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# When the ground shook: The Canterbury Earthquakes

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## Requirements:

- Internet access
- Web browser (e.g. Internet Explorer, Mozilla Firefox, Google Chrome)\*\*
- An Esri Global Account

\*\*Please ensure that pop ups are not blocked for the [arcgis.com](http://arcgis.com) site.

## Introduction:

This assessment activity requires you to comprehensively apply spatial analysis, with direction, to solve a geographic problem.

Between 2010 and 2012 the Canterbury region experienced a series of earthquakes some producing devastating results. Geologists have recorded these earthquakes.

Canterbury Earthquake Recovery Authority (CERA) is an organisation set up by the New Zealand Government to lead recovery work in the Canterbury Region following the earthquakes of 2010 and 2011. CERA wants to produce material to inform the wider NZ population of the effects and significance of the earthquakes. They want this material to be easy to understand and available for organisations such as newspapers, internet writers to use.

Imagine that you have the job of producing a report for CERA on the effects of the Canterbury Earthquake. Your task is to:

- Produce a WebMap that shows the distribution of earthquakes during the 2010 and 2012 period in the Canterbury region.
- Write a report about the effects of the earthquakes on people, and the built environment of the Canterbury Region.
- Write a process summary outlining what spatial analysis tools and other activities completed.

You will work individually on parts of the assessment.

You will share your map with your teacher and hand in your written report.

Your final work is due on:

## Instructions

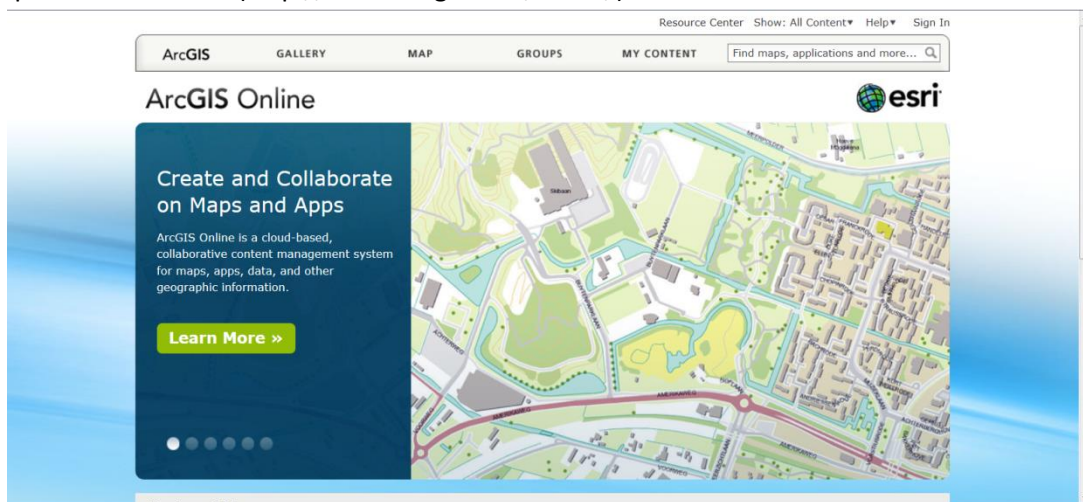
*The questions are to help you analyse your maps. For merit and excellence you should consider other questions and gain other information from your spatial analysis. You should also consider other ways of collecting and presenting the information in your WebMap by developing the basic skills included here. You may discuss your ideas with your teacher.*

*You may also consider other information you could add to your map and other spatial tools you could use to analyse the data in greater depth. For example you could make a comparison with other major earthquakes in NZ.*

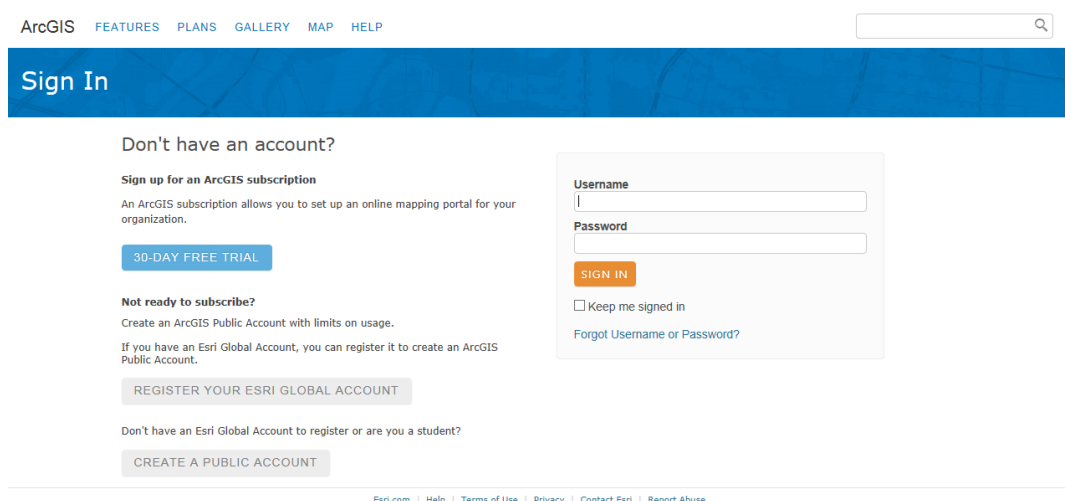
*Remember you are trying to provide an interactive visual solution for CERA that allows people to interact with your map to understand the effects of the 2010-2011 earthquakes on people and the environment.*

## Setup ArcGIS Online

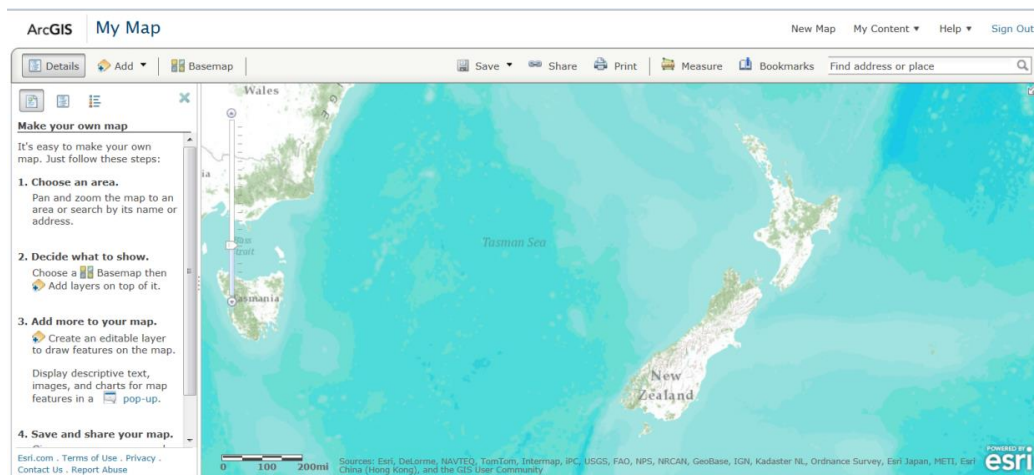
1. Open ArcGIS Online (<http://www.arcgis.com/home/>).



2. Click Sign In to ArcGIS Online.
  - a. If necessary create an Esri Global Account, you will only need to do this once, don't forget your password.



3. Click on map to open a new map.



#### 4. Change the Basemap to Imagery.

Saving your map.

#### 5. Click the Save button.

#### 6. Fill in the Save Map dialog that appears with the appropriate information. You should prefix your title with your name; tags are words that are used to search for a WebMap.

#### 7. Click Save Map.

*Click Save to save your map updates before you sign out of ArcGIS Online.*

### Collecting Information

**Task A:** Download earthquake information from the Geonet Site

1. Open the following webpage <http://quakesearch.geonet.org.nz/>
2. Download and save a csv file containing the earthquakes centred in Canterbury from the start of 2010 to the end of 2012, make sure the earthquakes you download have a minimum magnitude of five and a maximum magnitude of ten. Save the downloaded file to your own workspace.

**Q1** Why did you only download the earthquakes of magnitude 5 and above?

**Thinking further:** You could select this data in different ways – i.e. select 2010 and 2011 separately. Why might this be helpful on your Webmap?

**Task B:** Research on-line the effects the earthquake had on land and buildings in Christchurch. You will need this information later

Keep a record in a word document of:

- The location of the effect. Some effects may have been widespread you only need one example though you may refer to the distribution in your description
- a description and explanation of what happened.
- The URL of a photograph showing the effect

## Manipulating the data

**Hint:** *You should take screen captures to include in your written report as you complete each task*

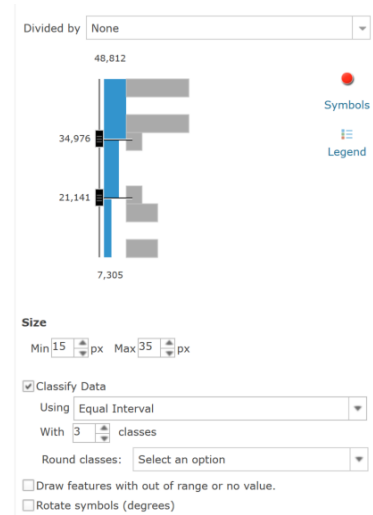
**Task A:** Create points in your map to represent earthquakes in the Canterbury Region.

1. Reopen your map if you have closed ArcGIS Online
2. Add a layer from file to the map, this layer will be the csv file you downloaded in Task A of the collecting information section.
  - a. Click add
  - b. Click add layer from file
  - c. Browse to your workspace where you saved the file you down loaded from Geonet

*If you csv file contains accurate information the location of your map should change to the Canterbury region of New Zealand.*

3. Change the appearance of the earthquakes so that the smaller magnitude earthquakes are represented by small dots on the map and the larger magnitude earthquakes are represented by larger dots on the map.

- a. Click the little arrow to the right hand side of your csv file name in the Contents Pane
- b. In the menu that appears click Change Style
- c. Make sure the attribute to show is set to magnitude
- d. Select counts and amounts (size), if necessary.
- e. Click options in the counts and amounts graphic
- f. Put a tick in the classify data check box
- g. Change the Using drop down to Equal Interval.
- h. Change the number of classes to 3.
- i. Set the min size to 15px and the max size to 45px
- j. Click OK and Done

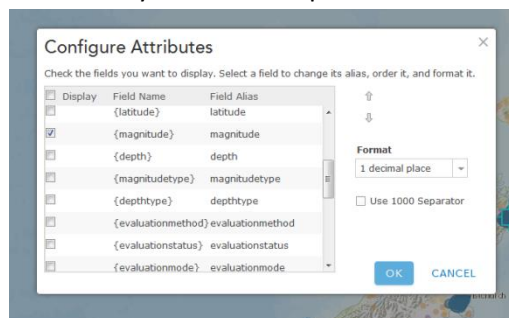


**Task B:** Create a pop-up for the Canterbury Earthquakes. (A Pop-up is an information box that pops up when you click on a location)

1. Click the little arrow to the right hand side of your csv file name in the Contents Pane
2. In the menu that appears click Configure Pop-up
3. Type Earthquake in the Pop-up Title
4. Configure Attributes maintain the ticks beside the eventtype, origintime, magnitude and depth fields, all other fields should not have a tick beside them
5. Click OK

Go back to configure attributes for each field – the format box is on the right

6. Format the Magnitude field to have only one decimal place and untick Use 1000 Separator.



7. Save the Pop-up.
8. Click an earthquake in the map and have a look at the pop up. If there is more than one earthquake close to the point where you clicked have a look at all the information by using the arrow button(s) at the top of the pop-up



**Q2** Can you explain the distribution of earthquakes that you see?

**Task C:** Create Areas on your map that represent locations of major damage

1. Using the following web site to locate the areas of Canterbury that sustained major damage (red zoned) in the 2010 – 2012 Canterbury earthquakes.

[www.cera.govt.nz/maps/land-status](http://www.cera.govt.nz/maps/land-status)

The location of the original red zone can be found here

<http://gisinschools-nz.maps.arcgis.com/home/item.html?id=88b7d9e2d9184ea483cfed6f44d90cfe>

**Q3** On this site you can explore how the red zone has changed over time. Why might this be?

2. In ArcGIS Online go to Add

4. Click on Add map notes. Create a layer with a name of Areas of Damage
5. Using the Area edit tool create polygons around red zoned areas.
6. Give each area you create a name and short description.

- Q4** Does the distribution of the earthquakes explain the pattern of damage you have mapped?
- Q5** What other factors could be taken into consideration if you were explaining the major damage that Canterbury sustained?
- Q6** Major Damage only occurred as a result of a few of the earthquakes shown in this map. Why was that?
- Q7** What were the earthquakes called that didn't cause major damage?

**Task D:** Locate Christchurch Cathedral and other significant effects.

1. Zoom and pan around the map until you locate the Christchurch Cathedral in the Centre of Christchurch. If you are unfamiliar with Christchurch change the Basemap to Streets and locate Christchurch Cathedral within the city block created by Gloucester, Manchester, Oxford and Hereford Streets.
2. Create another layer using map notes with a name of Christchurch Cathedral
3. Place a pushpin at Christchurch Cathedral
4. Give the push pin a title and description considering what the Cathedral meant to Christchurch and the implications of its potential demolition.
5. Go to the internet and find a picture of the Christchurch Cathedral before and after the Canterbury earthquakes. If you can't find a shot like this try to locate just an after shot. Save the URL for the image



6. Place the URL in the Image URL field,
7. Change the symbol colour to something that will show up against a green and grey background.
8. Close the Points dialog.
9. Close the Add features pane and click on the pushpin you have just created.



**Q8** Does all the information you added in the above steps appear in your pop-up?



- Q9** As you look at the Christchurch Cathedral in the after picture why do you think the decision to demolish the Cathedral was made in 2012?
- Q10** Was anyone killed or hurt in the Christchurch Cathedral during the earthquakes that occurred in the Canterbury Region 2010 – 2012?
- Q11** Collate eyewitness accounts of the damage sustained to the Christchurch Cathedral and using your own words write a paragraph summarising these eyewitness accounts.
- Q12** Was anyone killed in other areas of Canterbury during the earthquakes that occurred in the Canterbury Region 2010 – 2012? If so, how many people died and where did they die?
- Q13** Find out about the controversy over what should be done with the cathedral

**Create pop-ups for other effects of the earthquake and annotate these effects. Include an image for each effect. You could use the information you collected in Task B of the collecting information section.**

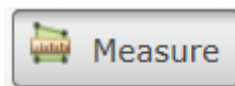
You might consider rock falls, liquefaction, and property damage.

Use the steps above to create the further pop-ups

**Thinking further: you could consider organising the pop-ups so that the pins are different colours as they relate to either 2010 or 2011. You can add other general information even if it has no specific location you could locate it is logically to give more detailed explanations**

**Task E:** Measure distances between the largest magnitude earthquakes to Christchurch Cathedral.

1. Zoom out to an extent that you can see all of the Canterbury earthquakes you added to the map at the beginning on the lesson
2. Click Measure close to the top of your screen



3. Hover over the icons that appear and choose the one that pops up distance when you hover over it. This is the distance measure tool.



4. Change the measure unit to Kilometres

5. Click on one of the earthquakes with the biggest circle symbol (earthquake magnitude greater than 6.41) and then use your cursor to double click on your push pin for Christchurch Cathedral. Write down this distance and also the date time and magnitude of the earthquake.
6. Repeat this process for the other earthquakes that have the biggest circle symbol.

**Q14** Is there any relationship between the distance, Date and time of the earthquakes and the damage to the Christchurch Cathedral?

7. Close the “Find area, length, or location” menu.

**Fully explain a valid answer solution supported by detailed evidence.**

**Task A:** Analyse your data to provide a solution to the geographic problem

This task requires you to provide a report for CERA showing why a Webmap is a good solution to provide information about the effects of the earthquakes on people. Your report must clearly outline the effects of the earthquake on people, and the built environment of the Canterbury Region. Ensure that your report is valid, detailed, and based on information that is shown in your WebMap and the questions you answered throughout this lesson.

You should have screen captures of your webmap to provide evidence to support your discussion.

- State clearly which areas of the Canterbury Region sustained major damage as a result of earthquakes. Refer to your WebMap and include screen captures.
- Include specific details in your answer, such as suburbs, streets, and statistics. Use your answers from this lesson to help you do this.

**Submit your work by the due date.**

Ensure that you:

1. Share your map with your teacher.
  - If you are ready to share your map for marking, click the share button and put a tick in the box beside the name of the group for this lesson.
  - Click Close. Your map is now shared with your teacher for marking.

Note: If you get stuck with sharing you map visit Sharing Items at [http://help.arcgis.com/en/arcgisonline/help/index.html#/Sharing\\_items/010q000000100000000/](http://help.arcgis.com/en/arcgisonline/help/index.html#/Sharing_items/010q000000100000000/) for help.
2. Hand a written report to your teacher.
  - Your written report must include a cover sheet with your name and assessment details on it



*How will you know the level of your own work in relation to the requirements of the standard?*

### **Achieved**

You will *apply spatial analysis* which involves:

- collecting spatial data relevant to the geographic question or problem
  - Data from Geonet
  - Red Zone data
  - Location of cathedral and distance from the major earthquakes
- completing simple manipulations of the spatial data to produce a layout related to the question or problem
  - adding points
  - Drawing polygons – most areas draw with good accuracy
  - Creating a pop-up
- describing a valid answer or solution based on the manipulations.
  - Using both your Webmap and report you describe effects to locations in Christchurch in relation to location of major earthquakes

### **Merit**

You will *effectively apply spatial analysis* which involves:

- collecting sufficient spatial data to address the geographic question or problem
  - As above
- completing simple manipulations of the spatial data to produce an accurate layout related to the question or problem
  - polygons more accurate and complete
  - Create several pop-ups with accurate information showing effects
- explaining a valid answer or solution, based on the manipulations, that is supported by evidence.
  - Using both your Webmap and report you explain the effects to location in Christchurch in relation to location of major earthquakes – you use detailed specific evidence gained from analysis of the information on your Webmap

### **Excellence**

You will *comprehensively apply spatial analysis* which involves:

- fully explaining a valid answer or solution, based on the manipulations, that is supported by detailed evidence.
  - Using both your Webmap and report you fully explain the effects to location in Christchurch in relation to location of major earthquakes – you use detailed specific evidence gained from analysis of the information on your Webmap