TOP TIP: We recommend using Google Chrome when accessing the StoryMap and creating your own.

You will also need a laptop or computer, internet access, access to the online StoryMap, this Workbook and your login to ArcGIS online.

Your teacher will set you up with a login and password for ArcGIS Online account:

URL: storymaps.arcgis.com

My ArcGIS username is: _____

Keep your password safe.

This is the account you will use to create your own StoryMap to complete this assessment.

Use the Ākonga StoryMap to complete Sections 1-5. This is information that may be useful for when you create your own StoryMap.

The Ākonga StoryMap can be found here: af8.org.nz/the-alpine-fault-and-our-active-faults

Assessment Outline

This Assessment requires ākonga to show understanding of the spatial distribution of active faults across the South Island of New Zealand.

TOP TIP: Mark your own work against the assessment schedule and check to see if you are missing any information before you submit your assessment.

What to do

You are going to create a StoryMap using ArcGIS to show your understanding of the spatial distribution of active faults across the South Island of New Zealand including:

- → where they are
- → why they are there
- → the impact of them being there.

Use the following structure to produce your presentation. You must use relevant evidence, including geographic terminology, that develops the analysis throughout your presentation.

Begin with a description of the spatial distribution of the phenomena within te taiao.

Next, use and include an annotated diagram, map, or another type of visual to explain the factors or processes contributing to the spatial distribution of the phenomena within te taiao and their impacts.

Finish your presentation with some analysis on the spatial distribution of the phenomena by making judgements about the significance of the impacts that active faults have within the South Island.

Remember to use relevant evidence, including geographic terminology, so that it develops your analysis throughout your presentation.

How to present your learning

You will create a StoryMap using maps, images and text (within 750 to 800 words) to show what you learned through exploration.

Timeframe

Your kaiako will provide details of the duration, the checkpoints, and the submission date for the final assessment

Assessment Schedule

This shows you how you will be assessed on your work to gain Achieved, Merit or Excellence credits.

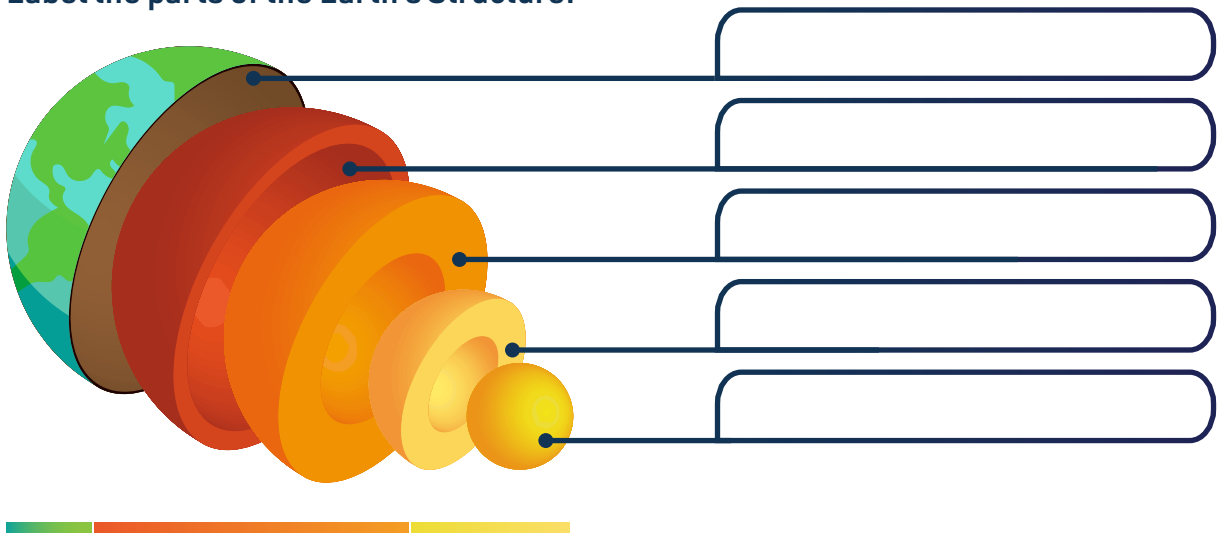
	Achievement	Achievement with Merit	Achievement with Excellence
Achievement Criteria	Demonstrate understanding of the spatial distribution of a phenomenon and its impacts on place	Explain the spatial distribution of a phenomenon and its impacts on place	Analyse the spatial distribution of a phenomenon and its impacts on place
Teacher judgements	The ākonga is able to: → describe the spatial distribution of active faults across the South Island. → describe factors or processes, or a combination of both, that contribute to the spatial distribution of active faults across the South Island. → describe impacts of the phenomenon on the South Island. → include relevant evidence and geographic terminology in the descriptions.	The ākonga is able to: → explain the factors or processes, or a combination of both, that contribute to the spatial distribution of active faults across the South Island. → explain the impacts of the active faults on the South Island. → use evidence and geographic terminology to support the explanation.	The ākonga is able to: → examine factors or processes, or a combination of both, that contribute to the spatial distribution of active faults across the South Island. → make judgements about the significance of impacts of the phenomenon on South Island. → use evidence and geographic terminology to develop the explanation.
For example (description of possible student response to this activity)	The ākonga has: → described the spatial distribution of active faults across the South Island. → used geographic terms or distance and proximity to other features. This may include a description of the spatial distribution of the active faults that run mostly parallel to plate boundary. → described different factors that contribute to the spatial distribution of active faults within the South Island. This may include a description of the plate boundary. → described the impacts of active faults within the South Island such as increased earthquake risk from the Alpine Fault included evidence in the description.	The ākonga has: → explained factors that contribute to the spatial distribution of active faults in the South Island. For example: *explained that spatial distribution of the active faults in the South Island is due to the movement of plate boundary and weaknesses in the earth's crust.* → explained the impacts of active faults on the South Island. For example: *explained that active faults produce earthquakes and there is a potential for a large earthquake on the Alpine Fault that could cause, no power, no phone or internet, and mean some residents may not be able to get home or have to evacuate.* → used relevant evidence and geographic terminology that supports the explanation.	The ākonga has: → examined processes that contribute to the spatial distribution of active faults across the South Island. For example: *examined how some faults are surface faults whereas other faults are buried beneath the surface of the earth.* → made judgments about the significance of the impacts of active faults within the South Island. For example: *made the judgement that the earthquake risk from the Alpine Fault is significant giving the likelihood of a future earthquake and the potential range of impact it will have on te taio and that communities need to plan and prepare to manage the future impacts of an Alpine fault earthquake.* → used relevant evidence and geographic terminology that develops the analysis

Overall level of achievement will be based on a holistic examination of the evidence provided against the criteria in the Achievement Standard

Section 1: Plate Boundary

The Earth's Structure

Label the parts of the Earth's Structure:



DID YOU KNOW?

The Earth's crust is also called the lithosphere, and tectonic plates are sometimes called lithospheric plates. Where two plates meet each other, stress builds up overtime. This stress is eventually released in the form of an earthquake.

Our Plate Boundary

Which of these plates is subducting near the East Coast of the North Island? *(circle one)*

Australian Plate Pacific Plate

Which of these plates is subducting near the South-West Coast of the South Island? *(circle one)*

Australian Plate Pacific Plate

Where in New Zealand can you put your finger on the plate boundary?

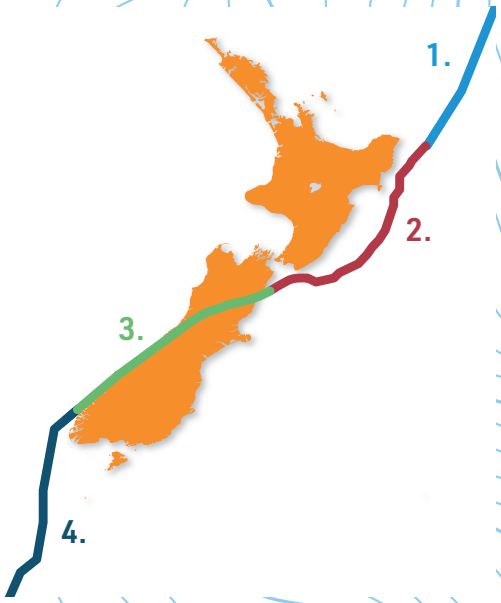
What are the common names for these sections of the plate boundary?

1.

2.

3.

4.



Answer Questions 1-2 using about 50 words. Then describe how you could visualise your answer.

Plate boundary	Text	Visual e.g.. photo, graphic, video or map.
Q1. What are faults?		
Q2. Why do we have faults in New Zealand?		

TOP TIP: Make sure you mention the processes that cause faults in your answer.

Section 2: Faults

A variety of faults

Faults vary in?

1. _____
2. _____
3. _____

What is a buried fault?

_____

_____

_____

What is a surface fault?

_____

_____

_____

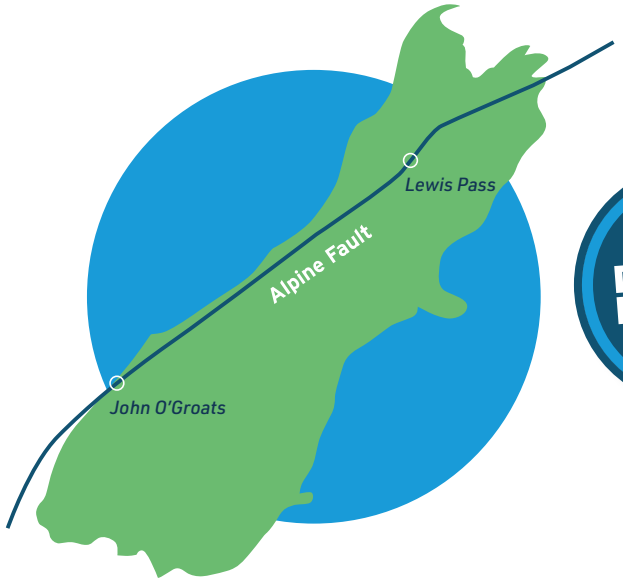
Active faults

What is an active fault?

_____

_____

_____



DID YOU KNOW?

The John o'Groats River was named after the 'Milford Sound Hermit' Donald Sutherland, a Scottish man who travelled from Europe to explore and never left, accompanied by his little dog – John o'Groats!

The Alpine Fault

How much longer is the Alpine Fault than the Greendale Fault?

_____

The straightest part of the Alpine Fault measures _____ from the Lewis Pass in the north to John o'Groats in the south.

Scientists have mapped all the active faults in New Zealand. Where can you see a map of these active faults?

_____

_____

_____

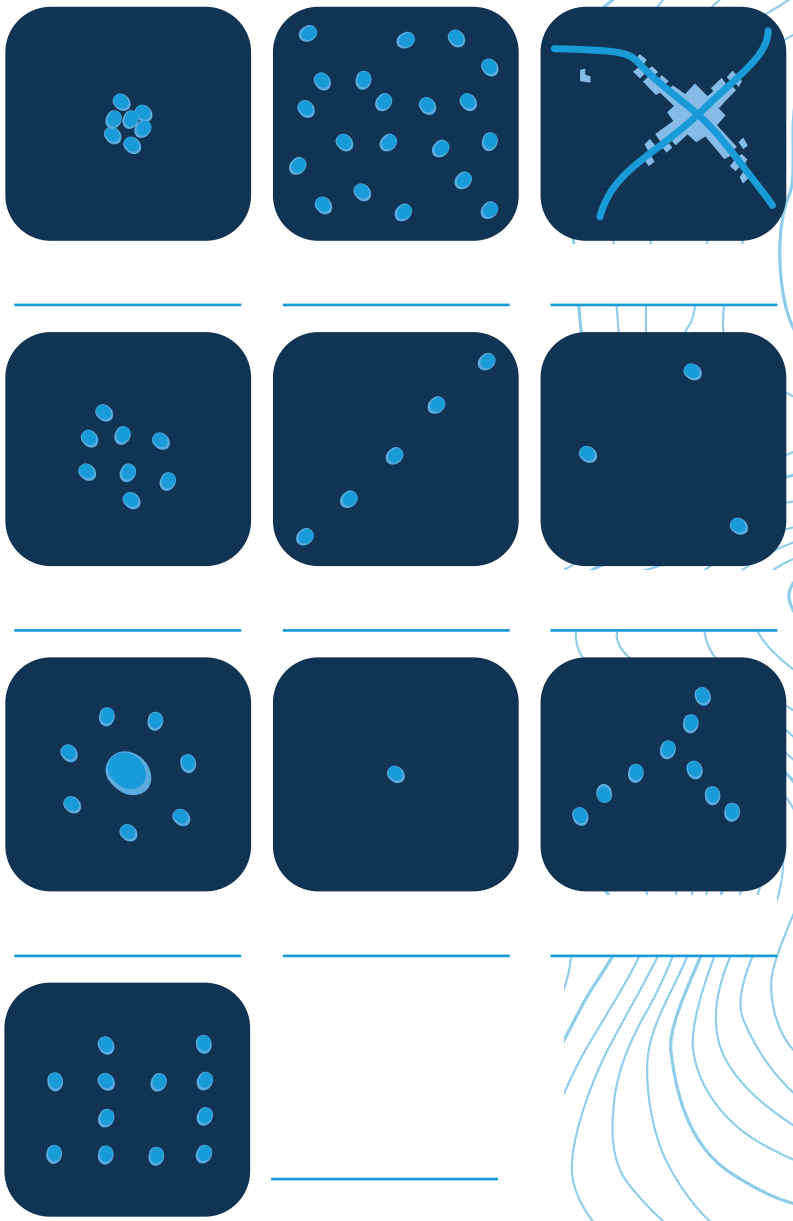
Spatial distribution

Which fault is closest to where you live?

Match the word with the description of the pattern.

Linear	Features appear to originate from a point
Random	Features are likely to occur at any location
Peripheral	Features collect around a central point
Nucleated	Dense arrangement of features
Dispersed	Features appear in a line
Clustered	Features are in parallel lines
Sparse	Many of the same features are concentrated close together
Radial	Features are around the outside
Grid	Few features in the same area
Concentrated	Features are quite far away from each other

Label each pattern with the correct geography term



Alpine Fault earthquakes

What is the name given to the period of time between earthquakes?

What is the average time period between earthquakes on the Alpine Fault? *(circle one)*

90 *yrs* **140** *yrs* **170** *yrs* **200** *yrs* **290** *yrs* **500** *yrs*

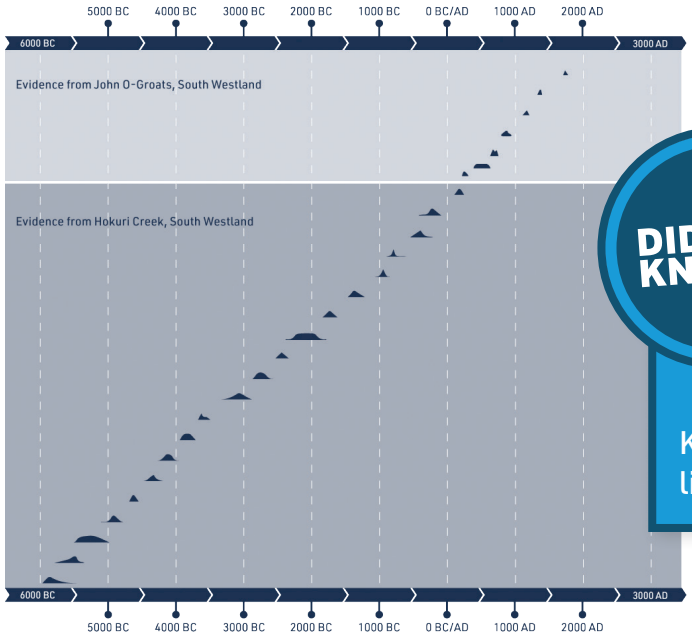
Roughly how long ago was the last 'Great Earthquake' on the Alpine Fault? *(circle one)*

90 *yrs* **140** *yrs* **170** *yrs* **200** *yrs* **290** *yrs* **300** *yrs*

Which fault is more likely to rupture next?

Circle the answer that best fits.

The fault closest to you **The Alpine Fault**



DID YOU KNOW?

Did you know: the Kaikōura 7.8 magnitude earthquake lifted the seabed by up to 2 metres in places along a 20 kilometre stretch of the Kaikōura Coast, and in one place lifted the land by 5.5 metres!

Why do you think this fault is more likely to rupture next?

Evidence of earthquakes

Sediment is studied to identify where earthquakes have occurred, and radiocarbon dating tells us exactly when they occurred.

What else do scientists look for to tell them what the environment was like at the time of these earthquakes?

What is the name given to the testing method that scientists use to work out how long ago an earthquake happened?

What do scientists look for in sediment layers when they want to test for dates and times of earthquakes?

Answer Questions 3-7 using around 150 words. Then describe how you could visualise your answer.

Faults	Text	Visual e.g.. photo, graphic, video or map.
Q3. What is the spatial distribution of active faults across the South Island?		
Q4. What are the processes or factors that have caused this spatial distribution?		

Faults	Text	Visual e.g.. photo, graphic, video or map.
Q5. How do we know where active faults are located?		
Q6. Why do we want to know where faults are located?		
Q7. What is the difference between a buried fault and a surface fault?		

Section 3: Risk

Earthquake Anatomy

On average how many earthquakes are recorded every year in Aotearoa New Zealand?
(circle one)

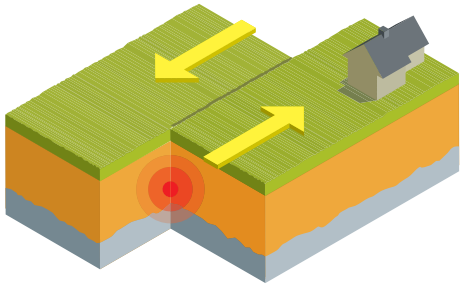
1,500 5,000 15,000 20,000 35,000

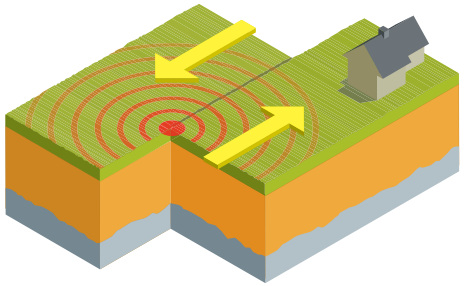
The location an earthquake first reaches the surface is called the?

_____

Earthquakes can begin at different depths underground. The point underground where the earthquake begins is called the?

_____





DID YOU KNOW?

On average, GeoNet record 50-80 earthquakes every day across Aotearoa New Zealand!

Thankfully you won't have felt them all due to a few different factors, that we'll explore here.

Measuring Magnitude

Magnitude measures the _____ released at the source of the earthquake. And helps us to understand the size of an earthquake.

The magnitude scale is logarithmic.

This means each level of magnitude up the scale releases _____ times more energy than the last.

How much more energy would a magnitude 7.1 earthquake releases than a 6.3 earthquake?

_____

How much more energy would a magnitude 8 earthquake releases than a 6.3 earthquake?

_____

FILL IN THE BLANK

A magnitude **6** earthquake releases ☐ times more energy than a magnitude **5**

Shaking Intensity

Intensity measures the _____ of shaking produced by the earthquake at a certain location.

We measure earthquake intensity using the MMI Scale. What does MMI stand for?

M_____ M_____ I_____

The higher the number on the MMI Scale the _____ intense the shaking is in that location.

What are the four key factors that impact how we feel an earthquake? *(circle four)*

01	MMI 1 : Imperceptible
02	MMI 2 : Scarcely felt
03	MMI 3 : Weak
04	MMI 4 : Largely observed
05	MMI 5 : Strong
06	MMI 6 : Slightly damaging
07	MMI 7 : Damaging
08	MMI 8 : Heavily damaging
09	MMI 9 : Destructive
10	MMI 10 : Very destructive
11	MMI 11 : Devastating
12	MMI 12 : Completely devastating

DID YOU KNOW?

Did you know you can help GeoNet work out the intensity of an earthquake you feel?

Go to: felt.geonet.org.nz/ or download the app to your phone.

Answer Questions 8-11 using around 200 words. Then describe how you could visualise your answer.

Risk	Text	Visual e.g.. photo, graphic, video or map.
Q8. What cities and towns in New Zealand are located near active faults?		
Q9. What active faults are near where you live?		
Q10. What is the likelihood of an Alpine Fault earthquake occurring in the next fifty years?		
Q11. What level intensity of shaking would be experienced across the South Island in an Alpine Fault earthquake of magnitude 8?		

Section 4: Impacts

TOP TIP: Impacts can be positive or negative.

Q12. How would your community be affected?

Think about the timeline of events of how you or someone in the South Island could experience an Alpine Fault earthquake in your answer.

Ngā taiao	Short Term	Long Term
a) Built – our homes, school, businesses, our power, water and phone infrastructure networks.		
b) Natural– our mountains, hills, rivers and land.		

Ngā taiao	Short Term	Long Term
c) Economic – our savings and investments		
d) Social– our families, friends and communities		

Answer Question 13 using around 50 words. Then describe how you could visualise your answer.

Impacts	Text	Visual e.g.. photo, graphic, video or map.
Q13. Why is the distribution of active faults significant within the South Island?		

Section 5: Plan & Prepare

Planning ahead

Name one action you could do before an earthquake occurs to prepare for these impacts?

1 _____

_____

_____

_____

1 _____

_____

_____

_____

1 _____

_____

_____

_____

1 _____

_____

_____

_____

1 _____

_____

_____

_____

1 _____

_____

_____

_____

DID YOU KNOW?

For more information on how to plan ahead, visit:

getready.govt.nz/en/prepared/household/make-a-plan/

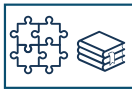
DID YOU KNOW?

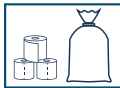
Use this interactive game to work out what you should have in your own emergency grab bag:

www.ready.gov/kids/games/data/bak-english/index.html

STEP ONE: If you could only have 12 items in your emergency kit what would they be? Rank your top 1-12 items in the square shape

STEP TWO: In the circle shape, note any items you could put in your own grab bag with a "G" here.

	A list of emergency phone numbers and contacts	☐ ○
	A copy of your Household Emergency Plan	☐ ○
	Toothbrush, toothpaste and soap	☐ ○
	Tub for washing clothes and dishes	☐ ○
	Dish washing + laundry soap	☐ ○
	Prescription medicines for each family member	☐ ○
	Phone chargers and extra battery packs	☐ ○
	Warm + waterproof clothing, and sturdy shoes	☐ ○
	Non-perishable food (e.g. dried fruit, Marmite and peanut butter)	☐ ○
	Cash	☐ ○
	Books, games, puzzles or other fun things to do	☐ ○
	Sports equipment: bat and ball, rugby or soccer ball etc.	☐ ○

	Rubbish bags for waste	☐ ○
	Water for drinking, washing + cooking, (7 days worth)	☐ ○
	Play Station / Xbox	☐ ○
	Water purifying tablets	☐ ○
	Toilet paper + large rubbish bags for your emergency toilet	☐ ○
	A gas barbecue or camp stove to cook on	☐ ○
	Matches in a waterproof container	☐ ○
	Small flashlight or headlamp + extra batteries	☐ ○
	Tinned food and tin opener	☐ ○
	Hand-cranked or battery-powered radio, with extra batteries	☐ ○
	First aid kit	☐ ○
	Non-perishable lollies, snacks and sweet treats	☐ ○
	Pet and animal supplies: food, water, toys, bedding	☐ ○

Prepare your home, protect your whānau

Spot the difference! One of the homes to the left has been prepared to be safer in an earthquake, the other one hasn't.

Can you spot the 13 differences? Circle them when you find them. Keep a special eye out for the 11 household items that have been fixed or fastened to stop them for causing damage in an earthquake.

Now list 3 things you or your whānau could secure in you own home BEFORE an earthquake to make sure they don't cause damage when things start shaking:

1. _____

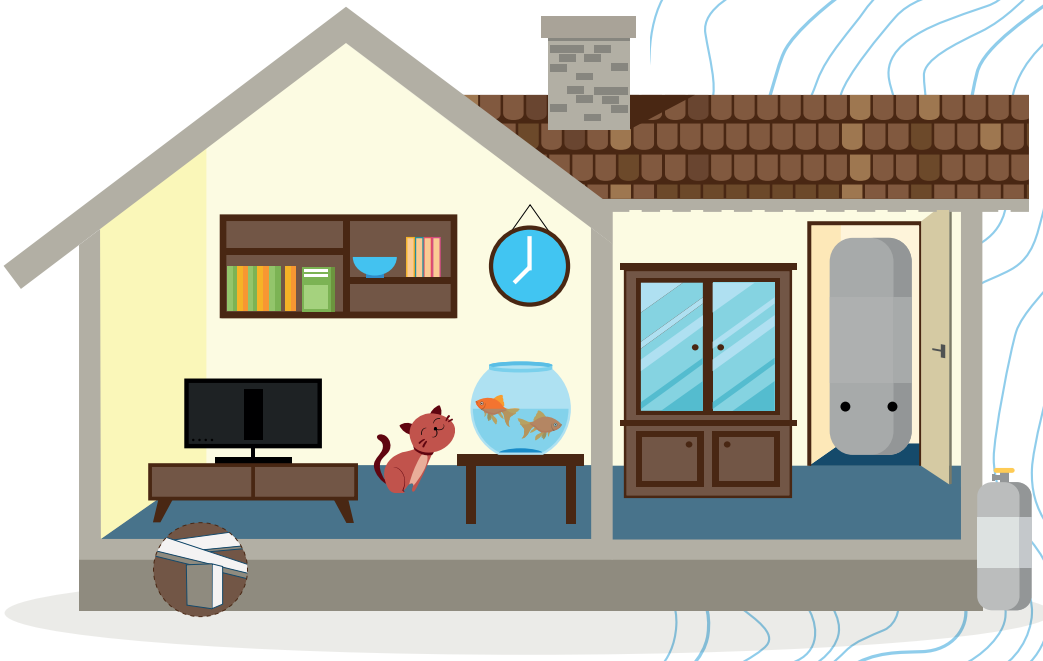
_____

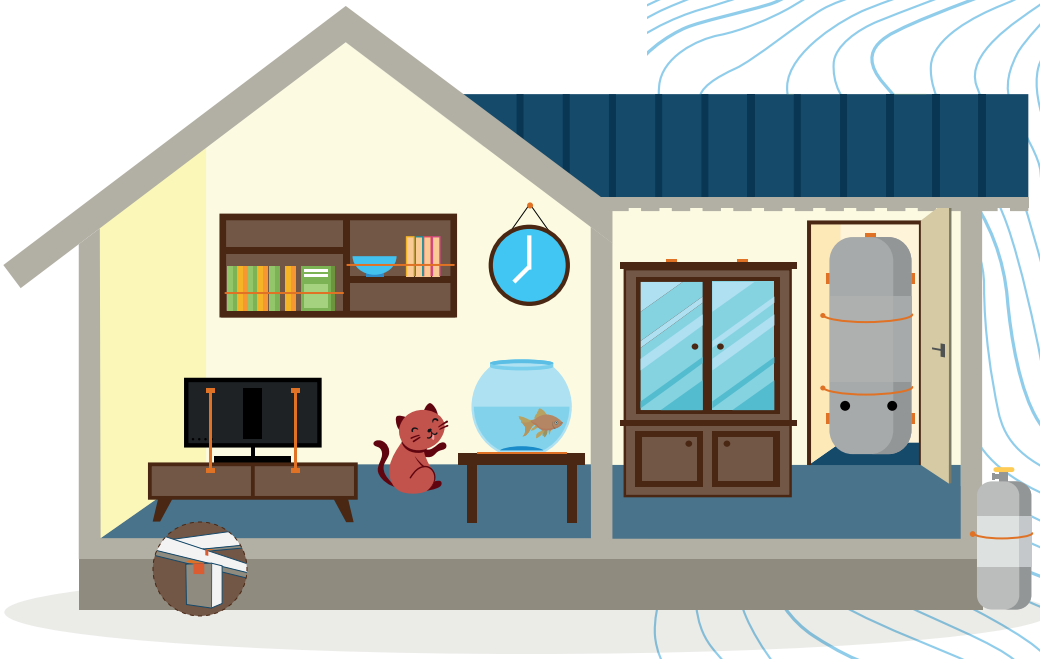
2. _____

_____

3. _____

_____





DID YOU KNOW?

For more information on how to QuakeSafe your home to protect your whānau check out:

eqc.govt.nz/assets/Be-Prepared/Quake-Safe-Your-Home-/QuakeSafeHome_2023_Web.pdf

Answer Question 14 using around 50 words. Then describe how you could visual your answer.

Plan & Prepare	Text	Visual e.g.. photo, graphic, video or map.
Q14. How could people organise themselves to prepare for the rupture of an Alpine Fault?		

Internal Assessment

Getting started with your StoryMap

Before you get started with this assessment activity, you should:

- ◯ learn how to login to and use ArcGIS Online.
- ◯ locate active faults on a map of the South Island of New Zealand.
- ◯ comprehend that earthquakes occur along faults.
- ◯ understand the impacts of an earthquake within the South Island.
- ◯ look at visuals of spatial distribution and practise using different ways of describing the pattern.
- ◯ practise applying geographic terms such as factors, processes, impact, and importance.

Your StoryMap

Now that you are an expert on **Active Faults and Our Alpine Fault**, it's your turn to create a StoryMap. Follow these instructions to begin.

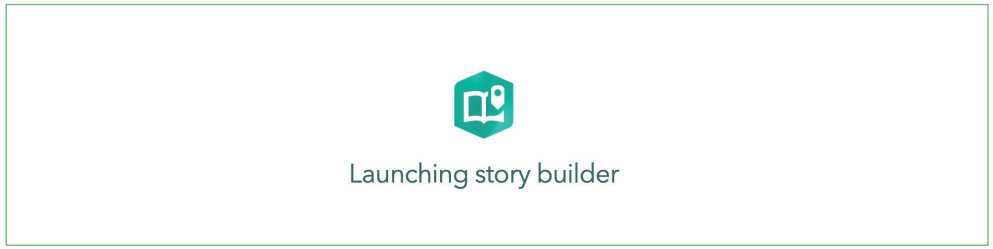
Login to ArcGIS online

To login go to storymaps.arcgis.com. This will open a page called Stories.

Create a StoryMap

Click on the **+New Story** button and then select **Start from scratch** from the drop-down menu.

You will see this screen appear.



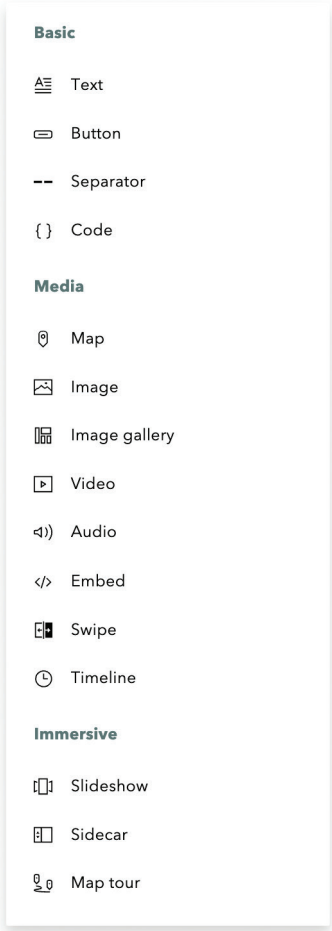
And then your StoryMap's Title Page will appear.

Click on **Title your story** and create your title. Click below the title to add a subtitle (it's optional), and then write your name in the byline. Click on **Add cover image or video** to add a cover image to your title page. Then your title page is done.

Next click the little plus sign below the title, and you'll see a menu of options.

This menu provides you with different types of features that you can use to create your StoryMap. Have a go at adding different section to explore how you might display your information for your assessment.

TOP TIP: ArcGIS StoryMaps auto-saves your story (provided you have not yet published your changes).



Plan your Content

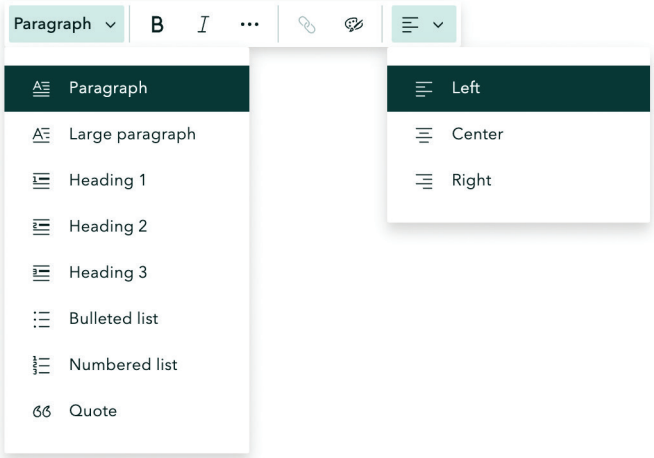
Use the **Heading** feature to break up your content into sections. This will help your organise your information.

Use the answers to your questions at the end of each section to draft your key information and then consider the type of immersive function you will use to display your information.

TOP TIP: Remember to explain why something occur and go back to the Assessment Schedule to make sure you have everything you need covered off in your StoryMap.

Add Text

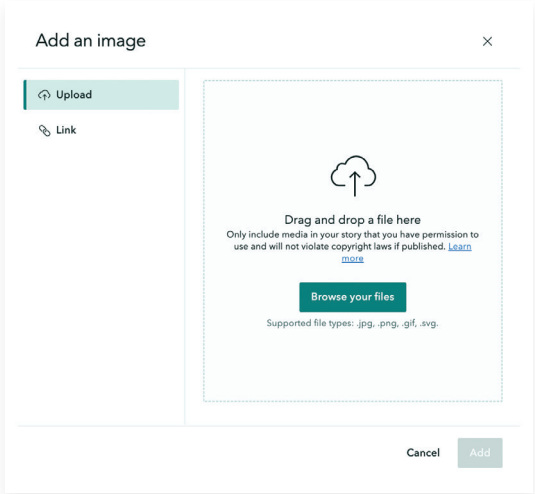
When you choose **Text**, you'll see a flashing cursor, below which is a little menu of text formatting options. If you want to add standard text, just start typing.



Add an Image

Add an Image from the menu. Navigate to your folders to find an image you'd like to include and add it to your story.

Make sure to create a caption for each you use and credit the source of the image or where you found the information.



Make a map

Select **Map** from the menu, and then click **Shared with Me** to look for the maps shared within the ArcGIS Group your teacher has created.

Layout

Think about how you will present your information. There are a few different options:

→ **Sidecar** is a scrolling, slide-based section with three different options.

1. The **floating panel** layout is ideal for short captions or descriptions, were users scroll down through the content.
2. The **docked panel** layout is ideal for longer content
3. The **slideshow** layout is ideal for short captions or descriptions, were users click manual across the content.

TOP TIP: Once you've added text, images and other media, you can drag and drop items to move them around within your StoryMap.

Design

Click **Design** in the top menu to turn the **Navigation** and **Credits** on.

- → Enable navigation so that your headings become bookmarks that appear as a navigation bar.
- → Enable credits so that you can provide links to your sources.

You can also chose different **Cover** layouts and **Themes**.

TOP TIP: You can Undo/Redo anything my click the arrows in the header (provided you have not yet published your changes.

Preview and Publish

Click **Preview** to see how your StoryMap will look like when it is published. The Preview button is also in the top menu next to **Publish**.

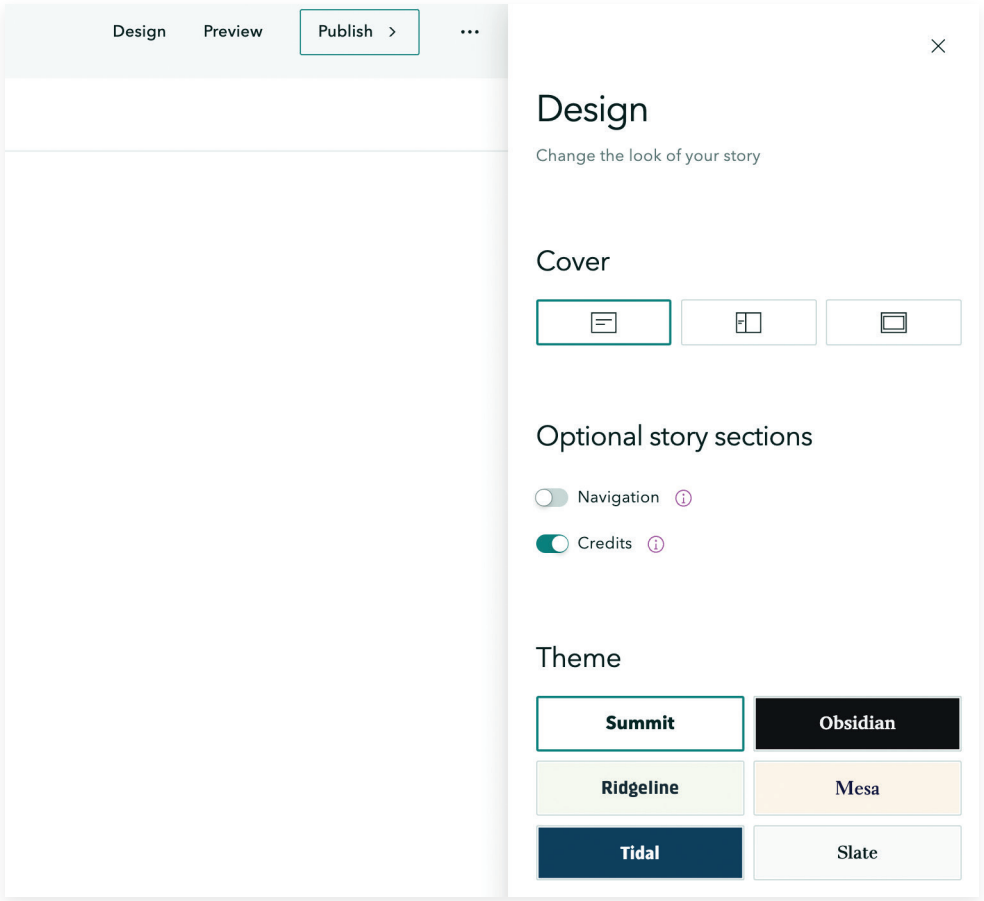
When you are happy with your StoryMap and have finished proofreading it you can click **Publish**. When you publish you StoryMap you have the option to make it visible to:

- → Only you via **Private**
- → Others from you school via **My Organisation**
- → Public via **Everyone**.

You can also share your story to ArcGIS groups that you are a member of by using the search box.

You can carry on editing once you have published. Any edits you make will published will show as **Unpublished Changes**.

These changes will not show until your click **Publish** again.



Good luck!

Glossary

Aftershock – An earthquake that comes after the mainshock. Most large earthquakes are followed by additional earthquakes, called aftershocks. While these are smaller than the mainshock, it may not be by much and they can still be damaging or deadly.

Describe – To state the features of.

Earthquake / fault rupture – The movement that occurs along a fault when an earthquake happens. It starts at a point and moves in one direction along the fault, like a tear or unzipping of the earth.

Epicentre – The point directly above the focus on the surface of the earth. Used to describe the location of an earthquake.

Explain – To make known the cause or detail of something.

Examine – To look at in detail.

Fault – A fracture between two bodies of rock caused by repeated movement – either slow and ongoing (creep) or sudden and periodic (earthquakes). Faults range in length from a few mm to hundreds of km. The Alpine Fault is approximately 400km long and is created by movement along the boundary between the Australian and Pacific tectonic plates

Focus/ hypocentre – The point inside the earth where an earthquake rupture begins.

Foreshock – A smaller earthquake that occurs before the mainshock.

Impacts – Are changes to aspects of a place due to a phenomenon such as changes to the environment, access to resources, or the ways that people are able to interact with each other

Intensity – Describes the amount of ground movement caused by an earthquake at a specific location. In NZ we use the Modified Mercalli scale (MMI) which goes from MMI 1 (imperceptible) to MMI 12 (completely devastating). The intensity of shaking at a site depends on many factors including distance from epicentre, ground conditions, magnitude.

Magnitude – Describes the amount of energy released by an earthquake. It is calculated from seismograph measurements and expressed using the moment magnitude scale (M1-M10). Each earthquake has just one magnitude measurement so this measurement is useful for comparing earthquakes.

The scale is logarithmic so each step up the scale e.g. M7 to M8 represents 10 times more ground movement and 32 x times more energy released. A magnitude 8 earthquake is the equivalent energy release to 1 trillion kilos of dynamite or the same as the volcanic eruption that created Lake Taupō. The largest earthquake ever measured was M9.5 in Chile in 1960, whereas the 2016 Kaikōura earthquake was M7.8.

Mainshock - The largest earthquake in a sequence. In a series of large earthquakes, defining the mainshock (as opposed to foreshocks or aftershocks) is not usually possible until well after the event. For example, the 2010 Darfield earthquake is now considered to be a foreshock of the 2011 Christchurch earthquake.

Phenomenon – A type of geographic feature, object, or event, that can be mapped. It can exist at a local, regional, national, or global scale.

Probability – Earthquakes cannot be predicted so the likelihood of an earthquake happening within a certain time frame is given as a probability. The more that is known about past earthquakes on a fault the higher the probability as accuracy improves. The last Alpine Fault earthquake was in 1717 and the probability of the next one in the next 50 years is 75%.

Processes – Are sequences of actions or steps.

Rupture Length – The length of fault over which movement occurs during an earthquake.

Seismic wave – When an earthquake happens, energy travels out from the focus in waves of seismic energy. There are several different types of seismic waves – P or primary waves, S or secondary waves and surface waves – which travel at different speeds and in different ways. These waves cause the shaking we feel.

Seismometer – A device that measures the shaking or movement of the earth at that point. New Zealand has a network of different size and types of seismometers that constantly feed data back to scientists.

Spatial – Relating to space, including position, location, and size.

Taiao – The taiao is the space you stand in or observe. This includes features such as rivers, mountains, people, buildings, and infrastructure. The taiao can exist at different scales and can be located wherever we place ourselves. Features of the taiao are all closely interconnected, including people. We stand in the taiao and are intrinsically part of it. "**Te taiao**" means one taiao. "**Ngā taiao**" means more than one taiao.

Tectonic Plate – The earth's crust is divided into pieces that move around on a molten layer beneath. New Zealand sits on the boundary between the Australian and pacific tectonic plates.

Tectonic Plate Boundary – The boundary or meeting point between two tectonic plates. This can be convergent (moving towards each other), divergent (moving away from each other) or transverse (moving alongside each other). New Zealand's plate boundary has convergent and transverse sections.

Notes, ideas and sketches

OPTIONAL: You can use these extra pages to keep notes, brainstorm ideas and draft sketches as you complete the workbook and the assessment.

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Toka Tū Ake EQC

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